TransPeshawar (The Urban Mobility Company)
A company set up under section 42 of the Companies Act, 2017

Request for Proposal Document

for

Operation and Maintenance of VRF System, and Sewerage Treatment Plant in KPUMA Building

Issued on.: April 04, 2026

Request for Proposal No.: TPC/HR & Admin/OCB/Services/VRF&STP/2025-26/001/RB

Procuring Entity.: TransPeshawar (The Urban Mobility Company)

Preface

This Request for Proposal document is prepared by TransPeshawar (The Urban Mobility Company) and will be used for hiring Service Provider for Operation and Maintenance of VRF System and Sewerage Treatment Plant in KPUMA Building.

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Table of Contents - Summary Description

Section 1 - Instructions to Service Providers

This Section specifies the procedures to be followed by Service Providers in the preparation and submission of their Proposals. Information is also provided on the submission, opening, evaluation of Proposals, and on the award of contract.

Table of Clauses

Section 1 - Instructions to Service Providers

A. General

1. Scope of Proposal

1.1 In connection with the Invitation for Request for Proposal (RFP) as indicated in the **Data Sheet (DS)**, the Procuring Entity, as indicated in the **DS**, issues this Request for Proposal document for the scope of Services as specified in Section 5 (Schedule of Requirements). The name, identification, and number of contracts of the open competitive bidding (OCB) are provided in the **DS**.

1.2 Throughout this Request for Proposal document,

(a) the term “in writing” means communicated in written form and delivered against receipt;

(b) except where the context requires otherwise, words indicating the singular also include the plural and words indicating the plural also include the singular; and

(c) “day” means calendar day.

2. Source of Funs

2.1 The source of funds required by the Procuring Entity for undertaking this procurement is as indicated in the **DS**.

3. Fraud and Corruption

3.1 It is required that Service Providers shall observe the highest standard of ethics during the procurement and execution of contract. Khyber Pakhtunkhwa Public Procurement of Goods, Works and Services Rules, 2014 defines corrupt and fraudulent practices as follows:

(i) “Corrupt practice” means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party;

(ii) “Fraudulent practice” means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;

(iii) “Coercive practice” means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

(iv) “Collusive practice” means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party;

(v) “obstructive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in a procurement process, or affect the execution of a contract or deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements before investigators in order to materially impede an investigation

into allegations of a corrupt, fraudulent, coercive or collusive practice; or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or acts intended to materially impede the exercise of inspection and audit rights provided for under these rules and

3.2 The Procuring Entity will reject a proposal for award if it determines that the Service Provider during bidding or while recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations in competing for the Contract apart from other remedies provided for under the relevant laws.

4. Eligible Service Providers

4.1 A Service Provider may be a natural person or private entity, or any combination thereof with a formal intent to enter into an agreement or under an existing agreement in the form of a Joint Venture or as indicated in **DS**. In the case of a Joint Venture,

(a) all partners shall be jointly and severally liable; and

(b) the Joint Venture shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the parties of the Joint Venture during the bidding process and, in the event the Joint Venture is awarded the Contract, during contract execution.

4.2 A Service Provider, and all parties constituting the Service Provider, shall have the nationality of Pakistan. A Service Provider shall be deemed to have the nationality of Pakistan if the Service Provider is a citizen of Pakistan or is constituted, incorporated, or registered, and operates in conformity with the provisions of the laws of Pakistan.

4.3 A Service Provider shall not have a conflict of interest. All Service Providers found to have a conflict of interest shall be disqualified. A Service Provider may be considered to be in a conflict of interest with one or more parties in this bidding process if any of, including but not limited to, the following apply:

(a) they have controlling partners in common; or

(b) they receive or have received any direct or indirect subsidy from any of them; or

(c) they have the same legal representative for purposes of this proposal; or

(d) they have a relationship with each other, directly or through common third parties, that puts them in a position to have access to material information about or improperly influence the proposal of another Service Provider, or influence the decisions of the Procuring Entity regarding this bidding process; or

(e) a Service Provider participates in more than one proposal in this bidding process, either individually or as a partner in a joint venture, except for alternative offers permitted under ITSP 13 of the Request for Proposal Document. This will result in the

disqualification of all Proposals in which it is involved; or

(f) a Service Provider or any affiliated entity, participated as a consultant in the preparation of the design or technical specifications of the procurement that is the subject of the proposals; or

4.4 Service Providers shall provide such evidence of their continued eligibility satisfactory to the Procuring Entity, as the Procuring Entity shall reasonably request.

4.5 Apart from above, the Service Providers shall provide their eligibility satisfactory to the Procuring Entity, as indicated in **DS**.

5. Eligible Materials, Equipment and Services

5.1 The materials, equipment, and services to be supplied under the Contract shall have their origin in eligible source countries and all expenditures under the Contract will be limited to such materials, equipment, and services. At the Procuring Entity's request, Service Providers may be required to provide evidence of the origin of materials, equipment, and services.

5.2 For purposes of ITSP 5.1 above, "origin" means the place where the materials and equipment are mined, grown, produced, or manufactured, and from which the services are provided. Materials and equipment are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that differs substantially in its basic characteristics or in purpose or utility from its components.

B. Contents of Request for Proposal Document

6. Sections of Request for Proposal Document

6.1 The Request for Proposal document consist of Parts I, II, and III, which include all the sections indicated below, and should be read in conjunction with any addenda issued in accordance with ITSP 8.

PART I Bidding Procedures
Section 1 - Instructions to Service Providers (ITSP)
Section 2 - Data Sheet (DS)
Section 3 – Eligibility and Qualification Criteria (EQC)
Section 4 - Bidding Forms (BDF)

PART II Requirements
Section 5 – Schedule of Requirements (SoR)

PART III Conditions of Contract and Contract Forms
Section 6 - General Conditions of Contract (GCC)
Section 7 - Particular Conditions of Contract (PCC)
Section 8 - Contract Forms (COF)

6.2 The Invitation for RFP issued by the Procuring Entity is not part of the Request for Proposal document.

6.3 The Procuring Entity is not responsible for the completeness of the Request for Proposal document and their addenda, if they were not obtained directly from the source stated by the Procuring Entity in the

Invitation for RFP.

6.4 The Service Provider is expected to examine all instructions, forms, terms, and specifications in the Request for Proposal document. Failure to furnish all information or documentation required by the Request for Proposal document may result in the rejection of the Proposal.

7. Clarification of Request for Proposal Document, Site Visit, Pre-Bid Meeting

7.1 A prospective Service Provider requiring any clarification on the Request for Proposal document shall contact the Procuring Entity in writing through EPADS on or before the date and time indicated in the **DS** or raise his inquiries during the pre-bid meeting if provided for in accordance with ITSP 7.4. The Procuring Entity will respond to any request for clarification in the manner as indicated in the **DS**. Should the Procuring Entity deem it necessary to amend the Request for Proposal document as a result of a request for clarification, it shall do so following the procedure under ITSP 8 and ITSP 20.2.

7.2 The Service Provider is advised to visit and examine the Premises and its surroundings and obtain for itself, on its own risk and responsibility, all information that may be necessary for preparing the Proposal and entering into a contract. The costs of visiting the Premises shall be at the Service Provider's own expense.

7.3 The Service Provider and any of its personnel or agents will be granted permission by the Procuring Entity to enter its premises and lands for the purpose of such visit, but only upon the express condition that the Service Provider, its personnel, and agents will release and indemnify the Procuring Entity and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the inspection.

7.4 The Service Providers are encouraged to attend a pre-bid meeting, if provided for in the **DS**. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.

7.5 Minutes of the pre-bid meeting, including the text of the questions raised, without identifying the source, and the responses given, together with any responses prepared after the meeting, will be disseminated in a manner as indicated in **DS**. Any modification to the Request for Proposal document that may become necessary as a result of the pre-bid meeting shall be made by the Procuring Entity exclusively through the issue of an addendum pursuant to ITSP 8 and not through the minutes of the pre-bid meeting.

7.6 Nonattendance at the pre-bid meeting will not be a cause for disqualification of a Service Provider.

8. Amendment of Request for Proposal Document

8.1 The Procuring Entity may amend the Request for Proposal document by issuing addenda at least five (05) days before the deadline for submission of Proposals.

8.2 Any addendum issued shall be part of the Request for Proposal document and shall be communicated in manner as indicated in **DS**

8.3 To give prospective Service Providers reasonable time in which to take an addendum into account in preparing their Proposals, the Procuring Entity may, at its discretion, extend the deadline for the submission of Proposals, pursuant to ITSP 20.2.

C. Preparation of Proposals

9. Cost of Bidding

9.1 The Service Provider shall bear all costs associated with the preparation and submission of its Proposal, and the Procuring Entity shall in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

10. Language of Proposal

10.1 The Proposal, as well as all correspondence and documents relating to the Proposal exchanged by the Service Provider and the Procuring Entity, shall be written in the language specified in the **DS**. Supporting documents and printed literature that are part of the Proposal may be in another language provided they are accompanied by an accurate translation of the relevant passages in the language specified in the **DS**, in which case, for purposes of interpretation of the Proposal, such translation shall govern.

11. Documents Comprising the Proposal

11.1 The Proposal shall comprise two separate files submitted simultaneously through EPADS portal, one called the Technical Proposal containing the documents listed in TABLE-1, “CONTENTS OF TECHNICAL PROPOSAL” and TABLE-2, “CONTENTS OF FINANCIAL PROPOSAL” under Section 4 (Bidding Forms) of Request of Proposal document.

11.2 In addition to the requirements under ITSP 11.1, Proposals submitted by a Joint Venture shall include, in Technical Proposal, a copy of the Joint Venture Agreement entered into by all partners. Alternatively, a Letter of Intent to execute a Joint Venture Agreement in the event of a successful Service Provider shall be signed by all partners and submitted with the Technical Proposal, together with a copy of the proposed agreement.

12. Letters of Proposal and Schedules

12.1 The Letters of Technical Proposal and Financial Proposal, Schedules along with attachments, and all documents listed under Clause 11, shall be prepared using the relevant forms in Section 4 (Bidding Forms), if so provided. The forms must be completed without any alterations to the text, and no substitutes shall be accepted. All blank spaces shall be filled in with the information as required.

13. Alternative Proposals

13.1 Unless otherwise indicated in the **DS**, alternative Proposals shall not be considered.

14. Proposal Prices

14.1 The prices quoted by the Service Provider in the Letter of Financial Proposal, EPADS and in the relevant Schedule (s) shall conform to the requirements specified below.

14.2 The Service Provider shall submit Proposal for complete scope of services as indicated in Section 5 (Schedule of Requirements) on given forms as identified in Section 4 (Bidding Forms). Proposals submitted for incomplete scope shall be rejected.

14.3 The Price to be quoted in Letter of Financial Proposal and in the EPADS shall be the total price of the services. Absence of the total price in the Letter of Financial Proposal and on EPADS portal may result in the rejection of the Proposal. In case there is discrepancy/difference between the Price quoted in Letter of Financial Proposal and the one entered in EPADS portal, the proposal shall be rejected summarily.

14.4 The offered price shall be inclusive of taxes, as per requirement of Letter of Financial Proposal, and Service Provider shall be liable for payment of all applicable taxes, duties, minimum wage, and other levies under the Contract as per relevant law.

14.5 The entered prices shall be typewritten or if written by hand, must be in indelible ink. The relevant schedule not presented accordingly may be considered nonresponsive.

15. Currencies of Proposal and Payment

15.1 The rates shall be quoted by the Service Provider entirely in Pak Rupees.

15.2 The currency of payment of contract price shall entirely be in Pak Rupees.

16. Period of Validity of Proposals

16.1 Proposals shall remain valid for the period specified in the **DS** after the Proposal submission deadline prescribed by the Procuring Entity. A Proposal valid for a shorter period or absence of period of validity shall be rejected by the Procuring Entity as nonresponsive.

16.2 In exceptional circumstances, prior to the expiration of the Proposals' validity period, the Procuring Entity may request Service Providers to extend the period of validity of their Proposals. The request and the responses shall be made in writing. If a bid security is requested in accordance with ITSP 17, it shall also be extended 28 days beyond the deadline of the extended validity period. A Service Provider may refuse the request without forfeiting its bid security. A Service Provider granting the request shall not be required or permitted to modify its Proposal.

17. Bid Security

17.1 Unless otherwise specified in the **DS**, the Service Provider shall furnish as part of its Proposal, in original form, a bid security in the form, amount and currency as specified in the **DS**.

17.2 Unless otherwise specified in the **DS**, any Proposal not accompanied by a substantially compliant bid security shall be rejected by the Procuring Entity as nonresponsive.

17.3 If a bid security is specified pursuant to ITSP 17.1, the bid security of unsuccessful Service Providers shall be returned promptly upon the successful Service Provider's furnishing of the performance security pursuant to ITSP 37.

17.4 If a bid security is specified pursuant to ITSP 17.1, the bid security of the successful Service Provider shall be returned as promptly as possible once the successful Service Provider has signed the Contract and furnished the required performance security.

17.5 The bid security may be forfeited, if

(a) a Service Provider withdraws its proposal during the period of proposal validity, except as provided in ITSP 16.2; or

(b) the successful Service Provider fails to

(i) sign the Contract in accordance with ITSP 36;

(ii) furnish a performance security in accordance with ITSP 37;

(iii) accept the arithmetical correction of its Proposal in accordance with ITSP 30.

17.6 . The bid security of a Joint Venture shall be submitted as indicated in **DS**.

18. Format and Signing of Proposal

18.1 The Service Provider shall prepare Proposal comprising the documents as described in ITSP 11.

18.2 The Proposal shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Service Provider. This authorization shall consist of a written confirmation as specified in the **DS** and shall be enclosed in Technical Proposal. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the Proposal, except for unamended printed literature, shall be signed or initialed by the person signing the Proposal. If a Service Provider submits a deficient authorization, the Proposal shall not be rejected in the first instance. The Procuring Entity shall request the Service Provider to submit an acceptable/valid authorization within the number of days as specified in the **DS**. Failure to provide an acceptable/valid authorization within the prescribed period of receiving such a request shall cause the rejection of the Proposal.

18.3 Any amendments such as interlineations, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the Proposal.

D. Submission and Opening of Proposals

19. Sealing and Marking of Proposals

19.1 Service Providers shall submit their Proposals electronically by uploading PDF file through the KP-EPADS portal (kp.eprocure.gov.pk) under the Single Stage – Two Envelope Bidding Procedure. Procedures for sealing, marking and submission of Proposals electronically is specified in **DS**.

20. Deadline for Submission of Proposals

20.1 Proposals must be submitted through EPADS portal not later than the date and time as indicated in the **DS**.

20.2 The Procuring Entity may, at its discretion, extend the deadline for the submission of Proposals by amending the Request for Proposal documents in accordance with ITSP 8, in which case all rights and obligations of the Procuring Entity and Service Providers previously subject to the deadline shall thereafter be subject to the deadline as extended.

21. Late Proposals

21.1 In accordance with ITSP 20, the EPADS portal shall not permit the submission of any Proposal after the deadline prescribed for submission. Any attempt to submit after the deadline shall be system-restricted, and such Proposals shall neither be received nor considered by the Procuring Entity.

22. Withdrawal, Substitution, and Modification of Proposals

22.1 A Service Provider may modify, substitute, or withdraw its Proposal – Technical or Financial – at any time prior to the deadline for submission of Proposals, by using the relevant functions available in the EPADS portal, if any. The system shall record the latest version of the Proposal submitted before the deadline as the valid Proposal.

22.2 A Proposal withdrawn through the EPADS portal in accordance with ITC 22.1 shall not be accessible to the Procuring Entity at the time of opening.

22.3 No Proposal may be withdrawn, substituted, or modified in the interval between the deadline for submission of Proposals and the expiration of specified period of proposal validity.

23. Proposal Opening

23.1 The Procuring Entity will open the Technical Proposals in public at the address, on the date and time and procedure as specified in the **DS** in the presence of Service Providers designated representatives and anyone who chooses to attend. The Financial Proposals along with original bid security will remain unopened until the specified time of their opening.

23.2 All Technical Proposals shall be opened one at a time, and the following read out and recorded:

(a) the name of the Service Provider;

(b) the presence of an affidavit stating that a bid security amounting to 2 percent of proposal price without indicating the figure in the letter, has been placed in the Financial Proposal; and

(c) any other details as the Procuring Entity may consider appropriate.

Only Technical Proposals and alternative Technical Proposals, if any, read out and recorded at Proposal opening shall be considered for evaluation. No Proposal shall be rejected at the opening of Technical Proposals.

23.3 The Procuring Entity shall prepare a record of the opening of Technical Proposals that shall include, as a minimum, the name of the Service

Provider, the presence or absence of an affidavit (s) and submission of bid security. The Service Providers representatives who are present shall be requested to sign the record. The omission of a Service Provider's signature on the record shall not invalidate the contents and effect of the record. A copy of the record may be distributed to the Service Providers if so requested.

23.4 At the end of the evaluation of the Technical Proposals, the Procuring Entity will invite Service Providers who have submitted substantially responsive Technical Proposals to attend the opening of the Financial Proposal.

23.5 The date, time, and location of the opening of Financial Proposals will be advised in writing by the Procuring Entity. Service Provider shall be given reasonable notice of the opening of Financial Proposals.

23.6 The Service Provider will notify Service Providers in writing who have been rejected on the grounds of their Technical Proposals being substantially nonresponsive to the requirements of the Request for Proposal Document and return their Financial Proposals unopened.

23.7 The Procuring Entity shall conduct the opening of Financial Proposals of all Service Providers who submitted substantially responsive Technical Proposals, in the presence of Service Provider` representatives who choose to attend at the address, on the date, and time specified by the Procuring Entity. The Service Provider's representatives who are present shall be requested to sign the attendance.

23.8 All Financial Proposals shall be opened one at a time and the following read out and recorded:

(a) the name of the Service Provider;

(b) Amount of Bid Security:

(c) the Proposals Prices; and

(d) any other details as the Procuring Entity may consider appropriate.

Only Financial Proposals read out and recorded during the opening of Financial Proposals shall be considered for evaluation. No Proposal shall be rejected at the opening of Financial Proposals.

23.9 The Service Provider shall prepare a record of the opening of Financial Proposals that shall include, as a minimum, the name of the Service Provider, the Proposal Price, any discounts, and alternative offers. The Service Providers' representatives who are present shall be requested to sign the record. The omission of a Service Provider's signature on the record shall not invalidate the contents and effect of the record.

E. Evaluation and Comparison of Proposals

24. Confidentiality

24.1 Information relating to the examination, evaluation, and comparison of Proposals and recommendation of contract award, shall not be disclosed to Service Providers or any other persons not officially

concerned with such process until information on the Contract award is communicated to all Service Providers.

24.2 Any attempt by a Service Provider to influence the Procuring Entity in the evaluation of the Proposals or Contract award decisions may result in the rejection of its Proposal.

24.3 Notwithstanding ITSP 24.2, from the time of proposal opening to the time of Contract award, if any wishes to contact the Procuring Entity on any matter related to the bidding process, it may do so in writing.

25. Clarification of Proposals

25.1 To assist in the examination, evaluation, and comparison of the Technical and Financial Proposals, the Procuring Entity may, at its discretion, ask any Service Provider for a clarification of its Proposal. Any clarification submitted by a Service Provider that is not in response to a request by the Procuring Entity shall not be considered. The Procuring Entity's request for clarification and the response shall be in writing. No change in the substance of the Technical Proposal or prices in the Financial Proposal, accept as permissible under relevant law, shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Procuring Entity in the evaluation of the Financial Proposals, in accordance with ITSP 30 or as provided for under relevant rules.

25.2 If a Service Provider does not provide clarifications of its Proposal by the date and time set in the Procuring Entity's request for clarification, its Proposal may be rejected.

26. Deviations, Reservations, and Omissions

26.1 During the evaluation of Proposals, the following definitions apply:

(a) "Deviation" is a departure from the requirements specified in the Request for Proposal Document;

(b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Request for Proposal Document; and

(c) "Omission" is the failure to submit part or all of the information or documentation required in the Request for Proposal Document.

27. Examination of Technical Proposals

27.1 The Procuring Entity shall examine the Technical Proposals to confirm that it is in compliance with requirement of the Request for Proposal terms and conditions and that all documents requested in ITSP 11.1 have been provided, and to determine the completeness of each document submitted.

27.2 The Procuring Entity shall confirm that the all the documents and information have been provided in the Technical Proposal as per requirement of the RFP and in accordance with ITSP clause 11. If any of the document or information is missing, the offer may be rejected.

28. Responsiveness of Technical Proposal

28.1 The Procuring Entity's determination of responsiveness of Technical Proposal is to be based on the contents of the Technical Proposal itself, as defined in ITSP11.

28.2 A substantially responsive Technical Proposal is one that meets the requirements of the Request for Proposal Document including Eligibility and Qualification Criteria as stipulated under Section 3 (Eligibility and Qualification Criteria) without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that,

(a) if accepted, would:

(i) affect in any substantial way the scope, quality, or performance of the Services specified in the Contract; or

(ii) limit in any substantial way, inconsistent with the Request for Proposal Document, the Procuring Entity's rights or the Service Provider's obligations under the proposed Contract; or

(b) if rectified, would unfairly affect the competitive position of other Service Providers presenting substantially responsive Proposals.

28.3 If Technical Proposal is not substantially responsive to the requirements of the Request for Proposal Document, it shall be rejected by the Procuring Entity and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.

28.4 Substantial responsiveness shall be pre-requisite for opening of Financial Proposal. Financial Proposal and sealed envelope of bid security of nonresponsive Service Providers will be returned unopened.

29. Nonmaterial Nonconformities

29.1 Provided that Technical Proposal is substantially responsive, the Procuring Entity may waive any nonconformities in the Technical Proposal that do not constitute a material deviation, reservation, or omission.

29.2 Provided that a Technical Proposal is substantially responsive, the Procuring Entity may request that the Service Provider to submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities in the Technical Proposal related to documentation requirements. Requesting information or documentation on such nonconformities shall not be related to any aspect of the Financial Proposal. Failure of the Service Provider to comply with the request may result in the rejection of its Proposal.

30. Correction of Arithmetical Errors

30.1 During the evaluation of Financial Proposals, the Procuring Entity shall correct arithmetical errors on the following basis:

(a) If there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of the Service Provider there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected.

(b) If there is an error in a total corresponding to the addition or

subtraction of subtotals, the subtotals shall prevail and the total shall be corrected.

(c) If there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a), and (b) above.

30.2 If the Service Provider that submitted the lowest evaluated Financial Proposal does not accept the correction of errors, its Proposal shall be disqualified and its bid security shall be forfeited.

31. Evaluation of Financial Proposals

31.1 The Procuring Entity shall evaluate Financial Proposal of substantially responsive Technical Proposals only. Price adjustment due to correction of arithmetic errors, if any, will be affected in accordance with ITSP 30.

32. Comparison of Proposals

32.1 The Procuring Entity shall compare all substantially responsive Proposals to determine the lowest evaluated Proposal, in accordance with ITSP 31.1.

33. Employer's Right to Accept Any Proposal, and to Reject Any or All Proposals

33.1 The Procuring Entity reserves the right to accept or reject any Proposal, and to annul the bidding process and reject all Proposals at any time prior to contract award, without thereby incurring any liability to Service Providers. In case of annulment, all Proposals submitted and specifically, bid securities, shall be promptly returned to the Service Providers.

F. Award of Contract

34. Award Criteria

34.1 The Procuring Entity shall award the Contract to the Service Provider who is substantially responsive to the requirements of Request for Proposal documents and/ or Eligibility and Qualification Criteria and whose financial offer has been determined to be the lowest evaluated financial offer and will be declared as successful Service Provider.

35. Notification of Award

35.1 Prior to the expiration of the period of proposal validity, the Procuring Entity shall transmit the Notification of Award using the form included in Section 8 (Contract Forms) to the successful Service Provider, in writing, that its Proposal has been accepted.

35.2 Until a formal contract is prepared and executed, the notification of award shall constitute a binding Contract.

36. Signing of Contract

36.1 Promptly after notification, the Procuring Entity shall send the successful Service Provider the Contract Agreement.

36.2 Within 28 days of issuance of the Contract Agreement or as indicated in **DS**, the successful Service Provider shall sign, date, and return it to the Procuring Entity.

36.3 The original proposals submitted by the service providers shall be retained by the Procuring Entity

37. Performance

37.1 Within 28 days, or as indicated in **DS**, of the issuance of notification of award from the Procuring Entity, the successful Service Provider shall

Security

furnish the performance security in accordance with the Conditions of Contract, using for that purpose the Performance Security Form included in Section 8 (Contract Forms), or another form acceptable to the Procuring Entity.

37.2 Failure of the successful Service Provider to submit the above-mentioned Performance Security or to sign the Contract Agreement shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security. In that event, the Procuring Entity may award the Contract to the next lowest evaluated Service Provider whose offer is substantially responsive.

Section 2 - Data Sheet

A. General

ITSP 1.1	The number of the Invitation for Request for Proposal (RFP) is: **TPC/HR & Admin/OCB/Services/VRF&STP/2025-26/001/RB**
ITSP 1.1	The Procuring Entity is: **TransPeshawar (The Urban Mobility Company)**
ITSP 1.1	The name of the bidding process is: **Operation and Maintenance of VRF System and Sewerage Treatment Plant in KPUMA building** The identification number of the Request for Proposal Document is: **TPC/HR & Admin/OCB/Services/VRF&STP/2025-26/001/RB**
ITSP 2.1	Govt. of Khyber Pakhtunkhwa.
ITSP 4.1	A Service Provider must be a natural person (a sole proprietor having CNIC and Pakistani national) or a firm or a company incorporated in or registered with Registrar of Firms or Security and Exchange Commission of Pakistan or any combination thereof with a formal intent to enter into an agreement or under an existing agreement in the form of a Joint Venture.
ITSP 4.5	The Service Provider must be: i. Registered with FBR for income tax and sales tax and reflected on active taxpayers list (in case of Joint Venture mandatory for all members); ii. Registered with KPRA for sales tax on services with active taxpayer status (in case of Joint Venture mandatory for all members); iii. Valid Registration with PEC for Electrical and Mechanical works (ME05 and CE09) with category C-6 or above. (in case of Joint Venture mandatory for lead partner); iv. not be blacklisted by any federal or provincial public entity in Pakistan, is neither insolvent nor bankrupt, is not in the process of winding up nor his/her properties are under the control of receiver nor his/her business activities have been suspended nor legal proceedings for any of the foregoing are imminent or have been initiated against him/her and has fulfilled all obligations under law for the time being in force (in case of Joint Venture mandatory for all members).

B. Contents of Request for Proposal Document

ITSP **7.1**	Requests for clarification should be received by the Procuring Entity on or before April 09, 2026, 05:00 PM (PST). Request for clarification shall be received and responded through EPADS.

ITSP 7.4	A Pre-Bid meeting shall take place. Date: April 09, 2026 Time: 11:30 AM (PST) Place: Main Board Room, TransPeshawar (The Urban Mobility Company), First Floor KPUMA Building Near Main BRT Depot, Chamkani, GT Road, Peshawar, KPK, Pakistan A site visit conducted by the Procuring entity will be organized on the date fixed for pre-bid meeting, if so conducted, on the request of prospective service providers.
ITSP 7.5	Minutes of pre-bid meeting will be hoisted on website of the Procuring Entity and sent to all Service Providers who attended pre-bid meeting apart from publishing on EPADS.
ITSP 8.2	The addendum will be hoisted on website of the Procuring Entity or KPPRA or both apart from EPADS and may be published in newspapers if the Procuring Entity deems necessary and if the amendments are of substantial nature.

C. Preparation of Proposals

ITSP 10.1	The language of the Proposal is: **English**
ITSP 13.1	Alternative Proposals are not permitted.
ITSP 16.1	The Proposal validity period shall be one hundred eighty (180) days.
ITSP 17.1	The Service Provider shall upload a copy of Bid Security on EPADS Portal along with Financial Proposal to the amount of two (2) % of Total Proposal Price in the shape of Call Deposit Receipt (CDR) in favour of “Chief Executive Officer TransPeshawar” valid thirty (30) beyond the validity of the proposal. The Bid Security in original form (in hard form) shall be submitted in separate envelop to the procuring entity on the address given below, on or before the deadline for submission of proposal. The bid security shall be submitted from the account of the bidder who submits the proposal. The Service Provider shall in addition, place an affidavit on E-Stamp paper of PKR150 or above, and duly notarized, in the Technical Proposal stating that a bid security amounting to 2 percent of the total proposal price, without indicating the figure in the letter, has been placed in the Financial Proposal. Otherwise, the Technical Proposal will be considered non-responsive and Financial Proposal will not be considered. The original bid security shall be kept sealed until opening of Financial Proposal. **Procuring Entity Address:** **Attention:** Chief Executive Officer (CEO), TransPeshawar **Address:** TransPeshawar (The Urban Mobility Company), First Floor KPUMA Building Near Main BRT Depot, Chamkani, GT Road, Peshawar, KPK, Pakistan

	The sealed envelope shall clearly mark with: • Bidder's name and address; • Title of the procurement; and • The words "Original Bid Security" for [Name of Procurement]".
ITSP 17.2	Non-submission of bid security in prescribed manner shall be sufficient ground for rejection of proposal.
ITSP 17.6	In case of Joint Venture is submitting bid security in the Shape of Call Deposit Receipt, the Bid security may be in the name of any one member of Joint Venture in accordance with ITSP 17.1.
ITSP 18.1	In addition to the original Proposal, the number of copies is: **Not Applicable**
ITSP 18.2	The written confirmation of authorization to sign on behalf of the Service Provider shall consist of: The authorization is required if the Service Provider is a firm or company or any combination thereof. If the Service Provider is a sole proprietor or individual, he is not supposed to submit authorization if he is not represented by any representative. An authorization shall be provided on the format as given under Section 4 (Bidding Forms) specifying the representative's authority to sign the Proposal on behalf of, and to legally bind, the Service Provider. If the Service Provider is an intended or an existing Joint Venture, the authorization/power of attorney shall be signed by all partners individually and specify the authority of the named representative of the Joint Venture to sign on behalf of, and legally bind, the intended or existing Joint Venture on the relevant Schedule. If the Joint Venture has not yet been formed, also include evidence from all proposed Joint Venture partners of their intent to enter into a Joint Venture in the event of a contract award.
ITSP 18.2	The Service Provider shall submit an acceptable authorization within three (03) working days.

D. Submission and Opening of Proposals

ITSP 19.1	19.1.1. Once signed and stamped, each Proposal (Technical and Financial) shall be scanned and compiled into separate **PDF files**. 19.1.2. The files shall be clearly named as: • *"Technical Proposal* – Operation and Maintenance of VRF System and Sewerage Treatment Plant in KPUMA Building – *[Name of Service Provider]"* • *"Financial Proposal* – Operation and Maintenance of VRF System and Sewerage Treatment Plant in KPUMA Building – *[Name of Service Provider]"* 19.1.3. If more than one version of a file is uploaded, the version most recently uploaded **before the deadline** will be considered the **Final/Original Proposal**.

	19.1.4. Physical sealing of proposals [except the document (s) required in hard] is not required. However, bidders must ensure that Technical and Financial Proposals are uploaded in **separate clearly named PDF files** as stipulated above. The proposals not submitted accordingly shall be rejected summarily. 19.1.5 Apart from the electronic submission the following documents shall be submitted physically (in hard form), on the address as indicated, on or before the deadline for submission of proposals. i. Original bid security **Client Address Documents to be Submitted Physically:** **Attention:** Chief Executive Officer (CEO), TransPeshawar **Address:** TransPeshawar (The Urban Mobility Company), First Floor KPUMA Building Near Main BRT Depot, Chamkani, GT Road, Peshawar, KPK, Pakistan 19.1.5. Any document required physically in original form shall be sealed in an envelope, clearly marked with: • Bidder's name and address; • Title of the Procurement; and • The words *"Original Bid Security for [Name of Procurement]"*.
ITSP 20.1	**The deadline for Proposal submission is:** Date: April 23, 2026 Time: 11:30 AM (PST)
ITSP 23.1	The Technical Proposal opening shall take place at: Main Board Room, TransPeshawar (The Urban Mobility Company), First Floor KPUMA Building Near Main BRT Depot, Chamkani, GT Road, Peshawar, KPK, Pakistan Date: April 23, 2026 Time: 12:00 PM (PST)
ITSP 36.2	With in 14 days of issuance of Notification of award/contract agreement
ITSP 37.1	With in 14 days of issuance of Notification of award/contract agreement

Section 3 – Eligibility and Qualification Criteria

Table of Criteria

1. Eligibility Criteria

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	

1.1 Nationality or Country of Constitution

Sole proprietor, Pakistani national having CNIC, or Firms or Company incorporated in or registered with Registrar of Firms or Security and Exchange Commission of Pakistan.	must meet requirement	not applicable	must meet requirement	not applicable	CNIC or certificate of incorporation/registration as an attachment with Schedule 1 (in case of sole proprietor/firm/company or Schedule 1 & Schedule 2 (in case of JV)

1.2 Conflict of Interest

No conflicts of interest	must meet requirement	not applicable	must meet requirement	not applicable	Letter of Technical Proposal

1.3 Registration with FBR

Registered with FBR for income tax and sales tax and reflected on active taxpayer list.	must meet requirement	not applicable	must meet requirement	not applicable	Registration and ATL status as an attachment with Schedule 1 (in case of sole proprietor/firm/company or Schedule 1 & Schedule 2 (in case of JV) along with attachments

1.4 Registration with KPRA

Registered with KPRA for sales tax on Services and having active taxpayer status.	must meet requirement	not applicable	must meet requirement	not applicable	Registration and active status as an attachment with Schedule 1 (in case of sole proprietor/firm/company or Schedule 1 & Schedule 2 (in case of JV) along with attachments

1.5 Registration with PEC

Valid Registration with PEC for Electrical and Mechanical works (ME05 and CE09) work with category C-6 or above.	must meet requirement	not applicable	not applicable	must meet requirement (Lead Partner)	Registration certificate as an attachment with Schedule 1 (in case of sole proprietor/firm/company or Schedule 1 &

					Schedule 2 (in case of JV) along with attachments

1.6 Not Blacklisted

The Service Provider shall not be blacklisted by any federal or provincial public entity in Pakistan, is neither insolvent nor bankrupt, is not in the process of winding up nor his/her properties are under the control of receiver nor his/her business activities have been suspended nor legal proceedings for any of the foregoing are imminent or have been initiated against him/her and has fulfilled all obligations under law for the time being in force.	must meet requirement	not applicable	must meet requirement	not applicable	E-stamp paper of PKR.150 and duly notarized as an attachment with Schedule 1 Schedule 1 (in case of sole proprietor/firm/company or Schedule 1 & Schedule 2 (in case of JV)

2. Qualification Criteria

2.1. Financial Soundness (Historical Financial Performance)

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
The Service Provider's net worth for the last year (2024) calculated as the difference between total assets and total liabilities should be positive.	must meet requirement	not applicable	must meet requirement	not applicable	Audited financial statements for the last three (03) years (2022-2024) (if the bidder is a company) or list of certified payment received from contracts in progress or completed satisfying the net worth criteria for last year (2024) along with income tax returns for the same year (if the bidder is a firm or individual) as an attachment with Schedule 3)

2.2. Financial Soundness (Average Annual Business Turnover)

Minimum average annual business turnover of PKR. 20 million calculated within last three (03) years (2022-24).	must meet requirement	must meet requirement	Must meet 25% of the requirement	The Lead shall meet at least 40% of Requirement	Audited financial statements for the last three (03) years (2022-2024) (if the bidder is a company) or a list of certified payment received from contracts in progress or completed satisfying the turnover criteria for last three years, 2022, 2023 and 2024, along with income tax returns for the same years. (if the bidder is a firm or individual) as an attachment with Schedule 3.

2.3. Contractual Experience

The Service Provider must demonstrate experience in the operation and maintenance of both types of systems, as described below: **1. VRF/HVAC System:** At least one project (in progress or completed), with public or private entities, in last 5 years (2021 onward) involving	must meet requirement	must meet requirement	not applicable	The Lead Partner must meet at least 50% of the technical experience requirement i.e.; have	i. Letter of Award or contract agreement or any other credible record to substantiate experience; and ii. Completion

operation and maintenance of a VRF or HVAC system with a minimum combined capacity of 100 HP. **2. Sewage Treatment Plant (STP):** At least one project (in progress or completed), with public or private entities, in the last 5 years (2021 onward) involving operation and maintenance of a sewage treatment plant with a capacity of at least 100 m^3/day, including pump operations and sludge management. **Note:** A single project covering both components (VRF and STP) will be acceptable. Otherwise, separate projects must be submitted for each.				one executed/ in-progress at least one project related to VRF or STP).	certificate (in case the project is completed) or anticipated completion certificate (in case the contract is in progress). (Both as an attachment with Schedule-4)

Section 4 - Bidding Forms

Table of Forms

TABLE-1. CONTENTS OF TECHNICAL PROPOSAL

Order	Document Number and Information Required	Check (Y/N)	Page No.
A	**Proposal Submission**		
1.	Letter of Technical Proposal		
2.	An affidavit on E-Stamp paper of PKR.150 or above and dully notarized stating that a bid security amounting to 2 percent of the total proposal price, without indicating the figure in the affidavit, has been placed in the Financial Proposal in accordance with ITSP 17.1.		
3.	Non-blacklisting certificate on E-Stamp Paper of PKR.150 and dully notarized (affidavit) to the effect that the Service Provider is not blacklisted by any federal or provincial public entity in Pakistan, is neither insolvent nor bankrupt, is not in the process of winding up nor his/her properties are under the control of receiver nor his/her business activities have been suspended nor legal proceedings for any of the foregoing are imminent or have been initiated against him/her and has fulfilled all obligations under law for the time being in force.		
4.	**Schedule-5. Affidavit of Integrity Pact** on E-Stamp Paper of PKR.150 and dully notarized		
5.	**Schedule-6. Authorization/Power of Attorney (**if the Service Provider participating in the bidding through a representative. In case of a Joint Venture, power of attorney shall be submitted separately by each partner**)** on E-Stamp Paper of PKR.150 and dully notarized (affidavit) authorizing the signatory of the Proposal, in accordance with ITSP 18.2 on the forms provided under Section 4 (Bidding Forms) **Schedule-7**. **Authorization/Power of Attorney (for Joint Venture only)** for nomination of Lead Member shall be signed by legally Authorized Representatives/signatories of all the joint venture partners members to be submitted on E-Stamp Paper of PKR.150 and dully notarized (affidavit). The authorization shall exclusively bear the statement that All partners of the joint venture shall at all times and under all circumstances be liable jointly and severally for the execution of the Contract in accordance with the Contract terms as per ITB Clause 4.1 (d) of the RFP.		
6.	A copy of the Joint Venture Agreement or a Letter of Intent to execute a Joint Venture Agreement in the event of a successful Service Provider shall be signed by all partners and submitted with the Technical Proposal, together with a copy of the proposed agreement. **(submitted in case of the Service Provider is a Joint Venture)**		
B	**Eligibility**		
1.	**Scheduel-1. Service Provider's/Lead Member's Information Sheet** along with relevant attachments **OR** **(In case of Joint Venture)** **Schedule-1. Service Provider's/Lead Member's Information Sheet** along with relevant attachments &		

	Schedule-2 Joint Venture Information Sheet along with attachments		
C	**Qualification**		
1.	**Schedule-3. Financial Soundness** along with attachments		
2.	**Schedule-4. Contractual Experience** along with relevant attachments.		

TABLE-2. CONTENTS OF FINANCIAL PROPOSAL

Order	Document Number and Information Required	Check (Y/N)	Page No.
1.	Letter of Financial Proposal		
2.	Copy of bid security in accordance with ITSP 17.1.		
3.	**Schedule-8. Breakup of Proposal Prices**		

Note: The Service Provider shall be required to submit original bid security in hard, sealed and enclosed in and envelope as per requirement of RFP, on or before deadline for submission of bids. Non-submission of bid security in hard, on or before the deadline for submission of bid, shall lead to rejection of the proposal.

Letter of Technical Proposal

Note-

The service provider must accomplish the Letter of Technical Proposal on its letterhead (in case of JV letterhead of lead partner is allowed) clearly showing the service provider's complete name and address.

Date: .....

Request for Proposal Document No.: .....

To:

Chief Executive Officer (CEO), TransPeshawar,
First Floor, KPUMA Building,
Main BRT Depot, Near NHA Complex,
Chamkani, Peshawar.

I/We, the undersigned, declare that:

(a) I/We have examined and have no reservations to the Request for Proposal Document, including Addenda issued in accordance with Instructions to Service Providers (ITSP) Clause 8.

(b) I/We offer to execute in conformity with the Request for Proposal Document the following Services:

"Operation and Maintenance of VRF System and Sewerage Treatment Plant in KPUMA building.

(c) My/Our Proposal consisting of the Technical Proposal and the Financial Proposal shall be valid for a period of one hundred Eighty (180) days from the date fixed for the Proposal submission deadline in accordance with the Request for Proposal Document, and it shall remain binding upon me/us and may be accepted at any time before the expiration of that period.

(d) If my/our proposal is accepted, I/we commit to obtain a performance security in accordance with the Request for Proposal Document.

(e) [I have nationality of Pakistan]/[We are incorporated/registered in Pakistan.]

(f) I/We do not have any conflict of interest and have no pending litigation decided against us.

(g) I/We are not participating, as a Service Provider in more than one Proposal in this bidding process.

(h) I/We have never been blacklisting from any provincial or federal public entity.

(i) I/We agree to permit the Procuring Entity or its representative to inspect our accounts and records and other documents relating to the bid submission.

(j) I/We understand that this Proposal, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed.

(k) I/We understand that you are not bound to accept the lowest evaluated Proposal or any other Proposal that you may receive.

Name of Authorized Representative .....

Designation .....

Sign of Authorized Representative .....
.....

Name of Service Provider with Seal (in case of JV, Name of JV with Seal and signatures of all partners). .....

Date .....
.....

Schedule-1

(Eligibility)

Service Provider's/Lead Member's Information Sheet	
Service Provider's legal name	
In case of Joint Venture Lead member's legal name	
In case of a Joint Venture, legal name of each partner	
Service provider's/Lead member's nationality or country of constitution	
Service provider's/Lead member's year of constitution in case the bidder is a firm or company	
Service provider's/Lead member's Year of registration with FBR for income tax and sales tax	
Service provider's/Lead member's Year of registration with KPRA for sales tax on service	
Service provider's/Lead member's year of registration with PEC for Electrical and Mechanical works (ME05 and CE09) with category C-6 or above.	
Service provider's/Lead member's legal address in country of nationality/constitution	
Name of Service provider's authorized representative in case the service provider is a firm/company (In case of JV authorized representative of JV) (name, address, telephone number(s), fax number(s), e-mail address)	

Attached are copies of the following documents.

- ❑ 1. In case of sole proprietor attach a copy of CNIC, or articles of incorporation or constitution or certificate of registration of the legal entity if the service provider is a firm/ or company (In case of JV particulars of Lead Member);
- ❑ 2. In case of a Joint Venture, a letter of intent to form a Joint Venture along with copy of proposed JV agreement or Joint Venture agreement;
- ❑ 3. Certificate of Registration with FBR for income tax and sales tax and reflected on Active Taxpayer List (ATL) (In case of JV particulars of Lead Member);
- ❑ 4. Certificate of Registration with KPRA for Sales Tax on Services (In case of JV particulars of Lead Member);
- ❑ 5. Certificate of registration with PEC for Electrical and Mechanical works (ME05 and CE09) with category C-6 or above (In case of JV particulars of Lead Member);
- ❑ 6. Non-blacklisting certificate on E-stamp paper of PKR.150 and duly notarized to the effect that Lead Member is not blacklisted by any federal or provincial public entity in Pakistan, is neither insolvent nor bankrupt, is not in the process of winding up nor his/her properties are under the control of receiver nor his/her business activities have been suspended nor legal proceedings for any of the foregoing are imminent or have been initiated against him/her and has fulfilled all obligations under law for the time being in force.

Schedule-2

(Eligibility)

Each member of the Joint Venture must fill out this form separately and attach respective documents indicated below.

Joint Venture Information Sheet	
Service Provider's legal name	
Joint Venture Partner's legal name	
Joint Venture Partner's nationality or country of constitution	
Joint Venture Partner's year of constitution in case the Joint Venture Partner is a firm or company	
Joint Venture Partner's Year of registration with FBR for income and sales tax	
Joint Venture Partner's Year of registration with KPRA for sales tax on service	
Joint Venture Partner's year of registration with PEC for Electrical and Mechanical works (ME05 and CE09) with category C-6 or above.	
Joint Venture Partner's legal address in country of nationality/constitution	
Joint Venture Partner's authorized representative information (name, address, telephone number(s), fax number(s), e-mail address)	

Attached are copies of the following documents.

- ❑ 1. In case of sole proprietor attach a copy of CNIC, or articles of incorporation or constitution or certificate of registration of the legal entity if the joint venture partner is a firm/company;
- ❑ 2. Certificate of Registration with FBR for income tax and sales and reflected on Active Taxpayer List (ATL);
- ❑ 3. Certificate of Registration with KPRA for Sales Tax on Services;
- ❑ 4. Non-blacklisting certificate on E-stamp paper of PKR.150 and duly notarized to the effect that JV partner is not blacklisted by any federal or provincial public entity in Pakistan, is neither insolvent nor bankrupt, is not in the process of winding up nor his/her properties are under the control of receiver nor his/her business activities have been suspended nor legal proceedings for any of the foregoing are imminent or have been initiated against him/her and has fulfilled all obligations under law for the time being in force..

Schedule-3

Financial Soundness

Each Service Provider must fill out this form.

In case of a Joint Venture, each Joint Venture Partner must fill out this form separately and provide the Joint Venture Partner's name below:

Name of Joint Venture Partner (if applicable): _____

Financial Data for Previous 03 Years		
Year 1: 2022	**Year 2: 2023**	**Year: 2024**

Information from Balance Sheet

Total Assets (TA)			
Total Liabilities (TL)			
Net Worth = TA – TL			

Information from Income Statement

Total Revenues			
Profits Before Taxes			
Profits After Taxes			

❑ In case the Service Provider is a company, attached are copies of audited financial statements (balance sheets including all related notes and income statements) for the last 03 years, as indicated above, complying with the following conditions. In case joint venture, financial statements shall be submitted by all members.

- Unless otherwise required by Section 3 of the Request for Proposal Document, all such documents reflect the financial situation of the legal entity or entities comprising the Service Provider and not the Service Provider's parent companies, subsidiaries, or affiliates.
- Historical financial statements must be audited by external auditor approved by SECP having UDIN as per applicable law.
- Historical financial statements must be complete, including all notes to the financial statements.
- Historical financial statements must correspond to accounting periods already completed and audited (no statements for partial periods shall be requested or accepted).

❑ In case the Service Provider is a sole proprietor or a firm, attach as list of certified payment received from contracts in progress or completed satisfying the turnover and net worth criteria for last three years, 2022, 2023 and 2024, along with income tax returns for the same years.

Schedule-4

Contractual Experience

Each Service Provider must fill out this form. Submit separate form for Joint Venture Partner.

Name of Joint Venture Partner (if applicable): _____

Contract of Similar Size and Nature		
Contract No . . . . . **of**	**Contract Name**	
Award Date		**On Going/Completed (if completed provide Date of completion)**
Total Contract Amount	**PKR.**	
Combined capacity of VRF or HVAC system (in HP) and capacity of sewage treatment plant (in m³/day) for a given project		
If partner in a Joint Venture or subcontractor, specify participation of total contract amount	**Percent of Total**	**Amount**
Employer's name **Address** **Telephone number** **Fax number E-mail**		
Description of the Similarity in Accordance with Criterion 2.3 of Section 3 (Eligibility and Qualification Criteria)		

❑ Attached Letter of Award/Acceptance or contract agreement or any other credible record to substantiate information provided in Schedule 4.

❑ Attach completion certificate (in case the contract completed) or anticipated completion certificate (in case the contract is in progress).

Schedule 5

Affidavit of Integrity Pact

(To be submitted on E-stamp paper of PKR.150 and duly notarized)

(In case of Joint Venture to be submitted by each joint venture partner)

_____ [Name of Service Provider] hereby declares its intention not to obtain or induce the procurement of any contract, right, interest, privilege or other obligation or benefit from Government of Pakistan or any administrative subdivision or agency thereof or any other entity owned or controlled by it (Government of Pakistan) through any corrupt and fraudulent business practice.

Without limiting the generality of the foregoing, [Name of Service Provider] represents and warrants that it has fully declared the brokerage, commission, fees etc. paid or payable to anyone and not given or agreed to give and shall not give or agree to give to anyone within or outside Pakistan either directly or indirectly through any natural or juridical person, including its affiliate, agent, associate, broker, consultant, director, promoter, shareholder, sponsor or subsidiary, any commission, gratification, bribe, finder's fee or kickback, whether described as consultation fee or otherwise, with the object of obtaining or including the procurement of a contract, right, interest, privilege or other obligation or benefit in whatsoever form from Government of Pakistan, except that which has been expressly declared pursuant hereto.

_____ [Name of Service Provider] certifies that it has made and will make full disclosure of all agreements and arrangements with all persons in respect of or related to the transaction with Government of Pakistan and has not taken any action or will not take any action to circumvent the above declaration, representation or warranty.

_____ [Name of Service Provider] accepts full responsibility and strict liability for making any false declaration, not making full disclosure, misrepresenting facts or taking any action likely to defeat the purpose of this declaration, representation and warranty. It agrees that any contract, right, interest, privilege or other obligation or benefit obtained or procured as aforesaid shall, without prejudice to any other right and remedies available to Government of Pakistan under any law, contract or other instrument, be voidable at the option of Government of Pakistan.

Notwithstanding any rights and remedies exercised by Government of Pakistan in this regard, [Name of Service Provider] agrees to indemnify Government of Pakistan for any loss or damage incurred by it on account of its corrupt and fraudulent business practices and further pay compensation to Government of Pakistan in an amount equivalent to ten time the sum of any commission, gratification, bribe, finder's fee or kickback given by [Name of Service Provider] as aforesaid for the purpose of obtaining or inducing the procurement of any contract, right, interest, privilege or other obligation or benefit in whatsoever form from Government of Pakistan.

Name of Authorized Representative .....

Designation .....

Sign of Authorized Representative .....
.....

Name of Service Provider with Seal .....

Date

Schedule 6
Authorization/Power of Attorney

(For a Service Provider participating in the bidding through a representative. In case of a Joint Venture, power of attorney shall be submitted separately by each partner)

(To be submitted on E-stamp paper of PKR. 150 and duly notarized)

THIS POWER OF ATTORNEY is executed at _____ **[insert Place]** on this day of_____ **[insert Date]**, by _____ **[insert name of the Service Provider]** at _____ **[insert the address]** (hereinafter, referred to as the "Grantor"), which expression wherever occur in these presents shall also mean and include its successors-in-interest and assigns.

WITNESSETH

WHEREAS the Grantor intends to submit a proposal to the TransPeshawar (The Urban Mobility Company) (hereinafter, referred to as "the Procuring Entity"), in respect of "**Operation and Maintenance of VRF System and Sewerage Treatment Plant in KPUMA building"** (hereinafter, referred to as "the Services"), and to do the follow up related actions (hereinafter, jointly referred to as "the Transaction"), and for this purpose, the Grantor considers it necessary and expedient to appoint a representative/attorney.

WHEREAS the Instructions to Service Providers contained in the Request for Proposal Document (RFP), for the Services, warrants submission of a Power of Attorney to the said appointment.

WHEREAS the Grantor represents and warrants to the Procuring Entity that all corporate and other actions required to give effect to this Power of Attorney have been duly taken and are subsisting.

NOW THEREFORE THIS DEED WITNESSETH the Grantor does hereby, irrevocably and unconditionally, nominate, constitute and appoint Mr./Ms. _____, son/daughter of_____, residing at _____and holding CNIC No. _____as its true and lawful attorney holding designation [**insert the designation**] (hereinafter, referred to as "the Attorney") to do or cause to be done all such acts, deeds, matters, and things which the Grantor may now do or in future may become interested to do in connection with the Transaction, including:

1. to visit and inspect the Site, seek clarification of the RFP, and attend the pre-bid meeting;
2. to prepare and submit a Proposal following provisions of the RFP;
3. to attend the Proposal opening event and the bidding process in respect of the Transaction and generally to take such actions and decisions as may be necessary for the bidding;
4. to negotiate, execute (underhand or under seal), sign, and deliver all contracts, instruments, deeds, agreements, applications, and other documents, to make amendments to the same whether or not material, and to submit the same to the Procuring Entity and/or any other interested parties;
5. to receive notices, instructions, and orders for and on behalf of the Grantor(s); and
6. to do all other things and to take all necessary steps incidental to the exercise of the above powers or which the Attorney considers necessary or expedient concerning the foregoing or the effective exercise of any power listed above.

The Grantor agrees that whatever the Attorney shall do or cause to be done according to this Power of Attorney shall be binding on the Grantor.

The Grantor agrees to ratify and confirm whatever the Attorney shall do or cause to be done under this Power of Attorney.

All terms used in this instrument, but not defined herein, shall have the meaning given to them in the RFP.

This Power of Attorney has not been revoked, amended or modified and remain valid and binding on the Granter.

IN WITNESS WHEREOF, the Grantor has executed this Power of Attorney on the date and place first written above.

WITNESSES: [Signature, Name, Father's Name, and CNIC]	[INSERT NAME OF THE GRANTOR] [Signature, Name, Designation, and CNIC]
1. _____	_____
2._____	_____

NOTARY PUBLIC: (Name, Signature, Seal, Number, and Date) _____

Letter of Financial Proposal

-Note-

The service provider must accomplish the Letter of Financial Proposal on its letterhead clearly showing the service provider's complete name and address.

Date: .....

Request for Proposal Document No.: .....

To:

Chief Executive Officer (CEO), TransPeshawar,
First Floor, KPUMA Building,
Main BRT Depot, Near NHA Complex,
Chamkani, Peshawar.

I/We, the undersigned, declare that:

(a) I/We have examined and have no reservations to the Request for Proposal Documents, including Addenda issued in accordance with Instructions to Service Providers (ITSP) 7.

(b) I/We offer to execute in conformity with the Request for Proposal Documents and the Proposal submitted for the following Services:

"Operation and Maintenance of VRF System and Sewerage Treatment Plant in KPUMA building"

(c) The Total Proposal Price is:

[*amount in PKR in words*], [*amount in PKR in figures*]

The total proposal price from the breakup of prices should be entered by the service provider inside this box. Absence of the total proposal price in the Letter of Financial Proposal may result in the rejection of the Proposal.

(d) My/Our Proposal shall be valid for a period of one hundred eighty (180) days from the date fixed for the proposal submission deadline in accordance with the Request for Proposal Documents, and it shall remain binding upon me/us and may be accepted at any time before the expiration of that period.

(e) If my/our Proposal is accepted, we commit to obtain a performance security in accordance with the Request for Proposal Documents.

(f) I/We understand that this proposal, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed.

(g) I/We understand that you are not bound to accept the lowest evaluated proposal or any other proposal that you may receive.

(h) I/We agree to permit the Procuring Entity or its representative to inspect our accounts and records and other documents relating to the proposal submission.

Name of Authorized Representative .....

Designation .....

Sign of Authorized Representative .....

.....

Name of Service Provider (in case of JV, Name of JV with Seal and Sign of all partners) .....

Date .....

Schedule-8

Breakup of Proposal Prices

S#	Description of Services	Unit	Quantity [A]	Price per unit in PKR Inclusive of All Taxes including sales tax on services [B]	Total Price in PKR Inclusive of All Taxes including sales tax on services C = [A x B]
1.	Operation and Maintenance of VRF System and Sewerage Treatment Plant in KPUMA building in accordance with Schedule of Requirement	Month	36		
2.	Items to be procured one time for VRF as per specification and standards provided under Annex- 3 to the Schedule of Requirement				
i	CU Compressors	No.	01		
Total Proposal Price in PKR (Inclusive of Taxes)					

Name of Authorized Representative .....

Designation .....

Sign of Authorized Representative .....

.....

Name of Service Provider (in case of JV, name of JV with Seal of all JV Partner).....

Date **.....**

Schedule of Requirement

TransPeshawar (The Urban Mobility Company) has been handed over multiple systems in Peshawar BRT which are installed and / or commissioned by Peshawar Development Authority (PDA). TransPeshawar, in this Schedule of Requirements (SoR), requires detailed Operations and Maintenance of these systems for their intended purposes. The services are required in KPUMA building.

The Service Provider shall be responsible for all costs of required services mentioned in RFP, Agreement, SOR and their annexures/ attachments. The operations and maintenance services are required for following Equipment:

a) Variable Refrigerant Flow (VRF) System which includes but not limited to the complete assembly, indoor ceiling mounted cassette units, outdoor condensing units (CU), compressors, sensors, Fan PCB, Invertor PCB, EMI PCB, main PCB, fan motor, 4 way valve, hub PCB, indoor EEV, indoor main PCB, indoor fan motor, control panels/ DBs, breakers, condensers fans, drain pumps, copper pipes, insulation, ssoftwire and fan coil units, filters, remotes, electrical wirings/ cables, communication cables, cards, ducting and complete overhauling of system installed at KPUMA building and allied components which are required for its intended use and operations. The jurisdictions are ground, first and second floor of KPUMA building from cassette type indoor unit to the outdoor units including control panels/ DBs (both units included). The work also involves supply, installation, commissioning, testing, operations and maintenance of Remote Monitoring solution for VRF system. The VRF System is installed in KPUMA building for heating and cooling system of offices at all floors.

b) Sewage Treatment Plant (STP) which includes but not limited to the complete assembly collection and distribution system, inlet chamber, screen chamber, equalization tank, drain channel, aeration tank, secondary clarifier(sedimentation tank), chlorine contact tank, sand filter, pumps, submersible pumps, chlorine pump, sludge pump, blowers, electric motors, pressure gauges, valves, filter water tank, shed, control panels/ DBs, sludge tank, product tank, civil tanks and manholes etc installed outside KPUMA building and allied components which are required for its intended use and operations. Procurement, operation and maintenance of one dewatering truck. The scope of work starts and ends at 70 feet from both sides of the plant and operations and maintenance activity includes for all items/ components within this range. STP is a treatment for all wastes and rain water accumulated in Depot, KPUMA building, ZU business center, and Station 01 which are collectively called ZU Complex. The STP is intended to treat and disposed all water and waste accumulated in ZU Complex to outlet.

The detail documents, drawings summery of above mention Equipment/Scope are provided in following Annexures: -

i. Details of Variable Refrigerant Flow (VRF) system s(Annex-1)

ii. Details of Sewerage Treatment Plant Location and number (Annex-2)

iii. VRF one-time Procurement (Annex-3)

1.1 HANDING OVER OF EQUIPMENTS FOR OPERATIONS & MAINTENANCE

1.1.1 The Equipment as mentioned in Section 1 of this document will be handed over to the Service Provider in the state handed over by Peshawar Development Authority and Service provider will take-over these for required operations and maintenance in accordance with scope of this Contract/Agreement.

1.1.2 If both parties do not agree to extend the Contract, the Service Provider shall seek in writing a Handing Back Certificate (HBC) from the TPC at least 60 days before the expiry of the

Contract. The TPC will issue such a certificate within 45 days provided that the equipment handed back is in good condition. Upon obtaining the HBC, the Service Provide shall be deemed clear of all obligations. However, until issuance of HBC which does not affect liability of Service Provider to keep System in fully operational condition even after expiry of contract, the Service Provider shall be bound to continue rendering O&M services, and the TPC shall continue to pay for such additional O&M Services. In addition, during this period, TPC and the Service Provider shall work jointly to solve any pending issues (if any). The final Invoice from the Service Provider shall include any such period of Services, which in any case shall not exceed 45 days.

1.2 GENERAL MAINTENANCE OBLIGATIONS OF EQUIPMENTS

The Service Provider shall: -

1.2.1 Ensure that all Equipment are in satisfactory operational condition (fair wear and tear excluded) so that they conform to the operational standards mentioned in the SoR. This means, in particular, that all Equipment should be clean, tidy, well-maintained, in running conditions and meeting all health and safety requirements;

1.2.2 Take responsibility for provision of all replacement parts and supplies for all maintenance issues of Equipment. The Service Provider shall procure any future spare parts and supplies (lubricants, Compressor oil, Refrigerant gas, Chemicals/Chlorin, wires and all other parts/fluids mentioned above.) pursuant to documentation provided by the manufacturer, their agent, supplier or required for maintenance and / or operation of Equipment. The spare parts shall be genuine, brand new, non-refurbished, un-altered and imported through proper channel and incorporate all recent improvements in design and material. Service Provider shall provide proof of genuine and/or imported item/spare parts to TPC on demand;

1.2.3 Be responsible for all material and associated costs for repair actions of Equipment caused by theft or other scheduled / unscheduled incidents;

1.2.4 Keep record of each spare part used, reason for replacement, total spare used, remaining spare parts etc. and follow Protocol issued by TPC for use, record and inventory of the same. The Service Provider shall provide to TPC such record in prescribed time on demand;

1.2.5 Arrange spare parts store within the locality of BRT containing all necessary items / parts required for the maintenance of the said systems. This critical inventory list need be prepared on monthly basis. Ensure that the critical spare parts which may delay the operation for prolonged duration are in stock in sufficient quantity to ensure the smooth operations. TPC may notify such spare parts and their quantity to be always available in stock during period of the contract.

1.2.6 Procure, transport and maintain any tools, software and diagnostic equipment, lifting equipment, machinery (boom buckets, lifters & cranes when required), calibrated test equipment, which it deems necessary to carry out the Services in accordance with the Agreement;

1.2.7 Coordinate with authorized agent of Equipment and /or Original Equipment Manufacturer (OEM) for defects / software issues or any other purpose to perform the required services at its own cost and risk. Service Provider shall bear the cost of such coordination;

1.2.8 Follow direction / Protocol of TPC regarding cleaning of Equipment;

1.2.9 Maintain and provide tags to all electrical and mechanical equipment including tags on cables;

1.2.10 Maintain all conduits /pipes relevant to the scope of work. Maintain, protect and provide replacement (where required) for all types of wires and cables (both data and power cables) connecting to Equipment;

1.2.11 Maintain Asset register having details of all Equipment in his custody with asset number and facilitate TPC to include in their Assets management System, if asked by TPC;

1.2.12 Prepare code of conduct for its staff and obtain approval of TPC;

1.2.13 Get additional information or missing information at its own cost about equipment, or its maintenance and operations requirements, if required; and

1.2.14 Ensure and maintain protective devices and earthing systems are operated and maintained to reduce the risk to equipment and operations/maintenance personnel from hazardous voltages or currents. Maintenance for each earth pit consists of checking of earth connection / continuity from equipment's end to earth pit end, fixing of earth plate and measuring of earth resistance with the help of standard earth resistance test meter. Proper cleaning of earth pit. Maintain standard earth resistance by providing standard moisture level deep inside earth pit.

1.3 OPERATIONS & CONTROL OBLIGATIONS OF THE EQUIPMENTS

The Service Provider shall: -

1.3.1 Operate reliably Equipment to meet the operational requirements of the systems mentioned in section 1 and respective operational and maintenance manual. The Equipment operational hours are 24 hours/day, 7 days a week and 365 days a year;

1.3.2 Engage suitable, skilled and appropriate number of human resource to carry out all Required Services and responsible for all costs including human resource regarding operation and maintenance of the systems mentioned in section 1 which includes replacement of parts for preventive, corrective, and operational maintenance and /or defective/damaged goods/Equipment due to whatever reason. These includes costs of all services mentioned in the SOR and Agreement;

1.3.3 The Service Provider shall provide staff or train authorized representative of TransPeshawar to perform operation on/off activity of all systems at its own responsibility. The staff provided by the Operator shall be in proper uniform;

1.3.4 Ensure safety tool in working condition and checked periodically as recommended by manufacturer. Provide safety equipment, personal protection equipment and other necessary materials as required for the execution of services under the contract;

1.3.5 To prepare Operation Control and Maintenance Procedure/ Manual for all equipment's mentioned in this document, and shall submit to TPC for approval. Service Provider shall update Manual from time to time and the Manual shall include operation hours of equipment, routine checks/ daily check-list, preventive and corrective maintenance schedules, standard operation procedures of the equipment, training duration etc. Service Provider shall finalise the details format with TPC and update as and when needed;

1.3.6 To respond to Operation and maintenance issues reported by TPC;

1.3.7 Follow instructions / Protocol of TPC regarding procedure of operation, duration of operation of all Equipment, Energy plan and schedule for operation of such Equipment; and

1.3.8 Coordinate all hardware and software maintenance activities as well as routine maintenance activities in advance with TPC.

1.4 DETAILED MAINTENACE OBLIGATION OF THE EQUIPMENTS

The Service Provider maintenance and repair obligations shall include but not be limited to: -

a) The Service Provider shall procure any future spare parts and supplies (Compressor Oils, lube, Refrigerant Gas, supplies (wires, cables, switches, electronic/mechanical gadgets, electronic/mechanical material, etc.), spare parts i.e. filters, Compressors, PCB Cards, all cards, condensers, valves, relays, grease, coolant, filter, relays, batteries, switches, breaker, pressure Gauges, sand filters, valves, Pumps motors, submersible pumps non-return, screen bars, rails valves ,sensors, air blower, Probe, electrical equipment detergents, cleaners, preservative, cotton waster etc. If required, pursuant to documentation provided by the manufacturer, their agent, supplier or required for maintenance and / or operation of Equipment.

b) A detailed monthly maintenance program covering daily activities shall be developed and implemented by Service Provider. Such schedules shall be produced to TransPeshawar on demand. The operation staff shall maintain a log sheet and book, for the documenting the maintenance data, activities and events as per the requirements;

c) Preventive, corrective and operational maintenance including minor and major overhaul in accordance with the manufacturer's maintenance / operational manual and shall be documented. The data documentation shall be in accordance with the maintenance requirements, mentioned herein and those which are given in the manufacturer's instruction manuals;

d) Rectify all faults occurred in relevant Equipment i.e., Water leakage, welding, short circuit, open circuit, phase sequence, under/over voltage, change, under / over voltage, phase missing, leakage current and earth faults etc.

e) Any repair or replacement required, necessitated or caused as a result of, or generally resulting from, or in connection with, the following;

   i) Accidental or intentional damage to Equipment;

   ii) Labour disturbances attributed to the Service Provider's employee;

   iii) Improper or negligent use of the Equipment;

   iv) Use of Equipment in breach of the terms and conditions of the Agreement;

   v) Incompetence's of the Service Provider or the employees, subcontractors or any third party in operating, handling, working, or otherwise dealing with the Equipment;

   vi) Servicing, maintenance or repairs to the Equipment by any third party other than in accordance with the OEM recommendations;

   vii) Minor repairs strictly necessary and carried out in an emergency situation or breakdown;

   viii) Theft of Equipment or their components;

   ix) Failure to comply with the manuals applicable to Equipment,

   x) Failure or malfunction of any component or equipment which is not provided by an OEM or TPC;

   xi) Use of contaminated or non-OEM approved lubricants, additives or spare parts;

xii) Maintenance, repair or replacement, as the case may be, of the paintwork, side railing, approaches to Equipment, structure, stone damage, accident damage, etc. where Equipment are installed and handed over for operation and maintenance;

xiii) Attending to breakdowns and generally delivery to or collection or transportation from the point of service, salvage or breakdown;

xiv) Non- compliance by the Service Provider with any other obligations under the maintenance provisions specified in the Agreement;

xv) Tempering with the Equipment or its parts, controls and any specialised Equipment;

xvi) Operating the Equipment in a manner that may harm the Equipment, electrical and other components;

xvii) Equipment component damage due to Service Provider negligence during maintenance and in checking and maintaining oil, lubricants and fluid levels as applicable in the applicable OEM operating manual; and

xviii) Breakdown of equipment due to whatsoever reason.

f) In addition to above, the Service Provider shall, among other things:

i) Protect the work area to ensure general public safety prior to start of any Equipment maintenance work;

ii) Perform the required regular checks, in accordance with the manuals and including the checking of coolant levels, lubricant levels, alignment, Oil testing etc.;

iii) Replace lost parts, and safety tool of Equipment or components of Equipment;

iv) Attend to the fitment, service or repair of any parts or equipment necessary pursuant to any applicable law which may come into force after the Signature Date;

v) Carry out maintenance and repairs of the Equipment in accordance with industry best practices to maintain Technical Specification and meet functional Specifications;

vi) Keep and use the Equipment in a proper and prudent manner and ensure that only duly qualified and competent persons are allowed to operate the Equipment;

vii) Ensure that the OEM running-in instructions and proper responses to systems warnings are fully understood and properly observed;

viii) Not use Equipment for any purpose for which it is not designed or its use is specified;

ix) Ensure that no components of the Equipment are removed or exchanged except where defective and in the course of normal service, repair or replacement and generally ensure that the Equipment are operated in complete condition;

x) Take all reasonable steps and precautions to minimise damage to the Equipment and in particular, but without limitation, in the event of any defect or failure occurring in the Equipment.

xi) Service the Equipment at relevant internals in accordance with the relevant Equipment manual, best industry practices and/ or TPC’s instructions;

xii) Promptly repair the Equipment in accordance with the relevant Equipment Manual and instructions. The service provider shall provide feasible solution for repeatedly occurring faults resulting operational loss;

xiii) Ensure that only Compressor oils, Spare parts and additive as prescribed by the OEM/TPC are used. In the event that the Service Provider proposes to use any

alternative to the additive as prescribed by the OEM, first obtain authorization from TPC and reasonable conditions may be imposed;

xiv) Allow TPC's authorized Representative to inspect the Equipment, have access to and be entitled to, download, all information available from the Equipment (whether directly or indirectly);

xv) Execute required improvements (holes, piping, welding, cutting, replacement, railing etc.), clear the site from all debris and restore the structure to original condition during the performance of his duties; and

xvi) Responsible for all daily checks.

1.5 SPECIAL OBLIGATIONS REGARDING VRF SYSTEM

The Service Provider shall be responsible:

1.5.1 To operate reliably Equipment to meet the operational requirements of human Comfort temperature (18°C to 30°C) in KPUMA building;

1.5.2 To undertake deep cleaning/overhauling of indoor & outdoor VRF system immediately and periodically in accordance with the requirements;

1.5.3 For Copper pipe/ gas leakages rectifications, circuit malfunction/ repair/ replacement, insulation rectification, washing services (indoor & Outdoor), drain piping rectification, compressors repair/ replacement, filters replacement, remotes, Fan PCB, Invertor PCB, EMI PCB, main PCB, fan motor, 4-way valve, hub PCB, indoor EEV, indoor main PCB, indoor fan motor, electrical wiring/ cabling and allied components which are required for its intended use and operations.;

1.5.4 For regular cleaning of filters in cassette units and any damage to sensors in cassette units;

1.5.5 For regular cleaning of outdoor condensing units and any damage to sensors/ cards in outdoor units;

1.5.6 For detailed cleaning of ducts and any leakage from indoor units;

1.5.7 For the operation and maintenance of software system of VRF;

1.5.8 For any cost/ risks associated with the original manufacturer or their agent for operation and maintenance of the system;

1.5.9 For operation and maintenance of electrical system of VRF system in KPUMA building;

1.5.10 For the operations and maintenance of training from the OEM original manufacturer;

1.5.11 To conduct any other activity which is required for the operations/ intended use of the system;

1.5.12 To service (in-door / out-door), and maintain six standing units (2 tons each) in control centre along with maintenance of drainage/ leakage control every six months;

1.5.13 Arrangement of ladder or any other tools, machinery and accessories required for deep cleaning; and

1.5.14 Supply, installation, commissioning, operations and maintenance of Web Based Remote Monitoring System (RMS) / Energy Management System of VRF system. The following minimum feature shall be provided in RMS;

a. Dashboard showing status of all out door / indoor units;
b. Able to ON/OFF each outdoor and indoor unit remotely;
c. Faults status;
d. Temperature Control;
e. Electrical Parameters of system;
f. Operation Scheduling;
g. Load status;
h. Printing of reports;
i. Consumption of each unit; and
j. Any other parameter required for operation.

1.5.15 The One No of CU Compressor are faulty or non-functional in the outdoor condensing unit of the VRF system and shall be replaced under this agreement as a one-time procurement.

1.5.16 The Service Provider shall be responsible for engaging two (02) technicians, who shall work in two shifts, and one (01) janitor, who shall work in the morning shift or as per the direction and requirements of TransPeshawar. The staff shall be compensated at or above the applicable minimum wage rate as well as per the labour law.

1.5.17. The service provider shall ensure one expert visit on a monthly basis to conduct a technical inspection of the system. TransPeshawar shall pay PKR 10,000 per month upon submission of the attendance sheet/proof to the concerned department.

1.6 SPECIAL OBLIGATIONS REGARDING SEWERAGE TREATMENT PLANT (STP)

The Service Provider shall be responsible:

1.6.1 To understand the STP operation and maintenance requirements as mentioned in the “Operation and Maintenance Manual Package Type Sewerage Treatment Plant” (**Annex-2**) (hereafter called Manual) attached with this agreement and its associated costs;

1.6.2 For the Operation and maintenance of STP Equipment to meet the operational requirement of the system;

1.6.3 For the replacement of missing or additional parts required for the operational requirements of the system in accordance with the Manual;

1.6.4 For all the civil works which are incomplete or constructed improperly and not meeting the intended purpose for operations of the plant. These civil works are perquisite for the operation of the plant in accordance with the Manual. These works include but not limited to the flushing of tanks, removal of concrete blocks or debris, leakage involves, broken pipe, leveling required etc. The Service Provider understands that this is one-time activity and which needs to be done within first week of the commencement date. During this period the Service provider shall arrange to remove sewerage manually. The Service Provider shall also maintain the Civil works as required for the operations and maintenance of the STP;

1.6.5 For movable pump/ truck, if required due to whatsoever reason, to discharge waste from sewerage tank to sewer/Khwar or sludge removalal to avoid overflow in drainage system;

1.6.6 For removal and safe disposal of wastes, sludge, waste collected in surrounding manholes/ manual cleaning chambers in accordance with the Applicable law.

1.6.7 For additional lighting works within the vicinity of the STP if required and development and maintenance of green belt in 70-feet length near STP;

1.6.8 For the installation of additional fibre sheets to protect equipment of the STP (if required), painting of shed and plant structure (at least once in a year) and cleaning of STP yard within 70 feet inside boundary wall;

1.6.9 For the arrangement of movable dewatering trucks/ pumps (if required) in case of overflow or excessive rains or breakdown of plant;

1.6.10 For top up of chlorine in the plant, removal of activated sludge from sludge tank in accordance with the Manual, cleaning of fine screeners at least 2 to 3 times a day;

1.6.11 To provide training to the Plant Operator from the OEM original manufacturer or its agent and provide refresher courses at least once in a year. The Service provider shall provide certificates of such training to TPC on demand;

1.6.12 Will hired truck/sucker tanker in case of overflow/ flooding anywhere in ZU Complex (Station 01, depot, KPUMA, ZU Business Centre) when required.

1.6.13 For Plant performance monitoring tests on frequency in accordance with the Manual;

1.6.14 For cleaning of underground drainage / sewerage system including manholes in scope of area (approximately 20 Nos), pipes, removal of debris in manhole, periodic removal / closing of covers (to release gases), maintenance of manhole covers etc. Service Provider shall engage necessary human resource and machinery for this purpose as and when required. The service provider shall remove/clean all the manholes and submit report quarterly with pictures that all the manholes are cleared;

1.6.15 For provision of Personal protective equipment in accordance with the Manual; and

1.6.16 Conduct any other activity which is required for the operations/ intended use of the system or specified in the Manual.

1.6.17 The Service Provider shall be responsible for engaging two (02) technicians, who shall work in two shifts, and one (02) driver/janitor, who shall work in the morning shift or as per the direction and requirements of TransPeshawar. The staff shall be compensated at or above the applicable minimum wage rate as well as per the labour law.

1.7 MONTHLY OPERATIONS REPORT

No later than 17:00 PM on the 3rd Business Day of each month, starting on the last Business Day of the first Calendar month after the Commencement Date, the Service Provider shall submit to TPC a report on the Performance of its obligations under the Agreement (on TPC demand) during the previous month, covering at a minimum:

a) List of Staff /Operator working and updated on monthly basis for the duration of the Agreement by the way of an exception report indicating the incoming and exiting staff/Operator for implementation in attendance system of TPC;

b) Quarterly Manholes and drainage report:

c) Performance on KPIs;

d) Items required by TPC for monitoring and performance evaluations;

e) Payment made to applicable l and ESSI for the previous month; and

f) Other indicator as agreed between the Service Provider and TPC.

1.8 KEY PERFORMANCE INDICATORS

i. The Service Provider's performance of operation, maintenance and services shall be evaluated by means of key performance indicators ("**KPIs"**). Failure to comply with KPIs ("**Failure Events"**) shall lead to the application of performance deduction as per the below table ("**Performance Deduction**"):

ii. The Service Provider shall, pay the Liquidated Damages depending on its performance in achieving the agreed performance rule as measure during course of the Contract.

iii. The Liquidated Damages for failure to achieve Key Performance Indicators (KPI) parameters will be implemented in accordance with Key Performance Indicators.

iv. Except for information available through SCADA system /Software, Network Monitoring System or complaint management system, or other system generated reports known to the Service Provider; any other information, if any, used by the TP to evaluate KPI will be transferred to the Service Provide once a week on request.

v. The Liquidated Damages is the final and full remedy of the TPC for the Service Provider failure to achieve the KPI targets, and such Liquidated Damages shall be deemed to have balance any breach whatsoever due to the lapses/deficiencies in performance.

vi. Any breach of defined service levels will entail Liquidated Damages which shall not exceed 10% of the monthly payments.

vii. STP is non-operated due to whatsoever reason continuously for more than one-month period will be considered as non-service. This will not constitute as Liquidated Damages and deduction per month will be made as per following details:

Non-Service deduction per month for STP = PKR: 15 % of the monthly invoice

1.8.1 General Violations and Their Liquidated Damages applicable to the Agreement

Sr. No	KPI	Failure Event	Performance Deduction Percentage
1	Prevention of Severe Accidents	Accident involving Equipment and software due to the Service Provider fault or malfunctioning of equipment resulting in death or severe physical injury of a person (**Severe Accident**)	10% per occurrence of monthly invoice

Sr. No	KPI	Failure Event	Performance Deduction Percentage
2	Prevention of Material Accidents	Accident involving Equipment and software due to the Service Provider fault or malfunctioning of equipment resulting in minor physical injury of a person or material damage to the TPC assets (**Material Accident**)	5% per occurrence
3	Repetition of issues	Occurrence of same issues by more than 10 times in the same month in same or multiple equipment	3 % per 10 occurrences
4	Transparent self-reporting	False or misreporting of monthly operations report	2 % per occurrence
5	Operations and Maintenance Manual	Operation and Maintenance activity not carried out in accordance with the Manual	3 % per occurrence
6	EVS System	Failure to respond to complaints/ resolution within 30 minutes	30 minutes – 1 hour = 1% per occurrence 1 – 3 hours = 2% per occurrence More than 3 hours = 3% per 2 hours
7.	Dragnet clause	Any act/instance that is non-conforming or a violation of Contract, Schedules of Requirements, Rules or Regulations of TPC, Instructions given by the TPC or violation of Protocol unless covered by another KPI	1 % per occurrence

1.8.2 Variable refrigerant flow system (VRF) KPI's

Sr.NO	KPI-1: VRF System Fault Rectification (FR)

	Fault shall be considered based on number of units effected: - 1. **Critical Category Fault (CCF):** Complete shutdown of VRF system (no cooling/ or heating as the case may be) during working hours at TPC office/control centre/building etc leading to service loss. Responding time is 30 Minutes and resolution time is 2 hours. 2. **High Category Fault (HCF):** Partial shutdown of VRF system (no cooling/ or heating as the case may be) during working hours at TPC office/control centre/building etc leading to service loss. Resolution time is 4 hours. 3. **Low Category Fault (LCF):** The VRF System can operate but not as per designed and intended functional use or within acceptable limits specified. There is no likelihood of service loss or safety issue and a possible workaround exists. Resolution time is 12 hours. TF = Total Faults Considered for KPI-1: = A + B x (C/ D) A = No of Faults Responded above the assigned resolution time but within 2 times the Assigned Resolution Time for a Particular Category; B = No of Faults Responded in more than 2 times the Assigned Resolution Time for a Particular Category C = Average Actual Resolution Time of 'B' expressed in units of Assigned Resolution Time of the Category under Consideration D = Assigned Resolution Time of the Category under Consideration		
	FR	**Threshold of FR**	**Performance Deduction Percentage (PDP)**
1	CCF= (Critical Fault solved within assigned resolution time) / (Critical Fault solved within assigned resolution time +TF Critical) x 100	More than 98 %	1 x $TF_{Critical}$
2	HCF= (High Fault solved within assigned resolution time) / (High Fault solved within assigned resolution time +TF High) x 100	More than 95 %	0.5 x TF_{High}
3	LCF= (Low Faults solved within assigned resolution time) / (Low faults solved within assigned resolution time +TF Low) x 100	More than 90 %	0.2 x TF_{Low}

1.8.3 Sewage Treatment plant (STP) KPI's

Sr.NO	KPI-2: Sewage Treatment plant (STP) System Fault Rectification (FR)		
	Fault shall be considered based on number of units effected: - 1. **CRITICAL CATEGORY FAULT (CCF):** Complete shutdown of the system or no/ less discharge from STP causing overflow of water in manholes/ washrooms. Resolution time is 2 hours. 2. **HIGH CATEGORY FAULT (HCF):** STP can operate but not as per designed and intended functional use or within acceptable limits specified in the and there is likelihood of service loss. The tests/ performance parameters are not in accordance with the Manual mentioned in plant performance monitoring. Resolution time is 12 hours. 3. **LOW CATEGORY FAULT (LCF):** STP can operate but not as per designed and intended functional use or within acceptable limits specified. there is no likelihood of service loss or safety issue and a possible workaround exists. resolution time is 24 hours. TF = Total Faults Considered for KPI-1: = A + B x (C/ D) A = No of Faults Responded above the assigned resolution time but within 2 times the Assigned Resolution Time for a Particular Category; B = No of Faults Responded in more than 2 times the Assigned Resolution Time for a Particular Category C = Average Actual Resolution Time of 'B' expressed in units of Assigned Resolution Time of the Category under Consideration D = Assigned Resolution Time of the Category under Consideration		
	FR	**Threshold of FR**	**Performance Deduction Percentage (PDP)**
1	CCF= (Critical Fault solved within assigned resolution time) / (Critical Fault solved within assigned resolution time +TF Critical) x 100	More than 98 %	$1 \times TF_{Critical}$
2	HCF= (High Fault solved within assigned resolution time) / (High Fault solved within assigned resolution time +TF High) x 100	More than 95 %	$0.5 \times TF_{High}$
3	LCF= (Low Faults solved within assigned resolution time) / (Low faults solved within assigned resolution time +TF Low) x 100	More than 90 %	$0.2 \times TF_{Low}$

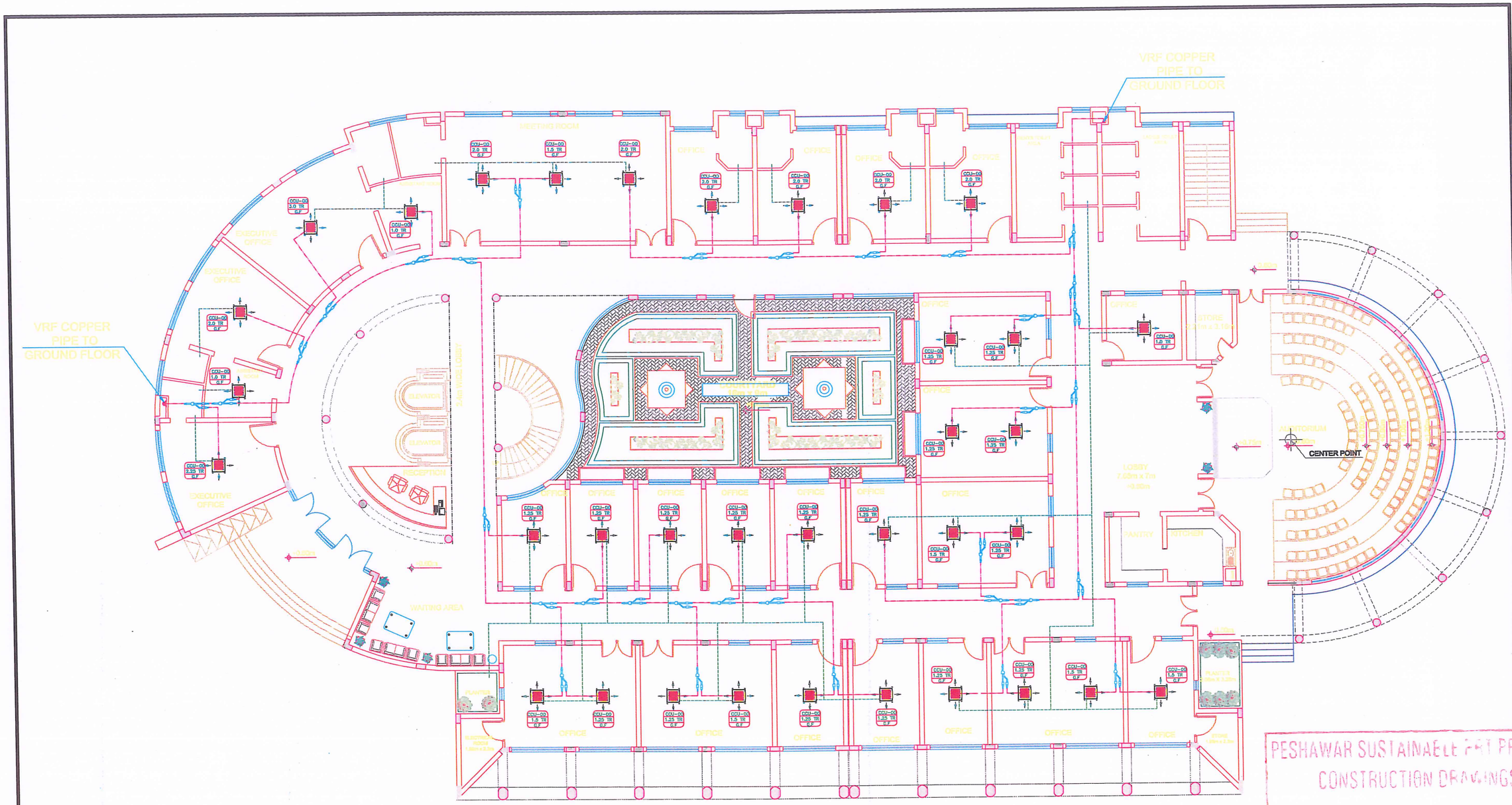
Annex-1

Details of Airconditioning Units Installed			
S. No.	**Device Type**	**Location**	**Quantity**
1	Indoor Unit Cassette Type	KPUMA Building-Ground Floor (Capacity Ranges: 1 to 2.5 Ton)	37
2	Indoor Unit Cassette Type	KPUMA Building-First Floor (Capacity Ranges: 1 to 2.5 Ton)	37
3	Indoor Unit CassetteType	KPUMA Building-Second Floor (Capacity Ranges: 1 to 2.5 Ton)	35
4	Outdoor Unit- Standing Type	KPUMA Building- Roof-Top (Capacity: 175 Ton Combined)	12
5	Indoor Standing Unit	KPUMA Building -Control Center (Capacity: 2 Ton Each)	6
6	Outdoor unit- Wall Monuted	KPUMA Building (Capacity: 2 Ton Each)	6
7	Distribution Boards	KPUMA Building- Roof-Top (for VRF Outdoor Units)	2
	Total Units Installed		**135**

Note: The quantities may vary in the limit of +/- 5%

VARIABLE REFRIGERANT FLOW (VRF) SYSTEM DRAWINGS

KPUMA,TRANS PESHAWAR AND CONTROL CENTER BUILDING



GROUND FLOOR VRF PLAN

PESHAWAR SUSTAINABLE BRT PROJECT
CONSTRUCTION DRAWINGS
ISSUED BY: DATE:

Consultants

MMP M M MOTT MACDONALD

CENTRAL DESIGN CELL
2nd Floor, CTI Building,
27-Empress Road, Lahore
042-36282625-7
042-36282626
cdc.mmp@mmpakistan.com
http://www.mmpakistan.com

Client

Transport and Mass -Transit Department (TMTD)
Government of Khyber Pakhtunkhwa
Pakistan

Peshawar Development Authority (PDA)
Government of Khyber Pakhtunkhwa
Pakistan

Financing Agency

ADB ASIAN DEVELOPMENT BANK

Project

Peshawar Sustainable Bus Rapid Transit Corridor Project - Project Design Advance

Rev	Date	Drawn	Description	Ch'k'd	App'd
A	23-01-2019	MA	ISSUE FOR CONSTRUCTION	MAM	TM

Title

GROUND FLOOR VRF PLAN
KPUMA,Trans-Peshawar, Control Center

Drawing No.

MMP-001020P01-BRT-MEP-VRF-001

Designed	M.A.M
Drawn	M.S
Checked	M.A.M
Approved	T.M
Scale at A3	NTS
Rev	A
Status	CON

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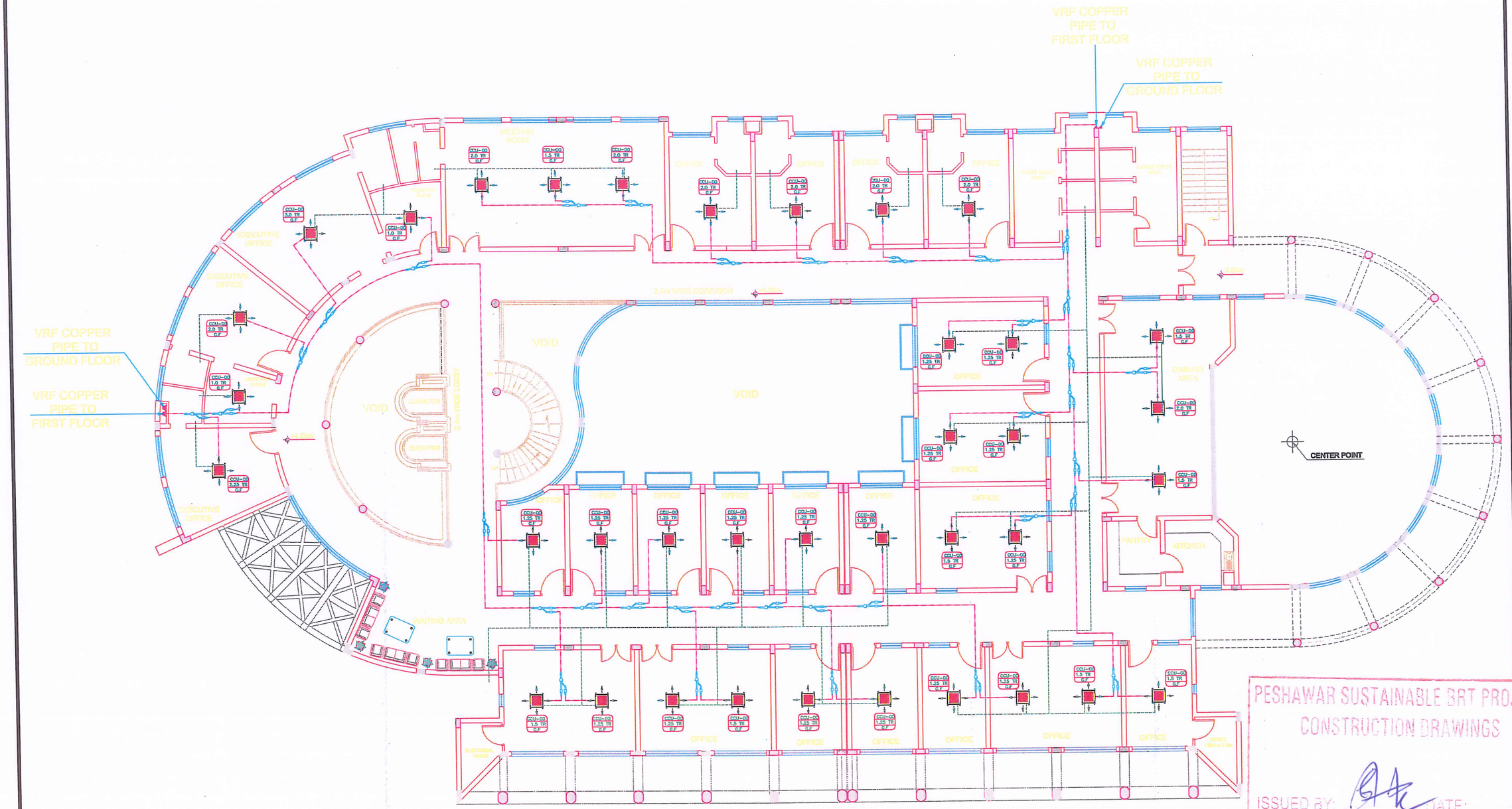

PESHAWAR SUSTAINABLE BRT PROJECT
CONSTRUCTION DRAWINGS

ISSUED BY: _____ DATE: _____

FIRST FLOOR VRF PLAN

Consultants

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Client

Transport and Mass -Transit Department (TMTD)
Government of Khyber Pakhtunkhwa
Pakistan

Peshawar Development Authority (PDA)
Government of Khyber Pakhtunkhwa
Pakistan

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Project

Peshawar Sustainable Bus Rapid Transit Corridor Project - Project Design Advance

Rev	Date	Drawn	Description	Ch'k'd	App'd
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Title

FIRST FLOOR VRF PLAN
KPUMA,Trans-Peshawar, Control Center

Drawing No.

MMP-001020P01-BRT-MEP-VRF-002

Designed	M.A.M
Drawn	M.A
Checked	M.A.M
Approved	T.M
Scale at A3	NTS
Rev	A
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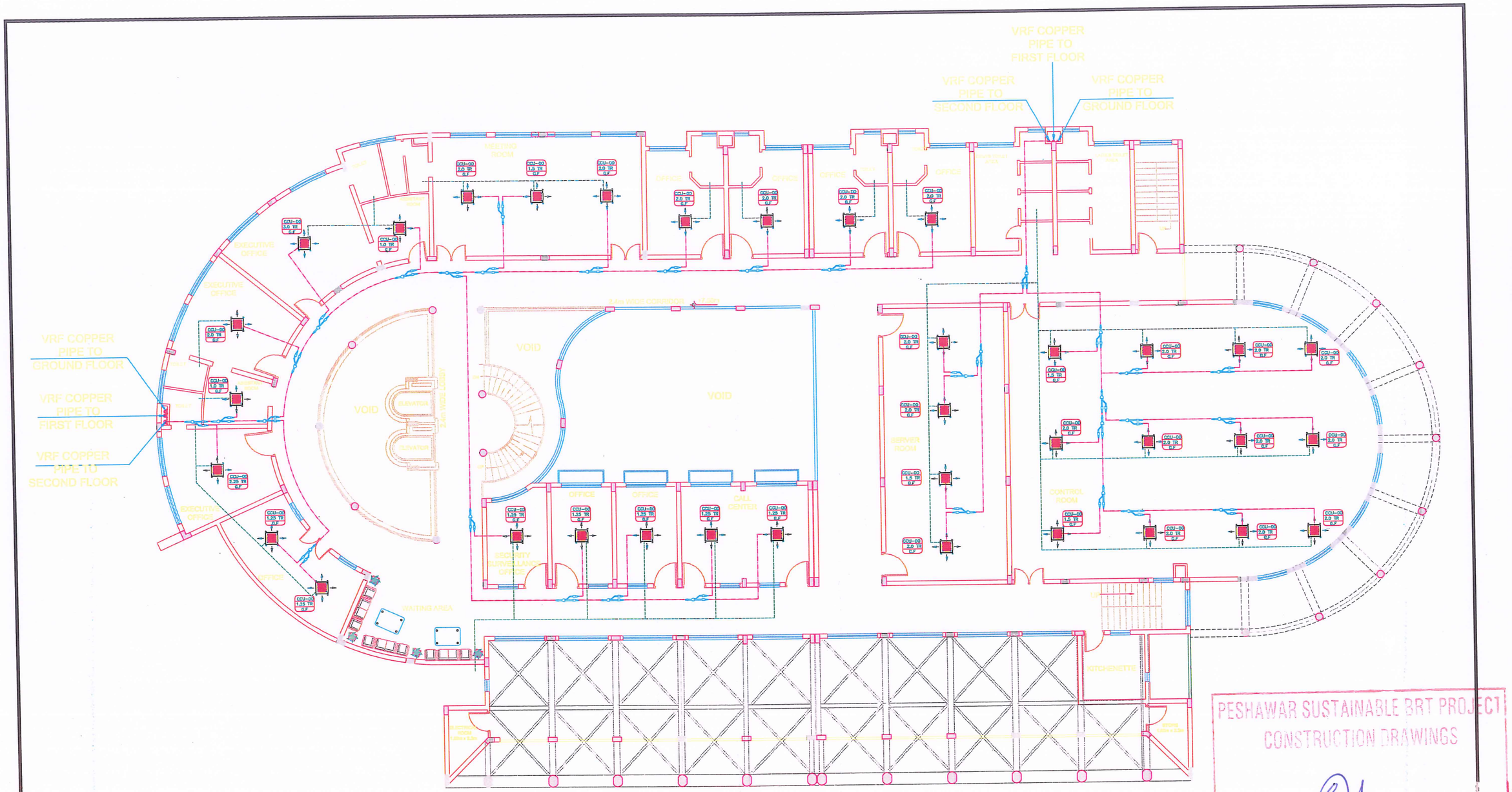

SECOND FLOOR VRF PLAN

PESHAWAR SUSTAINABLE BRT PROJECT
CONSTRUCTION DRAWINGS
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Consultants: MMP M M MOTT MACDONALD CENTRAL DESIGN CELL 2nd Floor, CTI Building, 27-Empress Road, Lahore 042-36282925-7 042-36282928 cdc.mmp@mmpMotm.com http://www.mmpMotm.com	Client: Transport and Mass -Transit Department (TMTD) Government of Khyber Pakhtunkhwa Pakistan Peshawar Development Authority (PDA) Government of Khyber Pakhtunkhwa Pakistan	Financing Agency: ADB ASIAN DEVELOPMENT BANK Project: Peshawar Sustainable Bus Rapid Transit Corridor Project - Project Design Advance						Title: SECOND FLOOR VRF PLAN KPUMA,Trans-Peshawar, Control Center	Designed: M.A.M Drawn: M.A Checked: M.A.M Approved: T.M Scale at A3: NTS
			Rev	Date	Drawn	Description	Ch'k'd	App'd	
			A	23-01-2019	MA	ISSUE FOR CONSTRUCTION	MAM	TM	
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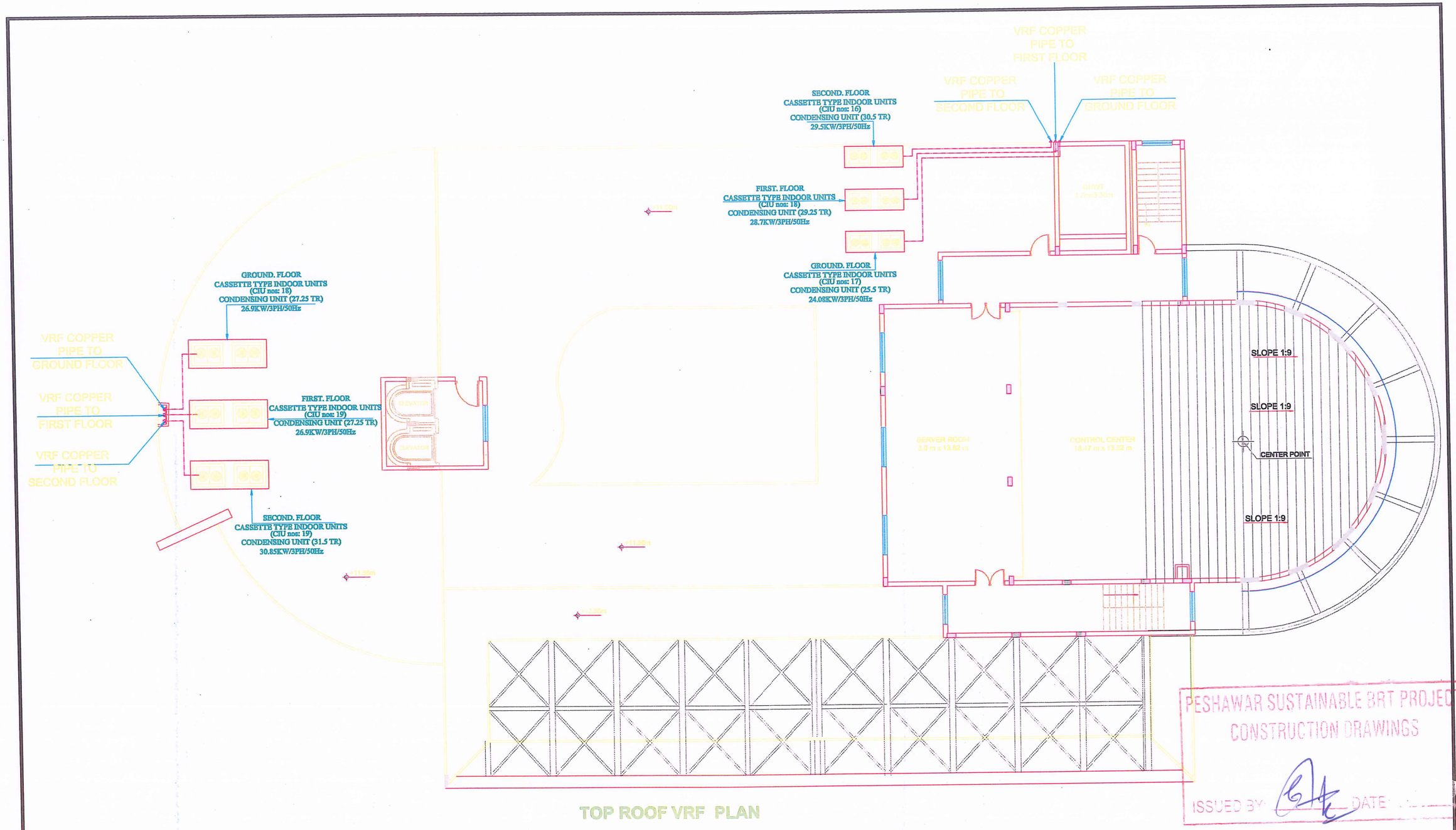

TOP ROOF VRF PLAN

PESHAWAR SUSTAINABLE BRT PROJECT
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Consultants	**Client**	**Financing Agency**	**Rev**	**Date**	**Drawn**	**Description**	**Ch'k'd**	**App'd**	**Title**
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KPUMA,TRANS PESHAWAR, CONTROL CENTER BUILDING
BRT PESHAWAR

OUTDOOR (CU) AND INDOOR (CIU) UNITS COMBINATION

CU-01				CU-02				CU-03				CU-04				CU-05				CU-06			
S.no	TAG	US RT	QTY	S.no	TAG	US RT	QTY	S.no	TAG	US RT	QTY	S.no	TAG	US RT	QTY	S.no	TAG	US RT	QTY	S.no	TAG	US RT	QTY
1	CU-01	25.5	—	2	CU-02	27.25	—	2/3	CU-03	27.25	—	4	CU-04	29.25	—	5	CU-05	30.5	—	6	CU-06	31.5	—
	CIU	1	1		CIU	1	2		CIU	1	2		CIU	1.25	5		CIU	1.5	3		CIU	1	2
	CIU	1.25	7		CIU	1.25	9		CIU	1.25	12		CIU	1.5	6		CIU	2	13		CIU	1.25	7
	CIU	1.5	3		CIU	1.5	3		CIU	1.5	1		CIU	2	7		—	—	—		CIU	1.5	1
	CIU	2	5		CIU	2	1		CIU	2	1		—	—	—		—	—	—		CIU	2	7
	—	—	—		CIU	2.25	1		CIU	2.25	1		—	—	—		—	—	—		CIU	2.25	1
	—	—	—		CIU	3	1		CIU	3	1		—	—	—		—	—	—		CIU	3	1

CONDENSING UNITS SPECIFICATIONS

S.no	ITEM	LOCATION	SERVED AREA	COOLING/HEATING CAPACITY (TR)	EER	COP	AMBIENT TEMPERATURE(C)	INPUT POWER (KW)	VOLT (V)	PHASE (Ø)	CYCLE (Hz)	QTY
1	CU-1	ROOF TOP	GROUND FLOOR	25.50	3.57	4.11	45	24.08	380	3	50	1
2	CU-2	ROOF TOP		27.25	3.52	4.06		26.9	380	3	50	1
3	CU-3	ROOF TOP	FIRST FLOOR	29.25	3.48	4.01		28.74	380	3	50	1
4	CU-4	ROOF TOP		27.25	3.52	4.01		29.9	380	3	50	1
5	CU-5	ROOF TOP	SECOND FLOOR	30.50	3.21	4.79		29.5	380	3	50	1
6	CU-6	ROOF TOP		31.50	3.35	4.41		30.84	380	3	50	1

PESHAWAR SUSTAINABLE BRT PROJECT
CONSTRUCTION DRAWINGS
ISSUED BY DATE

Consultants
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Title
CONDENSING UNITS SPECIFICATIONS
KPUMA,Trans-Peshawar, Control Center

Drawing No.
MMP-001020P01-BRT-MEP-VRF-007

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Rev	A
Status	CON

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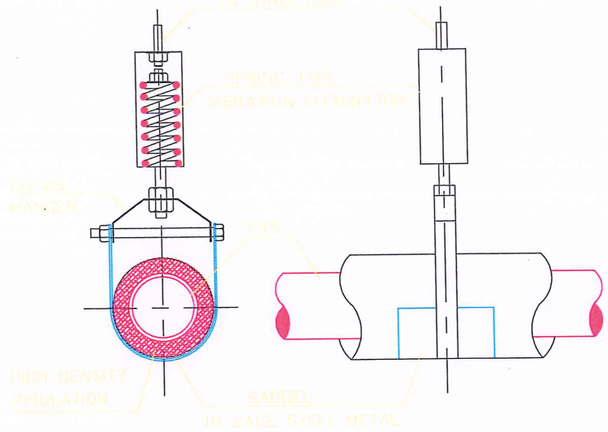
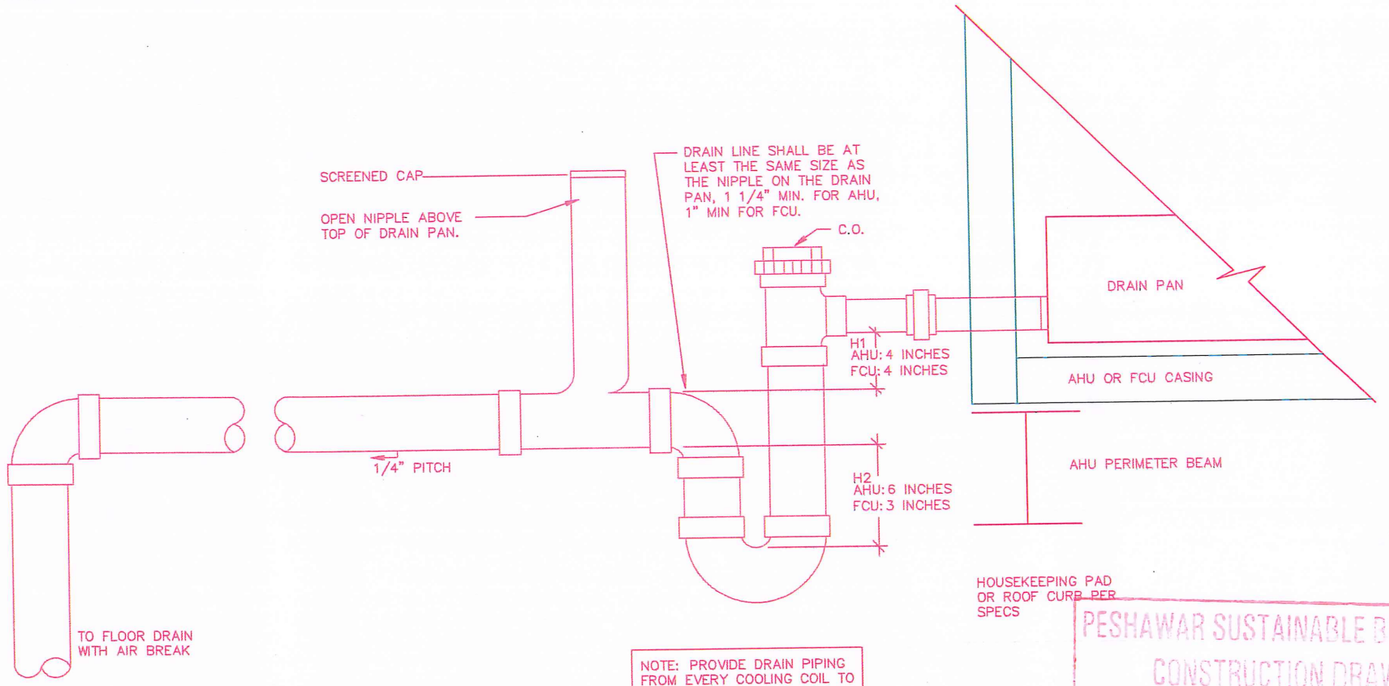


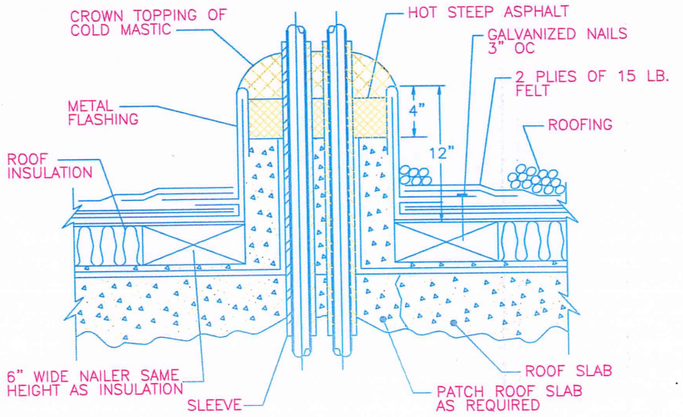
FOR PIPES 75 mm & LARGER ROLLER HANGERS SHALL BE USED

PIPE HANGER

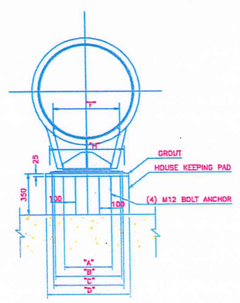


NOTE: PROVIDE DRAIN PIPING FROM EVERY COOLING COIL TO NEAREST DRAIN.

03 CONDENSATE DRAIN TRAP DETAIL
NO SCALE



PIPING THROUGH ROOF



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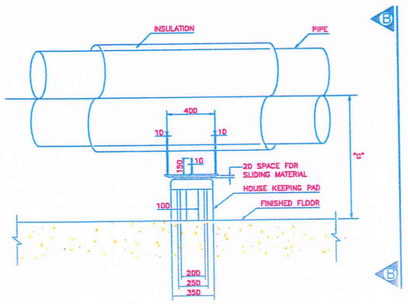

SLIDING SUPPORT
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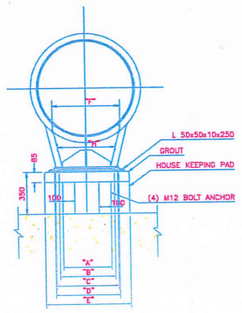

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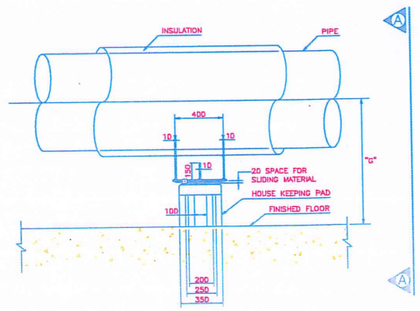

SLIDING SUPPORT WITH GUIDE
NOT TO SCALE

PESHAWAR SUSTAINABLE BRT PROJECT
CONSTRUCTION DRAWINGS
ISSUED BY: DATE:

Consultants
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Financing Agency
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Peshawar Sustainable Bus Rapid Transit Corridor Project - Project Design Advance

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Title
VRF DETAILS PLAN
KPUMA,Trans-Peshawar, Control Center

Drawing No.
MMP-001020P01-BRT-MEP-VRF-005

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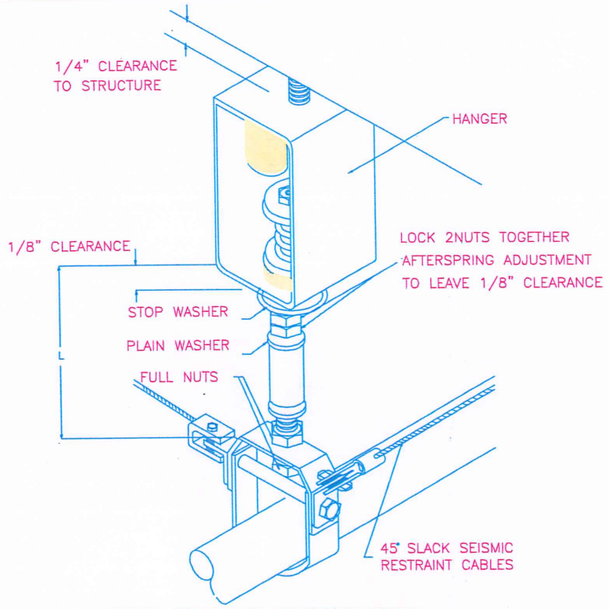
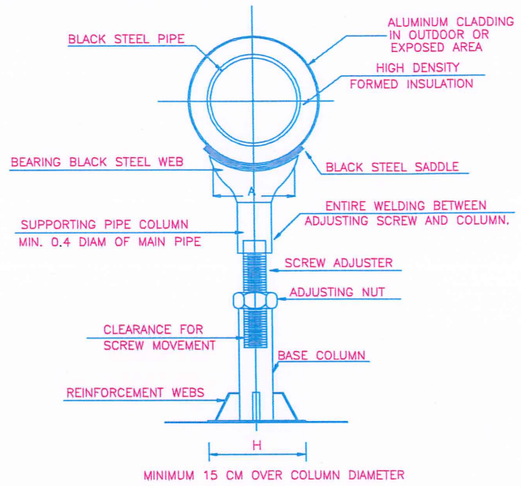
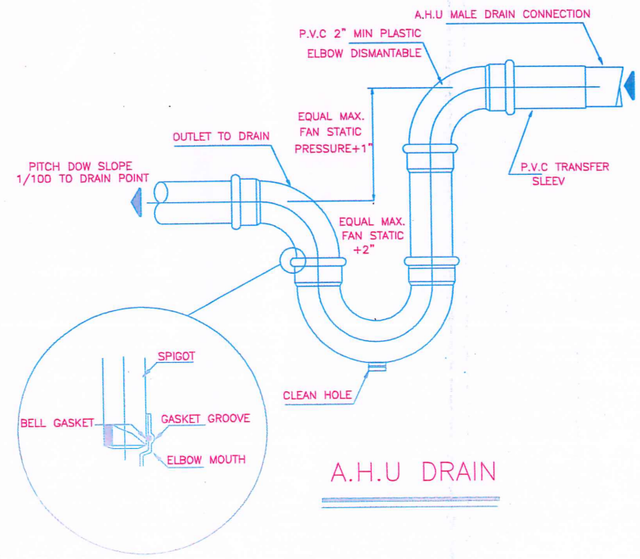


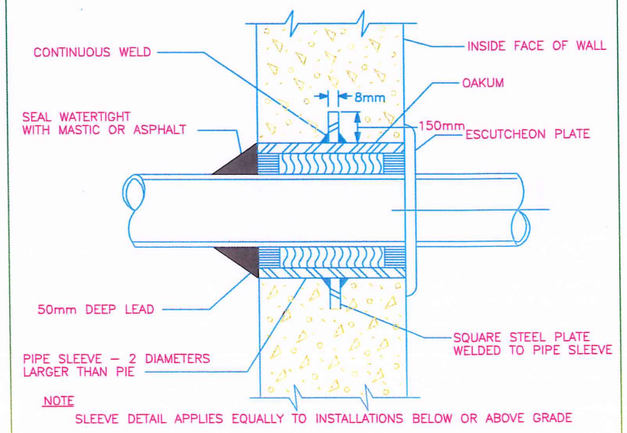
PIPE SEISMIC SUSPENSION



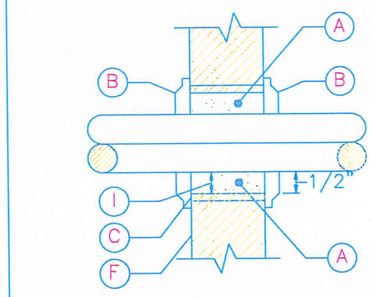
PIPE FLOOR MOUNTED SUPPORT



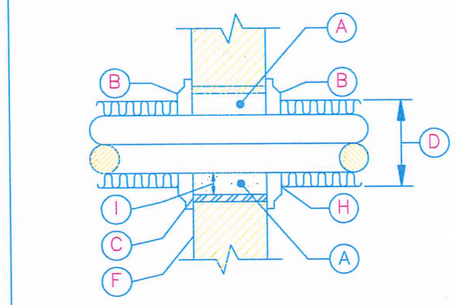
A.H.U DRAIN



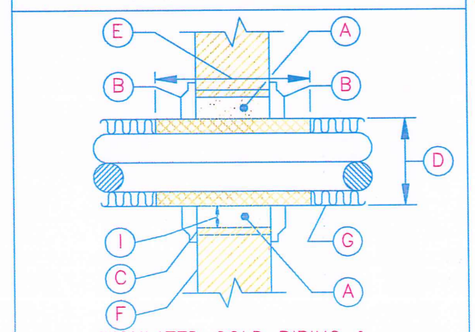
PIPE SLEEVE AT OUTSIDE WALL



BARE PIPING



INSULATED HOT PIPING



INSULATED COLD PIPING &
INSULATED HOT PIPING (ABOVE 180 F)

(A) PACK ALL SPACES FULL DEPTH W/MINERAL WOOL OR OTHER EQUALLY APPROVED FIRE RESISTIVE MATERIAL. (ASBESTOS OR FIBERGLASS SHALL NOT BE USED) FIRE RESISTANT FOAM SEALANT CHASE FOAM CTC P2-655(N.Y.C. MEA 58-79 M1 & 11) MAY BE USED. INSTALLATION AS PER MANUFACTURER.

(B) ESCUTCHEON BOTH SIDES.

(C) SLEEVE

(D) INSULATION (OUTSIDE DIAMETER)

(E) ANHYDROUS CALCIUM SILICATE INSULATION THRU SLEEVE.

(F) FIRE RATED PARTITION, WALL OR FLOOR.

(G) FIBERGLASS INSULATION

(H) TERMINATE INSULATION AT ESCUTCHEON

(I) MAXIMUM 1/2" CLEARANCE BETWEEN INSIDE OF SLEEVE & PIPE.

PESHAWAR SUSTAINABLE BRT PROJECT
CONSTRUCTION DRAWINGS
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DETAIL OF PIPING PIERCING FIRE RATED PARTITIONS, WALLS & FLOORS.

Consultants

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Title

VRF DETAILS PLAN
KPUMA,Trans-Peshawar, Control Center

Drawing No.

MMP-001020P01-BRT-MEP-VRF-006

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SAMSUNG

SYSTEM AIR CONDITIONER

OUTDOOR UNIT

AM080/100/120/140/160/180/200/220/240/260✳XV✳✳✳
AM080/100/120/200FXWA✳✳✳
AM080/100/120/140/160/180/200/220JXVA✳✳
AM140/160/180/200/220/240/260/280/300KXV✳✳✳

SERVICE *Manual*

AIR CONDITIONER

CONTENTS

Contents

Contents

Contents

1. Precautions

1-1 Precautions for the Service

- **Use the correct parts when changing the electric parts.**
  – Please check the labels and notices for the model name, proper voltage, and proper current for the electric parts.
- **Fully repair the connection for the types of harness when repairing the product after breakdown.**
  – A faulty connection can cause irregular noise and problems.
- **When disassembling or assembling, make sure that the product is laid down on a work cloth.**
  – Doing so will prevent scratching to the exterior of the rear side of the product.
- **Completely remove dust or foreign substances on the housing, connection, and inspection parts when performing repairs.**
  – This can prevent fire hazards for tracking, short, etc.
- **Please tighten the service valve of the outdoor unit and the valve cap of the charging valve as securely as possible by using a monkey spanner.**
- **Check whether the parts are properly and securely assembled after performing repairs.**
  – These parts should be in the same condition as before the repair.

1-2 Precautions for the Static Electricity and PL

- **Please carefully handle the PCB power terminal during repair and measurement when it is turned on since it is vulnerable to static electricity.**
  – Please wear insulation gloves before performing PCB repair and measurement.
- **Check if the place of installation is at least 2m away from electronic appliances such as TV, video players, and stereos.**
  – This can cause irregular noise or degrade the picture quality.
- **Please make sure the customer does not directly repair the product.**
  – Arbitrary dismantling may result in electric shock or fire.

1-3 Precautions for the Safety

- **Do not pull or touch the power plug or the subsidiary power switch with wet hands.**
  – This may result in electric shock or fire.
- **If the power line or the power plug is damaged, then it must be changed since this is a hazard.**
- **Do not bend the wire too much or position it so that it can be damaged by a heavy object on top.**
  – This may result in electric shock or fire.
- **The use of multiple electric outlets should be prohibited.**
  – This may result in electric shock or fire.
- **Ground the connection if it is necessary.**
  – The connection must be grounded if there is any risk of electrical short due to water or moisture.
- **Unplug the power or turn off the subsidiary power switch when changing or repairing electrical parts.**
  – Doing so will prevent electric shock.
- **Explain to workers that the battery for the remote control needs to be separated for storage purposes when the product will not be used for a long time.**
  – This can cause a problem for the remote control since battery fluid may trickle out.

1-4 Precautions for Handling Refrigerant for Air Conditioner

Environmental Cautions: Air pollution due to gas release

- **Safety Cautions**
  If liquid gas is released, then body parts that come into contact with it may experience frostbite/blister/numbness.
  If a large amount of gas is released, then suffocation may occur due to lack of oxygen. If the released gas is heated, then noxious gas may be produced by combustion.
- **Container Handling Cautions**
  Do not subject container to physical shock or overheating. (Flowage is possible while moving within the regulated pressure.)

1-5 Precautions for Welding the Air Conditioner Pipe

- **Dangerous or flammable objects around the pipe must be removed before the welding.**
- **If the refrigerant is kept inside the product or the pipe, then remove the refrigerant prior to welding.**
  If the welding is carried out while the refrigerant is kept inside, the welding cannot be properly performed. This will also produce noxious gas that is a health hazard. This leakage will also explode with the refrigerant and oil due to an increase in the refrigerant pressure, posing a danger to workers.
- **Please remove the oxide produced inside the pipe during the welding with nitrogen gas.**
  Using another gas may cause harm to the product or others.

1-6 Precautions for Additional Supplement of Air Conditioner Refrigerant

- **Precisely calculate the refrigerant by using a scale and S-net, and proceed with the test operation.**
  Excessive supplement can cause harm to the product since it can cause an inflow of the liquid refrigerant into the compressor.
- **Do not heat the refrigerant container for a forced injection.**
  This may cause harm to the product or others since the refrigerant container may burst.
- **Do not operate the product after removing the product safety pressure switch and sensor.**
  If the product is blocked inside, then this may cause harm to the product or others due to the excess pressure increase of the refrigerant gas.

1-7 Other Precautions

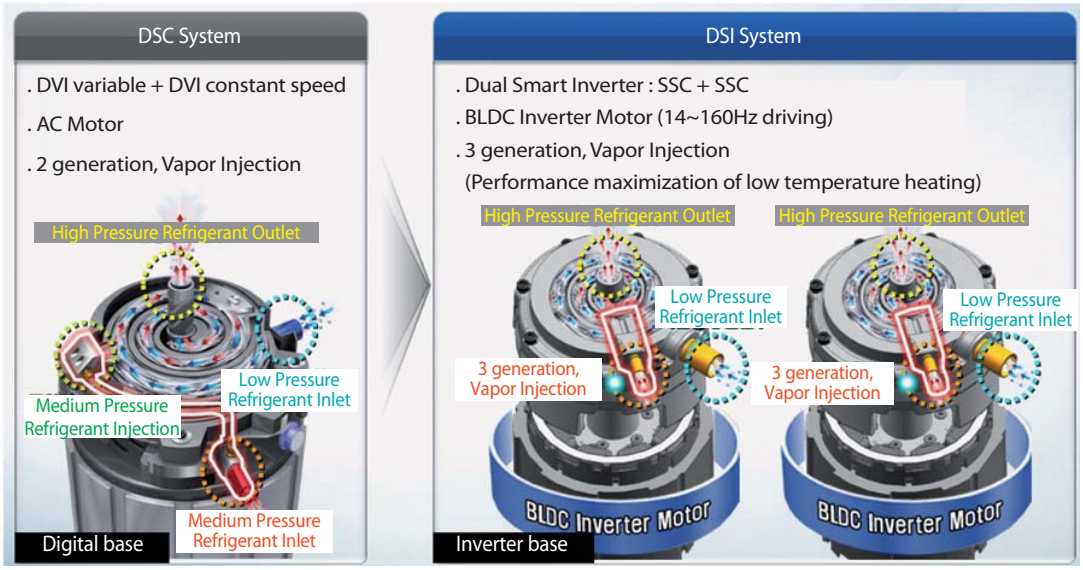
- **There should be no leakage of the pipes after installation. When withdrawing the refrigerant, the compressor should be stopped before removing the connecting pipe.**
  If the compressor is operating while the refrigerant pipe is not correctly connected and the service valve is opened, then air and other substances can enter the pipe. The interior of the refrigerant cycle may then build up excessive high pressure resulting in explosion and damage.

2. Product Specifications

2-1 The Feature of Product

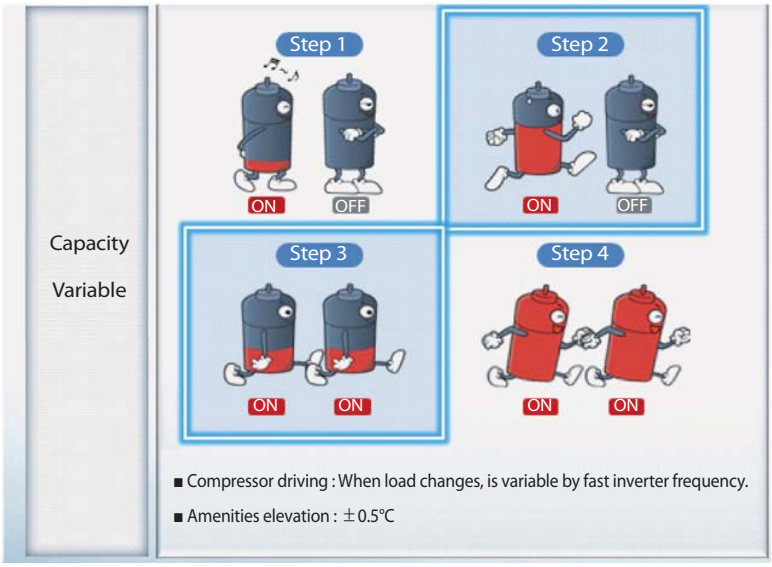
2-1-1 Feature

■ Dual Smart Inverter System



■ Dual SSC System Technology

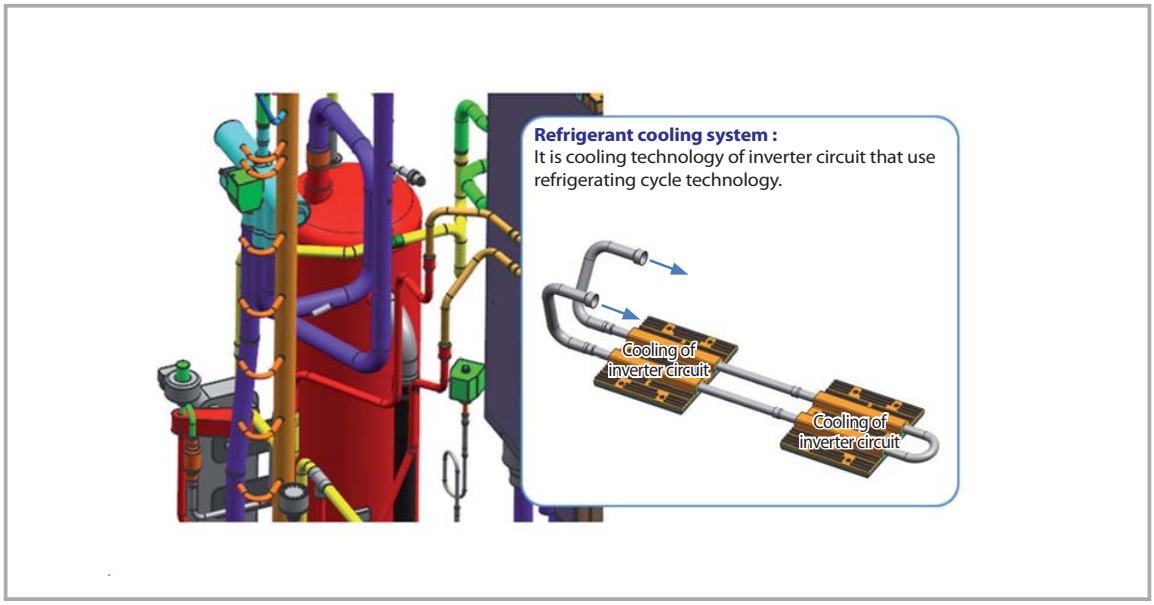
When load changes, capacity amendment that is soft by continuous operation of Dual Inverter is available.



Feature (cont.)

■ Inverter circuit refrigerant cooling technology

- Applied high efficiency refrigerant cooling circuit. Secured stable Inverter PCB cooling performance.
- Air cooling method : When natural convection / electric heat performance is low and is high load, efficiency is fallen.
- Refrigerant cooling system : Forced circulation / electric heat performance is high and control of (thermal conductivity is 10 times higher than air) load is available.



2-1-2 Changes in comparison to basic mode

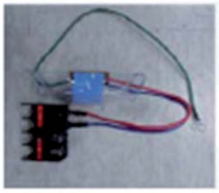
Changed part	Changed item and feature	Basic	After changed
CABINET	Change the color : TOUCH GRAY →EARTH BROWN Wire Harness installation part change LOGO change		

■ Control Box & PCB

Changed part	Changed item and feature	Basic	After changed
Control Box structure	Monolayer structure→Double Layer Structure - Inverter technology integration (Inverter control circuit composition) - C/Box volume maximum use Built-in type Controller embodiment - Integrated power supply + control unit - Piping service easiness	 	

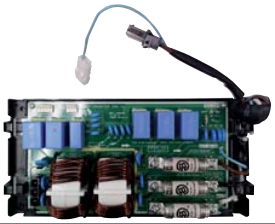
Changes in comparison to basic mode (cont.)

■ AM080/100/120/140/160/180/200/220JXV✳✳✳

Changed part	Changed item and feature	Basic	After changed
Main PCB	Change Main PCB - Separation for load / control. - Option resistance delete by model. (standardization) - When do PCB replace, need option download.		
Hub PCB	Hub PCB newly application - Separation for load / control. - Enhanced fixing of load / sensor wire.		
FAN PCB	Use controller of 3 phase power - Prevented phase unbalance. - Temperature protection of IPM.		
Inverter PCB (Compressor Control PCB)	Applied inverter Compressor - Refrigerant cooling method - Mount power relay on PCB		
EMI PCB	3 phase power EMI PCB - Fuse mount		
Communication Terminal block	- Mount communication terminal block on PCB		

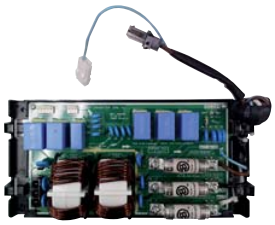
Changes in comparison to basic mode (cont.)

■ AM080/100/120/200FXWA✳✳

Changed part	Changed item and feature	Basic	After changed
Main PCB	Change Main PCB - Separation for load / control. - Option resistance delete by model. (standardization) - When do PCB replace, need option download.		←
Hub PCB	Hub PCB newly application - Separation for load / control. - Enhanced fixing of load / sensor wire.		←
FAN PCB	Use controller of 3 phase power - Prevented phase unbalance. - Temperature protection of IPM.		–
Inverter PCB (Compressor Control PCB)	Applied inverter Compressor - Refrigerant cooling method - Magnet S/W → Did Power Relay mount to PCB.		←
EMI PCB	3 phase power EMI PCB - Fuse mount		←
Communication Terminal block	Did Communication Terminal block mount to PCB.		←
Water Hub PCB	Water Hub PCB - External contact for DVM S WATER	-	

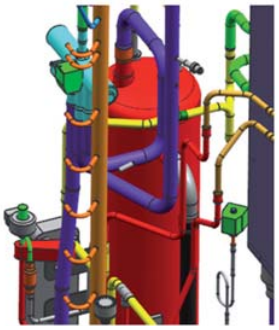
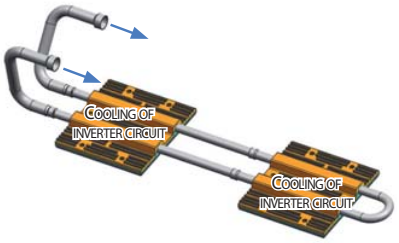
Changes in comparison to basic mode (cont.)

■ AM140/160/180/200/220/240/260/280/300KXV✳✳✳

Changed part	Changed item and feature	Basic	After changed
Main PCB	Change Main PCB - Increase MICOM capability		
FAN PCB	Applies 600V IPM by LC resonance buck-converter		
Inverter PCB (Compressor Control PCB)	- Increases current due to high capacity compressor - Increases capacitor's capacity - Applies EMI coil on board (Deletes core in wire)		
EMI PCB	- Develops 50A EMI PBA → Increases coil size and fuse capacity - Improves EMI characteristic.		
REACTOR	- Increases current due to high capacity compressor - Improved wire connection terminal		
Refrigerant cooling	- Increases heat cooling capacity - Increases pipe size and heat exchange area		

Changes in comparison to basic mode (cont.)

■ PIPE COOLING

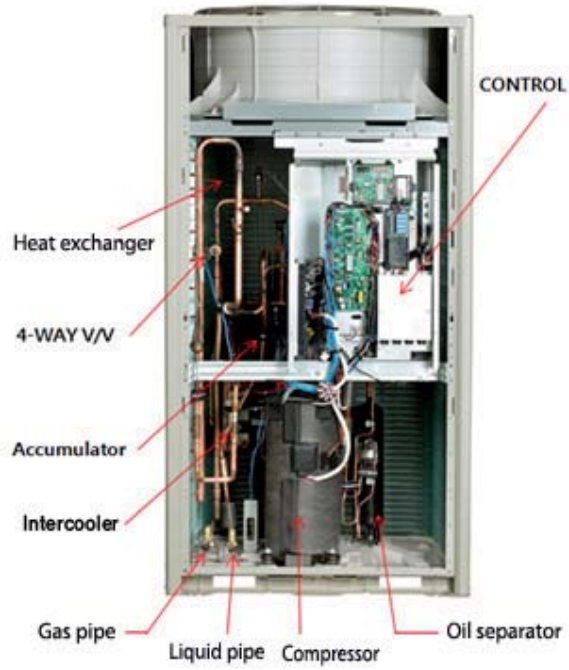
Changed part	Changed item and feature	Basic	After changed
Pipe Cooling	New Pipe Cooling for cooling of inverter PCB.	Unapplied	 **REFRIGERANT COOLING SYSTEM :** IT IS COOLING TECHNOLOGY OF INVERTER CIRCUIT THAT USE REFRIGERATING CYCLE TECHNOLOGY. 

■ TUBE

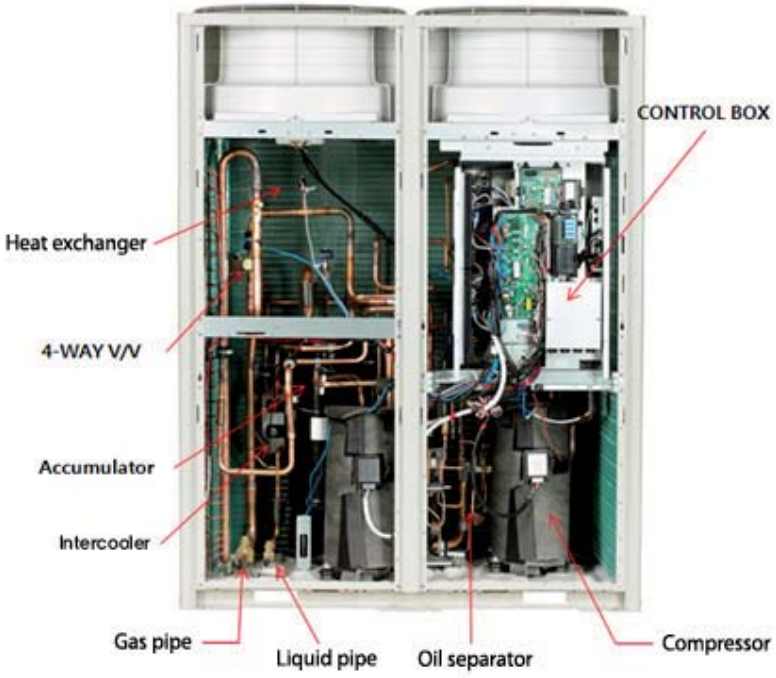
Changed part	Changed item and feature	Basic	After changed [HP]	After changed [HR]
Tube structure	New inverter cycle technology application New piping			

2-1-3 Structure of product (Heat Pump: AM✳✳✳✳XV✳✳H Series)

Small size

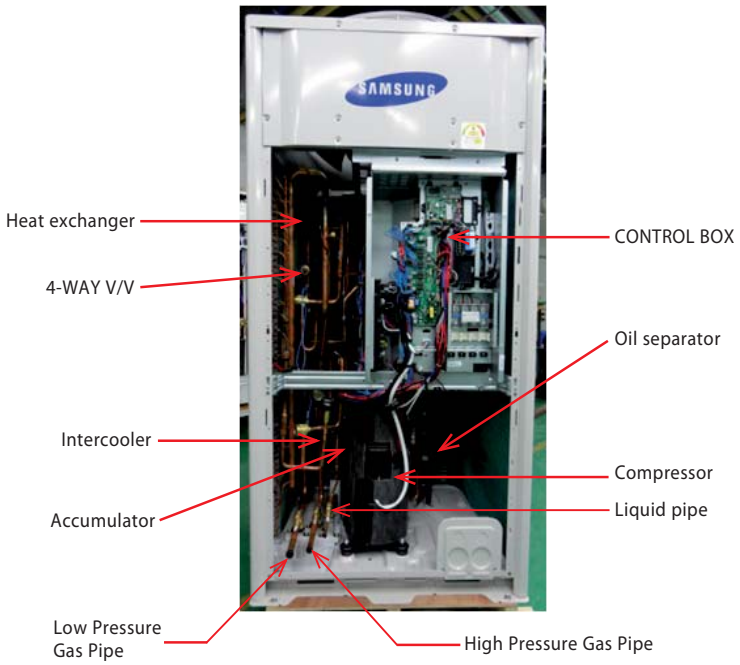


Large size

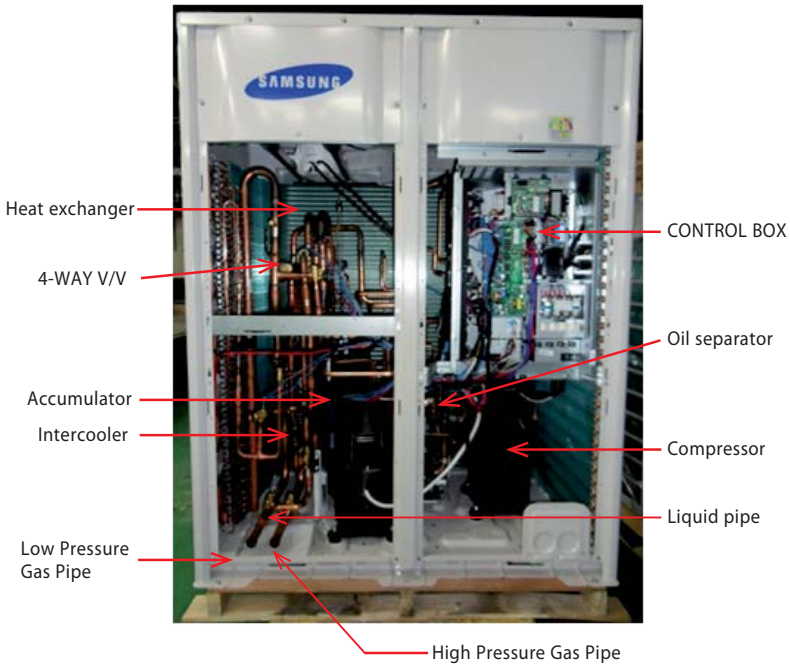


2-1-4 Structure of product (Heat Recovery: AM✳✳✳✳XV✳✳R Series)

Small size

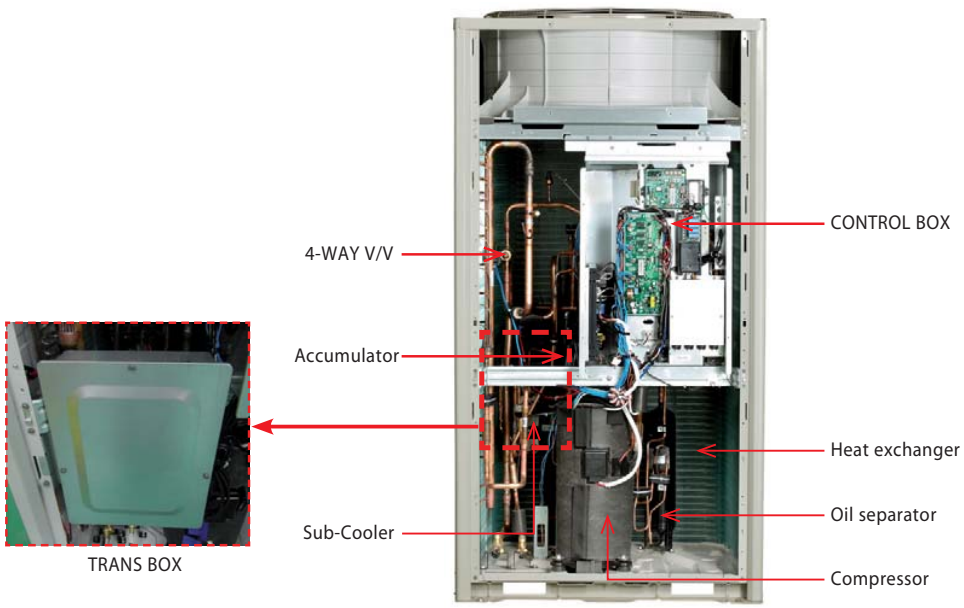


Large size

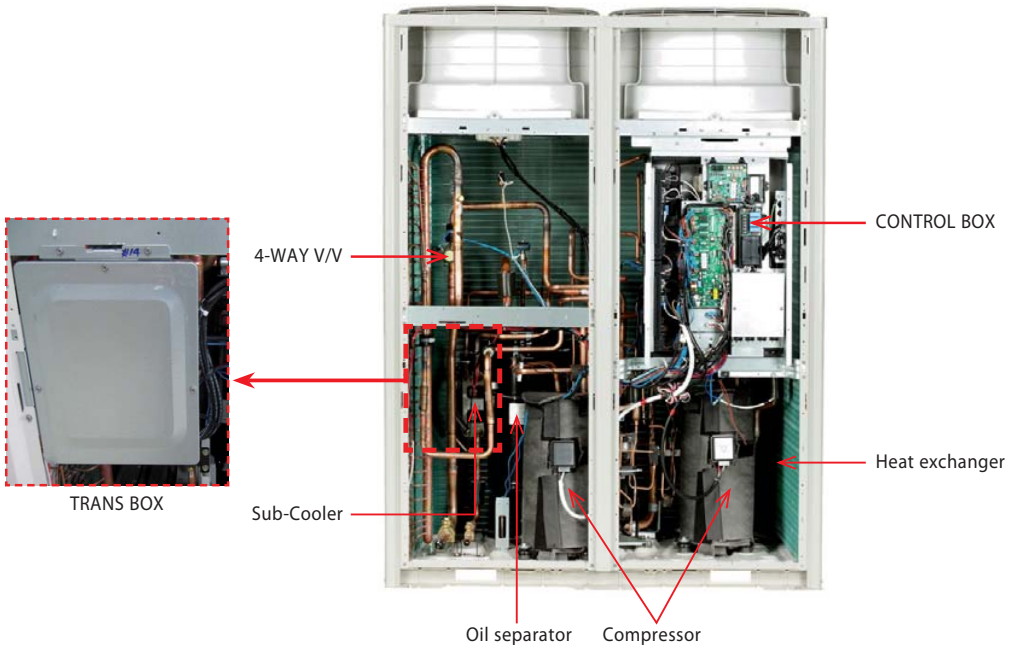


2-1-5 Structure of product (Power supply for 460V, 60Hz, 3Φ : AM✳✳✳✳XV✳✳J✳ Series)

Small size

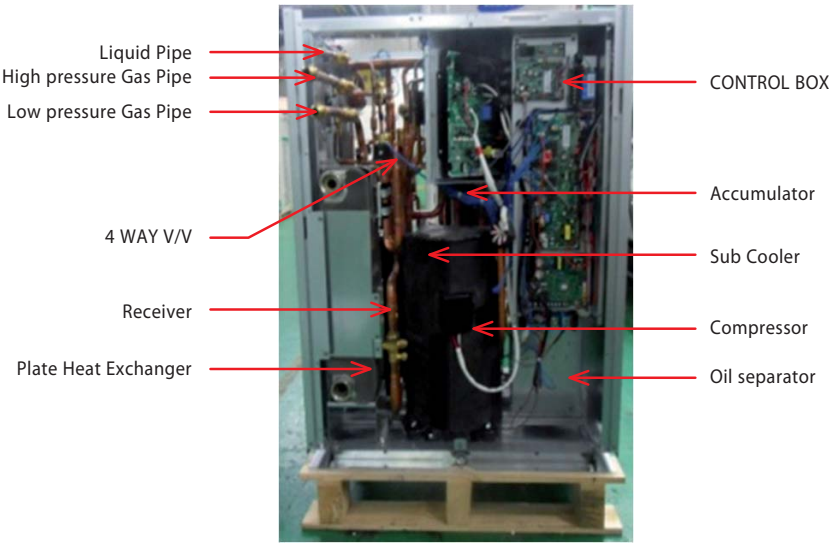


Large size

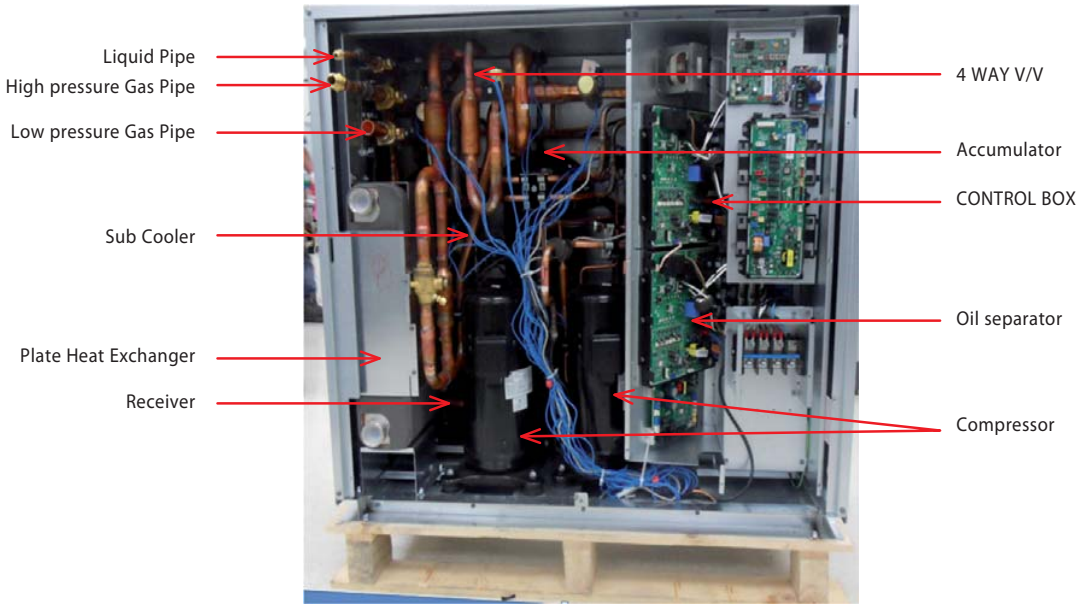


2-1-6 Structure of product (DVM S WATER)

Small size

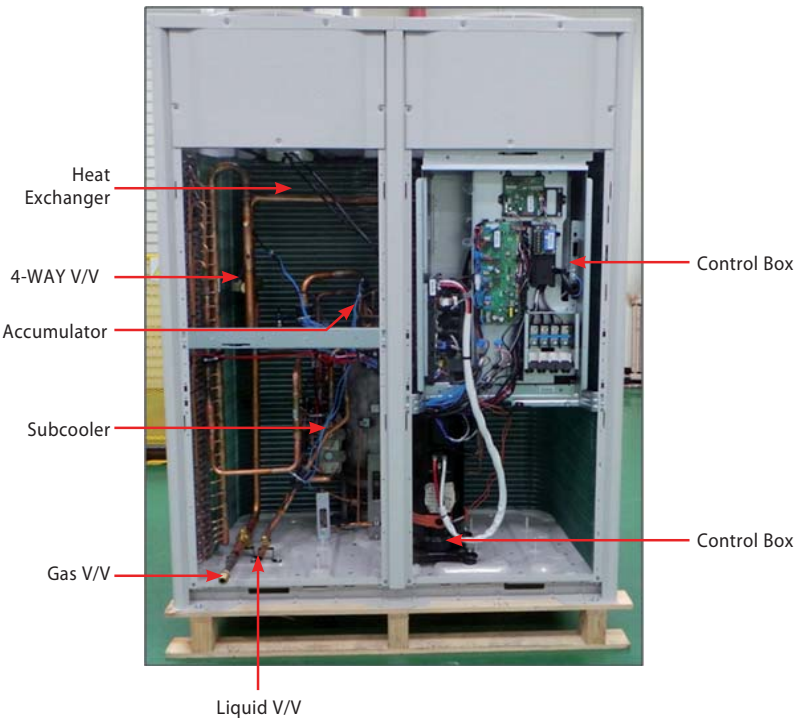


Large size

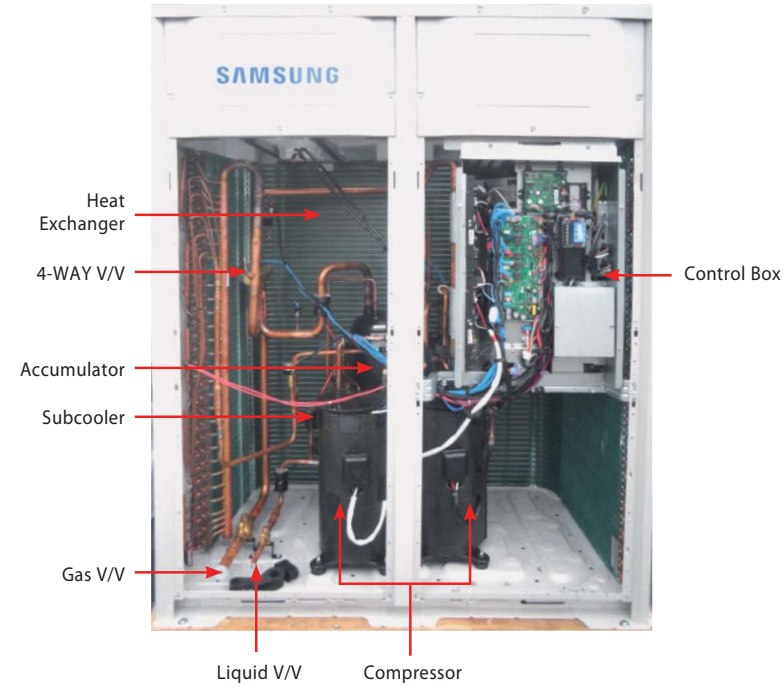


2-1-7 Structure of product (Heat Pump AM✳✳✳KX✳ Series)

AM140/160KXVG✳✳, AM140/160/180KXVA✳✳

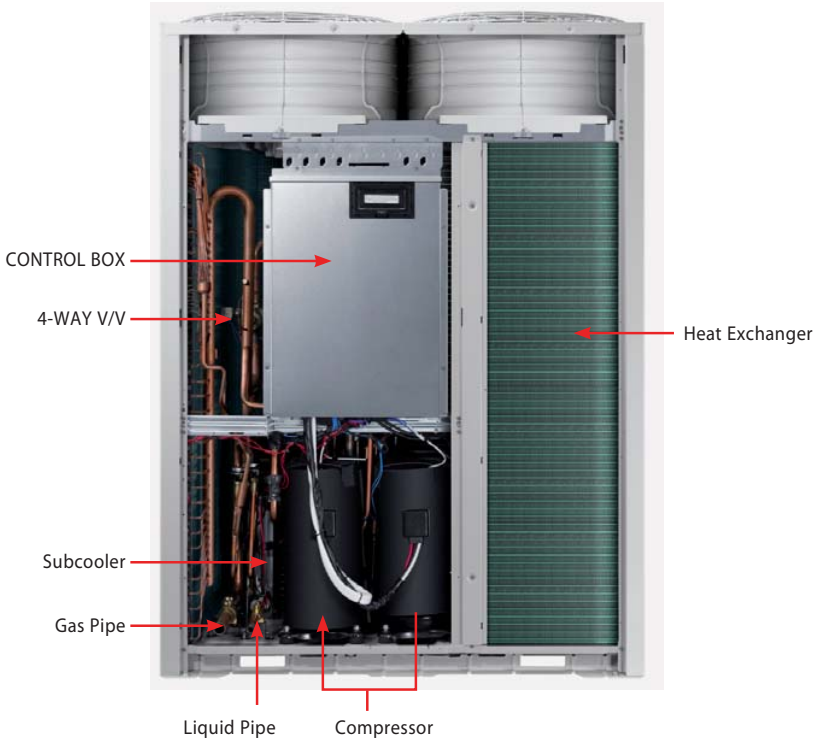


AM180/200/220KXVG✳✳, AM200/220KXVA✳✳



Structure of product (Heat Pump AM✳✳✳KX✳ Series)

AM240/260/280KXVG✳✳, AM240/260/280/300KXVA✳✳, AM080KXVS✳✳



2-2 Product Specifications

2-2-1 Outdoor Unit

TYPE				New Model			Comparative Model		
									
Model				AM080FXVAGH	AM100FXVAGH	AM120FXVAGH	RD080HHXG*	RD100HHXG*	RD120HHXG*
Mode				HP	HP	HP	HP	HP	HP
Power			Ø,V,Hz	3/AC380~415/50	3/AC380~415/50	3/AC380~415/50	3/AC380~415/50	3/AC380~415/50	3/AC380~415/50
Capacity	Horse Power		HP	8	10	12	8	10	12
	Cooling		kW	22.4	28.0	33.6	22.4	28.0	33.6
			btu/h	76,400	95,500	114,600	76,400	95,500	114,600
	Heating		kW	25.2	31.5	37.8	25.2	31.5	37.8
			btu/h	86,000	107,500	129,000	86,000	107,500	129,000
Power	Power Input (Nominal)	Cooling 1)	kW	5.00	6.80	8.40	-	-	-
		Heating 2)		5.10	6.70	8.70	-	-	-
	Current Input (Nominal)	Cooling 1)	A	8.00	10.90	13.50	-	-	-
		Heating 2)		8.20	10.70	14.00	-	-	-
	Running Current	Cooling	A	8.00	10.90	13.50	8.80	13.00	20.00
		Heating	A	8.20	10.70	14.00	11.40	12.70	18.40
		Max.	A	18.00	21.10	25.00	18.40	21.50	28.40
	Power Consumption	Cooling	kW	5.00	6.80	8.40	5.20	7.04	9.20
		Heating	kW	5.10	6.70	8.70	5.46	6.89	8.50
	MCA / MFA		A	22.5 / 30	29.9 / 40	31.3 / 40	-	-	-
COP	Nominal Cooling		-	4.48	4.12	4.00	-	-	-
	Nominal Heating		-	4.94	4.70	4.34	-	-	-
	ESEER (HP)			7.85	7.25	7.03	-	-	-
Compressor	Model		-	DS-GB052FA****	DS-GB066FA****	DS-GB066FA****	ZPJ61KCE-TFD ZPI61KCE-TFD	ZPJ61KCE-TFD ZPI61KCE-TFD	ZPJ83KCE-TFD ZPI83KCE-TFD
	Type			INV x1	INV x1	INV x1	DVI x1 + FVI x1	DVI x1 + FVI x1	DVI x1 + FVI x1
	Output		kW	4.70	5.80	5.80	4.36 + 4.36	4.36 + 4.36	5.87 + 5.87
	Lubricant	Type	-	FVC68D	FVC68D	FVC68D	3MAF POE	3MAF POE	3MAF POE
		Charging	cc	3,900	3,900	3,900	4,370	4,370	4,370
Refrigerant	Type		-	R410A	R410A	R410A	R410A	R410A	R410A
	Factory Charging		kg	5.5	5.2	5.5	5.0	5.0	5.0
FAN	Type		-	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC
	Motor Output		W	400	400	400	630	630	630
	Airflow rate		㎥/min	173	173	210	173	173	210
Pipe	Piping Connections	Liquid	Ø,mm	9.52	9.52	12.70	9.52	9.52	12.70
			Ø,inch	3/8"	3/8"	1/2"			
		Gas	Ø,mm	19.05	22.22	28.58	19.05	22.22	25.40
			Ø,inch	3/4"	7/8"	1 1/8"			
		Dis. Gas	Ø,mm	15.88	19.05	19.05	-	-	-
			Ø,inch	5/8"	3/4"	3.4"			
	Installation Limitation	Max.Length	m	200(220)	200(220)	200(220)	200	200	200
		Max.Height	m	110(40)	110(40)	110(40)	50(40)	50(40)	50(40)
Cable	Main Power(Below/about20m)		mm2	4.0	4.0	4.0	1.5	2.5	4.0
	Communication		mm2	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)
Set Dimension	Net Weight	DVM S HP	kg	190.0	190.0	190.0	237	237	240
		DVM S HR		195.0	195.0	195.0			
	Shipping Weight	DVM S HP	kg	206.0	206.0	206.0	253	253	256
		DVM S HR		211.0	211.0	211.0			
	Net Dimension(WxHxD)		mm	880x1,695x765	880x1,695x765	880x1,695x765	880x1695x765	880x1695x765	880x1695x765
	Gross Dimension(WxHxD)		mm	948x1,657x832	948x1,657x832	948x1,657x832	948x1912x832	948x1912x832	948x1912x832
Operating Temp Range	Cooling	DVM S HP	℃	-5.0~48.0	-5.0~48.0	-5.0~48.0	-5.0 ~ 48	-5.0 ~ 48.0	-5.0 ~ 48.0
		DVM S HR		-15.0~48.0	-15.0~48.0	-15.0~48.0			
	Heating			-20.0~24.0	-20.0~24.0	-20.0~24.0	-20.0 ~ 24.0	-20.0 ~ 24.0	-20.0 ~ 24.0

1. Proper form capacity standard of air conditioning
- Cooling capacity : It is figures that appear in indoor 27˚C DB/19˚C WB, outdoor 35˚C DB, length 7.5m of piping, fall 0m standard.
- Heating capacity : It is figures that appear in indoor 20˚C DB, outdoor 7˚C DB, length 7.5m of piping, fall 0m standard.
2. If proper form heating capacity is outdoor temperature 7˚C standard and outdoor temperature goes down by below zero, heating capacity can drop according to temperature condition.
3. Need special load calculation in case of use by main heating in the winter, and please buy product for low temperature that heating effect excels at low temperature.
4. Maximum length between outdoor and indoor units allows up to 200m (Equivalent length 220m).
5. If the indoor unit is below, height length allows up to 110m (If over 50m, decide whether to install the PDM kit). If the outdoor unit is below, allowable height length is 40m.

Outdoor Unit (cont.)

TYPE				New Model		Comparative Model	
							
Model				AM140FXVAGH	AM160FXVAGH	RD140HHXG*	RD160HHXG*
Mode				HP	HP	HP	HP
Power			Ø,V,Hz	3/AC380~415/50	3/AC380~415/50	3/AC380~415/50	3/AC380~415/50
Capacity	Horse Power		HP	14	16	14	16
	Capacity		kW	40.0	45.0	39.2	44.8
			btu/h	136,000	153,000	133,800	152,900
	Heating		kW	45.0	50.0	44.1	50.0
			btu/h	153,000	170,000	150,500	172,000
Power	Power Input (Nominal)	Cooling 1)	kW	8.90	11.00	-	-
		Heating 2)		9.50	11.50	-	-
	Current Input (Nominal)	Cooling 1)	A	14.30	17.60	-	-
		Heating 2)		15.20	18.40	-	-
	Running Current	Cooling	A	14.30	17.60	20.90	22.00
		Heating	A	15.20	18.40	19.40	27.20
		Max.	A	25.00	32.00	29.40	38.30
	Power Consumption	Cooling	kW	8.90	11.00	10.10	12.00
		Heating	kW	9.50	11.50	9.65	11.30
	MCA / MFA		A	31.3 / 40	40 / 40	-	-
COP	Nominal Cooling		-	4.49	4.09	-	-
	Nominal Heating		-	4.74	4.35	-	-
	ESEER (HP)			7.02	6.78	-	-
Compressor	Model		-	DS-GB066FA****	DS-GB052FA****	ZPJ83KCE-TFD ZPI83KCE-TFD	ZPJ72KCE-TFD ZPI72KCE-TFD
	Type			INV x1	INV x2	DVI x1 + FVI x1	DVI x1 + FVI x2
	Output		kW	5.80	4.7 x2	5.87 + 5.87	5.16 + 5.16 x2
	Lubricant	Type	-	FVC68D	FVC68D	3MAF POE	3MAF POE
		Charging	cc	3,900	6,200	4,370	6,540
Refrigerant	Type		-	R410A	R410A	R410A	R410A
	Factory Charging		kg	7.7	7.4	7.0	7.0
FAN	Type		-	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC
	Motor Output		W	630 x 2	630 x 2	630 x 2	630 x 2
	Airflow rate		m^3 / min	226	250	226	250
Pipe	Piping Connections	Liquid	Ø,mm	12.70	12.70	12.70	12.70
			Ø,inch	1/2"	1/2"		
		Gas	Ø,mm	28.58	28.58	25.40	28.58
			Ø,inch	1 1/8"	1 1/8"		
		Dis. Gas	Ø,mm	19.05	22.22	-	-
			Ø,inch	3/4"	7/8"		
	Installation Limitation	Max.Length	m	200(220)	200(220)	200	200
		Max.Height	m	110(40)	110(40)	50(40)	50(40)
Cable	Main Power(Below/about20m)		mm2	4.0	6.0	4.0	6.0
	Communication		mm2	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)
Set Dimension	Net Weight	DVM S HP	kg	235.0	278.0	280	329
		DVM S HR		214.0	184.0		
	Shipping Weight	DVM S HP	kg	254.0	297.0	301	350
		DVM S HR		260.0	303.0		
	Net Dimension(WxHxD)		mm	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765
	Gross Dimension(WxHxD)		mm	1363x1857x832	1363x1857x832	1363x1912x832	1363x1912x832
Operating Temp Range	Cooling	DVM S HP	℃	-5.0~48.0	-5.0~48.0	-5.0 ~ 48.0	-5.0 ~ 48.0
		DVM S HR		-15.0~48.0	-15.0~48.0		
	Heating			-20.0~24.0	-20.0~24.0	-20.0 ~ 24.0	-20.0 ~ 24.0

1. Proper form capacity standard of air conditioning
- Cooling capacity : It is figures that appear in indoor 27˚C DB/19˚C WB, outdoor 35˚C DB, length 7.5m of piping, fall 0m standard.
- Heating capacity : It is figures that appear in indoor 20˚C DB, outdoor 7˚C DB, length 7.5m of piping, fall 0m standard.
2. If proper form heating capacity is outdoor temperature 7˚C standard and outdoor temperature goes down by below zero, heating capacity can drop according to temperature condition.
3. Need special load calculation in case of use by main heating in the winter, and please buy product for low temperature that heating effect excels at low temperature.
4. Maximum length between outdoor and indoor units allows up to 200m (Equivalent length 220m).
5. If the indoor unit is below, height length allows up to 110m (If over 50m, decide whether to install the PDM kit). If the outdoor unit is below, allowable height length is 40m.

Outdoor Unit (cont.)

TYPE				New Model			Comparative Model	
								
Model				AM180FXVAGH	AM200FXVAGH	AM220FXVAGH	RD180HHXG✳	RD200HHXG✳
Mode				HP	HP	HP	HP	HP
Power			Ø,V,Hz	3/AC380~415/50	3/AC380~415/50	3/AC380~415/50	3/AC380~415/50	3/AC380~415/50
Capacity	Horse Power		HP	18	20	22	18	20
	Cooling		kW	50.4	56.0	61.6	50.4	56.0
			btu/h	171,900	191,000	210,000	171,900	191,000
	Heating		kW	56.7	63.0	69.3	56.7	63.0
			btu/h	193,500	215,000	236,000	193,500	215,000
Power	Power Input (Nominal)	Cooling 1)	kW	12.80	15.19	17.35	-	-
		Heating 2)		11.90	13.90	16.70	-	-
	Current Input (Nominal)	Cooling 1)	A	20.70	24.40	27.80	-	-
		Heating 2)		19.10	22.30	26.80	-	-
	Running Current	Cooling	A	20.70	24.40	27.80	31.30	32.80
		Heating	A	19.10	22.30	26.80	26.70	29.10
		Max.	A	39.10	42.50	44.50	42.50	44.10
	Power Consumption	Cooling	kW	12.88	15.19	17.35	15.70	17.00
		Heating	kW	11.90	13.90	16.70	12.90	14.50
	MCA / MFA		A	48.9 / 50	52.5 / 75	52.5 / 75	-	-
COP	Nominal Cooling		-	3.91	3.69	3.55	-	-
	Nominal Heating		-	4.76	4.53	4.15	-	-
	ESEER (HP)			6.59	6.56	6.25	-	-
Compressor	Model		-	DS-GB066FA****	DS-GB066FA****	DS-GB066FA****	ZPJ83KCE-TFD ZPI83KCE-TFD	ZPJ83KCE-TFD ZPI83KCE-TFD
	Type			INV x2	INV x2	INV x2	DVI x1 + FVI x2	DVI x1 + FVI x2
	Output		kW	5.8 x2	5.8 x2	5.8 x2	5.87 + 5.87 x2	5.87 + 5.87 x2
	Lubricant	Type	-	FVC68D		FVC68D	3MAF POE	3MAF POE
		Charging	cc	6,200	6,200	6,200	6,540	6,540
Refrigerant	Type		-	R410A	R410A	R410A	R410A	R410A
	Factory Charging		kg	8.7	8.4	8.4	8.5	8.5
FAN	Type		-	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC
	Motor Output		W	630 x2	630 x2	630 x2	630 x2	630 x2
	Airflow rate		㎥ /min	270	275	280	270	275
Pipe	Piping Connections	Liquid	Ø,mm	15.88	15.88	15.88	15.88	15.88
			Ø,inch	5/8"	5/8"	5/8"		
		Gas	Ø,mm	28.58	28.58	28.58	28.58	28.58
			Ø,inch	1 1/8"	1 1/8"	1 1/8"		
		Dis. Gas	Ø,mm	22.22	28.58	28.58	-	-
			Ø,inch	7/8"	1 1/8"	1 1/8"		
	Installation Limitation	Max.Length	m	200(220)	200(220)	200(220)	200	200
		Max.Height	m	110(40)	110(40)	110(40)	50(40)	50(40)
Cable	Main Power(Below/about20m)		mm2	10.0	10.0	10.0	6.0	10.0
	Communication		mm2	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)
Set Dimension	Net Weight	DVM S HP	kg	300.0	300.0	300.0	340.0	349.0
		DVM S HR		306.0	306.0	306.0		
	Shipping Weight	DVM S HP	kg	319.0	319.0	319.0	361.0	370.0
		DVM S HR		325.0	325.0	325.0		
	Net Dimension(WxHxD)		mm	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765
	Gross Dimension(WxHxD)		mm	1363x1857x832	1363x1857x832	1363x1857x832	1363x1912x832	1363x1912x832
Operating Temp Range	Cooling	DVM S HP	℃	-5.0 ~ 48.0	-5.0 ~ 48.0	-5.0 ~ 48.0	-5.0~ 48.0	-5.0 ~ 48.0
		DVM S HR		-15.0~48.0	-15.0~48.0	-15.0~48.0		
	Heating			-20.0 ~ 24.0	-20.0 ~ 24.0	-20.0 ~ 24.0	-20.0 ~ 24.0	-20.0 ~ 24.0

1. Proper form capacity standard of air conditioning
- Cooling capacity : It is figures that appear in indoor 27˚C DB/19˚C WB, outdoor 35˚C DB, length 7.5m of piping, fall 0m standard.
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3. Need special load calculation in case of use by main heating in the winter, and please buy product for low temperature that heating effect excels at low temperature.
4. Maximum length between outdoor and indoor units allows up to 200m (Equivalent length 220m).
5. If the indoor unit is below, height length allows up to 110m (If over 50m, decide whether to install the PDM kit). If the outdoor unit is below, allowable height length is 40m.

Outdoor Unit (cont.)

TYPE				New Model			Comparative Model		
									
Model				AM080FXVAGR	AM100FXVAGR	AM120FXVAGR	RD080HRXG*	RD100HRXG*	RD120HRXG*
Mode				HR	HR	HR	HR	HR	HR
Power			Ø,V,Hz	3/AC380~415/50	3/AC380~415/50	3/AC380~415/50	3/AC380~415/50	3/AC380~415/50	3/AC380~415/50
Capacity	Horse Power		HP	8	10	12	8	10	12
	Capacity		kW	22.4	28.0	33.6	22.4	28.0	33.6
			btu/h	76,400	95,500	114,600	76,400	95,500	114,600
	Heating		kW	25.2	31.5	37.8	25.2	31.5	37.8
			btu/h	86,000	107,500	129,000	86,000	107,500	129,000
Power	Power Input (Nominal)	Cooling 1)	kW	5.00	6.80	8.40	-	-	-
		Heating 2)		5.10	6.70	8.70	-	-	-
	Current Input (Nominal)	Cooling 1)	A	8.00	10.90	13.50	-	-	-
		Heating 2)		8.20	10.70	14.00	-	-	-
	Running Current	Cooling	A	8.00	10.90	13.50	8.80	13.00	20.00
		Heating	A	8.20	10.70	14.00	11.40	12.70	18.40
		Max.	A	18.00	21.10	25.00	18.40	21.50	28.40
	Power Consumption	Cooling	kW	5.00	6.80	8.40	5.20	7.04	9.20
		Heating	kW	5.10	6.70	8.70	5.46	6.89	8.50
	MCA / MFA		A	22.5 / 30	29.9 / 40	31.3 / 40	-	-	-
COP	Nominal Cooling		-	4.48	4.12	4.00	-	-	-
	Nominal Heating		-	4.94	4.70	4.34	-	-	-
	ESEER (HP)			7.85	7.25	7.03	-	-	-
Compressor	Model		-	DS-GB052FA****	DS-GB066FA****	DS-GB066FA****	ZPJ61KCE-TFD ZPI61KCE-TFD	ZPJ61KCE-TFD ZPI61KCE-TFD	ZPJ83KCE-TFD ZPI83KCE-TFD
	Type			INV x1	INV x1	INV x1	DVI x1 + FVI x1	DVI x1 + FVI x1	DVI x1 + FVI x1
	Output		kW	4.70	5.80	5.80	4.36 + 4.36	4.36 + 4.36	5.87 + 5.87
	Lubricant	Type	-	FVC68D	FVC68D	FVC68D	3MAF POE	3MAF POE	3MAF POE
		Charging	cc	3,900	3,900	3,900	4,370	4,370	4,370
Refrigerant	Type		-	R410A	R410A	R410A	R410A	R410A	R410A
	Factory Charging		kg	5.5	5.2	5.5	5.0	5.0	5.0
FAN	Type		-	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC
	Motor Output		W	400	400	400	630	630	630
	Airflow rate		㎥ /min	173	173	210	173	173	210
Pipe	Piping Connections	Liquid	Ø,mm	9.52	9.52	12.70	9.52	9.52	12.70
			Ø,inch	3/8"	3/8"	1/2"			
		Gas	Ø,mm	19.05	22.22	28.58	19.05	22.22	25.40
			Ø,inch	3/4"	7/8"	1 1/8"			
		Dis. Gas	Ø,mm	15.88	19.05	19.05	15.88	19.05	22.22
			Ø,inch	5/8"	3/4"	3.4"			
	Installation Limitation	Max.Length	m	200(220)	200(220)	200(220)	200	200	200
		Max.Height	m	110(40)	110(40)	110(40)	50(40)	50(40)	50(40)
Cable	Main Power(Below/about20m)		mm2	4.0	4.0	4.0	1.5	2.5	4.0
	Communication		mm2	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)
Set Dimension	Net Weight	DVM S HP	kg	190.0	190.0	190.0	243	243	243
		DVM S HR		195.0	195.0	195.0			
	Shipping Weight	DVM S HP	kg	206.0	206.0	206.0	259	259	259
		DVM S HR		211.0	211.0	211.0			
	Net Dimension(WxHxD)		mm	880x1,695x765	880x1,695x765	880x1,695x765	880x1695x765	880x1695x765	880x1695x765
	Gross Dimension(WxHxD)		mm	948x1,657x832	948x1,657x832	948x1,657x832	948x1912x832	948x1912x832	948x1912x832
Operating Temp Range	Cooling	DVM S HP	℃	-5.0~48.0	-5.0~48.0	-5.0~48.0	-5.0 ~ 48.0	-5.0 ~ 48.0	-5.0 ~ 48.0
		DVM S HR		-15.0~48.0	-15.0~48.0	-15.0~48.0			
	Heating			-20.0~24.0	-20.0~24.0	-20.0~24.0	-20.0 ~ 24.0	-20.0 ~ 24.0	-20.0~ 24.0

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Outdoor Unit (cont.)

TYPE				New Model		Comparative Model	
							
Model				AM140FXVAGR	AM160FXVAGR	RD140HRXG*	RD160HRXG*
Mode				HR	HR	HR	HR
Power			Ø,V,Hz	3/AC380~415/50	3/AC380~415/50	3/AC380~415/50	3/AC380~415/50
Capacity	Horse Power		HP	14	16	14	16
	Capacity		kW	40.0	45.0	39.2	44.8
			btu/h	136,000	153,000	133,800	152,900
	Heating		kW	45.0	50.0	44.1	50.0
			btu/h	153,000	170,000	150,500	172,000
Power	Power Input (Nominal)	Cooling 1)	kW	8.90	11.00	-	-
		Heating 2)		9.50	11.50	-	-
	Current Input (Nominal)	Cooling 1)	A	14.30	17.60	-	-
		Heating 2)		15.20	18.40	-	-
	Running Current	Cooling	A	14.30	17.60	20.90	22.00
		Heating	A	15.20	18.40	19.40	27.20
		Max.	A	25.00	32.00	29.40	38.30
	Power Consumption	Cooling	kW	8.90	11.00	10.10	12.00
		Heating	kW	9.50	11.50	9.65	11.30
	MCA / MFA		A	31.3 / 40	40 / 40	-	-
COP	Nominal Cooling		-	4.49	4.09	-	-
	Nominal Heating		-	4.74	4.35	-	-
	ESEER (HP)			7.02	6.78	-	-
Compressor	Model		-	DS-GB066FA****	DS-GB052FA****	ZPJ83KCE-TFD ZPI83KCE-TFD	ZPJ72KCE-TFD ZPI72KCE-TFD
	Type			INV x1	INV x2	DVI x1 + FVI x1	DVI x1 + FVI x2
	Output		kW	5.80	4.7 x2	5.87 + 5.87	5.16 + 5.16 x2
	Lubricant	Type	-	FVC68D	FVC68D	3MAF POE	3MAF POE
		Charging	cc	3,900	6,200	4,370	6,540
Refrigerant	Type		-	R410A	R410A	R410A	R410A
	Factory Charging		kg	7.7	7.4	7.0	7.0
FAN	Type		-	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC
	Motor Output		W	630 x 2	630 x 2	630 x 2	630 x 2
	Airflow rate		㎥ /min	226	250	226	250
Pipe	Piping Connections	Liquid	Ø,mm	12.70	12.70	12.70	12.70
			Ø,inch	1/2"	1/2"		
		Gas	Ø,mm	28.58	28.58	25.40	28.58
			Ø,inch	1 1/8"	1 1/8"		
		Dis. Gas	Ø,mm	19.05	22.22	22.22	25.40
			Ø,inch	3/4"	7/8"		
	Installation Limitation	Max.Length	m	200(220)	200(220)	200	200
		Max.Height	m	110(40)	110(40)	50(40)	50(40)
Cable	Main Power(Below/ about20m)		mm2	4.0	6.0	4.0	6.0
	Communication		mm2	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)
Set Dimension	Net Weight	DVM S HP	kg	235.0	278.0	293	338
		DVM S HR		214.0	184.0		
	Shipping Weight	DVM S HP	kg	254.0	297.0	314	359
		DVM S HR		260.0	303.0		
	Net Dimension(WxHxD)		mm	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765
	Gross Dimension(WxHxD)		mm	1363x1857x832	1363x1857x832	1363x1912x832	1363x1912x832
Operating Temp Range	Cooling	DVM S HP	℃	-5.0~48.0	-5.0~48.0	-5.0~ 48.0	-5.0~ 48.0
		DVM S HR		-15.0~48.0	-15.0~48.0		
	Heating			-20.0~24.0	-20.0~24.0	-20.0~ 24.0	-20.0~ 24.0

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Outdoor Unit (cont.)

TYPE				New Model			Comparative Model	
								
Model				AM180FXVAGR	AM200FXVAGR	AM220FXVAGR	RD180HRXG*	RD200HRXG*
Mode				HR	HR	HR	HR	HR
Power			Ø,V,Hz	3/AC380~415/50	3/AC380~415/50	3/AC380~415/50	3/AC380~415/50	3/AC380~415/50
Capacity	Horse Power		HP	18	20	22	18	20
	Capacity		kW	50.4	56.0	61.6	50.4	56.0
			btu/h	171,900	191,000	210,000	171,900	191,000
	Heating		kW	56.7	63.0	69.3	56.7	63.0
			btu/h	193,500	215,000	236,000	193,500	215,000
Power	Power Input (Nominal)	Cooling 1)	kW	12.80	15.19	17.35	-	-
		Heating 2)		11.90	13.90	16.70	-	-
	Current Input (Nominal)	Cooling 1)	A	20.70	24.40	27.80	-	-
		Heating 2)		19.10	22.30	26.80	-	-
	Running Current	Cooling	A	20.70	24.40	27.80	31.30	32.80
		Heating	A	19.10	22.30	26.80	26.70	29.10
		Max.	A	39.10	42.50	44.50	42.50	44.10
	Power Consumption	Cooling	kW	12.88	15.19	17.35	15.70	17.00
		Heating	kW	11.90	13.90	16.70	12.90	14.50
	MCA / MFA		A	48.9 / 50	52.5 / 75	52.5 / 75	-	-
COP	Nominal Cooling		-	3.91	3.69	3.55	-	-
	Nominal Heating		-	4.76	4.53	4.15	-	-
	ESEER (HP)			6.59	6.56	6.25	-	-
Compressor	Model		-	DS-GB066FA****	DS-GB066FA****	DS-GB066FA****	ZPJ83KCE-TFD ZPI83KCE-TFD	ZPJ83KCE-TFD ZPI83KCE-TFD
	Type			INV x2	INV x2	INV x2	DVI x1 + FVI x2	DVI x1 + FVI x2
	Output		kW	5.8 x2	5.8 x2	5.8 x2	5.87 + 5.87 x2	5.87 + 5.87 x2
	Lubricant	Type	-	FVC68D		FVC68D	3MAF POE	3MAF POE
		Charging	cc	6,200	6,200	6,200	6,540	6,540
Refrigerant	Type		-	R410A	R410A	R410A	R410A	R410A
	Factory Charging		kg	8.7	8.4	8.4	8.5	8.5
FAN	Type		-	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC
	Motor Output		W	630 x2	630 x2	630 x2	630 x2	630 x2
	Airflow rate		㎥ /min	270	275	280	270	275
Pipe	Piping Connections	Liquid	Ø,mm	15.88	15.88	15.88	15.88	15.88
			Ø,inch	5/8"	5/8"	5/8"		
		Gas	Ø,mm	28.58	28.58	28.58	28.58	28.58
			Ø,inch	1 1/8"	1 1/8"	1 1/8"		
		Dis. Gas	Ø,mm	22.22	28.58	28.58	28.58	28.58
			Ø,inch	7/8"	1 1/8"	1 1/8"		
	Installation Limitation	Max.Length	m	200(220)	200(220)	200(220)	200	200
		Max.Height	m	110(40)	110(40)	110(40)	50(40)	50(40)
Cable	Main Power(Below/ about20m)		mm2	10.0	10.0	10.0	6.0	10.0
	Communication		mm2	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)	VCTF 0.75~1.5(2P)
Set Dimension	Net Weight	DVM S HP	kg	300.0	300.0	300.0	349	355
		DVM S HR		306.0	306.0	306.0		
	Shipping Weight	DVM S HP	kg	319.0	319.0	319.0	369	376
		DVM S HR		325.0	325.0	325.0		
	Net Dimension(WxHxD)		mm	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765
	Gross Dimension(WxHxD)		mm	1363x1857x832	1363x1857x832	1363x1857x832	1363x1912x832	1363x1912x832
Operating Temp Range	Cooling	DVM S HP	℃	-5.0 ~ 48.0	-5.0 ~ 48.0	-5.0 ~ 48.0	-5.0 ~ 48.0	-5.0 ~ 48.0
		DVM S HR		-15.0~48.0	-15.0~48.0	-15.0~48.0		
	Heating			-20.0 ~ 24.0	-20.0 ~ 24.0	-20.0 ~ 24.0	-20.0 ~ 24.0	-20.0~ 24.0

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Outdoor Unit (cont.)

TYPE				New Model				Comparative Model		
										
Model Name				AM080FXWANR/EU	AM100FXWANR/EU	AM120FXWANR/EU	AM200FXWANR/EU	RD100DRXH1	RD200DRXH1	RD300DRXH1
Power Supply			Φ, #, V, Hz	3/AC380~415/50				3/AC380~415/50		
Performance	HP		HP	8	10	12	20	10	20	30
	Capacity (Nominal)	Cooling	kW	23	29	34.8	58	29	58	87
			kcal/h	19780	24940	29928	49880	24940	49880	74820
		Heating	kW	26	32.6	39.2	65.2	32.6	65.2	97.9
			kcal/h	22360	28036	33712	56072	28036	56072	84194
Power	Power Input (Nominal)	Cooling	kW	4.18	5.58	6.69	11.15	5.8	11.6	17.4
		Heating		4.33	5.62	6.76	11.24	5.69	11.8	17.8
	Current Input (Nominal)	Cooling	A	7.0	9.4	11.3	18.8	10.5	21.4	31.9
		Heating		7.3	9.5	11.4	19.0	9.5	20.9	31.1
	MFA		-	20	20	30	40	20	40	60
COP	Nominal Cooling 1)		-	5.50	5.20	5.20	5.20	-	-	-
	Nominal Heating 2)		-	6.00	5.80	5.80	5.80	-	-	-
Compressor	Type			SSC Scroll x 1	SSC Scroll x 1	SSC Scroll x 1	SSC Scroll x 2	DVI Scrollx1	DVI Scrollx1 + FVI Scrollx1	DVI Scroll + FVI Scrollx2
	Output		kW	4.96	4.96	6.13	4.96 x 2	7.04	7.48 + 7.43	7.48 + (7.43 x 2)
	Oil	Type	-	PVE	PVE	PVE	PVE	3MAF POE	3MAF POE	3MAF POE
		Initial Charge	Liter	3.9	3.9	3.9	6.2	2.185	4.37	6.555
Condenser	Type		-	Stainless steel plate	Stainless steel plate	Stainless steel plate	Stainless steel plate	Stainless steel plate	Stainless steel plate	Stainless steel plate
	Pipe Size		Φ, inch(A)	PT1-1/4 (32)	PT1-1/4 (32)	PT1-1/4 (32)	PT1-1/4 (32)	1 1/4" (32A)	1 1/4" (32A)	2 (50A)
	Lost Head		kPa	22	30	43	54	30	54	54
	Water Flow Rate		LPM	80	96	114	190	96	190	285
	Max. Pressure		MPa	1.96	1.96	1.96	1.96	1.96	1.96	1.96
Piping Connections	Liquid Pipe		Φ, mm	9.52	9.52	12.7	15.88	9.52	15.88	19.05
	Gas Pipe		Φ, mm	19.05	22.23	25.4	28.58	22.23	28.58	31.75
	Discharge Gas Pipe		Φ, mm	15.88	19.05	22.23	25.4	19.05	25.4	28.58
	Oil Equalizing Pipe		Φ, mm	-	-	-	-	-	6.35	6.35
	Installation Limitation	Max. Length	m	170	170	170	170	150	150	150
	Airflow rate	Max. Height	m	50	50	50	50	50(40)	50(40)	50(40)
Field Wiring	Power Source Wire		mm2	2.50	2.50	4.00	6.00	1.5	4.0	10.0
	Transmission Cable		mm2	0.75~1.25	0.75~1.25	0.75~1.25	0.75~1.25	0.75~1.5	0.75~1.5	0.75~1.5
Refrigerant	Type		-	R410A	R410A	R410A	R410A	R410A	R410A	R410A
	Factory Charging		kg	5.5	5.8	6.0	9.8	5.8	9.4	12.0
External Dimension	Net Weight		kg	160	160	160	240	160	235	320
	Shipping Weight			167	167	167	250	167	242	330
	Net Dimensions (WxHxD)		kg	770x1000x545	770x1000x545	770x1000x545	1100x1000x545	770 x 1,117 x 545	770 x 1,117 x 545	1,100 x 1,117 x 550
	Shipping Dimensions (WxHxD)			840x1200x620	840x1200x620	840x1200x620	1170x1200x620	840 x 1,287 x 620	840 x 1,287 x 620	1,170 x 1,170 x 620
Operating Temp. Range(Water)	Cooling		℃	10~45	10~45	10~45	10~45	10~45	10~45	10~45
	Heating		℃	10~45	10~45	10~45	10~45	10~45	10~45	10~45

1. Proper form capacity standard of air conditioning
- Cooling capacity : It is figures that appear in indoor 27˚C DB/19˚C WB, outdoor 35˚C DB, length 7.5m of piping, fall 0m standard.
- Heating capacity : It is figures that appear in indoor 20˚C DB, outdoor 7˚C DB, length 7.5m of piping, fall 0m standard.
2. If proper form heating capacity is outdoor temperature 7˚C standard and outdoor temperature goes down by below zero, heating capacity can drop according to temperature condition.
3. Need special load calculation in case of use by main heating in the winter, and please buy product for low temperature that heating effect excels at low temperature.
4. Maximum length between outdoor and indoor units allows up to 200m (Equivalent length 220m).
5. If the indoor unit is below, height length allows up to 110m (If over 50m, decide whether to install the PDM kit). If the outdoor unit is below, allowable height length is 40m.

Outdoor Unit (cont.)

TYPE				New Model	
					
Model				AM240HXVAGH	AM260HXVAGH
Mode				HP	HP
Power			Φ, V, Hz	3/AC380~415/50	
Capacity	Horse Power		HP	24	26
	Cooling		kW	67.2	72.8
			btu/h	-	-
	Heating		kW	75.6	81.9
			btu/h	-	-
Power	Power input (Nominal)	Cooling 1)	kW	17.10	19.30
		Heating 2)		19.80	21.80
	Current Input (Nominal)	Cooling 1)	A	26.83	30.28
		Heating 2)		31.06	34.20
	Running Current"	Cooling	A	26.83	30.28
		Heating	A	31.06	34.20
		Max	A	55	58
	Power Consumption	Cooling	kW	26.83	30.28
		Heating	kW	31.06	34.20
	MCA/MFA		A	60.5/75	63.8/75
COP	Nominal Cooling		-	3.930	3.772
	Nominal Heating		-	3.818	3.757
	ESEER (HP)		-	-	-
Compressor	Model		-	DS-GB066FA*	DS-GB070FA*
	Type			INV x 2EA	INV x 2EA
	Output		kW	-	-
	Lubricant	Type	-	FVC68D	FVC68D
		Charging	cc	6,200	6,200
Refrigerant	Type		-	R410A	R410A
	Factory Charging		kg	14.3	14.3
Fan	Type		-	Propeller + BLDC	Propeller + BLDC
	Motor Output		W	620 x 2	620 x 2
	Airflow rate		㎥ /min	310	310
Piping Connections	Liquid pipe		Φ, mm	15.88	19.05
			Φ, inch	5/8"	3/4"
	Gas pipe		Φ, mm	34.92	34.92
			Φ, inch	1 3/8"	1 3/8"
	High pressure gas pipe		Φ, mm	-	-
			Φ, inch		
	Installation Limitation	Max. Length	m	200(220)	200(220)
		Max. Height	m	110.0(40.0)	110.0(40.0)
Cable	Main Power(Below 20m)		mm2	16	16
	Communication		mm2	VCTF 0.75 ~ 1.5(2P)	VCTF 0.75 ~ 1.5(2P)
Set Dimension	Net weight		kg	360	360
	Gross weight		kg	370	370
	Net dimension (WxHxD)		mm	1,295 x 1,695 x 765	1,295 x 1,695 x 765
	Gross dimension (WxHxD)		mm	1,363 x 1,887 x 832	1,363 x 1,887 x 832
Operating Temp. Range	Cooling		℃	-5.0 ~ 48.0	-5.0 ~ 48.0
	Heating		℃	-25.0 ~ 24.0	-25.0 ~ 24.0

1. Proper form capacity standard of air conditioning
- Cooling capacity : It is figures that appear in indoor 27˚C DB/19°C WB, outdoor 35˚C DB, length 7.5m of piping, fall 0m standard.
- Heating capacity : It is figures that appear in indoor 20˚C DB, outdoor 7˚C DB, length 7.5m of piping, fall 0m standard.
2. If proper form heating capacity is outdoor temperature 7˚C standard and outdoor temperature goes down by below zero, heating capacity can drop according to temperature condition.
3. Need special load calculation in case of use by main heating in the winter, and please buy product for low temperature that heating effect excels at low temperature.
4. Maximum length between outdoor and indoor units allows up to 200m (Equivalent length 220m).
5. If the indoor unit is below, height length allows up to 110m (If over 50m, decide whether to install the PDM kit). If the outdoor unit is below, allowable height length is 40m.

Outdoor Unit (cont.)

TYPE				New Model			New Model				
											
Model				AM080JXVAGH	AM100JXVAGH	AM120JXVAGH	AM140JXVAGH	AM160JXVAGH	AM180JXVAGH	AM200JXVAGH	AM220JXVAGH
Mode				HP	HP	HP	HP	HP	HP	HP	HP
Power			Φ, V, Hz	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50
Capacity	Horse Power		HP	8	10	12	14	16	18	20	22
	Cooling		kW	22.4	28.0	33.6	40.0	45.0	50.4	56.0	61.6
	Heating		kW	25.2	31.5	37.8	45.0	50.4	56.7	63.0	69.3
Power	Power input (Nominal)	Cooling 1)	kW	5.00	6.85	8.16	10.93	11.98	12.45	14.59	17.35
		Heating 2)		5.10	6.65	8.03	10.15	11.60	11.90	13.90	16.70
	Current Input (Nominal)	Cooling 1)	A	8.00	11.00	13.10	17.50	19.20	20.00	13.90	27.80
		Heating 2)		8.20	10.70	12.90	16.30	18.60	19.10	23.40	26.80
	Running Current*	Cooling	A	8.00	11.00	13.10	17.50	19.20	20.00	13.90	27.80
		Heating	A	8.20	10.70	12.90	16.30	18.60	19.10	23.40	26.80
		Max	A	18.0	21.1	25.0	25.0	32.0	39.1	22.30	44.5
	Power Consumption	Cooling	kW	5.00	6.85	8.16	10.93	11.98	12.45	14.59	17.35
		Heating	kW	5.10	6.65	8.03	10.15	11.60	11.90	13.90	16.70
	MCA/MFA		A	22.5/30	29.9/40	31.3/40	31.3/40	40.0/40	48.9/50	52.5/75	55.6/75
COP	Nominal Cooling		-	4.480	4.090	4.120	3.660	3.760	4.050	3.840	3.550
	Nominal Heating		-	4.940	4.740	4.710	4.430	4.340	4.760	4.530	4.150
	ESEER (HP)		-	-	-	-	-	-	-	-	-
Compressor	Model		-	DS-GA046FA*	DS-GB066FA*	DS-GB066FA*	DS-GB066FA*	DS-GA046FA*	DS-GB066FA*	DS-GB066FA*	DS-GB066FA*
	Type			INV x 1EA	INV x 1EA	INV x 1EA	INV x 1EA	INV x 2EA	INV x 2EA	INV x 2EA	INV x 2EA
	Output		kW	-	-	-	-	-	-	-	-
	Lubricant	Type	-	FVC68D	FVC68D	FVC68D	FVC68D	FVC68D	FVC68D	FVC68D	FVC68D
		Charging	cc	3700	3900	3900	3900	5800	6200	6200	6200
Refrigerant	Type		-	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A
	Factory Charging		kg	5.5	5.5	6.5	7.7	7.7	8.4	8.4	8.4
Fan	Type		-	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC
	Motor Output		W	830	830	830	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2
	Airflow rate		㎥ /min	170	170	220	255	255	290	290	290
Piping Connections	Liquid pipe		Φ, mm	9.52	9.52	12.7	12.7	12.7	15.88	15.88	15.88
			Φ, inch	3/8"	3/8"	1/2"	1/2"	1/2"	5/8"	5/8"	5/8"
	Gas pipe		Φ, mm	19.05	22.22	28.58	28.58	28.58	28.58	28.58	28.58
			Φ, inch	3/4"	7/8"	1+1/8"	1+1/8"	1+1/8"	1+1/8"	1+1/8"	1+1/8"
	High pressure gas pipe		Φ, mm	-	-	-	-	-	-	-	-
			Φ, inch	-	-	-	-	-	-	-	-
	Installation Limitation	Max. Length	m	220	220	220	220	220	220	220	220
		Max. Height	m	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40
Cable	Main Power(Below 20m)		mm2	-	-	-	-	-	-	-	-
	Communication		mm2	-	-	-	-	-	-	-	-
Set Dimension	Net weight		kg	186	197	210	239	269	307	307	307
	Gross weight		kg	193	204	217	249	279	317	317	317
	Net dimension (WxHxD)		mm	880x1695x765	880x1695x765	880x1695x765	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765
	Gross dimension (WxHxD)		mm	948x1887x832	948x1887x832	948x1887x832	1363x1887x832	1363x1887x832	1363x1887x832	1363x1887x832	1363x1887x832
Operating Temp. Range	Cooling		℃	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48
	Heating		℃	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24

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- Cooling capacity : It is figures that appear in indoor 27˚C DB/19˚C WB, outdoor 35˚C DB, length 7.5m of piping, fall 0m standard.
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Outdoor Unit (cont.)

TYPE				New Model			New Model				
											
Model				AM080JXVHGH	AM100JXVHGH	AM120JXVHGH	AM140JXVHGH	AM160JXVHGH	AM180JXVHGH	AM200JXVHGH	AM220JXVHGH
Mode				HP	HP	HP	HP	HP	HP	HP	HP
Power			Φ, V, Hz	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50
Capacity	Horse Power		HP	8	10	12	14	16	18	20	22
	Cooling		kW	22.4	28.0	33.6	40.0	45.0	50.4	56.0	61.6
	Heating		kW	25.2	31.5	37.8	45.0	50.4	56.7	63.0	69.3
Power	Power input (Nominal)	Cooling 1)	kW	4.59	6.22	7.57	10.55	10.92	11.51	13.05	15.75
		Heating 2)		4.59	5.89	7.56	9.72	10.75	11.62	13.10	15.86
	Current Input (Nominal)	Cooling 1)	A	7.40	10.00	12.10	16.90	17.50	18.50	20.90	25.30
		Heating 2)		7.40	9.40	12.10	15.60	17.20	18.60	21.00	25.40
	Running Current*	Cooling	A	7.40	10.00	12.10	16.90	17.50	18.50	20.90	25.30
		Heating	A	7.40	9.40	12.10	15.60	17.20	18.60	21.00	25.40
		Max	A	18.0	21.1	25.0	25.0	32.0	39.1	42.5	44.5
	Power Consumption	Cooling	kW	4.59	6.22	7.57	10.55	10.92	11.51	13.05	15.75
		Heating	kW	4.59	5.89	7.56	9.72	10.75	11.62	13.10	15.86
	MCA/MFA		A	22.5/30	29.9/40	31.3/40	31.3/40	40.0/40	48.9/50	52.5/75	55.6/75
COP	Nominal Cooling		-	4.880	4.500	4.440	3.790	4.120	4.380	4.290	3.910
	Nominal Heating		-	5.490	5.350	5.000	4.630	4.690	4.880	4.810	4.370
	ESEER (HP)		-	-	-	-	-	-	-	-	-
Compressor	Model		-	DS-GB052FA*	DS-GB066FA*	DS-GB066FA*	DS-GB066FA*	DS-GA046FA*	DS-GB066FA*	DS-GB066FA*	DS-GB066FA*
	Type			INV x 1EA	INV x 1EA	INV x 1EA	INV x 1EA	INV x 2EA	INV x 2EA	INV x 2EA	INV x 2EA
	Output		kW	-	-	-	-	-	-	-	-
	Lubricant	Type	-	FVC68D	FVC68D	FVC68D	FVC68D	FVC68D	FVC68D	FVC68D	FVC68D
		Charging	cc	3900	3900	3900	3900	5800	6200	6200	6200
Refrigerant	Type		-	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A
	Factory Charging		kg	6.5	6.5	6.5	7.7	7.7	8.4	8.4	8.4
Fan	Type		-	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC
	Motor Output		W	830	830	830	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2
	Airflow rate		㎥ /min	170	170	200	255	255	290	290	290
Piping Connections	Liquid pipe		Φ, mm	9.52	9.52	12.7	12.7	12.7	15.88	15.88	15.88
			Φ, inch	3/8"	3/8"	1/2"	1/2"	1/2"	5/8"	5/8"	5/8"
	Gas pipe		Φ, mm	19.05	22.22	28.58	28.58	28.58	28.58	28.58	28.58
			Φ, inch	3/4"	7/8"	1+1/8"	1+1/8"	1+1/8"	1+1/8"	1+1/8"	1+1/8"
	High pressure gas pipe		Φ, mm	-	-	-	-	-	-	-	-
			Φ, inch	-	-	-	-	-	-	-	-
	Installation Limitation	Max. Length	m	220	220	220	220	220	220	220	220
		Max. Height	m	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40
Cable	Main Power(Below 20m)		mm2	-	-	-	-	-	-	-	-
	Communication		mm2	-	-	-	-	-	-	-	-
Set Dimension	Net weight		kg	201	201	201	235	266	300	300	300
	Gross weight		kg	217	217	217	254	285	319	319	319
	Net dimension (WxHxD)		mm	880x1695x765	880x1695x765	880x1695x765	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765
	Gross dimension (WxHxD)		mm	948x1887x832	948x1887x832	948x1887x832	1363x1887x832	1363x1887x832	1363x1887x832	1363x1887x832	1363x1887x832
Operating Temp. Range	Cooling		℃	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48
	Heating		℃	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24

1. Proper form capacity standard of air conditioning
- Cooling capacity : It is figures that appear in indoor 27˚C DB/19˚C WB, outdoor 35˚C DB, length 7.5m of piping, fall 0m standard.
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2. If proper form heating capacity is outdoor temperature 7˚C standard and outdoor temperature goes down by below zero, heating capacity can drop according to temperature condition.
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Outdoor Unit (cont.)

TYPE				New Model			New Model				
											
Model				AM080JXVHGR	AM100JXVHGR	AM120JXVHGR	AM140JXVHGR	AM160JXVHGR	AM180JXVHGR	AM200JXVHGR	AM220JXVHGR
Mode				HR	HR	HR	HR	HR	HR	HR	HR
Power			Φ, V, Hz	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50
Capacity	Horse Power		HP	8	10	12	14	16	18	20	22
	Cooling		kW	22.4	28.0	33.6	40.0	45.0	50.4	56.0	61.6
	Heating		kW	25.2	31.5	37.8	45.0	50.4	56.7	63.0	69.3
Power	Power input (Nominal)	Cooling 1)	kW	4.59	6.22	7.57	10.55	10.92	11.51	13.05	15.75
		Heating 2)		4.59	5.89	7.56	9.72	10.75	11.62	13.10	15.86
	Current Input (Nominal)	Cooling 1)	A	7.40	10.00	12.10	16.90	17.50	18.50	20.90	25.30
		Heating 2)		7.40	9.40	12.10	15.60	17.20	18.60	21.00	25.40
	Running Current*	Cooling	A	7.40	10.00	12.10	16.90	17.50	18.50	20.90	25.30
		Heating	A	7.40	9.40	12.10	15.60	17.20	18.60	21.00	25.40
		Max	A	18.0	21.1	25.0	25.0	32.0	39.1	42.5	44.5
	Power Consumption	Cooling	kW	4.59	6.22	7.57	10.55	10.92	11.51	13.05	15.75
		Heating	kW	4.59	5.89	7.56	9.72	10.75	11.62	13.10	15.86
	MCA/MFA		A	22.5/30	29.9/40	31.3/40	31.3/40	40.0/40	48.9/50	52.5/75	55.6/75
COP	Nominal Cooling		-	4.880	4.500	4.440	3.790	4.120	4.380	4.290	3.910
	Nominal Heating		-	5.490	5.350	5.000	4.630	4.690	4.880	4.810	4.370
	ESEER (HP)		-	-	-	-	-	-	-	-	-
Compressor	Model		-	DS-GB052FA*	DS-GB066FA*	DS-GB066FA*	DS-GB066FA*	DS-GA046FA*	DS-GB066FA*	DS-GB066FA*	DS-GB066FA*
	Type			INV x 1EA	INV x 1EA	INV x 1EA	INV x 1EA	INV x 2EA	INV x 2EA	INV x 2EA	INV x 2EA
	Output		kW	-	-	-	-	-	-	-	-
	Lubricant	Type	-	FVC68D	FVC68D	FVC68D	FVC68D	FVC68D	FVC68D	FVC68D	FVC68D
		Charging	cc	3900	3900	3900	3900	5800	6200	6200	6200
Refrigerant	Type		-	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A
	Factory Charging		kg	6.5	6.5	6.5	7.7	7.7	8.4	8.4	8.4
Fan	Type		-	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC
	Motor Output		W	830	830	830	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2
	Airflow rate		㎥ /min	170	170	200	255	255	290	290	290
Piping Connections	Liquid pipe		Φ, mm	9.52	9.52	12.7	12.7	12.7	15.88	15.88	15.88
			Φ, inch	3/8"	3/8"	1/2"	1/2"	1/2"	5/8"	5/8"	5/8"
	Gas pipe		Φ, mm	19.05	22.22	28.58	28.58	28.58	28.58	28.58	28.58
			Φ, inch	3/4"	7/8"	1+1/8"	1+1/8"	1+1/8"	1+1/8"	1+1/8"	1+1/8"
	High pressure gas pipe		Φ, mm	15.88	19.05	19.05	22.22	22.22	28.58	28.58	28.58
			Φ, inch	5/8"	3/4"	3/4"	7/8"	7/8"	1+1/8"	1+1/8"	1+1/8"
	Installation Limitation	Max. Length	m	220	220	220	220	220	220	220	220
		Max. Height	m	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40
Cable	Main Power(Below 20m)		mm2	-	-	-	-	-	-	-	-
	Communication		mm2	-	-	-	-	-	-	-	-
Set Dimension	Net weight		kg	206	206	206	241	272	306	306	306
	Gross weight		kg	222	222	222	260	291	325	325	325
	Net dimension (WxHxD)		mm	880x1695x765	880x1695x765	880x1695x765	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765
	Gross dimension (WxHxD)		mm	948x1887x832	948x1887x832	948x1887x832	1363x1887x832	1363x1887x832	1363x1887x832	1363x1887x832	1363x1887x832
Operating Temp. Range	Cooling		℃	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48
	Heating		℃	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24

1. Proper form capacity standard of air conditioning
- Cooling capacity : It is figures that appear in indoor 27℃ DB/19℃ WB, outdoor 35℃ DB, length 7.5m of piping, fall 0m standard.
- Heating capacity : It is figures that appear in indoor 20℃ DB, outdoor 7℃ DB, length 7.5m of piping, fall 0m standard.
2. If proper form heating capacity is outdoor temperature 7℃ standard and outdoor temperature goes down by below zero, heating capacity can drop according to temperature condition.
3. Need special load calculation in case of use by main heating in the winter, and please buy product for low temperature that heating effect excels at low temperature.
4. Maximum length between outdoor and indoor units allows up to 200m (Equivalent length 220m).
5. If the indoor unit is below, height length allows up to 110m (If over 50m, decide whether to install the PDM kit). If the outdoor unit is below, allowable height length is 40m.

Outdoor Unit (cont.)

■ **AM080/100/120/140/160/180/200/220JXVA**✳✳

TYPE				New Model														
																		
Model				AM080JXVAFH/AZ	AM100JXVAFH/AZ	AM120JXVAFH/AZ	AM140JXVAFH/AZ	AM160JXVAFH/AZ	AM180JXVAFH/AZ	AM200JXVAFH/AZ	AM080JXVAJH/AZ	AM100JXVAJH/AZ	AM120JXVAJH/AZ	AM140JXVAJH/AZ	AM160JXVAJH/AZ	AM180JXVAJH/AZ	AM200JXVAJH/AZ	AM220JXVAJH/AZ
Mode				HEAT PUMP	HEAT PUMP	HEAT PUMP	HEAT PUMP	HEAT PUMP	HEAT PUMP	HEAT PUMP	HEAT PUMP	HEAT PUMP	HEAT PUMP	HEAT PUMP	HEAT PUMP	HEAT PUMP	HEAT PUMP	HEAT PUMP
Power			Φ, #, V, Hz	3,3,208-230,60	3,3,208-230,60	3,3,208-230,60	3,3,208-230,60	3,3,208-230,60	3,3,208-230,60	3,3,208-230,60	3,3,460,60	3,3,460,60	3,3,460,60	3,3,460,60	3,3,460,60	3,3,460,60	3,3,460,60	3,3,460,60
Performance	HP		HP	8	10	12	14	16	18	20	8	10	12	14	16	18	20	22
	Capacity (Nominal)	Cooling	kW	22.4	28.0	33.6	40.0	45.0	50.4	56.0	22.4	28.0	33.6	40.0	45.0	50.4	56.0	61.6
			Btu/h	76,400	95,500	114,600	136,500	153,500	172,000	191,100	76,400	95,500	114,600	136,500	153,500	172,000	191,100	210,200
		Heating	kW	25.2	31.5	37.8	45.0	50.4	56.7	63.0	25.2	31.5	37.8	45.0	50.4	56.7	63.0	69.3
			Btu/h	86,000	107,500	129,000	153,500	172,000	193,500	215,000	86,000	107,500	129,000	153,500	172,000	193,500	215,000	236,500
Power	Power Input	Cooling 1)	kW	4.35	5.50	7.22	8.47	10.64	10.66	11.45	4.35	5.50	7.22	8.47	10.64	10.66	11.45	15.35
		Heating 2)		4.44	5.33	7.40	9.18	10.30	10.40	12.70	4.44	5.33	7.40	9.18	10.30	10.40	12.70	15.80
	Current Input	Cooling 1)	A	12.70	16.00	21.10	24.70	31.00	31.10	33.40	6.10	7.70	10.10	11.80	14.80	14.90	16.00	21.40
		Heating 2)		12.90	15.50	21.60	26.80	30.00	30.30	37.00	6.20	7.40	10.30	12.80	14.40	14.50	17.70	22.00
		Max. current		28.0	34.0	35.0	50.0	56.1	66.5	73.0	17.4	18.9	20.6	25.0	28.1	33.8	41.8	46.0
	MCA		A	35	43	44	55	62	73	80	22	24	26	31	35	42	52	58
	MFA (MOP)		A	40	50	50	75	75	75	90	30	30	30	40	40	50	75	75
COP	Nominal Cooling		W/W	5.15	5.09	4.65	4.72	4.23	4.73	4.89	5.15	5.09	4.65	4.72	4.23	4.73	4.89	4.01
	Nominal Heating		W/W	5.68	5.91	5.11	4.90	4.89	5.45	4.96	5.68	5.91	5.11	4.90	4.89	5.45	4.96	4.39
Compressor	Type		-	Scroll Inverter	Scroll Inverter	Scroll Inverter	Scroll Inverter	Scroll Inverter	Scroll Inverter	Scroll Inverter	Scroll Inverter	Scroll Inverter	Scroll Inverter	Scroll Inverter	Scroll Inverter	Scroll Inverter	Scroll Inverter	Scroll Inverter
	Output		kW x n	5.18 x 1	6.45 x 1	6.45 x 1	5.18 x 2	5.18 x 2	6.45 x 2	6.45 x 2	4.39 x 1	6.39 x 1	6.39 x 1	4.39 x 2	4.39 x 2	6.39 x 2	6.39 x 2	6.39 x 2
	Model Name		-	DS-GB052FBVASG x 1	DS4GJ5066EVASG x 1	DS4GJ5066EVASG x 1	DS-GB052FBVASG x 2	DS-GB052FBVASG x 2	DS4GJ5066EVASG x 2	DS4GJ5066EVASG x 2	DS-GA046FAVASG x 1	DS-GB066FAVBSG x 1	DS-GB066FAVBSG x 1	DS-GA046FAVASG x 2	DS-GA046FAVASG x 2	DS-GB066FAVBSG x 2	DS-GB066FAVBSG x 2	DS-GB066FAVBSG x 2
	Oil	Type	-	PVE	PVE	PVE	PVE	PVE	PVE	PVE	PVE	PVE	PVE	PVE	PVE	PVE	PVE	PVE
Refrigerant	Type		-	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A
	Factory Charging		kg	5.5	5.5	6.5	7.7	7.7	8.4	8.4	5.5	5.5	6.5	7.7	7.7	8.4	8.4	8.4
Fan	Type		-	Propeller	Propeller	Propeller	Propeller	Propeller	Propeller	Propeller	Propeller	Propeller	Propeller	Propeller	Propeller	Propeller	Propeller	Propeller
	Output x n		W	830 x 1	830 x 1	830 x 1	620 x 2	620 x 2	620 x 2	620 x 2	830 x 1	830 x 1	830 x 1	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2
	Air Flow Rate		CMM	170	170	220	255	255	260	265	170	170	220	255	255	260	265	290
	External Static Pressure	Max.	mmAq	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Piping Connections	Liquid Pipe		Φ, mm	9.52	9.52	12.7	12.7	12.7	15.88	15.88	9.52	9.52	12.7	12.7	12.7	15.88	15.88	15.88
			Φ, inch	3/8"	3/8"	1/2"	1/2"	1/2"	5/8"	5/8"	3/8"	3/8"	1/2"	1/2"	1/2"	5/8"	5/8"	5/8"
	Gas Pipe		Φ, mm	19.05	22.22	28.58	28.58	28.58	28.58	28.58	19.05	22.22	28.58	28.58	28.58	28.58	28.58	28.58
			Φ, inch	3/4"	7/8"	1+1/8"	1+1/8"	1+1/8"	1+1/8"	1+1/8"	3/4"	7/8"	1+1/8"	1+1/8"	1+1/8"	1+1/8"	1+1/8"	1+1/8"
	Installation Limitation	Max. Length	m	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220
		Max. Height	m	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40
Field Wiring	Power Source Wire		mm2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Transmission Cable		mm2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sound	Sound Pressure		dB(A)	57	61	61	61	63	64	65	57	58	62	61	63	64	65	65
	Sound Power			77	81	81	81	83	86	87	77	79	81	81	83	86	87	87
External Dimension	Net Weight		kg	190	193	204	292	292	300	300	188	195	206	283	283	305	305	305
	Shipping Weight		kg	206	209	220	311	311	319	319	204	211	222	302	302	324	324	324
	Net Dimensions (WxHxD)		mm	880x1695x765	880x1695x765	880x1695x765	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765	880x1695x765	880x1695x765	880x1695x765	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765
	Shipping Dimensions (WxHxD)		mm	948x1887x832	948x1887x832	948x1887x832	1363x1887x832	1363x1887x832	1363x1887x832	1363x1887x832	948x1887x832	948x1887x832	948x1887x832	1363x1887x832	1363x1887x832	1363x1887x832	1363x1887x832	1363x1887x832
Operating Temp. Range	Cooling		℃	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48
	Heating		℃	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24

1. Proper form capacity standard of air conditioning
- Cooling capacity : It is figures that appear in indoor 27˚C DB/19˚C WB, outdoor 35˚C DB, length 7.5m of piping, fall 0m standard.
- Heating capacity : It is figures that appear in indoor 20˚C DB, outdoor 7˚C DB, length 7.5m of piping, fall 0m standard.
2. If proper form heating capacity is outdoor temperature 7˚C standard and outdoor temperature goes down by below zero, heating capacity can drop according to temperature condition.
3. Need special load calculation in case of use by main heating in the winter, and please buy product for low temperature that heating effect excels at low temperature.
4. Maximum length between outdoor and indoor units allows up to 200m (Equivalent length 220m).
5. If the indoor unit is below, height length allows up to 110m (If over 50m, decide whether to install the PDM kit). If the outdoor unit is below, allowable height length is 40m.

Outdoor Unit (cont.)

TYPE				New Model			New Model				
											
Model				AM080JXVANH	AM100JXVANH	AM120JXVANH	AM140JXVANH	AM160JXVANH	AM180JXVANH	AM200JXVANH	AM220JXVANH
Mode				HP	HP	HP	HP	HP	HP	HP	HP
Power			Φ, V, Hz	3/AC380-415/50-60	3/AC380-415/50-60	3/AC380-415/50-60	3/AC380-415/50-60	3/AC380-415/50-60	3/AC380-415/50-60	3/AC380-415/50-60	3/AC380-415/50-60
Capacity	Horse Power		HP	8	10	12	14	16	18	20	22
	Cooling		kW	22.4	28.0	33.6	40.0	45.0	50.4	56.0	61.6
	Heating		kW	25.2	31.5	37.8	45.0	50.4	56.7	63.0	69.3
Power	Power input (Nominal)	Cooling 1)	kW	5.00	6.85	8.77	10.93	11.98	12.45	14.59	17.35
		Heating 2)		5.10	6.65	9.3	10.15	11.60	11.90	13.90	16.70
	Current Input (Nominal)	Cooling 1)	A	8.00	11.00	14.1	17.50	19.20	20.00	13.90	27.80
		Heating 2)		8.20	10.70	14.9	16.30	18.60	19.10	23.40	26.80
	Running Current*	Cooling	A	8.00	11.00	14.1	17.50	19.20	20.00	13.90	27.80
		Heating	A	8.20	10.70	14.9	16.30	18.60	19.10	23.40	26.80
		Max	A	18.0	21.1	25	25.0	32.0	39.1	22.30	44.5
	Power Consumption	Cooling	kW	5.00	6.85	8.77	10.93	11.98	12.45	14.59	17.35
		Heating	kW	5.10	6.65	9.3	10.15	11.60	11.90	13.90	16.70
	MCA/MFA		A	22.5/30	29.9/40	31.3/40	31.3/40	40.0/40	48.9/50	52.5/75	55.6/75
COP	Nominal Cooling		-	4.480	4.090	3.83	3.660	3.760	4.050	3.840	3.550
	Nominal Heating		-	4.940	4.740	4.06	4.430	4.340	4.760	4.530	4.150
	ESEER (HP)		-	-	-	-	-	-	-	-	-
Compressor	Model		-	DS-GA046FA*	DS-GB066FA*	DS-GB066FA*	DS-GB066FA*	DS-GA046FA*	DS-GB066FA*	DS-GB066FA*	DS-GB066FA*
	Type			INV x 1EA	INV x 1EA	INV x 1EA	INV x 1EA	INV x 2EA	INV x 2EA	INV x 2EA	INV x 2EA
	Output		kW	-	-	-	-	-	-	-	-
	Lubricant	Type	-	FVC68D	FVC68D	FVC68D	FVC68D	FVC68D	FVC68D	FVC68D	FVC68D
		Charging	cc	3700	3900	3900	3900	5800	6200	6200	6200
Refrigerant	Type		-	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A
	Factory Charging		kg	5.5	5.5	5.5	7.7	7.7	8.4	8.4	8.4
Fan	Type		-	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC
	Motor Output		W	830	830	830	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2
	Airflow rate		㎥ /min	170	170	220	255	255	290	290	290
Piping Connections	Liquid pipe		Φ, mm	9.52	9.52	12.7	12.7	12.7	15.88	15.88	15.88
			Φ, inch	3/8"	3/8"	1/2"	1/2"	1/2"	5/8"	5/8"	5/8"
	Gas pipe		Φ, mm	19.05	22.22	28.58	28.58	28.58	28.58	28.58	28.58
			Φ, inch	3/4"	7/8"	1+1/8"	1+1/8"	1+1/8"	1+1/8"	1+1/8"	1+1/8"
	High pressure gas pipe		Φ, mm	-	-	-	-	-	-	-	-
			Φ, inch	-	-	-	-	-	-	-	-
	Installation Limitation	Max. Length	m	220	220	220	220	220	220	220	220
		Max. Height	m	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40
Cable	Main Power(Below 20m)		mm2	-	-	-	-	-	-	-	-
	Communication		mm2	-	-	-	-	-	-	-	-
Set Dimension	Net weight		kg	186	197	210	239	269	307	307	307
	Gross weight		kg	193	204	217	249	279	317	317	317
	Net dimension (WxHxD)		mm	880x1695x765	880x1695x765	880x1695x765	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765
	Gross dimension (WxHxD)		mm	948x1887x832	948x1887x832	948x1887x832	1363x1887x832	1363x1887x832	1363x1887x832	1363x1887x832	1363x1887x832
Operating Temp. Range	Cooling		℃	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48
	Heating		℃	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24

1. Proper form capacity standard of air conditioning
- Cooling capacity : It is figures that appear in indoor 27˚C DB/19˚C WB, outdoor 35˚C DB, length 7.5m of piping, fall 0m standard.
- Heating capacity : It is figures that appear in indoor 20˚C DB, outdoor 7˚C DB, length 7.5m of piping, fall 0m standard.
2. If proper form heating capacity is outdoor temperature 7˚C standard and outdoor temperature goes down by below zero, heating capacity can drop according to temperature condition.
3. Need special load calculation in case of use by main heating in the winter, and please buy product for low temperature that heating effect excels at low temperature.
4. Maximum length between outdoor and indoor units allows up to 200m (Equivalent length 220m).
5. If the indoor unit is below, height length allows up to 110m (If over 50m, decide whether to install the PDM kit). If the outdoor unit is below, allowable height length is 40m.

Outdoor Unit (cont.)

TYPE				New Model					New Model			
												
Model				AM140KXVGGH/EU	AM160KXVGGH/EU	AM180KXVGGH/EU	AM200KXVGGH/EU	AM220KXVGGH/EU	AM240KXVGGH/EU	AM260KXVGGH/EU	AM280KXVGGH/EU	AM080KXVSGH/EU
Mode				HP	HP	HP	HP	HP	HP	HP	HP	HP
Power			Ø, V, Hz	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50
Capacity	Horse Power		HP	14	16	18	20	22	24	26	28	8
	Cooling		kW	40.0	45.0	50.4	56.0	61.6	67.2	72.8	78.6	22.4
	Heating		kW	45.0	50.4	56.7	63.0	69.3	75.6	81.9	88.2	25.2
Power	Power input (Nominal)	Cooling 1)	kW	8.89	10.92	10.68	12.50	15.75	16.00	17.33	19.65	4.26
		Heating 2)		9.62	10.75	10.52	12.75	15.86	15.43	17.06	18.77	4.38
	Current Input (Nominal)	Cooling 1)	A	14.30	17.50	17.10	20.00	25.30	25.70	27.80	31.50	6.83
		Heating 2)		15.40	17.20	16.90	20.50	25.40	24.70	27.40	30.10	7.02
	Running Current	Cooling	A	14.30	17.50	17.10	20.00	25.30	25.70	27.80	31.50	6.83
		Heating	A	15.40	17.20	16.90	20.50	25.40	24.70	27.40	30.10	7.02
		Max	A	25.0	32.0	39.2	42.0	44.6	55.0	60.0	67.0	29.0
	Power Consumption	Cooling	kW	8.89	10.92	10.68	12.50	15.75	16.00	17.33	19.65	4.26
		Heating	kW	9.62	10.75	10.52	12.75	15.86	15.43	17.06	18.77	4.38
	MCA/MFA		A	25.0 / 40	32.0 / 40	39.2 / 50	42.0 / 75	44.6 / 75	55.0 / 75	60.0 / 75	67.0 / 75	29.0 / 40
COP	Nominal Cooling		-	4.500	4.120	4.720	4.480	3.910	4.200	4.200	4.000	5.260
	Nominal Heating		-	4.680	4.690	5.390	4.940	4.370	4.900	4.800	4.700	5.750
	ESEER (HP)		-	-	-	-	-	-	-	-	-	-
Compressor	Model		-	DS-GB066FA*	DS4G*5080F*	DS-GB066FA*	DS-GB066FA*	DS-GB066FA*	DS-GB070FA*	DS4G*5080F*	DS4G*5080F*	DS4G*5080F*
	Type			INV x 1EA	INV x 1EA	INV x 2EA	INV x 2EA	INV x 2EA	INV x 2EA	INV x 2EA	INV x 2EA	INV x 2EA
	Output		kW	6.39 x 1	7.81 x 1	6.39 x 2	6.39 x 2	6.39 x 2	6.76 x 2	7.81 x 2	7.81 x 2	7.81 x 2
	Lubricant	Type	-	PVE	PVE	PVE	PVE	PVE	PVE	PVE	PVE	PVE
		Charging	cc	1100	1400	1100 x 2	1100 x 2	1100 x 2	1100 x 2	1400 x 2	1400 x 2	1400 x 2
Refrigerant	Type		-	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A
	Factory Charging		kg	9.4	8.4	8.4	8.4	8.4	14.0	14.0	14.0	14.0
Fan	Type		-	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC
	Motor Output		W	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2
	Airflow rate		m^3 / min	255	255	290	290	290	340	340	340	340
Piping Connections	Liquid pipe		Ø, mm	12.7	12.7	15.88	15.88	15.88	15.88	19.05	19.05	19.05
			Ø, inch	1/2"	1/2"	5/8"	5/8"	5/8"	5/8"	3/4"	3/4"	3/4"
	Gas pipe		Ø, mm	28.58	28.58	28.58	28.58	28.58	34.92	34.92	34.92	34.92
			Ø, inch	1+1/8"	1+1/8"	1+1/8"	1+1/8"	1+1/8"	1+3/8"	1+3/8"	1+3/8"	1+3/8"
	High pressure gas pipe		Ø, mm	-	-	-	-	-	-	-	-	-
			Ø, inch	-	-	-	-	-	-	-	-	-
	Installation Limitation	Max. Length	m	220	220	220	220	220	220	220	220	220
		Max. Height	m	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40
Cable	Main Power(Below 20m)		mm2	-	-	-	-	-	-	-	-	-
	Communication		mm2	-	-	-	-	-	-	-	-	-
Set Dimension	Net weight		kg	241	255	285	285	285	342	350	350	350
	Gross weight		kg	261	275	305	305	305	364	372	372	372
	Net dimension (WxHxD)		mm	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765	1295x1795x765	1295x1795x765	1295x1795x765	1295x1795x765
	Gross dimension (WxHxD)		mm	1363x1887x832	1363x1887x832	1363x1887x832	1363x1887x832	1363x1887x832	1363x1987x832	1363x1987x832	1363x1987x832	1363x1987x832
Operating Temp. Range	Cooling		℃	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48
	Heating		℃	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24

1. Proper form capacity standard of air conditioning
- Cooling capacity : It is figures that appear in indoor 27˚C DB/19˚C WB, outdoor 35˚C DB, length 7.5m of piping, fall 0m standard.
- Heating capacity : It is figures that appear in indoor 20˚C DB, outdoor 7˚C DB, length 7.5m of piping, fall 0m standard.
2. If proper form heating capacity is outdoor temperature 7˚C standard and outdoor temperature goes down by below zero, heating capacity can drop according to temperature condition.
3. Need special load calculation in case of use by main heating in the winter, and please buy product for low temperature that heating effect excels at low temperature.
4. Maximum length between outdoor and indoor units allows up to 200m (Equivalent length 220m).
5. If the indoor unit is below, height length allows up to 110m (If over 50m, decide whether to install the PDM kit). If the outdoor unit is below, allowable height length is 40m.

Outdoor Unit (cont.)

TYPE				New Model					New Model			
												
Model				AM140KXVAGH/EU	AM160KXVAGH/EU	AM180KXVAGH/EU	AM200KXVAGH/EU	AM220KXVAGH/EU	AM240KXVAGH/EU	AM260KXVAGH/EU	AM280KXVAGH/EU	AM300KXVAGH/EU
Mode				HP	HP	HP	HP	HP	HP	HP	HP	HP
Power			Ø, V, Hz	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50
Capacity	Horse Power		HP	14	16	18	20	22	24	26	28	30
	Cooling		kW	40.0	45.0	50.4	56.0	61.6	67.2	72.8	78.6	84.0
	Heating		kW	45.0	50.4	56.7	63.0	69.3	75.6	81.9	88.2	94.5
Power	Power input (Nominal)	Cooling 1)	kW	10.93	12.10	12.60	14.18	17.35	17.10	18.91	20.68	22.70
		Heating 2)		10.16	11.61	11.91	13.91	16.70	17.42	18.00	20.18	20.59
	Current Input (Nominal)	Cooling 1)	A	17.50	19.40	20.20	22.70	27.80	27.40	30.30	33.20	36.40
		Heating 2)		16.30	18.60	19.10	22.30	26.80	27.90	28.90	32.40	33.00
	Running Current	Cooling	A	17.50	19.40	20.20	22.70	27.80	27.40	30.30	33.20	36.40
		Heating	A	16.30	18.60	19.10	22.30	26.80	27.90	28.90	32.40	33.00
		Max	A	25.0	32.0	39.2	42.0	44.6	55.0	60.0	67.0	73.0
	Power Consumption	Cooling	kW	10.93	12.10	12.60	14.18	17.35	17.10	18.91	20.68	22.70
		Heating	kW	10.16	11.61	11.91	13.91	16.70	17.42	18.00	20.18	20.59
	MCA/MFA		A	25.0 / 40	32.0 / 40	39.2 / 50	42.0 / 75	44.6 / 75	55.0 / 75	60.0 / 75	67.0 / 75	73.0 / 90
COP	Nominal Cooling		-	3.660	3.720	4.000	3.950	3.550	3.930	3.850	3.800	3.700
	Nominal Heating		-	4.430	4.340	4.760	4.530	4.150	4.340	4.550	4.370	4.590
	ESEER (HP)		-	-	-	-	-	-	-	-	-	-
Compressor	Model		-	DS-GB066FA*	DS4G*5080F*	DS4G*5080F*	DS-GB052FA*	DS-GB066FA*	DS-GB066FA*	DS-GB066FA*	DS-GB070FA*	DS4G*5080F*
	Type			INV x 1EA	INV x 1EA	INV x 1EA	INV x 2EA	INV x 2EA	INV x 2EA	INV x 2EA	INV x 2EA	INV x 2EA
	Output		kW	6.39 x 1	7.81 x 1	7.81 x 1	5.18 x 2	6.39 x 2	6.39 x 2	6.39 x 2	6.76 x 2	7.81 x 2
	Lubricant	Type	-	PVE	PVE	PVE	PVE	PVE	PVE	PVE	PVE	PVE
		Charging	cc	1100	1400	1400	1100 x 2	1100 x 2	1100 x 2	1100 x 2	1100 x 2	1400 x 2
Refrigerant	Type		-	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A
	Factory Charging		kg	7.7	8.4	8.4	8.4	8.4	12.5	12.5	14.0	14.0
Fan	Type		-	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC
	Motor Output		W	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2
	Airflow rate		m^3 / min	255	255	290	290	290	340	340	340	340
Piping Connections	Liquid pipe		Ø, mm	12.7	12.7	15.88	15.88	15.88	15.88	19.05	19.05	19.05
			Ø, inch	1/2"	1/2"	5/8"	5/8"	5/8"	5/8"	3/4"	3/4"	3/4"
	Gas pipe		Ø, mm	28.58	28.58	28.58	28.58	28.58	34.92	34.92	34.92	34.92
			Ø, inch	1+1/8"	1+1/8"	1+1/8"	1+1/8"	1+1/8"	1+3/8"	1+3/8"	1+3/8"	1+3/8"
	High pressure gas pipe		Ø, mm	-	-	-	-	-	-	-	-	-
			Ø, inch	-	-	-	-	-	-	-	-	-
	Installation Limitation	Max. Length	m	220	220	220	220	220	220	220	220	220
		Max. Height	m	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40
Cable	Main Power(Below 20m)		mm2	-	-	-	-	-	-	-	-	-
	Communication		mm2	-	-	-	-	-	-	-	-	-
Set Dimension	Net weight		kg	226	253	255	277	285	333	333	342	350
	Gross weight		kg	246	273	275	297	305	355	355	364	372
	Net dimension (WxHxD)		mm	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765	1295x1795x765	1295x1795x765	1295x1795x765	1295x1795x765
	Gross dimension (WxHxD)		mm	1363x1887x832	1363x1887x832	1363x1887x832	1363x1887x832	1363x1887x832	1363x1987x832	1363x1987x832	1363x1987x832	1363x1987x832
Operating Temp. Range	Cooling		℃	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48
	Heating		℃	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24

1. Proper form capacity standard of air conditioning
- Cooling capacity : It is figures that appear in indoor 27˚C DB/19˚C WB, outdoor 35˚C DB, length 7.5m of piping, fall 0m standard.
- Heating capacity : It is figures that appear in indoor 20˚C DB, outdoor 7˚C DB, length 7.5m of piping, fall 0m standard.
2. If proper form heating capacity is outdoor temperature 7˚C standard and outdoor temperature goes down by below zero, heating capacity can drop according to temperature condition.
3. Need special load calculation in case of use by main heating in the winter, and please buy product for low temperature that heating effect excels at low temperature.
4. Maximum length between outdoor and indoor units allows up to 200m (Equivalent length 220m).
5. If the indoor unit is below, height length allows up to 110m (If over 50m, decide whether to install the PDM kit). If the outdoor unit is below, allowable height length is 40m.

Outdoor Unit (cont.)

TYPE				New Model					New Model		
											
Model				AM140KXVGGH/TK	AM160KXVGGH/TK	AM180KXVGGH/TK	AM200KXVGGH/TK	AM220KXVGGH/TK	AM240KXVGGH/TK	AM260KXVGGH/TK	AM280KXVGGH/TK
Mode				HP	HP	HP	HP	HP	HP	HP	HP
Power			Φ, V, Hz	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50
Capacity	Horse Power		HP	14	16	18	20	22	24	26	28
	Cooling		kW	40.0	45.0	50.4	56.0	61.6	67.2	72.8	78.6
	Heating		kW	45.0	50.4	56.7	63.0	69.3	75.6	81.9	88.2
Power	Power input (Nominal)	Cooling 1)	kW	8.89	10.92	10.68	12.50	15.75	16.00	17.33	19.65
		Heating 2)		9.62	10.75	10.52	12.75	15.86	15.43	17.06	18.77
	Current Input (Nominal)	Cooling 1)	A	14.30	17.50	17.10	20.00	25.30	25.70	27.80	31.50
		Heating 2)		15.40	17.20	16.90	20.50	25.40	24.70	27.40	30.10
	Running Current	Cooling	A	14.30	17.50	17.10	20.00	25.30	25.70	27.80	31.50
		Heating	A	15.40	17.20	16.90	20.50	25.40	24.70	27.40	30.10
		Max	A	25.0	32.0	39.2	42.0	44.6	55.0	60.0	67.0
	Power Consumption	Cooling	kW	8.89	10.92	10.68	12.50	15.75	16.00	17.33	19.65
		Heating	kW	9.62	10.75	10.52	12.75	15.86	15.43	17.06	18.77
	MCA/MFA		A	25.0 / 40	32.0 / 40	39.2 / 50	42.0 / 60	44.6 / 60	55.0 / 75	60.0 / 75	67.0 / 75
COP	Nominal Cooling		-	4.500	4.120	4.720	4.480	3.910	4.200	4.200	4.000
	Nominal Heating		-	4.680	4.690	5.390	4.940	4.370	4.900	4.800	4.700
	ESEER (HP)		-	-	-	-	-	-	-	-	-
Compressor	Model		-	DS-GB066FA*	DS4G*5080F*	DS-GB066FA*	DS-GB066FA*	DS-GB066FA*	DS-GB070FA*	DS4G*5080F*	DS4G*5080F*
	Type			INV x 1EA	INV x 1EA	INV x 2EA	INV x 2EA	INV x 2EA	INV x 2EA	INV x 2EA	INV x 2EA
	Output		kW	6.39 x 1	7.81 x 1	6.39 x 2	6.39 x 2	6.39 x 2	6.76 x 2	7.81 x 2	7.81 x 2
	Lubricant	Type	-	PVE	PVE	PVE	PVE	PVE	PVE	PVE	PVE
		Charging	cc	1100	1400	1100 x 2	1100 x 2	1100 x 2	1100 x 2	1400 x 2	1400 x 2
Refrigerant	Type		-	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A
	Factory Charging		kg	9.4	8.4	8.4	8.4	8.4	14.0	14.0	14.0
Fan	Type		-	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC
	Motor Output		W	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2
	Airflow rate		m^3 / min	255	255	290	290	290	340	340	340
Piping Connections	Liquid pipe		Φ, mm	12.7	12.7	15.88	15.88	15.88	15.88	19.05	19.05
			Φ, inch	1/2"	1/2"	5/8"	5/8"	5/8"	5/8"	3/4"	3/4"
	Gas pipe		Φ, mm	28.58	28.58	28.58	28.58	28.58	34.92	34.92	34.92
			Φ, inch	1+1/8"	1+1/8"	1+1/8"	1+1/8"	1+1/8"	1+3/8"	1+3/8"	1+3/8"
	High pressure gas pipe		Φ, mm	-	-	-	-	-	-	-	-
			Φ, inch	-	-	-	-	-	-	-	-
	Installation Limitation	Max. Length	m	220	220	220	220	220	220	220	220
		Max. Height	m	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40
Cable	Main Power(Below 20m)		mm2	-	-	-	-	-	-	-	-
	Communication		mm2	-	-	-	-	-	-	-	-
Set Dimension	Net weight		kg	241	255	285	285	285	342	350	350
	Gross weight		kg	261	275	305	305	305	364	372	372
	Net dimension (WxHxD)		mm	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765	1295x1795x765	1295x1795x765	1295x1795x765
	Gross dimension (WxHxD)		mm	1363x1887x832	1363x1887x832	1363x1887x832	1363x1887x832	1363x1887x832	1363x1987x832	1363x1987x832	1363x1987x832
Operating Temp. Range	Cooling		℃	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48
	Heating		℃	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24

1. Proper form capacity standard of air conditioning
- Cooling capacity : It is figures that appear in indoor 27˚C DB/19˚C WB, outdoor 35˚C DB, length 7.5m of piping, fall 0m standard.
- Heating capacity : It is figures that appear in indoor 20˚C DB, outdoor 7˚C DB, length 7.5m of piping, fall 0m standard.
2. If proper form heating capacity is outdoor temperature 7˚C standard and outdoor temperature goes down by below zero, heating capacity can drop according to temperature condition.
3. Need special load calculation in case of use by main heating in the winter, and please buy product for low temperature that heating effect excels at low temperature.
4. Maximum length between outdoor and indoor units allows up to 200m (Equivalent length 220m).
5. If the indoor unit is below, height length allows up to 110m (If over 50m, decide whether to install the PDM kit). If the outdoor unit is below, allowable height length is 40m.

Outdoor Unit (cont.)

TYPE				New Model					New Model			
												
Model				AM140KXVAGH/TK	AM160KXVAGH/TK	AM180KXVAGH/TK	AM200KXVAGH/TK	AM220KXVAGH/TK	AM240KXVAGH/TK	AM260KXVAGH/TK	AM280KXVAGH/TK	AM300KXVAGH/TK
Mode				HP	HP	HP	HP	HP	HP	HP	HP	HP
Power			Φ, V, Hz	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50	3/AC380-415/50
Capacity	Horse Power		HP	14	16	18	20	22	24	26	28	30
	Cooling		kW	40.0	45.0	50.4	56.0	61.6	67.2	72.8	78.6	84.0
	Heating		kW	45.0	50.4	56.7	63.0	69.3	75.6	81.9	88.2	94.5
Power	Power input (Nominal)	Cooling 1)	kW	10.93	12.10	12.60	14.18	17.35	17.10	18.91	20.68	22.70
		Heating 2)		10.16	11.61	11.91	13.91	16.70	17.42	18.00	20.18	20.59
	Current Input (Nominal)	Cooling 1)	A	17.50	19.40	20.20	22.70	27.80	27.40	30.30	33.20	36.40
		Heating 2)		16.30	18.60	19.10	22.30	26.80	27.90	28.90	32.40	33.00
	Running Current	Cooling	A	17.50	19.40	20.20	22.70	27.80	27.40	30.30	33.20	36.40
		Heating	A	16.30	18.60	19.10	22.30	26.80	27.90	28.90	32.40	33.00
		Max	A	25.0	32.0	39.2	42.0	44.6	55.0	60.0	67.0	73.0
	Power Consumption	Cooling	kW	10.93	12.10	12.60	14.18	17.35	17.10	18.91	20.68	22.70
		Heating	kW	10.16	11.61	11.91	13.91	16.70	17.42	18.00	20.18	20.59
	MCA/MFA		A	25.0 / 40	32.0 / 40	39.2 / 50	42.0 / 60	44.6 / 60	55.0 / 60	60.0 / 75	67.0 / 75	73.0 / 90
COP	Nominal Cooling		-	3.660	3.720	4.000	3.950	3.550	3.930	3.850	3.800	3.700
	Nominal Heating		-	4.430	4.340	4.760	4.530	4.150	4.340	4.550	4.370	4.590
	ESEER (HP)		-	-	-	-	-	-	-	-	-	-
Compressor	Model		-	DS-GB066FA*	DS4G*5080F*	DS4G*5080F*	DS-GB052FA*	DS-GB066FA*	DS-GB066FA*	DS-GB066FA*	DS-GB070FA*	DS4G*5080F*
	Type			INV x 1EA	INV x 1EA	INV x 1EA	INV x 2EA	INV x 2EA	INV x 2EA	INV x 2EA	INV x 2EA	INV x 2EA
	Output		kW	6.39 x 1	7.81 x 1	7.81 x 1	5.18 x 2	6.39 x 2	6.39 x 2	6.39 x 2	6.76 x 2	7.81 x 2
	Lubricant	Type	-	PVE	PVE	PVE	PVE	PVE	PVE	PVE	PVE	PVE
		Charging	cc	1100	1400	1400	1100 x 2	1100 x 2	1100 x 2	1100 x 2	1100 x 2	1400 x 2
Refrigerant	Type		-	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A	R410A
	Factory Charging		kg	7.7	8.4	8.4	8.4	8.4	12.5	12.5	14.0	14.0
Fan	Type		-	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC
	Motor Output		W	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2
	Airflow rate		m^3 / min	255	255	290	290	290	340	340	340	340
Piping Connections	Liquid pipe		Φ, mm	12.7	12.7	15.88	15.88	15.88	15.88	19.05	19.05	19.05
			Φ, inch	1/2"	1/2"	5/8"	5/8"	5/8"	5/8"	3/4"	3/4"	3/4"
	Gas pipe		Φ, mm	28.58	28.58	28.58	28.58	28.58	34.92	34.92	34.92	34.92
			Φ, inch	1+1/8"	1+1/8"	1+1/8"	1+1/8"	1+1/8"	1+3/8"	1+3/8"	1+3/8"	1+3/8"
	High pressure gas pipe		Φ, mm	-	-	-	-	-	-	-	-	-
			Φ, inch	-	-	-	-	-	-	-	-	-
	Installation Limitation	Max. Length	m	220	220	220	220	220	220	220	220	220
		Max. Height	m	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40
Cable	Main Power(Below 20m)		mm2	-	-	-	-	-	-	-	-	-
	Communication		mm2	-	-	-	-	-	-	-	-	-
Set Dimension	Net weight		kg	226	253	255	277	285	333	333	342	350
	Gross weight		kg	246	273	275	297	305	355	355	364	372
	Net dimension (WxHxD)		mm	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765	1295x1695x765	1295x1795x765	1295x1795x765	1295x1795x765	1295x1795x765
	Gross dimension (WxHxD)		mm	1363x1887x832	1363x1887x832	1363x1887x832	1363x1887x832	1363x1887x832	1363x1987x832	1363x1987x832	1363x1987x832	1363x1987x832
Operating Temp. Range	Cooling		℃	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48
	Heating		℃	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24

1. Proper form capacity standard of air conditioning
- Cooling capacity : It is figures that appear in indoor 27˚C DB/19˚C WB, outdoor 35˚C DB, length 7.5m of piping, fall 0m standard.
- Heating capacity : It is figures that appear in indoor 20˚C DB, outdoor 7˚C DB, length 7.5m of piping, fall 0m standard.
2. If proper form heating capacity is outdoor temperature 7˚C standard and outdoor temperature goes down by below zero, heating capacity can drop according to temperature condition.
3. Need special load calculation in case of use by main heating in the winter, and please buy product for low temperature that heating effect excels at low temperature.
4. Maximum length between outdoor and indoor units allows up to 200m (Equivalent length 220m).
5. If the indoor unit is below, height length allows up to 110m (If over 50m, decide whether to install the PDM kit). If the outdoor unit is below, allowable height length is 40m.

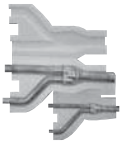
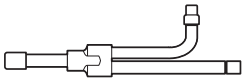
Outdoor Unit (cont.)

TYPE				New Model					
									
Model				AM240KXVANH/TL	AM260KXVANH/TL	AM280KXVANH/TL	AM300KXVANH/TL	AM220KXVJNH/ID	AM240KXVJNH/ID
Mode				HP	HP	HP	HP	HP	HP
Power			Φ, V, Hz	3/AC380-415/50-60	3/AC380-415/50-60	3/AC380-415/50-60	3/AC380-415/50-60	3/AC380-415/50-60	3/AC380-415/50-60
Capacity	Horse Power		HP	24	26	28	30	22	24
	Cooling		kW	67.2	72.8	78.6	84.0	61.6	67.2
	Heating		kW	75.6	81.9	88.2	94.5	69.3	75.6
Power	Power input (Nominal)	Cooling 1)	kW	17.10	18.91	20.68	22.70	15.50	17.10
		Heating 2)		17.42	18.00	20.18	20.59	15.80	17.42
	Current Input (Nominal)	Cooling 1)	A	27.40	30.30	33.20	36.40	24.80	27.40
		Heating 2)		27.90	28.90	32.40	33.00	25.30	27.90
	Running Current	Cooling	A	27.40	30.30	33.20	36.40	24.80	27.40
		Heating	A	27.90	28.90	32.40	33.00	25.30	27.90
		Max	A	55.0	60.0	67.0	73.0	57.1	63.3
	Power Consump-tion	Cooling	kW	17.10	18.91	20.68	22.70	15.50	17.10
		Heating	kW	17.42	18.00	20.18	20.59	15.80	17.42
	MCA/MFA		A	55.0 / 75	60.0 / 75	67.0 / 75	73.0 / 90	57.1 / 75	63.3 / 75
COP	Nominal Cooling		-	3.930	3.850	3.800	3.700	3.970	3.930
	Nominal Heating		-	4.340	4.550	4.370	4.590	4.390	4.340
	ESEER (HP)		-	-	-	-	-	-	-
Compressor	Model		-	DS-GB066FA*	DS-GB066FA*	DS-GB070FA*	DS4G*5080F*	DS-GB066FA*	DS-GB066FA*
	Type			INV x 2EA	INV x 2EA	INV x 2EA	INV x 2EA	INV x 2EA	INV x 2EA
	Output		kW	6.39 x 2	6.39 x 2	6.76 x 2	7.81 x 2	6.39 x 2	6.39 x 2
	Lubricant	Type	-	PVE	PVE	PVE	PVE	PVE	PVE
		Charging	cc	1100 x 2	1100 x 2	1100 x 2	1400 x 2	1100 x 2	1100 x 2
Refrigerant	Type		-	R410A	R410A	R410A	R410A	R410A	R410A
	Factory Charging		kg	12.5	12.5	14.0	14.0	10.0	10.0
Fan	Type		-	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC	Propeller + BLDC
	Motor Output		W	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2	620 x 2
	Airflow rate		m^3 / min	340	340	340	340	340	340
Piping Connections	Liquid pipe		Φ, mm	15.88	19.05	19.05	19.05	15.88	15.88
			Φ, inch	5/8"	3/4"	3/4"	3/4"	5/8"	5/8"
	Gas pipe		Φ, mm	34.92	34.92	34.92	34.92	28.58	34.92
			Φ, inch	1+3/8"	1+3/8"	1+3/8"	1+3/8"	1+1/8"	1+3/8"
	High pressure gas pipe		Φ, mm	-	-	-	-	-	-
			Φ, inch	-	-	-	-	-	-
	Installation Limitation	Max. Length	m	220	220	220	220	220	220
		Max. Height	m	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40	50(110)/40
Cable	Main Power(Below 20m)		mm2	-	-	-	-	-	-
	Communication		mm2	-	-	-	-	-	-
Set Dimension	Net weight		kg	333	333	342	350	330.5	330.5
	Gross weight		kg	355	355	364	372	352.5	352.5
	Net dimension (WxHxD)		mm	1295x1795x765	1295x1795x765	1295x1795x765	1295x1795x765	1295x1795x765	1295x1795x765
	Gross dimension (WxHxD)		mm	1363x1987x832	1363x1987x832	1363x1987x832	1363x1987x832	1363x1987x832	1363x1987x832
Operating Temp. Range	Cooling		℃	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 48	-5 ~ 54	-5 ~ 54
	Heating		℃	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24	-25 ~ 24

1. Proper form capacity standard of air conditioning
- Cooling capacity : It is figures that appear in indoor 27˚C DB/19ºC WB, outdoor 35˚C DB, length 7.5m of piping, fall 0m standard.
- Heating capacity : It is figures that appear in indoor 20˚C DB, outdoor 7˚C DB, length 7.5m of piping, fall 0m standard.
2. If proper form heating capacity is outdoor temperature 7˚C standard and outdoor temperature goes down by below zero, heating capacity can drop according to temperature condition.
3. Need special load calculation in case of use by main heating in the winter, and please buy product for low temperature that heating effect excels at low temperature.
4. Maximum length between outdoor and indoor units allows up to 200m (Equivalent length 220m).
5. If the indoor unit is below, height length allows up to 110m (If over 50m, decide whether to install the PDM kit). If the outdoor unit is below, allowable height length is 40m.

2-3 Accessory and Option Specifications

2-3-1 Accessories

Picture	Classification	Model Name	Remark
	Y-Joint	MXJ-YA1509M	15.0 kW and below
		MXJ-YA2512M	Over 15.0 kW~40.0 kW and below
		MXJ-YA2812M	Over 40.0 kW~45.0 kW and below
		MXJ-YA2815M	Over 45.0 kW~70.3 kW and below
		MXJ-YA3419M	Over 70.3 kW~98.4 kW and below
		MXJ-YA4119M	Over 98.4 kW~135.2 kW and below
		MXJ-YA4422M	Over 135.2 kW
	Y-Joint (Only H/R)	MXJ-YA1500M	22.4 kW and below
		MXJ-YA2500M	Over 22.4 kW~70.3 kW and below
		MXJ-YA3100M	Over 70.3 kW~135.2 kW and below
		MXJ-YA3800M	Over 135.2 kW
	Distribution header	MXJ-HA2512M	45.0 kW and below (for 4 rooms)
		MXJ-HA3115M	70.3 kW and below (for 8 rooms)
		MXJ-HA3819M	Over 70.3 kW ~ 135.2 kW and below (for 8 rooms)
	Y-Joint -Outdoor Unit	MXJ-TA3419M	135.2 kW and below
		MXJ-TA4122M	Over 140.2 kW
	Y-Joint (Only H/R)-Outdoor Unit	MXJ-TA3100M	135.2 kW and below
		MXJ-TA3800M	Over 140.2 kW
	MCU (Mode Control Unit)	MCU-S6NEE1N	6 ROOM
		MCU-S4NEE1N	4 ROOM
		MCU-S4NEE2N	4 ROOM
	EEV KIT (1 Room)	MEV-E24SA	Applty to products without EEV (Wall mount & Ceiling)
		MEV-E32SA	
	EEV KIT (2 Room)	MXD-E24K132A	
		MXD-E24K200A	
		MXD-E32K200A	
		MXD-E24K232A	
	EEV KIT (3 Room)	MXD-E24K132A	
		MXD-E24K300A	
		MXD-E32K224A	
		MXD-E32K300A	

3. Disassembly and Reassembly

3-1 Necessary Tools

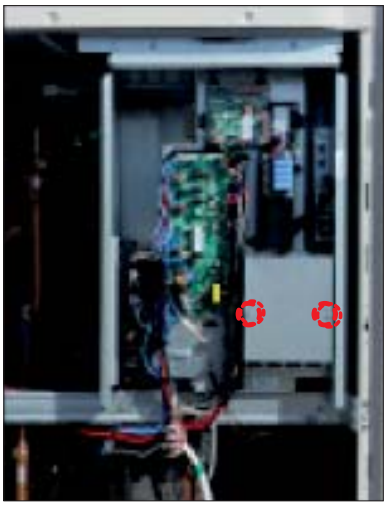
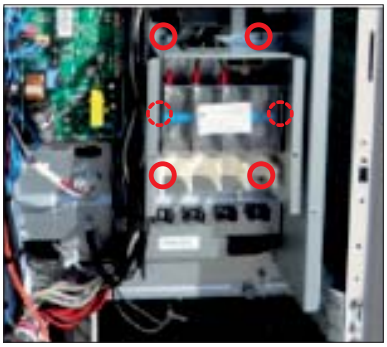
Item	Remark
+SCREW DRIVER	
MONKEY SPANNER	
-SCREW DRIVER	
NIPPER	
ELECTRIC MOTION DRIVER	
L-WRENCH	

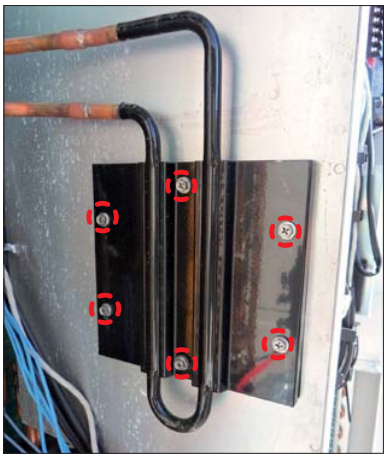
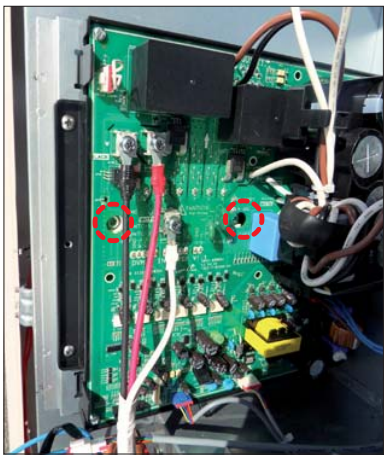
● For "disassembly and assembly" DVM PLUS □ indoor unit, please refer to the products with the same structures.
Only those products that are not specified elsewhere are described here.

3-2 Disassembly and Reassembly

3-2-1 AM080/100/120JXV✳✳✳

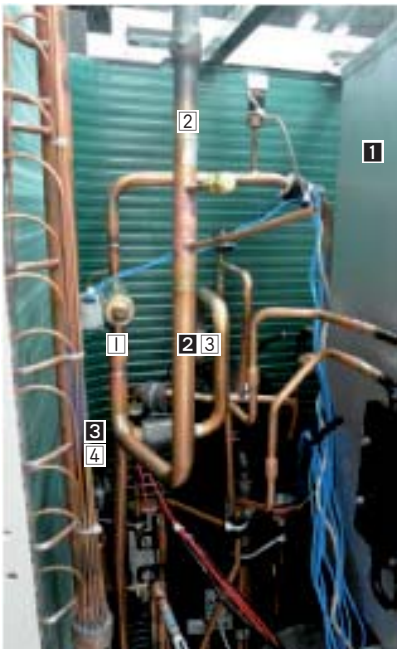
No.	Parts	Procedure	Remark
1	Electrical equipment Part	1) Remove 14 screws from the cabinet (Use + screw driver)	
		2) Remove 4 screws and separate cover control box (Use + screw driver)	
		3) Power, Compressor, Valve, Motor, Sensor connector connected to ASSY PCB remove.	

No.	Parts	Procedure	Remark
		4) 2 screws had fixed in terminal block cover when change power terminal block then, communication terminal block remove	
		5) 2 screws had fixed in terminal block after remove 4 screws had fixed to Cabinet for terminal block protection remove.	
		6) 5 screws had fixed to Front part remove.	

No.	Parts	Procedure	Remark
		7) 6 screws had fixed on side refrigerant cooling part outside remove . ⚠ Do not separate Heat Sink pulling Assy Piping Cooling piping compulsorily. (It can be a cause of parts damage)	
		8) 2 screws had fixed on side refrigerant cooling part inside remove.	

Binding Wire 1

■ AM080/100/120JXV✳✳H

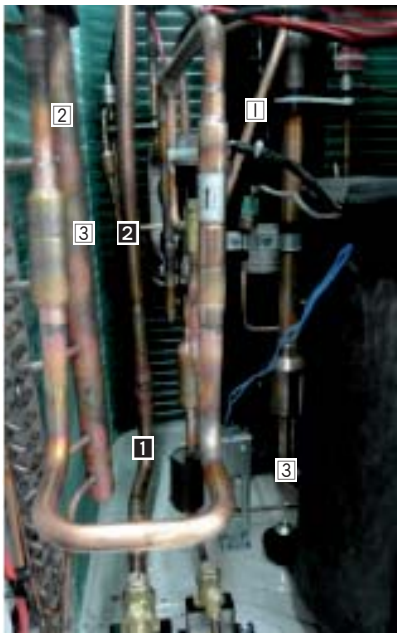


VALVE & SENSOR

No	Valve & Sensor
1	4WAY Valve
2	High Pressure Sensor
3	Suction Sensor
4	EVI Out Sensor

INSULATION

No	Model	Insu Code	Binding Wire
1	AM080/100/120JXV✳✳H	DB62-04154C	
2	AM080/100/120JXV✳✳H	DB62-03808B	
3	AM080/100/120JXV✳✳H	DB62-03808C	



VALVE & SENSOR

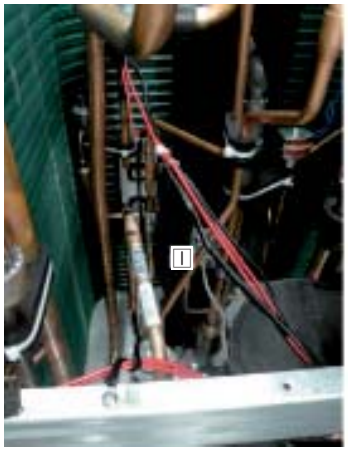
No	Valve & Sensor
1	Expansion Valve
2	EVI EEV Valve
3	Accum Oil Return Valve
4	EVI In Sensor

INSULATION

No	Model	Insu Code	Binding Wire
1	AM080/100/120JXV✳✳H	DB62-03808C	
2	AM080/100/120JXV✳✳H	DB62-03808E	

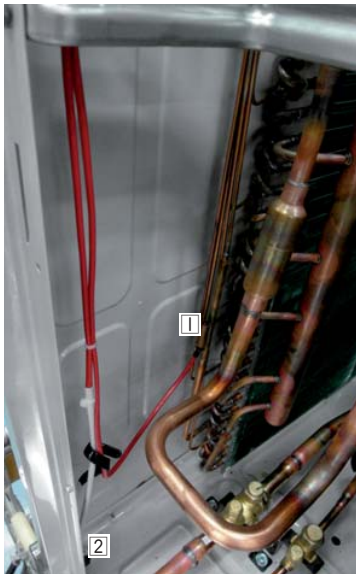
Binding Wire 2

■ AM080/100/120JXV✳✳H



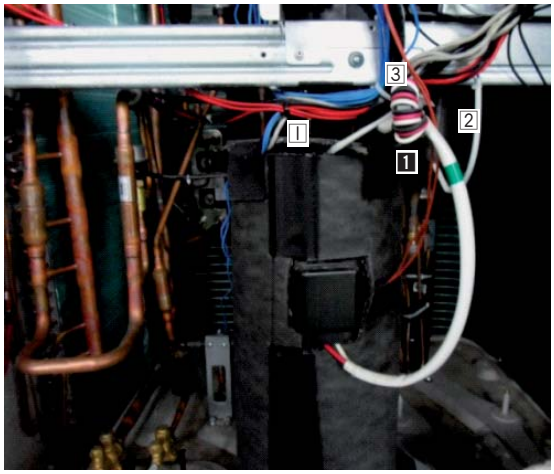
VALVE & SENSOR

No	Valve & Sensor
1	Low Pressure Sensor



VALVE & SENSOR

No	Valve & Sensor
1	Cond Out Sensor
2	Outdoor Temperature Sensor



VALVE & SENSOR

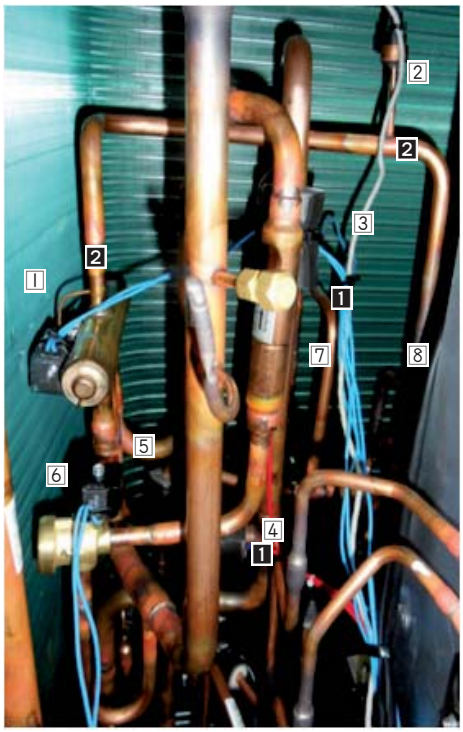
No	Valve & Sensor
1	Comp Top Sensor
2	Discharge Sensor
3	High Pressure Switch

INSULATION

No	Model	Insu Code	Binding Wire
1	AM080/100/120JXV✳✳H	DB62-03808D	

Binding Wire 1

■ AM080/100/120JXVHGR

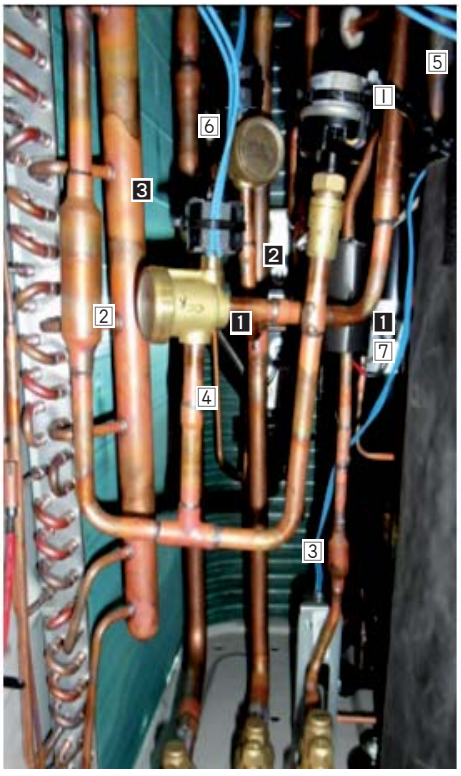


VALVE & SENSOR

No	Valve & Sensor
1	4WAY Valve
2	High Pressure Sensor
3	Suciton 1 Sensor
4	Suciton 2 Sensor
5	EVI Out Sensor
6	Main Cooling Valve
7	EVI Bypass Valve
8	EVI SOL Valve

INSULATION

No	Model	Insu Code	Binding Wire
1	AM080/100FXVAGR AM080/100JXVHGR	DB62-03808B	
	AM120FXVAGR AM120JXVHGR	DB62-03808G	
2	AM080/100/120FXVAGR AM080/100/120JXVHGR	DB62-04154B	



VALVE & SENSOR

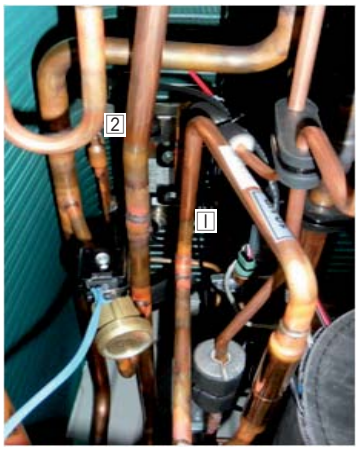
No	Valve & Sensor
1	Main EEV Valve
2	OD EEV Valve
3	Accum Return Valve
4	EVI In Sensor
5	Hot Gas 1 Valve
6	Hot Gas 2 Valve
7	Liquid Sensor

INSULATION

No	Model	Insu Code	Binding Wire
1	AM080/100/120JXVHGR	DB62-03808E	
2	AM080/100/120JXVHGR	DB62-04154B	
3	AM080/100/120JXVHGR	DB62-03808C	

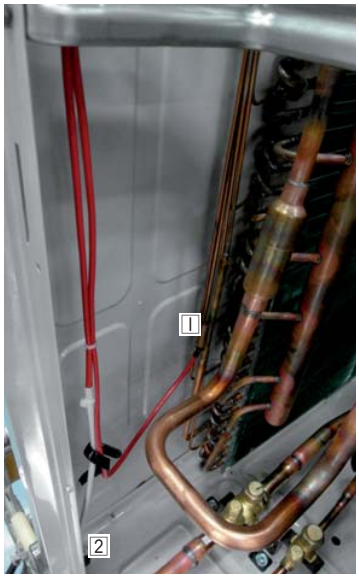
Binding Wire 2

■ AM080/100/120JXVHGR



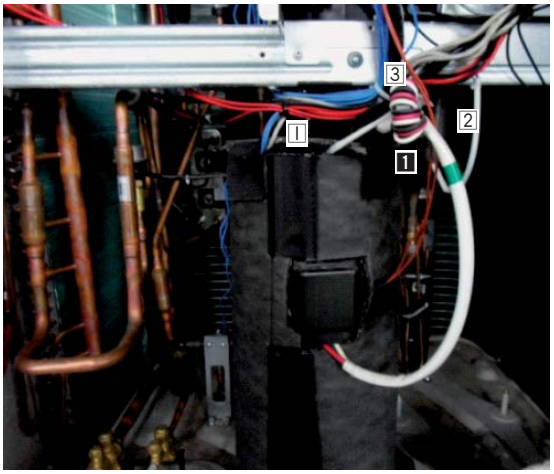
VALVE & SENSOR

No	Valve & Sensor
1	Low Pressure Sensor
2	EVI EEV Valve



VALVE & SENSOR

No	Valve & Sensor
1	Cond Out Sensor
2	Outdoor Temperature Sensor



VALVE & SENSOR

No	Valve & Sensor
1	Comp Top Sensor
2	Discharge Sensor
3	High Pressure Switch

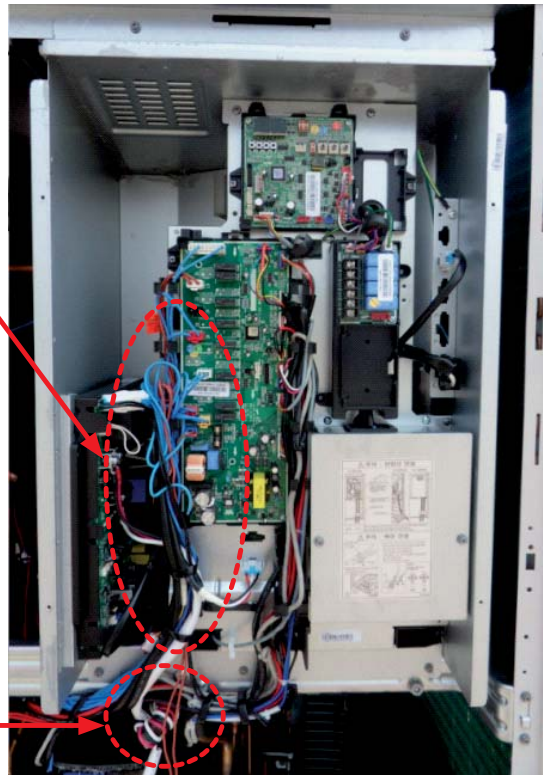
INSULATION

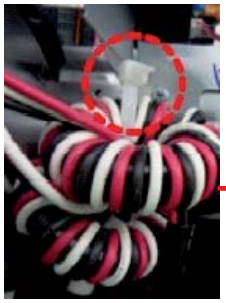
No	Model	Insu Code	Binding Wire
1	AM080/100/120JXVHGR	DB62-03808D	

Binding Wire 3

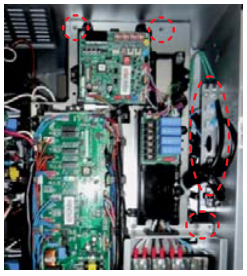
■ AM080/100/120JXV✳✳✳

► Comp Wire fix by Holder Wire.





► Fix Comp Wire-Core to Bracket Beam Control Box using large size Cable Tie(350mm).

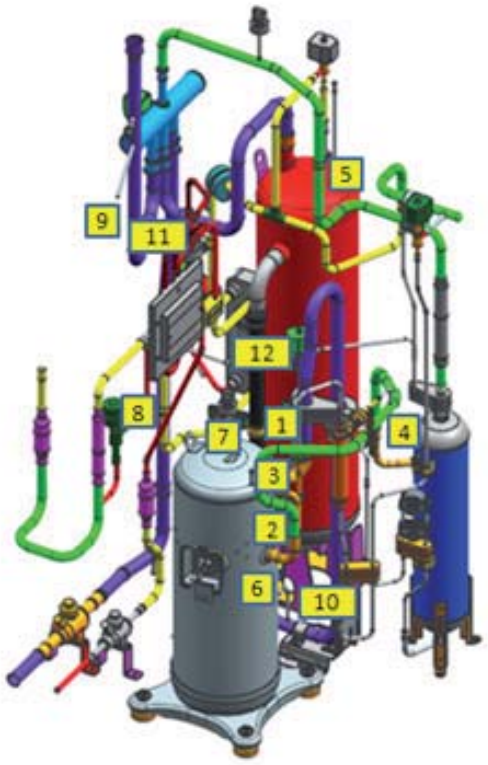
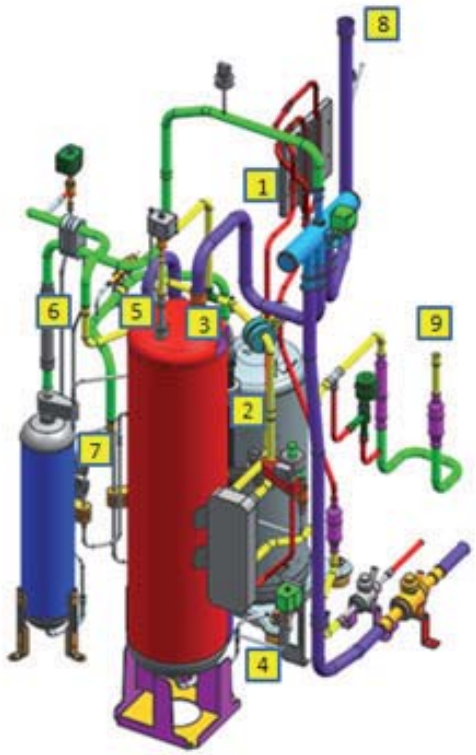


► Separate double layer structure of C/Box after remove 3 screws and connector.

[Reference Sheet]

Pipe Welding Position

■ AM080/100/120FXVAGH, AM080/100/120JXV✳✳H

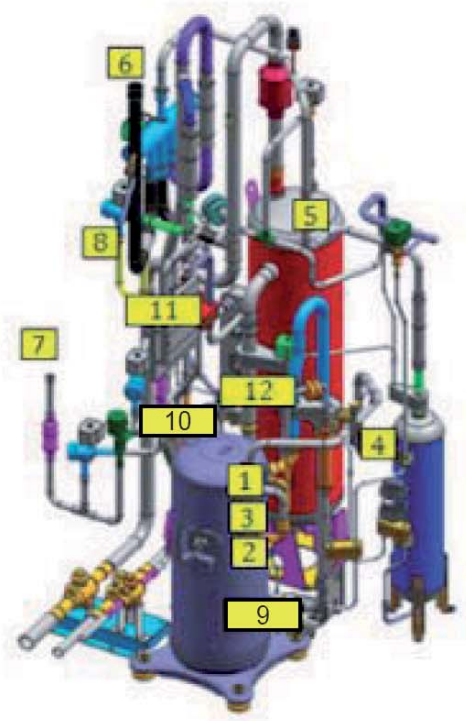
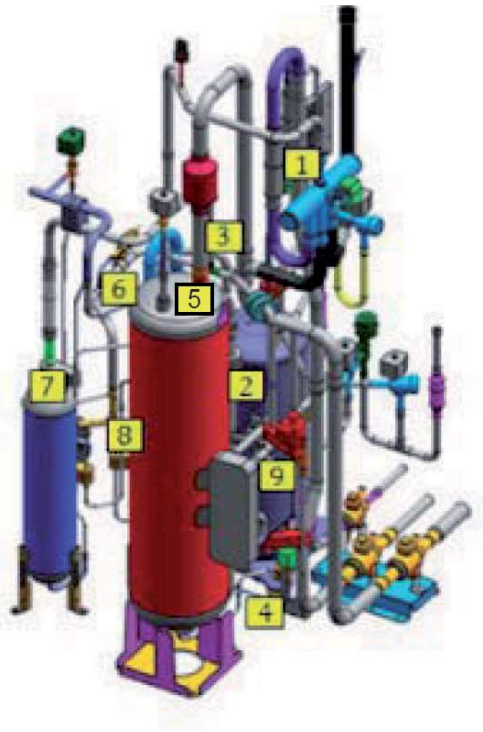
Front Welding Parts	Rear Welding Parts
	

No.	Welding Position	Q'ty	No.	Welding Position	Q'ty
1	Comp+Suction	1	1	Cooling+Subcooler	1
2	Comp+Discharge	1	2	Subcooler+EVI Bypass	1
3	Comp+Vapor Injection	1	3	Accum+4Way	1
4	Discharge+Oil Sepa	1	4	Accum+Accum Oil Vavle	1
5	4Way+Oil Sepa Out	1	5	Accum+EVI Bypass	1
6	Oil Return+Suction	1	6	Vapor Injection+EVI Bypass	1
7	Hot Gas Vavle +Suction	1	7	Hot Gas Vavle +Oil Sepa Out	1
8	Expansion+Subcooler	1	8	4Way+Cond In	
9	Pinch Pipe	1	9	Expansion+Cond Out	
10	Accum Oil Return Valve + Suction	1			
11	Liquid Ball Vavle +Colling	1			
12	Accum+Suction	1			

[Reference Sheet]

Pipe Welding Position

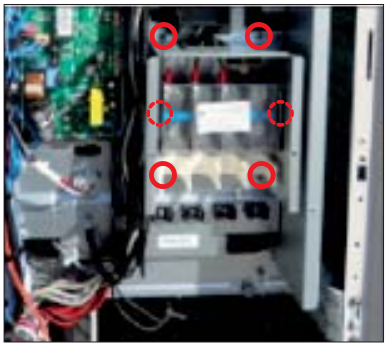
■ AM080/100/120FXVAGR, AM080/100/120JXVHGR

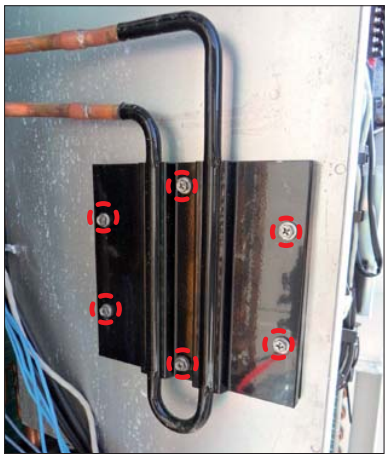
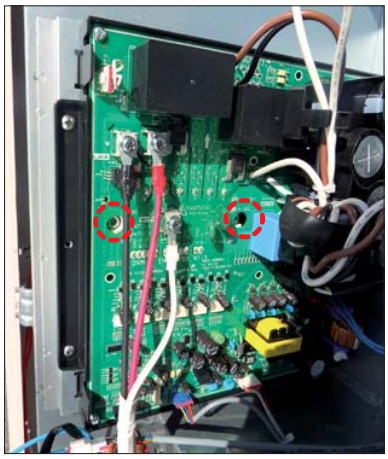
Front Welding Parts	Rear Welding Parts
	

No.	Welding Position	Q'ty	No.	Welding Position	Q'ty
1	Comp+Suction	1	1	Cooling+Subcooler	1
2	Comp+Discharge	1	2	Subcooler+EVI Bypass	1
3	Comp+Vapor Injection	1	3	Accum+4Way	1
4	Discharge+Oil Sepa	1	4	Accum+Accum Oil Vavle	1
5	4Way+Oil Sepa Out	1	5	Accum+EVI Bypass	1
6	4Way+Cond In	1	6	Vapor Injection+EVI Bypass	1
7	Expansion+Cond Out	1	7	Hot Gas Vavle +Oil Sepa Out	1
8	Pinch Pipe	1	8	Oil Return+Suction	
9	Accum Oil Return Valve+Suction	1	9	LQD Ball Valve+Subcooler	
10	Subcooler+Expansion	1			
11	LQD Ball Valve+Cooling	1			
12	Accum+Suction	1			

3-2-2 AM140FXVAGH, AM140JXV✳GH

No.	Parts	Procedure	Remark
1	Electrical equipment Part	1) Remove 11 screws from the cabinet (Use + screw driver)	
		2) Remove 4 screws and separate cover control box (Use + screw driver)	
		3) Power, Compressor, Valve, Motor, Sensor connector connected to ASSY PCB remove.	

No.	Parts	Procedure	Remark
		4) 2 screws had fixed in terminal block cover when change power terminal block, communication terminal block remove.	
		5) 2 screws had fixed in terminal block after remove 4 screws had fixed to Cabinet for terminal block protection remove.	
		6) 5 screws had fixed to Front part remove.	

No.	Parts	Procedure	Remark
		7) 6 screws had fixed on side refrigerant cooling part outside remove . ⚠ Do not separate Heat Sink pulling Assy Piping Cooling piping compulsorily. (It can be a cause of parts damage)	
		8) 2 screws had fixed on side refrigerant cooling part inside remove.	

Binding Wire 1

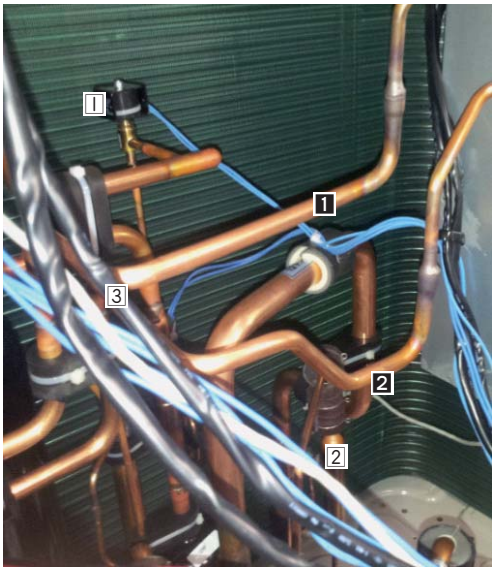
■ AM140JXV✳✳H

VALVE & SENSOR

No	Valve & Sensor
1	4WAY Valve
2	High Pressure Sensor
3	EVI Bypass Valve

INSULATION

No	Model	Insu Code	Binding Wire
1	AM140JXV✳✳H	DB62-03808G	



VALVE & SENSOR

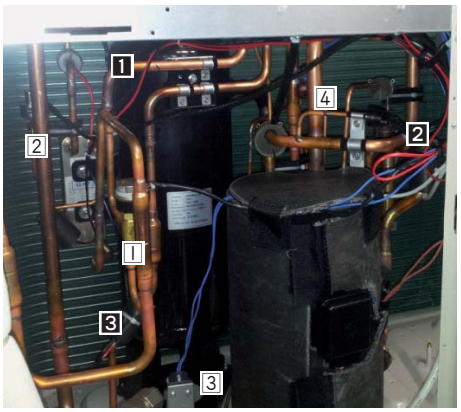
No	Valve & Sensor
1	EVI SOL Valve
2	Low Pressure Sensor
3	Hot Gas Valve

INSULATION

No	Model	Insu Code	Binding Wire
1	AM140JXV✳✳H	DB62-04154D	
2	AM140JXV✳✳H	DB62-04154D	

Binding Wire 2

■ AM140JXV✳✳H

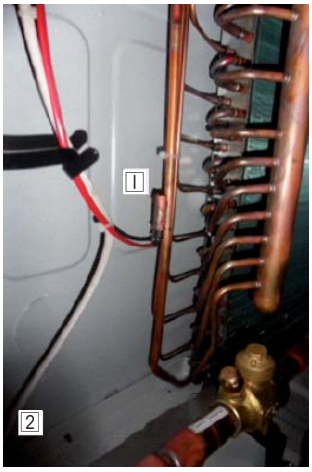


VALVE & SENSOR

No	Valve & Sensor
1	Expansion Valve
2	EVI EEV Valve
3	Accum Oil Return Valve
4	High Pressure Switch

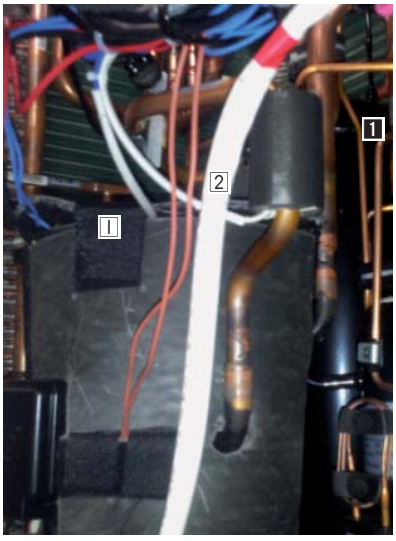
INSULATION

No	Model	Insu Code	Binding Wire
1	AM140JXV✳✳H	DB62-03808C	
2	AM140JXV✳✳H	DB62-03808D	
3	AM140JXV✳✳H	DB62-03808E	



VALVE & SENSOR

No	Valve & Sensor
1	Cond Out Sensor
2	Outdoor Temperature Sensor



VALVE & SENSOR

No	Valve & Sensor
1	Comp Top Sensor
2	Discharge Sensor

INSULATION

No	Model	Insu Code	Binding Wire
1	AM140JXV✳✳H	DB62-03808C	

Binding Wire 1

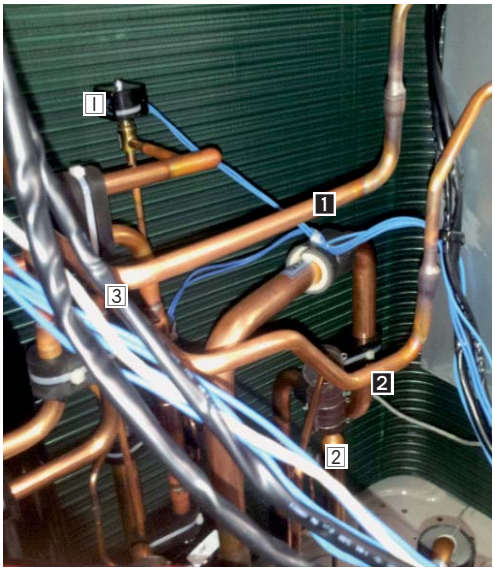
■ AM140JXVHGR

VALVE & SENSOR

No	Valve & Sensor
1	4WAY Valve
2	High Pressure Sensor
3	Suciton 1 Sensor
4	Suciton 2 Sensor
5	EVI Out Sensor
6	Main Cooling Valve
7	EVI Bypass Valve

INSULATION

No	Model	Insu Code	Binding Wire
1	AM140JXVHGR	DB62-03808G	
2	AM140JXVHGR	DB62-04154C	



VALVE & SENSOR

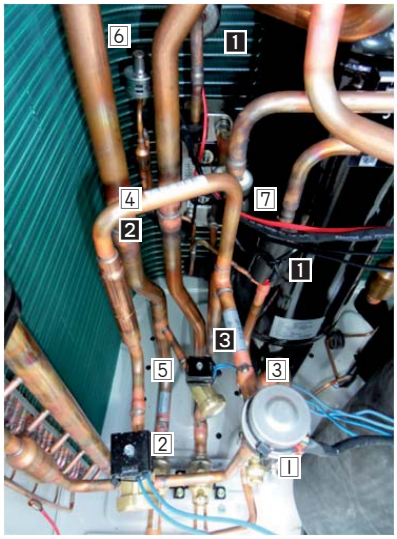
No	Valve & Sensor
1	EVI SOL Valve
2	Low Pressure Sensor
3	Hot Gas Valve

INSULATION

No	Model	Insu Code	Binding Wire
1	AM140JXVHGR	DB62-04154D	
2	AM140JXVHGR	DB62-04154D	

Binding Wire 2

■ AM140JXVHGR

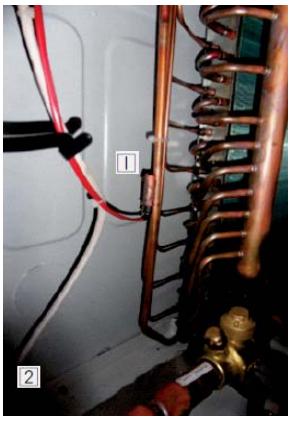


VALVE & SENSOR

No	Valve & Sensor
1	Main EEV Valve
2	OD EEV Valve
3	Accum Return Valve
4	EVI In Sensor
5	Hot Gas 2 Valve
6	EVI EEV Valve
7	Liquid Sensor

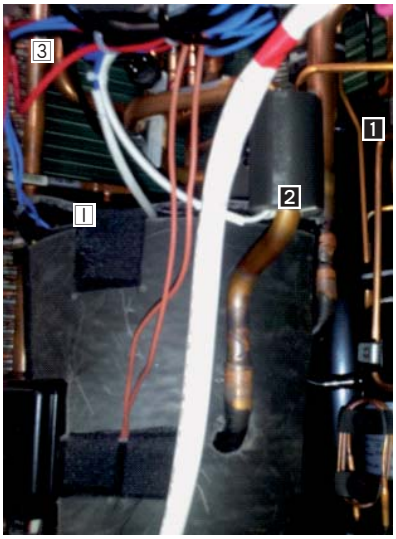
INSULATION

No	Model	Insu Code	Binding Wire
1	AM140JXVHGR	DB62-03808C	
2	AM140JXVHGR	DB62-03808E	
3	AM140JXVHGR	DB62-04154B	



VALVE & SENSOR

No	Valve & Sensor
1	Cond Out Sensor
2	Outdoor Temperature Sensor



VALVE & SENSOR

No	Valve & Sensor
1	Comp Top Sensor
2	Discharge Sensor
3	High Pressure Switch

INSULATION

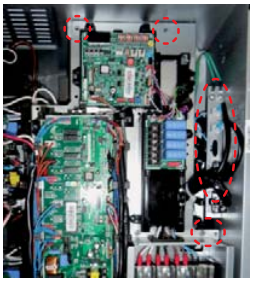
No	Model	Insu Code	Binding Wire
1	AM140JXVHGR	DB62-03808C	
2	AM140JXVHGR	DB62-03808D	

Binding Wire 3

■ AM140JXV✳✳✳

► Comp Wire fix by Holder Wire.

► Fix Comp Wire-Core to Bracket Beam Control Box using large size Cable Tie(350mm).

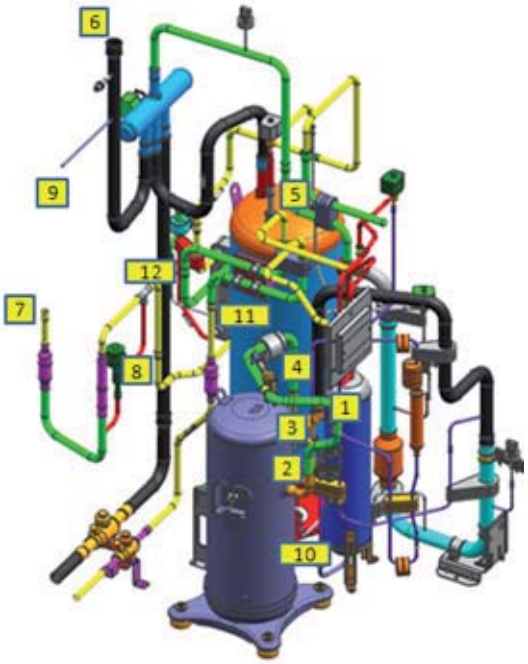
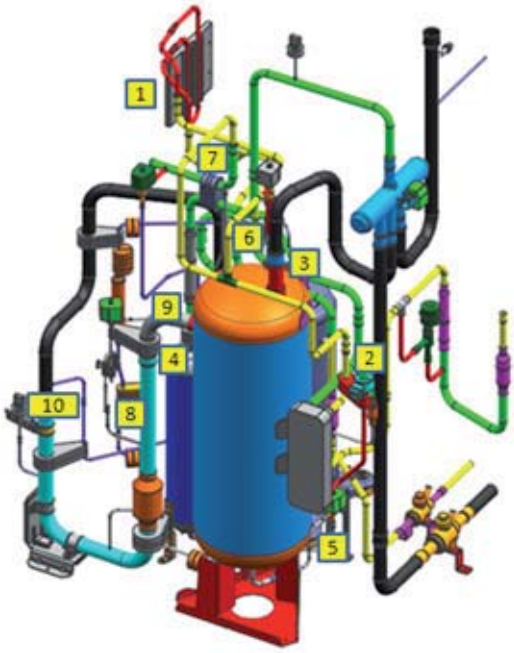


► Separate double layer structure of C/Box after remove 3 screws and connector.

[Reference Sheet]

Pipe Welding Position

■ AM140FXVAGH, AM140JXV✳✳H

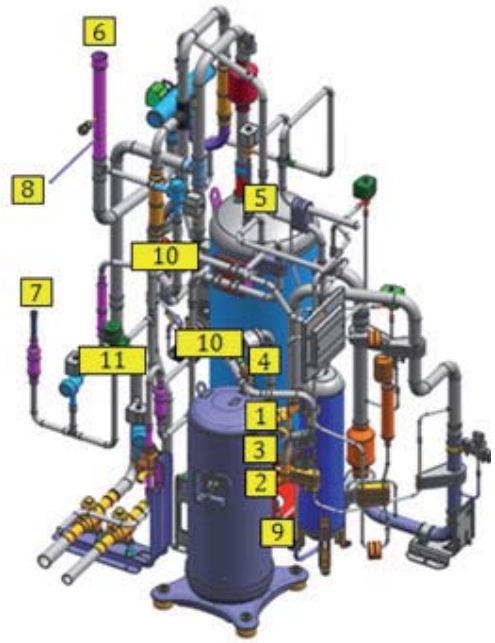
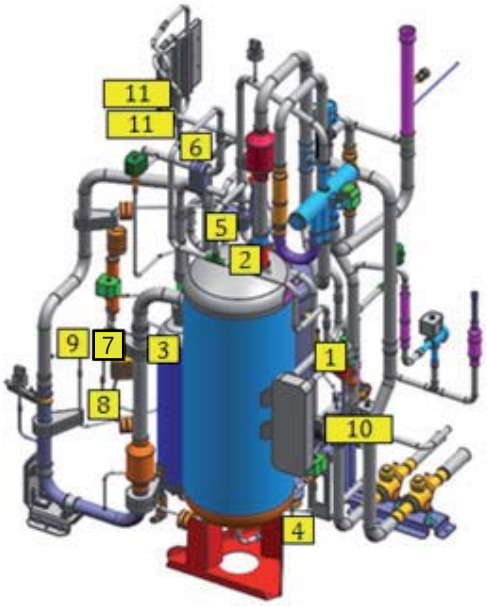
Front Welding Parts	Rear Welding Parts
	

No.	Welding Position	Q'ty	No.	Welding Position	Q'ty
1	Comp+Suction	1	1	Cooling+Subcooler In	2
2	Comp+Discharge	1	2	Subcooler+EVI Bypass	1
3	Comp+Vapor Injection	1	3	Accum+4Way	1
4	Discharge+Oil Sepa	1	4	Accum+Suction	1
5	4Way+Oil Sepa Out	1	5	Accum+Accum Oil Valve	1
6	4Way+Cond In	1	6	Accum+EVI Bypass	1
7	Expansion+Cond Out	1	7	Vapor Injection+EVI Bypass	1
8	Expansion+Subcooler	1	8	Hot Gas Valve+Suction	1
9	Pinch Pipe	1	9	Hot Gas Valve+Oil Sepa Out	1
10	Accum Oil Return Valve + Suction	1	10	Oil Return+Suction	1
11	Liquid Ball Valve+Subcooler In	1			
12	Subcooler+Subcooler In	1			

[Reference Sheet]

Pipe Welding Position

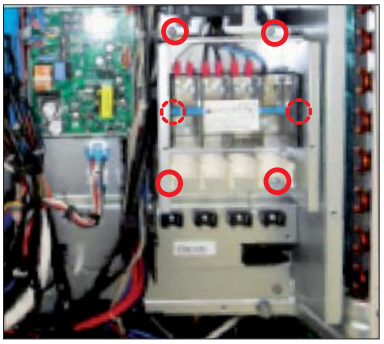
■ AM140FXVAGR,AM140JXV✳GR

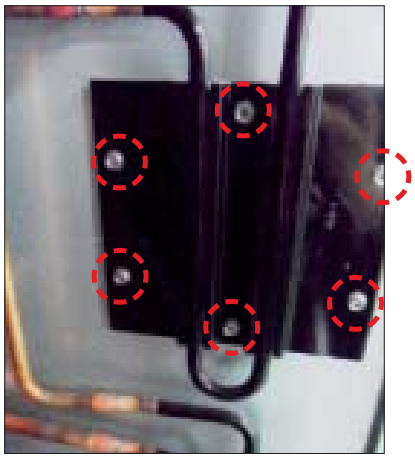
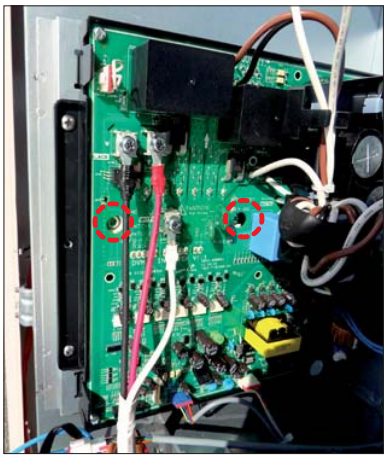
Front Welding Parts	Rear Welding Parts
	

No.	Welding Position	Q'ty	No.	Welding Position	Q'ty
1	Comp+Suction	1	1	Subcooler+EVI Bypass	1
2	Comp+Discharge	1	2	Accum+4Way	1
3	Comp+Vapor Injection	1	3	Accum+Suction	1
4	Discharge+Oil Sepa	1	4	Accum+Accum Oil Valve	1
5	4Way+Oil Sepa Out	1	5	Accum+EVI Bypass	1
6	4Way+Cond In	1	6	Vapor Injection+EVI Bypass	1
7	Expansion+Cond Out	1	7	Hot Gas Valve+Suction	1
8	Pinch Pipe	1	8	Hot Gas Valve+Oil Sepa Out	1
9	Accum Oil Return Valve+Suction	1	9	Oil Return+Suction	1
10	Subcooler+Subcooler In	1	10	LQD Valve+Subcooler In	1
11	Expansion+Subcooler	1	11	Cooling+Subcooler In	2
12	LQD Ball Valve+Subcooler In	1			

3-2-3 AM160/180/200/220/240/260✳XV✳✳✳
AM140JXVA✳H

No.	Parts	Procedure	Remark
1	Electrical equipment Part	1) 11 screws that is fixing CABINET remove.(Use + Screw driver)	
		2) Remove 4 screws that is fixing and separate Cover Control Box. (Use + Screw driver)	
		3) Power, Compressor, Valve, Motor, Sensor connector connected to ASSY PCB remove.	

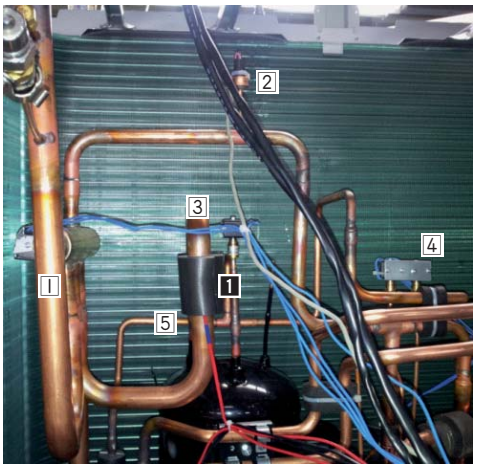
No.	Parts	Procedure	Remark
		4) 2 screws had fixed in terminal block cover when change power terminal block, communication terminal block remove.	
		5) 2 screws had fixed in terminal block after remove 4 screws had fixed to Cabinet for terminal block protection remove.	
		6) 5 screws had fixed to Front part remove.	

No.	Parts	Procedure	Remark
		7) 6 screws had fixed on side refrigerant cooling part outside remove . ⚠ Do not separate Heat Sink pulling Assy Piping Cooling piping compulsorily. (It can be a cause of parts damage)	
		8) 2 screws had fixed on side refrigerant cooling part inside remove.	

No.	Parts	Procedure	Remark
	< Reference > Heat Sink	Spread therminal grease on heat sink - Spread enough Thermal Grease evenly on Plate Heat Sink back whole using roller or brush. - Reassemble Plate Heat Sink in reverse order of disassembly.	

Binding Wire 1

■ AM160/180/200/220/240/260✳XV✳✳H
AM140JXVA✳H

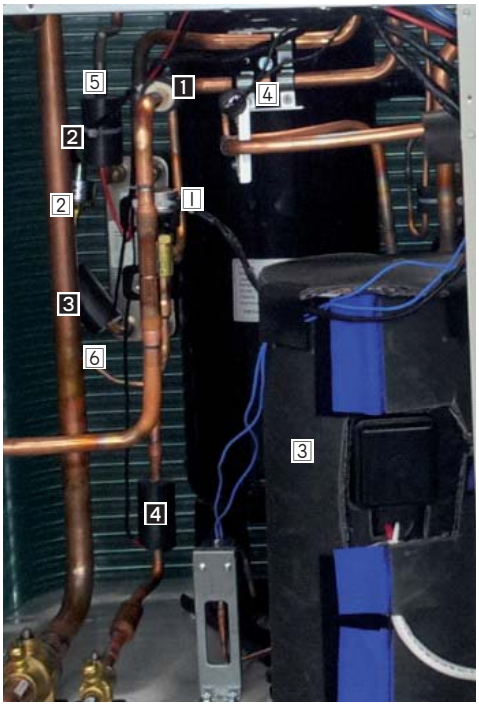


VALVE & SENSOR

No	Valve & Sensor
1	4WAY Valve
2	High Pressure Sensor
3	EVI Bypass Valve
4	EVI SOL Valve
5	Suction Sensor

INSULATION

No	Model	Insu Code	Binding Wire
1	AM160/180/200/220/240/260✳XV✳✳H AM140JXVA✳H	DB62-03808A	



VALVE & SENSOR

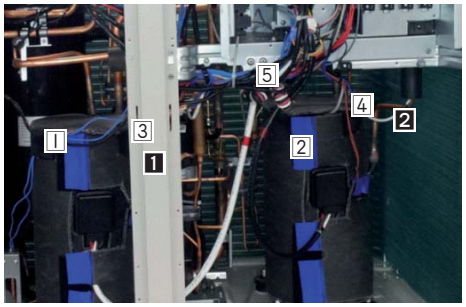
No	Valve & Sensor
1	Expansion Valve
2	EVI EEV Valve
3	Accum Oil Return Valve
4	High Pressure Switch #1
5	EVI Out Sensor
6	EVI In Sensor

INSULATION

No	Model	Insu Code	Binding Wire
1	AM160/180/200/220✳XV✳✳H AM140JXVA✳H	DB62-04154B	
2	AM160/180/200/220/240/260✳XV✳✳H AM140JXVA✳H	DB62-03808D	
3	AM160/180/200/220✳XV✳✳H	DB62-03808E	
	AM240/260✳XV✳✳H AM140JXVA✳H	DB62-03808C	
4	AM160/180/200/220✳XV✳✳H	DB62-03808C	
	AM240/260✳XV✳✳H AM140JXVA✳H	DB62-03808F	

Binding Wire 2

■ AM160/180/200/220/240/260✳XV✳✳H
AM140JXVA✳H

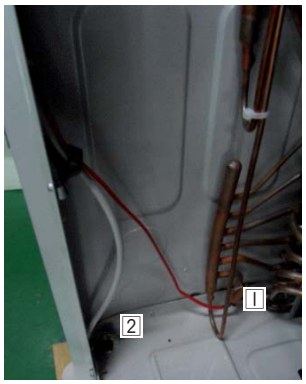


VALVE & SENSOR

No	Valve & Sensor
1	Comp Top #1 Sensor
2	Comp Top #1 Sensor
3	Discharge #1 Sensor
4	Discharge #2 Sensor
5	High Pressure Switch #2

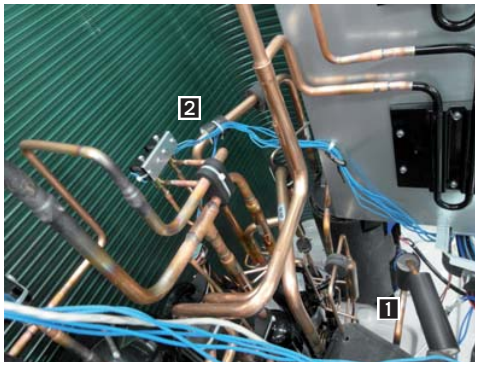
INSULATION

No	Model	Insu Code	Binding Wire
1	AM160/180/200/220/240/260✳XV✳✳H	DB62-03808D	
	AM260/240✳XV✳✳H AM140JXVA✳H	DB62-03808B	
2	AM160/180/200/220/240/260✳XV✳✳H	DB62-03808D	
	AM260/240✳XV✳✳H AM140JXVA✳H	DB62-03808B	



VALVE & SENSOR

No	Valve & Sensor
1	Cond Out Sensor
2	Outdoor Temperature Sensor

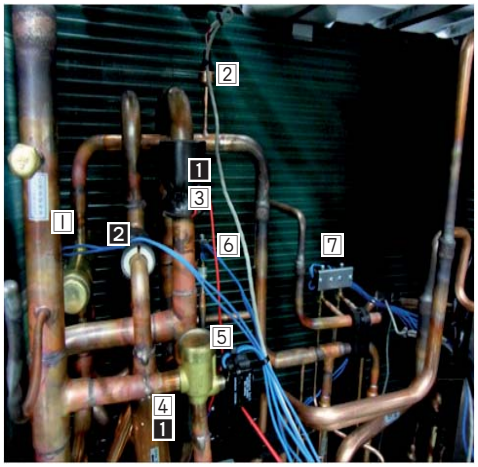


INSULATION

No	Model	Insu Code	Binding Wire
1	AM160/180/200/220/240/260✳XV✳✳H AM140JXVA✳H	DB62-04154C	
2	AM240/260✳XV✳H AM140JXVA✳H	DB62-04154C	

Binding Wire 1

■ AM160/180/200/220✳XV✳GR

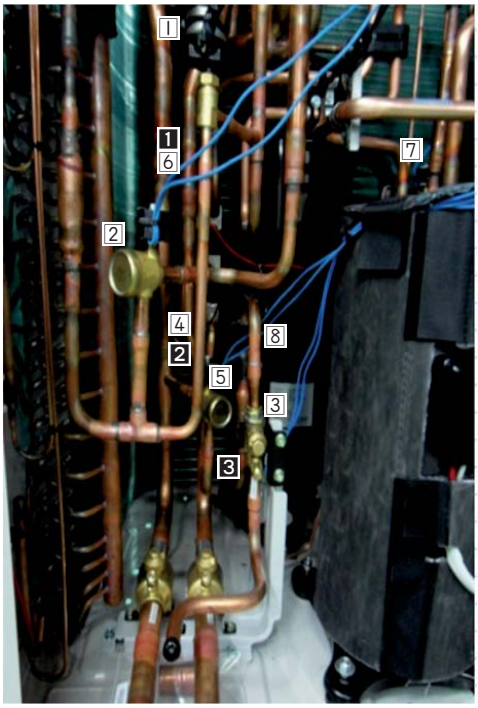


VALVE & SENSOR

No	Valve & Sensor
1	4WAY Valve
2	High Pressure Sensor
3	Suciton 1 Sensor
4	Suciton 2 Sensor
5	Main Cooling Valve
6	EVI Bypass Valve
7	EVI SOL Valve

INSULATION

No	Model	Insu Code	Binding Wire
1	AM160/180/200/220✳XV✳GR	DB62-03808A	
2	AM160/180/200/220✳XV✳GR	DB62-04154C	



VALVE & SENSOR

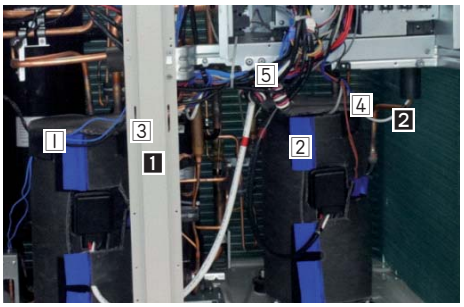
No	Valve & Sensor
1	Main EEV Valve
2	OD EEV Valve
3	ARV Valve
4	EVI In Sensor
5	Hot Gas 2 Valve
6	EVI Out Sensor
7	Hot Gas 1 Valve
8	Liquid Sensor

INSULATION

No	Model	Insu Code	Binding Wire
1	AM160/180/200/220✳XV✳GR	DB62-03808C	
2	AM160/180/200/220✳XV✳GR	DB62-03808E	
3	AM180/200/220✳XV✳GR	DB62-03808D	
	AM160✳XV✳GR	DB62-03808C	

Binding Wire 2

■ AM160/180/200/220F✳XV✳GR

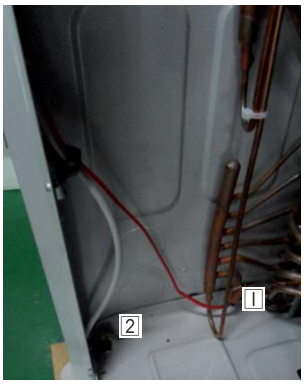


VALVE & SENSOR

No	Valve & Sensor
1	Comp Top #1 Sensor
2	Comp Top #1 Sensor
3	Discharge #1 Sensor
4	Discharge #2 Sensor
5	High Pressure Switch #2

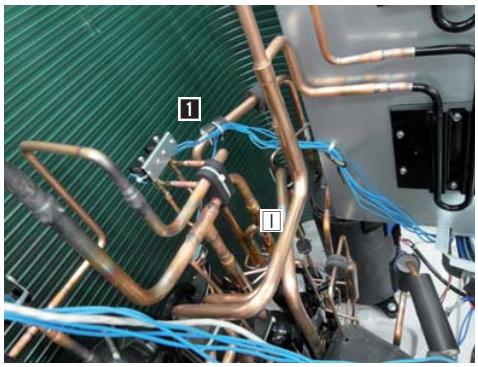
INSULATION

No	Model	Insu Code	Binding Wire
1	AM200/220✳XV✳GR	DB62-03808D	
	AM160/180✳XV✳GR	DB62-03808C	
2	AM180/200/220✳XV✳GR	DB62-03808D	
	AM160✳XV✳GR	DB62-03808C	



VALVE & SENSOR

No	Valve & Sensor
1	Cond Out Sensor
2	Outdoor Temperature Sensor



VALVE & SENSOR

No	Valve & Sensor
1	Low Pressure Sensor

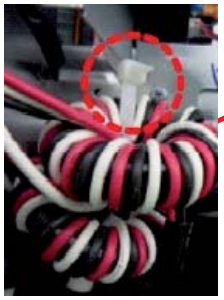
INSULATION

No	Model	Insu Code	Binding Wire
1	AM160/180/200/220✳XV✳GR	DB62-04154C	

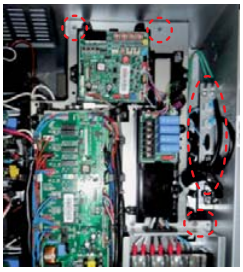
Binding Wire 3

■ AM160/180/200/220✳✳XV✳✳✳
AM140JXVA✳H

► Comp Wire fix by Holder Wire.



► Fix Comp Wire-Core to Bracket Beam Control Box using large size Cable Tie(350mm).

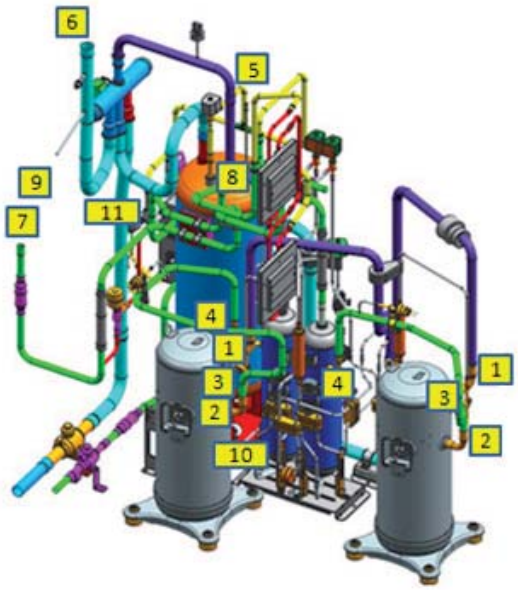
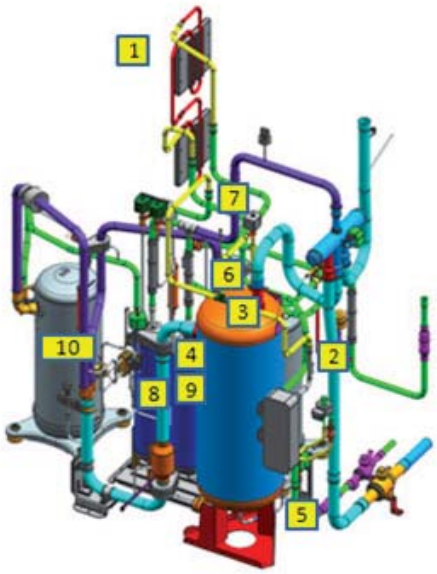


► Separate double layer structure of C/Box after remove 3 screws and connector.

[Reference Sheet]

Pipe Welding Position 4

■ AM160/180/200/220✳✳XV✳✳H
AM140JXVA✳H

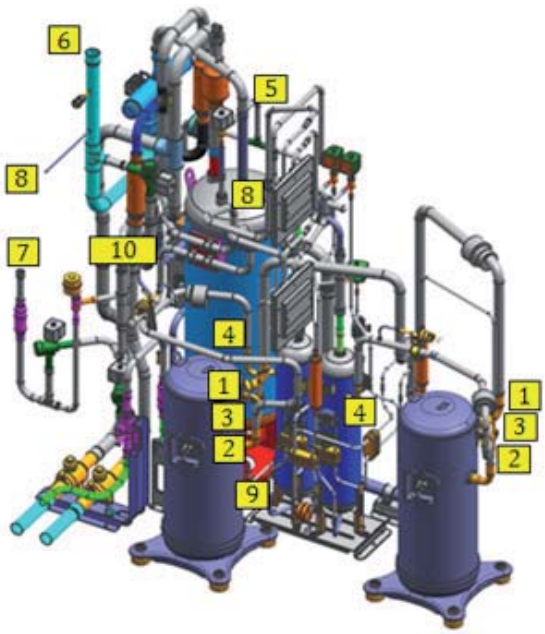
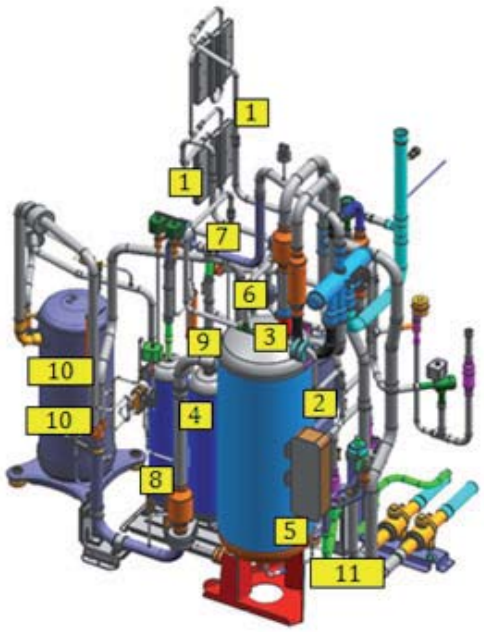
Front Welding Parts	Rear Welding Parts
	

No.	Welding Position	Q'ty	No.	Welding Position	Q'ty
1	Comp+Suction	2	1	Cooling+Subcooler In	1
2	Comp+Discharge	2	2	Subcooler+EVI Bypass	1
3	Comp+Vapor Injection	2	3	Accum+4Way	1
4	Discharge+Oil Sepa	2	4	Accum+Suction	1
5	4Way+Oil Sepa Out	1	5	Accum+Accum Oil Vavle	1
6	4Way+Cond In	1	6	Accum+EVI Bypass	1
7	Expansion+Cond Out	1	7	Vapor Injection+EVI Bypass	1
8	Expansion+Cooling	1	8	Hot Gas Vavle +Suction	1
9	Pinch Pipe	1	9	Hot Gas Vavle +Oil Sepa Out	1
10	Accum Oil Return Valve + Suction	1	10	Oil Return+Suction	2
11	Subcooler+Subcooler In	1			

[Reference Sheet]

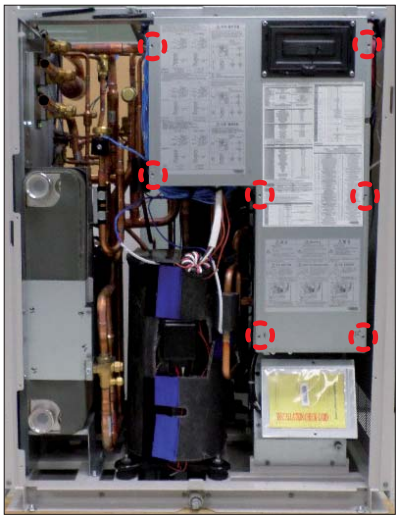
Pipe Welding Position 4

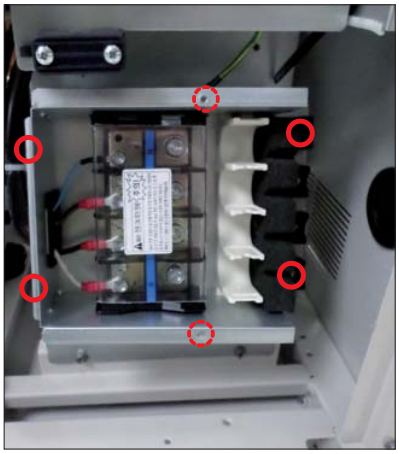
■ AM160/180/200/220F✳XV✳GR

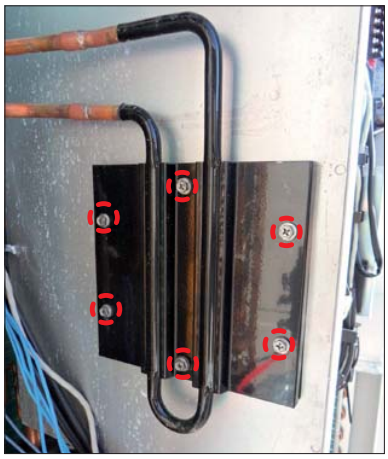
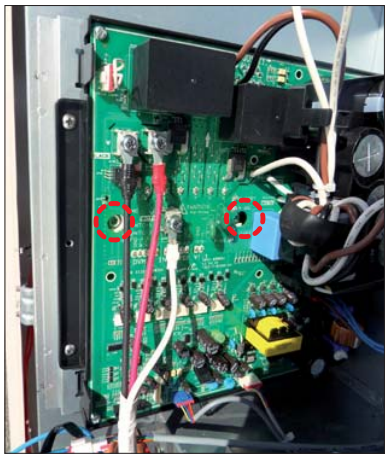
Front Welding Parts	Rear Welding Parts
	

No.	Welding Position	Q'ty	No.	Welding Position	Q'ty
1	Comp+Suction	2	1	Cooling+Subcooler In	2
2	Comp+Discharge	2	2	Subcooler+EVI Bypass	1
3	Comp+Vapor Injection	2	3	Accum+4Way	1
4	Discharge+Oil Sepa	2	4	Accum+Suction	1
5	4Way+Oil Sepa Out	1	5	Accum+Accum Oil Vavle	1
6	4Way+Cond In	1	6	Accum+EVI Bypass	1
7	Expansion+Cond Out	1	7	Vapor Injection+EVI Bypass	1
8	Pinch Pipe	1	8	Hot Gas Vavle +Suction	1
9	Accum Oil Return Valve+Suction	1	9	Hot Gas Vavle +Oil Sepa Out	1
10	Subcooler+Expansion	1	10	Oil Return+Suction	2
			11	LQD Ball Valve+Subcooler	1

3-2-4 AM080/100/120FXWA✳✳

No.	Parts	Procedure	Remark
1	Electrical equipment Part	1) 9 screws that is fixing CABINET remove. (Use + Screw driver)	
		2) Remove 7 screws that is fixing and separate Cover Control Box. (Use + Screw driver)	
		3) Power, Compressor, Valve, Motor, Sensor connector connected to ASSY PCB remove.	

No.	Parts	Procedure	Remark
		4) 2 screws had fixed in terminal block cover when change power terminal block, communication terminal block remove.	
		5) 2 screws had fixed in terminal block after remove 4 screws had fixed to Cabinet for terminal block protection remove.	
		6) 4 screws had fixed to Front part remove.	

No.	Parts	Procedure	Remark
		7) 6 screws had fixed on side refrigerant cooling part outside remove . ⚠ Do not separate Heat Sink pulling Assy Piping Cooling piping compulsorily. (Is responsible for parts damage.)	
		8) 2 screws had fixed on side refrigerant cooling part inside remove.	

No.	Parts	Procedure	Remark
	< Reference > Heat Sink	To Heat Sink Thermal Grease Spread service work - Spread enough Thermal Grease evenly on Plate Heat Sink back whole using roller or brush. - Reassemble Plate Heat Sink in reverse order of disassembly.	

Binding Wire 1

■ AM080/100/120FXWA✳✳

VALVE & SENSOR

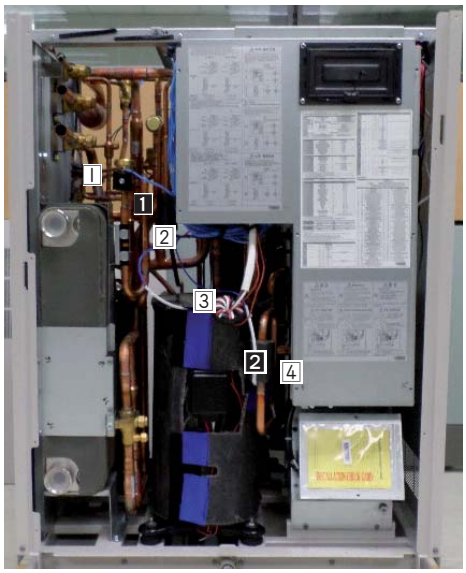
No	Valve & Sensor
1	4WAY Valve
2	High Pressure Sensor
3	Suciton 1 Sensor
4	Suciton 2 Sensor
5	Main Cooling Valve
6	EVI Bypass Valve
7	EVI SOL Valve
8	4WAY Valve
9	High Pressure Sensor
10	Suciton 1 Sensor
11	Suciton 2 Sensor
12	Main Cooling Valve
13	EVI Bypass Valve
14	EVI SOL Valve
15	Main Cooling Valve
16	EVI Bypass Valve

INSULATION

No	Model	Insu Code	Binding Wire
1	AM080/100/120FXWA✳✳	DB62-03808A	
2	AM080/100/120FXWA✳✳	DB62-04154C	
3	AM080/100/120FXWA✳✳	DB62-03808A	
4	AM080/100/120FXWA✳✳	DB62-04154C	
5	AM080/100/120FXWA✳✳	DB62-03808A	
6	AM080/100/120FXWA✳✳	DB62-04154C	

Binding Wire 2

■ AM080/100/120FXWA✳✳

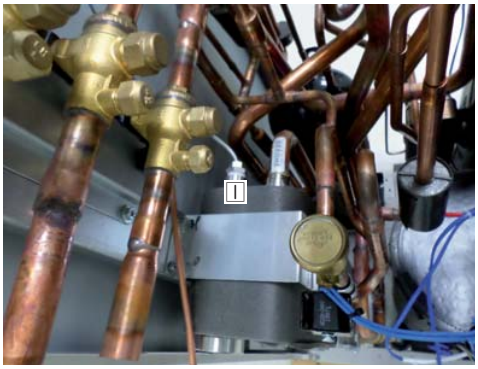


VALVE & SENSOR

No	Valve & Sensor
1	Liquid valve
2	Liquid temp. sensor
3	COMP TOP sensor
4	Discharge temp. sensor

INSULATION

No	Model	Insu Code	Binding Wire
1	AM080/100/120FXWA✳✳	DB62-04154A	
2	AM080/100/120FXWA✳✳	DB62-03808D	

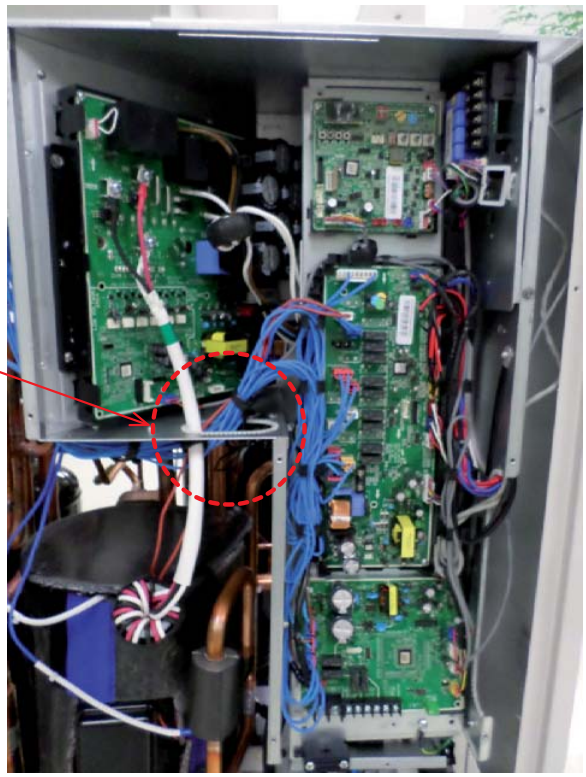


VALVE & SENSOR

No	Valve & Sensor
1	Water temp. sensor

Binding Wire 3

■ AM080/100/120FXWA✳✳



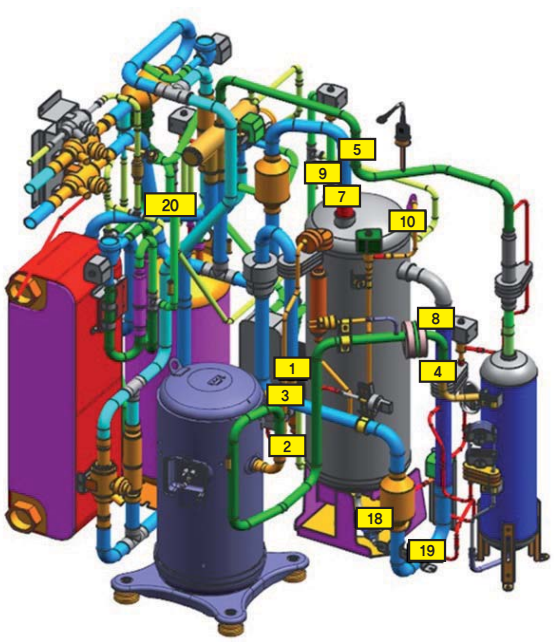
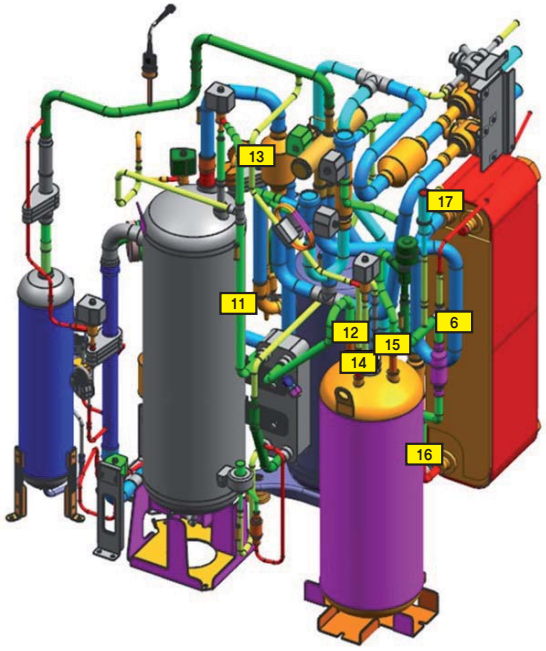
► Comp wire & valve,sensor wires fix by Holder wire with cover bushing hole.

► Separate double layer structure of C/Box after remove 3 screws and connector.

[Reference Sheet]

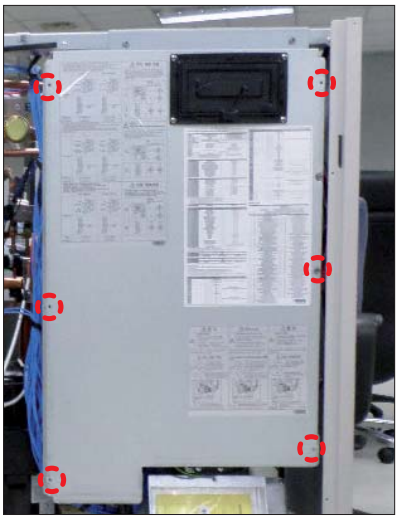
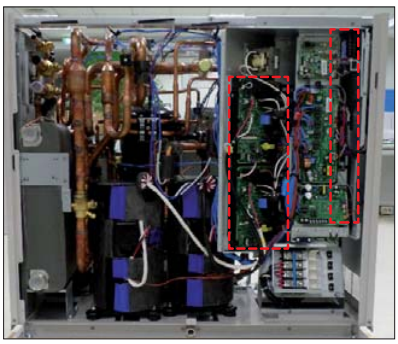
Pipe Welding Position 4

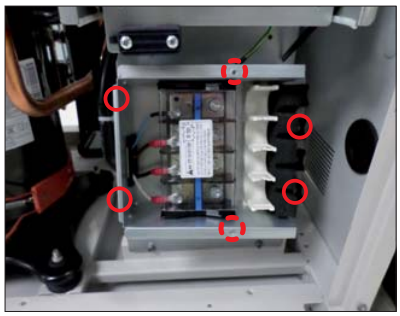
■ AM080/100/120FXWA✳✳

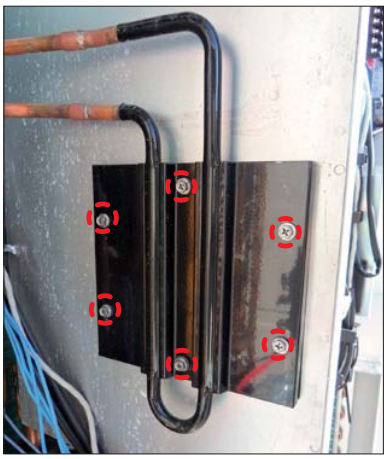
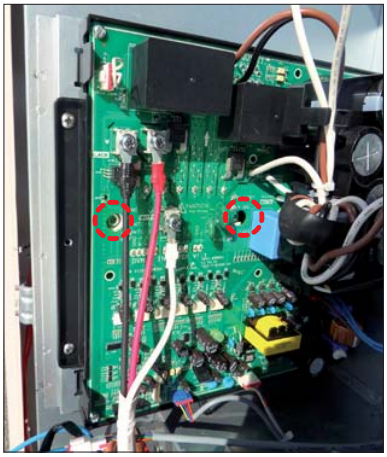
Front Welding Parts	Rear Welding Parts
	

No.	Welding Position	Q'ty	No.	Welding Position	Q'ty
1	Comp+Suction	1	11	Subcooler+EVI Bypass	1
2	Comp+Discharge	1	12	Subcooler+Receiver	1
3	Comp+Vapor Injection	1	13	Hot Gas Vavle+4way	1
4	Discharge+Oil Sepa	1	14	Hot Gas Vavle+Receiver	1
5	4Way+Oil Sepa Out	1	15	Receiver+Expansion	1
6	4Way+Cond In	1	16	Cond+Expansion	1
7	4Way+Accum	1	17	Expansion+Tube Liquid	1
8	Accum+Suction	1	18	Accum+Accum Oil Vavle	1
9	Accum+EVI Bypass	1	19	Accum Oil Vavle+Suction	1
10	Vapor Injection+EVI Bypass	1	20	Subcooler+Tube Liquid	2

3-2-5 AM200FXWA✳✳

No.	Parts	Procedure	Remark
1	Electrical equipment Part	1) 9 screws that is fixing CABINET remove.(Use + Screw driver)	
		2) Remove 6 screws that is fixing and separate Cover Control Box. (Use + Screw driver)	
		3) Power, Compressor, Valve, Motor, Sensor connector connected to ASSY PCB remove.	

No.	Parts	Procedure	Remark
		4) 2 screws had fixed in terminal block cover when change power terminal block, communication terminal block remove.	
		5) 2 screws had fixed in terminal block after remove 4 screws had fixed to Cabinet for terminal block protection remove.	
		6) 4 screws had fixed to Front part remove.	

No.	Parts	Procedure	Remark
		7) 6 screws had fixed on side refrigerant cooling part outside remove . ⚠ Do not separate Heat Sink pulling Assy Piping Cooling piping compulsorily. (Is responsible for parts damage.)	
		8) 2 screws had fixed on side refrigerant cooling part inside remove.	

Binding Wire 1

■ AM200FXWA✳✳

VALVE & SENSOR

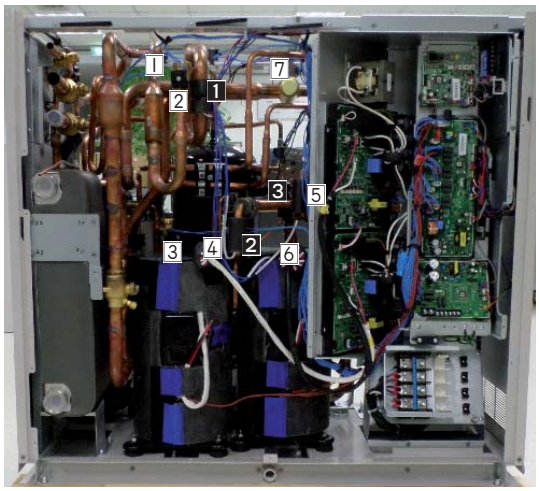
No	Valve & Sensor
1	Low pressure sensor
2	ACCUM. Return valve
3	HOT GAS #1 valve
4	High pressure sensor
5	EVI valve
6	SUCTION #2 temp. sensor
7	Subcooler inlet temp. sensor
8	Liquid temp. sensor
9	HOT GAS #2 valve
10	Main EEV
11	COND OUT temp. sensor
12	Bypass valve
13	High pressure sensor

INSULATION

No	Model	Insu Code	Binding Wire
1	AM200FXWA✳✳	DB62-04154A	
2	AM200FXWA✳✳	DB62-03808C	
3	AM200FXWA✳✳	DB62-03808E	
4	AM200FXWA✳✳	DB62-03808D	
2	AM200FXWA✳✳	DB62-03808D	

Binding Wire 2

■ AM200FXWA✳✳



VALVE & SENSOR

No	Valve & Sensor
1	HOT GAS #2 valve
2	Main cooling valve
3	COMP TOP sensor
4	Discharge temp. sensor
5	Discharge temp. sensor
6	COMP TOP sensor
7	4WAY VALVE

INSULATION

No	Model	Insu Code	Binding Wire
1	AM200FXWA✳✳	DB62-03808A	
2	AM200FXWA✳✳	DB62-03808D	
3	AM200FXWA✳✳	DB62-03808D	

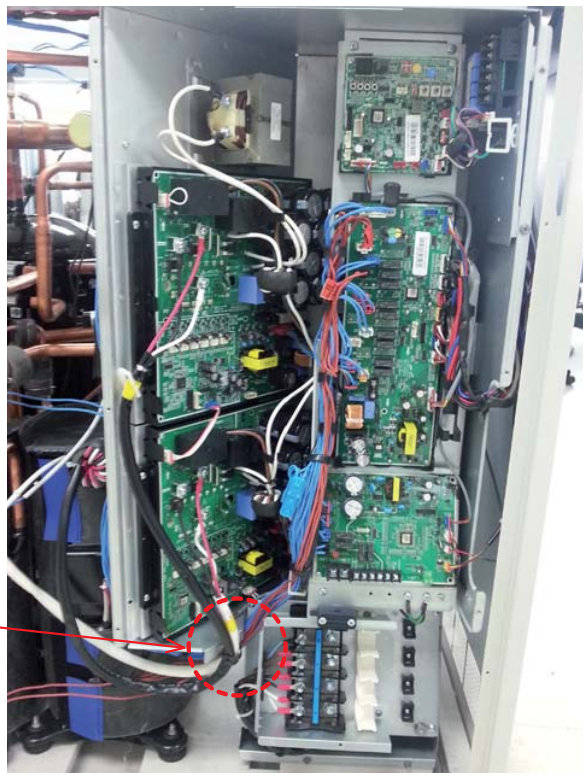
VALVE & SENSOR

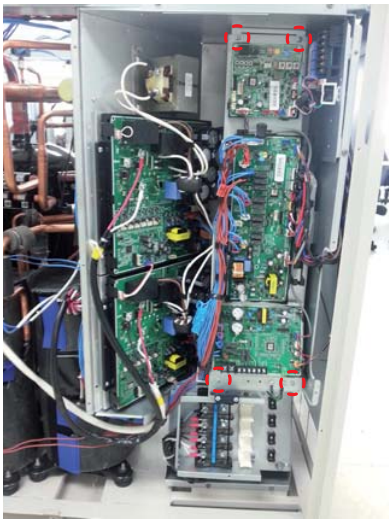
No	Valve & Sensor
1	Water temp. sensor

Binding Wire 3

■ AM200FXWA✳✳

► Comp wire & valve,sensor wires fix by Holder wire.



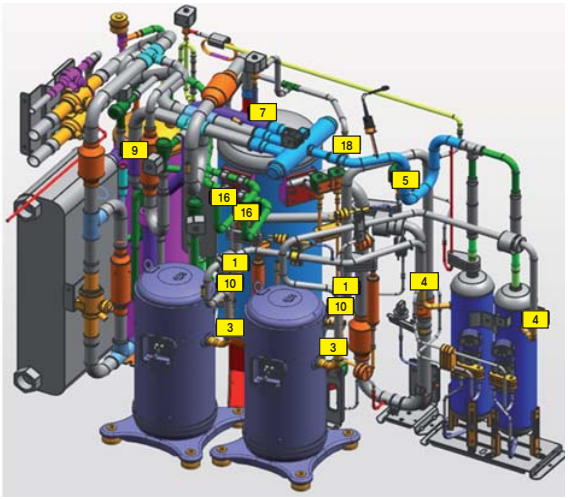
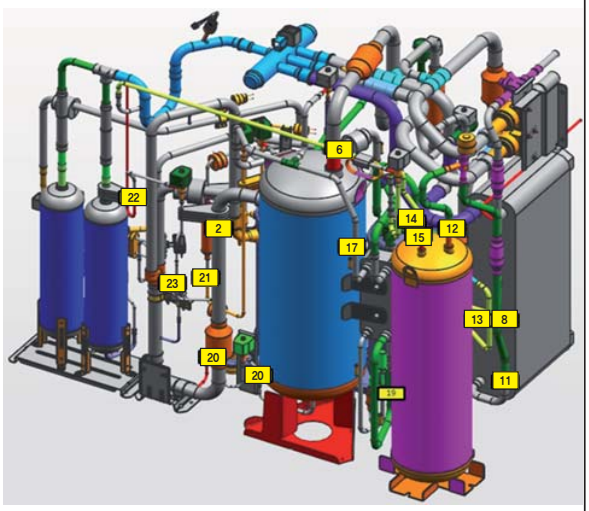


► Separate double layer structure of C/Box after remove 3 screws and connector.

[Reference Sheet]

Pipe Welding Position

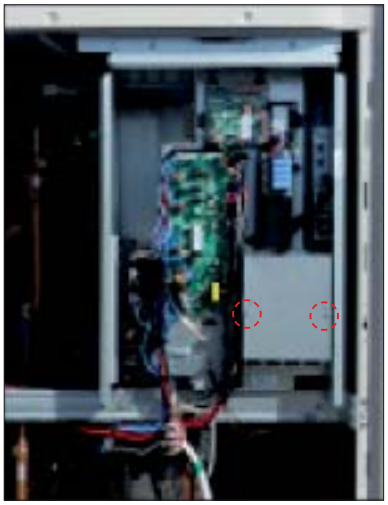
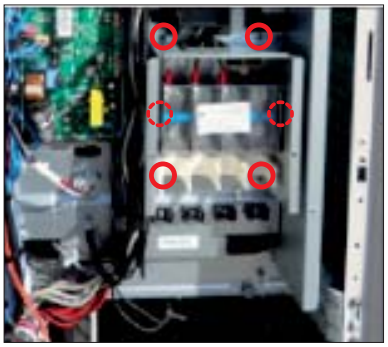
■ AM200FXWA✳✳

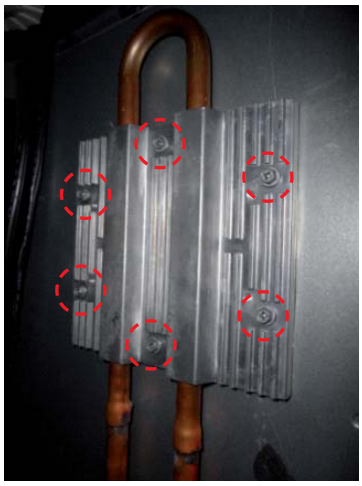
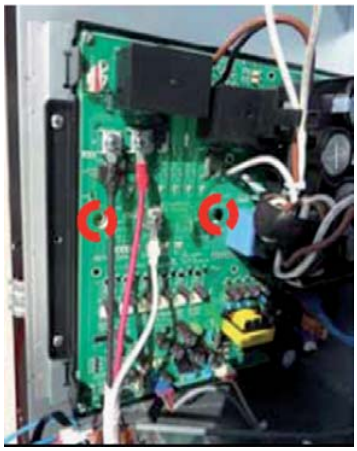
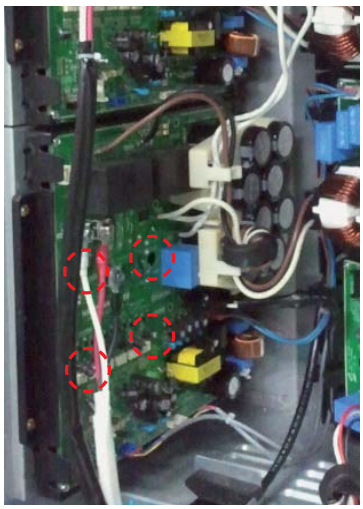
Front Welding Parts	Rear Welding Parts
	

No.	Welding Position	Q'ty	No.	Welding Position	Q'ty
1	Comp+Suction	2	13	Expansion+Tube Liquid	1
2	Accum+Suction	1	14	Receiver+Subcooler	1
3	Comp+Discharge	2	15	Receiver+Bypass hot gas	1
4	Discharge+Oil Sepa	2	16	Subcooler+Tube Liquid	2
5	4Way+Oil Sepa	1	17	Subcooler+EVI Bypass	1
6	4Way+Accum	1	18	EVI Bypass+Vapor Injection	1
7	Accum+EVI Bypass	1	19	Subcooler+Tube Liquid	1
8	4WAY+Tube Liquid	1	20	Accum+Accum oil	1
9	4WAY+Cond	1	21	Vapor Injection+Vapor Injection	1
10	Comp+Vapor Injection	2	22	Bypass hot gas+Oil Sepa	1
11	Expansion+Cond	1	23	Bypass hot gas+Suction	1
12	Receiver+Expansion	1			

3-2-6 AM140/160KXVG✳✳, AM140/160/180KXVA✳✳

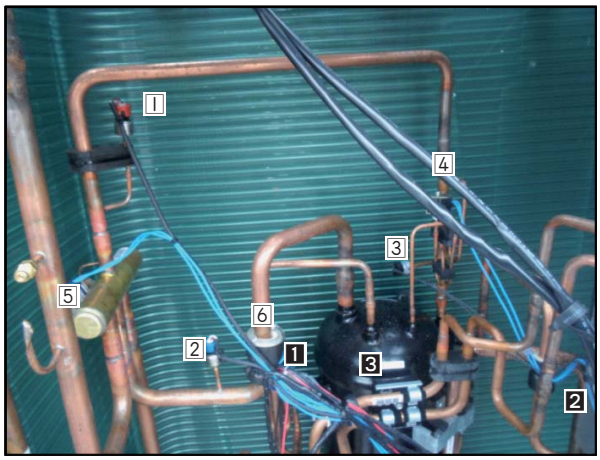
No.	Parts	Procedure	Remark
1	Electrical equipment Part	1) Remove 10 screws from the cabinet (Use + screw driver)	
		2) Remove 4 screws and separate cover control box (Use + screw driver)	
		3) Power, Compressor, Valve, Motor, Sensor connector connected to ASSY PCB remove.	

No.	Parts	Procedure	Remark
		4) 2 screws had fixed in terminal block cover when change power terminal block, communication terminal block remove.	
		5) 2 screws had fixed in terminal block after remove 4 screws had fixed to Cabinet for terminal block protection remove.	
		6) 5 screws had fixed to Front part remove.	

No.	Parts	Procedure	Remark
		7) 6 screws had fixed on side refrigerant cooling part outside remove . ⚠ Do not separate Heat Sink pulling Assy Piping Cooling piping compulsorily. (It can be a cause of parts damage)	
		8) 2 screws had fixed on side refrigerant cooling part inside remove. ⚠ Use the driver with magnetic.	AM140KXV✳✳✳  AM160/180KXVA✳✳✳ AM160KXVG✳✳ 

Binding Wire 1

■ AM140/160KXVG✳✳, AM140/160/180KXVA✳✳



VALVE & SENSOR

No	Valve & Sensor
1	High Pressure Sensor
2	Low Pressure Sensor
3	High Pressure Switch
4	Hot Gas Valve
5	4WAY Valve
6	Suction Sensor

INSULATION

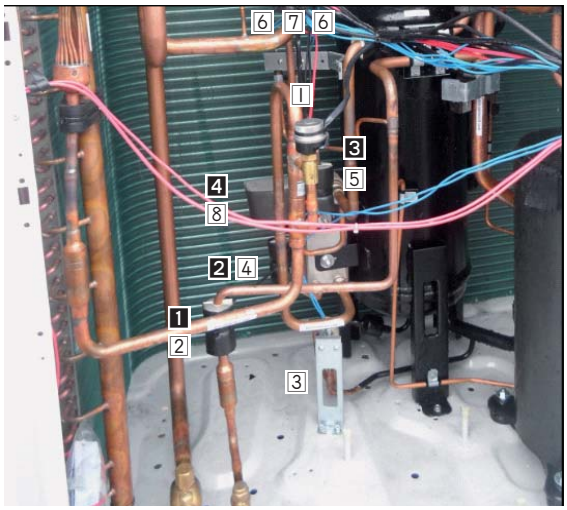
No	Model	Insu Code	Binding Wire
1	AM140/160/180✳XV✳✳	DB62-03808G	
2	AM140/160/180✳XV✳✳	DB62-08752B	
3	AM140/160/180✳XV✳✳	DB62-08752B	

VALVE & SENSOR

No	Valve & Sensor
1	Cond Out Sensor
2	Outdoor Temperature Sensor

Binding Wire 2

■ AM140/160KXVG✳✳, AM140/160/180KXVA✳✳



VALVE & SENSOR

No	Valve & Sensor
1	Expansion Valve
2	Liquid Sensor
3	Accum Oil Return Valve
4	EVI In Sensor
5	EVI Out Sensor
6	EVI SOL Valve
7	EVI Bypass Valve
8	EVI EEV

INSULATION

No	Model	Insu Code	Binding Wire
1	AM140/160/180✳XV✳✳	DB62-08751D	
2	AM140/160/180✳XV✳✳	DB62-08751E	
3	AM140/160/180✳XV✳✳	DB62-08751C	
4	AM140/160/180✳XV✳✳	DB62-11717A	

VALVE & SENSOR

No	Valve & Sensor
1	Comp Top #1 Sensor
2	Discharge #1 Sensor

INSULATION

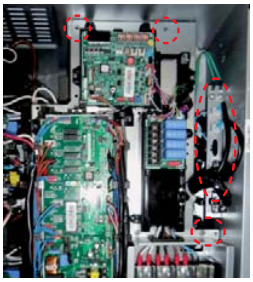
No	Model	Insu Code	Binding Wire
1	AM140/160/180✳XV✳✳	DB62-08751D	

Binding Wire 3

■ AM140/160KXVG✳✳, AM140/160/180KXVA✳✳

► Comp Wire fix by Holder Wire.

► Fix Comp Wire-Core to Bracket Beam Control Box using large size Cable Tie(350mm).

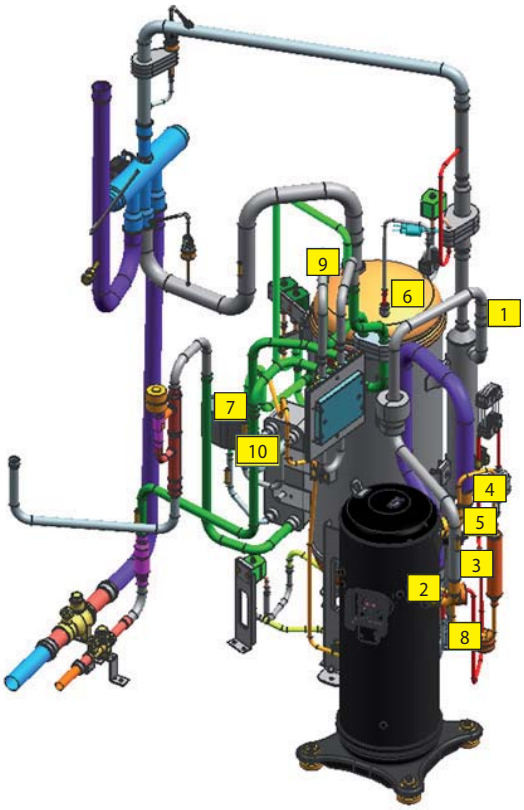
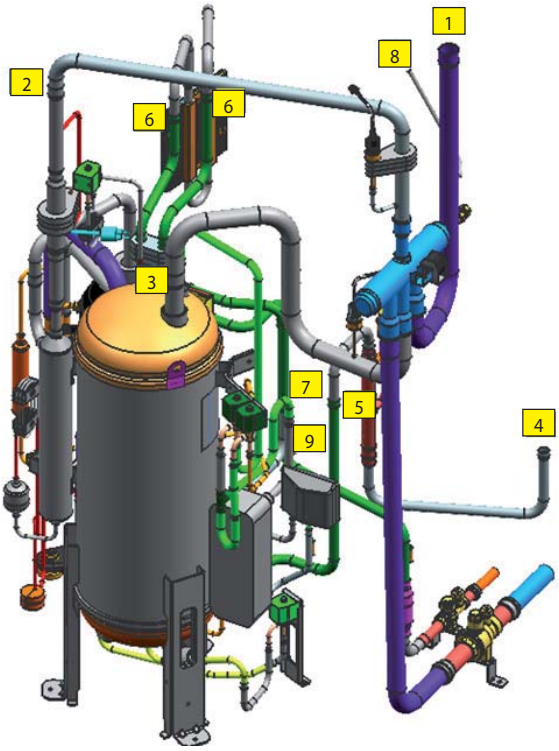


► Separate double layer structure of C/Box after remove 3 screws and connector.

[Reference Sheet]

Pipe Welding Position

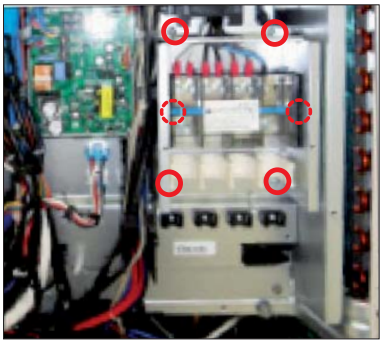
■ AM140/160KXVG✳✳, AM140/160/180KXVA✳✳

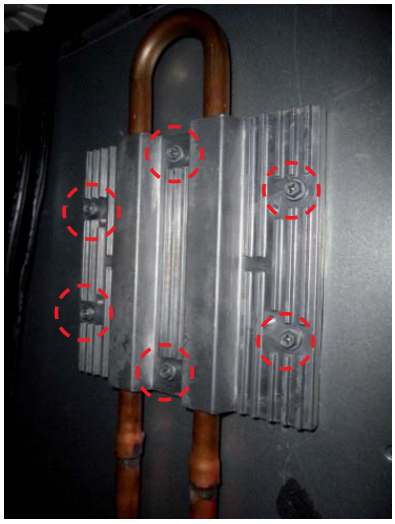
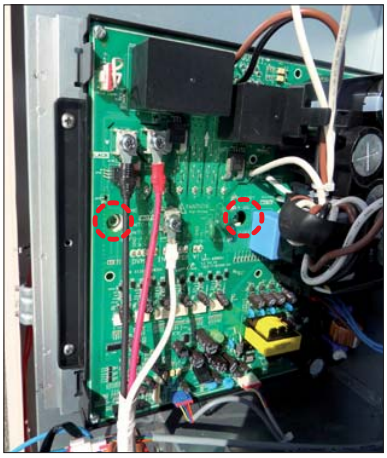
Front Welding Parts	Rear Welding Parts
	

No.	Welding Position	Q'ty	No.	Welding Position	Q'ty
1	Discharge+Oil-sepa	1	1	4way+Cond in	1
2	Discharge+Comp	1	2	4way+Oil-sepa out	1
3	Suction+Accum	1	3	4way+Accum	1
4	Suction+Comp	1	4	Expansion+Cond out	1
5	VI+Connector	1	5	Expansion+Subcooler	1
6	Hot-gas+Accum	1	6	Cooling+Connector	2
7	Connector+LQD	1	7	Connector+Subcooler	1
8	Suction+Oil-Return	1	8	Pinch Pipe	1
9	EVI-Bypass+Accum	1	9	EVI-Bypass+Subcooler	1
10	VI VALVE+Connector	1			

3-2-7 AM180/200/220KXVG✳✳, AM200/220KXVA✳✳

No.	Parts	Procedure	Remark
1	Electrical equipment Part	1) 10 screws that is fixing CABINET remove. (Use + Screw driver)	
		2) Remove 4 screws that is fixing and separate Cover Control Box. (Use + Screw driver)	
		3) Power, Compressor, Valve, Motor, Sensor connector connected to ASSY PCB remove.	

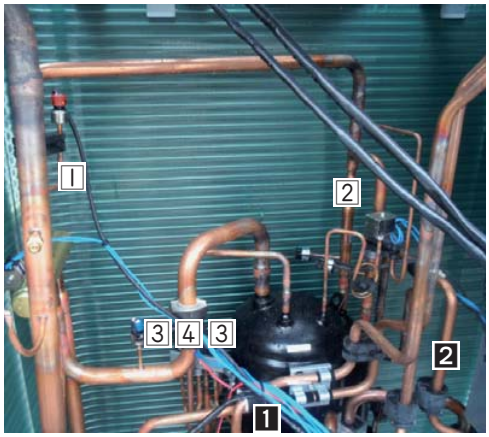
No.	Parts	Procedure	Remark
		4) 2 screws had fixed in terminal block cover when change power terminal block, communication terminal block remove.	
		5) 2 screws had fixed in terminal block after remove 4 screws had fixed to Cabinet for terminal block protection remove.	
		6) 6 screws had fixed to Front part remove.	

No.	Parts	Procedure	Remark
		7) 6 screws had fixed on side refrigerant cooling part outside remove . ⚠ Do not separate Heat Sink pulling Assy Piping Cooling piping compulsorily. (It can be a cause of parts damage)	
		8) 2 screws had fixed on side refrigerant cooling part inside remove. ⚠ Use the driver with magnetic.	

No.	Parts	Procedure	Remark
	< Reference > Heat Sink	Spread therminal grease on heat sink - Spread enough Thermal Grease evenly on Plate Heat Sink back whole using roller or brush. - Reassemble Plate Heat Sink in reverse order of disassembly.	

Binding Wire 1

■ AM180/200/220KXVG✳✳, AM200/220KXVA✳✳

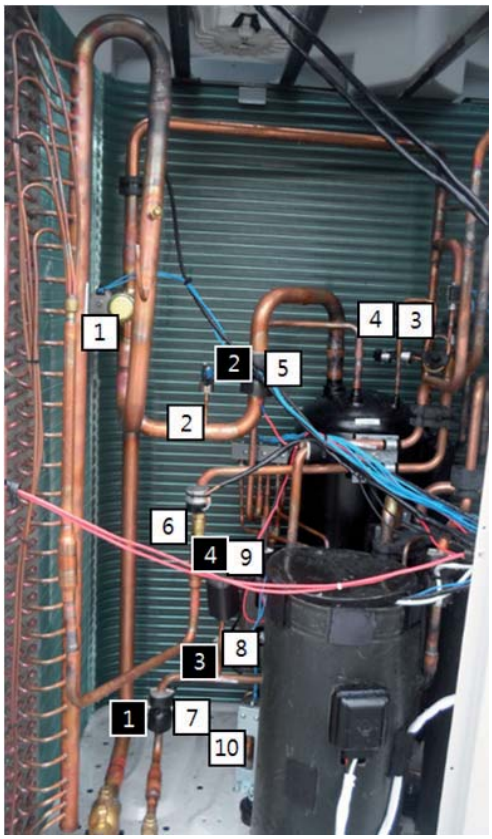


VALVE & SENSOR

No	Valve & Sensor
1	High Pressure Sensor
2	Hot Gas Valve
3	EVI SOL Valve
4	EVI Bypass Valve

INSULATION

No	Model	Insu Code	Binding Wire
1	AM200/220✳XV✳✳✳	DB62-08752B	
2	AM200/220✳XV✳✳✳	DB62-08752B	



VALVE & SENSOR

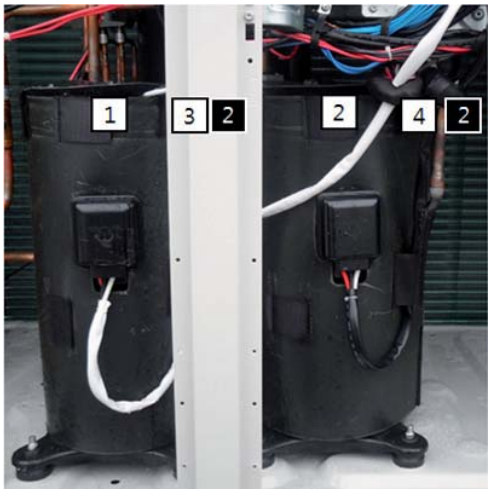
No	Valve & Sensor
1	4WAY Valve
2	Low Pressure Sensor
3	High Pressure Switch #1
4	High Pressure Switch #2
5	Suction Sensor
6	Expansion Valve
7	Liquid Sensor
8	EVI In Sensor
9	EVI Out Sensor
10	Accum Oil Return Valve

INSULATION

No	Model	Insu Code	Binding Wire
1	AM200/220✳XV✳✳✳	DB62-08751D	
2	AM200/220✳XV✳✳✳	DB62-08751A	
3	AM200/220✳XV✳✳✳	DB62-08751E	
4	AM200/220✳XV✳✳✳	DB62-08751C	

Binding Wire 2

■ AM180/200/220KXVG✳✳, AM200/220KXVA✳✳

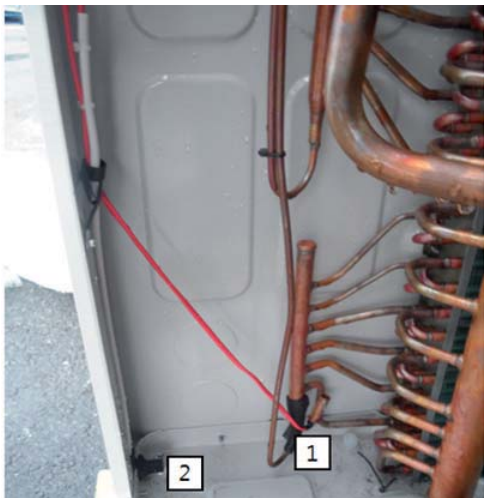


VALVE & SENSOR

No	Valve & Sensor
1	Comp Top #1 Sensor
2	Comp Top #2 Sensor
3	Discharge #1 Sensor
4	Discharge #2 Sensor

INSULATION

No	Model	Insu Code	Binding Wire
1	AM200/220✳XV✳✳✳	DB62-08751D	
2	AM200/220✳XV✳✳✳	DB62-08751D	



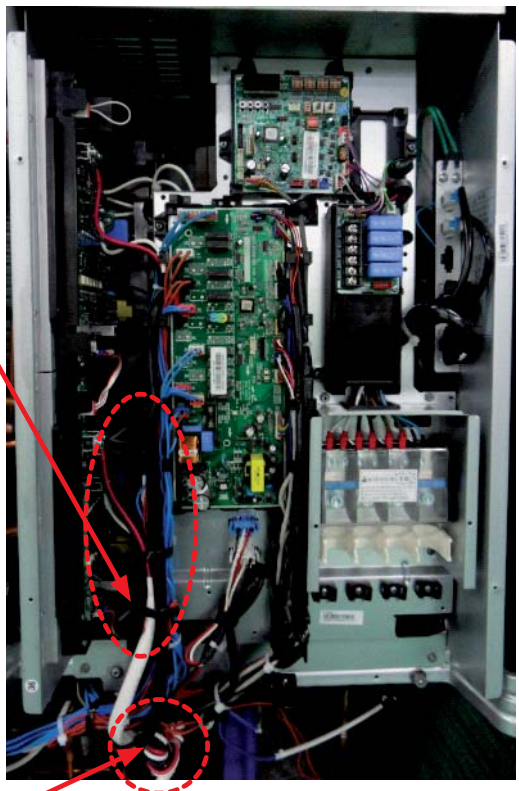
VALVE & SENSOR

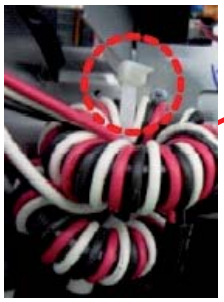
No	Valve & Sensor
1	Cond Out Sensor
2	Outdoor Temperature Sensor

Binding Wire 3

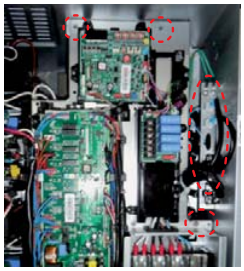
■ AM180/200/220KXVG✳✳, AM200/220KXVA✳✳

► Comp Wire fix by Holder Wire.





► Fix Comp Wire-Core to Bracket Beam Control Box using large size Cable Tie(350mm).

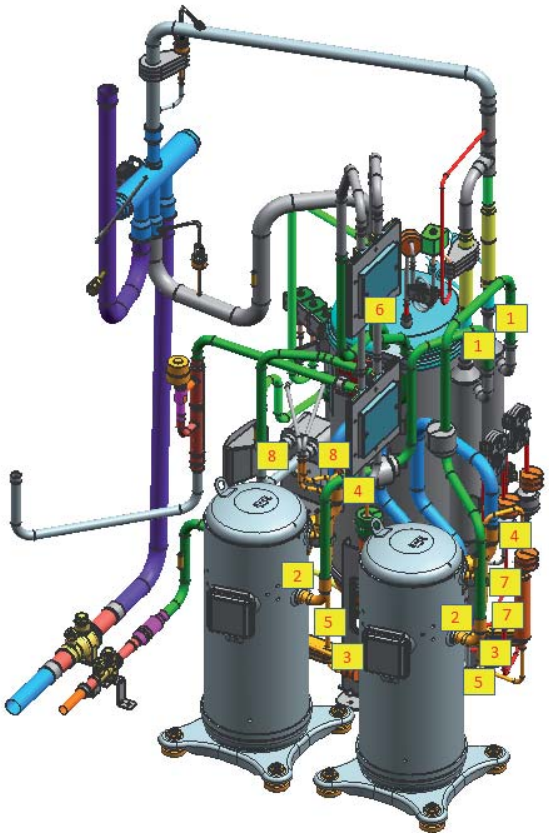
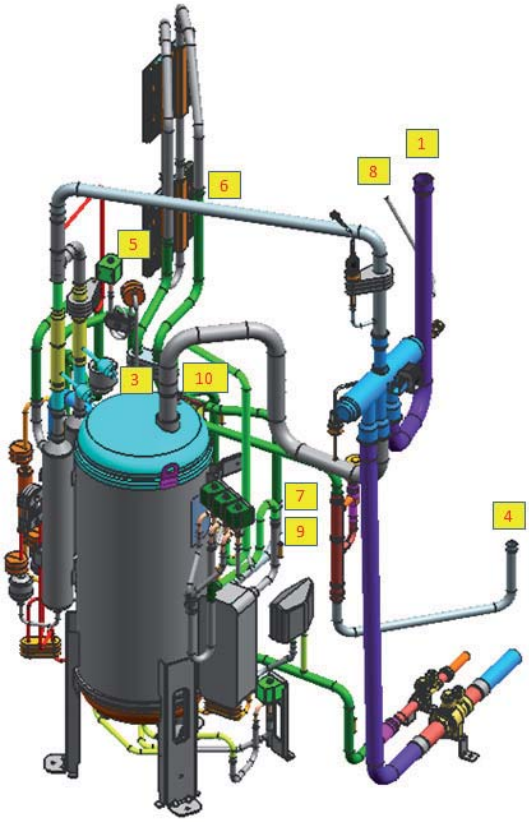


► Separate double layer structure of C/Box after remove 3 screws and connector.

[Reference Sheet]

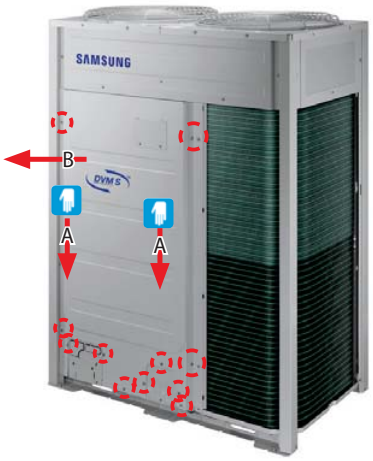
Pipe Welding Position 4

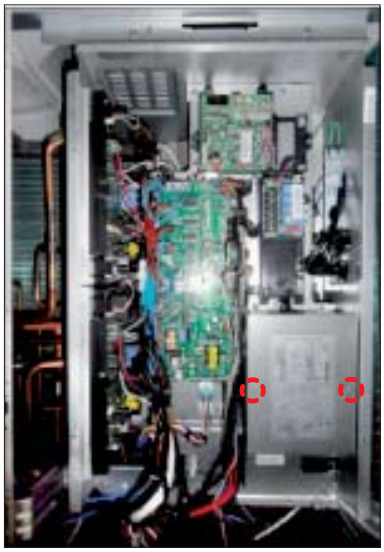
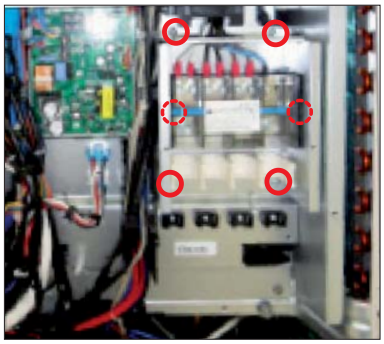
■ AM180/200/220KXVG✳✳, AM200/220KXVA✳✳

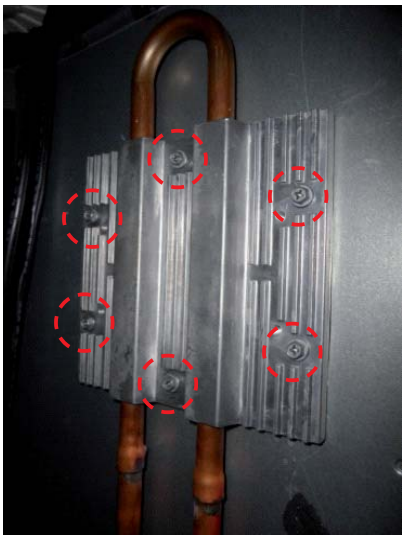
Front Welding Parts	Rear Welding Parts
	

No.	Welding Position	Q'ty	No.	Welding Position	Q'ty
1	Discharge+Oil-sepa	2	1	4way+Cond in	1
2	Discharge+Comp	1	2	4way+Oil-sepa out	1
3	Suction+Accum	1	3	4way+Accum	1
4	Suction+Comp	1	4	Expansion+Cond out	1
5	VI+Connector	1	5	Expansion+Cooling	1
6	Hot-gas+Accum	1	6	Cooling+Connector	2
7	Suction+Oil-Return	2	7	Cooling+Subcooler in	1
8	VI VALVE+Connector	2	8	Pinch Pipe	1
			9	EVI-Bypass+Subcooler	1
			10	EVI-Bypass+Accum	1

3-2-8 AM240/260/280/300KXV✳✳✳, AM080KXVS✳✳

No.	Parts	Procedure	Remark
1	Electrical equipment Part	1) 11 screws that is fixing CABINET remove. (Use Screw driver) 1. 9 screw remove of CABINET 2.Press the position with both hands and push down ('A' direction) 3.Carefully remove the CABINET ('B' direction)	
		2) Remove 4 screws that is fixing and separate Cover Control Box. (Use + Screw driver)	
		3) Power, Compressor, Valve, Motor, Sensor connector connected to ASSY PCB remove.	

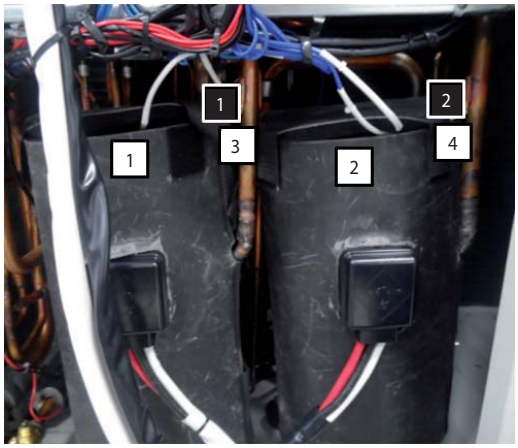
No.	Parts	Procedure	Remark
		4) 2 screws had fixed in terminal block cover when change power terminal block, communication terminal block remove.	
		5) 2 screws had fixed in terminal block after remove 4 screws had fixed to Cabinet for terminal block protection remove.	
		6) 5 screws had fixed to Front part remove.	

No.	Parts	Procedure	Remark
		7) 6 screws had fixed on side refrigerant cooling part outside remove . ⚠ Do not separate Heat Sink pulling Assy Piping Cooling piping compulsorily. (It can be a cause of parts damage)	
		8) 2 screws had fixed on side refrigerant cooling part inside remove. ⚠ Use the driver with magnetic.	

No.	Parts	Procedure	Remark
	< Reference > Heat Sink	Spread therminal grease on heat sink - Spread enough Thermal Grease evenly on Plate Heat Sink back whole using roller or brush. - Reassemble Plate Heat Sink in reverse order of disassembly.	

Binding Wire 1

■ AM240/260/280/300KXV✳✳✳, AM080KXVS✳✳

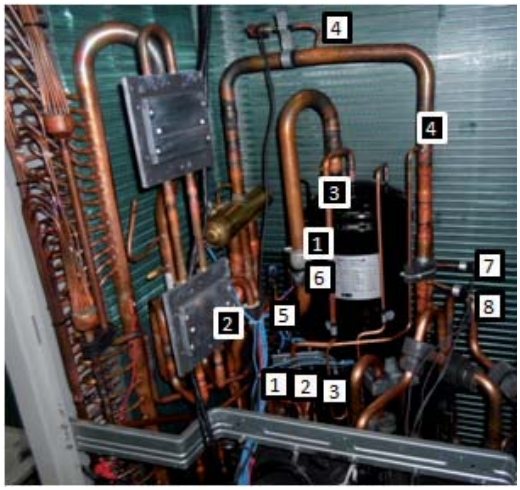


VALVE & SENSOR

No	Valve & Sensor
1	Comp Top #1 Sensor
2	Comp Top #2 Sensor
3	Discharge #1 Sensor
4	Discharge #2 Sensor

INSULATION

No	Model	Insu Code	Binding Wire
1	AM240/260/280/300✳XV✳✳✳	DB62-03808F	
2	AM240/260/280/300✳XV✳✳✳	DB62-03808F	



VALVE & SENSOR

No	Valve & Sensor
1	EVI SOL Valve
2	EVI Bypass Valve
3	Hot Gas Valve
4	High Pressure Sensor
5	Low Pressure Sensor
6	Suction Sensor
7	High Pressure Switch #1
8	High Pressure Switch #2

INSULATION

No	Model	Insu Code	Binding Wire
1	AM240/260/280/300✳XV✳✳✳	DB62-08751F	
2	AM240/260/280/300✳XV✳✳✳	DB62-04154C	
3	AM240/260/280/300✳XV✳✳✳	DB62-08752D	
4	AM240/260/280/300✳XV✳✳✳	DB62-04154D	

Binding Wire 2

■ AM240/260/280/300KXV✳✳✳, AM080KXVS✳✳

VALVE & SENSOR

No	Valve & Sensor
1	Accum Oil Return Valve

INSULATION

No	Model	Insu Code	Binding Wire
1	AM240/260/280/300✳XV✳✳✳	DB62-08752F	

VALVE & SENSOR

No	Valve & Sensor
1	Cond Out Sensor
2	Outdoor Temperature Sensor

VALVE & SENSOR

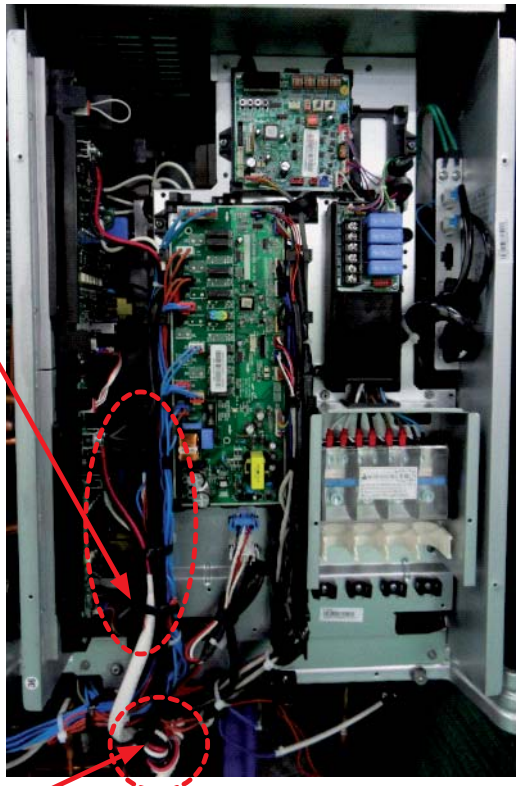
No	Valve & Sensor
1	Expansion Valve
2	Liquid Sensor
3	EVI In Sensor
4	EVI Out Sensor

INSULATION

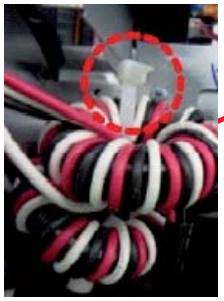
No	Model	Insu Code	Binding Wire
1	AM240/260/280/300✳XV✳✳✳	DB62-08751G	
2	AM240/260/280/300✳XV✳✳✳	DB62-08751C	
3	AM240/260/280/300✳XV✳✳✳	DB62-04154C	

Binding Wire 3

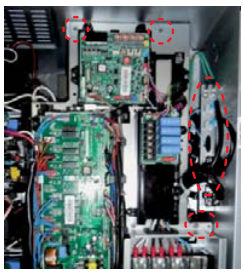
■ AM240/260/280/300KXV✳✳✳, AM080KXVS✳✳



► Comp Wire fix by Holder Wire.



► Fix Comp Wire-Core to Bracket Beam Control Box using large size Cable Tie(350mm).

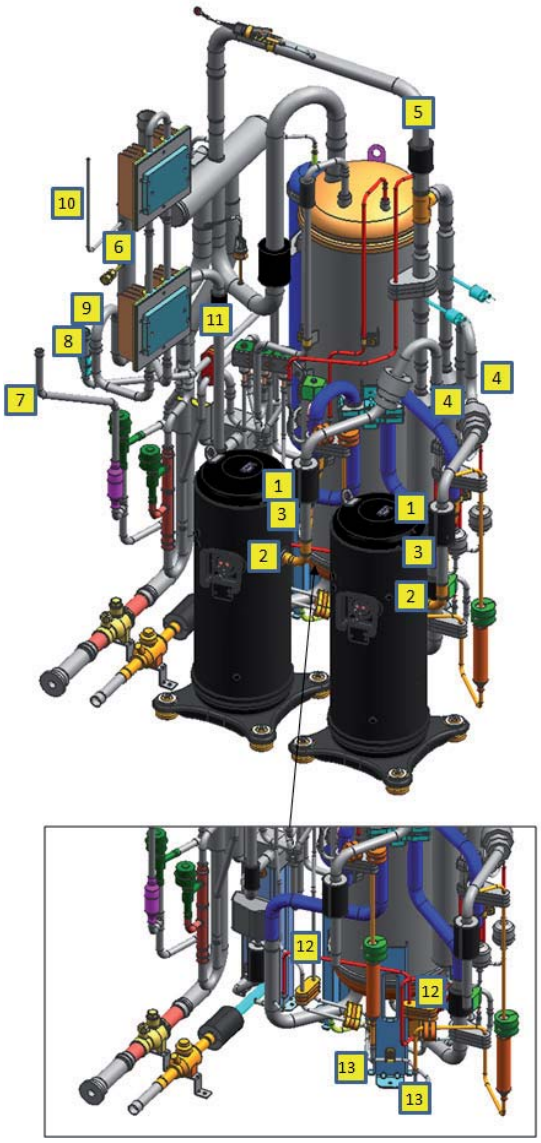
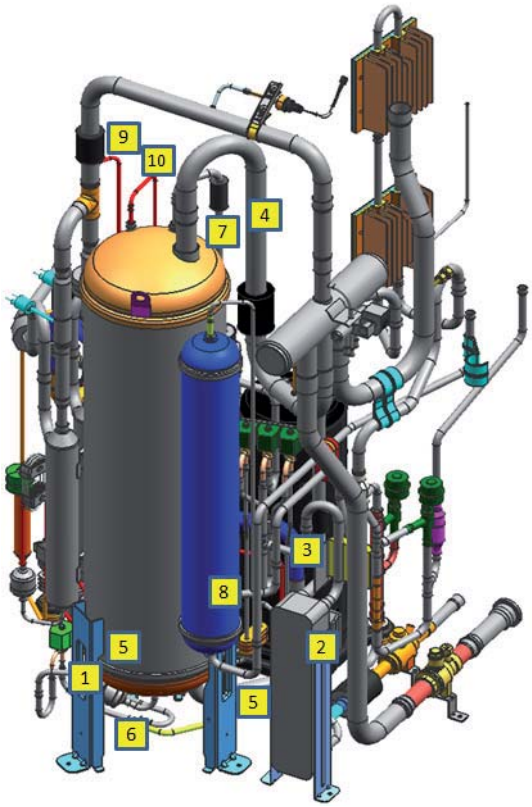


► Separate double layer structure of C/Box after remove 3 screws and connector.

[Reference Sheet]

Pipe Welding Position 4

■ AM240/260/280KXVG✳✳, AM280/300KXVA✳✳, AM080KXVS✳✳

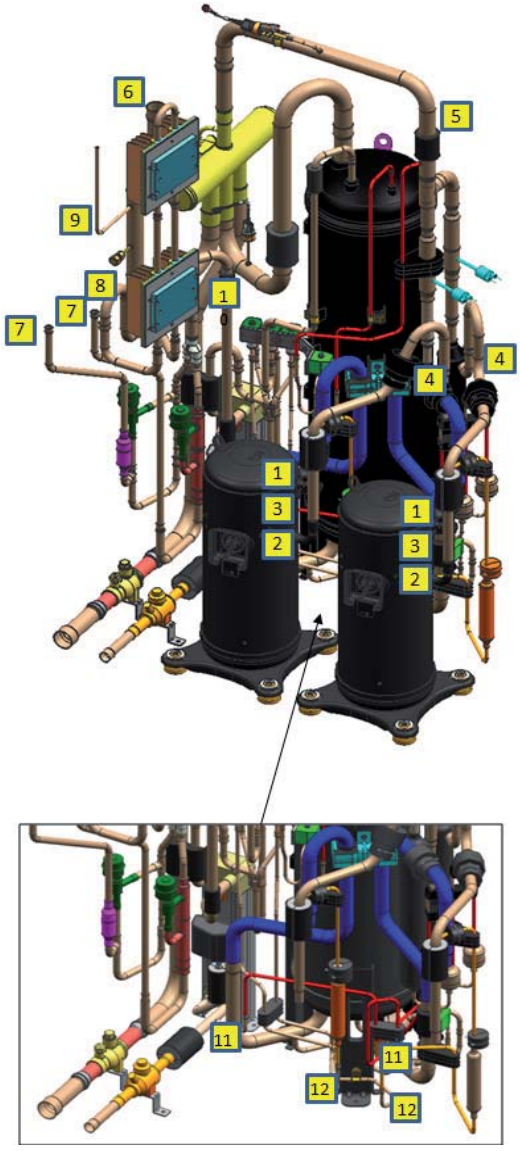
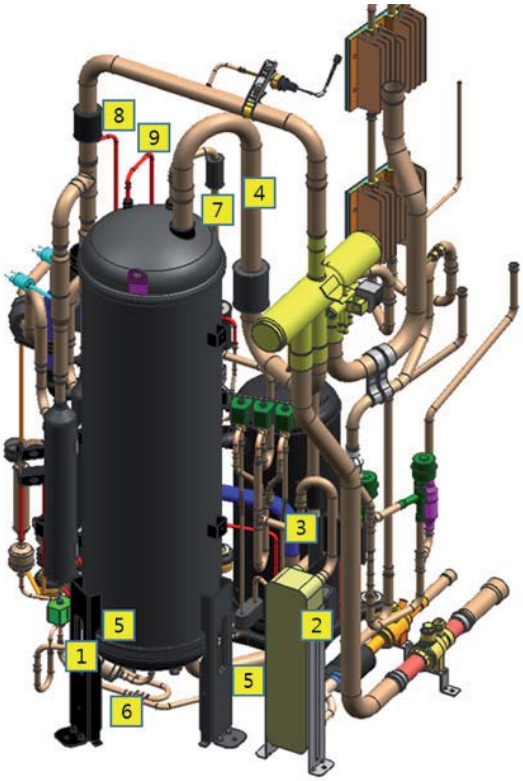
Front Welding Parts	Rear Welding Parts
	

No.	Welding Position	Q'ty	No.	Welding Position	Q'ty
1	Comp+Suction	2	1	Accum Oil Return Valve + Suction	1
2	Comp+Discharge	2	2	Subcooler + Subcooler In	1
3	Comp+Vapor Injection	2	3	Subcooler + EVI Bypass	1
4	Discharge + Oil Sepa	2	4	Acuum + 4Way	1
5	4Way + Oil Sepa Out	1	5	Acuum + Suction	2
6	4Way + Cond In	1	6	Accum + Accum Oil Valve	1
7	Expansion + Cond out	1	7	Accum + EVI Bypass	1
8	Receiver + Cond Out	1	8	Receiver + Expansion	1
9	Expansion +Cooling	1	9	Hot Gas Valve + Oil Sepa out	1
10	Pinch Pipe	1	10	Accum +Hot Gas Valve	1
11	Cooling + Subcooler In	1			
12	Oil Return + Suction	2			
13	Vapor Injection + EVI Bypass	2			

[Reference Sheet]

Pipe Welding Position 4

■ AM240/260KXVA✳✳

Front Welding Parts	Rear Welding Parts
	

No.	Welding Position	Q'ty	No.	Welding Position	Q'ty
1	Comp+Suction	2	1	Accum Oil Return Valve + Suction	1
2	Comp+Discharge	2	2	Subcooler + Subcooler In	1
3	Comp+Vapor Injection	2	3	Subcooler + EVI Bypass	1
4	Discharge + Oil Sepa	2	4	Acuum + 4Way	1
5	4Way + Oil Sepa Out	1	5	Acuum + Suction	2
6	4Way + Cond In	1	6	Accum + Accum Oil Valve	1
7	Expansion + Cond out	2	7	Accum + EVI Bypass	1
8	Expansion +Cooling	1	8	Hot Gas Valve + Oil Sepa out	1
9	Pinch Pipe	1	9	Accum +Hot Gas Valve	1
10	Cooling + Subcooler In	1			
11	Oil Return + Suction	2			
12	Vapor Injection + EVI Bypass	2			

3-3 Caution at compressor exchange

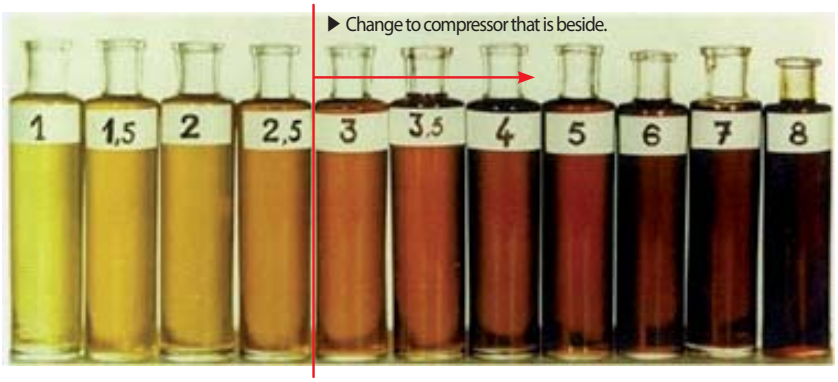
■ Compressor exchange order

STEP	Occasion that compressor is 1 inside outdoor unit	Occasion that compressor is 2 inside outdoor unit
1	-	Establish compressor to exchange by cutting.
2	-	Refrigerant release driving of applied outdoor unit ※ Refrigerant release driving enforces 1th necessarily. Release driving that enforce contiguously can be responsible for compressor breakdown.
3	Lock all SVC valve of liquid pipe and gas pipe.	
4	Enter in vacuum mode and establish as all EEV and Valve open.	
5	Reclaim refrigerant of outdoor unit using Recovery Unit. ※ When there is no Recovery Unit, refer to below contents. 1. If refrigerant release driving is enforced, refrigerant remaining amount of outdoor unit inside is about 1.5kg ordinarily. Temperature can remain more refrigerant because refrigerant fills to Accumulator in the winter day. 2. Refer to factory charging refrigerant had registered to Label of outdoor unit. 3. Can get help that decide an addition refrigerant quantity if use refrigerant quantity decision function that use S-Checker.	
6	Turn off the power linked by outdoor unit.	
7	Separate compressor that broke down from outdoor unit. ※ Confirm through manifold gauge whether refrigerant of outdoor unit was reclaimed all necessarily before use welding machine for replace of compressor.	
8	Measure quantity of broke down oil of compressor.	
9	Confirm state and color of compressor oil that broke down.	
10	-	When is judged that oil was polluted, compressor beside (ASTM : more than 3) measures quantity of replace and oil.
11	Decide quantity of oil to pour in addition according to sheep of changing oil of compressors.	
12	Change by new compressor. Add oil according to sheep of oil that pour decided addition before.	
13	Establish again by vacuum mode after connect power.	
14	Execute leakage examination using nitrogen → vacuum work	
15	Add a refrigerant quantity deciding from step 5.	
16	Execute Auto Trial Operation after open SVC Valve.	

■ Check point at compressor replacement

1) Check oil color of broken compressor.

- If one compressor is broken, you are not sure another compressor should be replaced together or not. At that time, check oil color of broken compressor comparing with below photo.



2) Weight of compressor and quantity of oil

- When compressor is shipped at factory, oil of (compressor unit standard) 1100cc was filled up.
- Weight of compressor including oil GB046FA* : 24.3 kg, GB052FA* : 31.6 kg, GB066FA* : 35.4 kg, GB070FA* : 36.7 kg, DS4GJ5080FVA* : 40.9 kg
- Add oil to outdoor unit as much as relevant weight if is heavy than weight of compressor that weight of compressor that is changed to locality is changed newly.
- Quantity(kg) of added oil = Weight(kg) of compressor that broke down - Weight(kg) of newly change compressor
- If quantity of calculated addition oil passes over 1kg, quantity of add oil does by 1kg.
- Problem of that is blocked in oil circulation of (remaining oil of compressor that broke down below 0.3kg) compressor if is light more than 0.8kg than weight of compressor that weight of compressor that is changed to locality is changed newly inspects oil circulating system because possibility occurred is high.

OIL SEPARATOR		
SVC CODE	**Weight information**	**Fig**
DB96-16927A	3.54kg	
DB96-17888A (DB96-17639A DB96-17640A)	7.86kg (7.14kg except for bracket base)	
DB96-20380A	16.21kg	
DB96-21902A	2.86kg	
DB96-21973A	2.71kg	

ACCUMULATOR		
SVC CODE	**Weight information**	**Fig**
DB96-17091A	16.64kg	
DB96-16928A	22.08kg	
DB96-20395A	30.37kg	
DB96-21957A	24.32kg	
DB96-21912A	32.33kg	

TANK-RECEIVER		
SVC CODE	**Weight information**	**Fig**
DB96-21951A	4.97kg	

3) Checking of oil circulating system

① Oil separator capillary tube or filter of block

- If filter or capillary tube of oil separator lower column is blocked by alien substance etc.., can become cause of compressor breakdown because oil is not collected.
- Can doubt that is blocked if oil separator capillary tube temperature is low after refrigerant outlet temperature of compressor, in driving, rises.

(※ Models with 2 compressors, oil separator capillary tubes are crossing each other.)

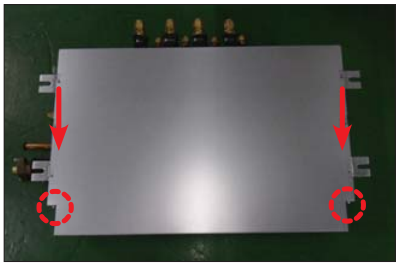
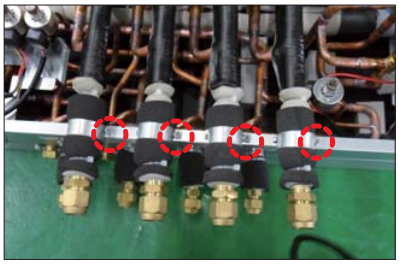
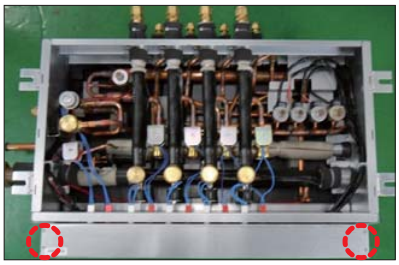
- Confirm that is blocked in stationary state through nitrogen pressurization availability.

② Breakdown of Accum Oil Return Valve (ARV)

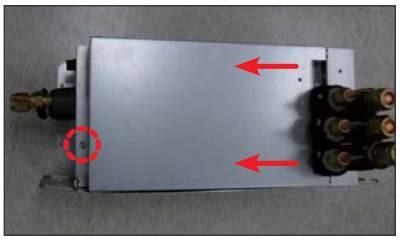
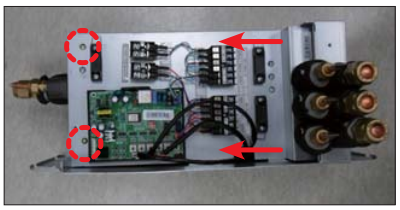
- Damage can become cause of compressor breakdown because oil is not collected if filter of valve front/piping etc.. is blocked with ARV is closed.
- Power connector of ARV confirms that was linked right.
- Extract connector in vacuum mode or confirm whether when insert, action sound of valve happens.

③ When CCH is badness, can become cause of compressor breakdown by oil foaming.

3-4 MCU

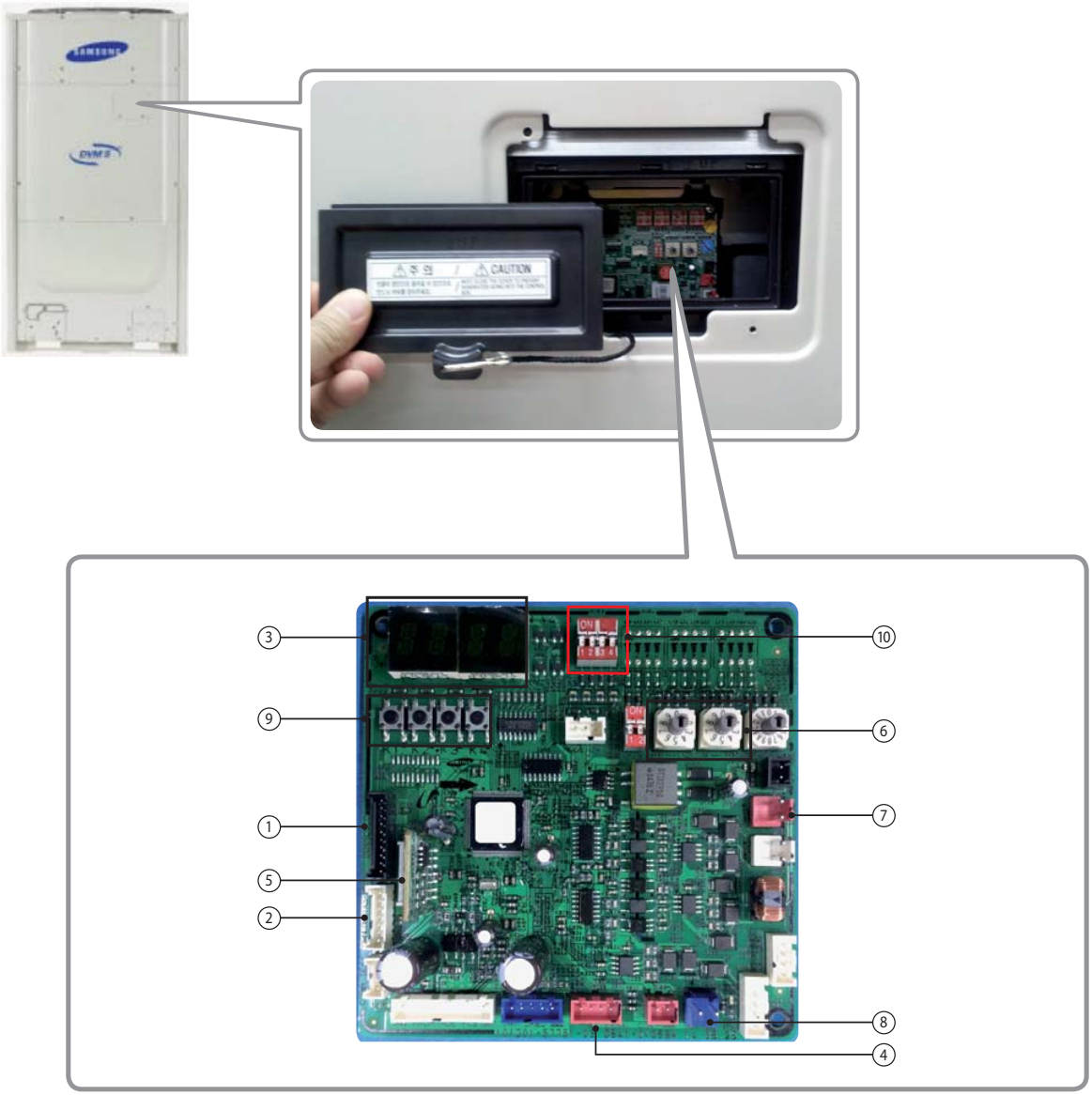
No	Parts	Procedure	Remark
1	Cabinet upper	1) Separate 2 fixing screws from the cabinet. (Use + Serew Driver) 2) Separate cabinet from MCU.	
2	Cabinet front	1) Separate 4 fixing screws from the cabinet. (Use + Serew Driver)	
		2) Separate 4 fixing screws from the brackets. (Use + Serew Driver)	
3	Cabinet front	1) Separate front cabinet from MCU.	
4	Control box cover	1) Separate 2 fixing screws from the control box cover. (Use + Serew Driver)	
		2) Separate control box cover from MCU.	

3-5 EEV KIT

No	Parts	Procedure	Remark
1	Cabinet front	1) Separate 1 fixing screw from EEV kit. (Use + Serew Driver)	
		2) Separate cabinet from EEV kit.	
2	Control parts	1) Separate 2 fixing screws from EEV kit. (Use + Serew Driver)	
		2) Separate control part from EEV kit.	

4. Troubleshooting

4-1 Check-up Window Description



No.	Function	No.	Function
1	CN22 download (PC) (SMW200-10 black)	6	Set up the number of connected Indoor units
2	MICOM. download (AS-PRO) (SMW200-07P white)	7	For checking indoor unit communication (YW396-02P red)
3	ERROR DISPLAY	8	Transmitter 12V (YW396-02P blue)
4	State Check (SMW250-04P red)	9	Outdoor Unit Tact Switch
5	EEPROM SOCKET	10	Outdoor Unit Dip Switch

4-2. Service Operation

4-2-1 Special Operation

■ AM080/100/120/140/160/180/200/220F✳XV✳G✳

► Key input of the outdoor unit when the service enters the operation mode.

K1 (Number of press)	Key operation	Display on segment
1 time	Refrigerant charging in Heating mode	K, 1, BLANK, BLANK
2 times	Trial operation in Heating mode	K, 2, BLANK, BLANK
3 times	Pump out in Heating mode (Outdoor unit address 1)	K, 3, BLANK, 1
4 times	Pump out in Heating mode (Outdoor unit address 2)	K, 3, BLANK, 2
5 times	Pump out in Heating mode (Outdoor unit address 3)	K, 3, BLANK, 3
6 times	Pump out in Heating mode (Outdoor unit address 4)	K, 3, BLANK, 4
7 times	Vacuumig (Outdoor unit address 1)	K, 4, BLANK, 1
8 times	Vacuumig (Outdoor unit address 2)	K, 4, BLANK, 2
9 times	Vacuumig (Outdoor unit address 3)	K, 4, BLANK, 3
10 times	Vacuumig (Outdoor unit address 4)	K, 4, BLANK, 4
11 times	Vacuuming (All outdoor units)	K, 4, BLANK, A
12 times	End Key operation	-
Press and hold 1 time	Auto Trial Operation	K, K, BLANK, BLANK

K2 (Number of press)	Key operation	Display on segment
1 time	Refrigerant charging in Cooling mode	K, 5, BLANK, BLANK
2 times	Trial operation in Cooling mode	K, 6, BLANK, BLANK
3 times	Pump down all units in Cooling mode	K, 7, BLANK, BLANK
4 times	H/R: Checking the pipe connection H/P: Automatic setting of operation mode (Cooling/Heating) for trail operation	K, 8, BLANK, BLANK
5 times	Checking the amount of refrigerant	"K""9" X X (Display of last two digits may differ depending on the progress)
6 times	Discharge mode of DC link voltage	K, A, BLANK, BLANK
7 times	Forced defrost operation	K, B, BLANK, BLANK
8 times	Forced oil collection	K, C, BLANK, BLANK
9 times	Inverter compressor 1 check	K, D, BLANK, BLANK
10 times	Inverter compressor 2 check	K, E, BLANK, BLANK
11 times	Fan 1 check	K, F, BLANK, BLANK
12 times	Fan 2 check	K, G, BLANK, BLANK
13 times	End Key operation	-

※ When pcb will be replaced or repaired , please shut off the power after carrying out discharge mode without fail

※ When discharge mode is progressing, DC voltage of inverter PBA 1 & inventer PBA 2 indicate on display alternately.

If LED display of inverter PBA 1 & inventer PBA 2 will be turned off and "OK" is displayed, a discharge is completed.

※ If INV error is occurred(E464/364, E461/361, etc.), please wait more than 15 minutes until self-discharging after shutting off the power because it can not enter a discharge mode.

※ If normal completion discharge mode or self-discharge will be not completed, it is very dangerous to contact because a high DC voltage of inverter PBA is charged.

■ Auto Trial Operation

► After initial installation, stable operation for a certain period of time limited to operation conditions.

	Cooling	Heating
Method of Entry	K2 Tact Switch twice	K1 Tact Switch twice
Compressor	Normal operation, but the maximum frequency limit (differ by model)	
Indoor Unit	Whole operation (The set temperature=3˚C)	Whole operation (The set temperature=40˚C)
Outdoor fan and valves	Normally control conduct	
Operation time	Min : 60 minutes, Max : 10 hours	
Etc.	· Exceed the maximum operating time at stops and waits. · Protection and control, self-diagnosis is performed.	

■ Refrigerant filling operation

► Operation to filling the refrigerant compressor was fixed at a certain frequency.

	Cooling	Heating
Method of Entry	K2 Tact Switch one time	K1 Tact Switch one time
Compressor	Starting frequency (Mild Start frequency) operation	
Indoor Unit	Whole operation (The set temperature=3˚C)	Whole operation (The set temperature=40˚C)
Outdoor fan and valves	Normally control conduct	
Operation time	60 minutes	
Etc.	During the filling operation does not enter the special operation, such as oil recovery, defrost.	

■ Heating Pump Out

► Operation for the repair of the Individual outdoor unit, the outdoor unit refrigerant emissions to the indoor part.
► Liquid pipe service valve and the gas pipe service valve operation, the operator manually need to close.

► Observe low pressure using View Mode of K4 button if compressor operate.
If low pressure goes down below about 0.2 MPa.g : Immediately lock the gas side service valve, Pump Out operation is shut down.
(Pump out operation shut down : K1 button once more press or K3 button one time press)
► If operation of low pressure goes down below 0.1 MPa.g : Will be stopped automatically for the protection of the compressor.

How to Initiate	K1 Tact Switch 3 times~6 times
Compressor	60Hz
Indoor Unit	Whole Operation (The set temperature=40℃)
4Way Valve	ON (Heating Mode)
Outdoor Fan	Maximum air flow
Main EEV	Operation side : 700 Step (Stop side : 0 step)
Maximum Operation Time	10 minutes
Protection Control	Conduct the discharge temperature, high pressure control. (Low pressure protection control is not carried out) ※ Low pressure is outside normal limits : Operation is shut down after gas pipe manually closed.
Etc.	Entry after safety start. (Only the corresponding Outdoor Unit operation.) To pump out more than 2 : Except communication between Outdoor Unit of relevant set after working for one, remainder set makes Pump Out add.

■ Cooling Pump Down

► Recover the refrigerant of Indoor Unit and Piping to outdoor side.
► Liquid pipe service valve and the gas pipe service valve operation, the operator manually need to close.
► If the installation of the long pipe : Any refrigerant into the outdoor unit can not be recovered, therefore should use a separate container.
► Observe low pressure using View Mode of K4 button if compressor operate.
If low pressure goes down below about 0.2 MPa.g : Immediately lock the gas side service valve, Pump Out operation is shut down.
(Pump out operation shut down : K1 button once more press or K3 button one time press)
► If operation of low pressure goes down below 0.1 MPa.g : Will be stopped automatically for the protection of the compressor.

How to Initiate	K2 Tact Switch 3 times
Compressor	Address No.1 Outdoor Unit - 60Hz (Other Outdoor Unit COMP OFF)
Indoor Unit	Whole Operation (The set temperature=3℃)
4Way Valve	OFF (Cooling Mode)
Outdoor Fan	Maximum air flow
Main EEV	Operation side : 2000 Step , Stop side : 2000 step
Maximum Operation Time	30 minutes
Etc.	Does not conduct the operation of the special operation, and protection control. Pressure and temperature is outside normal limits : Operation is shut down after gas pipe manually closed.

■ Vacuum Operation

► Operation to facilitate vacuum to open the valve after the Outdoor Unit repair.

How to Initiate	K1 Tact Switch 7 times~10 times	K1 Tact Switch 11 times
Compressor	OFF	
Indoor Unit/Outdoor Fan	OFF	
4Way Valve	OFF	
Valves	Open all valves of the outdoor unit	Open all valves of the system (Including indoor unit and mcu)
Etc.	If not turn off the vacuum mode, the start of normal operation is prohibited.	

■ Piping Inspection Operation

► Operation mode to check the status of the piping between the MCU and the indoor unit.

► MCU pipe connection check
- How to start : Press K2 4time (Heat Recovery only)
※ In heat pump model : select trial opration mode in cooling or heating mode automatically
- Operation sequence

	OUD	IDU for checking	Other IDUs	Check point
Cooling	Normal operation	Fan on / EEV open	Fan on / EEV close	Evap in temp-lowest
Heating	Normal operation	Fan on / EEV close	Fan on / EEV open	Evap out temp-lowest

- Display

1. Starting | P | i | P | E | ↔ | C | o | o | L | or | P | i | P | E | ↔ | H | E | A | T |

2. Starting | A | B | C | D | ↔ | E | F | G | H |

A , B : Checking IDU address
C , D : IDU which evap in temp changed, "--" means none
E , F : no display
G , H : IDU which evap out temp changed, "--" means none

3. Finishing | H | O | L | D |

4. Result - Normal communication or | E | r | r | P |

※ When we have | E | r | r | P | press K2 to see more information

Error code(E190) → MCU address & port (C00A) → IDU address chesked & IDU address temp changed(00--)
※ E190 - No or wrong IDU's Evap in temp chaged
※ E191 - No or wrong IDU's Evap out temp chaged

► Heat Pump Model : Outdoor temperature is more than 15℃ / Cooling Auto Trial Operation start
Outdoor temperature is less than 15℃ / Heating Auto Trial Operation start

■ Discharge Mode Operation

► Outdoor power is turned off, the Inverter PCB charging a high DC voltage, so dangerous to touch.
- To replace the PCB, first turn off the power and the begin if DC voltage is discharged.
- If not use the discharge mode, the discharge time of about 15 minutes takes.
- If an error occurs, the discharge mode may not properly run. (Wait until natural discharge.)
- In particular, E 464, E364, power devices may be damaged, therefore do not use the discharge mode.
(Natural discharge until Please wait for at least 15 minutes.)

► Block the Inverter PCB 3-phase relay after connected the power, and through compressor, DC voltage is discharging.
- INV1 and INV2 DC voltage during discharge mode are displayed alternately.
- Discharge mode Display (Rotate the three page display, as shown below.)
'K' 'A' '' ''→DC Link Volt1 (For example, 120[V] 0 1 2 0 display)
→DCLinkVolt2 (For example, 120[V] 0 1 2 0 display)→'K' 'A' '' ''→DC Link Volt1 …

► Discharge is complete, the power of the Inverter PCB is being blocked, communication function is blocked, E206 will occur.
► If want operation again after complete discharge mode : Restart after K3 key to Reset or Power Reset.

■ Forced defrost operation

► Forced defrost operation : Is operation when Frost Formation occurs in the outdoor. (When carried out the service)

Method of Entry	K2 Tact Switch 7 times
Start pattern	Heating Trial Operation pattern
Defrost start	Defrost start : It is after 10 minutes which Safety Start finishes.
Defrost off	General defrost operation conditions are the same as.
Etc.	Defrost shut down and stop the normal pattern of the outdoor unit stop.

■ Forced oil recovery operation

► Forced oil recovery operation : Oil recovery in the outdoor unit for the purpose of moving, installation if necessary.

Method of Entry	K2 Tact Switch 8 times
Start pattern	Outdoor temperature is more than 10°C : Cooling Auto Trial Operation Outdoor temperature is less than or equal to 10°C : Heating Auto Trial Operation
Oil recovery start	Oil recovery start : It is after 10 minutes which Safety Start finishes.
Etc.	Oil recovery shut down and stop the normal pattern of the outdoor unit stop.

■ AM080/100/120/200FXWA✳✳

► Key input of the outdoor unit when the service enters the operation mode.

K1 (Number of press)	Key operation	Display on segment
Press and hold 1 time	Auto trial operation	K, 1, BLANK, BLANK
1 time	Refrigerant charging in Heating mode	K, 1, BLANK, BLANK
2 times	Trial operation in Heating mode	K, 2, BLANK, BLANK
3 times	Pump out in Heating mode (Outdoor unit address 1)	K, 3, BLANK, 1
4 times	Pump out in Heating mode (Outdoor unit address 2)	K, 3, BLANK, 2
5 times	Pump out in Heating mode (Outdoor unit address 3)	K, 3, BLANK, 3
6 times	Pump out in Heating mode (Outdoor unit address 4)	K, 3, BLANK, 4
7 times	Vacuumig (Outdoor unit address 1)	K, 4, BLANK, 1
8 times	Vacuumig (Outdoor unit address 2)	K, 4, BLANK, 2
9 times	Vacuumig (Outdoor unit address 3)	K, 4, BLANK, 3
10 times	Vacuumig (Outdoor unit address 4)	K, 4, BLANK, 4
11 times	Vacuuming (All outdoor units)	K, 4, BLANK, A
12 times	End Key operation	-

K2 (Number of press)	Key operation	Display on segment
1 time	Refrigerant charging in Cooling mode	K, 5, BLANK, BLANK
2 times	Trial operation in Cooling mode	K, 6, BLANK, BLANK
3 times	Pump down all units in Cooling mode	K, 7, BLANK, BLANK
4 times	HR: Pipe connection inspection H/P: Auto trial operation	K, 8, BLANK, BLANK
5 times	Checking the amount of refrigerant	K, 9, X , X (Display of last two digits may differ depending on the status)
6 times	Discharge mode of DC link voltage	K, A, BLANK, BLANK
7 times	Forced oil collection	K, C, BLANK, BLANK
8 times	Inspect inverter compressor 1	K, D, BLANK, BLANK
9 times	Inspect inverter compressor 2	K, E, BLANK, BLANK
10 times	Water pipe valve/Pump check	K, F, BLANK, BLANK
11 times	Cooling fan/Flow control valve check	K, G, BLANK, BLANK
12 times	End key operation	-

※ During "Discharge mode of DC link voltage", voltage of INV1 and INV2 will be displayed alternately.

※ Even when the outdoor unit power is off, it is dangerous when you come in contact with inverter PCB and fan PCB since they are charged with high DC voltage.

※ When there were error, 'Dicharge mode of DC link voltage' may not have been effective. Especialy if error E464 and E364 have been occured, power element might be damaged by fire and therefore, do not use the 'Discharge mode of DC link

K3 (Number of press)	Key operation	Display on segment
1 time	Intialize (Reset) setting	Same as initial state

■ Auto Trial Operation

► After initial installation, stable operation for a certain period of time limited to operation conditions.

	Cooling	Heating
Method of Entry	K2 Tact Switch twice	K1 Tact Switch twice
Compressor	Normal operation, but the maximum frequency limit (differ by model)	
Indoor Unit	Whole operation (The set temperature=3˚C)	Whole operation (The set temperature=40˚C)
Other Actuators	Normally control conduct	
Operation time	Min : 60 minutes, Max : 10 hours	
Etc.	· Exceed the maximum operating time at stops and waits. · Protection and control, self-diagnosis is performed.	

■ Refrigerant filling operation

► Operation to filling the refrigerant compressor was fixed at a certain frequency.

	Cooling	Heating
Method of Entry	K2 Tact Switch one time	K1 Tact Switch one time
Compressor	Starting frequency (Mild Start frequency) operation	
Indoor Unit	Whole operation (The set temperature=3˚C)	Whole operation (The set temperature=40˚C)
Other Actuators	Normally control conduct	
Operation time	60 minutes	
Etc.	During the filling operation does not enter the special operation, such as oil recovery.	

■ Heating Pump Out

► Operation for the repair of the Individual outdoor unit, the outdoor unit refrigerant emissions to the indoor part.
► Liquid pipe service valve and the gas pipe service valve operation, the operator manually need to close.

► Observe low pressure using View Mode of K4 button if compressor operate.
If low pressure goes down below about 0.2 MPa.g : Immediately lock the gas side service valve, Pump Out operation is shut down.
(Pump out operation shut down : K1 button once more press or K3 button one time press)
► If operation of low pressure goes down below 0.1 MPa.g : Will be stopped automatically for the protection of the compressor.

How to Initiate	K1 Tact Switch 3 times~6 times
Compressor	60Hz
Indoor Unit	Whole Operation (The set temperature=40℃)
4Way Valve	ON (Heating Mode)
Main EEV	Operation side : 700 Step (Stop side : 0 step)
Maximum Operation Time	10 minutes
Protection Control	Conduct the discharge temperature, high pressure control. (Low pressure protection control is not carried out) ※ Low pressure is outside normal limits : Operation is shut down after gas pipe manually closed.
Etc.	Entry after safety start. (Only the corresponding Outdoor Unit operation.) To pump out more than 2 : Except communication between Outdoor Unit of relevant set after working for one, remainder set makes Pump Out add.

■ Cooling Pump Down

► Recover the refrigerant of Indoor Unit and Piping to outdoor side.
► Liquid pipe service valve and the gas pipe service valve operation, the operator manually need to close.
► If the installation of the long pipe : Any refrigerant into the outdoor unit can not be recovered, therefore should use a separate container.
► Observe low pressure using View Mode of K4 button if compressor operate.
If low pressure goes down below about 0.2 MPa.g : Immediately lock the gas side service valve, Pump Out operation is shut down.
(Pump out operation shut down : K1 button once more press or K3 button one time press)
► If operation of low pressure goes down below 0.1 MPa.g : Will be stopped automatically for the protection of the compressor.

How to Initiate	K2 Tact Switch 3 times
Compressor	Address No.1 Outdoor Unit - 60Hz (Other Outdoor Unit COMP OFF)
Indoor Unit	Whole Operation (The set temperature=3℃)
4Way Valve	OFF (Cooling Mode)
Main EEV	Operation side : 2000 Step , Stop side : 2000 step
Maximum Operation Time	30 minutes
Etc.	Does not conduct the operation of the special operation, and protection control. Pressure and temperature is outside normal limits : Operation is shut down after gas pipe manually closed. (However, all current limit control, and protection and control of IPM CompDown control is performed.)

■ Vacuum Operation

► Operation to facilitate vacuum to open the valve after the Outdoor Unit repair.

How to Initiate	K1 Tact Switch 7 times~11 times
Compressor	OFF
Indoor unit	OFF
4Way Valve	OFF
Valves	Open all valves maximum
Etc.	If not turn off the vacuum mode, the start of normal operation is prohibited.

■ Piping Inspection Operation

► Operation mode to check the status of the piping between the MCU and the indoor unit.

► Heat Pump Model : Water temperature is more than 25℃ / Cooling Auto Trial Operation start
Water temperature is less than 25℃ / Heating Auto Trial Operation start

■ Discharge Mode Operation

► Outdoor power is turned off, the Inverter PCB charging a high DC voltage, so dangerous to touch.
- To replace the PCB, first turn off the power and the begin if DC voltage is discharged.
- If not use the discharge mode, the discharge time of about 15 minutes takes.
- If an error occurs, the discharge mode may not properly run. (Wait until natural discharge.)
- In particular, E 464, E364, power devices may be damaged, therefore do not use the discharge mode.
(Natural discharge until Please wait for at least 15 minutes.)

► Block the Inverter PCB 3-phase relay after connected the power, and through compressor, DC voltage is discharging.
- INV1 and INV2 DC voltage during discharge mode are displayed alternately.
- Discharge mode Display (Rotate the three page display, as shown below.)
'K' 'A' '' ''→DC Link Volt1 (For example, 120[V] 0 1 2 0 display)
→DCLinkVolt2 (For example, 120[V] 0 1 2 0 display)→'K' 'A' '' ''→DC Link Volt1 …

► Discharge is complete, the power of the Inverter PCB is being blocked, communication function is blocked, E206 will occur.
► If want operation again after complete discharge mode : Restart after K3 key to Reset or Power Reset.

■ Forced oil recovery operation

► Forced oil recovery operation : Oil recovery in the outdoor unit for the purpose of moving, installation if necessary.

Method of Entry	K2 Tact Switch 7 times
Start pattern	Water temperature is more than 10℃ : Cooling Auto Trial Operation Water temperature is less than or equal to 10℃ : Heating Auto Trial Operation
Oil recovery start	Oil recovery start : It is after 10 minutes which Safety Start finishes.
Etc.	Oil recovery shut down and stop the normal pattern of the outdoor unit stop.

4-2-2 DVM S Models EEPROM Code Table

No.	Model Name	Inverter PBA	EEP Code	No.	Model Name	Inverter PBA	EEP Code
1	AM080FXVAGH/EU	DB92-03526B	DB82-01358A	50	AM140JXVAGH/EU	DB92-03339A	DB82-02503A
2	AM100FXVAGH/EU	DB92-03526A	DB82-01359A	51	AM160JXVAGH/EU	DB92-03339A	DB82-02504A
3	AM120FXVAGH/EU	DB92-03526A	DB82-01360A	52	AM180JXVAGH/EU	DB92-03339A	DB82-02505A
4	AM140FXVAGH/EU	DB92-03526A	DB82-01361A	53	AM200JXVAGH/EU	DB92-03339A	DB82-02506A
5	AM160FXVAGH/EU	DB92-03526B	DB82-01362A	54	AM220JXVAGH/EU	DB92-03339A	DB82-02507A
6	AM180FXVAGH/EU	DB92-03526A	DB82-01363A	55	AM080JXVANH/TL	DB92-03526B	DB82-02500A
7	AM200FXVAGH/EU	DB92-03526A	DB82-01364A	56	AM100JXVANH/TL	DB92-03526A	DB82-02501A
8	AM220FXVAGH/EU	DB92-03526A	DB82-01365A	57	AM120JXVANH/TL	DB92-03526A	DB82-02858A
9	AM080FXVAGR/EU	DB92-03526B	DB82-01330A	58	AM140JXVANH/TL	DB92-03339A	DB82-02503A
10	AM100FXVAGR/EU	DB92-03526A	DB82-01331A	59	AM160JXVANH/TL	DB92-03339A	DB82-02504A
11	AM120FXVAGR/EU	DB92-03526A	DB82-01332A	60	AM180JXVANH/TL	DB92-03339A	DB82-02505A
12	AM140FXVAGR/EU	DB92-03526A	DB82-01333A	61	AM200JXVANH/TL	DB92-03339A	DB82-02506A
13	AM160FXVAGR/EU	DB92-03526B	DB82-01334A	62	AM220JXVANH/TL	DB92-03339A	DB82-02507A
14	AM180FXVAGR/EU	DB92-03526A	DB82-01335A	63	AM080JXVAFH/AZ	DB92-03526C	DB82-02508A
15	AM200FXVAGR/EU	DB92-03526A	DB82-01336A	64	AM100JXVAFH/AZ	DB92-03337B	DB82-02509A
16	AM220FXVAGR/EU	DB92-03526A	DB82-01337A	65	AM120JXVAFH/AZ	DB92-03337B	DB82-02510A
17	AM080FXWANR/EU	DB92-03526A	DB82-01678A	66	AM140JXVAFH/AZ	DB92-03526C	DB82-02511A
18	AM100FXWANR/EU	DB92-03526A	DB82-01679A	67	AM160JXVAFH/AZ	DB92-03526C	DB82-02512A
19	AM120FXWANR/EU	DB92-03526A	DB82-01680A	68	AM180JXVAFH/AZ	DB92-03337B	DB82-02513A
20	AM200FXWANR/EU	DB92-03526A	DB82-01681A	69	AM200JXVAFH/AZ	DB92-03337B	DB82-02514A
21	AM080FXWAGR/SC	DB92-03526A	DB82-01682A	70	AM080JXVAJH/AZ	DB92-03526B	DB82-02515A
22	AM100FXWAGR/SC	DB92-03526A	DB82-01683A	71	AM100JXVAJH/AZ	DB92-03526A	DB82-02516A
23	AM120FXWAGR/SC	DB92-03526A	DB82-01684A	72	AM120JXVAJH/AZ	DB92-03526A	DB82-02517A
24	AM200FXWAGR/SC	DB92-03526A	DB82-01685A	73	AM140JXVAJH/AZ	DB92-03526B	DB82-02518A
25	AM240HXVAGH/EU	DB92-03337A	DB82-02333A	74	AM160JXVAJH/AZ	DB92-03526B	DB82-02519A
26	AM260HXVAGH/EU	DB92-03337A	DB82-02334A	75	AM180JXVAJH/AZ	DB92-03526A	DB82-02520A
27	AM080JXVHGH/EU	DB92-03526B	DB82-02484A	76	AM200JXVAJH/AZ	DB92-03526A	DB82-02521A
28	AM100JXVHGH/EU	DB92-03526A	DB82-02485A	77	AM220JXVAJH/AZ	DB92-03526A	DB82-02522A
29	AM120JXVHGH/EU	DB92-03526A	DB82-02486A	78	AM140KXVGGH	DB92-03339A	DB82-02981A
30	AM140JXVHGH/EU	DB92-03526A	DB82-02487A	79	AM160KXVGGH	DB92-03339A	DB82-02982A
31	AM160JXVHGH/EU	DB92-03526B	DB82-02488A	80	AM180KXVGGH	DB92-03339A	DB82-02983A
32	AM180JXVHGH/EU	DB92-03526A	DB82-02489A	81	AM200KXVGGH	DB92-03339A	DB82-02984A
33	AM200JXVHGH/EU	DB92-03526A	DB82-02490A	82	AM220KXVGGH	DB92-03339A	DB82-02985A
34	AM220JXVHGH/EU	DB92-03526A	DB82-02491A	83	AM240KXVGGH	DB92-03339A	DB82-02986A
35	AM080JXVHGR/EU	DB92-03526B	DB82-02492A	84	AM260KXVGGH	DB92-03339A	DB82-02987A
36	AM100JXVHGR/EU	DB92-03526A	DB82-02493A	85	AM280KXVGGH	DB92-03339A	DB82-02988A
37	AM200JXVHGH/EU	DB92-03526A	DB82-02490A	86	AM080KXVSGH	DB92-03339A	DB82-02989A
38	AM220JXVHGH/EU	DB92-03526A	DB82-02491A	87	AM140KXVAGH	DB92-03339A	DB82-02990A
39	AM080JXVHGR/EU	DB92-03526B	DB82-02492A	88	AM160KXVAGH	DB92-03339A	DB82-02991A
40	AM100JXVHGR/EU	DB92-03526A	DB82-02493A	89	AM180KXVAGH	DB92-03339A	DB82-02992A
41	AM120JXVHGR/EU	DB92-03526A	DB82-02494A	90	AM200KXVAGH	DB92-03339A	DB82-02993A
42	AM140JXVHGR/EU	DB92-03526A	DB82-02495A	91	AM220KXVAGH	DB92-03339A	DB82-02994A
43	AM160JXVHGR/EU	DB92-03526B	DB82-02496A	92	AM240KXVA✳H	DB92-03339A	DB82-02995A
44	AM180JXVHGR/EU	DB92-03526A	DB82-02497A	93	AM260KXVA✳H	DB92-03339A	DB82-02996A
45	AM200JXVHGR/EU	DB92-03526A	DB82-02498A	94	AM280KXVA✳H	DB92-03339A	DB82-02997A
46	AM220JXVHGR/EU	DB92-03526A	DB82-02499A	95	AM300KXVA✳H	DB92-03339A	DB82-02998A
47	AM080JXVAGH/EU	DB92-03526B	DB82-02500A	96	AM220KXVJNH/ID	DB92-03339A	DB82-03421A
48	AM100JXVAGH/EU	DB92-03526A	DB82-02501A	97	AM240KXVJNH/ID	DB92-03339A	DB82-03422A
49	AM120JXVAGH/EU	DB92-03526A	DB82-02502A				

4-2-3 Number Display Method (Outdoor Unit, MCU, Cable remote control, wall-mount, etc.)

■ How to Display Integrated Error Code

► Meanings of First Alphabetical Character / Number of Error Code

Displayed alphabet	Explanation	
E	When displaying Error 101~700	
P	When displaying Error 701~800	
C	When E206 occurs	Displays address of subordinate within the set C001 : HUB, C002: FAN, C003: INV1, C004: INV2
	When MCU error occurs	Displays address of MCU Ex) C100: MCU address 0, C101: MCU address 1, C102: MCU address 2
P	When displaying outdoor unit address Ex) U200~203 main, Sub 1, 2, 3	
U	When displaying indoor unit address Ex) A000: Indoor unit adress 0, A001: Indoor unit address 1, A002: Indoor unit address 2	

► Order of Error Display

Classification	Error display method	Display Example
Display method for error that occurred in indoor unit	Error Number → Indoor unit address → Error Number, repeat display	E471 → A002 → E471 → A002
Display method for error that occurred in outdoor unit and other methods of error display	Error Number → Outdoor unit address → Error Number, repeat display	E471 → U200 → E471 → U200 E206 → C001 → E206 → C002

■ Diagnosis and Adjustment (Error Code)

► Error code related indoor unit

CODE	Explanation
E-101	Indoor unit communication error. Indoor unit can not receive any data from outdoor unit.
E-102	Communication error between indoor unit and outdoor unit. Displayed in indoor unit.
E-108	Error due to repeated address setting (When 2 or more devices have same address within the network)
E-109	Incomplete communication error of indoor unit address
E-121	Error on indoor temperature sensor of indoor unit (Short or Open)
E-122	Error on EVA IN sensor of indoor unit (Short or Open)
E-123	Error on EVA OUT sensor of indoor unit (Short or Open)
E-128	EVA IN temperature sensor of indoor unit is detached from EVA IN pipe
E-129	EVA OUT temperature sensor of indoor unit is detached from EVA OUT pipe
E-130	Heat exchanger in/out sensors of indoor unit are detached
E-135	RPM feedback error of indoor unit's cleaning fan
E-149	Error due to AHU master indoor unit sensor setting.
E-151	Error due to opened EEV of indoor unit (2nd detection)
E-152	Error due to closed EEV of indoor unit (2nd detection)
E-153	Error on floating switch of indoor unit (2nd detection)
E-154	RPM feedback error of indoor unit
E-161	Mixed operation mode error of indoor unit; When outdoor unit is getting ready to operate in cooling (or heating) and some of the indoor unit is trying to operate in heating (or cooling) mode
E-162	EEPROM error of MICOM (Physical problem of parts/circuit)
E-163	Indoor unit's remote controller option input is Incorrect or missing. Outdo or unit EEPROM data error
E-180	Simultaneous opening of cooling/heating MCU SOL V/V (1st detection)
E-181	Simultaneous opening of cooling/heating MCU SOL V/V (2nd detection)
E-185	Cross wiring error between communication and power cable of indoor unit
E-186	Connection error or problem on SPi
E-190	No temperature changes in EVA IN during pipe inspection or changes in temperature is seen in indoor unit with wrong address
E-191	No temperature changes in EVA OUT during pipe inspection or changes in temperature is seen in indoor unit with wrong address
E-198	Error due to disconnected thermal fuse of indoor unit

■ Diagnosis and Adjustment (Error Code)

► Error code related to the Communications / Settings / HW (cont.)

Error mode	Cause
E-201	Communication error between indoor and outdoor units (installation number setting error, repeated indoor unit address, indoor unit communication cable error)
E-202	Communication error between indoor and outdoor units (Communication error on all indoor unit, outdoor unit communication cable error)
E-203	Communication error between main and sub outdoor units
E-205	Communication error on all PBA within the outdoor unit C-Box, communication cable error
E-206	E206-C001: HUB PBA communication error / E206-C002: FAN PBA communication error E206-C003: INV1 PBA communication error / E206-C004: INV2 PBA communication error E206-C005 : Water Hub PBA communication error
E-211	When single indoor unit uses 2 MCU ports that are not in series.
E-212	If the rotary switch (on the MCU) for address setting of the indoor unit has 3 or more of the same address
E-213	When total number of indoor units assigned to MCU is same as actual number of installed indoor units but there is indoor unit that is not installed even though it is assigned on MCU
E-214	When number of MCU is not set correctly on the outdoor unit or when two or more MCU was installed some of them have the same address
E-215	When two different MCU's have same address value on the rotary switch
E-216	When indoor unit is not installed to a MCU port but the switch on the port is set to On.
E-217	hen indoor unit is connected to a MCU port but indoor unit is assigned to a MCU and the switch on the port is set to Off
E-218	When there's at least one or more actual number of indoor unit connection compared to number of indoor units assigned to MCU
E-219	Error on temperature sensor located on MCU intercooler inlet (Short or Open)
E-220	Error on temperature sensor located on MCU intercooler outlet (Short or Open)
E-221	Error on outdoor temperature sensor of outdoor unit (Short or open)
E-224	Error on water temperature sensor of main outdoor unit (Short or Open)
E-225	Error on control box temperature sensor of main outdoor unit (Short or Open)
E-231	Error on COND OUT temperature sensor of main outdoor unit (Short or Open)
E-241	COND OUT sensor is detached
E-251	Error on discharge temperature sensor of compressor 1 (Short or Open)
E-257	Error on discharge temperature sensor of compressor 2 (Short or Open)
E-262	Discharge temperature sensor of compressor 1 is detached from the sensor holder on the pipe
E-263	Discharge temperature sensor of compressor 2 is detached from the sensor holder on the pipe
E-266	Top sensor of compressor 1 is detached
E-267	Top sensor of compressor 2 is detached
E-269	Suction temperature sensor is detached from the sensor holder on the pipe
E-276	Error on top sensor of compressor 1 (Short or Open)
E-277	Error on top sensor of compressor 2 (Short or Open)
E-291	Refrigerant leakage or error on high pressure sensor (Short or Open)
E-296	Refrigerant leakage or error on low pressure sensor (Short or Open)
E-308	Error on suction temperature sensor (Short or Open)
E-311	Error on temperature sensor of double layer pipe/liquid pipe(sub heat exchanger) (Short or Open)
E-321	Error on EVI (ESC) IN temperature sensor (Short or Open)
E-322	Error on EVI (ESC) OUT temperature sensor (Short or Open)
E-323	Error on suction sensor 2 (Short or Open)

■ Diagnosis and Adjustment (Error Code)

► Error code related to the Communications / Settings / HW (cont.)

Error mode	Cause
E-346	Error due to operation failure of Fan2
E-347	Motor wire of Fan2 is not connected
E-348	Lock error on Fan2 of outdoor unit
E-353	Error due to overheated motor of outdoor unit's Fan2
E-355	Error due to overheated IPM of Fan2
E-361	Error due to operation failure of inverter compressor 2
E-364	Error due to over-current of inverter compressor 2
E-365	V-limit error of inverter compressor 2
E-366	Error due to over voltage /low voltage of inverter PBA2
E-367	Error due to unconnected wire of compressor 2
E-368	Output current sensor error of inverter PBA2
E-369	DC voltage sensor error of inverter PBA2
E-371	Error due to the INV2 Data Flash
E-374	Heat sink temperature sensor error of inverter PBA2
E-378	Error due to overcurrent of Fan2
E-383	Error due to over current of Fan2
E-385	Error due to input current of inverter 2
E-386	Over-voltage/low-voltage error of Fan2
E-387	Hall IC connection error of Fan2
E-389	V-limit error on Fan2 of compressor
E-391	Error due to the Fan2 DataFlash
E-393	Output current sensor error of Fan2
E-396	DC voltage sensor error of Fan2
E-399	Heat sink temperature sensor error of Fan2
E-400	Error due to overheat caused by contact failure on IPM of Inverter PBA2
E-407	Compressor operation stop due to high pressure protection control
E-410	Compressor operation stop due to low pressure protection control or refrigerant leakage
E-416	Compressor operation stop due to discharge temperature protection control
E-425	Phase reversal or phase failure (3Ø outdoor unit wiring, R-S-T-N), connection error on 3 phase input
E-428	Compressor operation stop due abnormal compression ratio
E-435	Flow Switch Error
E-436	Error on the Heat exchanger frost protection
E-438	EVI (ESC) EEV leakage or internal leakage of intercooler or incorrect connector insertion of EVI (ESC) EEV
E-439	Error due to refrigerant leakage
E-440	Heating mode restriction due to high air temperature In case of DVM water, Heating mode restriction due to high water temperature
E-441	Cooling mode restriction due to low air temperature In case of DVM water, Heating mode restriction due to low water temperature
E-442	Refrigerant charing restriction in heating mode when air temperature is over 15 °C
E-443	Operation prohibited due to low pressure
E-445	CCH is deatched

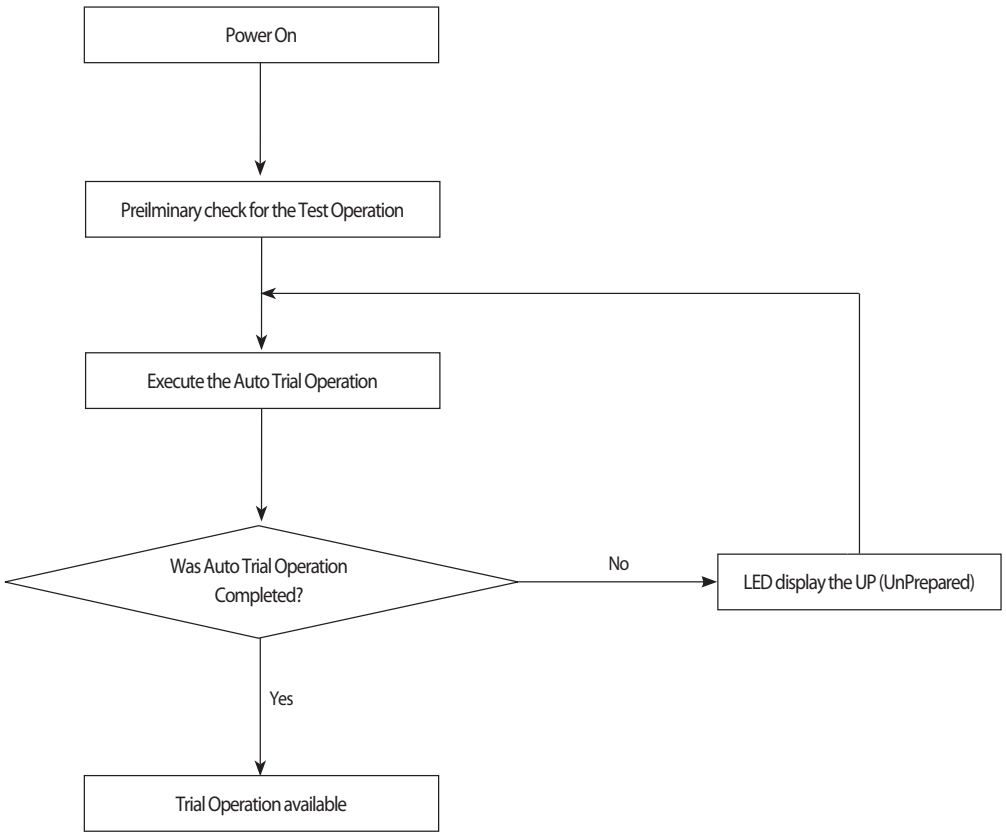
■ Diagnosis and Adjustment (Error Code)

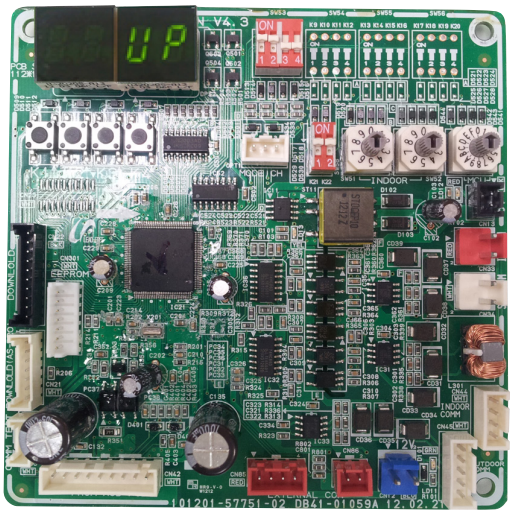
► Error code related to the Communications / Settings / HW (cont.)

Error mode	Cause
E-446	Error due to operation failure of Fan1
E-447	Motor wire of Fan1 is not connected
E-448	Lock error on Fan1
E-452	Error due to ZPC detection circuit problem or power failure
E-453	Error due to overheated motor of outdoor unit's Fan1
E-454	Error due to the outdoor unit fan RPM
E-455	Error due to the over heat Fan1 IPM
E-457	Outdoor unit Reversed direction of the wind Error
E-461	Error due to operation failure of inverter compressor 1
E-462	Compressor stop due to full current control or error due to low current on CT2
E-464	Error due to over-current of inverter compressor 1
E-465	V-limit error of inverter compressor 1
E-466	Error due to over voltage /low voltage of inveter PBA1
E-467	Error due to unconnected wire of compressor 1
E-468	Output current sensor error of inverter PBA1
E-469	DC voltage sensor error of inver PBA1
E-471	Error due to the INV1 Data Flash
E-474	Heat sink temperature sensor error of inverter PBA1
E-478	Error due to overcurrent of Fan1
E-483	Error due to over current of Fan1
E-485	Error due to input current of inverter 1
E-486	Error due to over voltage/low voltage of Fan
E-487	Hall IC error of Fan1
E-489	V-limit error on Fan1 of compressor
E-491	Error due to the Fan1 DataFlash
E-493	Output current sensor error of Fan1
E-496	DC voltage sensor error of Fan1
E-499	Heat sink temperature sensor error of Fan1
E-500	Error due to overheat caused by contact failure on IPM of Inverter PBA1
E-503	Error due to alert the user to check if the service valve is closed
E-504	Error due to self diagnosis of compressor operation
E-505	Error due to self diagnosis of high pressure sensor
E-506	Error due to self diagnosis of low pressure sensor
E-515	Error due to the over heat Control Box
E-516	Error due to the no feedback from the Fan of the control Box
E-552	Comp down due to the low discharge pressure
E-560	Outdoor unit's option switch setting error (when iinappropriate option switch is on)
E-563	Error due to module installation of indoor unit with old version (Micom version needs to be checked)
E-573	Error due to using single type outdoor unit in a module installation
E-702	Error due to closed EEV of indoor unit (1st detection)
E-703	Error due to opened EEV of indoor unit (1st detection)
UP	Auto Trial Operation incompleted (UnPrepared)

4-3 Appropriate Measures for Different Symptom

4-3-1 Outdoor Unit Test Operation Flow





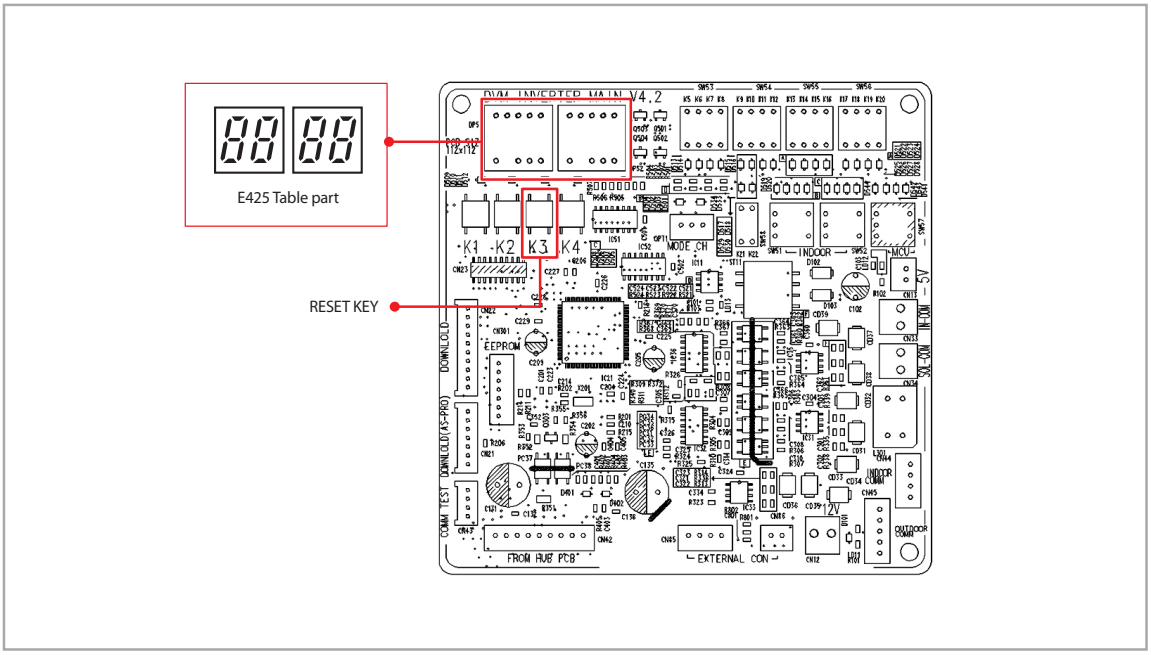
If the Auto Trial Operation is not completed - UP is displyed(UnPrepared)

Prior to starting the air conditioning operation after the initial installation and Auto Trial Operation is carried out. This process, the stable operation to protect the system and verify the defect of the product.

1. Tracking is complete and after the initial installation, if you do not have a history of Auto Trial Operation is completed, UP will be displayed.
2. Execute the Auto Trial Operation by Tact Switch.
3. UP display disappears after Auto Trial Operation is complete, normal operation is possible.
4. Auto Trial Operation is completed, if there is a history, normal operation execution.

■ Reversed Phase/No Phase Check (Outdoor Unit with 3 Phase power) – Display E425 for Problem

1. When the power is on, check the status of the power from the inverter.
   Three-phase L1(R)-L2(S)-L3(T) order, regardless of the power connection on the inverter does not phase power (no phase) can occur.
   In this case, E425 or E466 (E366) is displayed, and then air conditioner will then maintain normal conditions.
   However) N phase must be connected properly.



1) Check the voltage for L1 (R)-L2 (S) phase/L1 (R)-L3 (T) phase/L2 (S)-L3 (T) phase.
2) If there is any terminal without normal voltage, then check the power outside the air conditioner and take the appropriate measures.
3) If the 3-phase voltage is normal, then use the 3-phase tester to display the phase of the power cable.
   Change the power cable connection if reversed phase is displayed.
4) Take the above measures, press the reset key (K3), and then check the power once more.
5) Check the EMI PCB Fuse connection and wiring.
6) If the same problem occurs after another check, check the Inverter PCB.

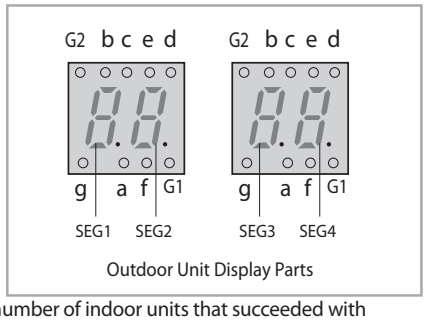
> **CAUTION**
> ● In case of wiring error (N-phase is changed with one of R, S and T) with the N-phase, will operate the power protection function, display E425 or stop the power. This is not a PCB power defect in this case, before PCB replacement, please check the power on.

■ Initial Tracking (Communication Check-up) - Display E201 for Problem

1. For the display module of the outdoor unit, there are differences in the contents displayed depending on whether the relevant outdoor unit is a master unit or a sub unit.
   1) Master Unit
   - The outdoor unit Micom attempts communication with the indoor unit connected to the communication cable (F1/F2) when the power is turned on.
   - Basic segment display

Step	Display content	Display			
At initial power input	Checking segment display	SEG1	SEG2	SEG3	SEG4
		"8"	"8"	"8"	"8"
While setting communication between indoor and outdoor unit (Addressing)	Number of connected indoor units	SEG1	SEG2	SEG3, 4	SEG3, 4
		"A"	"d"	Number of communicated units ※ Refer to "View Mode" for communication address	
After communication setting (usual occasion)	Transmit/ Reception address	SEG1	SEG2	SEG3, 4	SEG3, 4
		I/U : "A" MCU : "C"	I/U : "0" MCU : "1"	Reception address (in decimal number)	

※ I/U : Indoor unit

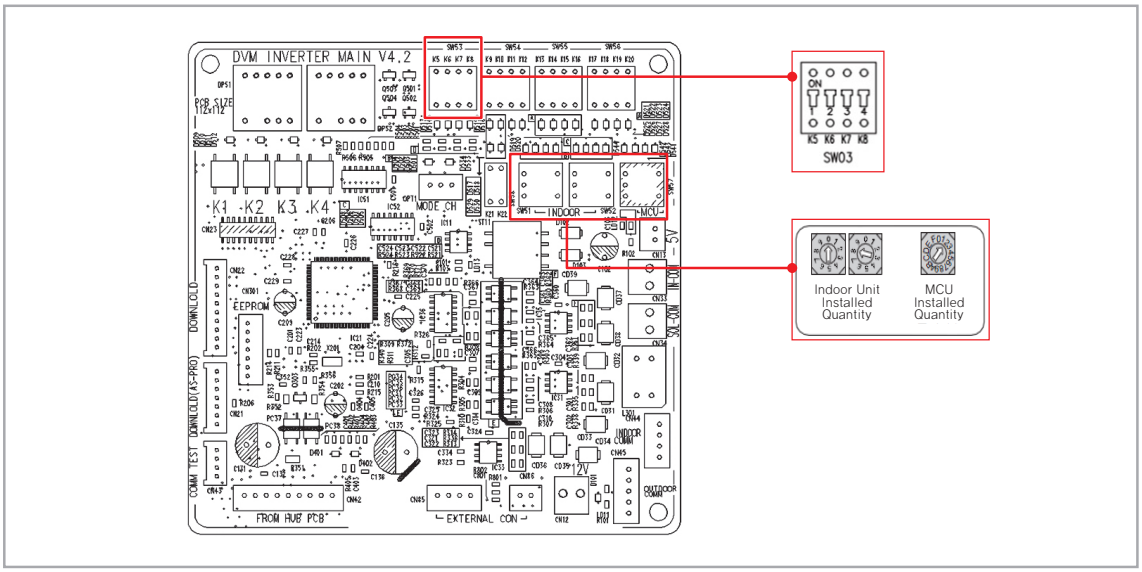


Outdoor Unit Display Parts

- If the number of indoor units set by the outdoor unit is not in accordance with the number of indoor units that succeeded with communication, then the four displaying parts will display E201.

   2) Sub(Slave) Unit
- The two left hand displays show its own address and the two right hand displays show the outdoor unit's address.
  Main address : C8, Sub1 address : C9, Sub2 address : CA, Sub3 address : CB

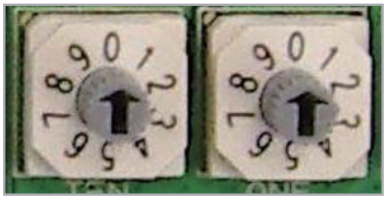
2. The number of the indoor Units Connected to the outdoor unit can be configured by using the indoor unit installation quantity setup switch.



■ Indoor Unit Installation Quantity Setup Switch

The following is an example of how to use the switch according to the number of indoor unit installations. The maximum number of possible indoor unit connections is 64.

3Units Connected		17Units Connected		31Units Connected		64Units Connected	
10's Digit	1's Digit	10's Digit	1's Digit	10's Digit	1's Digit	10's Digit	1's Digit
0	3	1	7	3	1	6	4

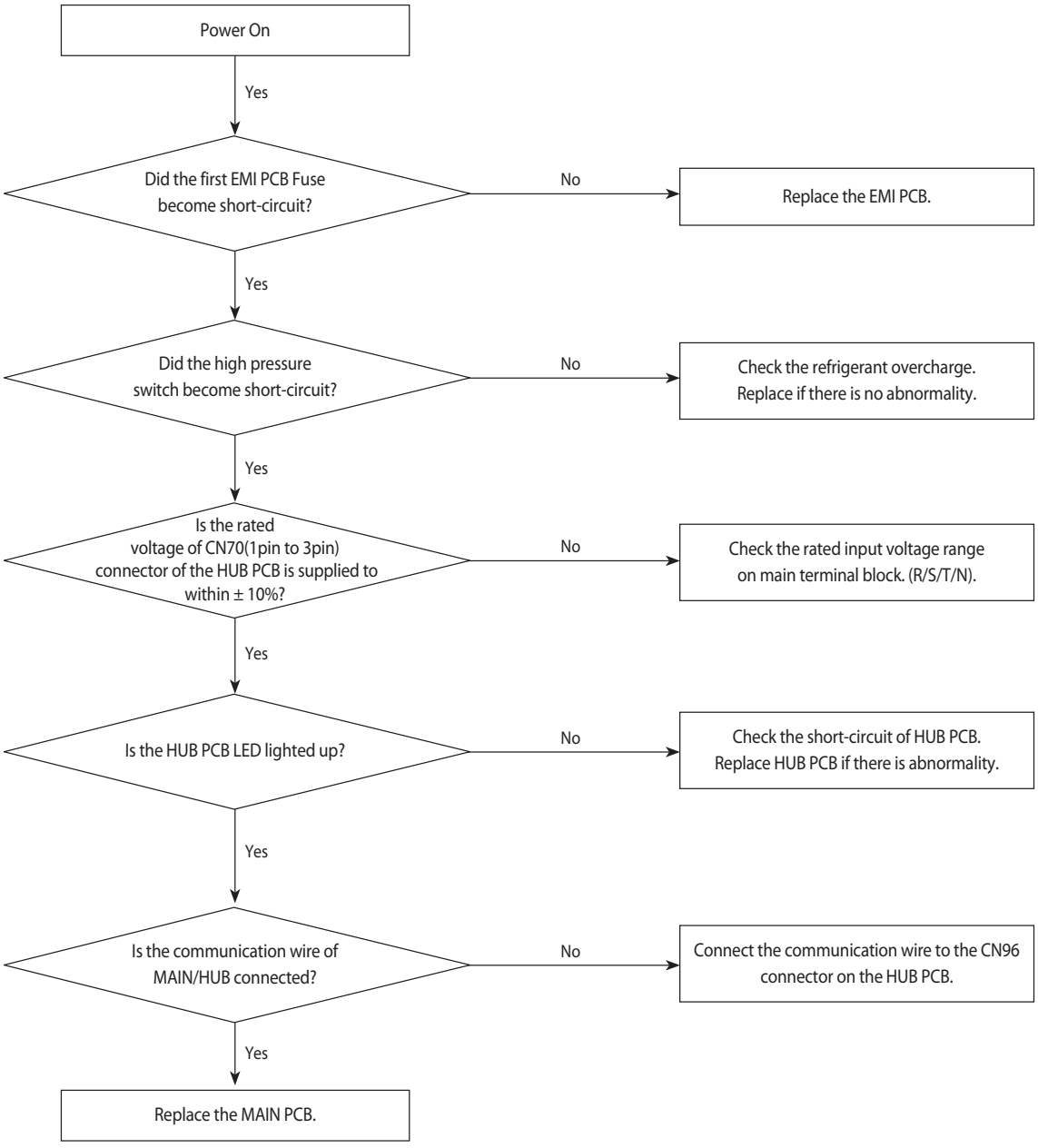

10's Digit (0~9) 1's Digit (0~9)

3. If the quantity of the indoor units configured with the indoor unit installation quantity setup switch does not match the quantity of the indoor units found during the tracking process, E201 and U200 will be displayed in order on the display module.
4. When you install more than one MCU, set the quantity of installed MCU.

4-3-2 Main PCB has no power phenomenon

Outdoor unit display	Main PCB has no power phenomenon (7-seg does not blink)
Judgment Method	Hub PCB power and connection wire to detect.
Connector check Method	CN96 on HUB PCB - 1pin to 4pin : DC 12V - 9pin to 4pin : DC 5V
Cause of problem	· HUB PCB connector wire defects and the connection is not. · Main PCB defective. · Hub PCB defective. · High pressure switch operation · Water hub PCB defective. CN96 on HUB PCB

1. Cause of problem



4-3-3 Communication Error between Indoor and Outdoor Units during Tracking

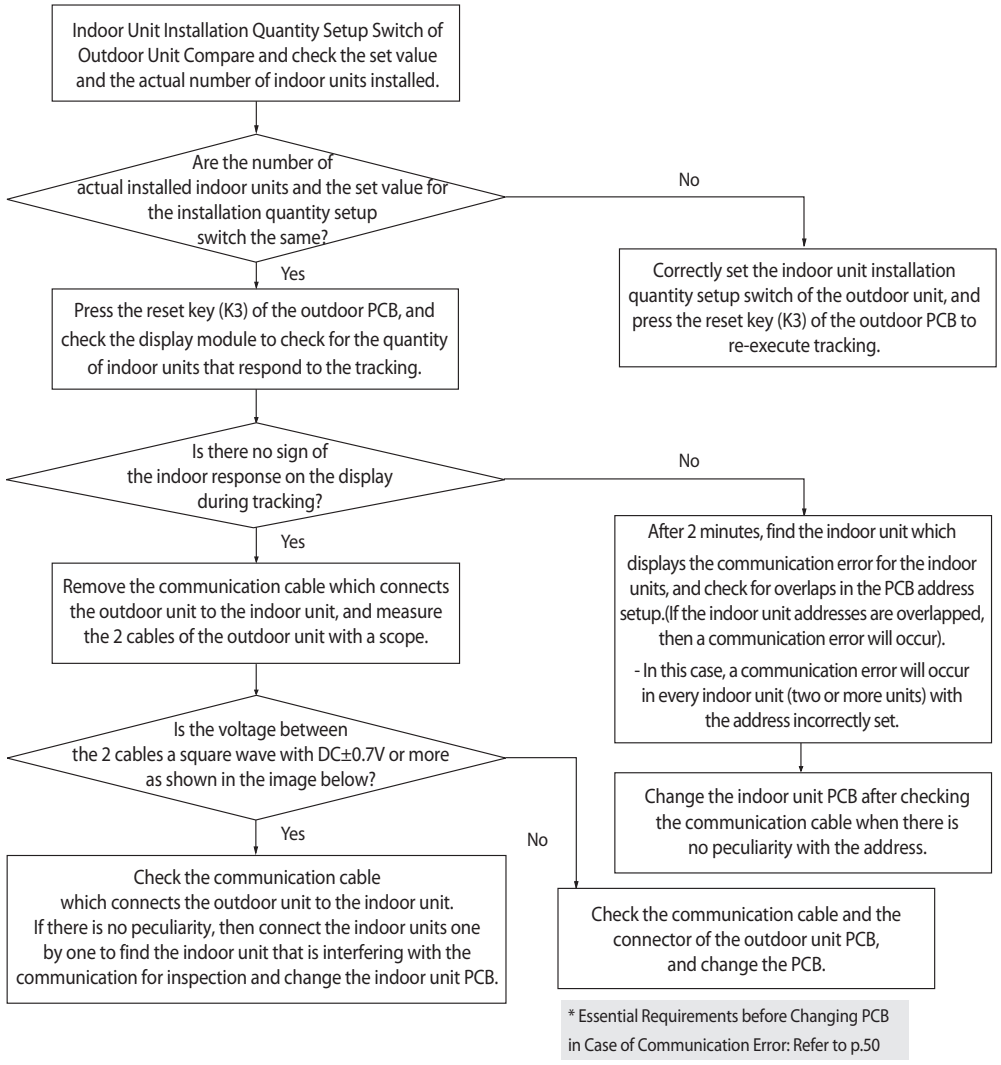
Outdoor unit display	E201
Indoorunit display	Duct, Cassette (1/2 Way),Console, Celing / Cassette (4/Mini4 Way) / Wall-mounted (NeoForte)

Duct, Cassette (1/2 Way),Console, Celing					Cassette (4/Mini4 Way)				Wall-mounted (NeoForte)				
Operation	Defrost	Timer	Fan	Filter/MPI	Operation	Defrost	Timer	Filter	Operation	Timer	Turbo	24℃	27℃
×	×	◑	◑	×	×	◑	◑	×	◑	◑	×	◑	×

※ ●: ON ◑: Flash ×: OFF

Judgment Method	· Communication error between indoor and outdoor units.
Cause of problem	· Refer to the judgment method below.

1. Cause of problem



※ Essential Requirements before PCB Changes in Case of Communication Error Occurrence

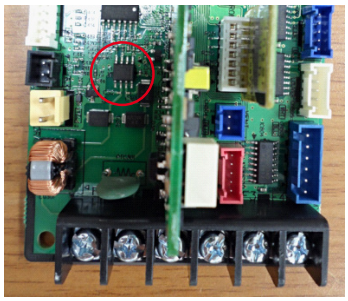
1. Find the communication IC near the communication terminal.

● Indoor Unit

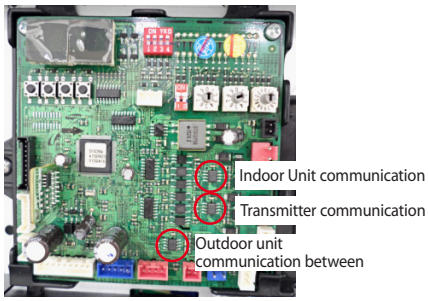
- Coil side or PTC (SMD) side : Communication IC between indoor and outdoor units.

● Outdoor Unit

- When there is module communication as in PLUS II and PLUS III –
  Above Red Connector of Main Unit : Communication IC between indoor and outdoor units.
- When there is no module communication as in PLUS II and PLUS III –
  Above Yellow Connector of Each Unit : Communication IC between outdoor units.
- Other Outdoor Unit- Above Communication Connector : Communication IC between indoor and outdoor unit.



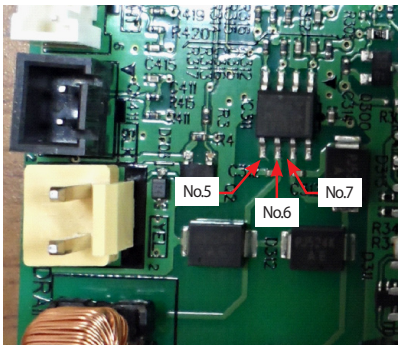
Indoor Unit



Outdoor Unit

2. Measure the resistance of the communication IC.

● Measurement Method : Measure the No.5 - No.6 Pin resistance
Measure the No.5 - No.7 Pin resistance



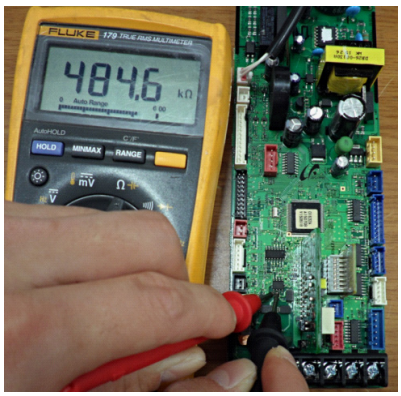
3. Defectiveness decision of the communication IC which uses a measurement resistance value.

● Judging as Normal

- Each resistance value should be measured in tens of kΩ~to hundreds of kΩ.
- Difference between the two resistance values should be of some number of kΩ.

● Judging as defective

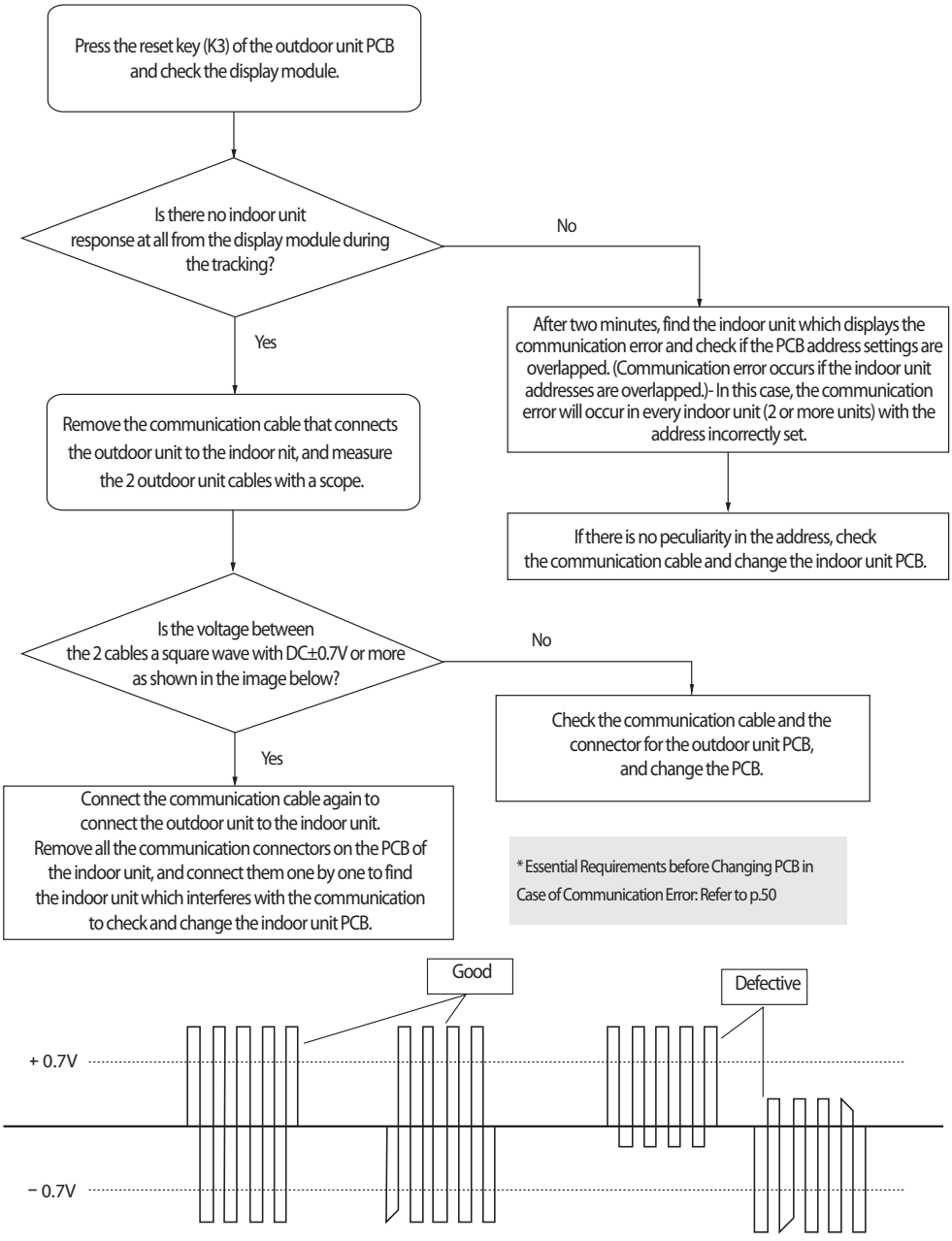
- One or both are low with tens of Ω
- One or both of them is open



4-3-4 Communication Error between Indoor and Outdoor Units after Tracking

Outdoor unit display	E202
Indoorunit display	Duct, Cassette (1/2 Way),Console, Celing: Operation × / Defrost × / Timer ◑ / Fan ◑ / Filter/MPI × Cassette (4/Mini4 Way): Operation × / Defrost ◑ / Timer ◑ / Filter × Wall-mounted (NeoForte): Operation ◑ / Timer ◑ / Turbo × / 24℃ ◑ / 27℃ × ※ ●: ON ◑: Flash ×: OFF
Judgment Method	· Outdoor unit is unable to communicate for two minutes during operation. (no reception of relocation)
Cause of problem	· Communication error between indoor and outdoor units and setup error of indoor unit installation quantity setup switch.

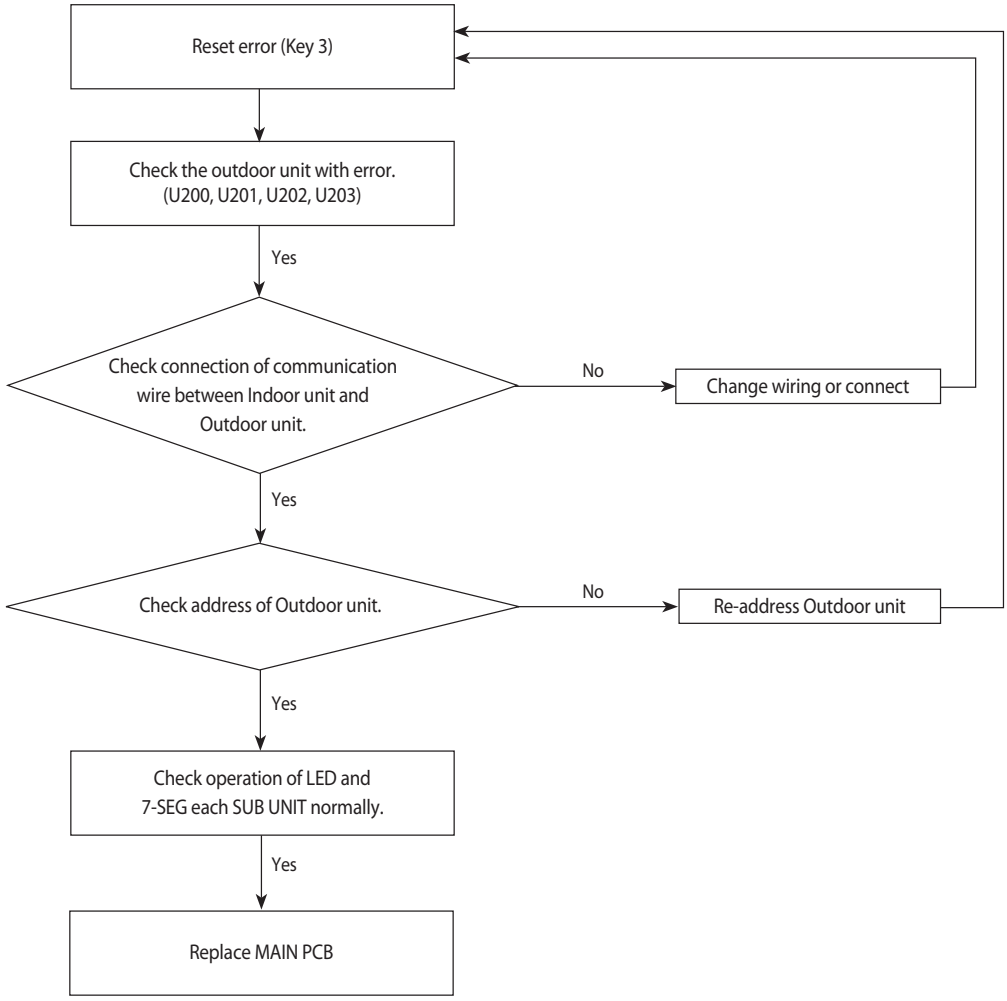
1. Cause of problem



4-3-5 Communication error between main and sub Unit of outdoor unit or between outdoor units

Outdoor unit display	E203
Indoorunit display	Duct, Cassette (1/2 Way),Console, Celing: Operation / Defrost / Timer / Fan / Filter/MPI; Cassette (4/Mini4 Way): Operation / Defrost / Timer / Filter; Wall-mounted (NeoForte): Operation / Timer / Turbo × × ◑ ◑ × × ◑ ◑ × × ◑ ◑ ※ ●: ON ◑: Flash ×: OFF
Judgment Method	· Refer to the judgment method below.
Cause of problem	· Communication error between outdoor units.

1. Cause of problem

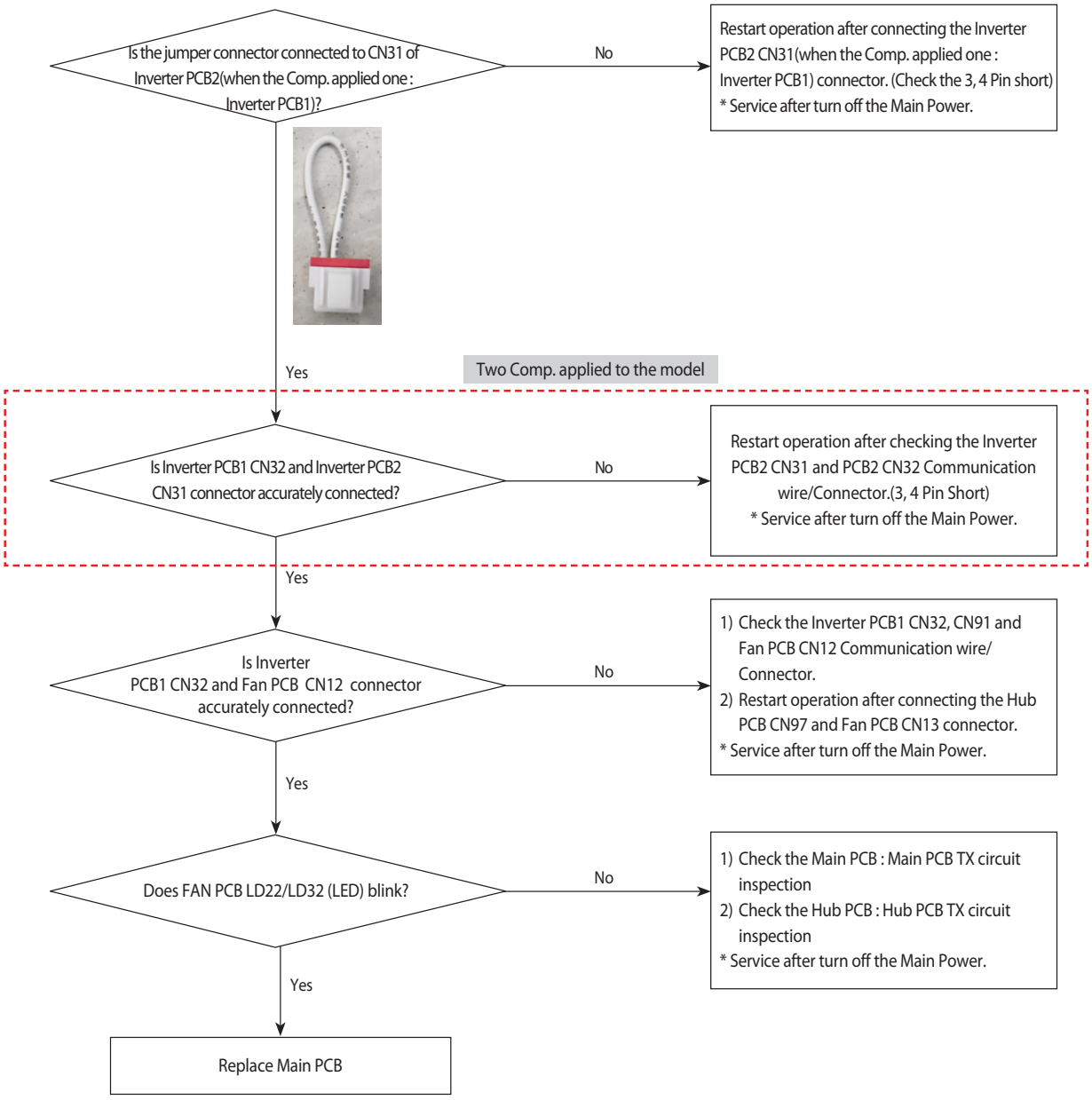


Essential Requirements before Changing PCB in Case of Communication Error: Refer to p.59

4-3-6 Internal Communication error of the Outdoor Unit C-Box

Outdoor unit display	E205 - All boards of outdoor unit are not communicating
Indoorunit display	Duct, Cassette (1/2 Way),Console, Celing: Operation × / Defrost × / Timer ◑ / Fan ◑ / Filter/MPI × Cassette (4/Mini4 Way): Operation × / Defrost ◑ / Timer ◑ / Filter × Wall-mounted (NeoForte): Operation × / Timer ◑ / Turbo ◑ ※ ●: ON ◑: Flash ×: OFF
Judgment Method	· Communication error between the C-Box PCB
Cause of problem	· Communication wire inside the C-Box is unconnected · Main PCB defective

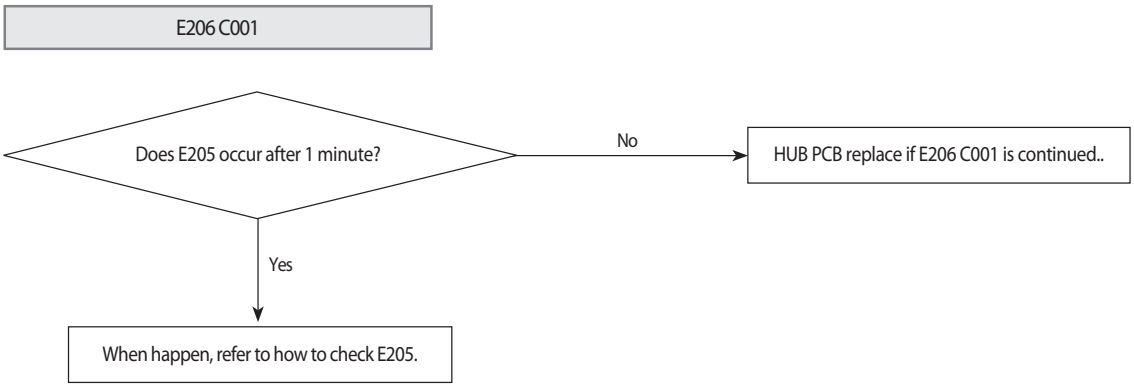
1. Cause of problem

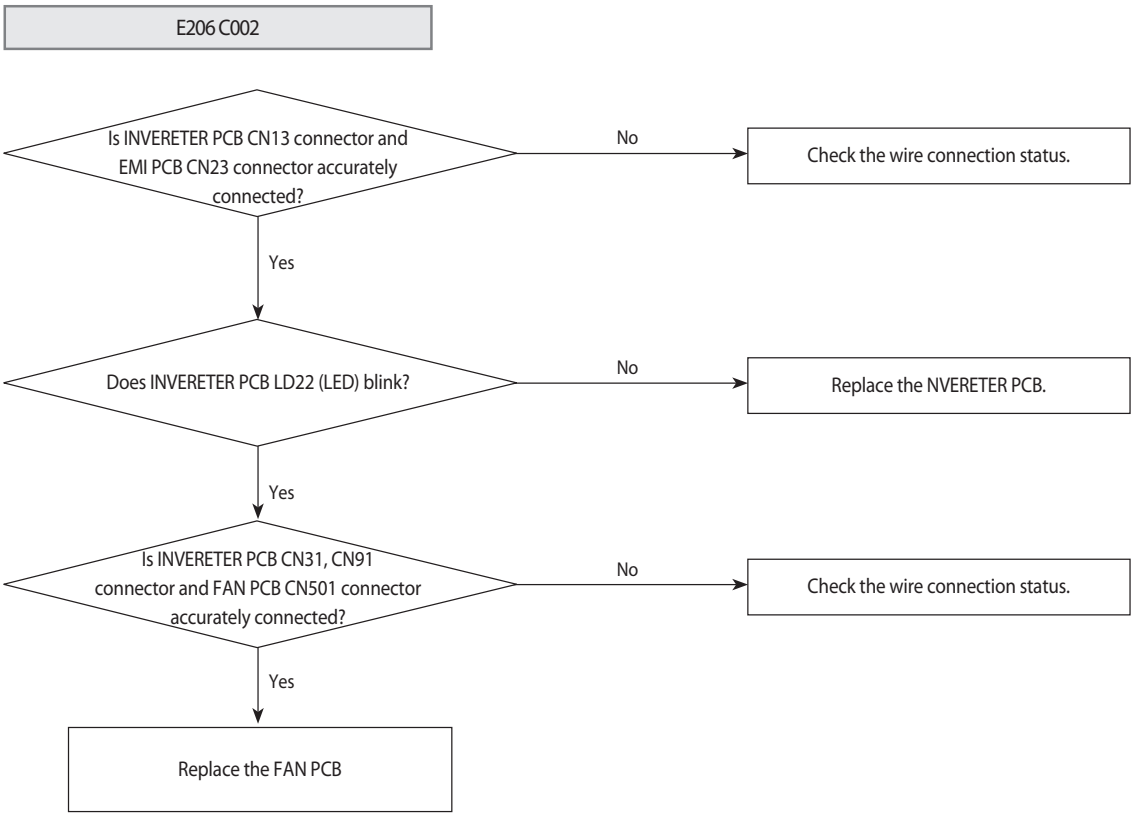


4-3-7 Internal PCB Communication error of the Outdoor Unit C-Box

Outdoor unit display	E206 (C001 ~ C004) - some boards of outdoor unit are not communicating
Indoorunit display	Duct, Cassette (1/2 Way),Console, Celing: Operation × / Defrost × / Timer ◑ / Fan ◑ / Filter/MPI × Cassette (4/Mini4 Way): Operation × / Defrost ◑ / Timer ◑ / Filter × Wall-mounted (NeoForte): Operation × / Timer ◑ / Turbo ◑ ※ ●: ON ◑: Flash ×: OFF
Judgment Method	· PCB does not respond to the invoked Main PCB
Cause of problem	· C-Box internal Inverter PCB, Fan PCB, Hub PCB defective

1. Cause of problem





Internal PCB Communication error of the Outdoor Unit C-Box (cont.)

E206 C003/C004

C003 : Replace the INVERTER PCB 1
C004 : Replace the INVERTER PCB 2

4-3-8 MCU branch part setup error – inconsecutive connection with the use of 2 branch parts

Outdoor unit display	E211
Indoorunit display	Duct, Cassette (1/2 Way),Console, Celing / Cassette (4/Mini4 Way) / Wall-mounted (NeoForte)

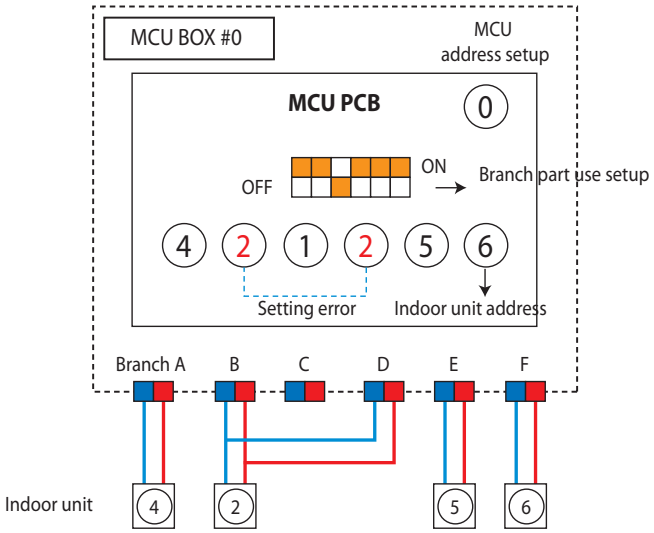
Duct, Cassette (1/2 Way),Console, Celing					Cassette (4/Mini4 Way)				Wall-mounted (NeoForte)				
Operation	Defrost	Timer	Fan	Filter/MPI	Operation	Defrost	Timer	Filter	Operation	Timer	Turbo	24℃	27℃
×	×	◑	◑	×	×	◑	◑	×	×	×	◑	◑	×

※ ●: ON ◑: Flash ×: OFF

Criteria	• When 2 branch parts are used for one indoor unit without connecting them consecutively.
Cause of problem	• Branch part assembly error

1. How to check

   Find an MCU that is composed as the following picture to carry out assembly of branch part again. After completing the re-setting, press K3 button on the button to reset or turn it off to restart.

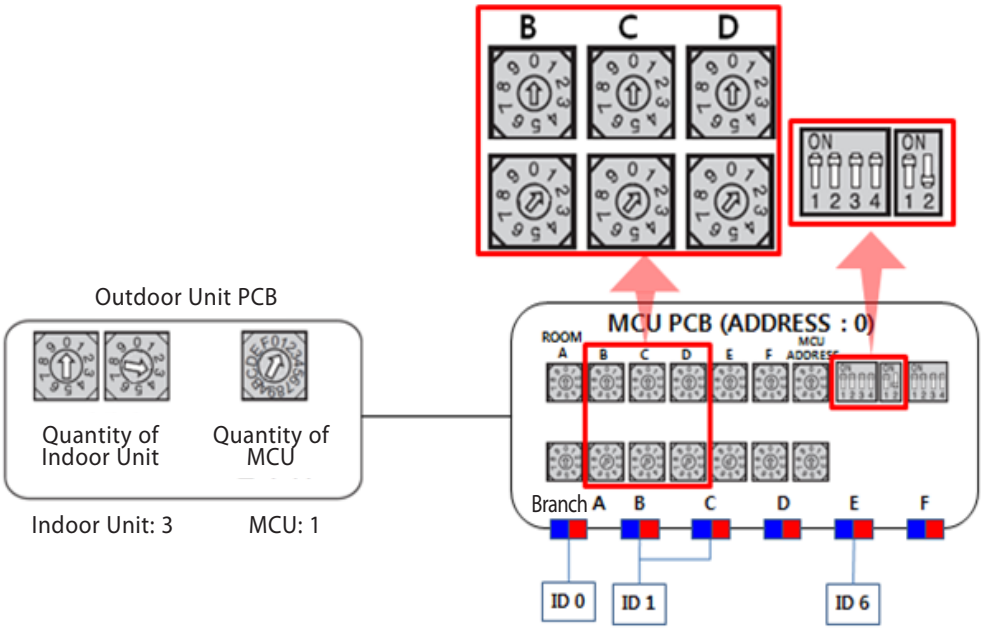


4-3-9 MCU branch part setup error – Repeated setup for the same address over 3 times

<table>
<tr><td>Outdoor unit display</td><td colspan="14">E2 12</td></tr>
<tr><td rowspan="4">Indoorunit display</td><td colspan="5">Duct, Cassette (1/2 Way),Console, Celing</td><td colspan="4">Cassette (4/Mini4 Way)</td><td colspan="5">Wall-mounted (NeoForte)</td></tr>
<tr><td>Operation</td><td>Defrost</td><td>Timer</td><td>Fan</td><td>Filter/MPI</td><td>Operation</td><td>Defrost</td><td>Timer</td><td>Filter</td><td>Operation</td><td>Timer</td><td>Turbo</td><td>24℃</td><td>27℃</td></tr>
<tr><td>×</td><td>×</td><td>◑</td><td>◑</td><td>×</td><td>×</td><td>◑</td><td>◑</td><td>×</td><td>×</td><td>×</td><td>◑</td><td>◑</td><td>×</td></tr>
<tr><td colspan="14">※ ●: ON ◑: Flash ×: OFF</td></tr>
<tr><td>Criteria</td><td colspan="14">• The same indoor unit address was setup more than 3 times in MCU</td></tr>
<tr><td>Cause of problem</td><td colspan="14">• MCU indoor unit address setting error</td></tr>
</table>

1. How to check

   Find an MCU that is composed as the following picture to carry out assembly of branch part again. After completing the re-setting, press K3 button on the button to reset or turn it off to restart.

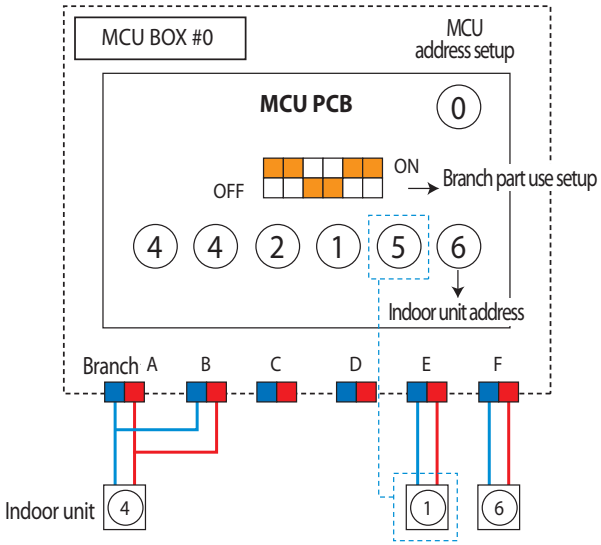


4-3-10 MCU branch part setup error – non-installed address setup

Outdoor unit display	E2 13
Indoorunit display	Duct, Cassette (1/2 Way),Console, Celing: Operation / Defrost / Timer / Fan / Filter/MPI Cassette (4/Mini4 Way): Operation / Defrost / Timer / Filter Wall-mounted (NeoForte): Operation / Timer / Turbo / 24℃ / 27℃ Operation: × / Defrost: × / Timer: ◑ / Fan: ◑ / Filter/MPI: × Operation: × / Defrost: ◑ / Timer: ◑ / Filter: × Operation: × / Timer: × / Turbo: ◑ / 24℃: ◑ / 27℃: × ※ ●: ON ◑: Flash ×: OFF
Criteria	• If there is an indoor unit that is not installed among MCU registered indoor units
Cause of problem	• Indoor unit, with the assigned address on MCU, not installed.

1. How to check

   Find an MCU that is composed as the following picture to carry out assembly of branch part again. After completing the re-setting, press K3 button on the button to reset or turn it off to restart.

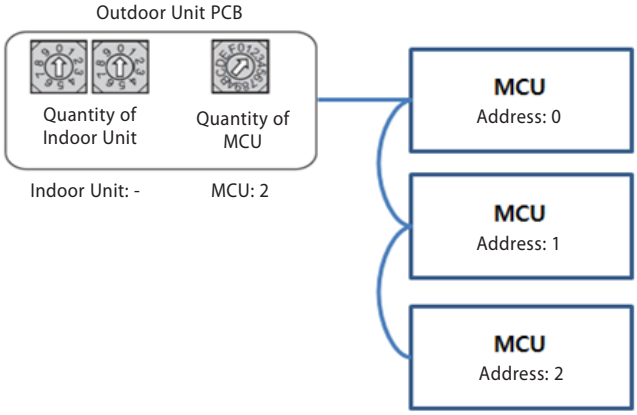


4-3-11 Setup Error for MCU Branch part – Setup Error for MCU Quantity Used

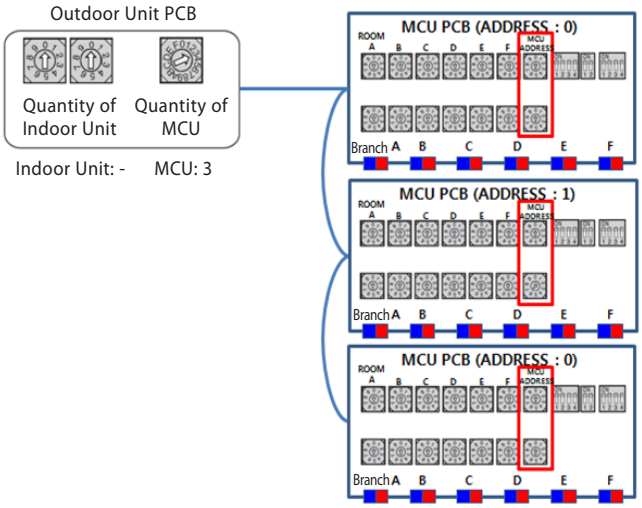
Outdoor unit display	E2 14
Indoorunit display	Duct, Cassette (1/2 Way),Console, Celing: Operation × / Defrost × / Timer ◑ / Fan ◑ / Filter/MPI × Cassette (4/Mini4 Way): Operation × / Defrost ◑ / Timer ◑ / Filter × Wall-mounted (NeoForte): Operation × / Timer × / Turbo ◑ / 24℃ ◑ / 27℃ × ※ ●: ON ◑: Flash ×: OFF
Judgment Method	• Occurs when the quantity of MCU is incorrectly set by the outdoor unit. • Occurs when same addresses are found when two or more MCU are connected.
Special Cause	• Outdoor unit MCU setup and same address errors when connecting two or more MCUs .

1. Inspection Method : Check the Main PCB MCU quantity setting switch of the outdoor unit and check the installed MCU quantity matches.
   Check whether each MCU PCB address switch was duplicated.
   To use, reset by pressing the K3 button of the outdoor unit after the reset is completed, or reset after turning off the power and then turn it on again.

• Example of MCU quantity setting error
ex) PCB MCU setting quantity of outdoor unit = 2 / MCU installed Quantity = 3



• Example of MCU address setting error
ex) Two among three of MCU address was set to 0



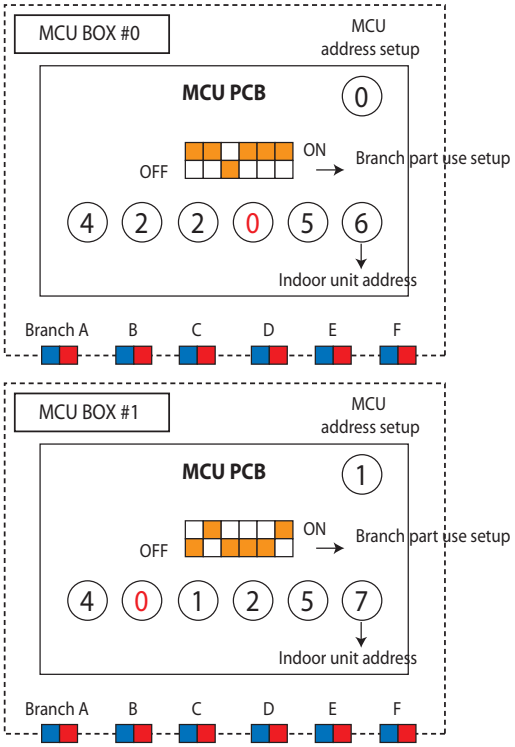
4-3-12 MCU branch part setup error – Overlapping Indoor unit Address setup

<table>
<tr><td>Outdoor unit display</td><td>E2 15</td></tr>
<tr><td>Indoorunit display</td><td>
<table>
<tr><td colspan="5">Duct, Cassette (1/2 Way),Console, Celing</td><td colspan="4">Cassette (4/Mini4 Way)</td><td colspan="5">Wall-mounted (NeoForte)</td></tr>
<tr><td>Operation</td><td>Defrost</td><td>Timer</td><td>Fan</td><td>Filter/MPI</td><td>Operation</td><td>Defrost</td><td>Timer</td><td>Filter</td><td>Operation</td><td>Timer</td><td>Turbo</td><td>24℃</td><td>27℃</td></tr>
<tr><td>×</td><td>×</td><td>◑</td><td>◑</td><td>×</td><td>×</td><td>◑</td><td>◑</td><td>×</td><td>×</td><td>×</td><td>◑</td><td>◑</td><td>×</td></tr>
</table>
※ ●: ON ◑: Flash ×: OFF
</td></tr>
<tr><td>Criteria</td><td>• Occurs when an indoor unit address setup switch in MCU has been overlapped</td></tr>
<tr><td>Cause of problem</td><td>• Repeated indoor unit address</td></tr>
</table>

1. How to check

   Check the setup switch for the number of indoor units in MCU

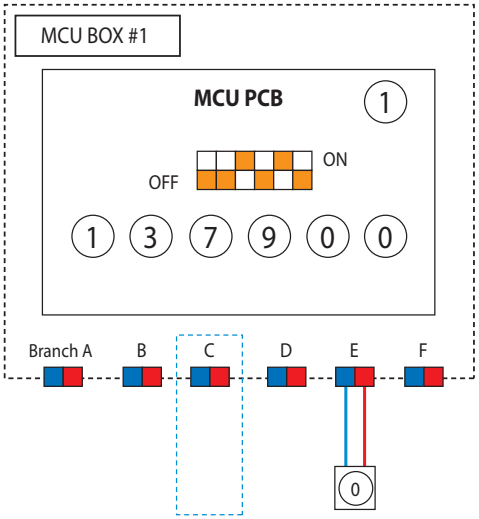
   After completing resetting, press the outdoor unit's K3 button to reset or turn off to restart.



4-3-13 MCU branch part setup error – Set as being used without connection to an Indoor unit

<table>
<tr><td>Outdoor unit display</td><td>E2 16</td></tr>
<tr><td>Indoorunit display</td><td>
<table>
<tr><td colspan="5">Duct, Cassette (1/2 Way),Console, Celing</td><td colspan="4">Cassette (4/Mini4 Way)</td><td colspan="5">Wall-mounted (NeoForte)</td></tr>
<tr><td>Operation</td><td>Defrost</td><td>Timer</td><td>Fan</td><td>Filter/MPI</td><td>Operation</td><td>Defrost</td><td>Timer</td><td>Filter</td><td>Operation</td><td>Timer</td><td>Turbo</td><td>24℃</td><td>27℃</td></tr>
<tr><td>×</td><td>×</td><td>◑</td><td>◑</td><td>×</td><td>×</td><td>◑</td><td>◑</td><td>×</td><td>×</td><td>×</td><td>◑</td><td>◑</td><td>×</td></tr>
</table>
※ ●: ON ◑: Flash ×: OFF
</td></tr>
<tr><td>Criteria</td><td>• Occurs when MCU PIPE is set as being used, yet not connected to an indoor unit</td></tr>
<tr><td>Cause of problem</td><td>• Pipe is not installed to the indoor unit with assigned address on MCU</td></tr>
</table>

1. How to check
   Adjust the Dip switch that sets up the use of MCU branch part to 'Not-Used'. After completing resetting, press the outdoor unit's K3 button to reset or turn off to restart.



4-3-14 MCU branch part setup error – Connect an Indoor unit to a branch part not being used

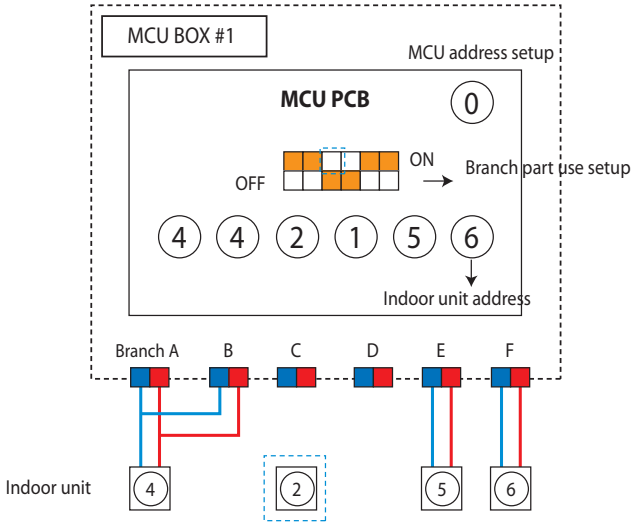
Outdoor unit display	E2 17
Indoorunit display	Duct, Cassette (1/2 Way),Console, Celing / Cassette (4/Mini4 Way) / Wall-mounted (NeoForte)

Duct, Cassette (1/2 Way),Console, Celing					Cassette (4/Mini4 Way)				Wall-mounted (NeoForte)				
Operation	Defrost	Timer	Fan	Filter/MPI	Operation	Defrost	Timer	Filter	Operation	Timer	Turbo	24℃	27℃
×	×	◑	◑	×	×	◑	◑	×	×	×	◑	◑	×

※ ●: ON ◑: Flash ×: OFF

Criteria	• Occurs when MCU PIPE is turned off, yet an indoor unit is registered
Cause of problem	• Indoor unit connection to the unused branch part

1. How to check
   Check the actual use of the branch part. If it is used, turn on the Dip switch for branch part setup. After completing resetting, press the outdoor unit's K3 button to reset or turn off to restart.



4-3-15 MCU branch part setup error – Connect more Indoor units than what is actually set up in MCU

Outdoor unit display	E2 18
Indoorunit display	Duct, Cassette (1/2 Way),Console, Celing / Cassette (4/Mini4 Way) / Wall-mounted (NeoForte)

Duct, Cassette (1/2 Way),Console, Celing					Cassette (4/Mini4 Way)				Wall-mounted (NeoForte)				
Operation	Defrost	Timer	Fan	Filter/MPI	Operation	Defrost	Timer	Filter	Operation	Timer	Turbo	24℃	27℃
×	×	◑	◑	×	×	◑	◑	×	×	×	◑	◑	×

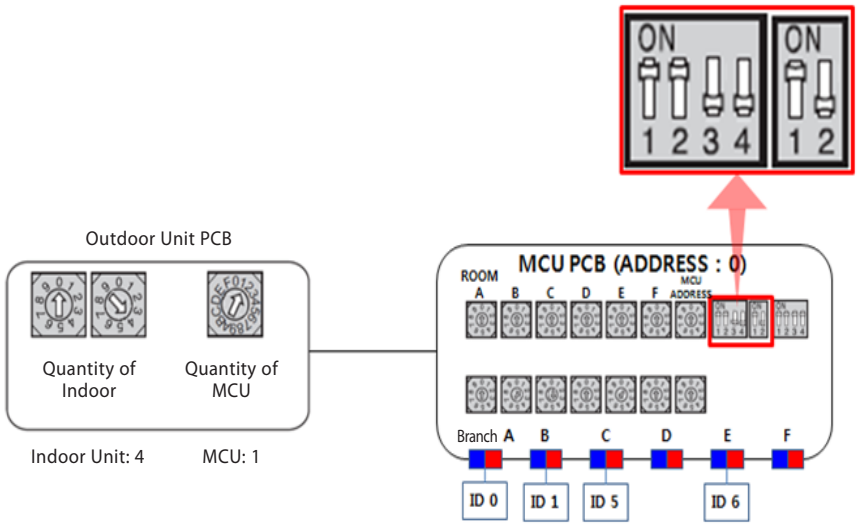
※ ●: ON ◑: Flash ×: OFF

Criteria	• Occurs when the number of indoor unit installed exceeds that setting in MCU
Cause of problem	• Number of indoor units exceeds number of indoor units entered on MCU setting

1. How to check
   Check the number of indoor units connected to MCU then readjust the switch for the number of units
   After completing resetting, press the outdoor unit's K3 button to reset or turn off to restart.

• Example of MCU indoor unit setting DIP switch error

ex) Indoor unit No.5 was connected to branch part C, but DIP switch No.3 (branch part C) is off.

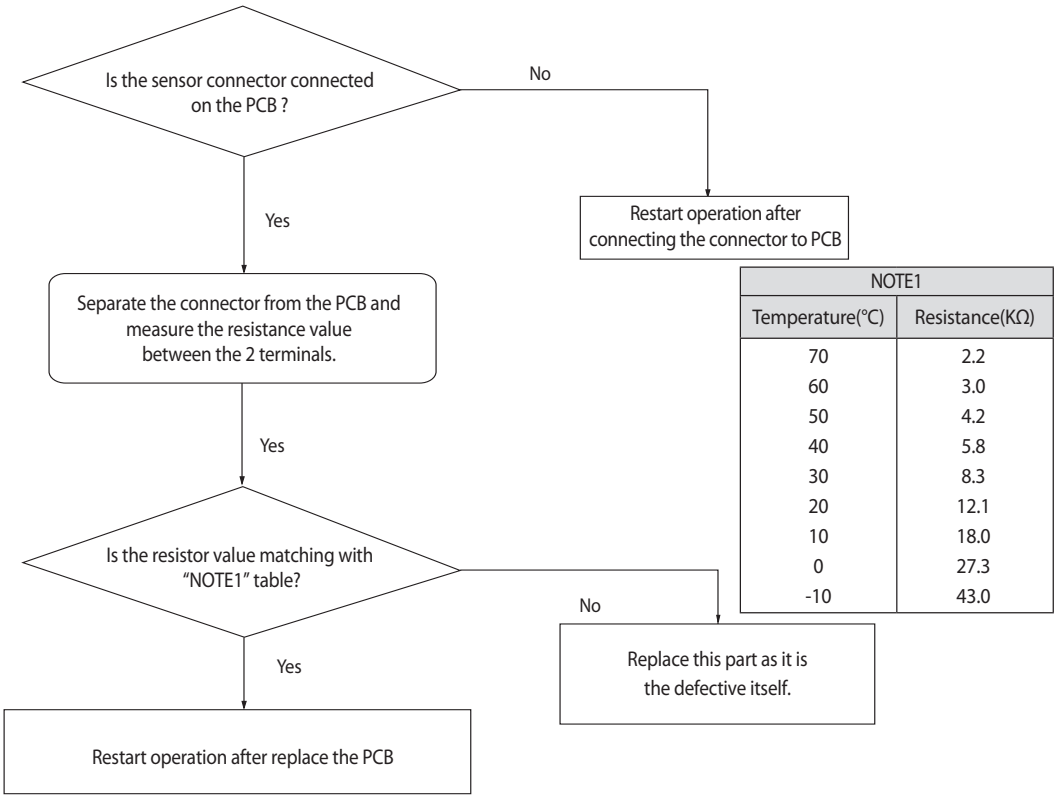


4-3-16 MCU/MCU subcooler entrance/exit sensor error (Open/Short)

Outdoor unit display	E219 (MCU subcooler) E220 (MCU)
Indoorunit display	※ ●: ON ◑: Flash ×: OFF
Judgment Method	· Refer to the judgment method below.
Cause of problem	· MCU/MCU subcooler entrance/exit sensor is open/short

Duct, Cassette (1/2 Way),Console, Celing					Cassette (4/Mini4 Way)				Wall-mounted (NeoForte)		
Operation	Defrost	Timer	Fan	Filter/MPI	Operation	Defrost	Timer	Filter	Operation	Timer	Turbo
×	×	◑	◑	◑	×	◑	◑	◑	●	◑	◑

1. Cause of problem



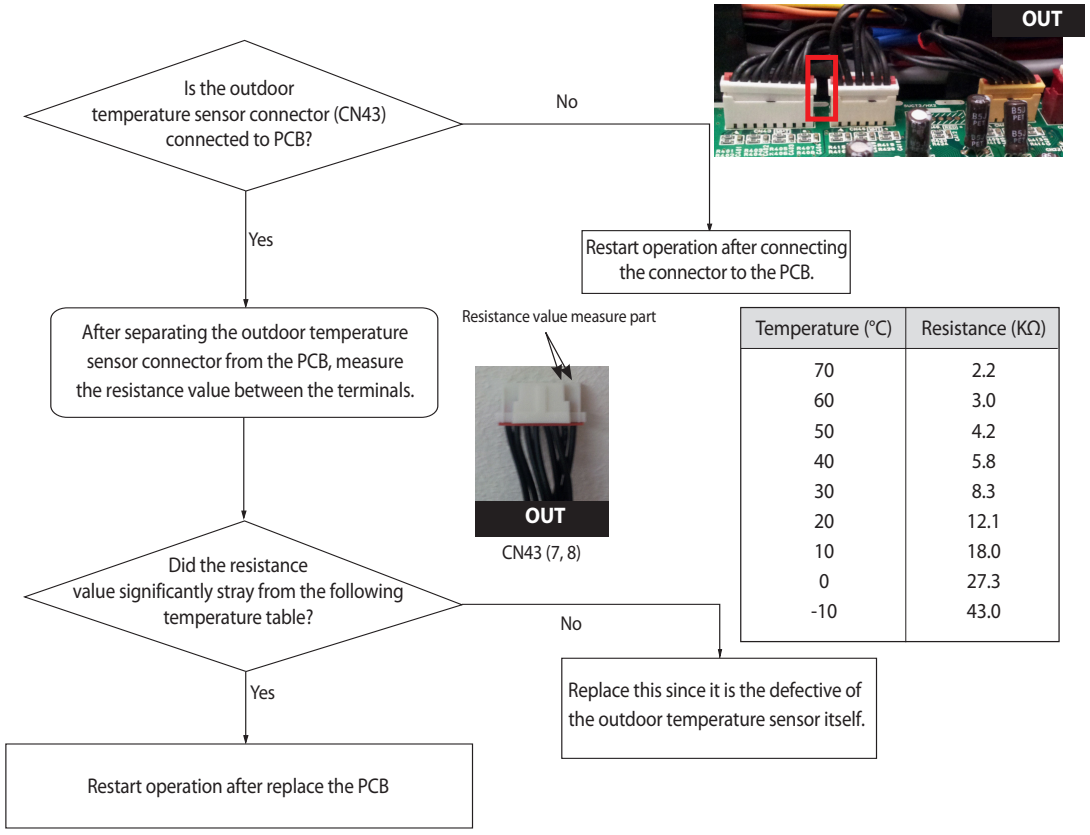
NOTE1

Temperature(℃)	Resistance(KΩ)
70	2.2
60	3.0
50	4.2
40	5.8
30	8.3
20	12.1
10	18.0
0	27.3
-10	43.0

4-3-17 Outdoor Temperature Sensor Error

Outdoor unit display	E221
Indoorunit display	Duct, Cassette (1/2 Way),Console, Celing: Operation ◑, Defrost ×, Timer ×, Fan ◑, Filter/MPI × Cassette (4/Mini4 Way): Operation ◑, Defrost ×, Timer ◑, Filter × Wall-mounted (NeoForte): Operation ◑, Timer ×, Turbo ×, 24℃ ◑, 27℃ × ※ ●: ON ◑: Flash ×: OFF
Judgment Method	· Refer to the judgment method below.
Cause of problem	· Outdoor temperature sensor Open/Short is defective.

1. Cause of problem



Temperature (°C)	Resistance (KΩ)
70	2.2
60	3.0
50	4.2
40	5.8
30	8.3
20	12.1
10	18.0
0	27.3
-10	43.0

4-3-18 Cond Out Temperature Sensor Error (Open/Short)

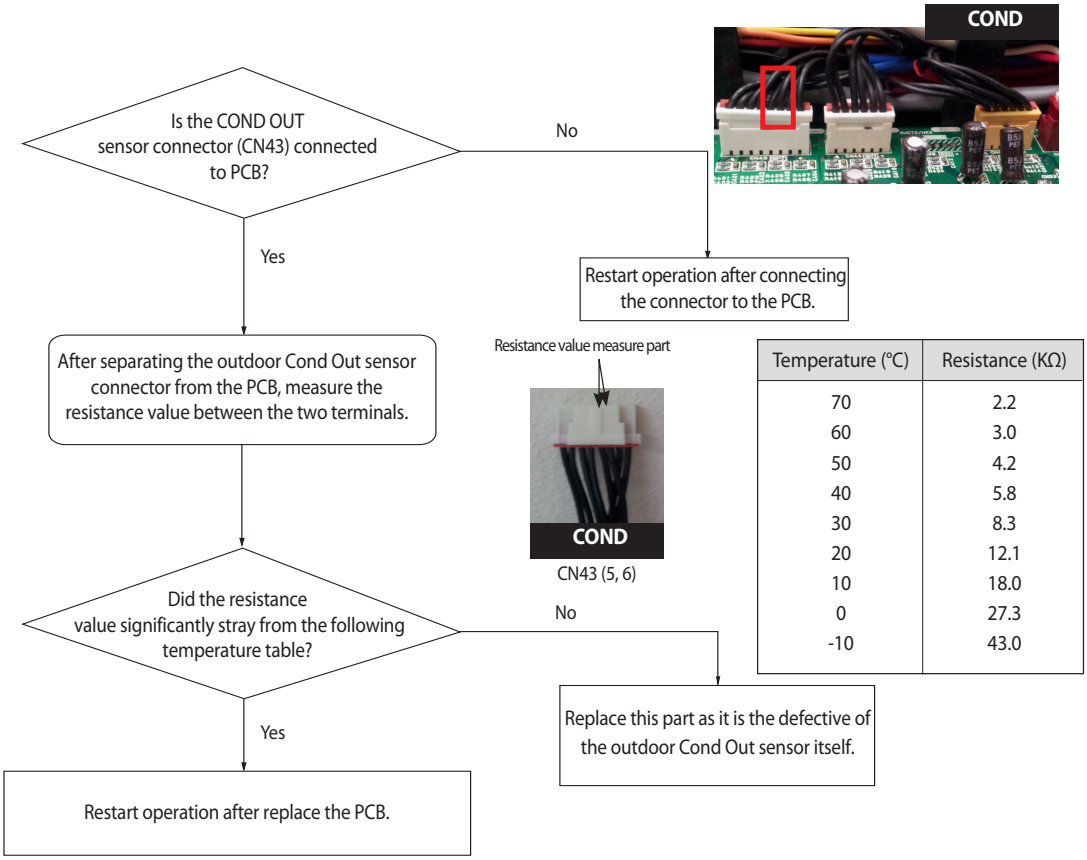
Outdoor unit display	E231
Indoorunit display	Duct, Cassette (1/2 Way),Console, Celing / Cassette (4/Mini4 Way) / Wall-mounted (NeoForte)

Duct, Cassette (1/2 Way),Console, Celing					Cassette (4/Mini4 Way)				Wall-mounted (NeoForte)				
Operation	Defrost	Timer	Fan	Filter/MPI	Operation	Defrost	Timer	Filter	Operation	Timer	Turbo	24℃	27℃
◑	×	×	◑	×	◑	×	◑	×	◑	×	×	◑	×

※ ●: ON ◑: Flash ×: OFF

Judgment Method	· Refer to the judgment method below.
Cause of problem	· Disconnection or breakdown of relevant sensor.

1. Cause of problem



Temperature (°C)	Resistance (KΩ)
70	2.2
60	3.0
50	4.2
40	5.8
30	8.3
20	12.1
10	18.0
0	27.3
-10	43.0

4-3-19 Outdoor Cond Out sensor breakaway error

Outdoor unit display	E241 (Air Cooled)
Indoorunit display	※ ●: ON ◑: Flash ×: OFF
Judgment Method	· Refer to the judgment method below.
Cause of problem	· Outdoor Cond Out sensor breakaway/defective/ relevant path blocked.

Duct, Cassette (1/2 Way),Console, Celing					Cassette (4/Mini4 Way)				Wall-mounted (NeoForte)		
Operation	Defrost	Timer	Fan	Filter/MPI	Operation	Defrost	Timer	Filter	Operation	Timer	Turbo
×	×	◑	◑	◑	×	◑	◑	◑	●	◑	◑

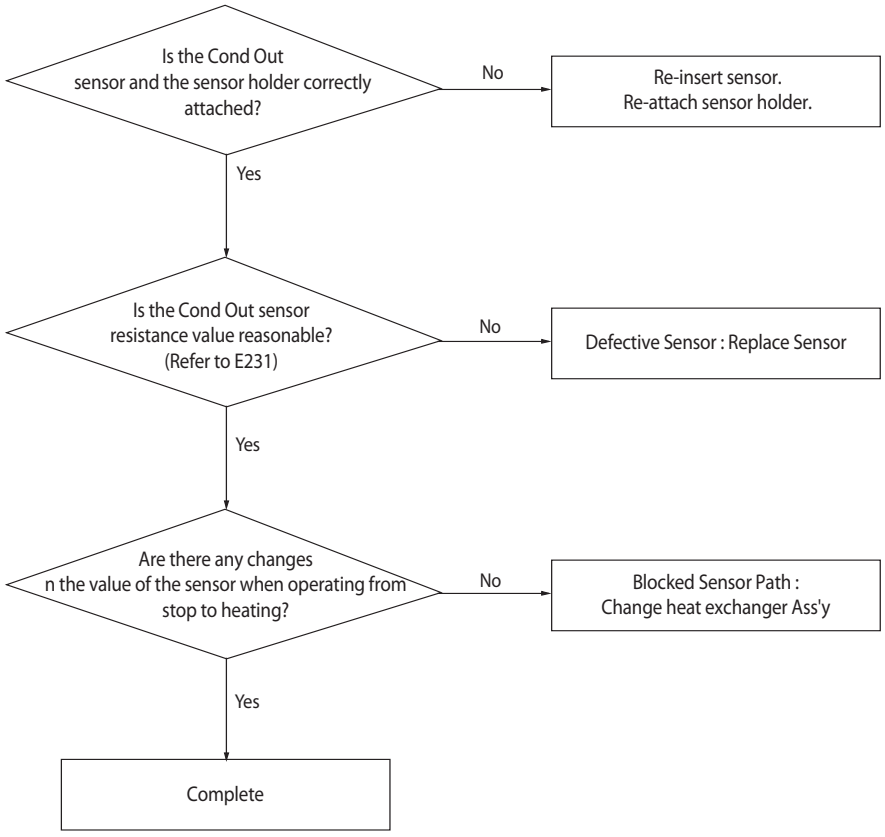
1. Judgment Method

   1) No inspection for Cooling operation.

   2) For heating operation (Each of the conditions below needs to be satisfied for more than 20 minutes.)

Checking of condition	satisfy condition ?
High pressure average > 25kg/cm^2	Yes
Low pressure average < 8.5kg/cm^2	Yes
Teva, out - Tair, in ≥ 3℃	Yes
Teva, in - Tair, in ≥ 2℃	Yes
Tcond, out - Tair, out ≤ 0℃	No
Every compressor is in operation & indoor unit operation and Thermo On	Yes
Error Content	Outdoor Cond Out sensor breakaway error

2. Cause of problem



<table>
<tr><td>Outdoor unit display</td><td colspan="12">E241 (Water Cooled)</td></tr>
<tr><td rowspan="3">Indoorunit display</td><td colspan="5">Duct, Cassette (1/2 Way),Console, Celing</td><td colspan="5">Cassette (4/Mini4 Way)</td><td colspan="3">Wall-mounted (NeoForte)</td></tr>
<tr><td>Operation</td><td>Defrost</td><td>Timer</td><td>Fan</td><td>Filter/MPI</td><td>Operation</td><td>Defrost</td><td>Timer</td><td>Filter</td><td>Operation</td><td>Timer</td><td>Turbo</td></tr>
<tr><td>×</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>●</td><td>◑</td><td>◑</td></tr>
<tr><td colspan="12">※ ●: ON ◑: Flash ×: OFF</td></tr>
<tr><td>Judgment Method</td><td colspan="12">· Refer to the judgment method below.</td></tr>
<tr><td>Cause of problem</td><td colspan="12">· Outdoor Cond Out sensor breakaway/defective/ relevant path blocked.</td></tr>
</table>

1. Judgment Method

1) No inspection for Cooling operation.

2) For heating operation (Each of the conditions below needs to be satisfied for more than 20 minutes.)

1. Point of enter.

① Detected only when heating operation.(Except main heating operation)

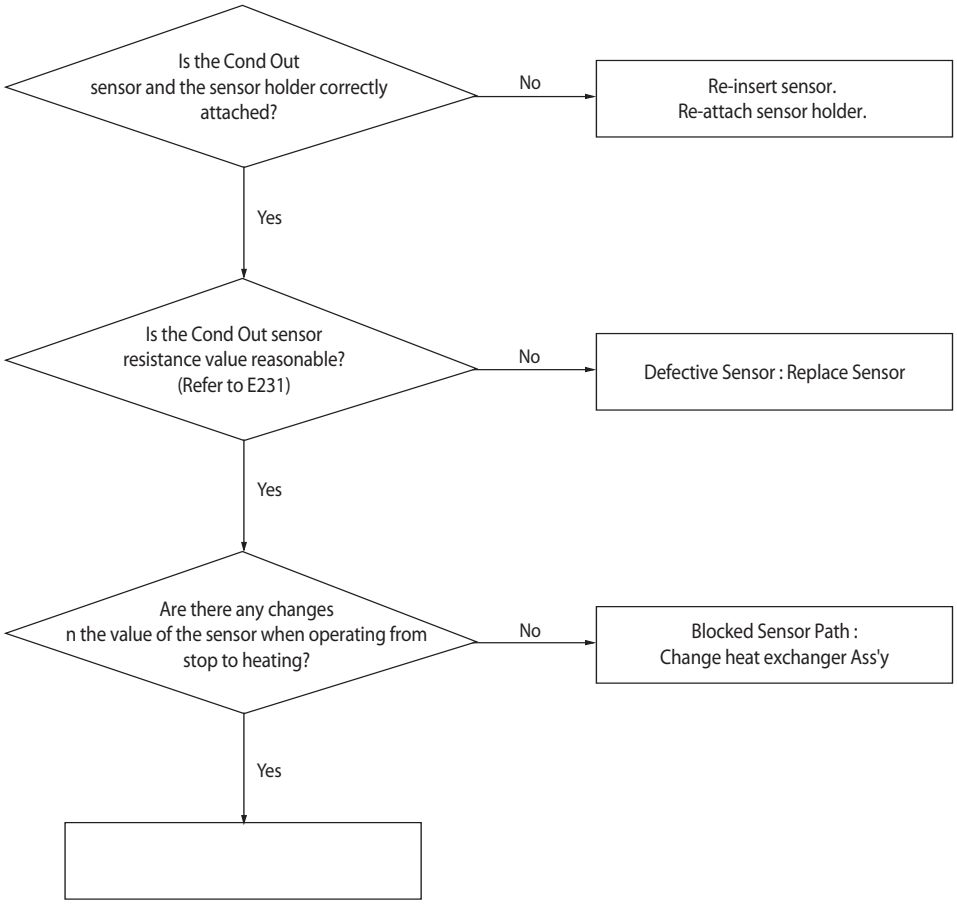
② Compressor operation maintained 40 minutes after start.

2. Point of enter

① | Tcondout_real-Tcondout_ini | < 2℃ maintain conditions during 40 minutes.

※ Tcondout_ini : Condout out temperature just before the compressor operating starts.
Tcondout_real : Condout temperature of the current compressor.

2. Cause of problem

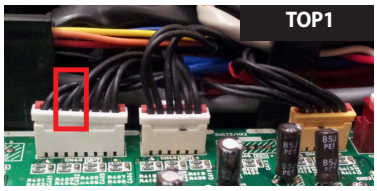


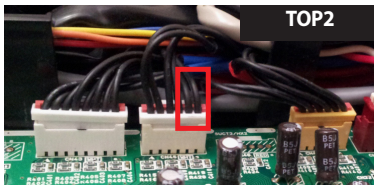
4-3-20 Compressor Discharge or Top 1/2 Temperature sensor error

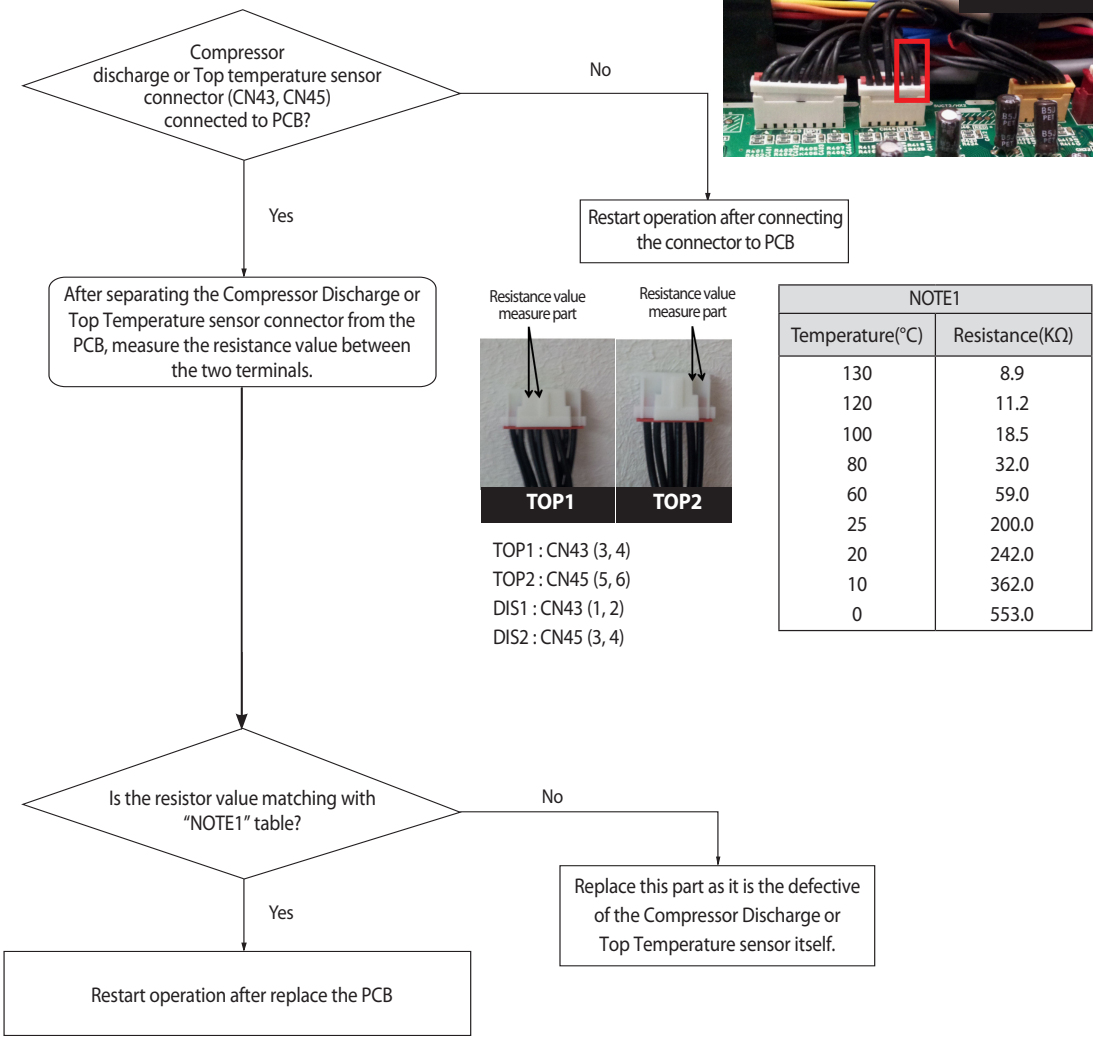
Outdoor unit display	E251 (Compressor 1 Discharge) E257 (Compressor 2 Discharge) E276 (Compressor 1 Top) E277 (Compressor 2 Top)
Indoorunit display	※ ●: ON ◑: Flash ×: OFF
Judgment Method	· Refer to the judgment method below.
Cause of problem	· Compressor Discharge or Top Temperature sensor defective. (Open/Short)

Duct, Cassette (1/2 Way),Console, Celing					Cassette (4/Mini4 Way)				Wall-mounted (NeoForte)		
Operation	Defrost	Timer	Fan	Filter/MPI	Operation	Defrost	Timer	Filter	Operation	Timer	Turbo
◑	×	×	◑	×	◑	×	◑	×	◑	×	◑

1. Cause of problem







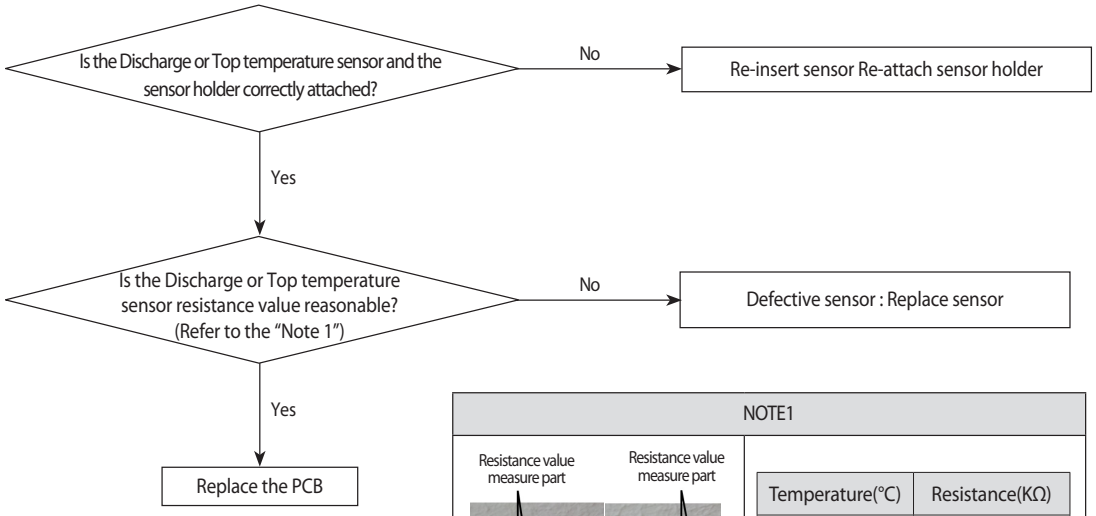
NOTE1	
Temperature(°C)	Resistance(KΩ)
130	8.9
120	11.2
100	18.5
80	32.0
60	59.0
25	200.0
20	242.0
10	362.0
0	553.0

4-3-21 Compressor Discharge or Top temperature sensor breakaway error

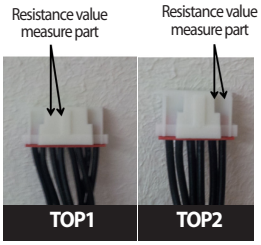
Outdoor unit display	E262 (Compressor 1 Discharge) E263 (Compressor 2 Discharge) E266 (Compressor 1 Top) E267 (Compressor 2 Top)
Indoorunit display	※ ●: ON ◑: Flash ×: OFF
Judgment Method	1) Faulty compressor frequency of 60Hz or higher. 2) Suction temperature > Low pressure saturation temperature +10 ℃ 3) Relevant discharge or Top temperature < High pressure saturation temperature 4) In case of keep 30 minutes in state that satisfy all above conditions (1,2&3) for 30min.
Cause of problem	· Compressor discharge or Top temperature sensor breakaway and defective / Ineffective start of compressor

Duct, Cassette (1/2 Way),Console, Celing					Cassette (4/Mini4 Way)				Wall-mounted (NeoForte)				
Operation	Defrost	Timer	Fan	Filter/MPI	Operation	Defrost	Timer	Filter	Operation	Timer	Turbo	24℃	27℃
×	×	◑	◑	◑	×	◑	◑	◑	×	×	◑	◑	◑

1. Cause of problem



NOTE1



TOP1 : CN43 (3, 4)
TOP2 : CN45 (5, 6)
DIS1 : CN43 (1, 2)
DIS2 : CN45 (3, 4)

Temperature(°C)	Resistance(KΩ)
130	8.9
120	11.2
100	18.5
80	32.0
60	59.0
25	200.0
20	242.0
10	362.0
0	553.0

4-3-22 E269 : Suction Temperature sensor breakaway error

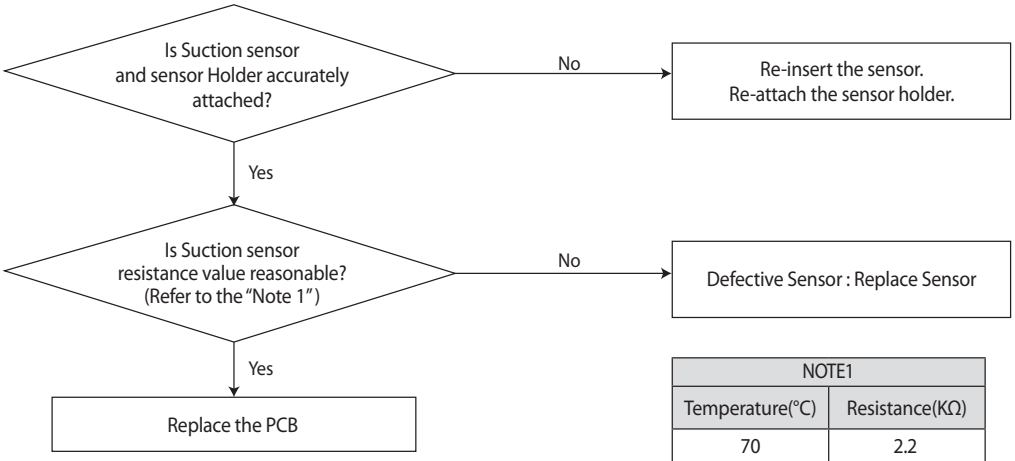
Outdoor unit display	E269
Indoorunit display	Duct, Cassette (1/2 Way),Console, Celing / Cassette (4/Mini4 Way) / Wall-mounted (NeoForte)

Duct, Cassette (1/2 Way),Console, Celing					Cassette (4/Mini4 Way)				Wall-mounted (NeoForte)		
Operation	Defrost	Timer	Fan	Filter/MPI	Operation	Defrost	Timer	Filter	Operation	Timer	Turbo
×	×	◑	◑	◑	×	◑	◑	◑	●	◑	◑

※ ●: ON ◑: Flash ×: OFF

Judgment Method	· Judgment Method : Difference of suction temperature of compressor starting verge and suction temperature that is on present operation : If less than 2 ℃ for 30 minutes to keep.(Judgment at heating operation only)
Cause of problem	· Suction temperature sensor breakaway/defective.

1. Cause of problem



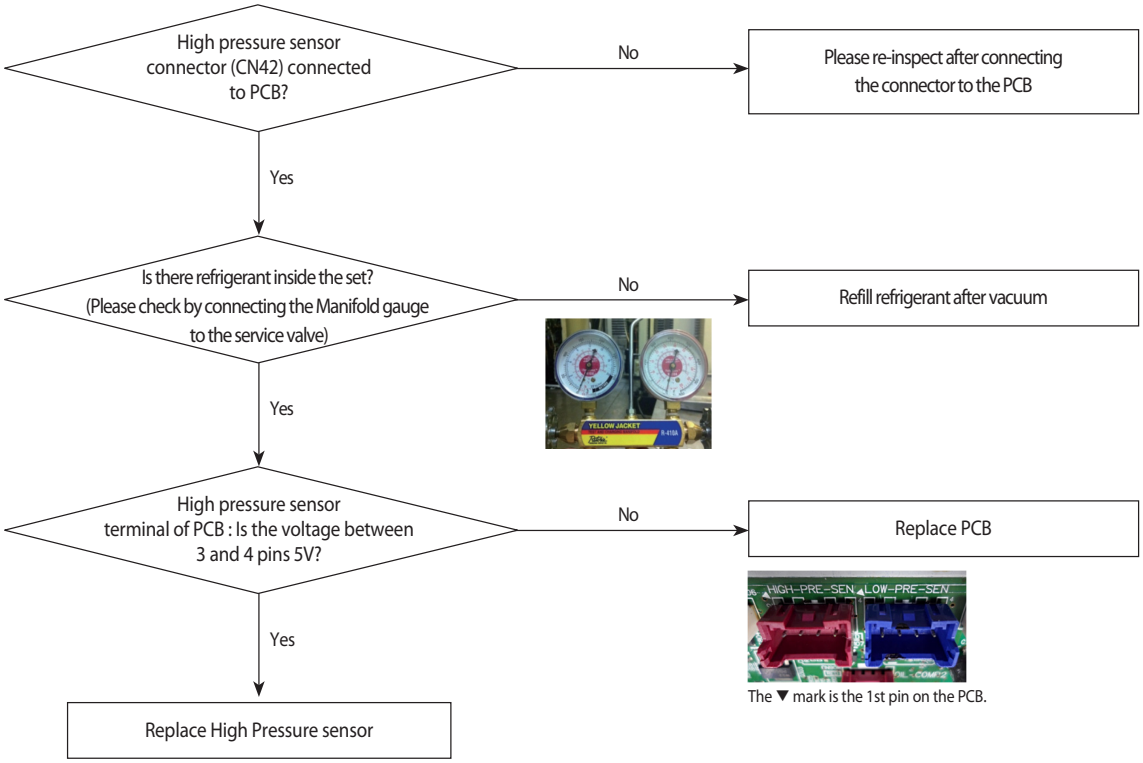
NOTE1	
Temperature(°C)	Resistance(KΩ)
70	2.2
60	3.0
50	4.2
40	5.8
30	8.3
20	12.1
10	18.0
0	27.3
-10	43.0

4-3-23 High Pressure sensor error (Open/Short)

<table>
<tr><td>Outdoor unit display</td><td>E291</td></tr>
<tr><td>Indoorunit display</td><td>
<table>
<tr><th colspan="5">Duct, Cassette (1/2 Way),Console, Celing</th><th colspan="4">Cassette (4/Mini4 Way)</th><th colspan="3">Wall-mounted (NeoForte)</th></tr>
<tr><th>Operation</th><th>Defrost</th><th>Timer</th><th>Fan</th><th>Filter/MPI</th><th>Operation</th><th>Defrost</th><th>Timer</th><th>Filter</th><th>Operation</th><th>Timer</th><th>Turbo</th></tr>
<tr><td>×</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>●</td><td>◑</td><td>◑</td></tr>
</table>
※ ●: ON ◑: Flash ×: OFF
</td></tr>
<tr><td>Judgment Method</td><td>· Refer to the judgment method below.</td></tr>
<tr><td>Cause of problem</td><td>· Disconnection or breakdown of relevant sensor.</td></tr>
</table>

1. High Pressure sensor Open/Short error determination method
   1) Identifies from when power is supplied or 2 minutes after RESET, and only when set is stopped.
   2) An Open/Short error will occur if the input voltage standard range of 0.5V ~ 4.95V is exceeded.

2. Inspection Method



The ▼ mark is the 1st pin on the PCB.

4-3-24 Low Pressure sensor error (Open/Short)

Outdoor unit display	E296
Indoorunit display	Duct, Cassette (1/2 Way),Console, Celing / Cassette (4/Mini4 Way) / Wall-mounted (NeoForte)

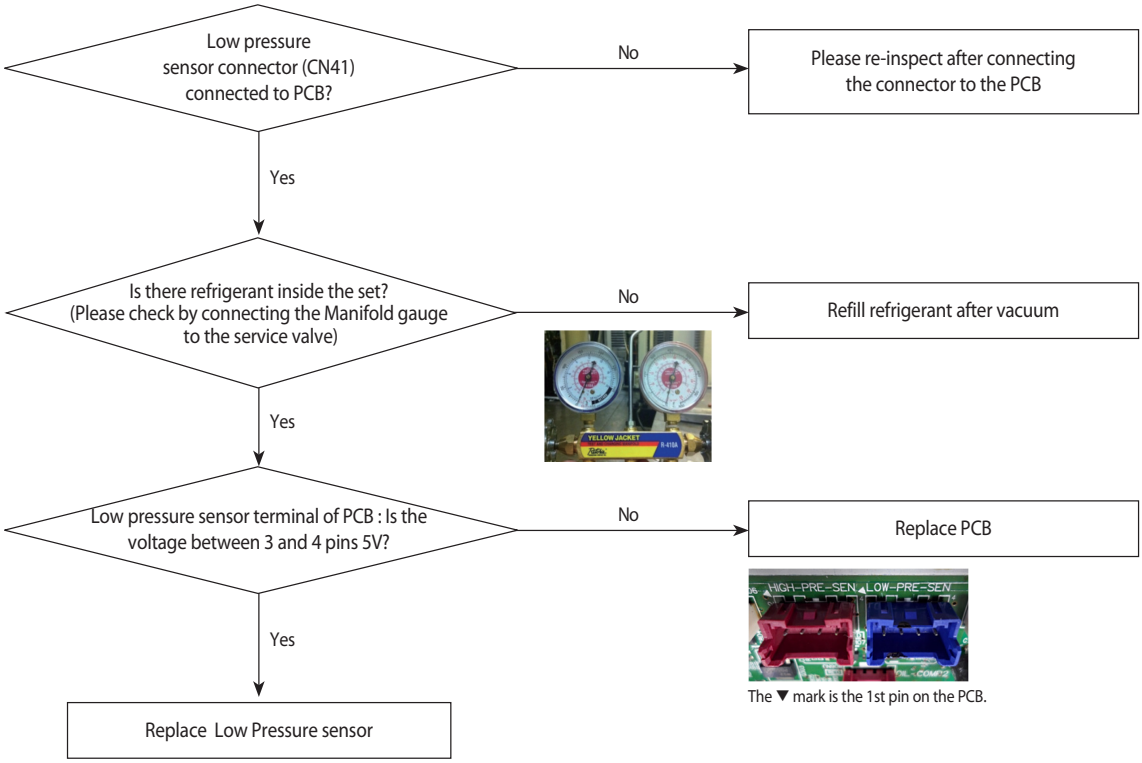
Duct, Cassette (1/2 Way),Console, Celing					Cassette (4/Mini4 Way)				Wall-mounted (NeoForte)		
Operation	Defrost	Timer	Fan	Filter/MPI	Operation	Defrost	Timer	Filter	Operation	Timer	Turbo
×	×	◑	◑	◑	×	◑	◑	◑	●	◑	◑

※ ●: ON ◑: Flash ×: OFF

Judgment Method	· Refer to the judgment method below.
Cause of problem	· Disconnection or breakdown of relevant sensor.

1. Low Pressure sensor Open/Short error determination method
   1) Identifies from when power is supplied or 2 minutes after RESET, and only when set is stopped.
   2) An Open/Short error will occur if the input voltage standard range of 0.5V ~ 4.95V is exceeded.

2. Inspection Method

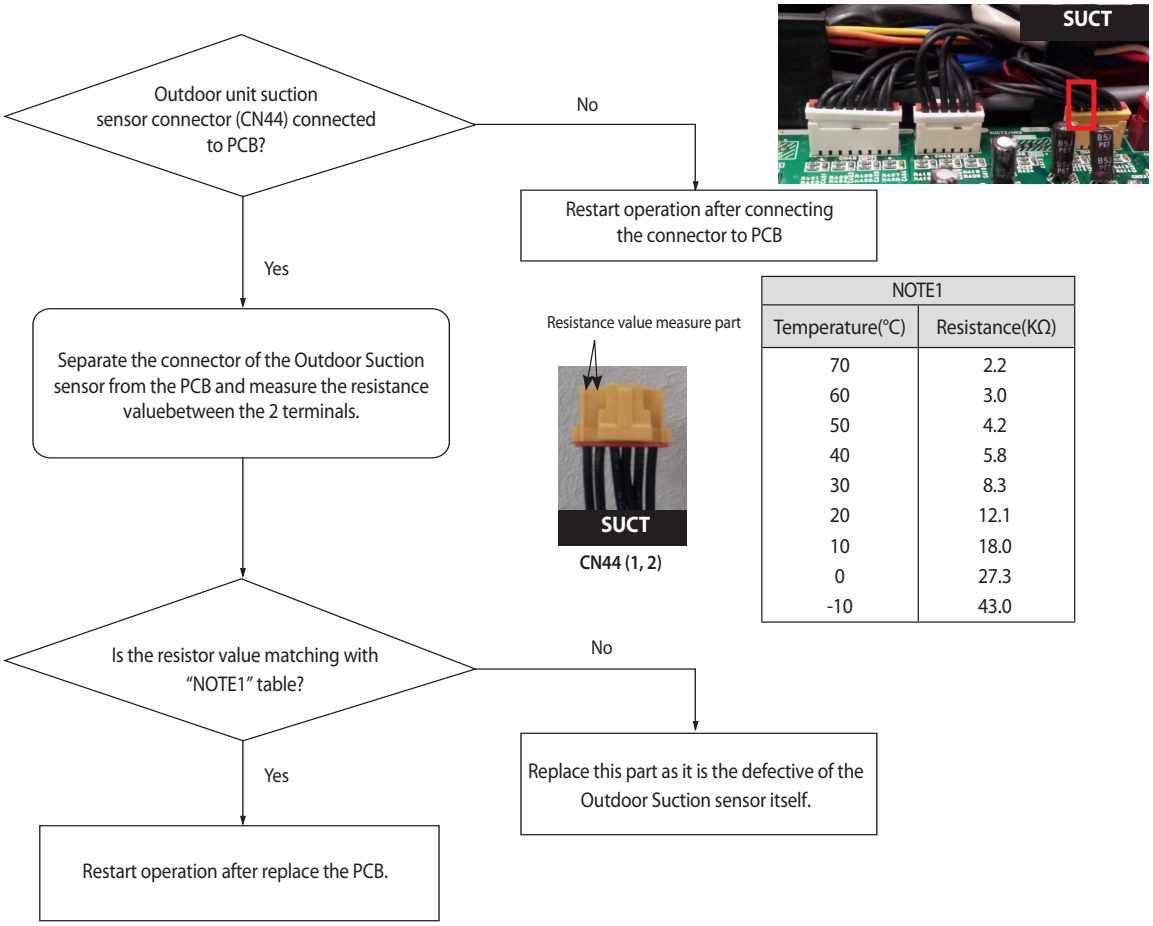


The ▼ mark is the 1st pin on the PCB.

4-3-25 Suction Temperature sensor error (Open/Short)

Outdoor unit display	E308
Indoorunit display	Duct, Cassette (1/2 Way),Console, Celing: Operation × / Defrost × / Timer ◑ / Fan ◑ / Filter/MPI ◑ Cassette (4/Mini4 Way): Operation × / Defrost ◑ / Timer ◑ / Filter ◑ Wall-mounted (NeoForte): Operation ● / Timer ◑ / Turbo ◑ ※ ●: ON ◑: Flash ×: OFF
Judgment Method	· Refer to the judgment method below.
Cause of problem	· Disconnection or breakdown of relevant sensor. (More than 4.5V or 0.5V less than)

1. Cause of problem



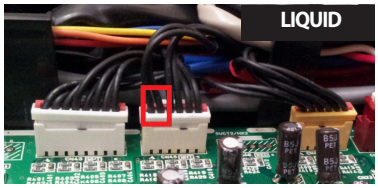
NOTE1

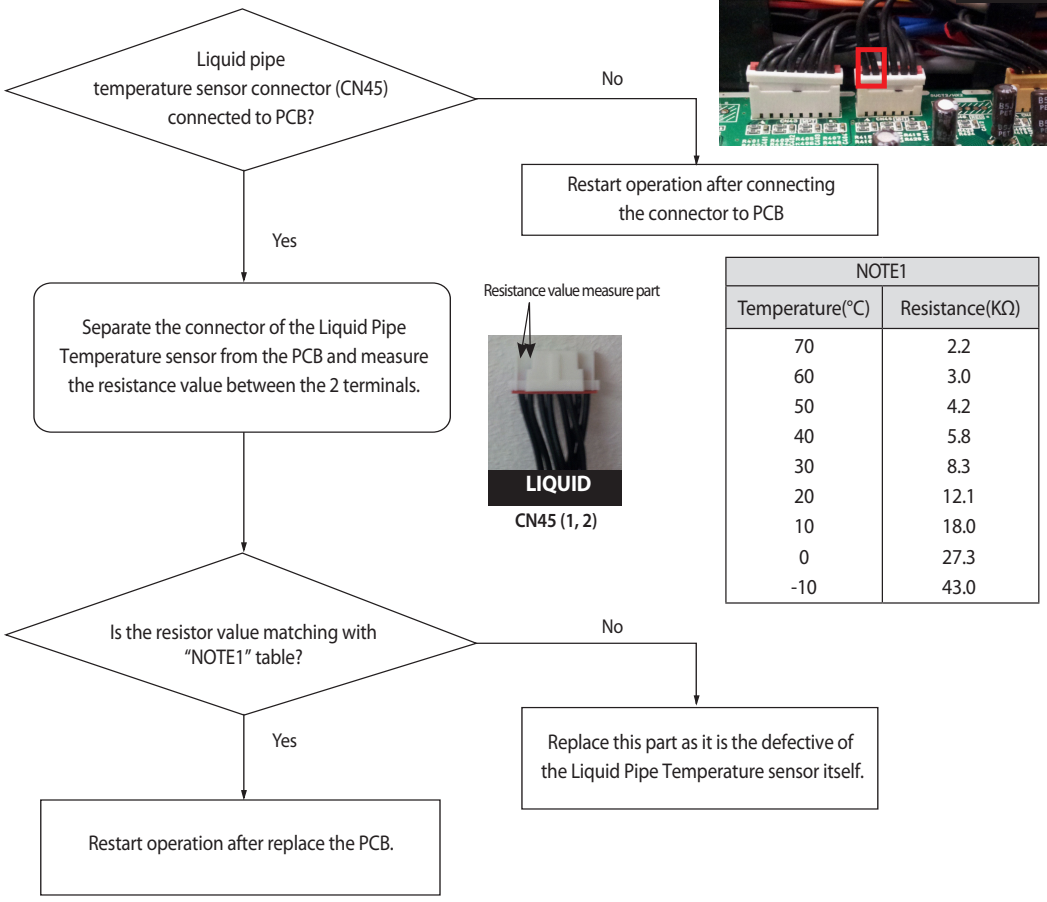
Temperature(℃)	Resistance(KΩ)
70	2.2
60	3.0
50	4.2
40	5.8
30	8.3
20	12.1
10	18.0
0	27.3
-10	43.0

4-3-26 Liquid Pipe Temperature sensor error (Open/Short)

Outdoor unit display	E311
Indoorunit display	Duct, Cassette (1/2 Way),Console, Celing: Operation: × / Defrost: × / Timer: ◑ / Fan: ◑ / Filter/MPI: ◑ Cassette (4/Mini4 Way): Operation: × / Defrost: ◑ / Timer: ◑ / Filter: ◑ Wall-mounted (NeoForte): Operation: ● / Timer: ◑ / Turbo: ◑ ※ ●: ON ◑: Flash ×: OFF
Judgment Method	· Refer to the judgment method below.
Cause of problem	· Disconnection or breakdown of relevant sensor. (More than 4.5V or 0.5V less than)

1. Cause of problem





NOTE1

Temperature(°C)	Resistance(KΩ)
70	2.2
60	3.0
50	4.2
40	5.8
30	8.3
20	12.1
10	18.0
0	27.3
-10	43.0

4-3-27 EVI In Temperature sensor error (Open/Short)

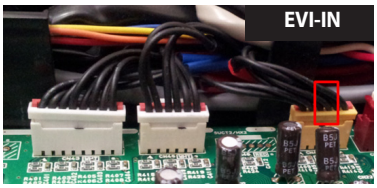
Outdoor unit display	E321
Indoorunit display	Duct, Cassette (1/2 Way),Console, Celing / Cassette (4/Mini4 Way) / Wall-mounted (NeoForte)

Duct, Cassette (1/2 Way),Console, Celing					Cassette (4/Mini4 Way)				Wall-mounted (NeoForte)		
Operation	Defrost	Timer	Fan	Filter/MPI	Operation	Defrost	Timer	Filter	Operation	Timer	Turbo
×	×	◑	◑	◑	×	◑	◑	◑	●	◑	◑

※ ●: ON ◑: Flash ×: OFF

Judgment Method	· Refer to the judgment method below.
Cause of problem	· Disconnection or breakdown of relevant sensor.

1. Cause of problem



Outdoor EVI IN sensor connector (CN44) connected to PCB?

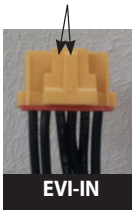
No

Restart operation after connecting the connector to PCB

Yes

Separate the connector of the Outdoor EVI In Temperature sensor from the PCB and measure the resistance value between the 2 terminals.

Resistance value measure part



CN44 (3, 4)

NOTE1	
Temperature(℃)	Resistance(KΩ)
70	2.2
60	3.0
50	4.2
40	5.8
30	8.3
20	12.1
10	18.0
0	27.3
-10	43.0

Is the resistor value matching with "NOTE1" table?

No

Replace this part as it is the defective of the Outdoor EVI In Temperature sensor itself.

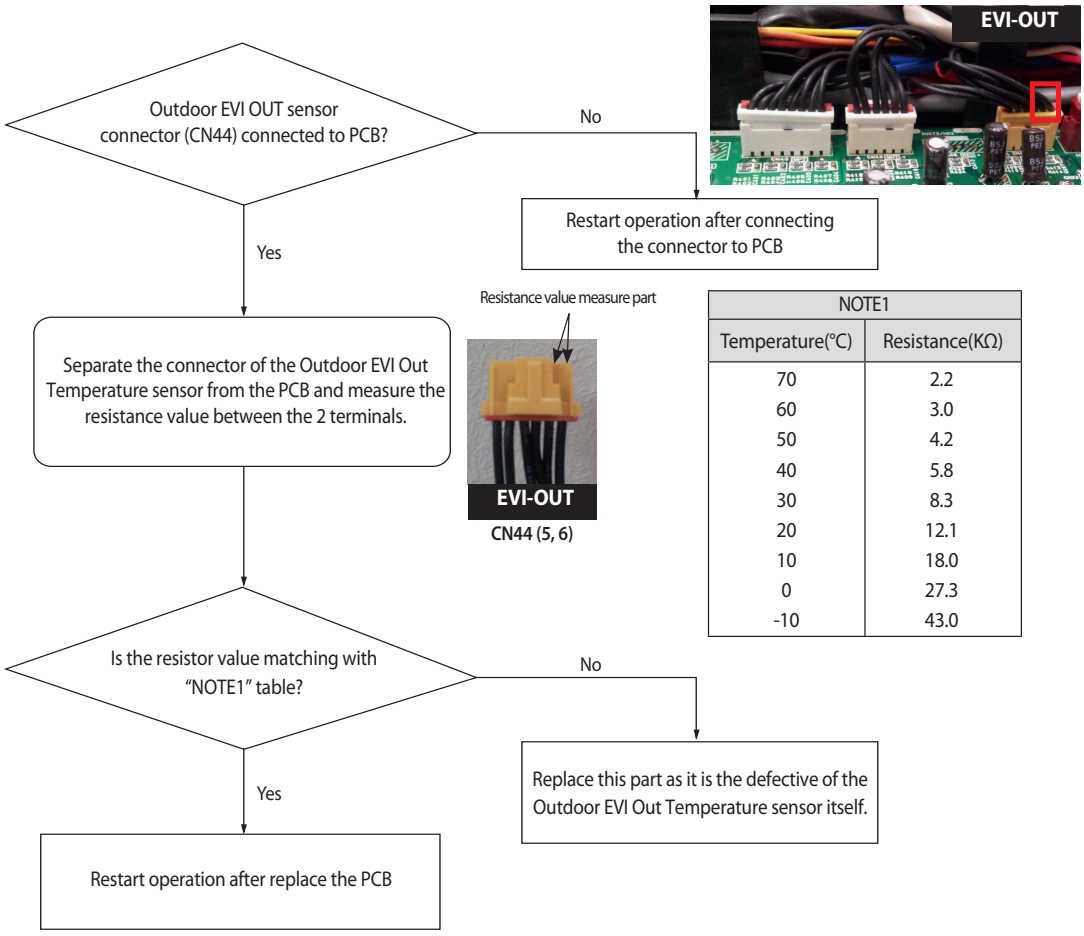
Yes

Restart operation after replace the PCB

4-3-28 EVI Out Temperature sensor error (Open/Short)

Outdoor unit display	E322
Indoorunit display	Duct, Cassette (1/2 Way),Console, Celing: Operation ×, Defrost ×, Timer ◑, Fan ◑, Filter/MPI ◑ / Cassette (4/Mini4 Way): Operation ×, Defrost ◑, Timer ◑, Filter ◑ / Wall-mounted (NeoForte): Operation ●, Timer ◑, Turbo ◑ ※ ●: ON ◑: Flash ×: OFF
Judgment Method	· Refer to the judgment method below.
Cause of problem	· Disconnection or breakdown of relevant sensor.

1. Cause of problem



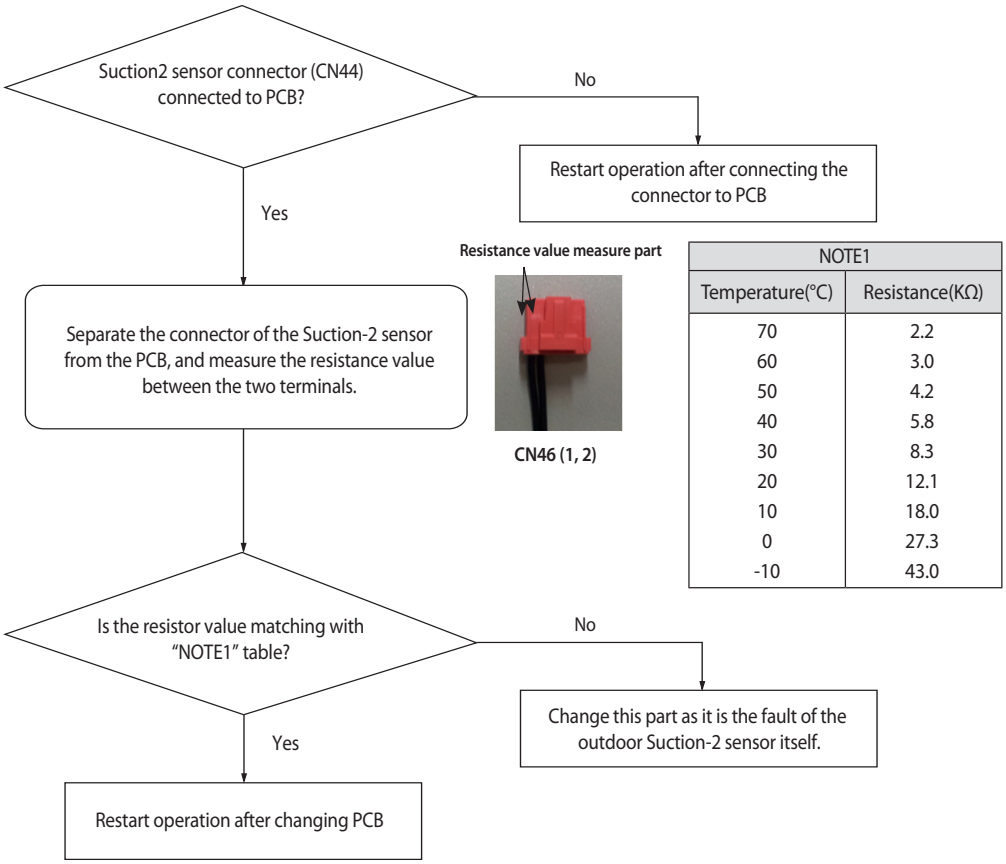
NOTE1

Temperature(℃)	Resistance(KΩ)
70	2.2
60	3.0
50	4.2
40	5.8
30	8.3
20	12.1
10	18.0
0	27.3
-10	43.0

4-3-29 Suction-2 Temperature Sensor Error (OPEN/SHORT)

Outdoor unit display	E323
Indoorunit display	Duct, Cassette (1/2 Way),Console, Celing: Operation: × / Defrost: × / Timer: ◑ / Fan: ◑ / Filter/MPI: ◑ Cassette (4/Mini4 Way): Operation: × / Defrost: ◑ / Timer: ◑ / Filter: ◑ Wall-mounted (NeoForte): Operation: ● / Timer: ◑ / Turbo: ◑ ※ ●: ON ◑: Flash ×: OFF
Judgment Method	• Refer to the judgment method below.
Special Cause	• Disconnection or breakdown of relevant sensor

1. Inspection Method



NOTE1

Temperature(°C)	Resistance(KΩ)
70	2.2
60	3.0
50	4.2
40	5.8
30	8.3
20	12.1
10	18.0
0	27.3
-10	43.0

4-3-30 Measures of other outdoor unit error

<table>
<tr><td>Outdoor unit display</td><td>E347 FAN2 wire unconnected error
E447 FAN1 wire unconnected error
E367 COMP.1 wire unconnected error
E467 COMP.1 wire unconnected error
E399 FAN2 PBA IPM temperature sensor error
E499 FAN1 PBA IPM temperature sensor error
E374 Inverter PBA1 IGBT temperature sensor error
E474 Inverter PBA1 IGBT temperature sensor error</td></tr>
<tr><td>Indoorunit display</td><td>
<table>
<tr><td colspan="5">Duct, Cassette (1/2 Way),Console, Celing</td><td colspan="4">Cassette (4/Mini4 Way)</td><td colspan="3">Wall-mounted (NeoForte)</td></tr>
<tr><td>Operation</td><td>Defrost</td><td>Timer</td><td>Fan</td><td>Filter/MPI</td><td>Operation</td><td>Defrost</td><td>Timer</td><td>Filter</td><td>Operation</td><td>Timer</td><td>Turbo</td></tr>
<tr><td>×</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>●</td><td>◑</td><td>◑</td></tr>
</table>
※ ●: ON ◑: Flash ×: OFF
</td></tr>
<tr><td>Judgment Method</td><td>· Refer to the measures code below.</td></tr>
<tr><td>Cause of problem</td><td>· Refer to the measures code below.</td></tr>
</table>

1. Judgement by code

Code	Error	Measures
E347	FAN2 wire unconnected error	1. Check the FAN motor and PBA connection. 2. When connected Inverterr checker, if LED operates in the normality : External factors or when LED operates by abnormality, replace the FAN PBA.
E447	FAN1 wire unconnected error	1. Check the FAN motor and PBA connection. 2. When connected Inverterr checker, if LED operates in the normality : External factors or when LED operates by abnormality, replace the FAN PBA.
E367	COMP.2 wire unconnected error	1. Check the Compressor and Inverter PBA connection. 2. When connected inverter checker, if LED operates in the normality : External factors or when LED operates by abnormality, replace the Inverter PBA.
E467	COMP.1 wire unconnected error	1. Check the Compressor and Inverter PBA connection. 2. When connected inverter checker, if LED operates in the normality : External factors or when LED operates by abnormality, replace the Inverter PBA.
E399	FAN2 PBA IPM temperature sensor error	Replace FAN PBA
E499	FAN1 PBA IPM temperature sensor error	Replace FAN PBA
E374	Inverter PBA2 IGBT temperature sensor error	Replace Inverter PBA
E474	Inverter PBA1 IGBT temperature sensor error	Replace Inverter PBA

4-3-31 E407 : Comp. Down due to High Pressure Protection Control

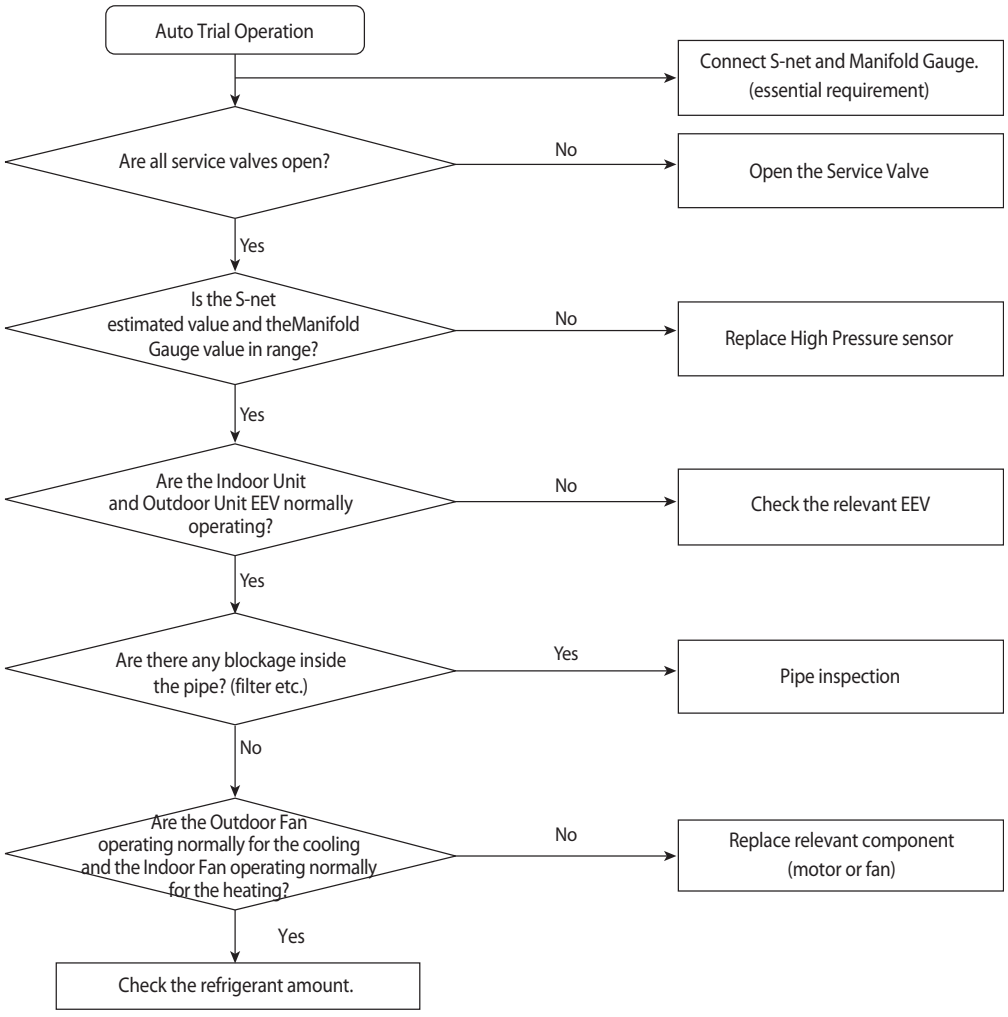
Outdoor unit display	E407 (Air Cooled)
Indoorunit display	

Duct, Cassette (1/2 Way),Console, Celing					Cassette (4/Mini4 Way)				Wall-mounted (NeoForte)		
Operation	Defrost	Timer	Fan	Filter/MPI	Operation	Defrost	Timer	Filter	Operation	Timer	Turbo
×	×	◑	◑	◑	×	◑	◑	◑	●	◑	◑

※ ●: ON ◑: Flash ×: OFF

Judgment Method	• Value of the high pressure sensor is detected at 40kg/cm² or more
Cause of problem	**<Cooling Operation>** · Outdoor unit fan motor problem (constrained, defective) · Outdoor heat exchanger is contaminated. · Service valve locked/Fill refrigerant **<Heating Operation>** · Service valve locked/Excessive refrigerant

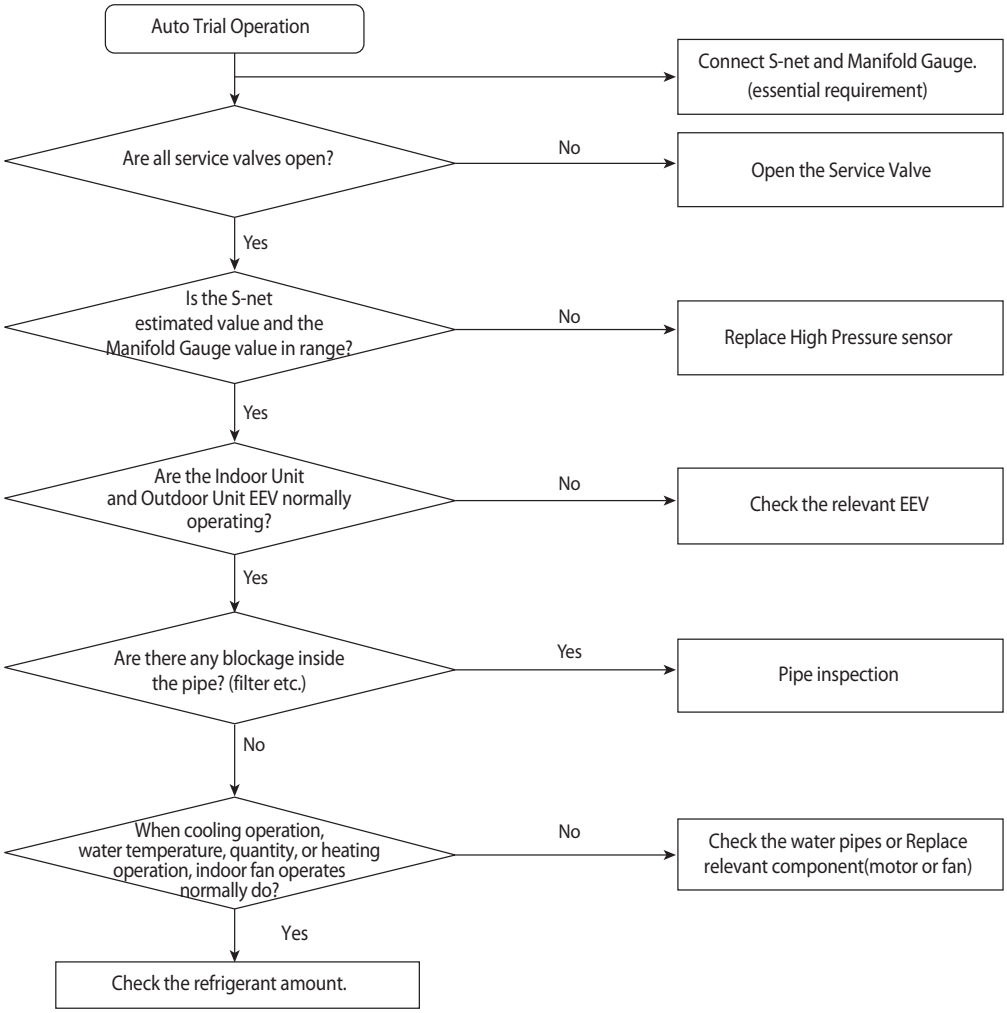
1. Cause of problem



<table>
<tr><td>Outdoor unit display</td><td>E407 (Water Cooled)</td></tr>
<tr><td>Indoorunit display</td><td>
<table>
<tr><th colspan="5">Duct, Cassette (1/2 Way),Console, Celing</th><th colspan="4">Cassette (4/Mini4 Way)</th><th colspan="3">Wall-mounted (NeoForte)</th></tr>
<tr><th>Operation</th><th>Defrost</th><th>Timer</th><th>Fan</th><th>Filter/MPI</th><th>Operation</th><th>Defrost</th><th>Timer</th><th>Filter</th><th>Operation</th><th>Timer</th><th>Turbo</th></tr>
<tr><td>×</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>●</td><td>◑</td><td>◑</td></tr>
</table>
※ ●: ON ◑: Flash ×: OFF
</td></tr>
<tr><td>Judgment Method</td><td>• Value of the high pressure sensor is detected at 41kg/cm² or more</td></tr>
<tr><td>Cause of problem</td><td><Cooling operation>
· Overheat of supplying water
· Shortage of supplying water
· Outdoor heat exchanger is contaminated.
· Service valve locked/Fill refrigerant

<Heating operation>
· Indoor unit fan motor problem(constrained, defective)
· Service valve locked/Excessive refrigerant</td></tr>
</table>

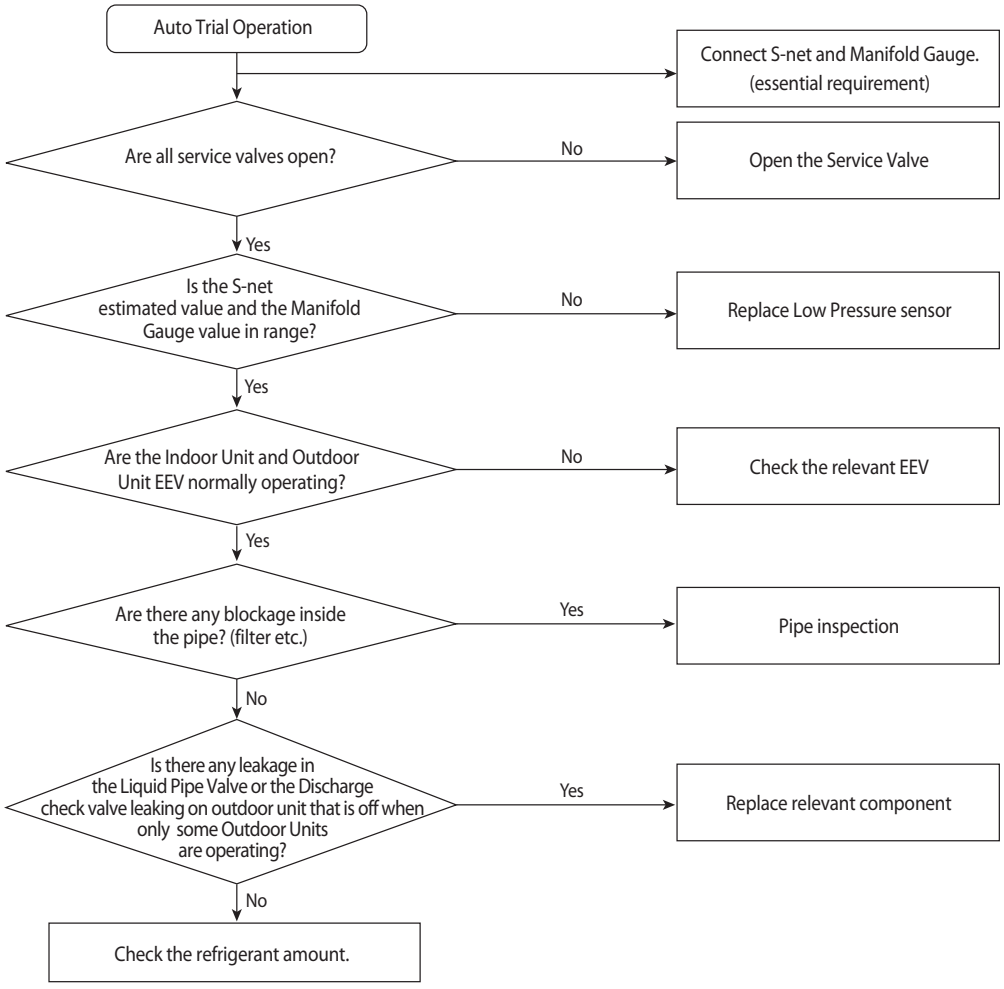
1. Cause of problem



4-3-32 E410 : Comp. Down due to Low Pressure Protection Control

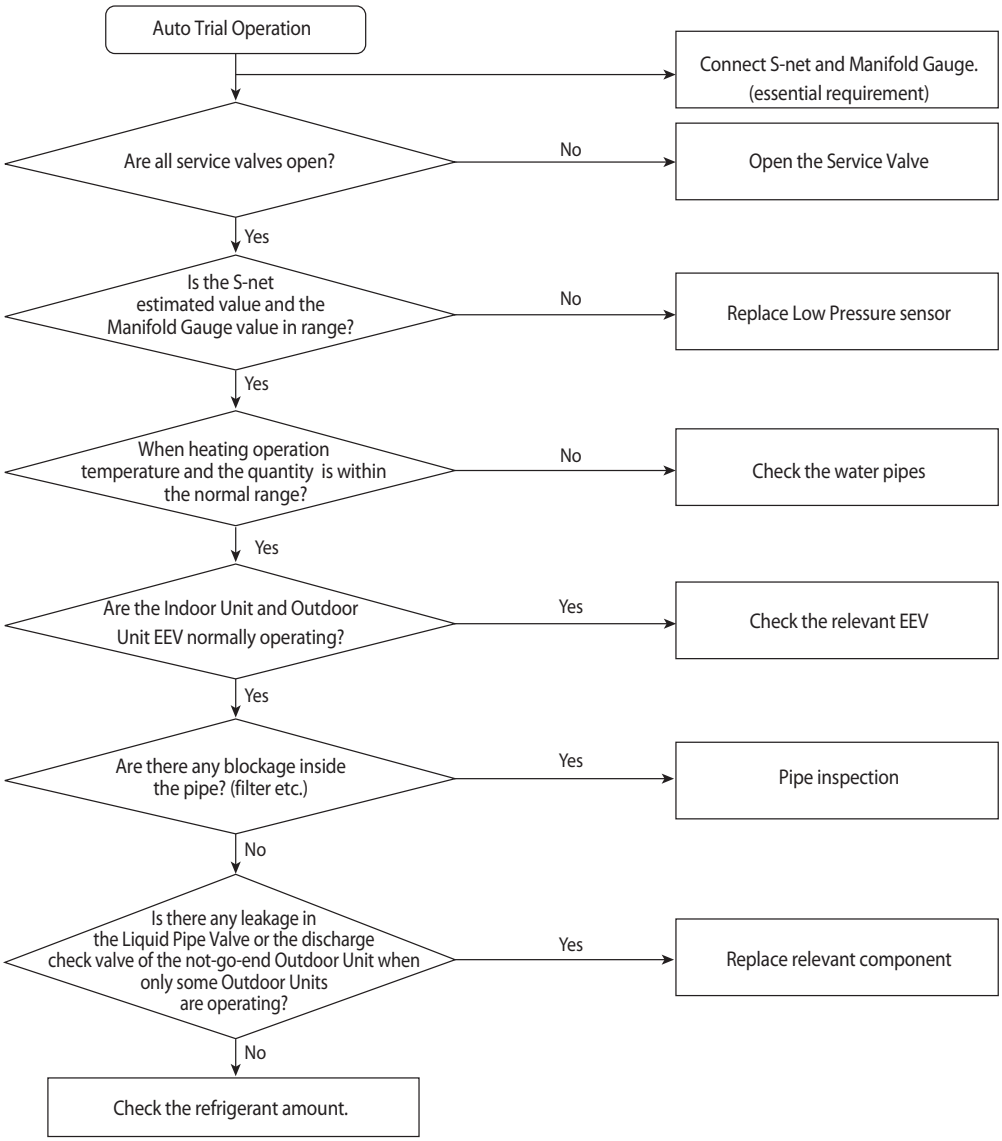
<table>
<tr><td>Outdoor unit display</td><td>E410 (Air Cooled)</td></tr>
<tr><td>Indoorunit display</td><td>
<table>
<tr><th colspan="5">Duct, Cassette (1/2 Way),Console, Celing</th><th colspan="4">Cassette (4/Mini4 Way)</th><th colspan="3">Wall-mounted (NeoForte)</th></tr>
<tr><th>Operation</th><th>Defrost</th><th>Timer</th><th>Fan</th><th>Filter/MPI</th><th>Operation</th><th>Defrost</th><th>Timer</th><th>Filter</th><th>Operation</th><th>Timer</th><th>Turbo</th></tr>
<tr><td>×</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>●</td><td>◑</td><td>◑</td></tr>
</table>
※ ●: ON ◑: Flash ×: OFF
</td></tr>
<tr><td>Judgment Method</td><td>· Judgment Method : Inspection when the value of low pressure sensor is 1.8kg//cm^2, or less for air conditioning and 0.8kg//cm^2 for heating</td></tr>
<tr><td>Cause of problem</td><td>· Refrigerant shortage
· Electronic expansion valve blocked
· Service valve blocked
· Low pressure sensor defective
· Discharge check valve leaking on outdoor unit that is off
· Error may be found when used in temperature range outside the conditions of use
(Operating outside temperature at -20℃ or less for heating and operating outside temperature at -5℃ or less for Cooling)</td></tr>
</table>

1. Cause of problem



<table>
<tr><td>Outdoor unit display</td><td>E410 (Water Cooled)</td></tr>
<tr><td>Indoorunit display</td><td>
<table>
<tr><th colspan="5">Duct, Cassette (1/2 Way),Console, Celing</th><th colspan="4">Cassette (4/Mini4 Way)</th><th colspan="3">Wall-mounted (NeoForte)</th></tr>
<tr><th>Operation</th><th>Defrost</th><th>Timer</th><th>Fan</th><th>Filter/MPI</th><th>Operation</th><th>Defrost</th><th>Timer</th><th>Filter</th><th>Operation</th><th>Timer</th><th>Turbo</th></tr>
<tr><td>×</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>●</td><td>◑</td><td>◑</td></tr>
</table>
※ ●: ON ◑: Flash ×: OFF
</td></tr>
<tr><td>Judgment Method</td><td>· Inspection when the value of low pressure sensor is 2.6kg/cm², or less for air conditioning and 1.4kg/cm² for heating.</td></tr>
<tr><td>Cause of problem</td><td>· Refrigerant shortage
· Electronic expansion valve blocked
· Service valve blocked
· Low pressure sensor defective
· Leakage of compressor discharge check valve of not-go-end outdoor unit
· Error may be found when used in temperature range outside the conditions of use (Operating outside temperature at -20℃ or less for heating and operating outside temperature at -5℃ or less for Cooling)
· When heating operation, if the water temperature and quantity are below the normal range.</td></tr>
</table>

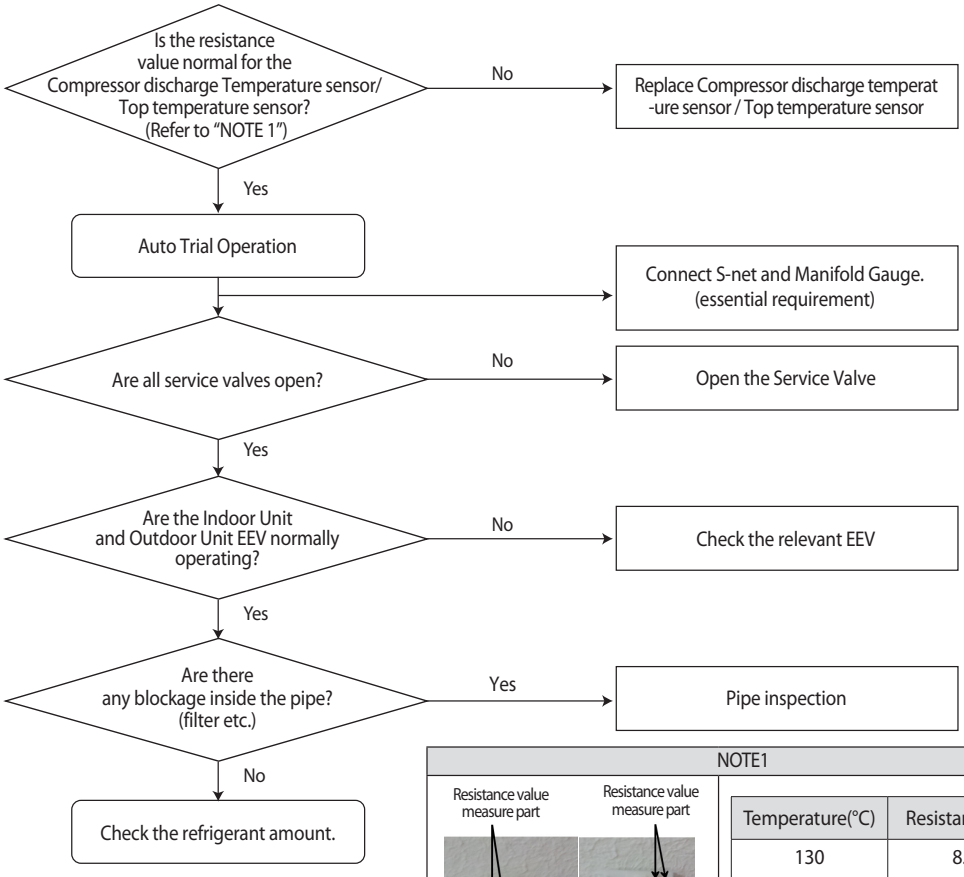
1. Cause of problem



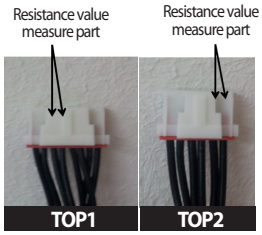
4-3-33 E416 : Suspension of starting due to Compressor discharge temperature sensor / Top temperature sensor

Outdoor unit display	E416
Indoorunit display	Duct, Cassette (1/2 Way),Console, Celing: Operation × / Defrost × / Timer ◑ / Fan ◑ / Filter/MPI ◑ Cassette (4/Mini4 Way): Operation × / Defrost ◑ / Timer ◑ / Filter ◑ Wall-mounted (NeoForte): Operation ● / Timer ◑ / Turbo ◑ ※ ●: ON ◑: Flash ×: OFF
Judgment Method	· When value of Compressor discharge temperature sensor / Top temperature sensor is checked at 120℃ or more
Cause of problem	· Refrigerant shortage · Electronic expansion valve is blocked. · Service valve blocked · Defective discharge temperature sensor · TOP temperature sensor defective · Blocked pipe and defective · Discharge check valve leaking on outdoor unit that is off

1. Cause of problem



NOTE1



TOP1 : CN43 (3, 4)
TOP2 : CN45 (5, 6)
DIS1 : CN43 (1, 2)
DIS2 : CN45 (3, 4)

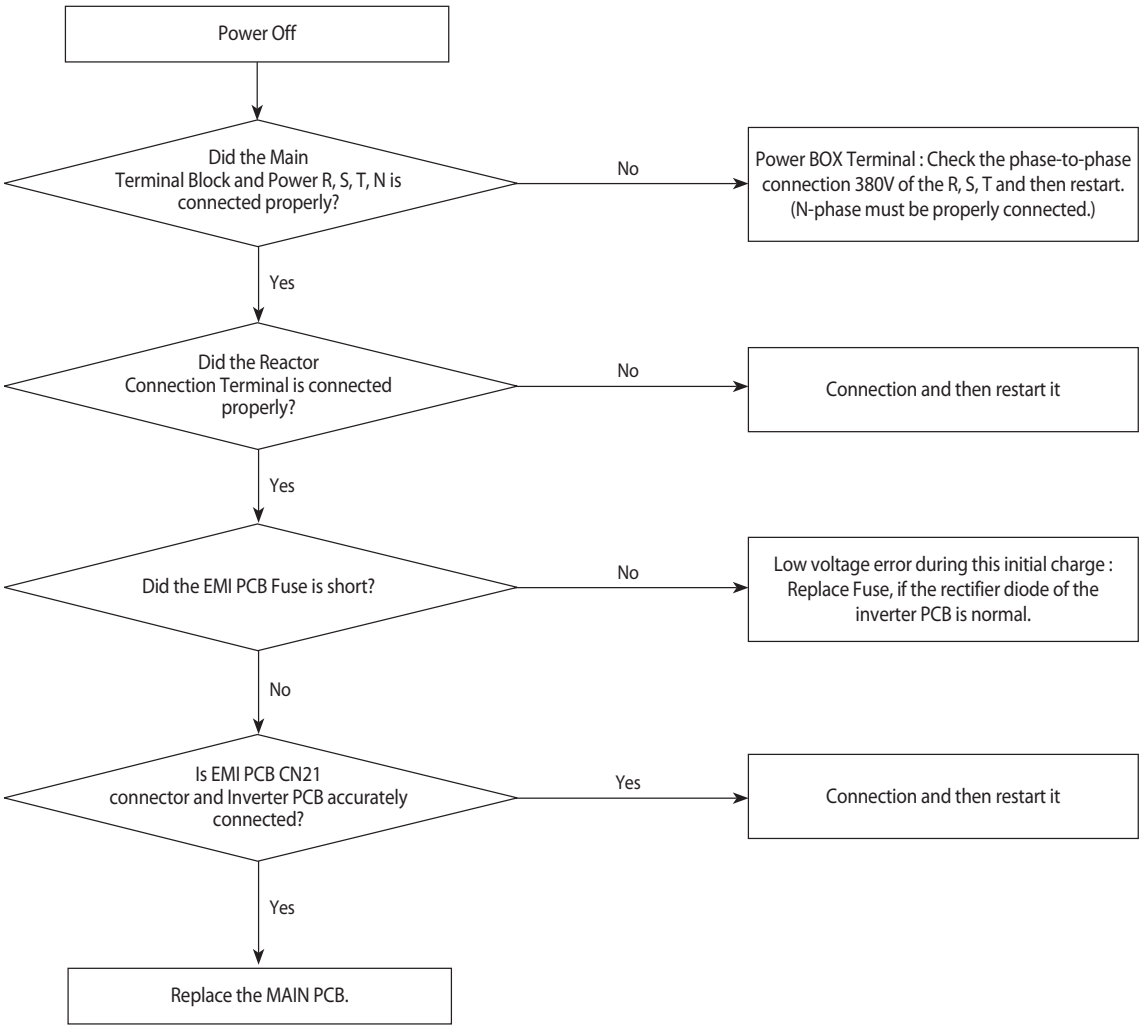
Temperature(°C)	Resistance(KΩ)
130	8.9
120	11.2
100	18.5
80	32.0
60	59.0
25	200.0
20	242.0
10	362.0
0	553.0

4-3-34 3-phase Input Wiring error

<table>
<tr><td>Outdoor unit display</td><td>E425</td></tr>
<tr><td>Indoorunit display</td><td>
<table>
<tr><td colspan="5">Duct, Cassette (1/2 Way),Console, Celing</td><td colspan="4">Cassette (4/Mini4 Way)</td><td colspan="3">Wall-mounted (NeoForte)</td></tr>
<tr><td>Operation</td><td>Defrost</td><td>Timer</td><td>Fan</td><td>Filter/MPI</td><td>Operation</td><td>Defrost</td><td>Timer</td><td>Filter</td><td>Operation</td><td>Timer</td><td>Turbo</td></tr>
<tr><td>×</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>●</td><td>◑</td><td>◑</td></tr>
</table>
※ ●: ON ◑: Flash ×: OFF</td></tr>
<tr><td>Judgment Method</td><td>. When turn on the power and check the status of the power from the inverter.
If the phase does not connect the power(no phase) : E425 or E466 (E366) is displayed
(Air conditioner to maintain the normal state.)

However) N-phase must be properly connected.</td></tr>
<tr><td>Cause of problem</td><td>· Check the input wiring
· EMI Fuse short</td></tr>
</table>

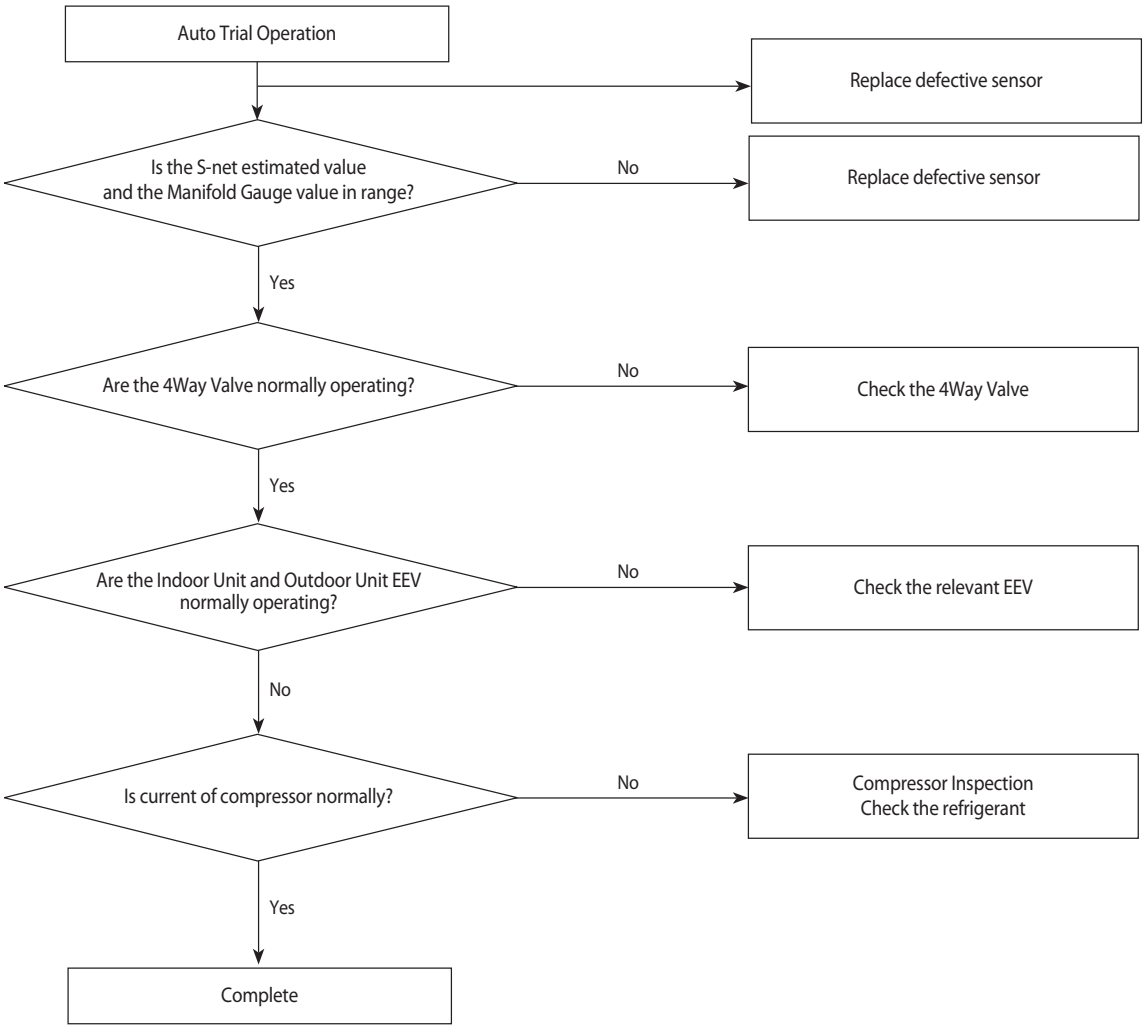
1. Cause of problem



4-3-35 E428 : Suspension of starting by abnormal compression ratio

Outdoor unit display	E428
Indoorunit display	Duct, Cassette (1/2 Way),Console, Celing: Operation × / Defrost × / Timer ◑ / Fan ◑ / Filter/MPI ◑ Cassette (4/Mini4 Way): Operation × / Defrost ◑ / Timer ◑ / Filter ◑ Wall-mounted (NeoForte): Operation ● / Timer ◑ / Turbo ◑ ※ ●: ON ◑: Flash ×: OFF
Judgment Method	· Compression ratio [(High pressure+1.03)/(Low pressure+1.03)] less than 1.5 and lasts for 10 minutes or more · Differential pressure (high pressure - low pressure) less than 0.4 MPa.g and lasts for 10 minutes or more
Cause of problem	· Indoor and Outdoor EEV breakdown · 4Way Valve breakdown · High and Low pressure sensor defective · Refrigerant shortage

1. Cause of problem



4-3-36 EVI EEV Open error

<table>
<tr><td>Outdoor unit display</td><td>E438</td></tr>
<tr><td>Indoorunit display</td><td>
<table>
<tr><td colspan="5">Duct, Cassette (1/2 Way),Console, Celing</td><td colspan="4">Cassette (4/Mini4 Way)</td><td colspan="3">Wall-mounted (NeoForte)</td></tr>
<tr><td>Operation</td><td>Defrost</td><td>Timer</td><td>Fan</td><td>Filter/MPI</td><td>Operation</td><td>Defrost</td><td>Timer</td><td>Filter</td><td>Operation</td><td>Timer</td><td>Turbo</td></tr>
<tr><td>×</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>●</td><td>◑</td><td>◑</td></tr>
</table>
※ ●: ON ◑: Flash ×: OFF
</td></tr>
<tr><td>Judgment Method</td><td>· DSH<5℃ , EVI Out-EVI In<0℃ & frequency> 65Hz 40 minutes maintaining</td></tr>
<tr><td>Cause of problem</td><td>· EVI EEV and Intercooler leakage, excessive refrigerant amount, Outdoor Check Valve inserted opposite.
· Indoor Unit EEV leakage, direct connection between Indoor Liquid Pipe and the Gas Pipe.</td></tr>
</table>

※ For the indoor EEV leakage check, operate one of the indoor units in cooling mode and the others in fan mode.

· In case of normal units in fan mode, EVA In/Out temperatures become close to the room temperature within 5minutes.

· Change the cooling unit to the fan mode and one of the fan unit to the cooling mode, and then check again.

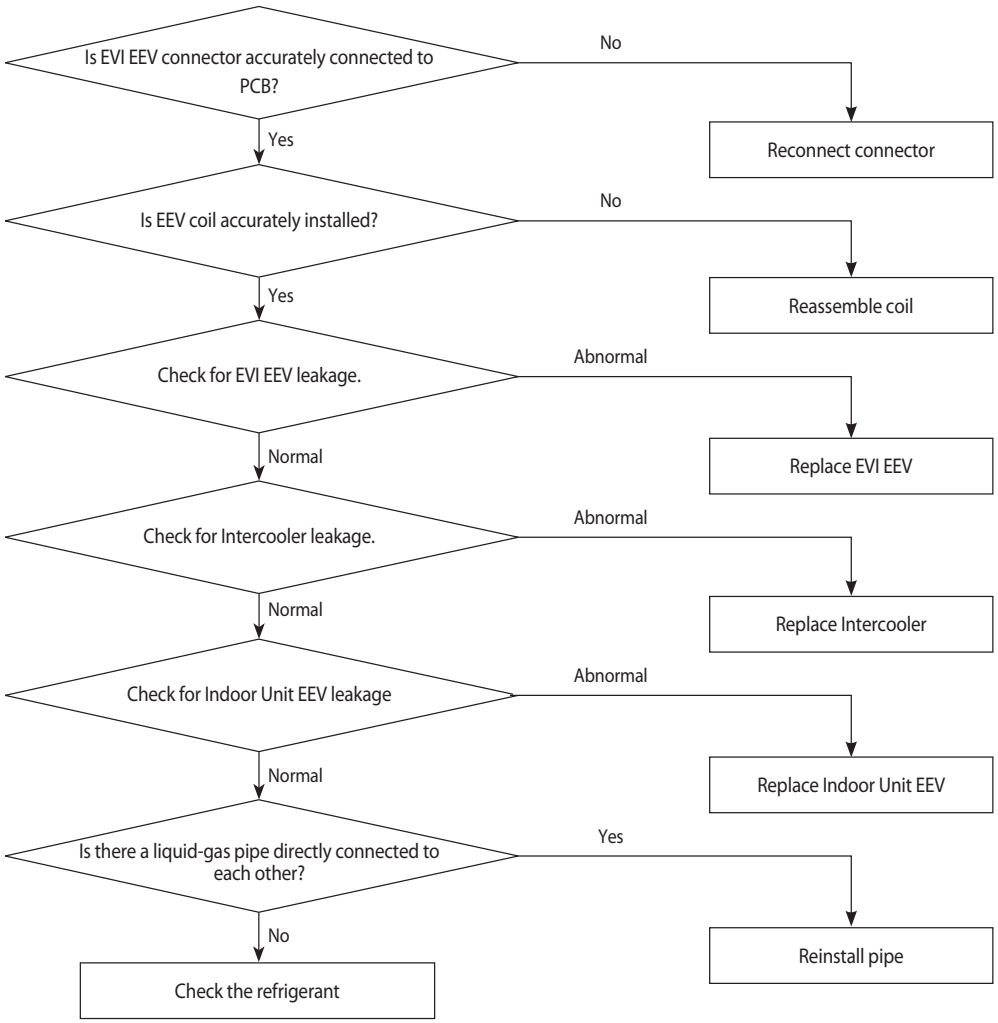
※ If the refrigerant amount was excessively charged, DSH may be decreased during the cooling operation at low temperature.

※ For the EVI EEV leakage check, check for the EVI in sensor temperature when the cooling operation with the EVI EEV 0step.

· Separate the EVI EEV connector from the HUB PBA, when the outdoor unit is off.

· In case of EVI EEV leakage in cooling mode, EVI In temperature at least 10℃ lower than the outside temperature.

1. Cause of problem

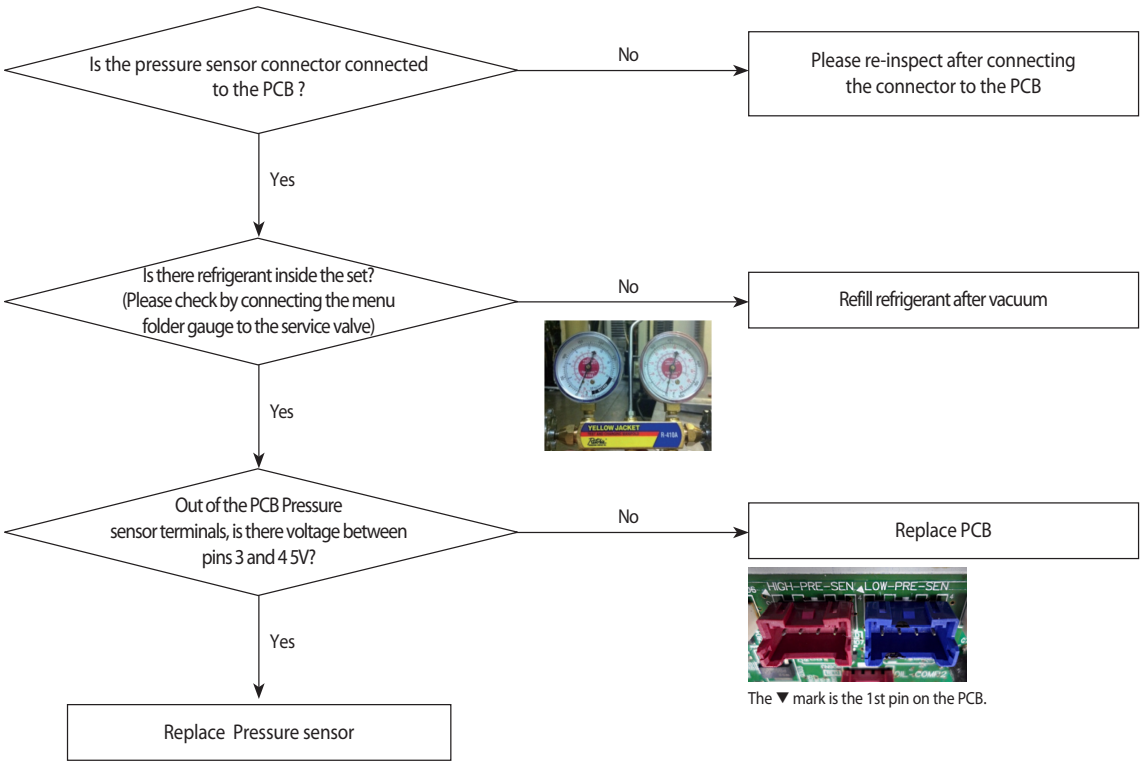


4-3-37 Refrigerant leakage error

Outdoor unit display	E439 (Refrigerant leakage judgment before starting) E443 (When start, refrigerant leakage judgment)
Judgment Method	· Before starting : Before compressor starting after system halt 2 minutes (High & low pressure sensor Open / Short error occurs and 1kg/cm2 or less) · When start : When the high pressure sensor value(cooling 3.1kg/ ㎠ , heating 2.2kg/ ㎠) is detection continuously for 3 seconds
Cause of problem	· Refrigerant leakage and shortage · Disconnection or breakdown of high & low pressure sensor

1. Pressure sensor Open/Short error determination method
   1) Identifies from when power is supplied or 2 minutes after RESET, and only when set is stopped.
   2) An Open/Short error will occur if the input voltage standard range of 0.5V ~ 4.95V is exceeded.

2. Inspection Method



The ▼ mark is the 1st pin on the PCB.

4-3-38 Prevention of heating / cooling operation due to outdoor temperature

<table>
<tr><td>Outdoor unit display</td><td>E440 (Prevention of heating operation due to high temperature of outdoor)
E441 (Prevention of cooling operation due to low temperature of outdoor)</td></tr>
<tr><td>Indoorunit display</td><td>
<table>
<tr><td colspan="5">Duct, Cassette (1/2 Way),Console, Celing</td><td colspan="4">Cassette (4/Mini4 Way)</td><td colspan="3">Wall-mounted (NeoForte)</td></tr>
<tr><td>Operation</td><td>Defrost</td><td>Timer</td><td>Fan</td><td>Filter/MPI</td><td>Operation</td><td>Defrost</td><td>Timer</td><td>Filter</td><td>Operation</td><td>Timer</td><td>Turbo</td></tr>
<tr><td>×</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>●</td><td>◑</td><td>◑</td></tr>
</table>
※ ●: ON ◑: Flash ×: OFF</td></tr>
<tr><td>Judgment Method</td><td>· Heating operation : When the outdoor temperature is more than 30℃
· Cooling operation : When the outdoor temperature is less than -25℃</td></tr>
<tr><td>Cause of problem</td><td>· System protection operation status (Is not breakdown)
· If the outdoor temperature is satisfied the operating range, it will clear the error and start the operation automatically.</td></tr>
</table>

4-3-39 Prevention of heating refrigerant charge due to outdoor temperature

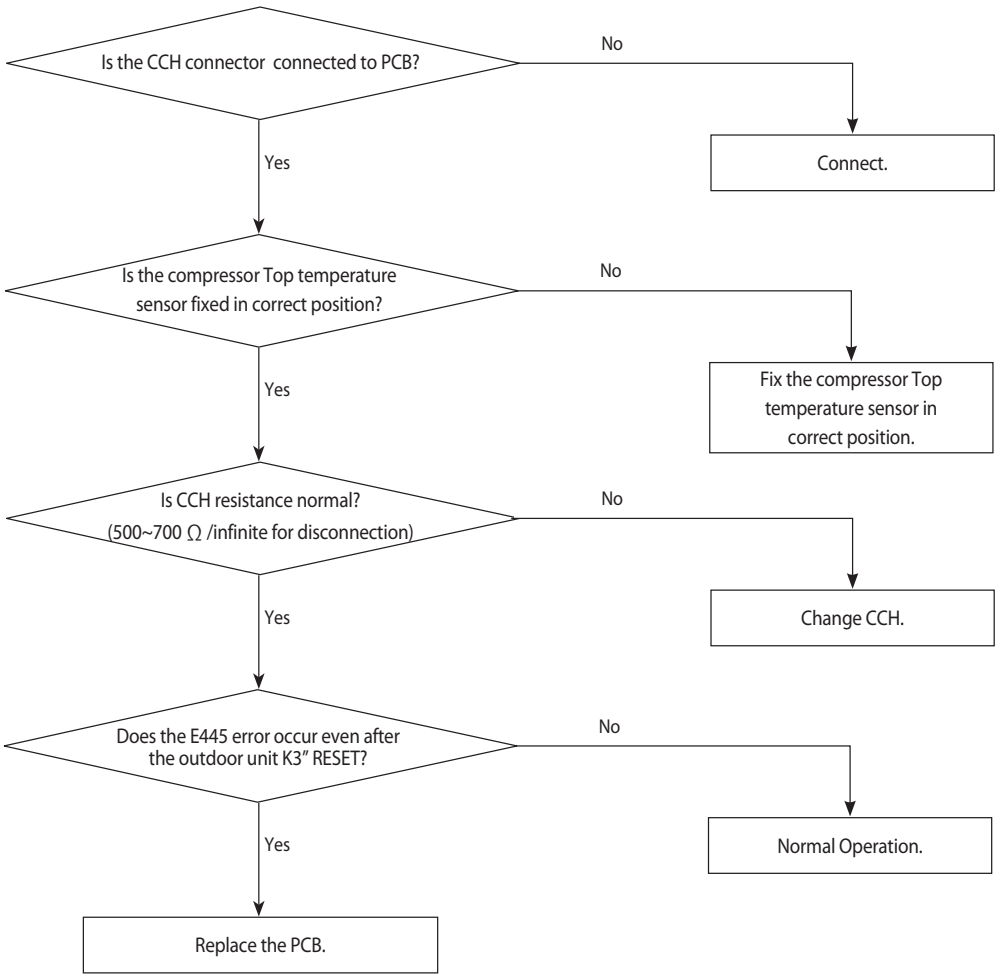
<table>
<tr><td>Outdoor unit display</td><td>E442</td></tr>
<tr><td>Indoorunit display</td><td>
<table>
<tr><th colspan="5">Duct, Cassette (1/2 Way),Console, Celing</th><th colspan="4">Cassette (4/Mini4 Way)</th><th colspan="3">Wall-mounted (NeoForte)</th></tr>
<tr><th>Operation</th><th>Defrost</th><th>Timer</th><th>Fan</th><th>Filter/MPI</th><th>Operation</th><th>Defrost</th><th>Timer</th><th>Filter</th><th>Operation</th><th>Timer</th><th>Turbo</th></tr>
<tr><td>×</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>●</td><td>◑</td><td>◑</td></tr>
</table>
※ ●: ON ◑: Flash ×: OFF
</td></tr>
<tr><td>Judgment Method</td><td>• When the heating refrigerant charge : If the outdoor temperature is more than 15℃</td></tr>
<tr><td>Special Cause</td><td>• System protection operation status (Is not breakdown)</td></tr>
</table>

4-3-40 CH wire breaking error

<table>
<tr><td>Outdoor unit display</td><td colspan="11">E445 (Air Cooled)</td></tr>
<tr><td rowspan="3">Indoorunit display</td><td colspan="5">Duct, Cassette (1/2 Way),Console, Celing</td><td colspan="4">Cassette (4/Mini4 Way)</td><td colspan="3">Wall-mounted (NeoForte)</td></tr>
<tr><td>Operation</td><td>Defrost</td><td>Timer</td><td>Fan</td><td>Filter/MPI</td><td>Operation</td><td>Defrost</td><td>Timer</td><td>Filter</td><td>Operation</td><td>Timer</td><td>Turbo</td></tr>
<tr><td>×</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>●</td><td>◑</td><td>◑</td></tr>
<tr><td colspan="12">※ ●: ON ◑: Flash ×: OFF</td></tr>
<tr><td>Judgment Method</td><td colspan="11">· Refer to the judgment method below.</td></tr>
<tr><td>Cause of problem</td><td colspan="11">· CCH Connector PCB is not connected / Compressor Top sensor breakaway / Own problem of CCH</td></tr>
</table>

1. Judgment Method (2hours after reset or power on, It will be judged once.)
   ① Compressor Top temperature at the time of judgment - Tini < 2℃ (※Tini : Power on or temperature of initial compressor Top after reset)
   ② Compressor Top temperature at the time of judgment - Outdoor temperature < 2℃
   ③ Outdoor temperature < 30℃
   ④ UP state

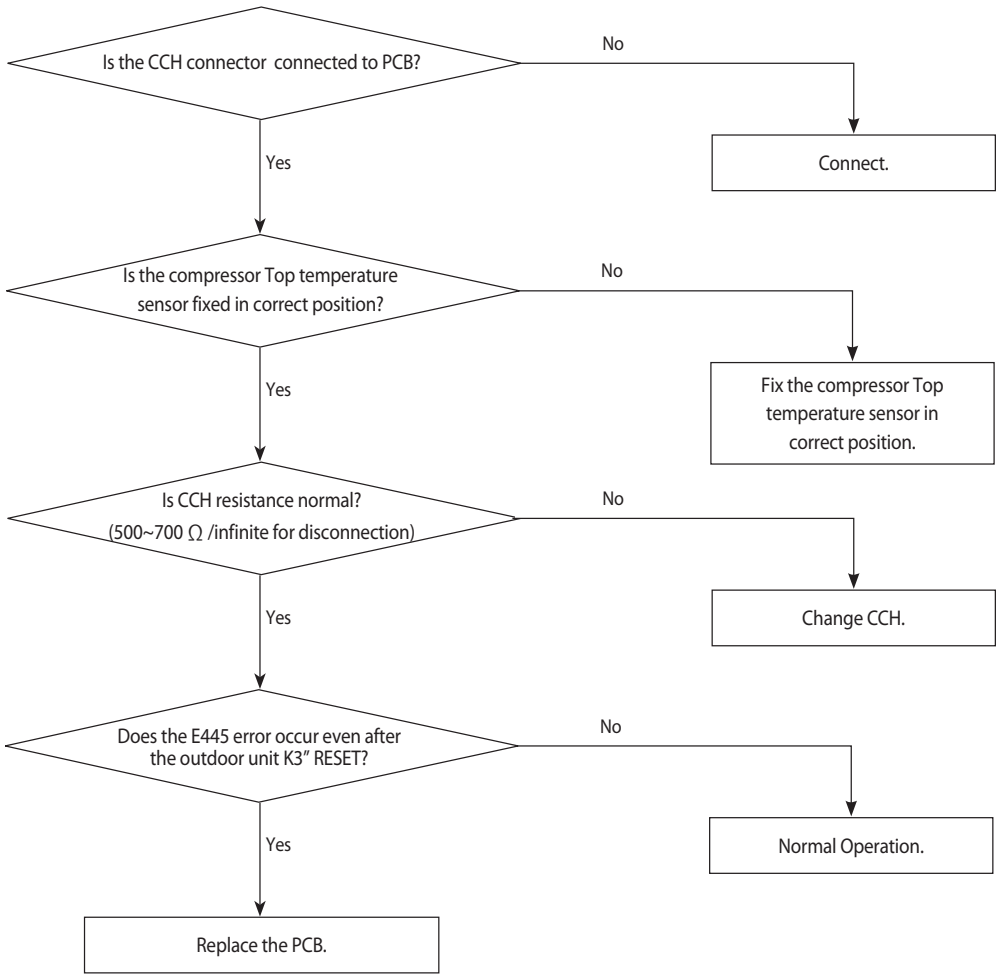
※ If all the conditions are satisfied at the same time : Mark the CCH wire breaking error (E445)



<table>
<tr><td>Outdoor unit display</td><td>E445 (Water Cooled)</td></tr>
<tr><td>Indoorunit display</td><td>
<table>
<tr><th colspan="5">Duct, Cassette (1/2 Way),Console, Celing</th><th colspan="4">Cassette (4/Mini4 Way)</th><th colspan="3">Wall-mounted (NeoForte)</th></tr>
<tr><th>Operation</th><th>Defrost</th><th>Timer</th><th>Fan</th><th>Filter/MPI</th><th>Operation</th><th>Defrost</th><th>Timer</th><th>Filter</th><th>Operation</th><th>Timer</th><th>Turbo</th></tr>
<tr><td>×</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>●</td><td>◑</td><td>◑</td></tr>
</table>
※ ●: ON ◑: Flash ×: OFF
</td></tr>
<tr><td>Judgment Method</td><td>· Refer to the judgment method below.</td></tr>
<tr><td>Cause of problem</td><td>· CCH Connector PCB is not connected / Compressor Top sensor breakaway / Own problem of CCH</td></tr>
</table>

1. Judgment Method (2hours after reset or power on, It will be judged once.)
   ① Compressor Top temperature at the time of judgment - Tini < 2℃ (※Tini : Power on or temperature of initial compressor Top after reset)
   ② Compressor Top temperature at the time of judgment- suction1 temp. sensor < 30℃
   ③ Outdoor temperature < 30℃
   ④ UP state

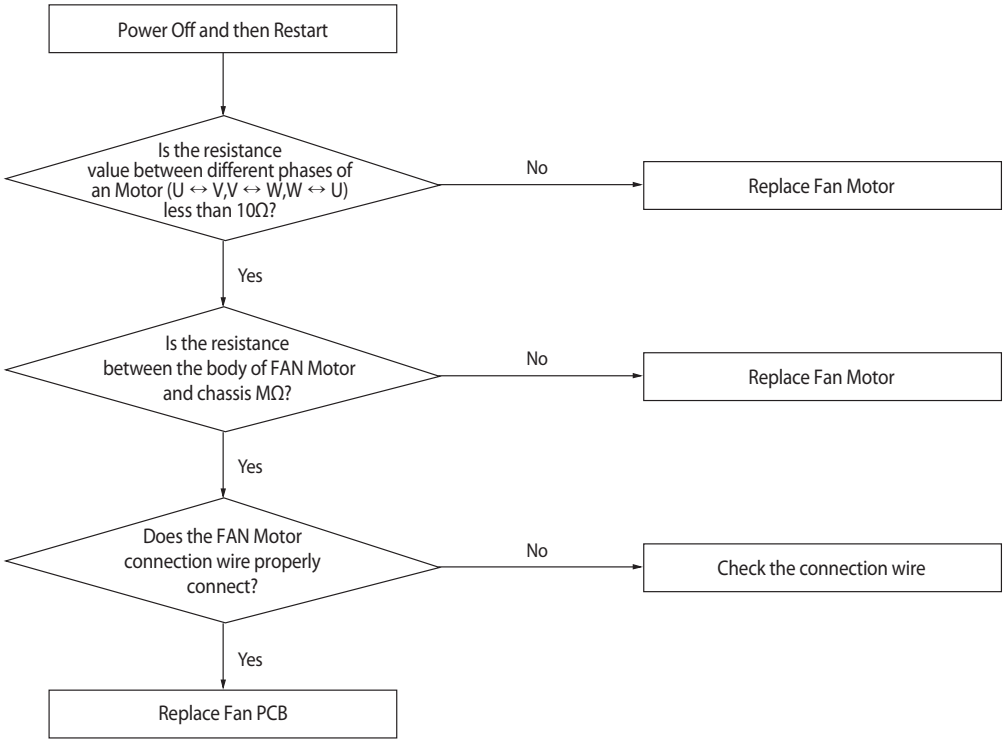
※ If all the conditions are satisfied at the same time : Mark the CCH wire breaking error (E445)



4-3-41 Fan starting error

Outdoor unit display	E446 (FAN PCB(FAN1)) E346 (FAN PCB(FAN2))
Judgment Method	· Startup, and then if the speed increase is not normally. · Detected by H/W or S/W
Cause of problem	· FAN motor connection error. · Defective FAN motor. · Defective PCB.

1. Cause of problem



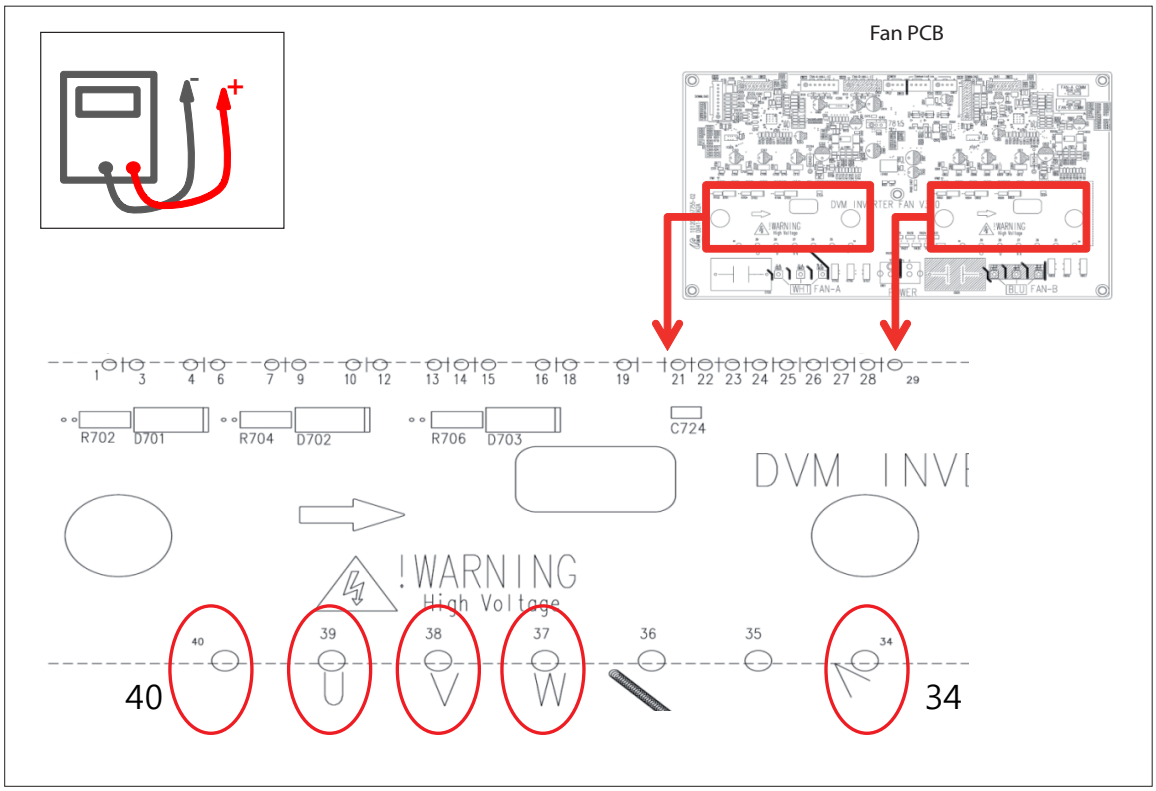
IPM breakdown diagnostics (FAN PCB)

1. Preparations before checking
   1) Power Off
   2) IPM failure, discharge mode may not work properly. Therefore, wait more than 15 minutes after the Power Off.
   3) Remove all of the Fan PCB connectors. ((FAN motor connector included.)
   4) Prepare the digital multi tester.

2. Inspection Method
   1) Refer to Figure1 and Table1, respectively the resistance value and diode voltage value measure.
   2) According to the criterion in Table 1 to determine whether the failure of IPM.

Division	Measured Point		Criterion	Remark
	+	-		
Measure the resistance values	40	U	More than 500 kΩ	Measurement error can occur for reasons such as the initial measurement condenser discharge. Measured over at least three times.
	40	V		
	40	W		
	U	34		
	V	34		
	W	34		
Measure the diode voltage values	U	40	0.3~0.7V	
	V	40		
	W	40		
	34	U		
	34	V		
	34	W		

< Table 1 >

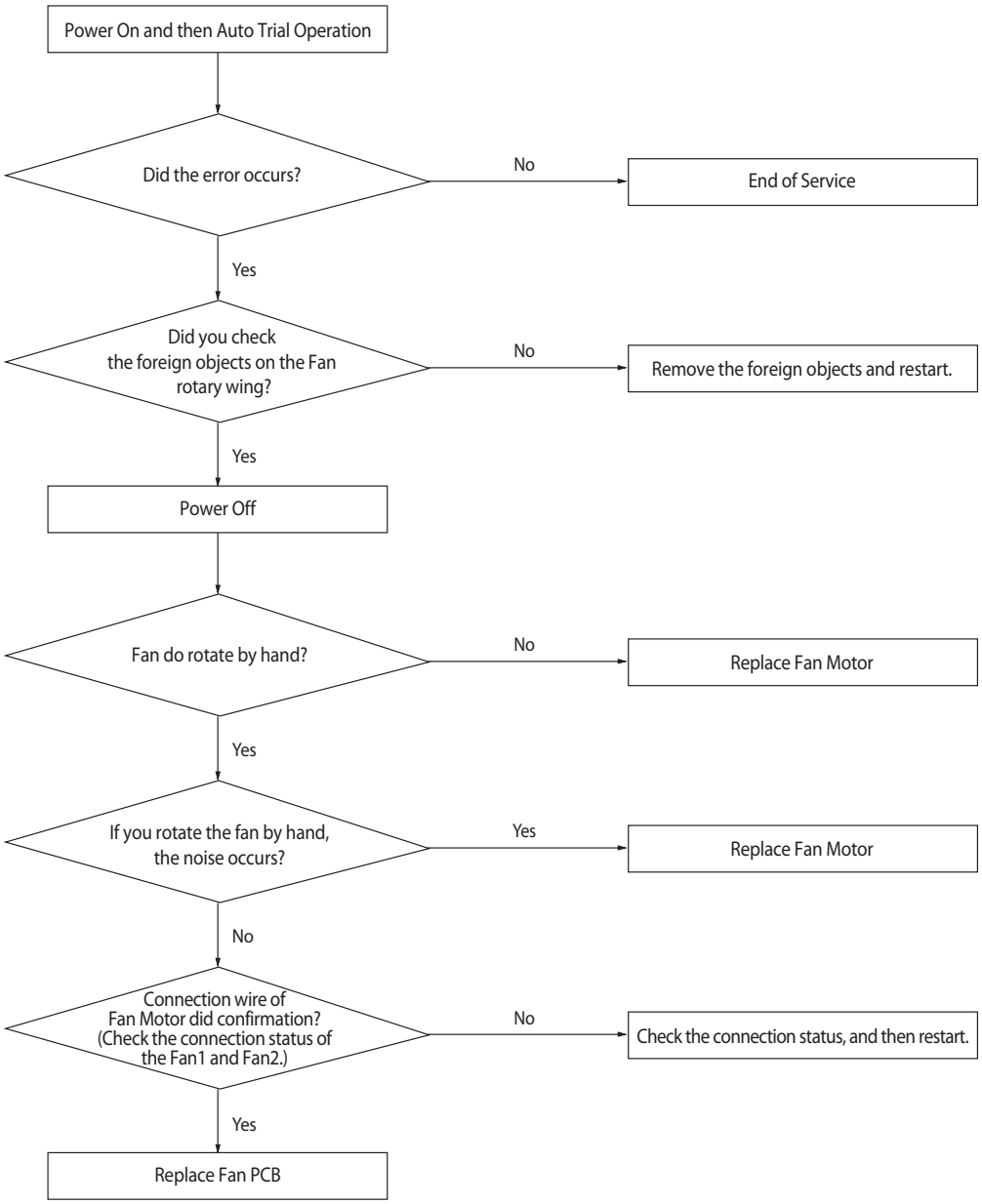


< Figure 1 >

4-3-42 Fan lock error

Outdoor unit display	E448 (FAN PCB(FAN1)) E348 (FAN PCB(FAN2))
Judgment Method	· Is checked symptoms by phase current of Fan Motor.
Cause of problem	· Fan Motor connection error. · Defective Fan · Defective PCB

1. Cause of problem



4-3-43 Momentary Blackout error

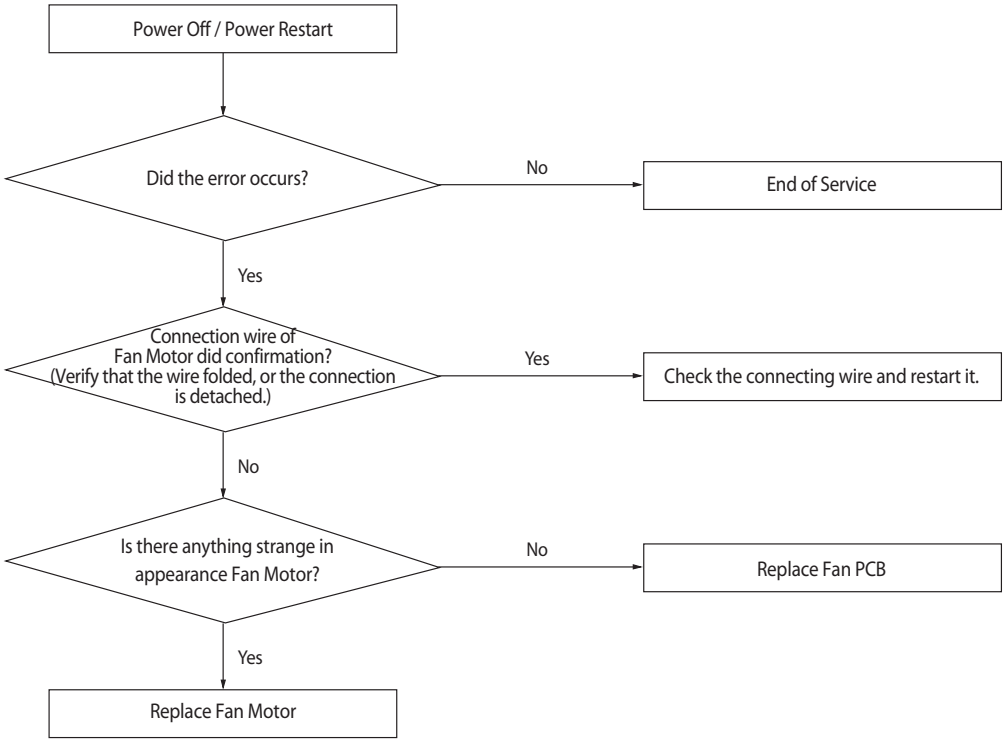
<table>
<tr><td>Outdoor unit display</td><td>E452</td></tr>
<tr><td>Indoorunit display</td><td>
<table>
<tr><td colspan="5">Duct, Cassette (1/2 Way),Console, Celing</td><td colspan="4">Cassette (4/Mini4 Way)</td><td colspan="3">Wall-mounted (NeoForte)</td></tr>
<tr><td>Operation</td><td>Defrost</td><td>Timer</td><td>Fan</td><td>Filter/MPI</td><td>Operation</td><td>Defrost</td><td>Timer</td><td>Filter</td><td>Operation</td><td>Timer</td><td>Turbo</td></tr>
<tr><td>×</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>×</td><td>◑</td><td>◑</td><td>◑</td><td>●</td><td>◑</td><td>◑</td></tr>
</table>
※ ●: ON ◑: Flash ×: OFF
</td></tr>
<tr><td>Judgment Method</td><td>· Momentary stop of compressor due to momentary blackout.</td></tr>
<tr><td>Cause of problem</td><td>· Momentary stop of compressor due to momentary blackout.</td></tr>
</table>

1. Precautions : Replace Hub PCB or Main PCB.

4-3-44 Outdoor Fan Motor overheating

Outdoor unit display	E453 (FAN PCB(FAN1)) E353 (FAN PCB(FAN2))
Judgment Method	· Overheating due to the internal sensor of the Fan Motor.
Cause of problem	· Defective connection wire · Defective Fan Motor · Defective PCB · Defective installation conditions

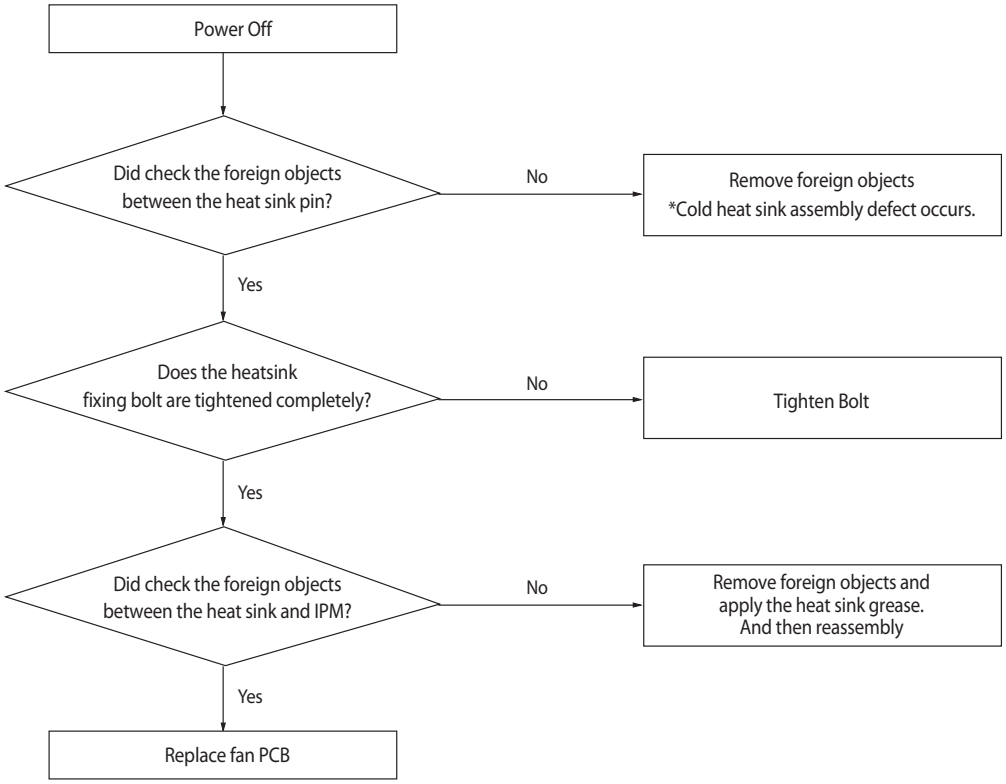
1. Cause of problem



4-3-45 Fan IPM Overheat error

Outdoor unit display	E455 (FAN1 PCB) E355 (FAN2 PCB)
Judgment Method	· IPM internal temperature more than 85°C (E455, E355)
Cause of problem	· Heat sink and IPM assembly defective. · Defective heat sink cooling

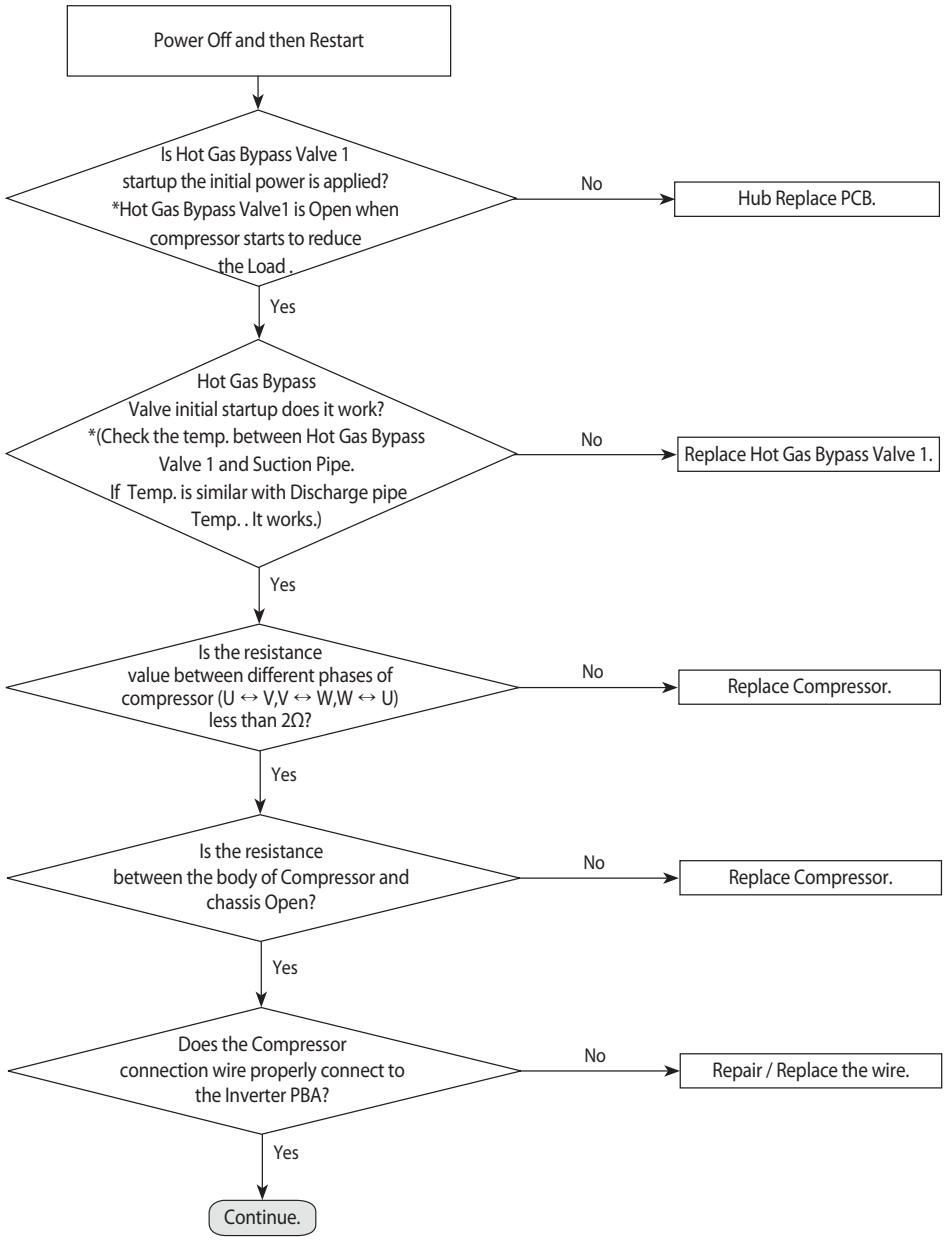
1. Cause of problem



4-3-46 Compressor starting error

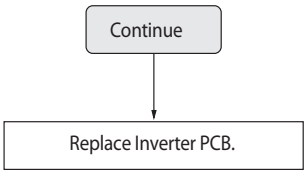
Outdoor unit display	E461 (INVERTER1 PCB) E361 (INVERTER2 PCB)
Judgment Method	· Startup, and then if the speed increase is not normally. · Detected by H/W or S/W.
Cause of problem	· Compressor connection error · Defective Compressor

1. Cause of problem

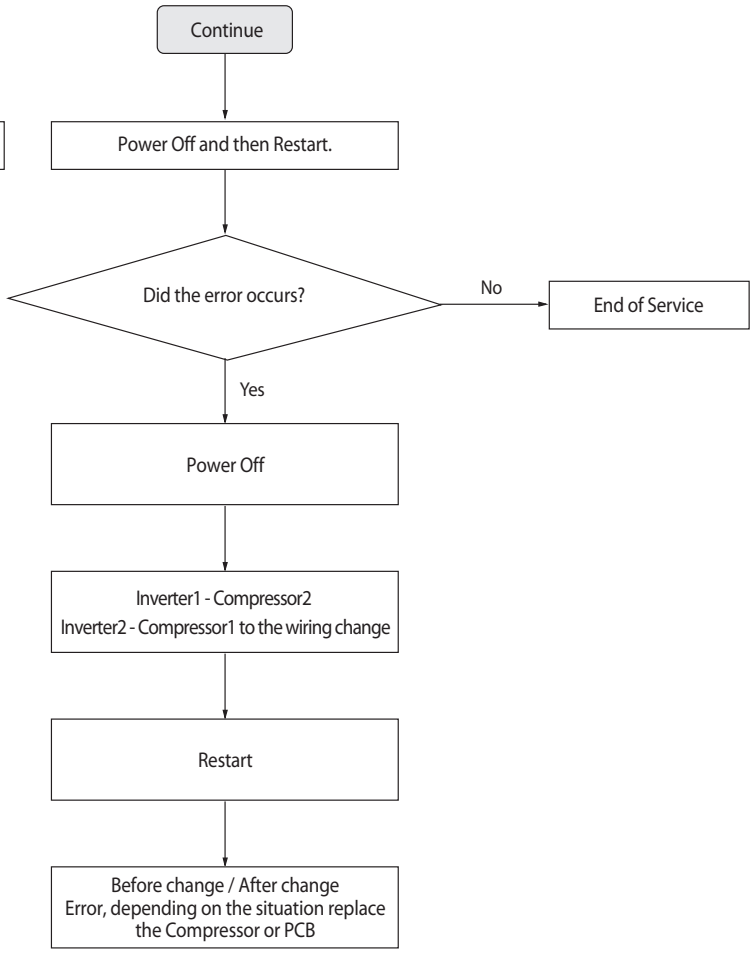


Compressor starting error (cont.)

■ **Compressor applied one**



■ **Compressor applied two**

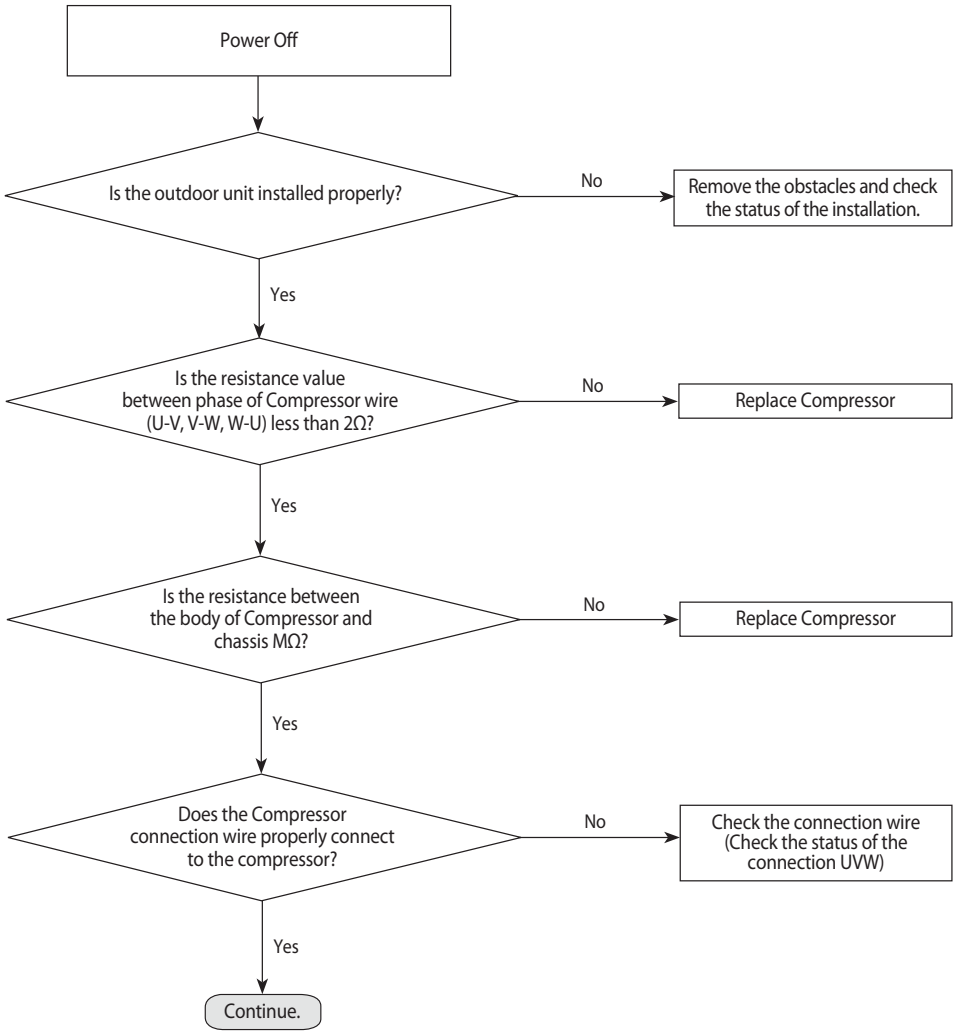


Before change	After change	Measure
E464	E464	Replace No.1Inverter PCB
E464	E364	Replace No.1 Compressor
E364	E364	Replace No.2 Inverter PCB
E364	E464	Replace No.2 Compressor

4-3-47 COMP Overcurrent error

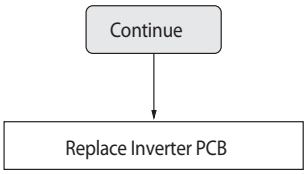
Outdoor unit display	E464/E465 (INVERTER1 PCB) E364/E365 (INVERTER2 PCB)
Judgment Method	· Will occur if the overcurrent flowing in the IPM. · Detected by H/W or S/W
Cause of problem	· COMP. defective. · Inverter PCB Defective.

1. Cause of problem

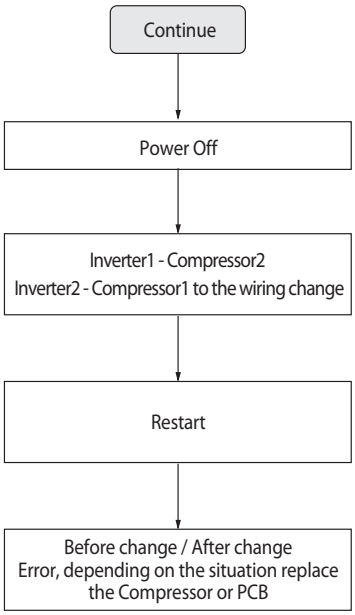


Inverter Overcurrent error (cont.)

■ Compressor applied one



■ Compressor applied two



Before change	After change	Measure
E464	E464	Replace No.1Inverter PCB
E464	E364	Replace No.1 Compressor
E364	E364	Replace No.2 Inverter PCB
E364	E464	Replace No.2 Compressor

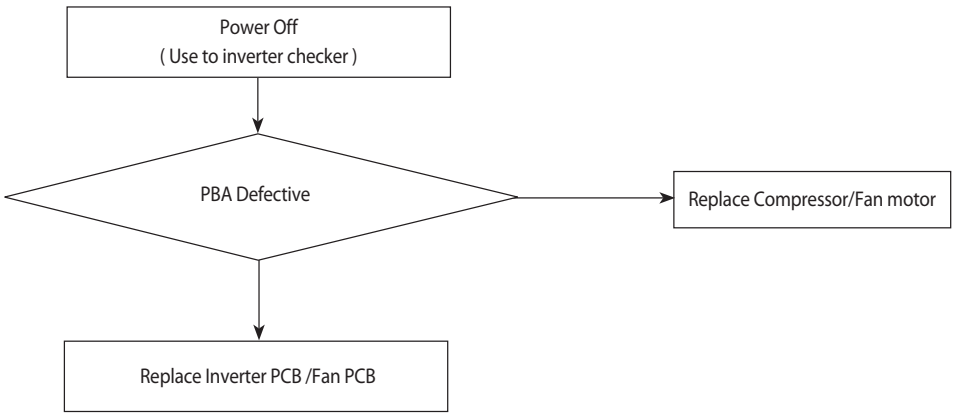
■ How to use inverter checker (Warning for high pressure)

► Check between MOTOR ↔ FAN PBA

1) After cut off, connect inverter checker with U,V,W of Motor
2) After turn on, enter Comp. check mode by pushing K2 in main PBA
3) Judgment
   - 6 LEDs of inverter checker are lightning successively (MOTOR PBA OK, MOTOR NG)
   - If one of 6 LEDs in inverter checker is not lightning (MOTOR PBA NG, MOTOR OK)

■ How to enter check mode/7Seg display

Type	DVM S	
Model	Air Cooled	Water Cooled
COMP 1	9times (KD__)	8times (KD__)
COMP 2	10times (KE__)	9times (KE__)
MOTOR 1	11times (KF__)	
MOTOR 2	12times (KG__)	



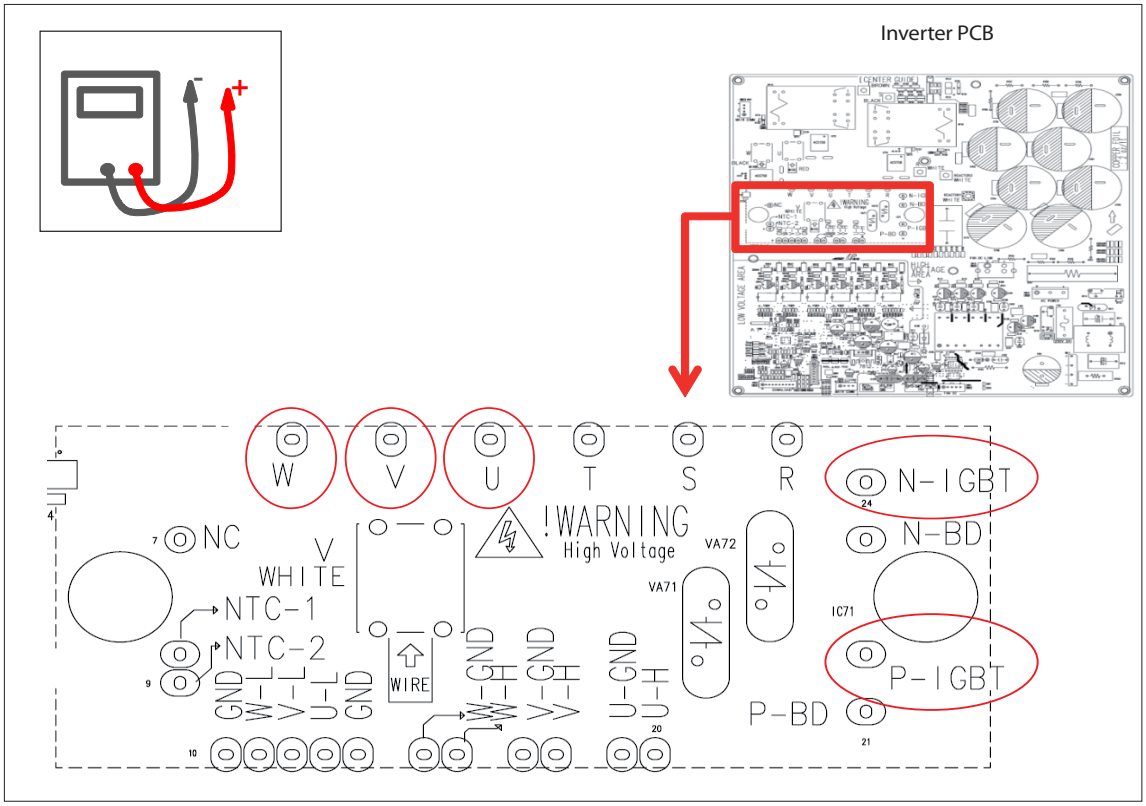
IPM [IGBT] breakdown diagnostics (Inverter PCB)

1. Preparations before checking
   1) Power Off.
   2) IPM failure, discharge mode may not work properly. Therefore, wait more than 15 minutes after the Power Off.
   3) Remove all of the Inverter PCB connectors and wire that is fixed as screw.
      (Include wire that is fixed to compressor and DC Reactor.)
   4) Prepare the digital multi tester.

2. Inspection Method
   1) Refer to Figure1 and Table1, respectively the resistance value and diode voltage value measure.
   2) According to the criterion in Table 1 to determine whether the failure of IPM.

Division	Measured Point		Criterion	Remark
	+	-		
Measure the resistance values	P-IGBT	U	More than 500 kΩ	Measurement error can occur for reasons s uch as the initial measurement condenser discharge. Measured over at least three times.
	P-IGBT	V		
	P-IGBT	W		
	U	N-IGBT		
	V	N-IGBT		
	W	N-IGBT		
Measure the diode voltage values	U	P-IGBT	0.3~0.7V	
	V	P-IGBT		
	W	P-IGBT		
	N-IGBT	U		
	N-IGBT	V		
	N-IGBT	W		

< Table 1 >

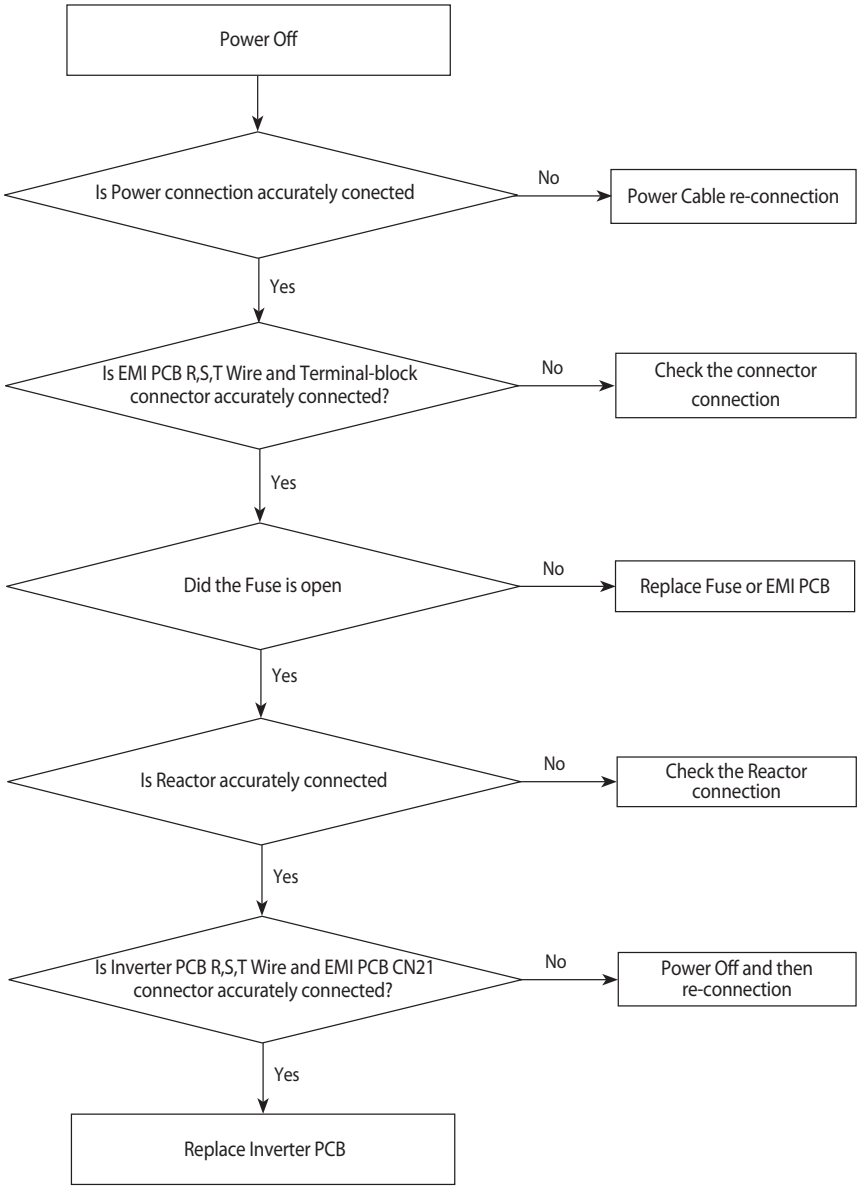


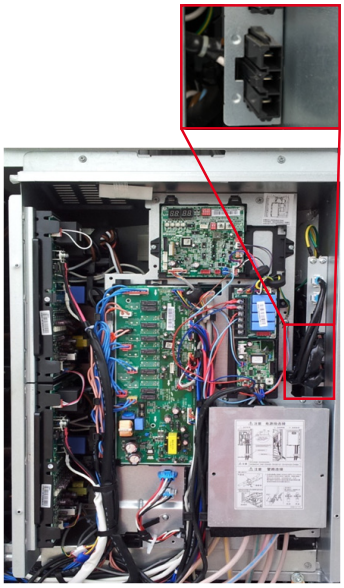
< Figure 1 >

4-3-48 Overvoltage / Low voltage error

Outdoor unit display	E466 (INVERTER1 PCB) E366 (INVERTER2 PCB)
Judgment Method	· Input wiring error EMI fuse open. · DC-Link Overvoltage / Low voltage occurs.
Cause of problem	· Check the input wiring · EMI Fuse OPEN

1. Cause of problem





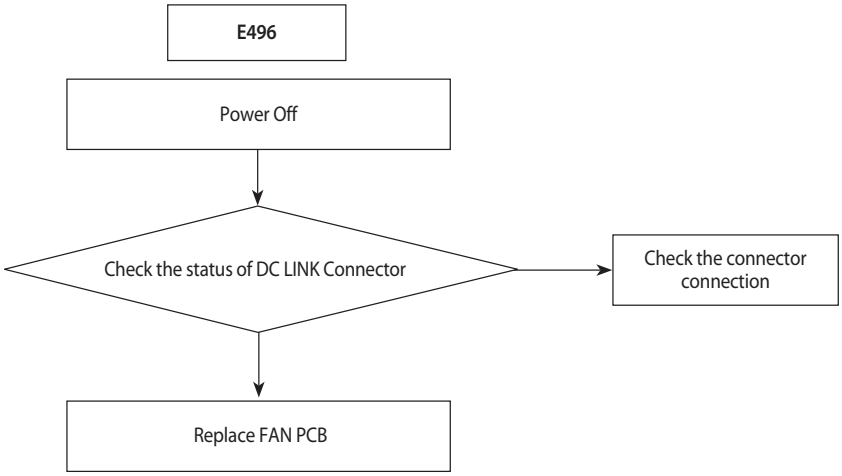
EMI PCB R,S,T Wire and Terminal-block connector

Type of Power Source	AC Input Voltage	Standard AC Voltage(Vac)		Standard DC Voltage(Vdc)	
		Min.	Max.	Min.	Max.
F	208~230V	177	265	250	374
J	460V	391	552	553	781

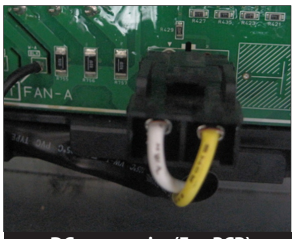
4-3-49 DC Link voltage sensor error

Outdoor unit display	E469 (INVERTER1 PCB) E369 (INVERTER2 PCB) E496 (OUTDOOR FAN 1 PCB)
Judgment Method	· DC voltage detection : Error judgment where the voltage value is more than 4.8V or less than 0.2V.
Cause of problem	· DC Link Connector disconnected · PCB voltage sensing circuit defective

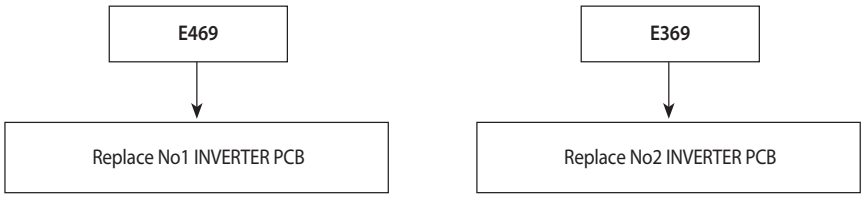
1. Cause of problem




DC power wire (Inv. PCB)



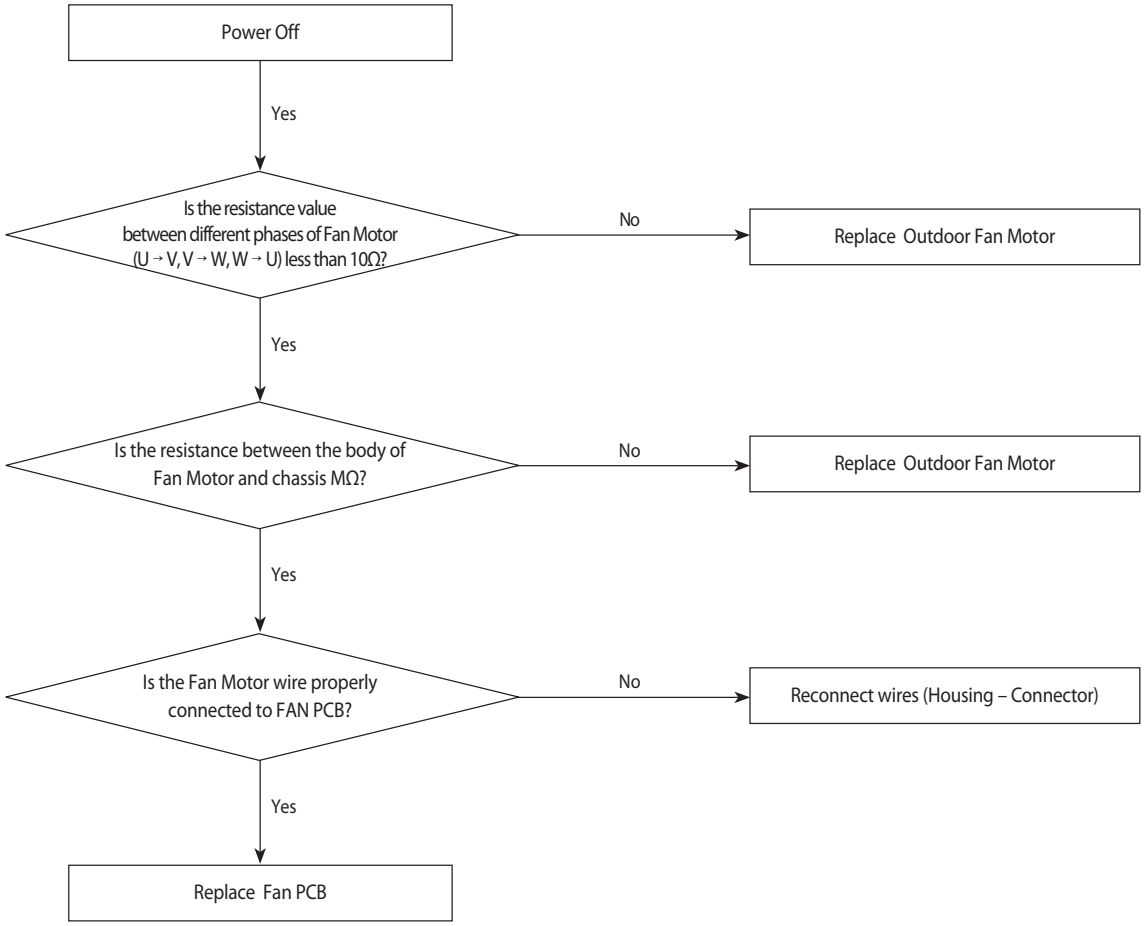
DC power wire (Fan PCB)



4-3-50 Fan Motor Overcurrent error

Outdoor unit display	E478/E489 (FAN PCB(FAN1)) E378/E389 (FAN PCB(FAN2))
Judgment Method	· Occurs when overcurrent flows in the IPM. · Detected by H/W or S/W
Cause of problem	· Defective FAN PCB · Connector error · Defective Motor

1. Cause of problem



Fan PCB wire connection


FAN Motor Connector

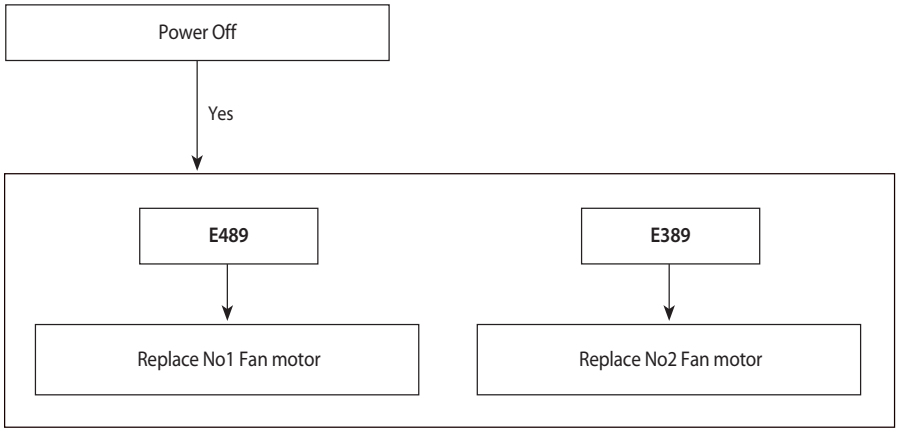

Hall-sensor Connector


[FAN PCB]
Hall-sensor Connector

Fan Motor Overcurrent error (cont.)

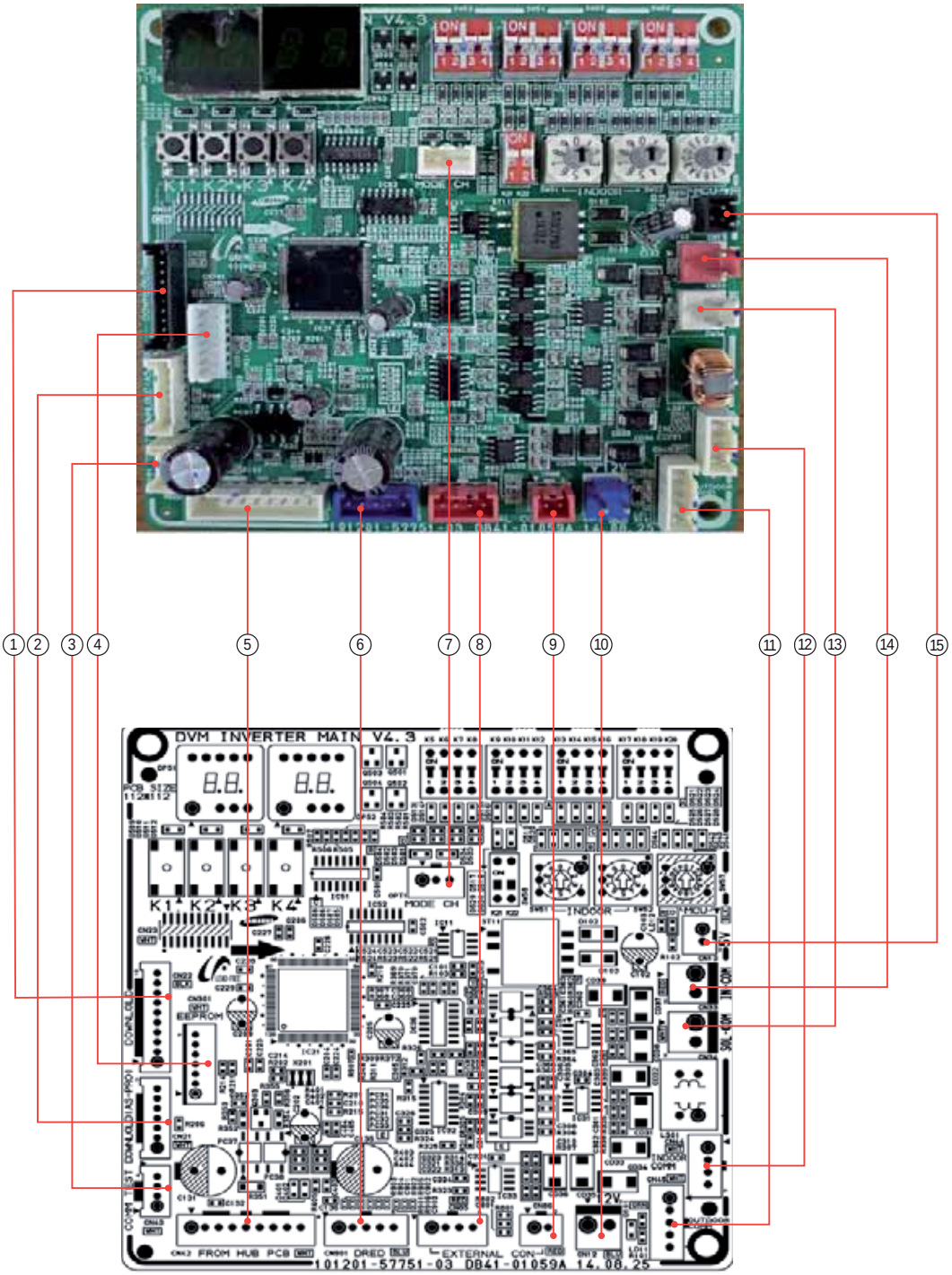
Outdoor unit display	E489 (FAN PCB(FAN1)) E389 (FAN PCB(FAN2))
Judgment Method	· Occurs when overcurrent flows in the IPM. · Detected by H/W or S/W
Cause of problem	· Defective FAN Motor

1. Cause of problem



5. PCB Diagram and Parts List

5-1 ASS'Y PCB MAIN

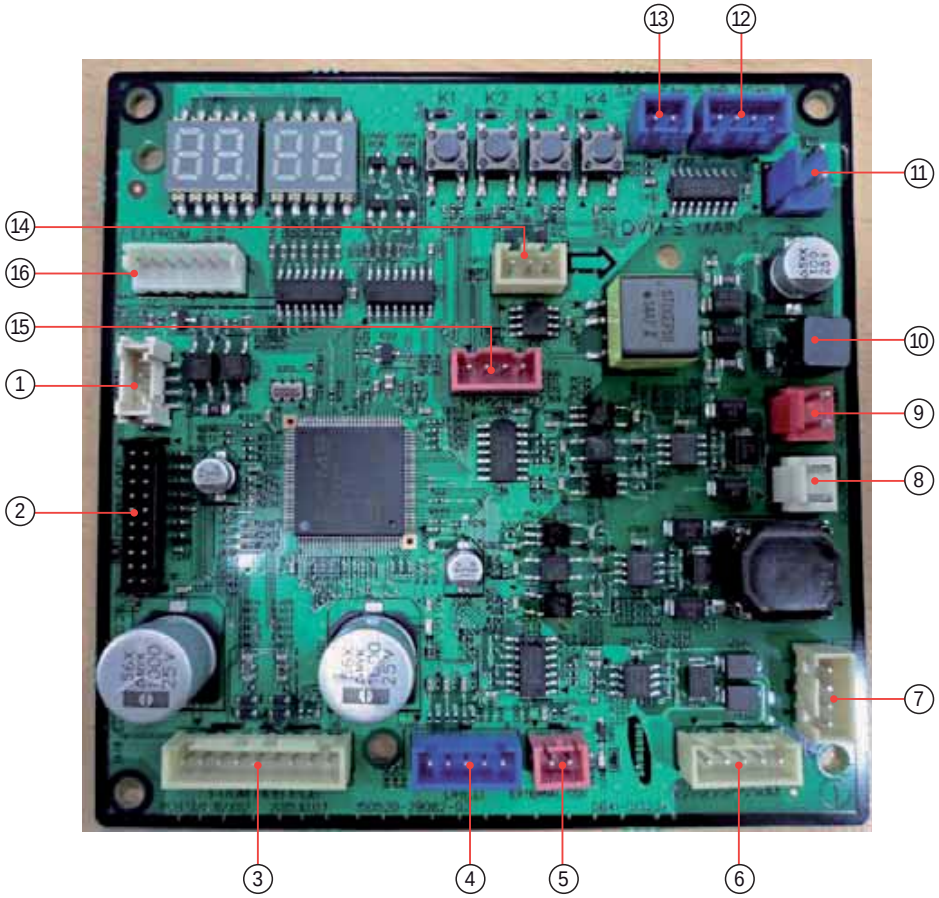


ASS'Y PCB MAIN (cont.)

① CN22-DOWNLOAD #1 : RX-DOWN #2 : TX-DOWN #3 : N-TRST #4 : TDO #5 : TCK #6 : TDI #7 : TMS #8 : #9 : GND #10 : VCC	② CN21-ASPRO DOWNLOAD #1 : VCC #2 : MODE0 #3 : RESET_MAIN #4 : #5 : F_SCLK #6 : F_SDAT #7 : GND	③ CN43-COMM TEST #1 : 12V #2 : INVERTER-INRUSH-OUT #3 : INVERTER-COMM #4 : GND	④ CN301-EEPROM #1 : GND #2 : #3 : VCC #4 : EEPROM-SELECT #5 : EEPROM-SO #6 : EEPROM-SI #7 : EEPROM-CLOCK
⑤ CN42 - HUB COMM #1 : 12V #2 : INVERTER-INRUSH-OUT #3 : INVERTER-COMM #4 : GND #5 : HIGH-PRESSURE-SENSOR #6 : LOW-PRESSURE-SENSOR #7 : ZERO-CROSSING #8 : GND #9 : VCC	⑥ CN901-DRED #1 : KEY3 #2 : GRID #3 : KEY4 #4 : GND #5 : VCC	⑦ OPT1 -MODE SELECTOR #1 : KEY3 #2 : GRID #3 : KEY4	⑧ CN85-CONDITION CHECK #1 : 12V #2 : ERROR-CHECK-OUT #3 : 12V #4 : COMP-CHECK-OUT
⑨ CN86-EXTERNAL CONTROL #1 : CONTROL #2 : GND	⑩ CN12 - 12V POWER #1 : 12V #2 : GND	⑪ CN45 -OUTDOOR COMM #1 : COM-C #2 : COM-D #3 : #4 : 12V #5 : GND	⑫ CN44 - INDOOR COMM #1 : COM-A #2 : COM-B #3 : 5V #4 : AGND
⑬ CN34- UNUSED COMM #1 : COM-E #2 : COM-F	⑭ CN33-INDOOR COMM (EXTRA) #1 : COM-A #2 : COM-B	⑮ CN13-5V POWER #1 : COM-A #2 : COM-B	

ASS'Y PCB MAIN (cont.)

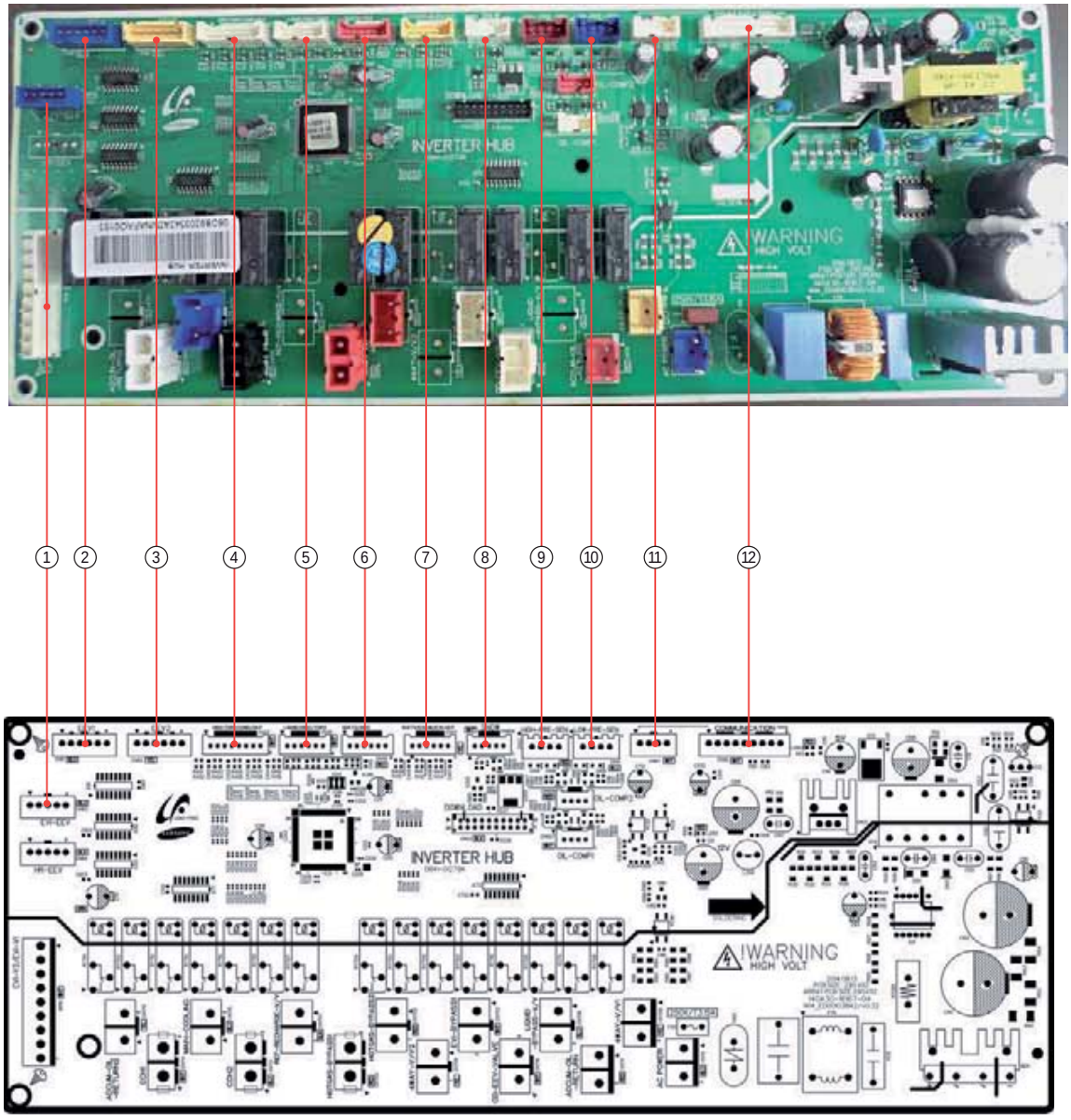
■ AM140/160/180/200/220/240/260/280/300KXV✳✳✳



1	INV COMM
2	Download
3	HUB PBA Comm.
4	DRED
5	External Con
6	COMM PBA Comm.(Outdoor)
7	COMM PBA Comm.(Indoor)
8	COMM PBA Comm.(SOL-COM)
9	IN-COM
10	5V
11	12V
12	Pump Down
13	Gas Leak
14	Option Switch
15	Error/Comp
16	EEPROM

5-2 ASS'Y PCB MAIN-HUB

■ AC



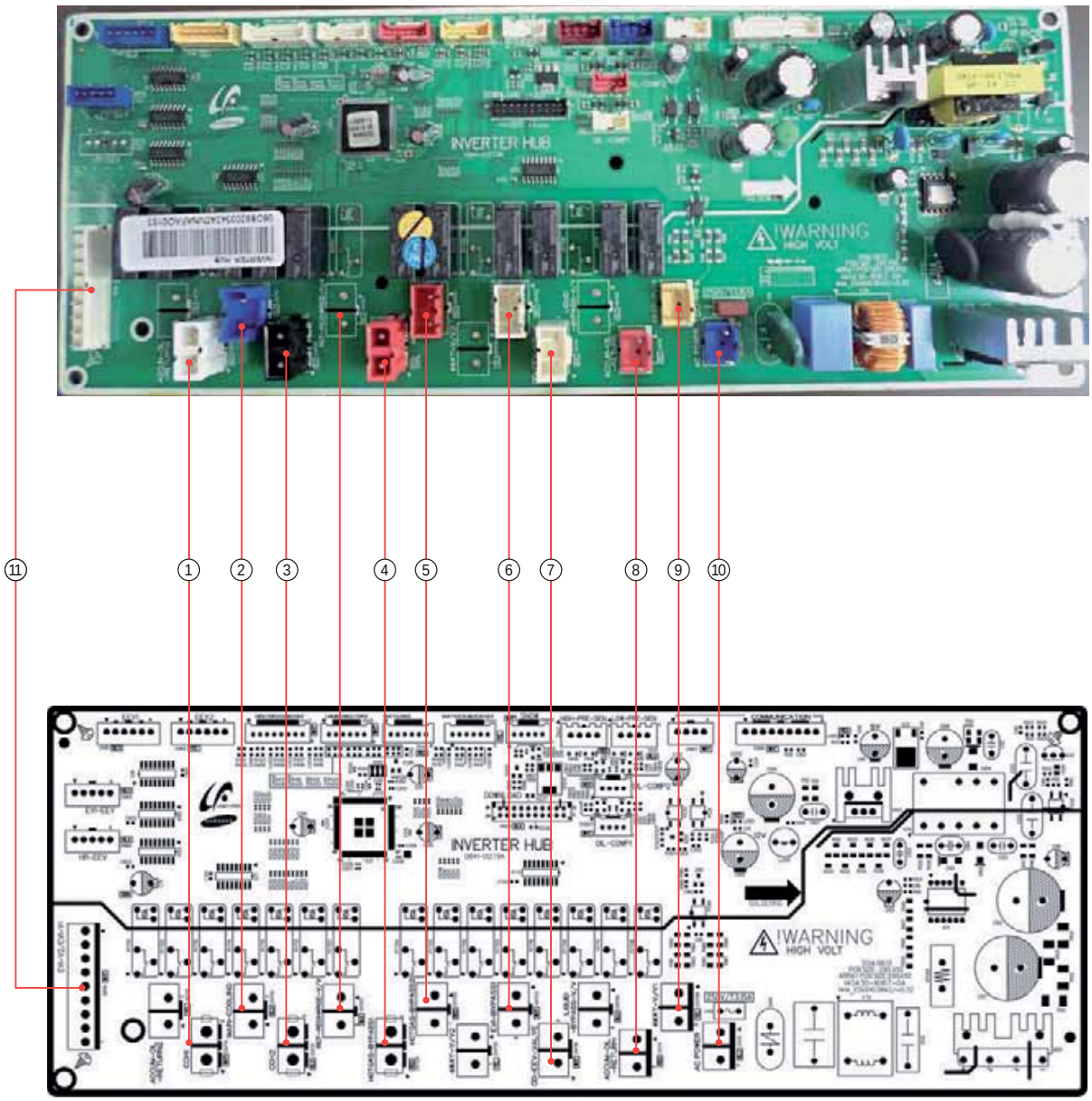
ASS'Y PCB MAIN-HUB (cont.)

■ AC (cont.)

① CN83-EVI EEV #1 : EEV3_A_OUT #2 : EEV3_B_OUT #3 : EEV3_A'_OUT #4 : EEV3_B'_OUT #5 : 12V	② CN81-EEV1 #1 : EEV1_B'_OUT #2 : EEV1_A'_OUT #3 : EEV1_B_OUT #4 : EEV1_A_OUT #5 : 12V #6 : 12V	③ CN82-EEV2 #1 : EEV2_B'_OUT #2 : EEV2_A'_OUT #3 : EEV2_B_OUT #4 : EEV2_A_OUT #5 : 12V #6 : 12V	④ CN43-TEMP. SENSOR #1 : COMP1 DISACHRGE #2 : COMP1 DISCHARGE #3 : COMP1 TOP #4 : COMP1 TOP1 #5 : COND OUT #6 : COND OUT #7 : OUTDOOR TEMP. #8 : OUTDOOR TEMP.
⑤ CN45-TEMP. SENSOR #1 : LIQUID #2 : LIQUID #3 : COMP2 DISCHARGE #4 : COMP2 DISCHARGE #5 : COMP2 TOP #6 : COMP2 TOP	⑥ CN46-SUCT #1 : SUCTION 2 #2 : SUCTION 2 #3 : GND #4 : GND #6 : GND	⑦ CN44 – TEMP. SENSOR #1 : SUCTION 1 #2 : SUCTION 1 #3 : EVI INLET #4 : ENI INLET #5 : ENI OUT ##6 : EVI OUT	⑧ CN906 –SNOW SENSOR #1 : 12V #3 : GND #4 : SNOW_SENSOR #5 : PSD_POWER
⑨ CN42 –HIGH PRESSURE SENSOR #1 : HIGH PRESSURE SENSOR #3 : GND #4 : VCC	⑩ CN41- LOW PRESSURE SENSOR #2 : LOW PRESSURE SENSOR #3 : GND #4 : VCC	⑪ CN97- INV COMM #1 : 12V #2 : INV_SMPS_RELAY #3 : COMM OUT #4 : GND	⑫ CN96 – MAIN–HUB COMM. #1 : 12V #2 : INV_SMPS_RELAY #3 : COMM-MAIN #4 : GND #5 : HIGH-PRESSURE-SENSOR #6 : LOW-PRESSURE-SENSOR #7 : ZERO-CROSSING #8 : GND #9 : VCC

ASS'Y PCB MAIN-HUB (cont.)

■ DC



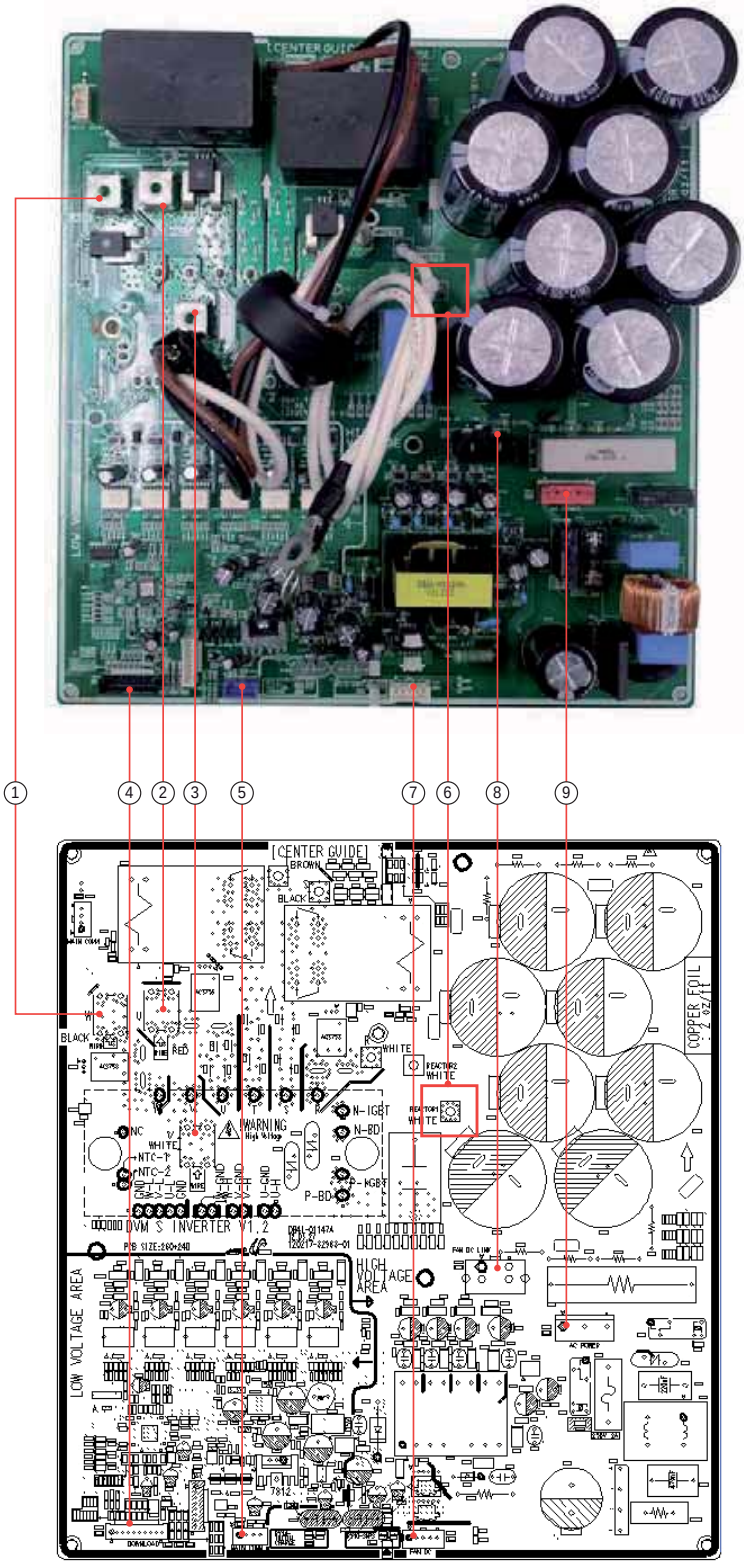
ASS'Y PCB MAIN-HUB (cont.)

■ DC (cont.)

① CN714-CCH1 #1 : CCH1 #2 : CCH1	② CN715-MAIN-COOLING #1: MAIN-COOLING #2: MAIN-COOLING	③ CN713-CCH2 ##1 : CCH2 #2 : CCH2	④ CN704-HOTGAS-VALVE1 #1 : HOTGAS BYPASS1 #2 : HOTGAS BYPASS1
⑤ CN705-HOTGAS-BYPASS2 #1:HOTGAS BYPASS2 #2:HOTGAS BYPASS2	⑥ CN703-EVI-BYPASS #1 : EVI BYPASS1 #2 : EVI BYPASS1	⑦ CN716-OD-EEV-VALVE #1: OD EEV VALVE #2: OD EEV VALVE	⑧ CN711-OIL-RETURN-VALVE #1 : ACCUM OIL RETURN VALVE #2 : ACCUM OIL RETURN VALVE
⑨ CN708- 4-WAY-VALVE #1 : 4-WAY VALVE #2 : 4-WAY VALVE	⑩ CN70-AC POWER INPUT #1 : AC LIVE #2 : AC NEUTRAL	⑪ CN701 EVI VALVE 1,2 #1: EVI VALVE 1 #3: EVI VALVE 2 #7: EVI VALVE 1 #8: EVI VALVE 2 #9: AC NEUTRAL	

5-3 ASSY PCB INVERTER

- Model : AM080/100/120/140/160/180/200/220FXV✳✳✳,
AM080/100/120/140/160/180/200/220JXV✳✳✳, AM140/200/220KXVA✳✳,
AM140/180/200/220KXVG✳✳

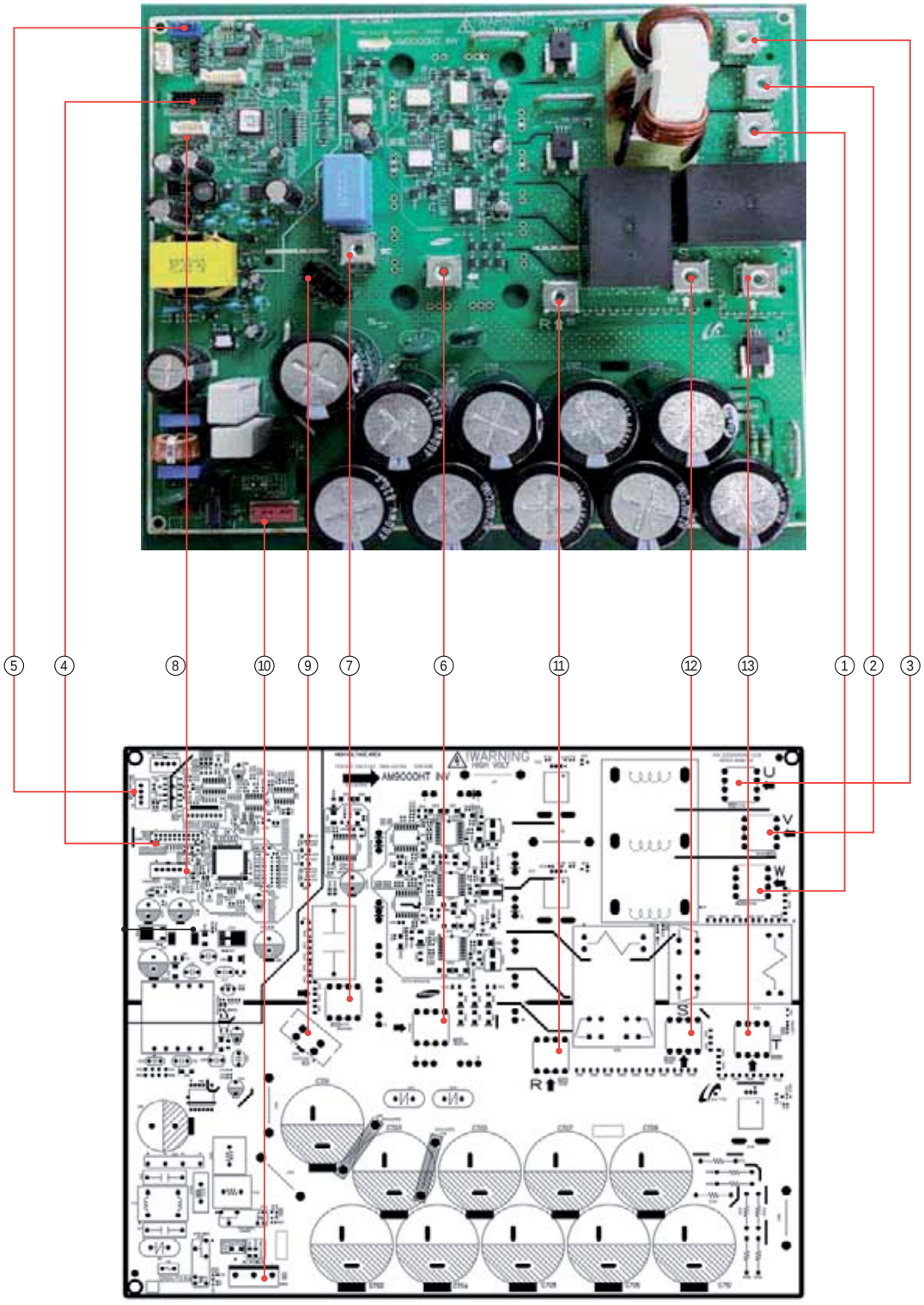


ASSY PCB INVERTER (cont.)

① W-COMP W #1 : COMP W	② U-COMP U #1 : COMP U	③ V-COMP V #1 : COMP V	④ CN22-DOWNLOAD #1 : RX-DOWN #2 : TX-DOWN #3 : N-TRST #4 : TDO #5 : TCK #6 : TDI #7 : TMS #8 : #9 : GND #10 : VCC
⑤ CN32 – MAIN COMM #1 : 12V-MAIN #2 : IN-SMPS-RELAY #3 : COMM-IN #4 : GND-MAIN	⑥ REACTOR (WIRE CONNECTION) #1 : REACTOR #2 : REACTOR	⑦ CN91- FAN DC #1 : 18V #2 : GND #3 : 5V-FAN #4 : AD-SELECT	⑧ CN15-FAN DC LINK #1 : 500V #2 : GND(500V)
⑨ CN13 - ACPOWER #1 : AC #2 : #3 : AC			

ASS'Y PCB INVERTER (cont.)

- Model : AM240/260HXV✳✳✳, AM240/260JXV✳✳✳,
AM160/180/240/260/280/300KXVA✳✳,
AM160/240/260/280KXVG✳✳, AM080KXVS✳✳

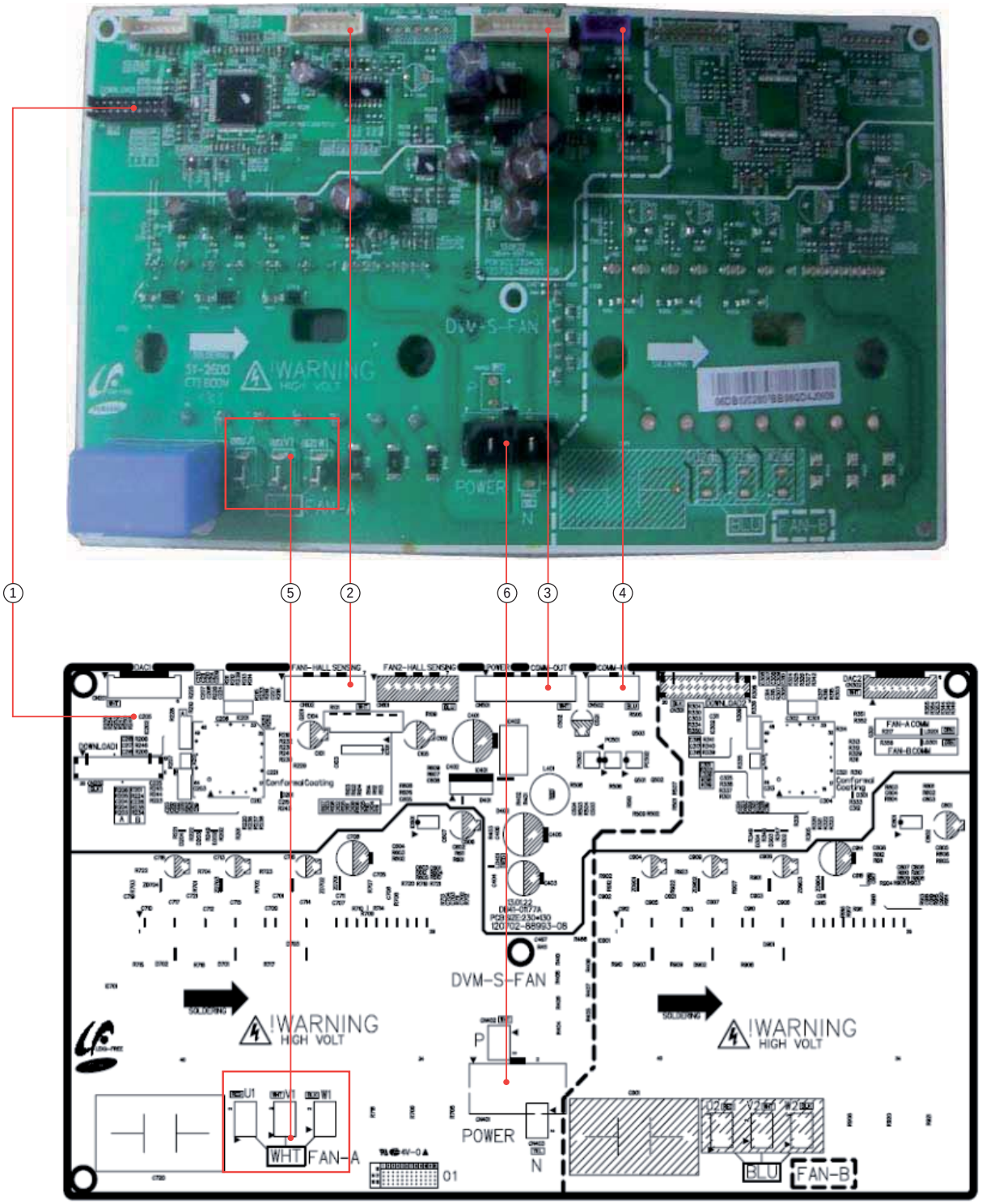


ASSY PCB INVERTER (cont.)

① W-COMP W #1 : COMP W	② U-COMP U #1 : COMP U	③ V-COMP V #1 : COMP V	④ CN22-DOWNLOAD #1: RX-DOWN #2: TX-DOWN #3: BOOT #4: TDO #5: TCK #6: TDI #7: TMS #9: GND #10: VCC
⑤ CN32 – MAIN COMM #1 : 12V-MAIN #2 : IN-SMPS-RELAY #3 : COMM-IN #4 : GND-MAIN	⑥ CN702-REACTOR1 #1: REACTOR1	⑦ CN701-REACTOR2 #1: REACTOR2	⑧ CN91-FAN DC #1: 18V #2: GND #3: 5V-FAN #4: AD-SELECT
⑨ CN15-FAN DC LINK #1 : AC #2 : #3 : AC	⑩ CN13-AC POWER #1: AC LIVE #2: AC NEUTRAL #3: AC NEUTRAL	⑪ R-INPUT R TOP #1: R-IN	⑫ S-INPUT S TOP #1: S-IN
⑬ T-INPUT T TOP #1: T-IN			

5-4 ASS'Y PCB FAN

- Model : 1-FAN chassis

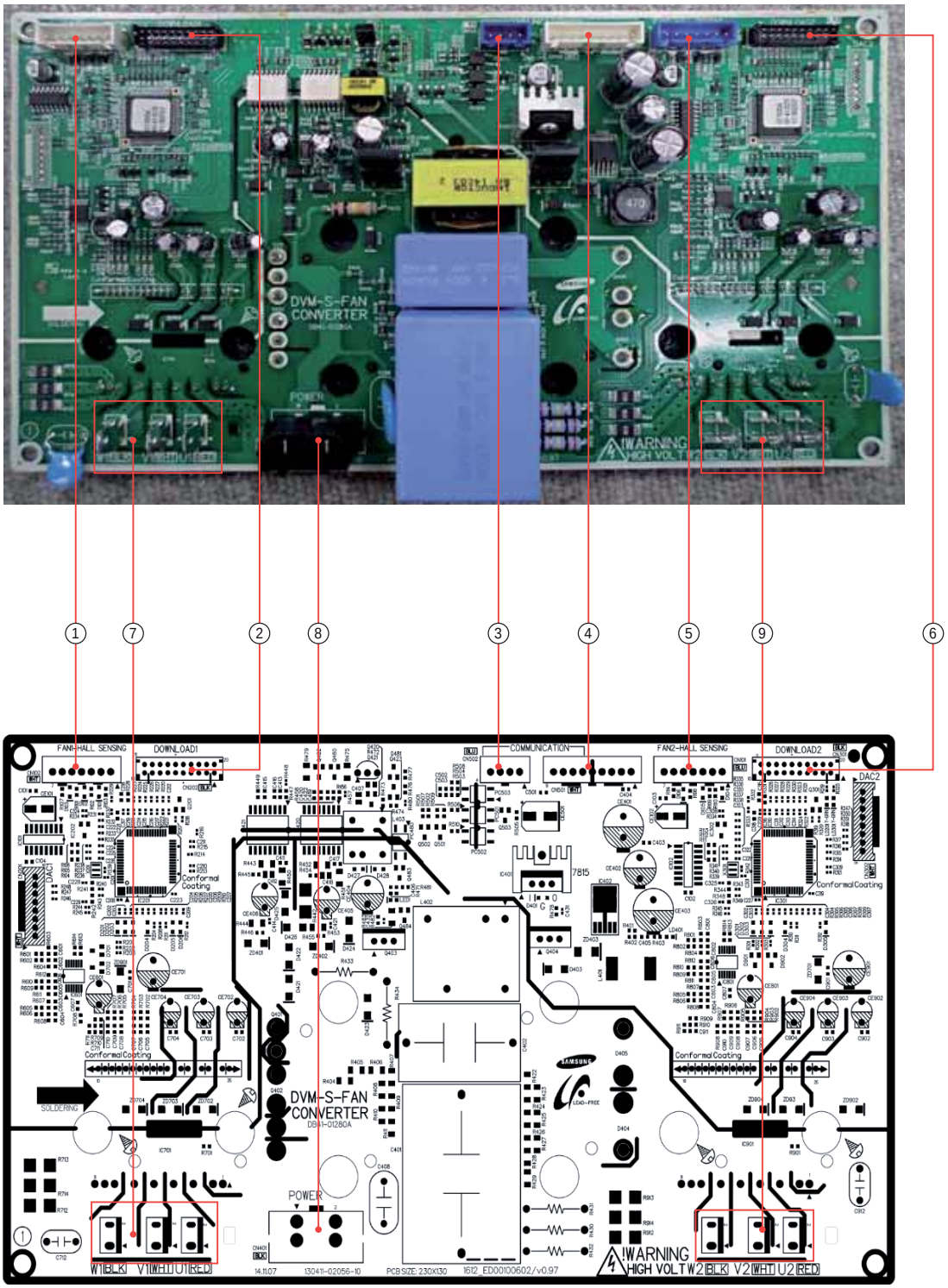


ASS'Y PCB FAN (cont.)

① CN102-FAN1 HALL SENSING	② CN202-DOWNLOAD1	③ CN502-COMMUNICATION	④ CN501-COMMUNICATION
#1 : HALL-U #2 : 5V #3 : HALL-V #4 : GND #5 : HALL-W #6 : MOTOR-TEMP #7 : GND	#1 : RX-DEBUG #2 : TX-DEBUG #3 : BOOT #4 : TDO #5 : TCK #6 : TDI #7 : TMS #9 : GND #10 : 5V	#1 : 12V-MAIN #2 : INV SMPS RELAY-MAIN #3 : COMM-MAIN #4 : GND-MAIN	#1 : 18V-INV #2 : GND-INV #4 : GND-INV #6 : 12V-MAIN #7 : INV SMPS RELAY-INV #8 : COMM-INV #9 : GND-INV
⑤ U1-V1-W1	⑥ CN401-POWER		
#1 : FAN1-U #2 : FAN1-V #3 : FAN1-W	#1 : DC 540V #2 : GND		

ASS'Y PCB FAN (cont.)

- Model : 2-FAN chassis

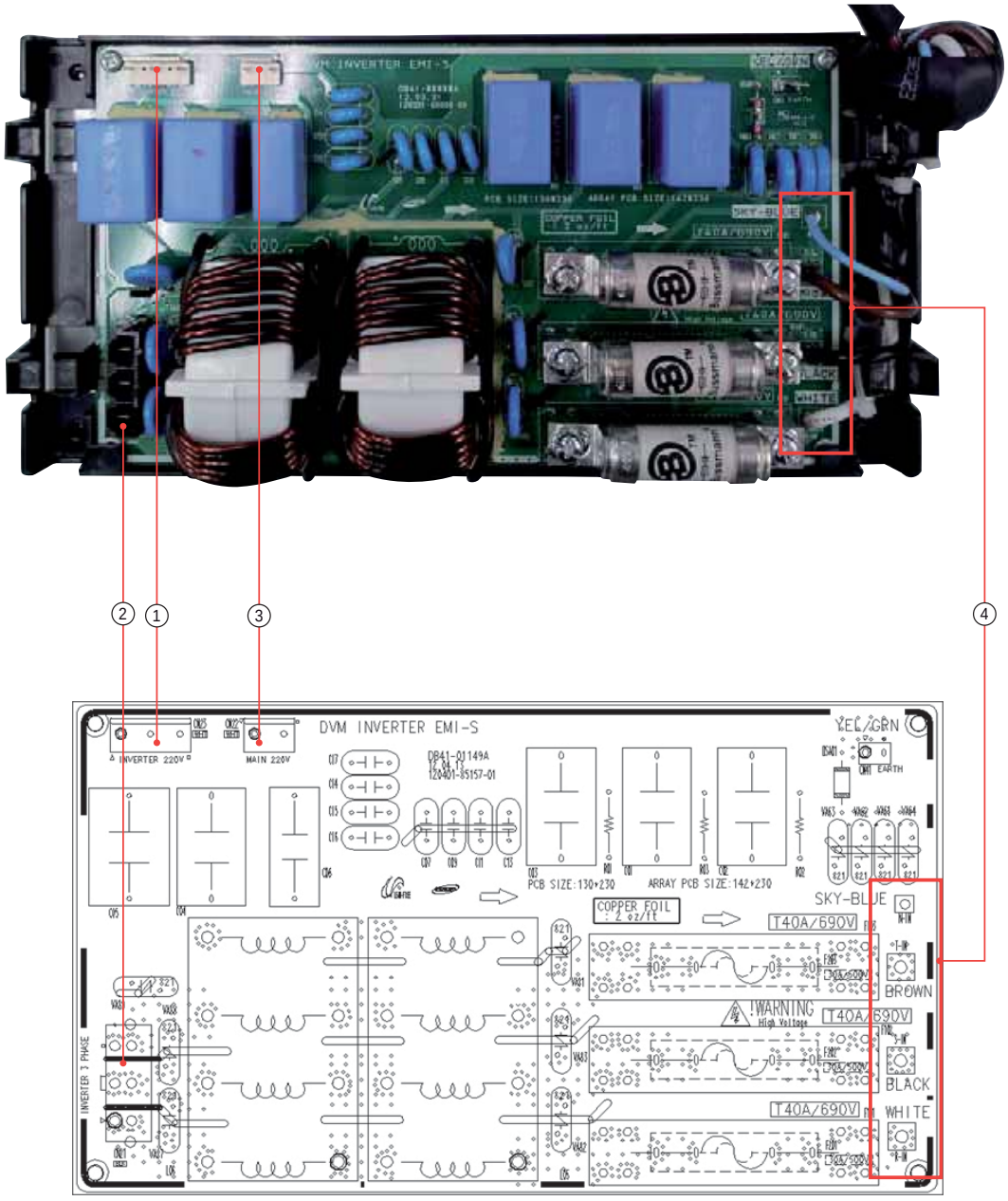


ASS'Y PCB FAN (cont.)

① CN102-FA1 HALL SENSING #1 : HALL-U #2 : 5V #3 : HALL-V #4 : GND #5 : HALL-W #6 : MOTOR-TEMP #7 : GND	② CN202-DOWNLOAD1 #1 : RX-DEBUG #2 : TX-DEBUG #3 : BOOT #4 : TDO #5 : TCK #6 : TDI #7 : TMS #9 : GND #10 : 5V	③ CN502-COMMUNICATION #1 : 12V-MAIN #2 : INV SMPS RELAY-MAIN #3 : COMM-MAIN #4 : GND-MAIN	④ CN501-COMMUNICATION #1 : 18V-INV #2 : GND-INV #4 : GND-INV #6 : 12V-MAIN #7 : INV SMPS RELAY-INV #8 : COMM-INV #9 : GND-INV
⑤ CN101-FAN2 HALL SENSING #1 : HALL-U #2 : 5V #3 : HALL-V #4 : GND #5 : HALL-W #6 : MOTOR-TEMP #7 : GND	⑥ CN301-DOWNLOAD2 #1 : RX-DEBUG #2 : TX-DEBUG #3 : BOOT #4 : TDO #5 : TCK #6 : TDI #7 : TMS #9 : GND #10 : 5V	⑦ U1-V1-W1 #1 : FAN1-U #2 : FAN1-V #3 : FAN1-W	⑧ CN401-POWER #1 : DC 540V #2 : GND
⑨ U2-V2-W2 #1 : FAN2-U #2 : FAN2-V #3 : FAN2-W			

5-5 ASS'Y PCB EMI

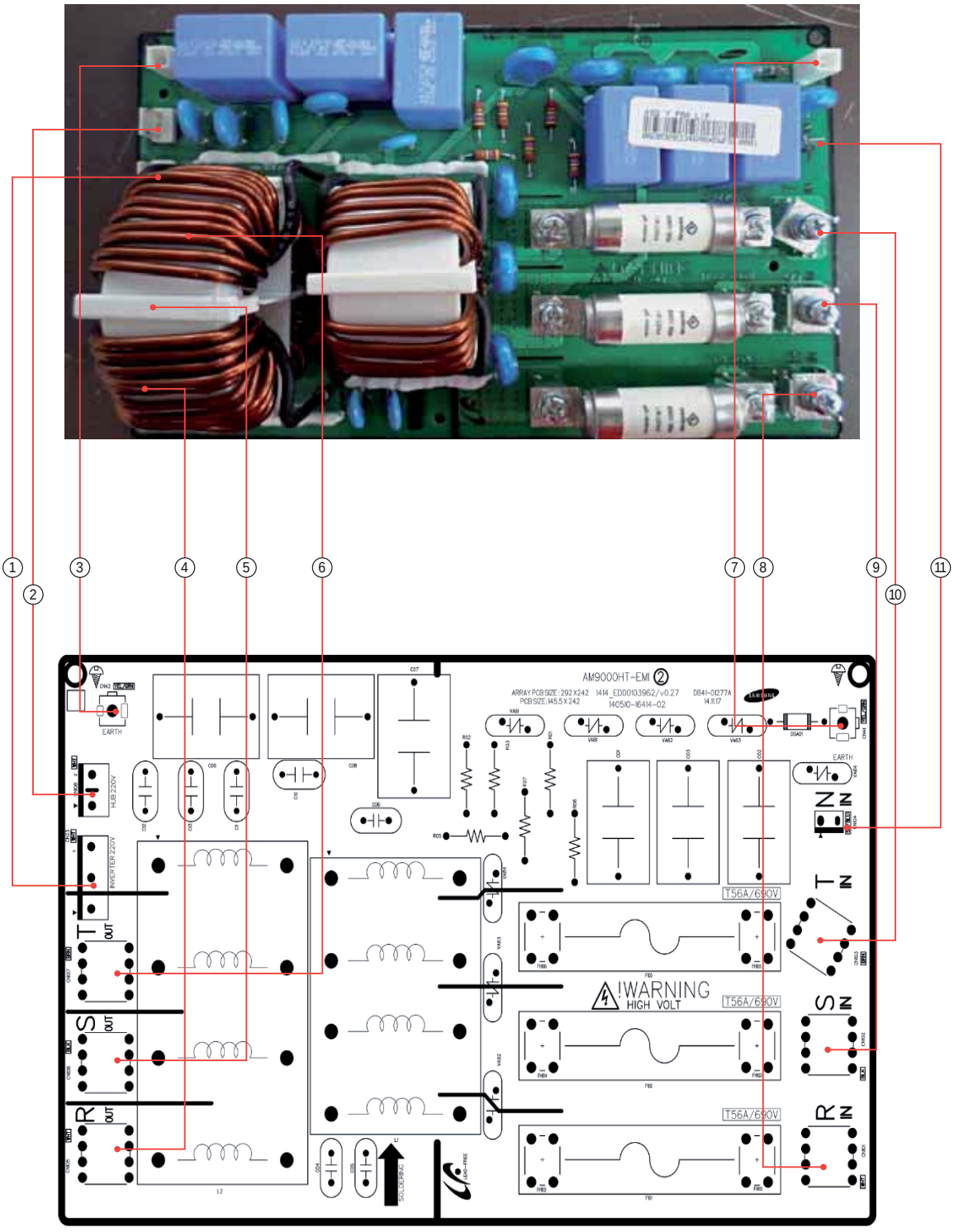
- Model : AM080/100/120/140/160/180/200/220FXV✳✳✳,
AM080/100/120/140/160/180/200/220JXV✳✳✳,
AM140/200/220KXVA✳✳,
AM140/180/200/220KXVG✳✳



① CN23- INVERTER 220V	② CN21-FAN A	③ CN22-MAIN 220	④ RST- RST INPUT
#1 : AC #2 : #3 : AC	#1 : R #2 : S #3 : T	#1 : AC #2 : AC	T-IN S-IN R-IN

ASS'Y PCB EMI (cont.)

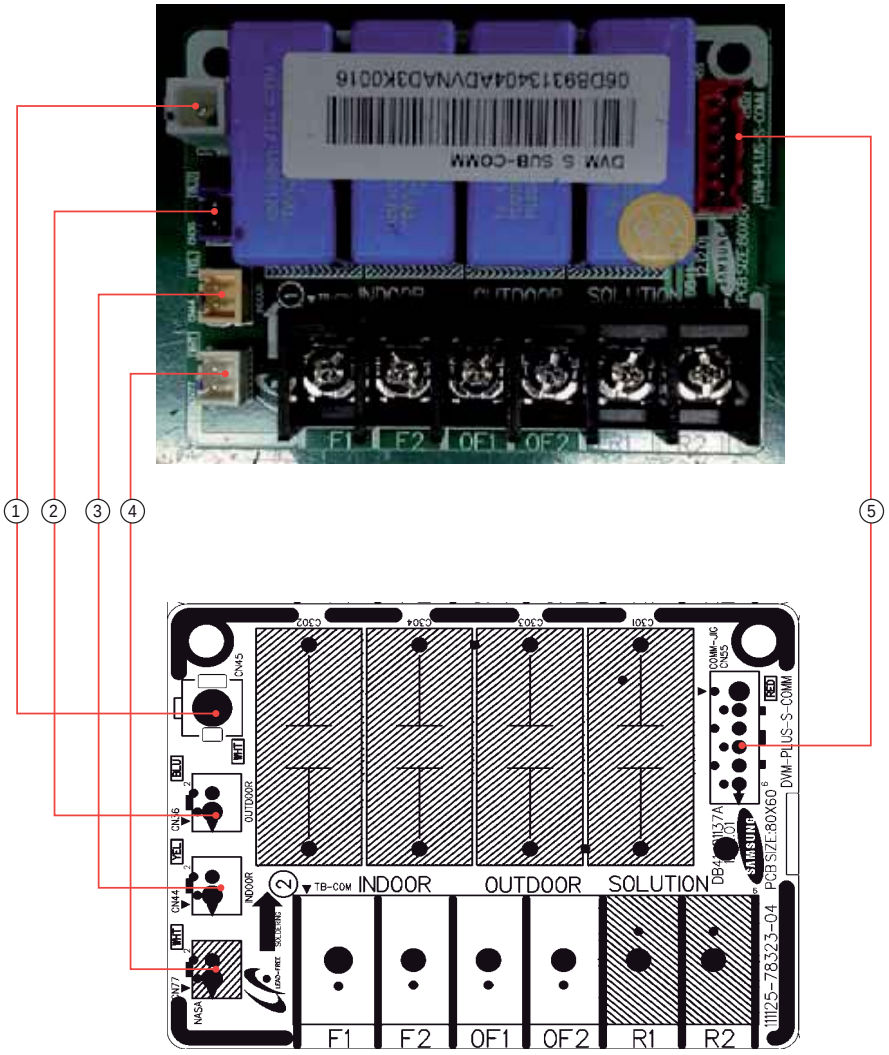
- **Model : AM240/260HXV✳✳✳, AM240/260JXV✳✳✳,**
  AM160/180/240/260/280/300KXVA✳✳,
  AM160/240/260/280KXVG✳✳,
  AM080KXVS✳✳



ASS'Y PCB EMI (cont.)

① CN23-INVERTER 220V #1 : AC LIVE #2 : #3 : AC NEUTRAL #4 : #5 : AC NEUTRAL	② CNCN108-HUB 220V #1 : AC LIVE #2 : #3 : AC NEUTRAL	③ CN502-COMMUNICATION #1 : EARTH (PE)	④ CN501-COMMUNICATION #1 : R-OUT
⑤ CN106-S OUT #1 : S-OUT	⑥ CN107-T OUT #1 : T-OUT	⑦ CN41-EARTH #1 : EARTH (PE)	⑧ CN101-R IN #1 : R-IN
⑨ CN102-S IN #1 : S-IN	⑩ CN103-T IN #1 : T-IN	⑪ R-INPUT R TOP #1 : R-IN	

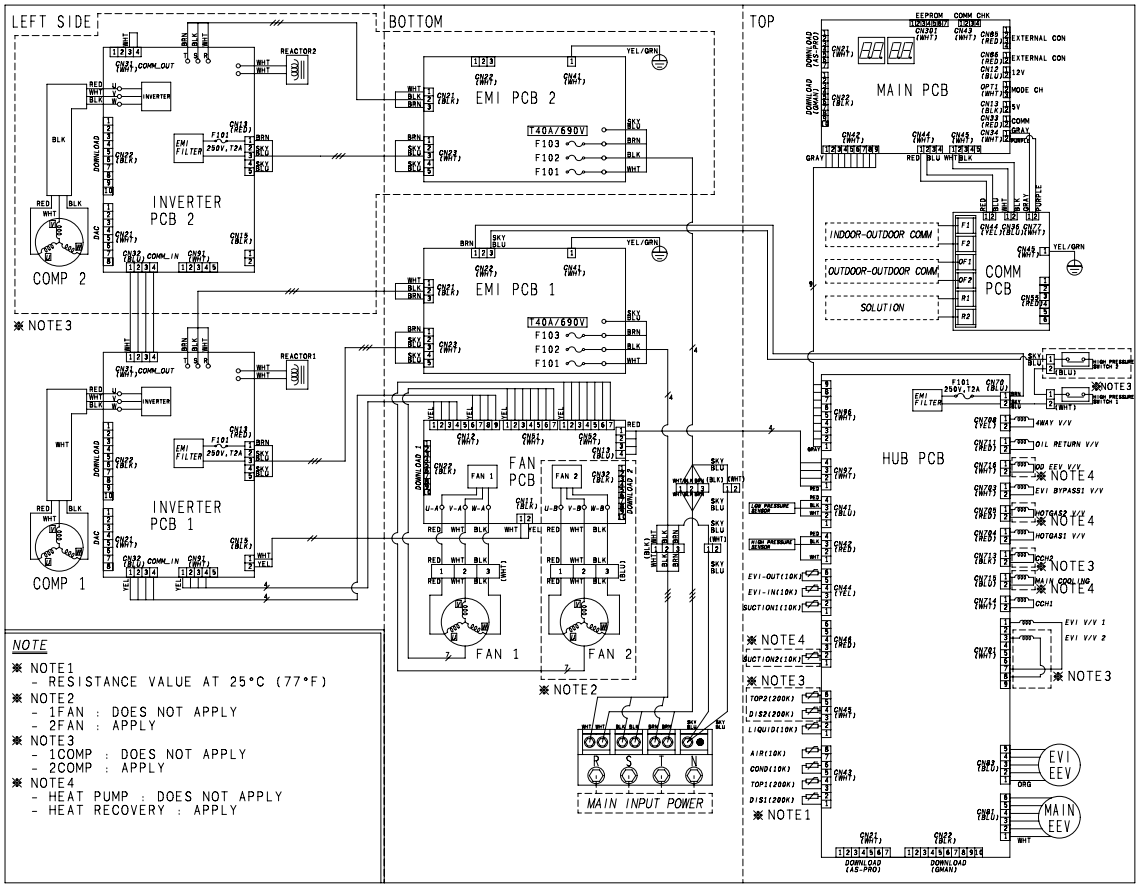
5-6 SUB-COMM



① CN44	② CN36	③ CN#44	④ CN45	⑤ CN55
#1 : F1 #2 : F2	#1 : OF1 #2 : OF2	#1 : R1 #2 : R2	GND	#1 : F1 #2 : F2 #3 : OF1 #4 : OF2 #5 : R1 #6 : R2

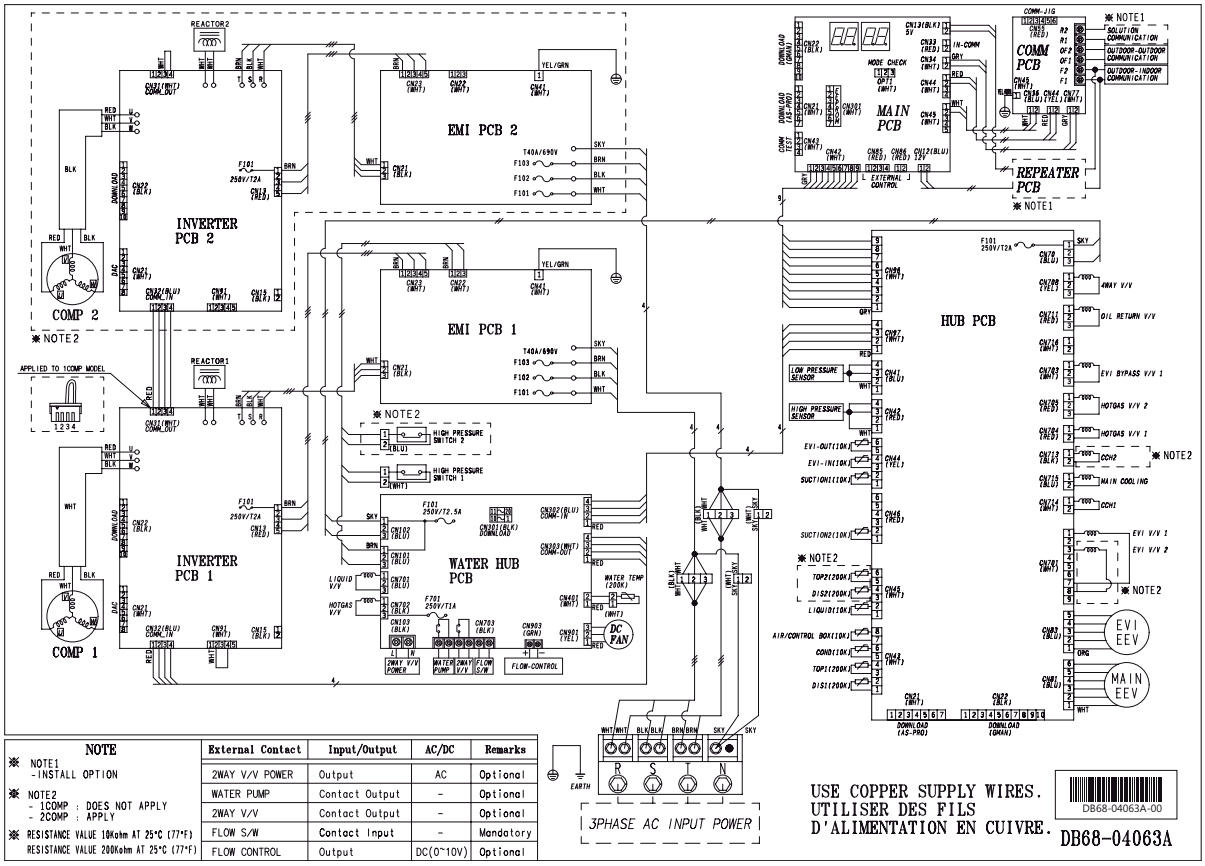
6. Wiring Diagram

6-1 AM080/100/120/140/160/180/200/220FXV✱✱✱, AM080/100/120/140/160/180/200/220JXV✱✱✱, AM140/200/220KXVA✱✱, AM140/180/200/220KXVG✱✱



Wiring Diagram

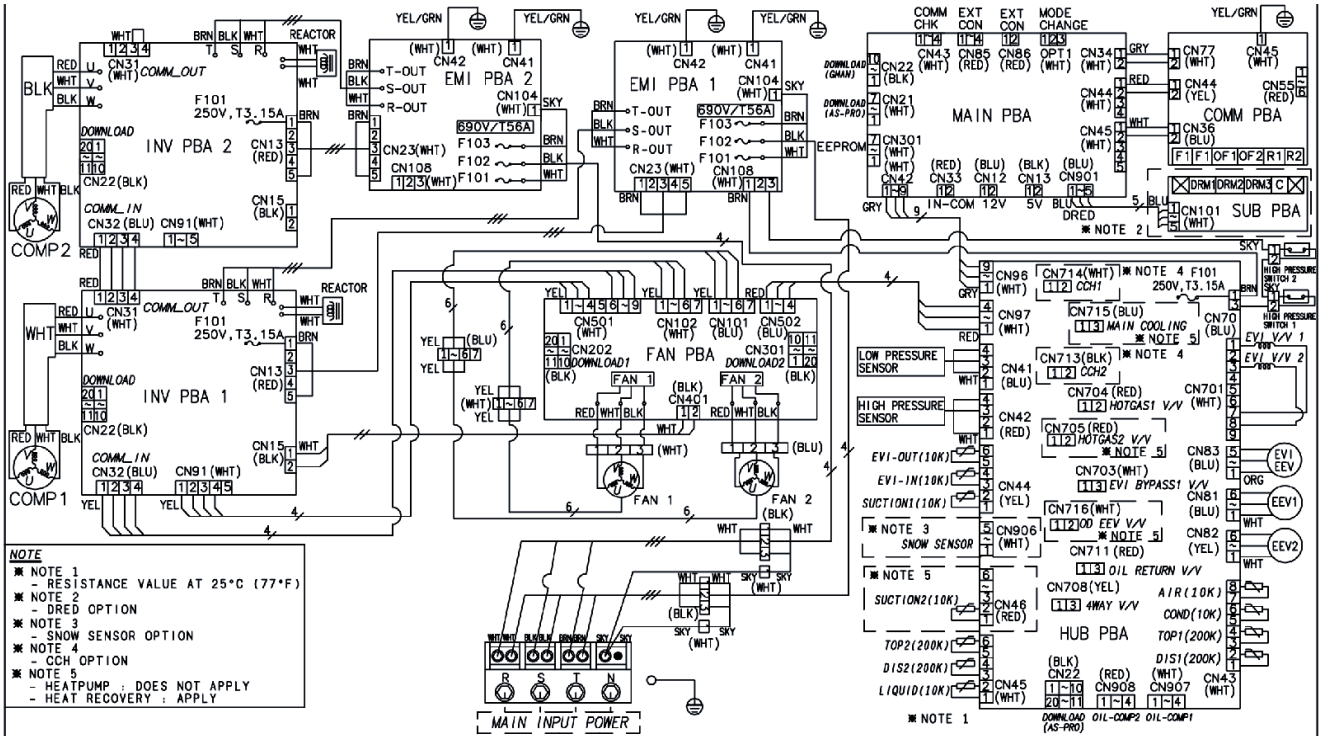
6-2 AM080/100/120/200FXWA✻✻



NOTE	External Contact	Input/Output	AC/DC	Remarks
✻ NOTE1 -INSTALL OPTION	2WAY V/V POWER	Output	AC	Optional
✻ NOTE2 - 1COMP : DOES NOT APPLY - 2COMP : APPLY	WATER PUMP	Contact Output	-	Optional
	2WAY V/V	Contact Output	-	Optional
✻ RESISTANCE VALUE 10Kohm AT 25°C (77°F) RESISTANCE VALUE 200Kohm AT 25°C (77°F)	FLOW S/W	Contact Input	-	Mandatory
	FLOW CONTROL	Output	DC(0~10V)	Optional

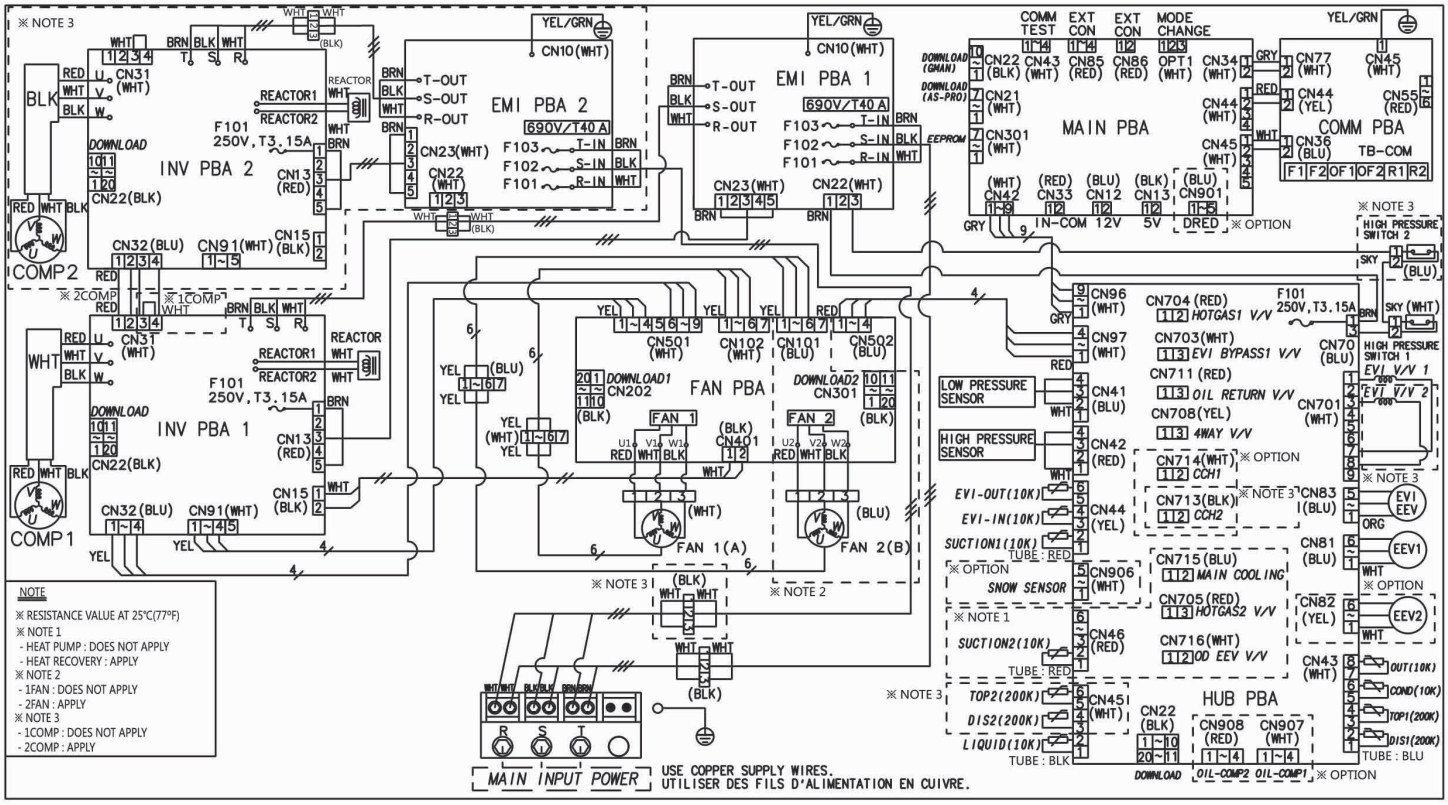
Wiring Diagram

6-3 AM240/260HXV✻✻✻, AM240/260JXV✻✻✻, AM160/180/240/260/280/300KXVA✻✻, AM160/240/260/280KXVG✻✻, AM080KXVS✻✻



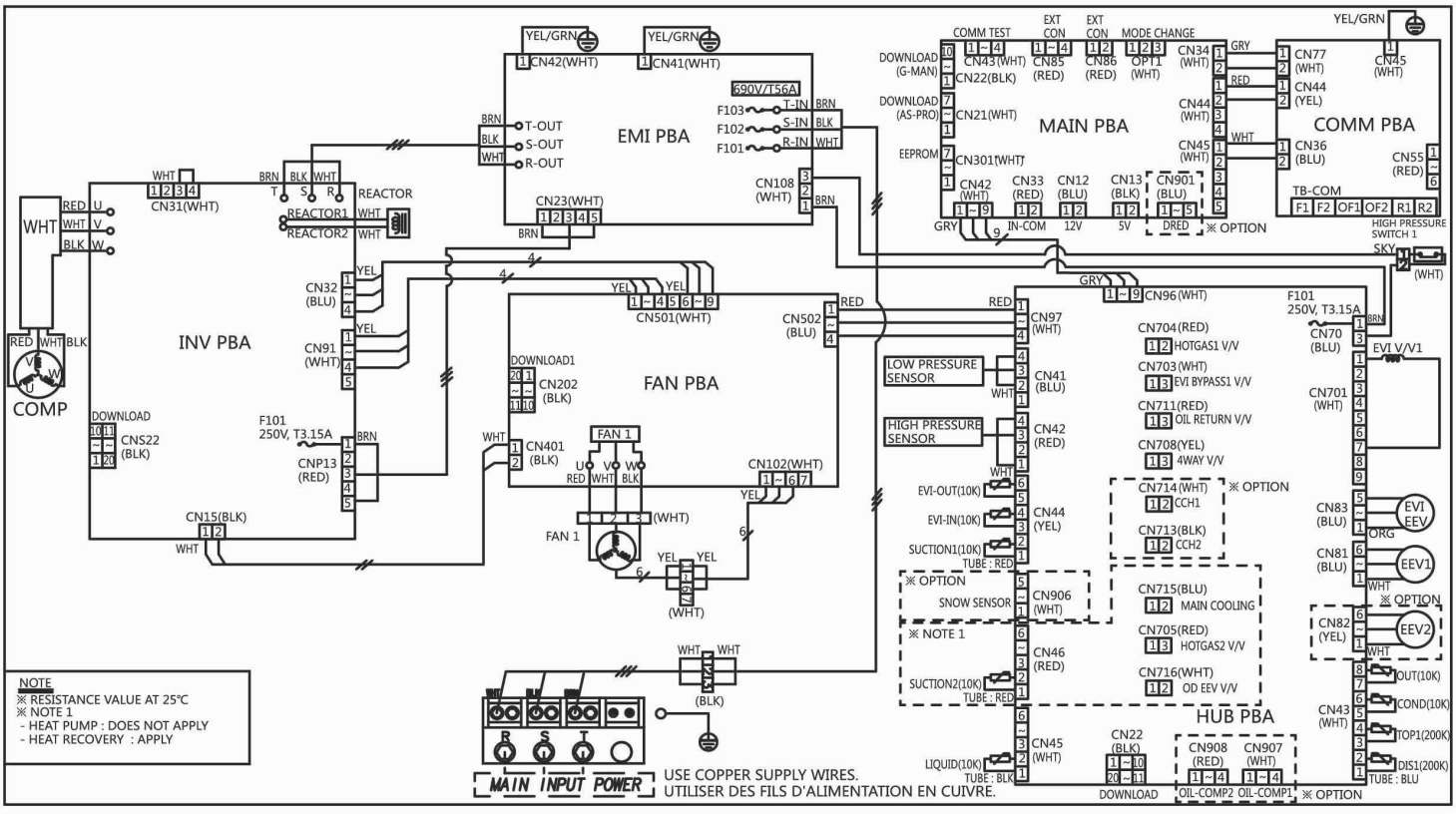
Wiring Diagram

6-4 AM080JXVAFH



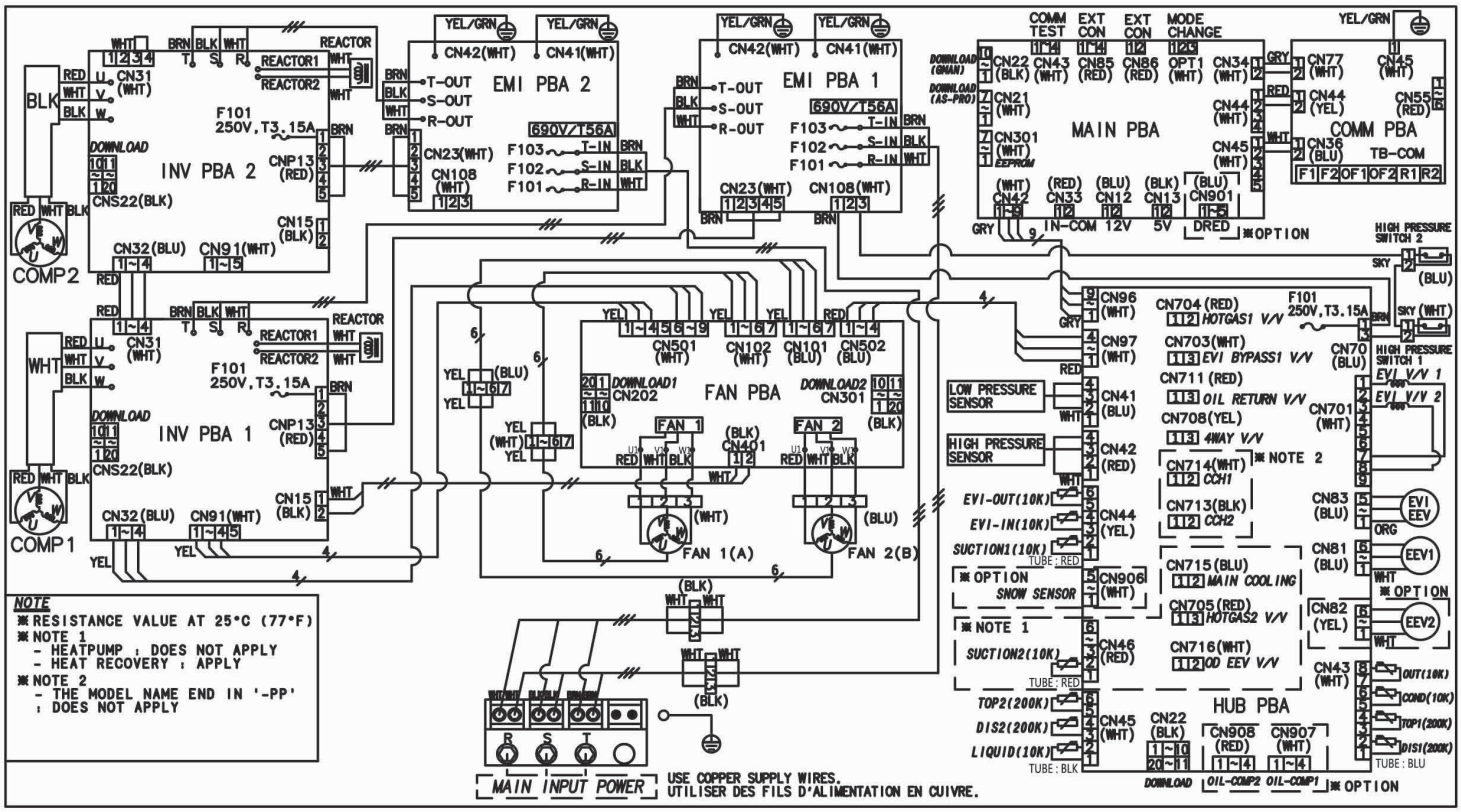
Wiring Diagram

6-5 AM100/120JXVAFH



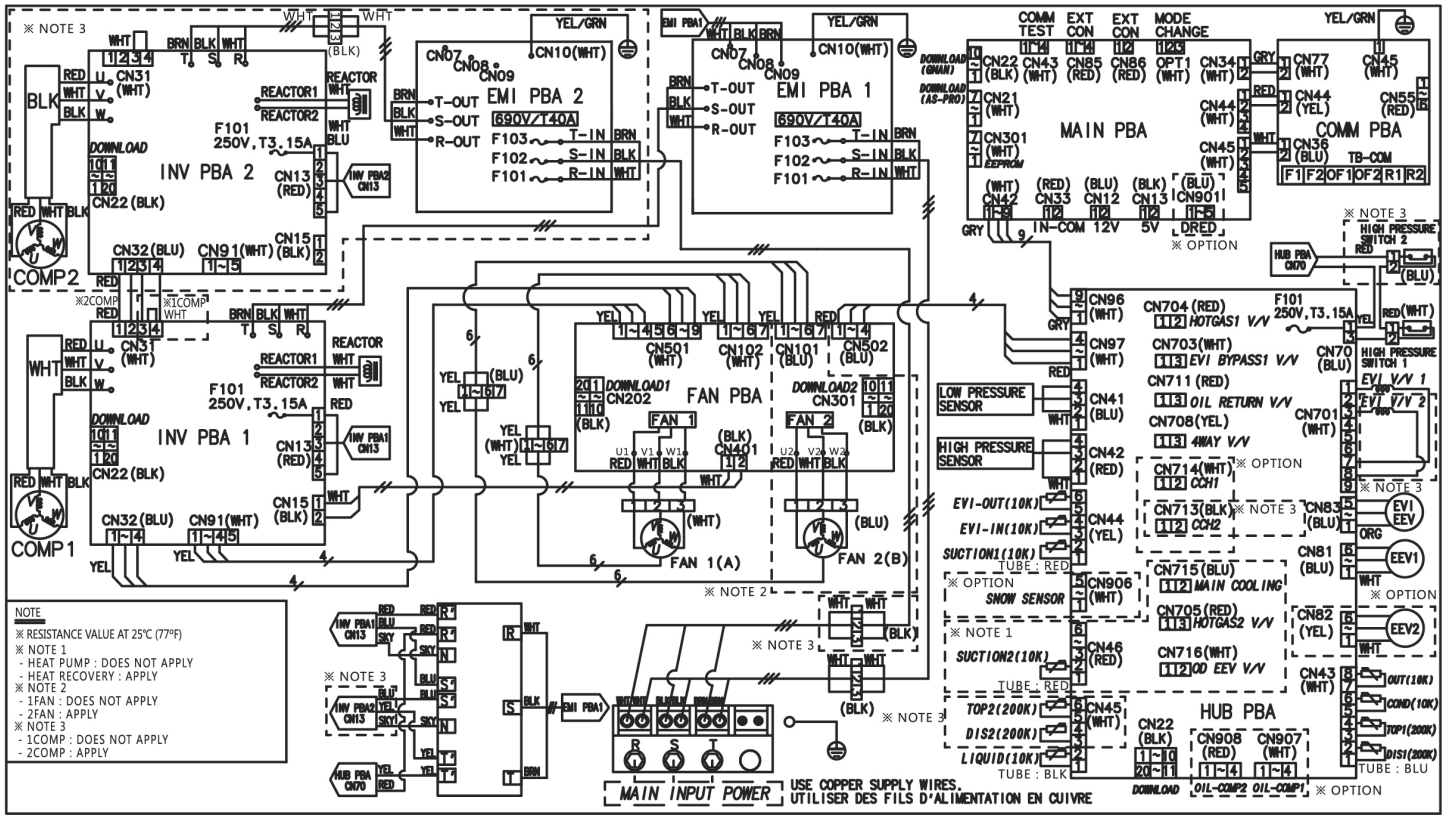
Wiring Diagram

6-6 AM140/160/180/200JXVAFH



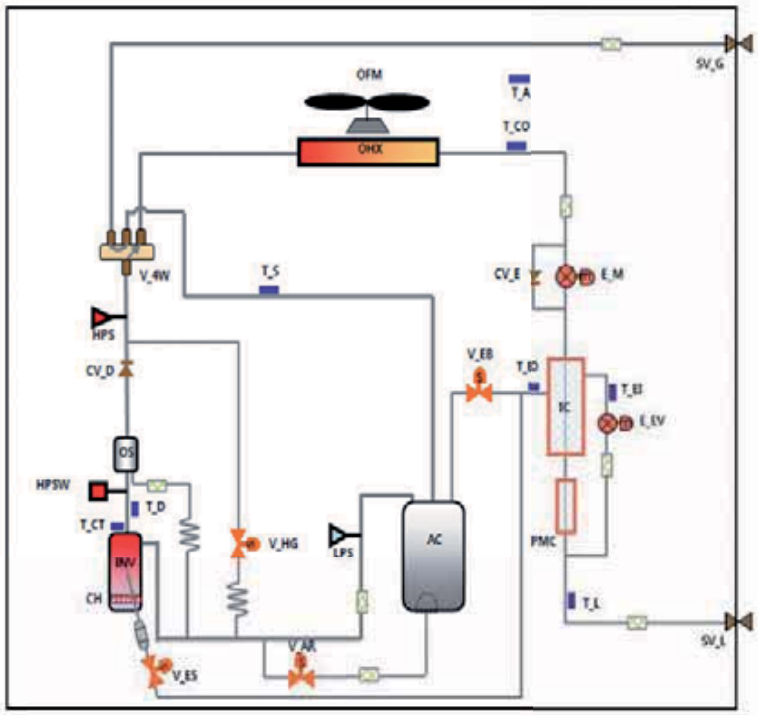
Wiring Diagram

6-7 AM080/100/120/140/160/180/200/220JXVAJH



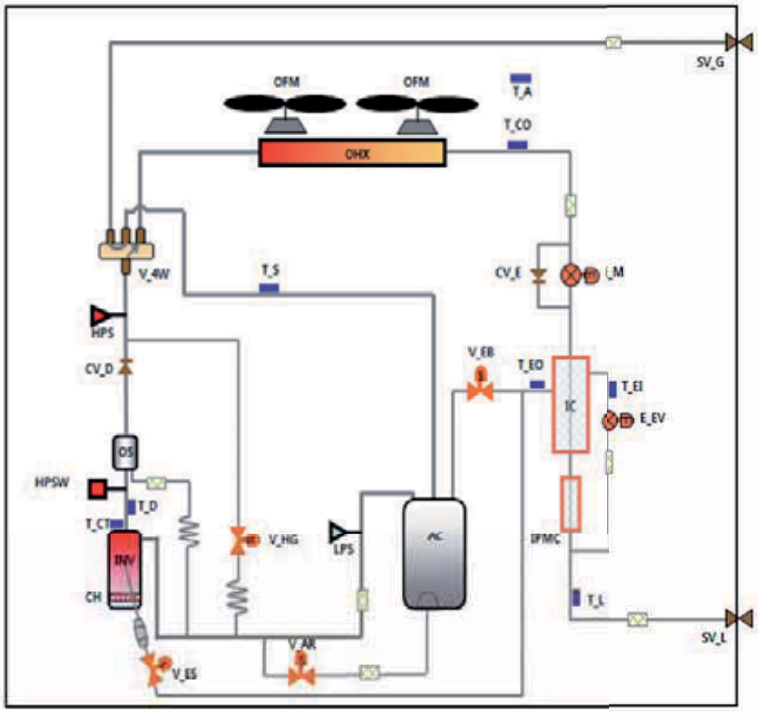
7. Cycle Diagram

7-1 AM080/100/120✳XV✳✳H



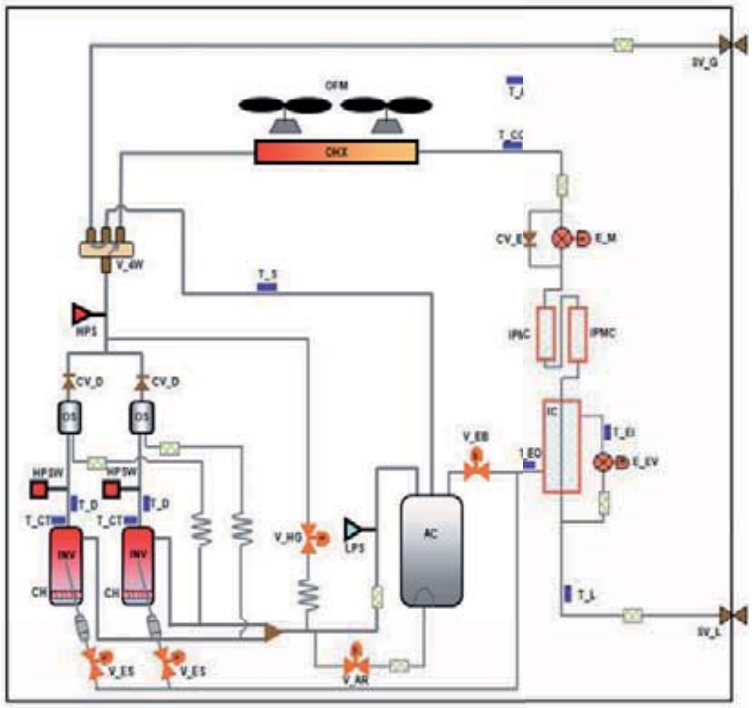
Abbreviation	Name
INV	Inveter Compressor
OFM	Outdoor Fan Motor
OHX	Outdoor Heat Exchanger
AC	Accumulator
OS	Oil Separator
IC	Intercooler
IPMC	IPM Cooler
CH	Crank Case Heater
HPS	High Pressure Sensor
LPS	Low Pressure Sensor
HPSW	High Pressure Switch
E_M	Main EEV
E_EV	EVI EEV
V_ES	EVI Sol. Valve
V_EB	EVI Bypass Valve
V_HG	Hot Gas Bypass Valve
V_4W	4Way Valve
V_AR	Accumulator Oil Return Valve
CV_E	EEV Bypass Check Valve
CV_D	Discharge Check Valve
T_D	Discharge Temperature Sensor
T_S	Suction Temperature Sensor
T_CO	Cond. Out Temperature Sensor
T_EI	EVI In Temperature Sensor
T_EO	EVI Out Temperature Sensor
T_L	Liquid Pipe Temperature Sensor
T_CT	Comp. Top Temperature Sensor
T_A	Ambient Temperature Sensor
SV_G	Gas Pipe Service Valve
SV_L	Liquid Pipe Service Valve

7-2 AM140✳XV✳GH



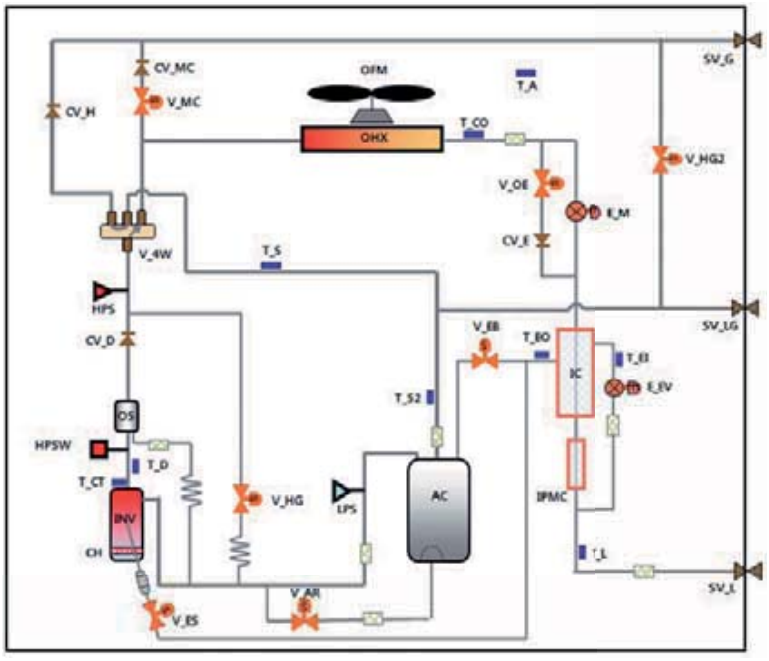
Abbreviation	Name
INV	Inveter Compressor
OFM	Outdoor Fan Motor
OHX	Outdoor Heat Exchanger
AC	Accumulator
OS	Oil Separator
IC	Intercooler
IPMC	IPM Cooler
CH	Crank Case Heater
HPS	High Pressure Sensor
LPS	Low Pressure Sensor
HPSW	High Pressure Switch
E_M	Main EEV
E_EV	EVI EEV
V_ES	EVI Sol. Valve
V_EB	EVI Bypass Valve
V_HG	Hot Gas Bypass Valve
V_4W	4Way Valve
V_AR	Accumulator Oil Return Valve
CV_E	EEV Bypass Check Valve
CV_D	Discharge Check Valve
T_D	Discharge Temperature Sensor
T_S	Suction Temperature Sensor
T_CO	Cond. Out Temperature Sensor
T_EI	EVI In Temperature Sensor
T_EO	EVI Out Temperature Sensor
T_L	Liquid Pipe Temperature Sensor
T_CT	Comp. Top Temperature Sensor
T_A	Ambient Temperature Sensor
SV_G	Gas Pipe Service Valve
SV_L	Liquid Pipe Service Valve

7-3 AM160/180/200/220✳XV✳✳H



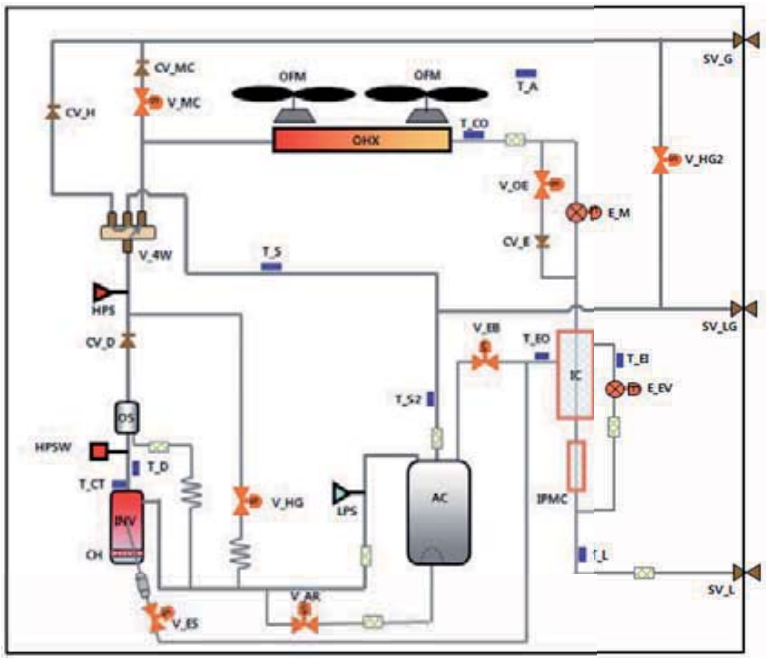
Abbreviation	Name
INV	Inveter Compressor
OFM	Outdoor Fan Motor
OHX	Outdoor Heat Exchanger
AC	Accumulator
OS	Oil Separator
IC	Intercooler
IPMC	IPM Cooler
CH	Crank Case Heater
HPS	High Pressure Sensor
LPS	Low Pressure Sensor
HPSW	High Pressure Switch
E_M	Main EEV
E_EV	EVI EEV
V_ES	EVI Sol. Valve
V_EB	EVI Bypass Valve
V_HG	Hot Gas Bypass Valve
V_4W	4Way Valve
V_AR	Accumulator Oil Return Valve
CV_E	EEV Bypass Check Valve
CV_D	Discharge Check Valve
T_D	Discharge Temperature Sensor
T_S	Suction Temperature Sensor
T_CO	Cond. Out Temperature Sensor
T_EI	EVI In Temperature Sensor
T_EO	EVI Out Temperature Sensor
T_L	Liquid Pipe Temperature Sensor
T_CT	Comp. Top Temperature Sensor
T_A	Ambient Temperature Sensor
SV_G	Gas Pipe Service Valve
SV_L	Liquid Pipe Service Valve

7-4 AM080/100/120✳XV✳GR



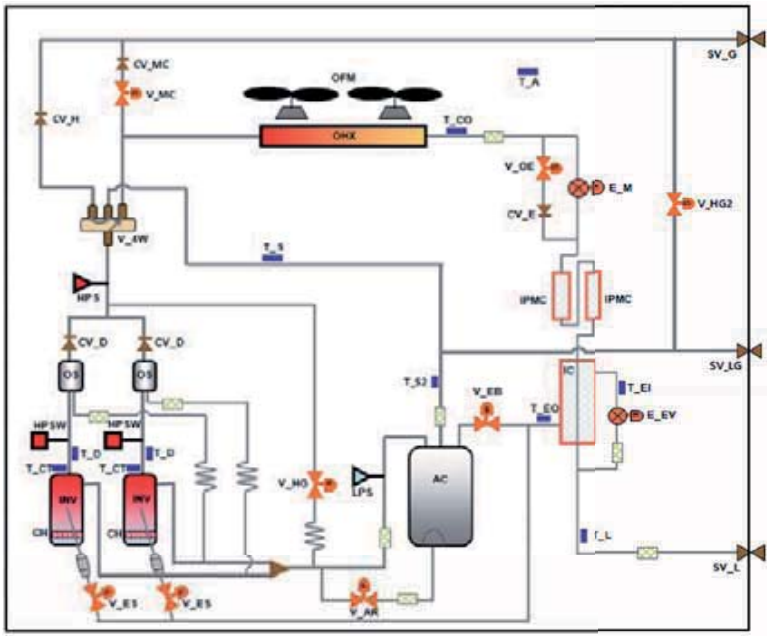
Abbreviation	Name
INV	Inveter Compressor
OFM	Outdoor Fan Motor
OHX	Outdoor Heat Exchanger
AC	Accumulator
OS	Oil Separator
IC	Intercooler
IPMC	IPM Cooler
CH	Crank Case Heater
HPS	High Pressure Sensor
LPS	Low Pressure Sensor
HPSW	High Pressure Switch
E_M	Main EEV
E_EV	EVI EEV
V_ES	EVI Sol. Valve
V_EB	EVI Bypass Valve
V_HG	Hot Gas Bypass Valve
V_HG2	Hot Gas Bypass Valve 2
V_4W	4Way Valve
V_AR	Accumulator Oil Return Valve
CV_E	EEV Bypass Check Valve
CV_D	Discharge Check Valve
CV_MC	MainCooling Check Valve
T_D	Discharge Temperature Sensor
T_S	Suction Temperature Sensor
T_S2	Suction Temperature Sensor 2
T_CO	Cond. Out Temperature Sensor
T_EI	EVI In Temperature Sensor
T_EO	EVI Out Temperature Sensor
T_L	Liquid Pipe Temperature Sensor
T_CT	Comp. Top Temperature Sensor
T_A	Ambient Temperature Sensor
SV_G	Gas Pipe Service Valve
SV_LG	Low P. Gas Pipe Service Valve
SV_L	Liquid Pipe Service Valve

7-5 AM140✳XV✳GR



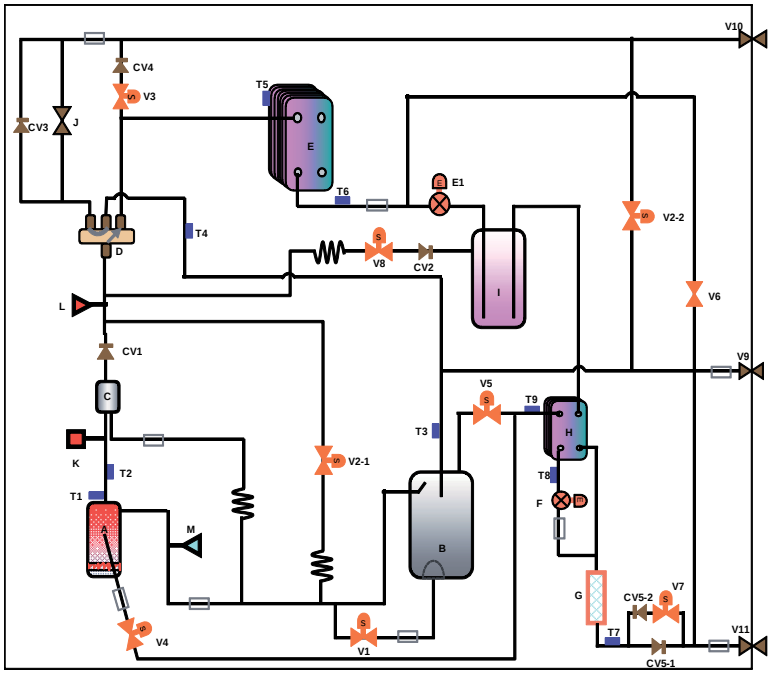
Abbreviation	Name
INV	Inveter Compressor
OFM	Outdoor Fan Motor
OHX	Outdoor Heat Exchanger
AC	Accumulator
OS	Oil Separator
IC	Intercooler
IPMC	IPM Cooler
CH	Crank Case Heater
HPS	High Pressure Sensor
LPS	Low Pressure Sensor
HPSW	High Pressure Switch
E_M	Main EEV
E_EV	EVI EEV
V_ES	EVI Sol. Valve
V_EB	EVI Bypass Valve
V_HG	Hot Gas Bypass Valve
V_HG2	Hot Gas Bypass Valve 2
V_4W	4Way Valve
V_AR	Accumulator Oil Return Valve
CV_E	EEV Bypass Check Valve
CV_D	Discharge Check Valve
CV_MC	MainCooling Check Valve
T_D	Discharge Temperature Sensor
T_S	Suction Temperature Sensor
T_S2	Suction Temperature Sensor 2
T_CO	Cond. Out Temperature Sensor
T_EI	EVI In Temperature Sensor
T_EO	EVI Out Temperature Sensor
T_L	Liquid Pipe Temperature Sensor
T_CT	Comp. Top Temperature Sensor
T_A	Ambient Temperature Sensor
SV_G	Gas Pipe Service Valve
SV_LG	Low P. Gas Pipe Service Valve
SV_L	Liquid Pipe Service Valve

7-6 AM160/180/200/220✳XV✳GR



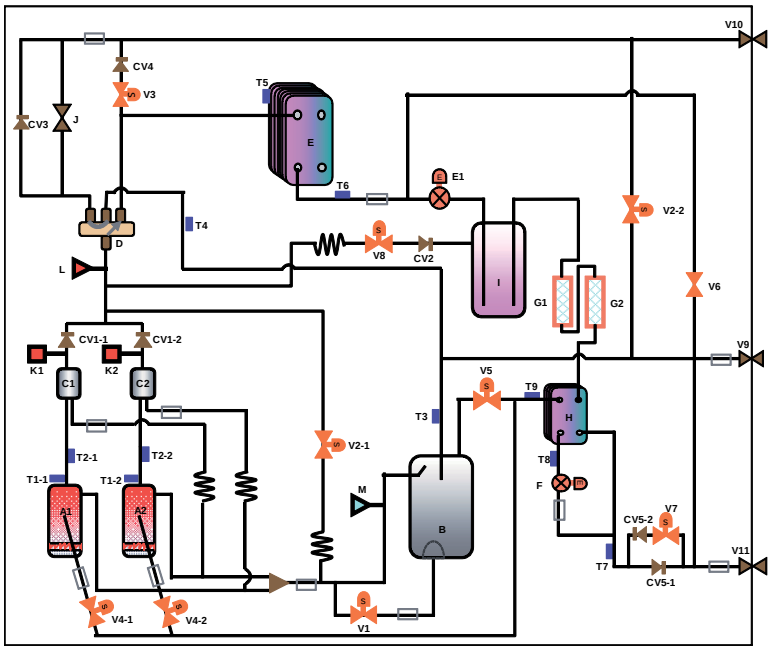
Abbreviation	Name
INV	Inveter Compressor
OFM	Outdoor Fan Motor
OHX	Outdoor Heat Exchanger
AC	Accumulator
OS	Oil Separator
IC	Intercooler
IPMC	IPM Cooler
CH	Crank Case Heater
HPS	High Pressure Sensor
LPS	Low Pressure Sensor
HPSW	High Pressure Switch
E_M	Main EEV
E_EV	EVI EEV
V_ES	EVI Sol. Valve
V_EB	EVI Bypass Valve
V_HG	Hot Gas Bypass Valve
V_HG2	Hot Gas Bypass Valve 2
V_4W	4Way Valve
V_AR	Accumulator Oil Return Valve
CV_E	EEV Bypass Check Valve
CV_D	Discharge Check Valve
CV_MC	MainCooling Check Valve
T_D	Discharge Temperature Sensor
T_S	Suction Temperature Sensor
T_S2	Suction Temperature Sensor 2
T_CO	Cond. Out Temperature Sensor
T_EI	EVI In Temperature Sensor
T_EO	EVI Out Temperature Sensor
T_L	Liquid Pipe Temperature Sensor
T_CT	Comp. Top Temperature Sensor
T_A	Ambient Temperature Sensor
SV_G	Gas Pipe Service Valve
SV_LG	Low P. Gas Pipe Service Valve
SV_L	Liquid Pipe Service Valve

7-7 AM080/100/120FXWA✳✳



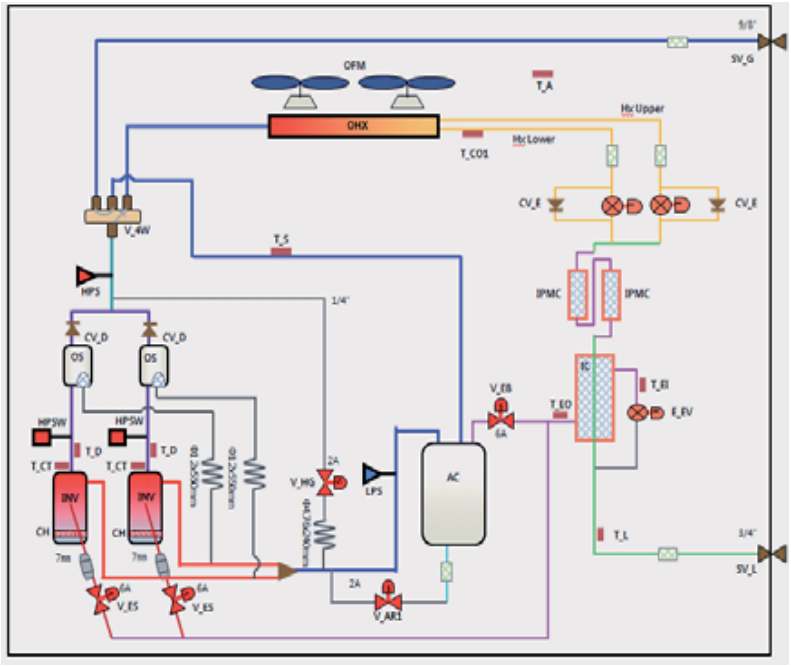
Abbreviation	Name
A	INV COMP
B	ACCUM
C	O/S
D	4WAY V/V
E	PLATE HEAT EXCHANGER
E1	MAIN EEV
F	EVI EEV
G	IPM COOLER
H	SUB COOLER
I	RECEIVER
J	HEAT PUMP V/V
K	HIGH PRE. S/W
L	HIGH PRE. SENSOR
M	LOW PRE. SENSOR
V1	ACCUM RETRUN V/V
V2-1, V2-2	HOT GAS BYPASS VV
V3	MAIN COOLING V/V
V4	EVI V/V
V5	EVI B/P V/V
V6	DPR V/V
V7	LIQUID TUBE V/V
V8	HOT GAS CHARGING V/V
V9	LOW PRE. GAS SERVICE V/V
V10	HIGH PRE. GAS SERVICE V/V
V11	LIQUID SERVICE V/V
CV1	DISC. CHECK V/V
CV2	HRV CHECK V/V
CV3	HR CHECK V/V
CV4	MAIN COOL CHECK V/V
CV5-1, CV5-2	LIQUID TUBE CHECK V/V
T1	COMP TOP SENSOR
T2	DISC. SENSOR
T3	SUC. SENSOR 2
T4	SUC. SENSOR 1
T5	WATER SENSOR
T6	COND OUT SENSOR
T7	LIQUID TUBE SENSOR
T8	SC IN SENSOR
T9	SC OUT SENSOR

7-8 AM200FXWA✳✳



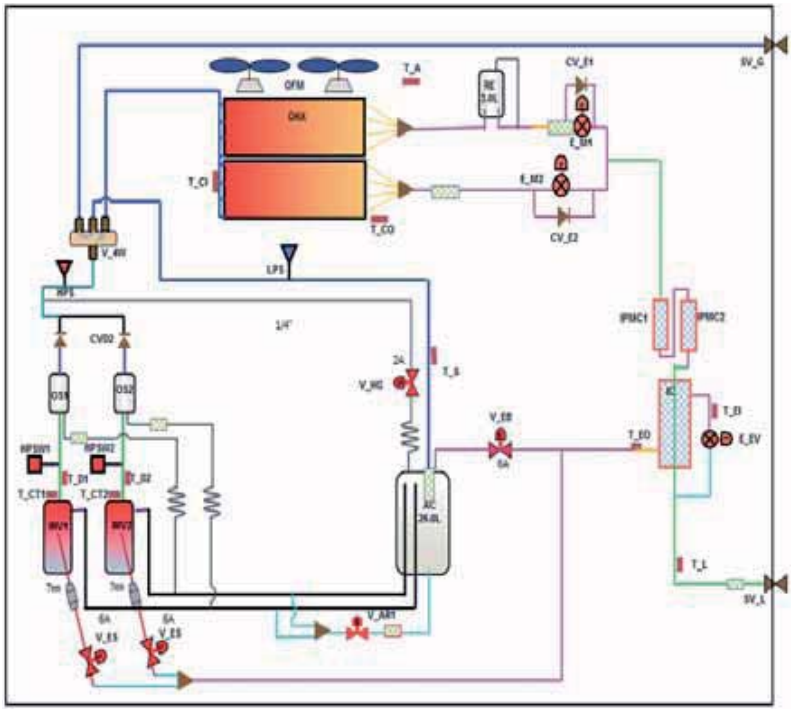
Abbreviation	Name
A1, A2	INV COMP
B	ACCUM
C1, C2	O/S
D	4WAY V/V
E	PLATE HEAT EXCHANGER
E1	MAIN EEV
F	EVI EEV
G1, G2	IPM COOLER
H	SUB COOLER
I	RECEIVER
J	HEAT PUMP V/V
K1, K2	HIGH PRE. S/W
L	HIGH PRE. SENSOR
M	LOW PRE. SENSOR
V1	ACCUM RETRUN V/V
V2-1, V2-2	HOT GAS BYPASS VV
V3	MAIN COOLING V/V
V4-1, V4-2	EVI V/V
V5	EVI B/P V/V
V6	DPR V/V
V7	LIQUID TUBE V/V
V8	HOT GAS CHARGING V/V
V9	LOW PRE. GAS SERVICE V/V
V10	HIGH PRE. GAS SERVICE V/V
V11	LIQUID SERVICE V/V
CV1-1, CV-2	DISC. CHECK V/V
CV2	HRV CHECK V/V
CV3	HR CHECK V/V
CV4	MAIN COOL CHECK V/V
CV5-1, CV5-2	LIQUID TUBE CHECK V/V
T1-1, T1-2	COMP TOP SENSOR
T2-1, T2-2	DISC. SENSOR
T3	SUC. SENSOR 2
T4	SUC. SENSOR 1
T5	WATER SENSOR
T6	COND OUT SENSOR
T7	LIQUID TUBE SENSOR
T8	SC IN SENSOR
T9	SC OUT SENSOR

7-9 AM240/260HXVAGH/EU



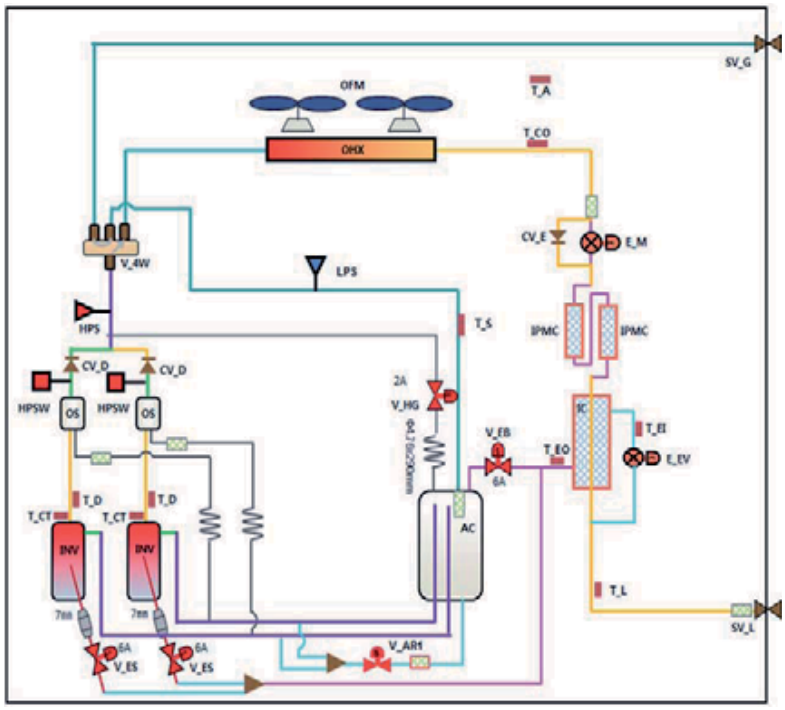
Abbreviation	Name
INV	Inverter compressor
OFM	Outdoor Fan Motor
OHX	Outdoor Heat Exchanger
AC	Accumulator
OS	Oil Separator
IC	Intercooler
IPMC	IPM Cooler
CH	Crank Case Heater
HPS	High Pressure Sensor
LPS	Low Pressure Sensor
HPSW	High Pressure Switch
E_M	Main EEV
E_EV	EVI EEV
V_ES	EVI Sol. Valve
V_EB	EVI Bypass Valve
V_HG	Hot Gas Bypass Valve
V_4W	4Way Valve
V_AR	Accumulator Oil Return Valve
CV_E	EEV Bypass Check Valve
CV_D	Discharge Check Valve
T_D	Discharge Temperature Sensor
T_S	Suction Temperature Sensor
T_CO	Cond. Out Temperature Sensor
T_EI	EVI In Temp. Sensor
T_EO	EVI Out Temp. Sensor
T_L	Liquid Pipe Temp. Sensor
T_CT	Comp. Top Temp. Sensor
T_A	Ambient Temperature Sensor
SV_G	Gas Pipe Service Valve
SV_L	Liquid Pipe Service Valve

7-10 AM240/260/280KXVG✳✳, AM280/300KXVA✳✳, AM080KXVS✳✳



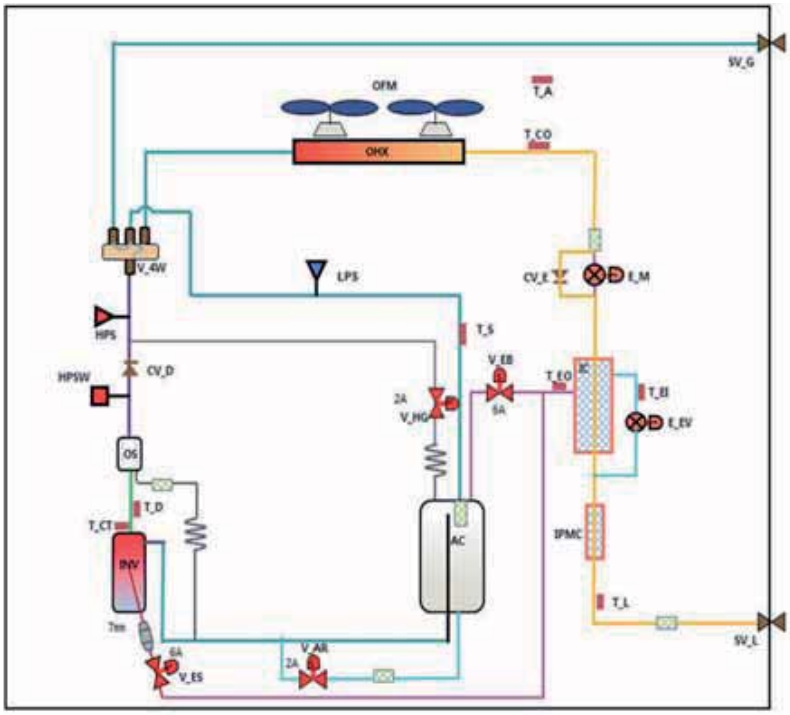
Abbreviation	Name
INV1	Inverter Compressor
INV2	Inverter Compressor
OFM	Outdoor Fan Motor
OHX	Outdoor Heat Exchanger
AC	Accumulator
RE	Receiver
OS1	Oil Separator
OS2	Oil Separator
CVD1	Discharge Check Valve
CVD2	Discharge Check Valve
IC	Intercooler
IPMC1	IPM Cooler
IPMC2	IPM Cooler
HPS	High Pressure Sensor
LPS	Low Pressure Sensor
HPSW1	High Pressure Switch
HPSW2	High Pressure Switch
E_M1	Main EEV
E_M2	Main EEV
E_EV	EVI EEV
V_ES	EVI Sol. Valve
V_EB	EVI Bypass Valve
V_HG	Hot Gas Bypass Valve
V_4W	4Way Valve
V_AR1	Accumulator Oil Return Valve
CV_E1	EEV Bypass Check Valve 1
CV_E2	EEV Bypass Check Valve 2
T_D1	Discharge Temp. Sensor
T_D2	Discharge Temp. Sensor
T_S	Suction Temp. Sensor
T_CO	Cond Out Temp. Sensor
T_CL	Cond In Temp. Sensor
T_EI	EVI In Temp. Sensor
T_EO	EVI Out Temp. Sensor
T_L	Liquid Tube Temp. Sensor
T_CT1	Comp. Top Temp. Sensor
T_CT2	Comp. Top Temp. Sensor
T_A	Ambient Temp. Sensor
SV_G	Gas Pipe Service Valve
SV_L	Liquid Pipe Service Valve

7-11 AM180/200/220KXVG✳✳, AM200/220KXVA✳✳



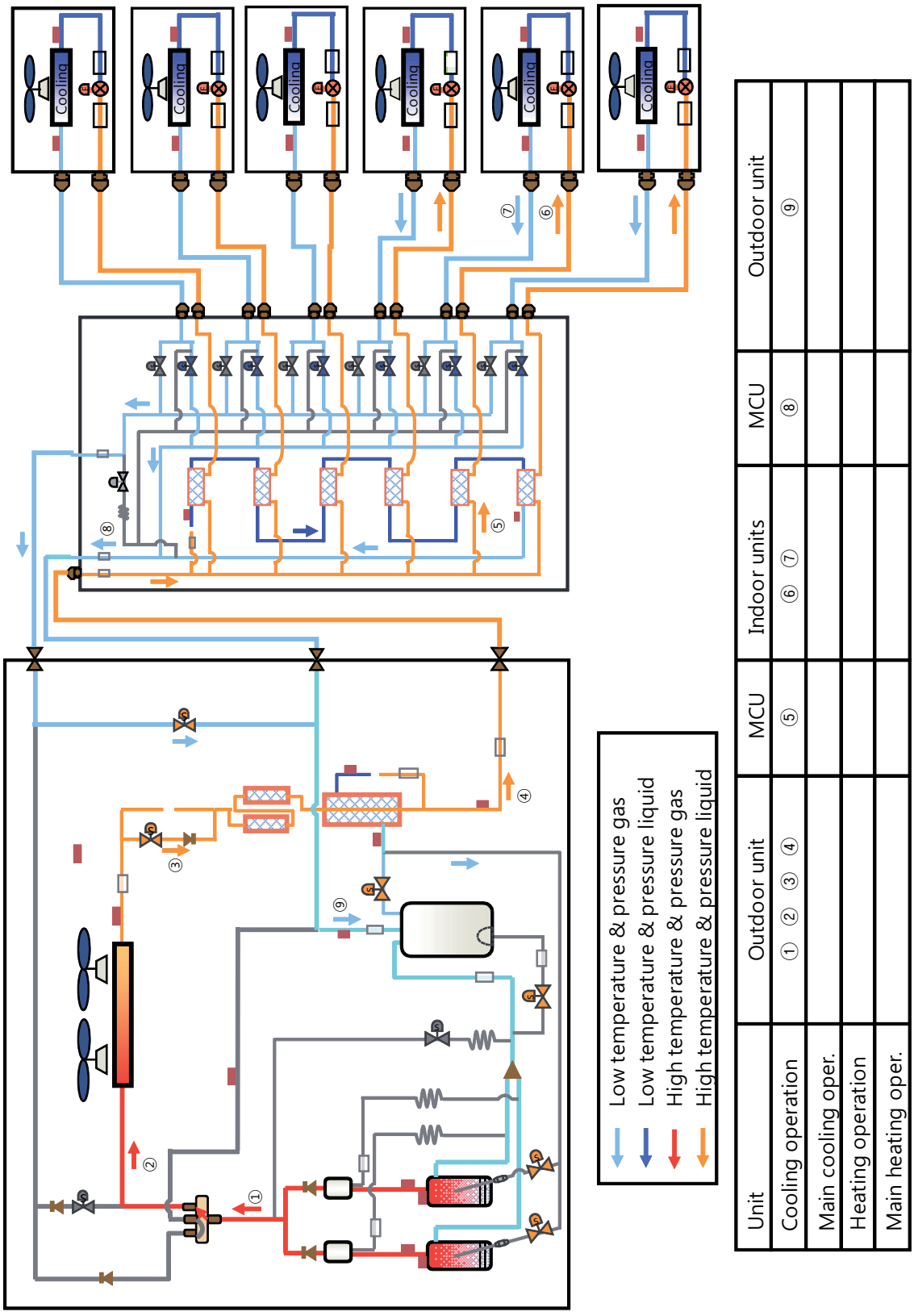
Abbreviation	Name
INV1	Inverter Compressor
INV2	Inverter Compressor
OFM	Outdoor Fan Motor
OHX	Outdoor Heat Exchanger
AC	Accumulator
RE	Receiver
OS1	Oil Separator
OS2	Oil Separator
CVD1	Discharge Check Valve
CVD2	Discharge Check Valve
IC	Intercooler
IPMC1	IPM Cooler
IPMC2	IPM Cooler
HPS	High Pressure Sensor
LPS	Low Pressure Sensor
HPSW1	High Pressure Switch
HPSW2	High Pressure Switch
E_M1	Main EEV
E_M2	Main EEV
E_EV	EVI EEV
V_ES	EVI Sol. Valve
V_EB	EVI Bypass Valve
V_HG	Hot Gas Bypass Valve
V_4W	4Way Valve
V_AR1	Accumulator Oil Return Valve
CV_E1	EEV Bypass Check Valve 1
CV_E2	EEV Bypass Check Valve 2
T_D1	Discharge Temp. Sensor
T_D2	Discharge Temp. Sensor
T_S	Suction Temp. Sensor
T_CO	Cond Out Temp. Sensor
T_CL	Cond In Temp. Sensor
T_EI	EVI In Temp. Sensor
T_EO	EVI Out Temp. Sensor
T_L	Liquid Tube Temp. Sensor
T_CT1	Comp. Top Temp. Sensor
T_CT2	Comp. Top Temp. Sensor
T_A	Ambient Temp. Sensor
SV_G	Gas Pipe Service Valve
SV_L	Liquid Pipe Service Valve

7-12 AM140/160KXVG✳✳, AM140/160/180KXVA✳✳



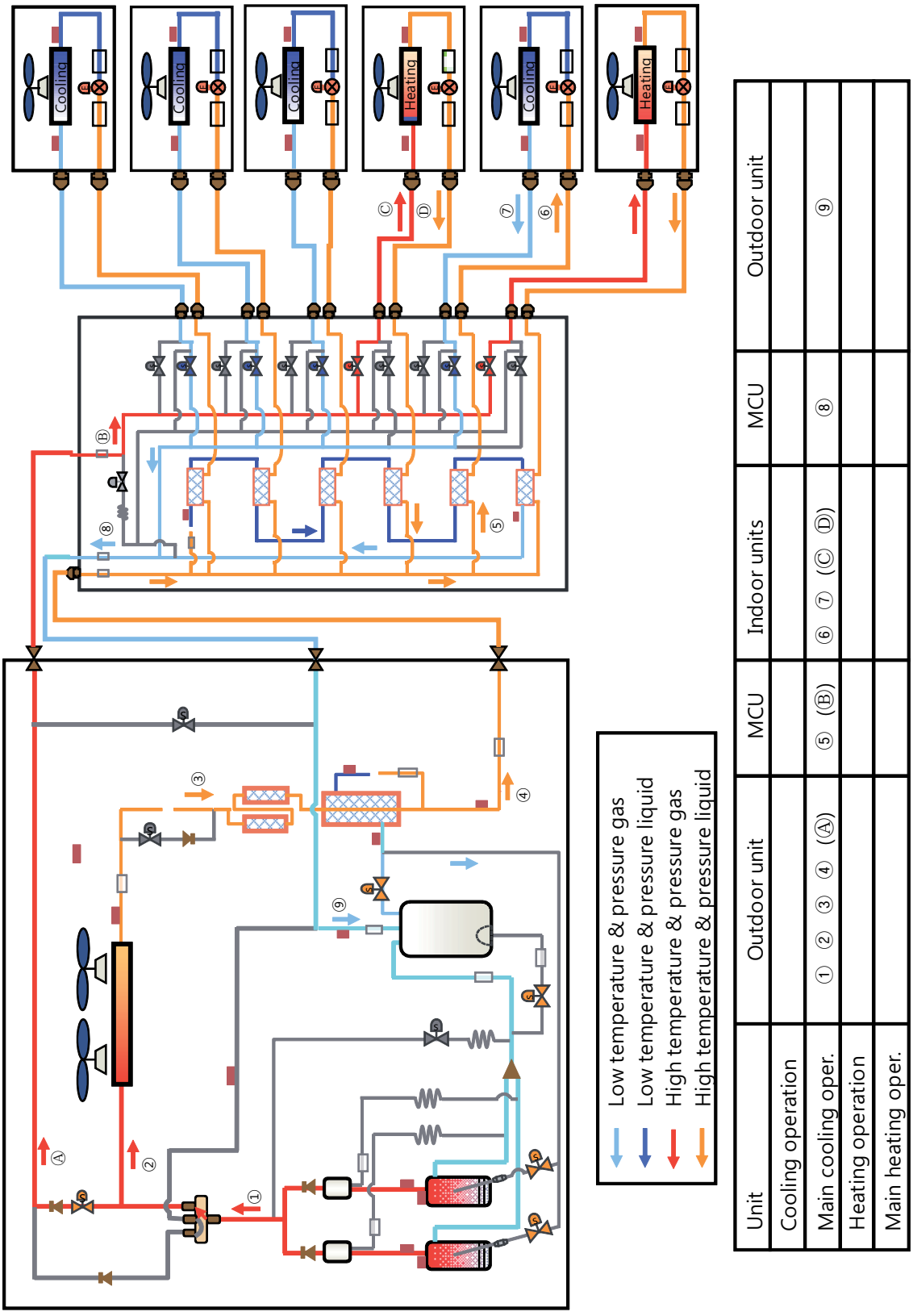
Abbreviation	Name
INV	Inveter Compressor
OFM	Outdoor Fan Motor
OHX	Outdoor Heat Exchanger
AC	Accumulator
OS	Oil Separator
IC	Intercooler
IPMC	IPM Cooler
HPS	High Pressure Sensor
LPS	Low Pressure Sensor
HPSW	High Pressure Switch
E_M	Main EEV
E_EV	EVI EEV
V_ES	EVI Sol. Valve
V_EB	EVI Bypass Valve
V_HG	Hot Gas Bypass Valve
V_4W	4Way Valve
V_AR	Accumulator Oil Return Valve
CV_E	EEV Bypass Check Valve
CV_D	Discharge Check Valve
T_D	Discharge Temp. Sensor
T_S	Suction Temp. Sensor
T_CO	Cond Out Temp. Sensor
T_EI	EVI In Temp. Sensor
T_EO	EVI Out Temp. Sensor
T_L	Liquid Tube Temp. Sensor
T_CT	Comp. Top Temp. Sensor
T_A	Ambient Temp. Sensor
SV_G	Gas Pipe Service Valve
SV_L	Liquid Pipe Service Valve

7-13 Cooling operation (H/R)



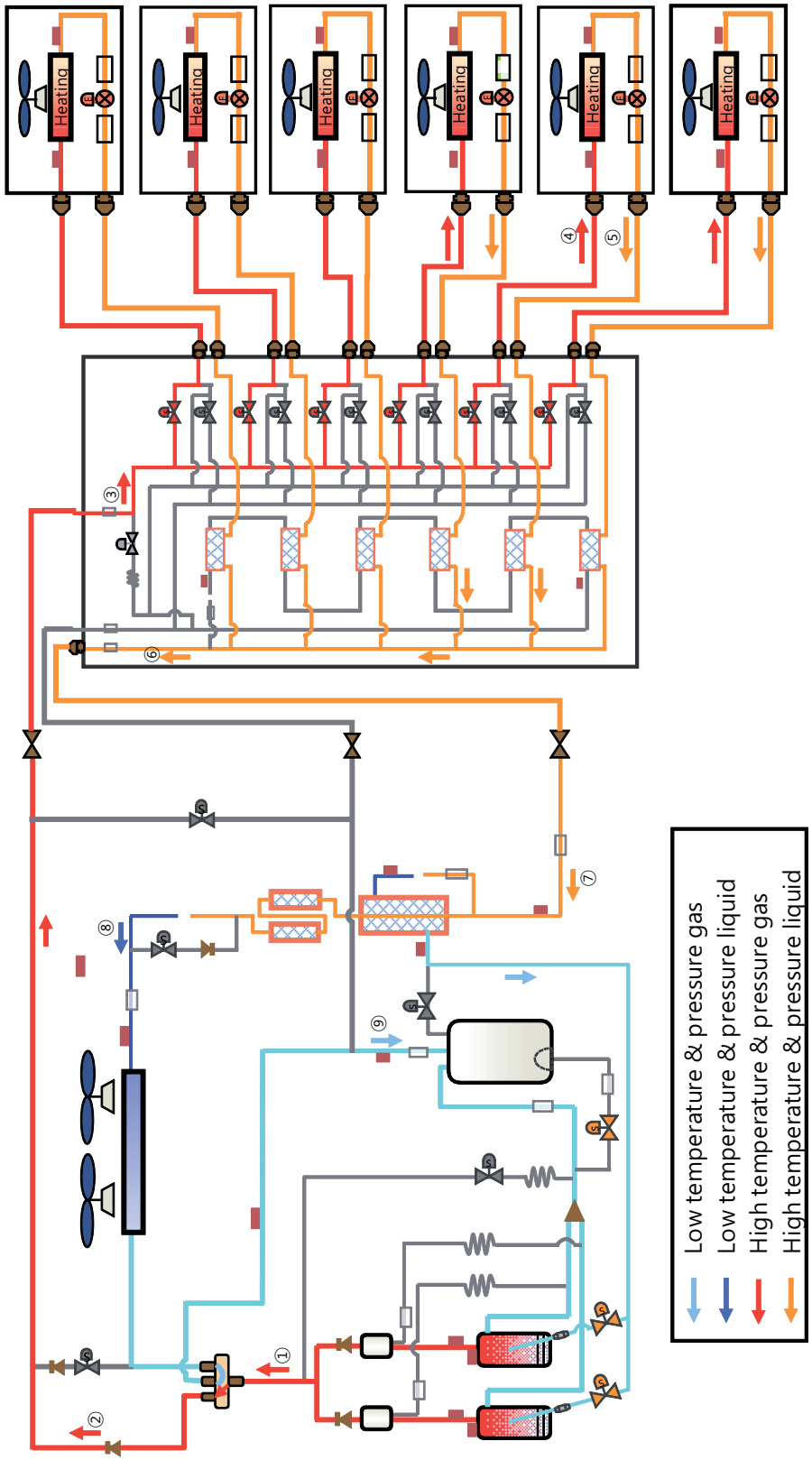
Unit	Outdoor unit	MCU	Indoor units	MCU	Outdoor unit
Cooling operation	① ② ③ ④	⑤	⑥ ⑦	⑧	⑨
Main cooling oper.					
Heating operation					
Main heating oper.					

7-14 Main cooling operation (H/R)



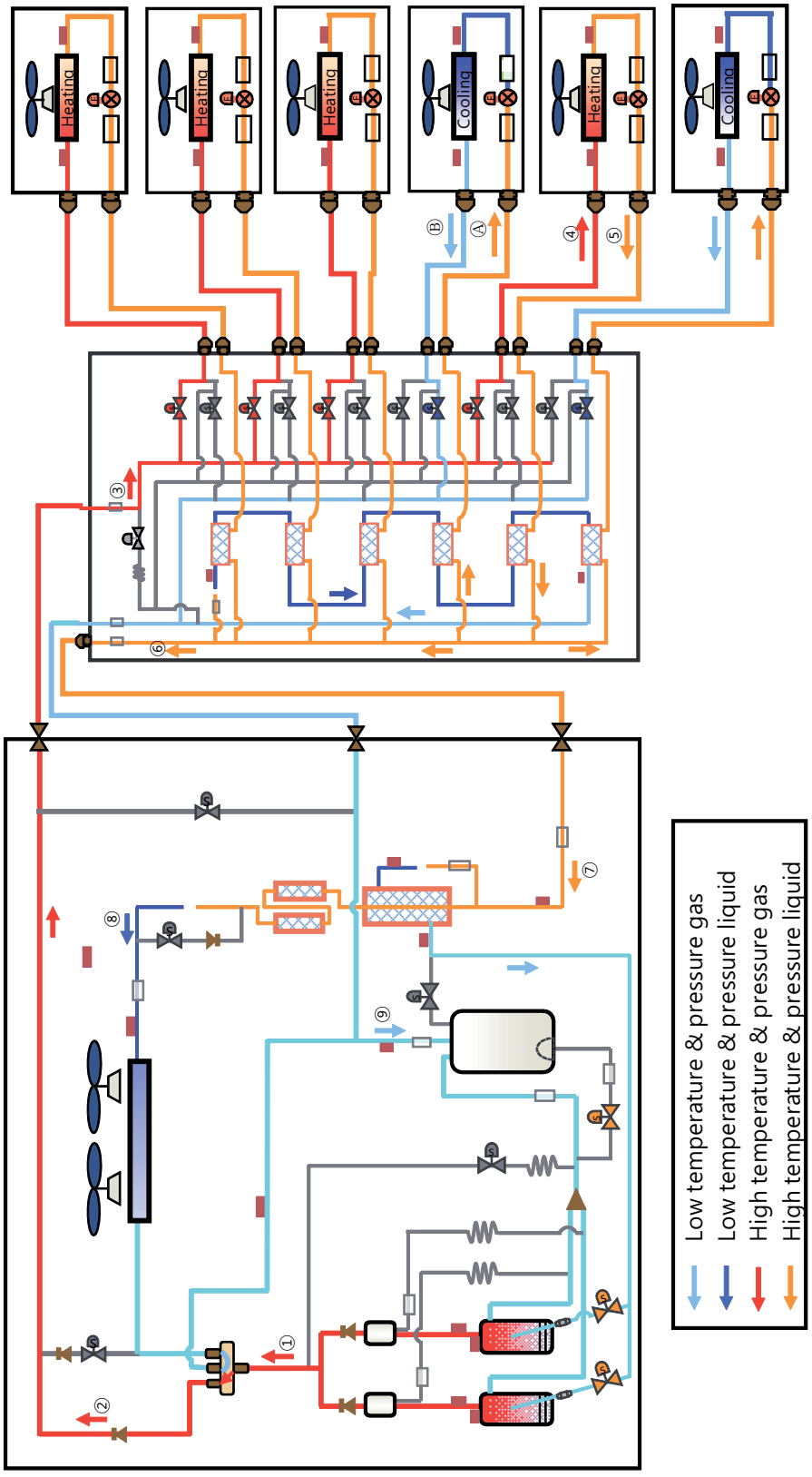
Unit	Outdoor unit	MCU	Indoor units	MCU	Outdoor unit
Cooling operation					
Main cooling oper.	① ② ③ ④ (Ⓐ)	⑤ (Ⓑ)	⑥ ⑦ (Ⓒ Ⓓ)	⑧	⑨
Heating operation					
Main heating oper.					

7-15 Heating operation (H/R)



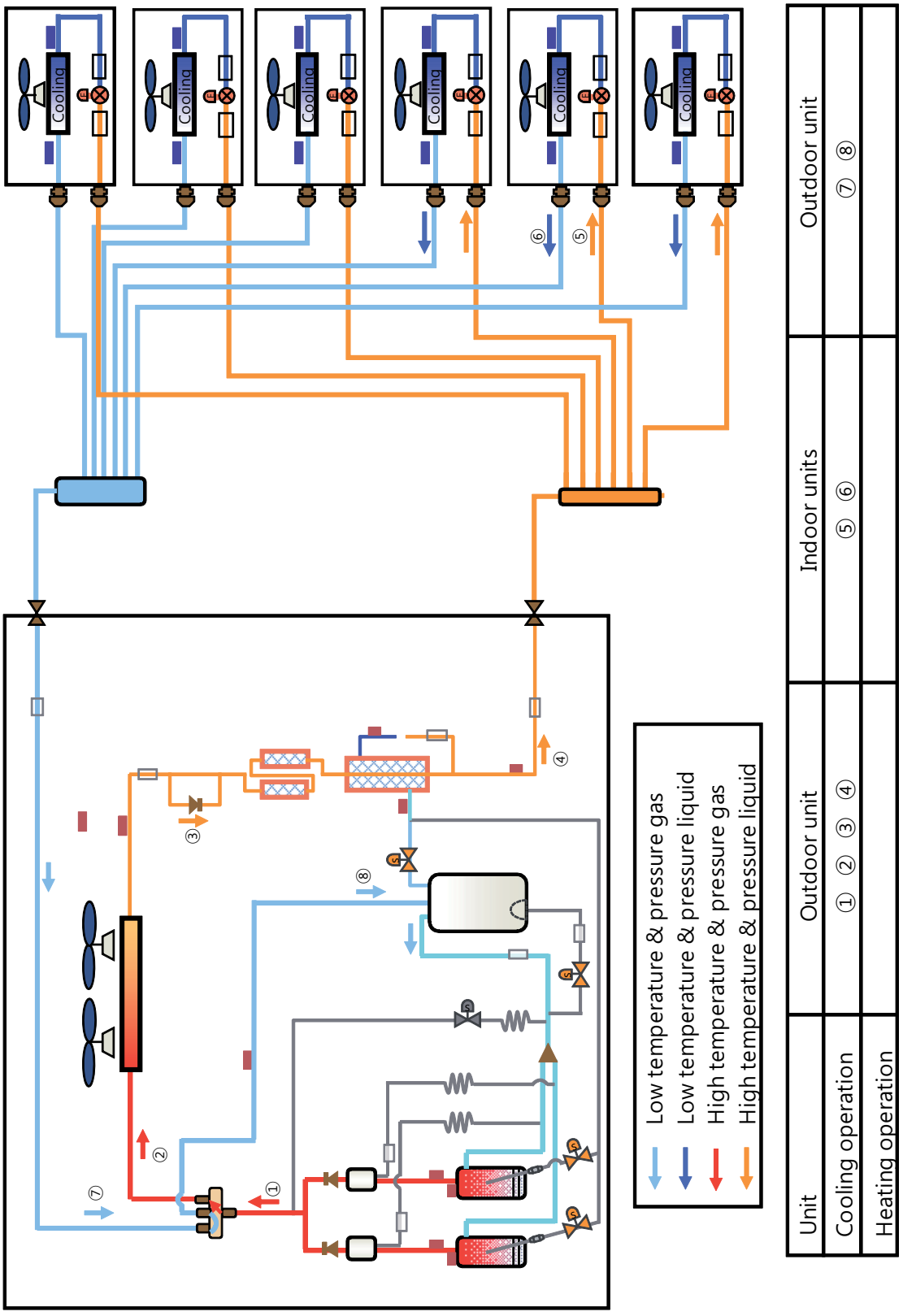
Unit	Outdoor unit	MCU	Indoor units	MCU	Outdoor unit
Cooling operation					
Main cooling oper.					
Heating operation	① ②	③	④ ⑤	⑥	⑦ ⑧ ⑨
Main heating oper.					

7-16 Main heating operation (H/R)

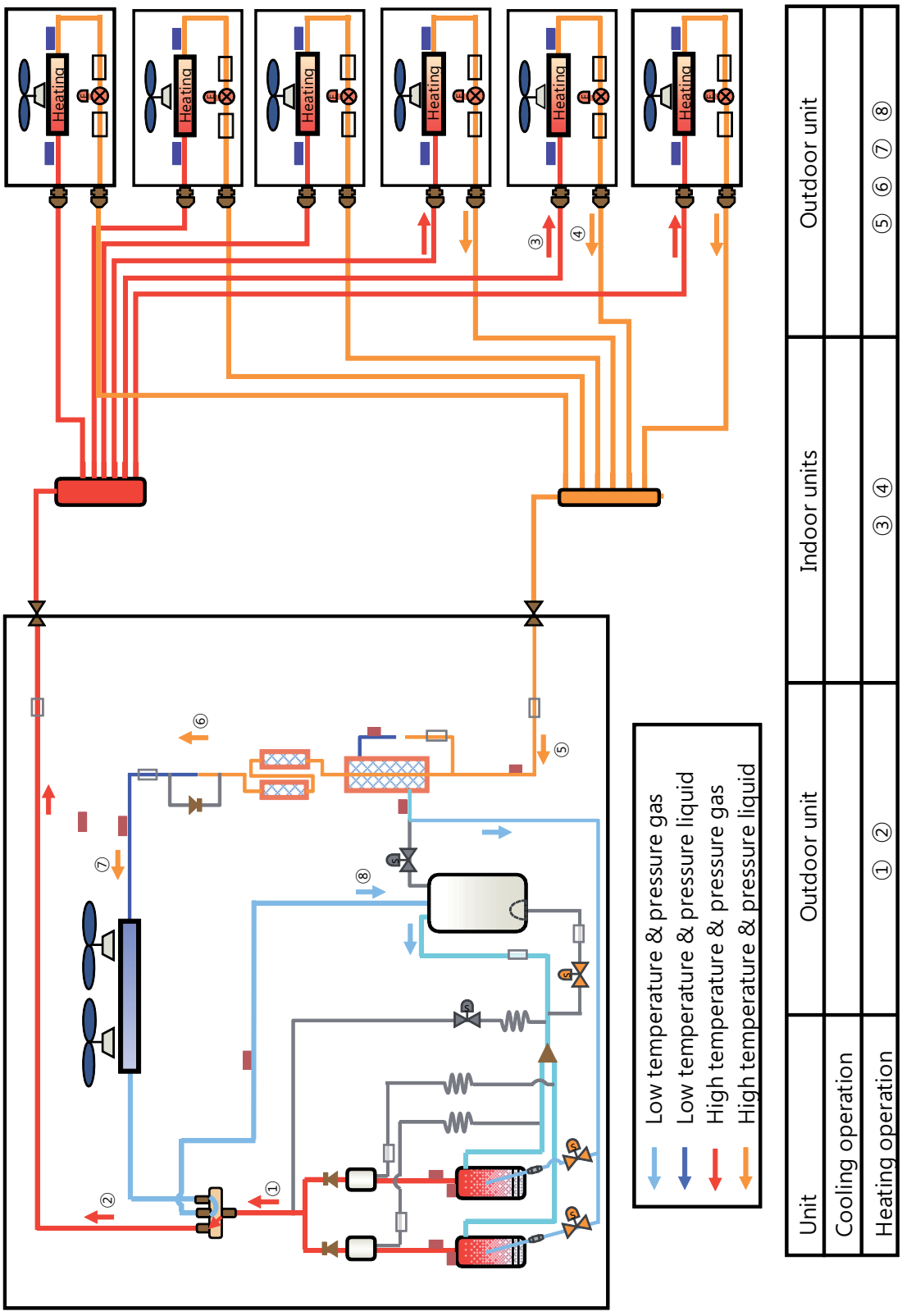


Unit	Outdoor unit	MCU	Indoor units	MCU	Outdoor unit
Cooling operation					
Main cooling oper.					
Heating operation					
Main heating oper.	① ②	③	④ ⑤ (Ⓐ Ⓑ)	⑥ (Ⓒ)	⑦ ⑧ ⑨

7-17 Cooling operation (H/P)



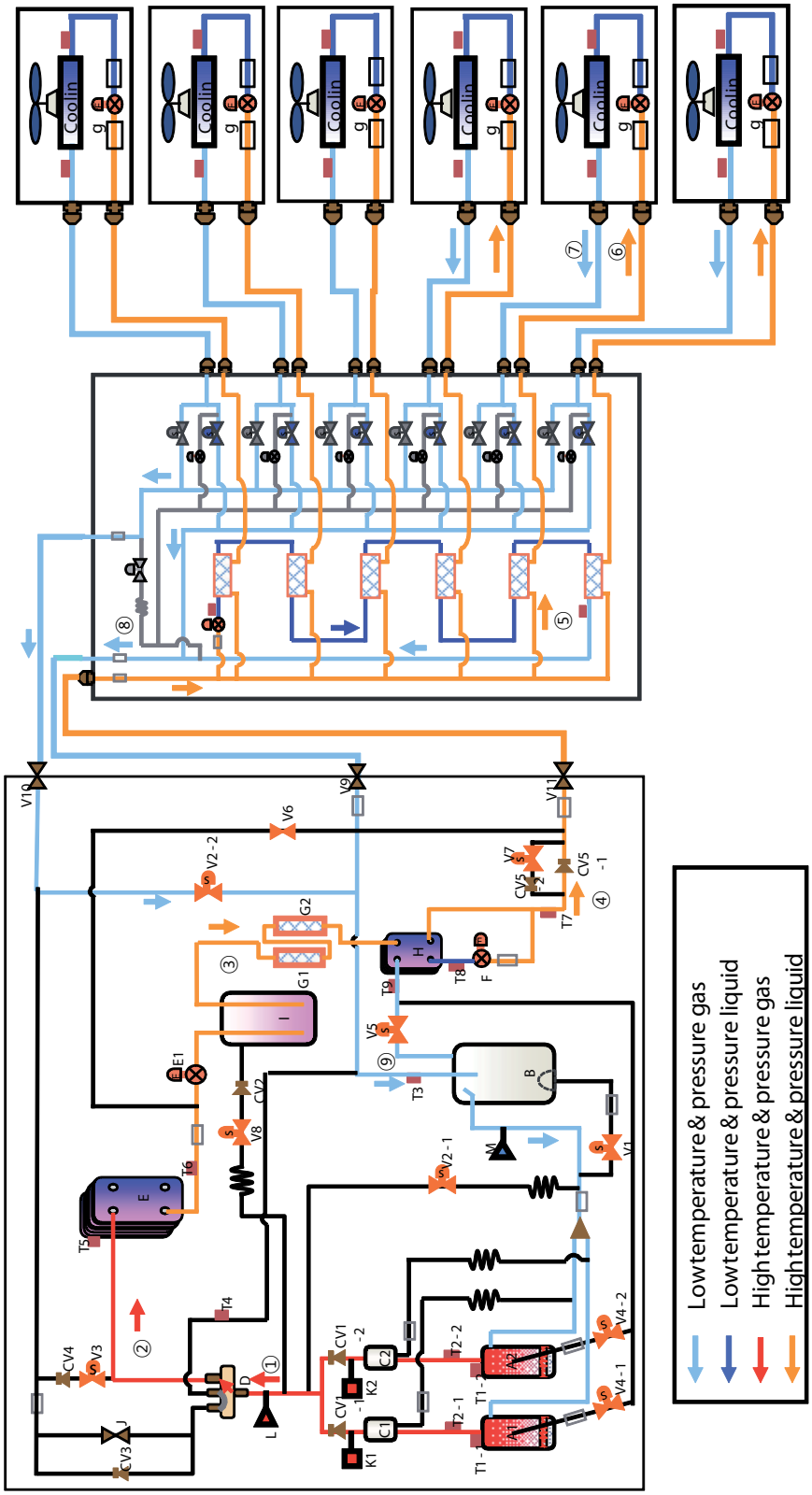
7-18 Heating operation (H/P)



Unit	Outdoor unit	Indoor units	Outdoor unit
Cooling operation		③ ④	⑤ ⑥ ⑦ ⑧
Heating operation	① ②		

7-19 Cooling operation(H/R)

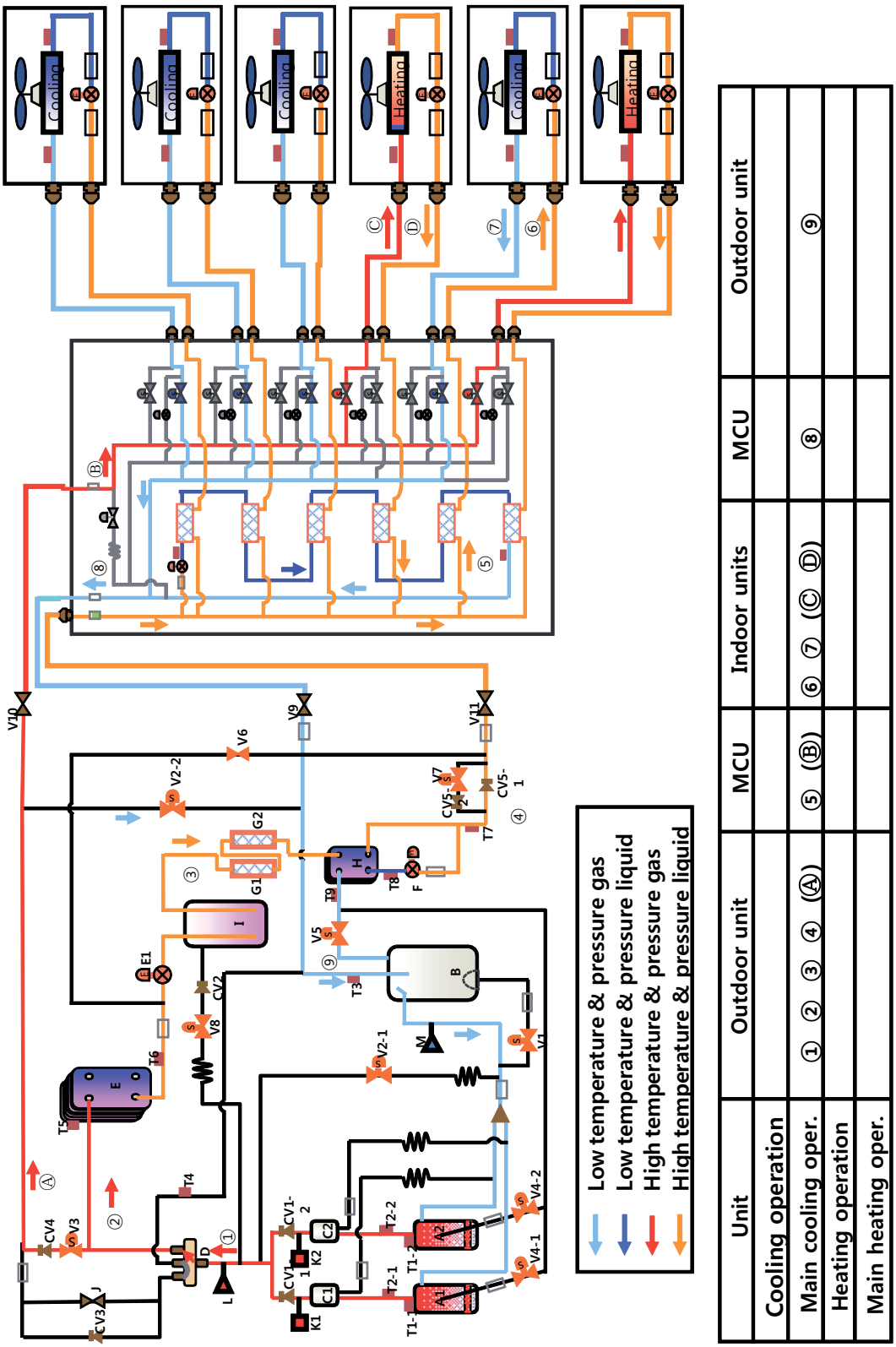
■ **AM080/100/120/200FXWA**✳✳



Unit	Outdoor unit				MCU	Indoor units		MCU	Outdoor unit
	①	②	③	④	⑤	⑥	⑦	⑧	⑨
Cooling operation									
Main cooling oper.									
Heating operation									
Main heating oper.									

7-20 Main cooling operation(H/R)

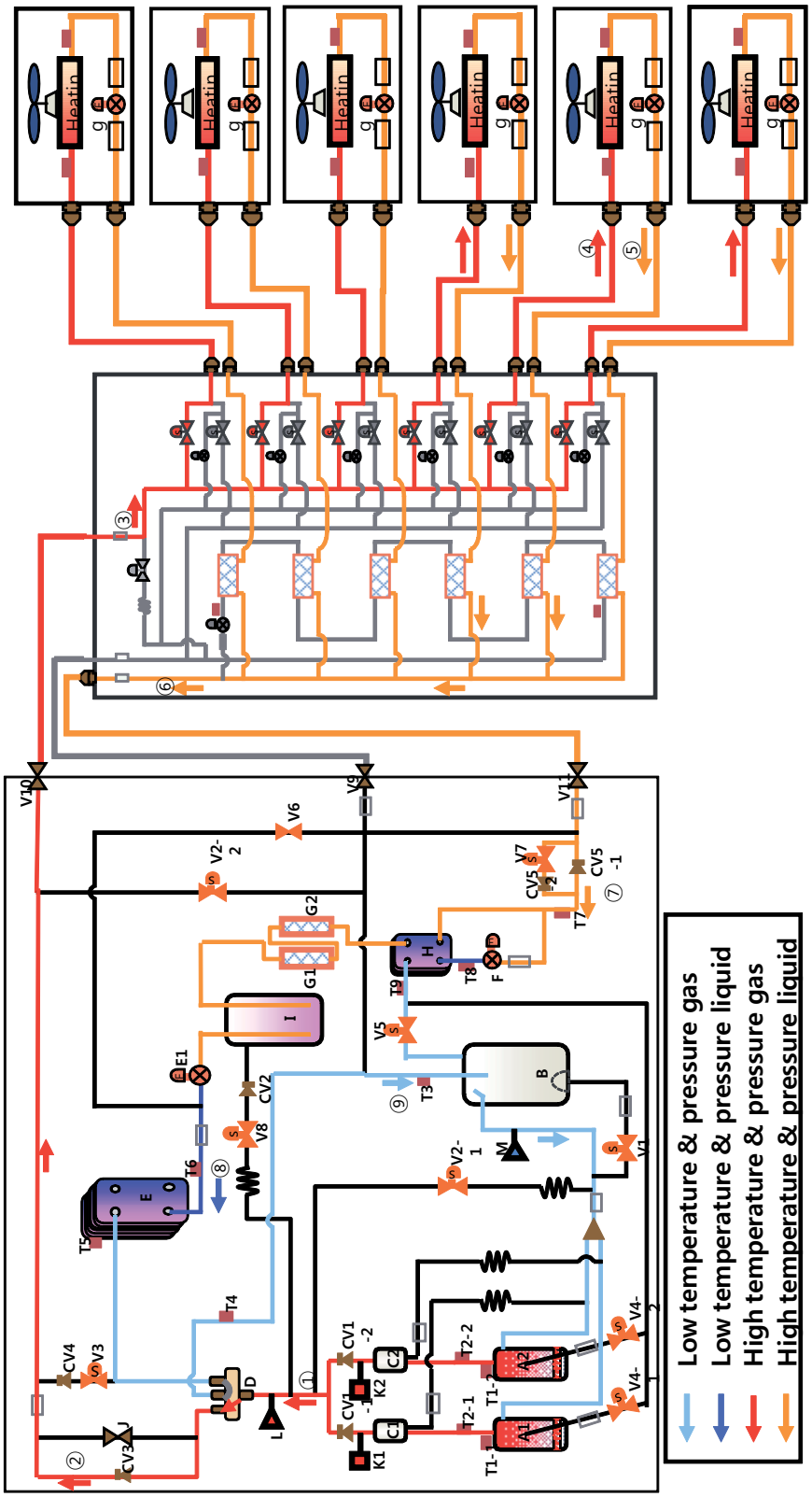
■ AM080/100/120/200FXWA✳✳



Unit	Outdoor unit	MCU	Indoor units	MCU	Outdoor unit
Cooling operation					
Main cooling oper.	① ② ③ ④ (Ⓐ)	⑤ (Ⓑ)	⑥ ⑦ (Ⓒ Ⓓ)	⑧	⑨
Heating operation					
Main heating oper.					

7-21 Heating operation(H/R)

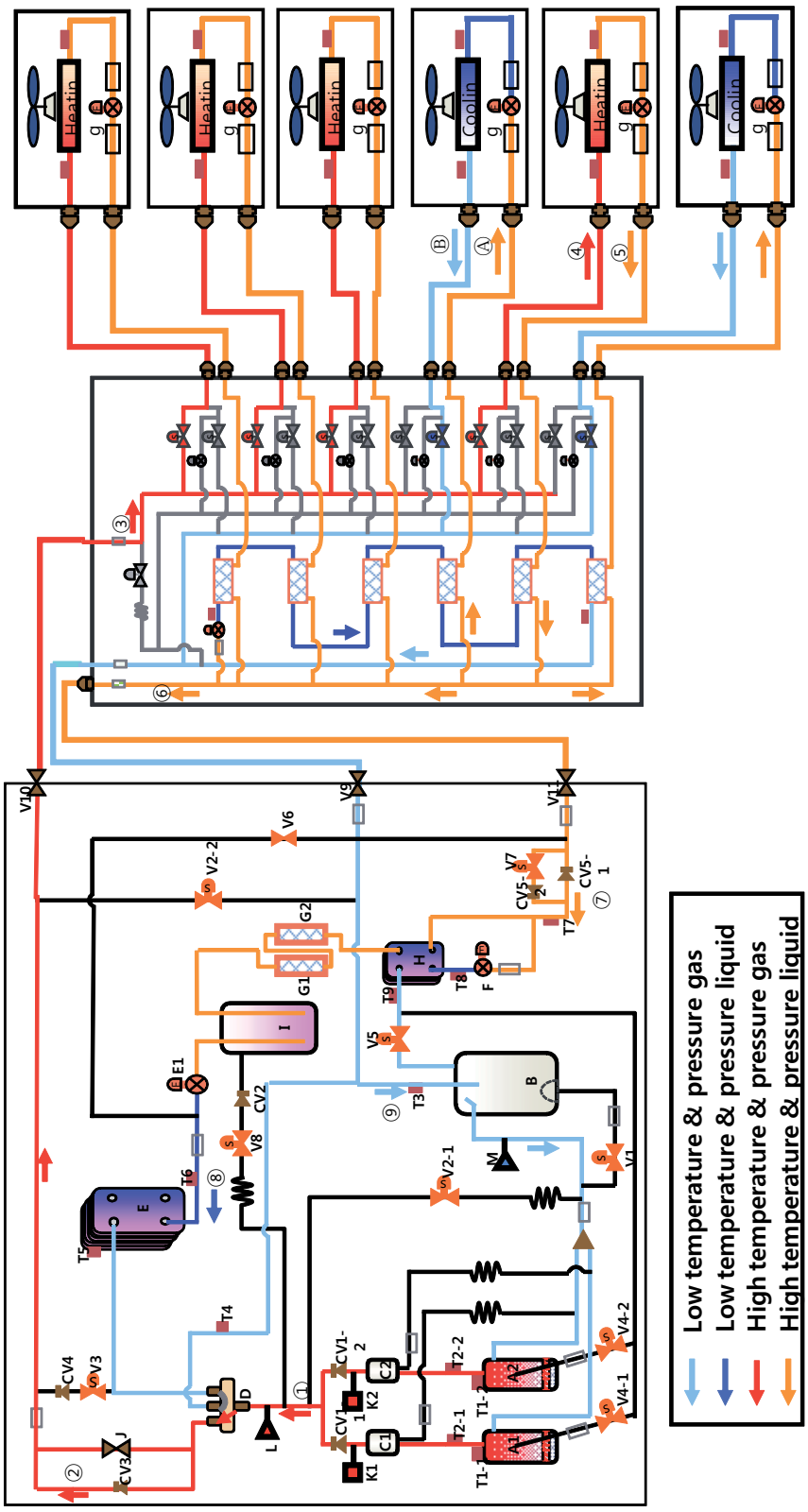
■ **AM080/100/120/200FXWA✳✳**



Unit	Outdoor unit	MCU	Indoor units	MCU	Outdoor unit
Cooling operation					
Main cooling oper.					
Heating operation	① ②	③	④ ⑤	⑥	⑦ ⑧ ⑨
Main heating oper.					

7-22 Main heating operation(H/R)

■ **AM080/100/120/200FXWA**✳✳



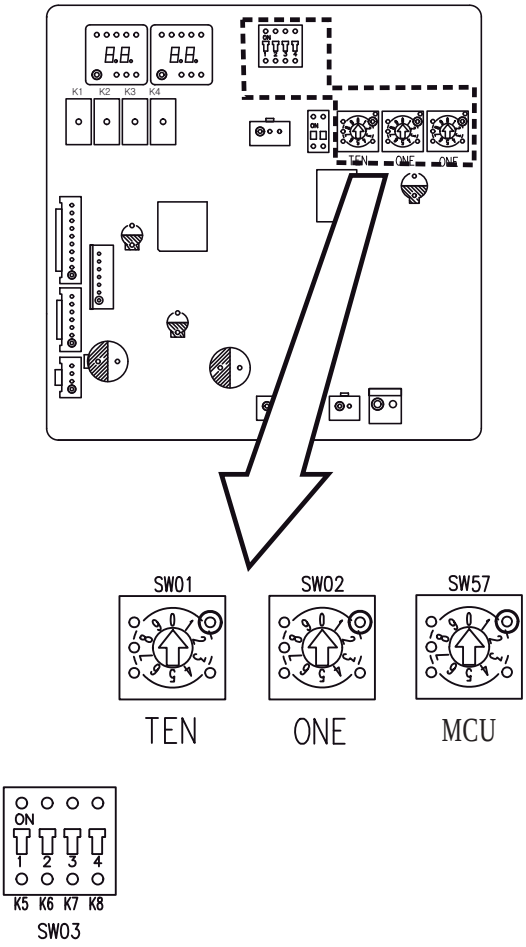
Unit	Outdoor unit	MCU	Indoor units	MCU	Outdoor unit
	① ②	③	④ ⑤ (Ⓐ Ⓑ)	⑥ (Ⓒ)	⑦ ⑧ ⑨
Cooling operation					
Main cooling oper.					
Heating operation					
Main heating oper.					

7-23 Cycle Component Function Explanation

1. Accumulator : Separating the incoming liquid refrigerant to the compressor in order to prevent liquid refrigerant.
2. Oil Separator : Separating the oil from the refrigerant discharged from the compressor, and the separated oil is returned to the compressor.
3. Intercooler : Supercooled liquid refrigerant through the heat exchanger and makes the medium pressure gas refrigerant injected into the compressor.
4. IPM Cooler : IPM (Intelligent Power Module) by cooling to prevent overheating.
5. High/Low Pressure Sensor : Measure high/low Pressure of system.
6. High Pressure Switch : Suspend immediately for protection of system if high pressure of system exceeds setting value.
7. Outdoor EEV (Main EEV) : Adjust the incoming refrigerant to the outdoor heat exchanger during heating operation.
8. EVI EEV : By adjusting the amount of refrigerant passing through the Subcooler to obtain the degree of supercooling and adjust the amount of gas refrigerant entering to the compressor.
9. 4Way Valve : Change the direction of flow of the refrigerant to the cooling / heating operation.
10. ARV (Accumulator Oil Return Valve) : Remaining at the bottom of the Accumulator recovered oil to the compressor.
11. MainCooling Valve : In the main cooling operation, sending the high pressure refrigerant to indoor unit in heating mode.
12. Outdoor EEV Valve : In the main cooling operation, It's closed so that the Outdoor EEV Valve can control the amount of the refrigerant.
13. Hotgas Valve : Sending the high pressure gas to low pressure pipe in order to protect low pressure.
14. Hotgas Valve 2 : In the cooling operation, changing high pressure pipe to low pressure pipe.
15. EVI SOL V : This valve opens when using the vapor Injection.
16. EVI BYPASS V : This valve opens in the sub cooling control. It's closed when using the vapor injection.
17. Discharge Temperature Sensor : Measure the temperature of the refrigerant discharged from the compressor.
18. Suction Temperature Sensor : Measure the temperature of the refrigerant to the compressor suction.
19. Cond. Out Temperature Sensor : Measure the temperature of the outdoor heat exchanger of the air conditioning operation.
20. EVI In/Out Temperature Sensor : Measure the temperature of the refrigerant inlet and outlet of the Subcooler.
21. Liquid Pipe Temperature Sensor : Measure the temperature of supercooling refrigerant in the outdoor unit of the air conditioning.
22. Comp. Top Temperature Sensor : Measure the temperature of compressor top cover.
23. Ambient Temperature Sensor : Measure the outdoor temperature.
24. Water Temperature Sensor : Plate Heat Exchanger internal temperature measurement
25. Control box temp. Sensor : Control box internal temperature measurement, thermal protection used for the control.
26. Receiver : Storing the refrigerant piping system, a stable liquid refrigerant supply
27. Liquid Tube Valve : Refrigerant in the outdoor unit side, the indoor unit during heating operation to rotate the valve operation.

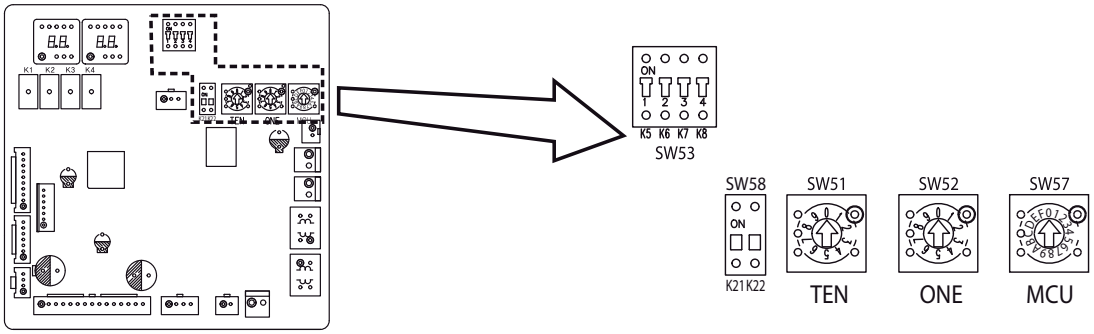
8. Key Options

8-1 Outdoor unit option switch settings



■ AM080~260✳XV✳✳✳

Switch	Setting		Function	Remarks
SW51/ SW52			Setting total number of installed indoor unit SW51: Tens digit, SW52: Units digit	Setting can be done from the main outdoor unit only (sub unit: setting is nnecessary) Ex) When 12 indoor units are installed → SW51: 1, SW52: 2
SW53	K6	ON	Enable maximum capacity restriction for cooling operation	Restrict excessive capacity increase when operating indoor units with small capacity
		OFF	Disable maximum capacity restriction for cooling operation	-
	K7	K8	Selecting outdoor unit address	
	ON	ON	Outdoor unit address: No 1	Main unit
	ON	OFF	Outdoor unit address: No 2	Sub unit 1
	OFF	ON	Outdoor unit address: No 3	Sub unit 2
	OFF	OFF	Outdoor unit address: No 4	Sub unit 3
SW57			Setting total number of connected MCU	Setting can be done from Main unit only. Ex) When 3 MCUs are installed → SW57: 3, When 10 MCUs are installed → SW57: A



■ AM080/100/120/200FXWA✳✳

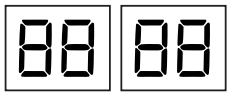
※ If you install HR products, you must match the address between the MCU and the indoor unit.

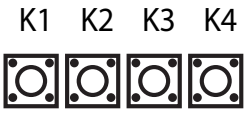
Switch	Setting		Function	Remarks
SW51/ SW52			Setting total number of installed indoor unit SW51: Tens digit, SW52: Units digit	Setting can be done from the main outdoor unit only (sub unit: setting is unnecessary) Ex) When 12 indoor units are installed → SW51: 1, SW52: 2
	K5	ON	H/P(Heat Pump) System	Connect Liguid pipe and High pressure gas pipe
		OFF	HR(Heat Recovery) System	Close outdoor unit's heatpump valve
	K6	ON	Enable maximum capacity restriction for cooling operation	Restrict excessive capacity increase when operating indoor units with small capacity
		OFF	Disable maximum capacity restriction for cooling operation	-
	K7	K8	Selecting outdoor unit address	
	ON	ON	Outdoor unit address: No 1	Main unit
	ON	OFF	Outdoor unit address: No 2	Sub unit 1
	OFF	ON	Outdoor unit address: No 3	Sub unit 2
	OFF	OFF	Outdoor unit address: No 4	Sub unit 3
SW57			Setting total number of connected MCU	Setting can be done from main unit only Ex) When 3 MCUs are installed → SW57: 3, SW52: 2
SW58	K21	K22	Selecting type of circulating water	
	ON	ON	Water circulation	-
	ON	OFF	Anti-freeze circulation (freezing point of anti-freeze must be below -8 ℃)	Minimum temperature of entering water -5 ℃
	OFF	ON	Anti-freeze circulation (freezing point of anti-freeze must be below -15 ℃)	Minimum temperature of entering water -10 ℃

※ Maintain appropriate concentration level of anti-freeze according to SW58 switch setting.

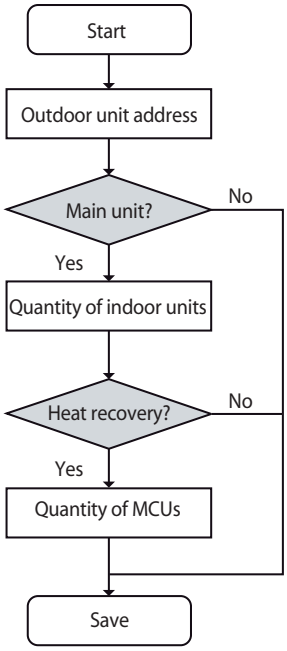
■ AM140/160/180/200/220/240/260/280/300KXV✳✳✳✳

※ Setting outdoor install option

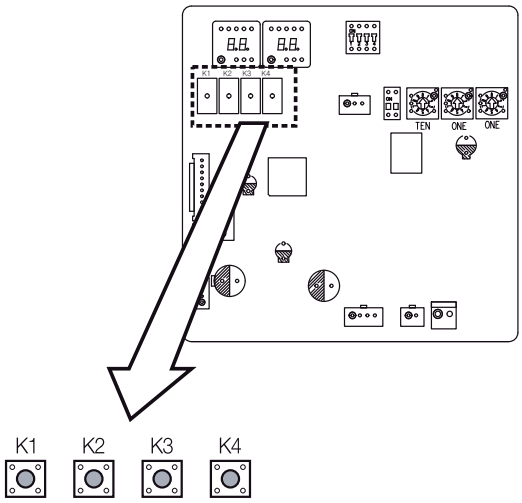




Step	Button	Display	Description	Note
Outdoor unit address				
Step1	Outdoor unit display	ad ad	Setting required-	
Step2	Press (K1+K2) for 2 seconds	ad 00	Unit address for module combination	00: Main unit
	K4 x 1 time	ad 01		01: Sub1 unit
	K4 x 2 times	ad 02		02: Sub2 unit
	K4 x 3 times	ad 03		03: Sub3 unit
Step3	If it is main unit, go to step4. Otherwise, press K2 button for 2 seconds to save & exit (system will be reset)			
Quantity of indoor units				
Step4	Press K1	Cd 00	Ready to set-	
Step5	K2 x n times	CdX0	Tens digit (0 ~ 6)	Ex) 03: 3 units 64: 64 units
	K4 x n times	Cd0X	Ones digit (0 ~ 9)	
	* K4: Press for 2 seconds - automatic detection of indoor units' quantity			
Step6	If it is heat recovery model, go to step 7. Otherwise, press K2 button for 2 seconds to save & exit (system will be reset)			
Quantity of MCUs * Heat recovery model only				
Step7	Press K1	nC 00	Ready to set-	
Step8	K2 x n times	nCX0	Tens digit (0 ~ 1)	Ex) 03: 3 units 16: 16 units
	K4 x n times	nC0X	Ones digit (0 ~ 9)	
	* K4: Press for 2 seconds - automatic detection of MCUs' quantity			
Step9	K2: long	Ad 00	Save	Restart
* Press K1 for 2 seconds to exit without save regardless of setting step.				



8-2 How to set the key function of the outdoor unit



■ AM080~260✳XV✳✳✳

Tact switch installation and options of how to set up and functional description

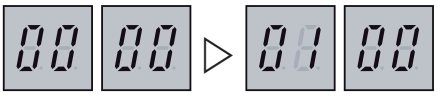
■ Options of how to set up

1. Entry by pressing the K2 for a long time.(However, the operation is only possible during the stop.)
   - Upon entering the following is displayed. (If the compressor is set truncation, 1 or 2 is displayed in Seg4.)

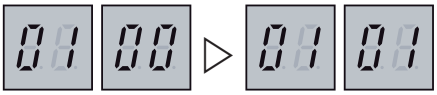
   - Displays the number of the currently selected option. Seg1, Seg2.
   - Displays the set value of the currently selected option. Seg3, Seg4.

2. After entering the option, briefly press the K1 switch will change the value of Seg1, Seg2 and then select the option to change.

   Example)



3. Press the switch briefly to the option you want to change the items of K2 will change the value of Seg3, Seg4 and then select the option to change.
   Example)



(4) K2 switch is pressed for 2 seconds after the option is selected, 7-Segment entire blinks and enters the tracking mode, and the option value is saved.

- As described above, if you do not normal shutdown the option settings can not be saved.

※ Press K1 for a long time, if you want to go back to the settings before the entry while setting the option to cancel the setting.

※ If you want the factory settings option in the setting mode, press K4 for a long time.

- K4 switch is pressed for a long time, all options settings return to the factory settings, but the settings are saved is not.
  K2 switch is pressed for a long time, 7-Segment enters the tracking mode and the settings will be saved.

How to set the key function of the outdoor unit (cont.)

■ AM080/100/120/200FXWA✳✳

Setting the option

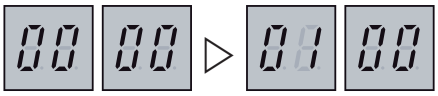
■ Options of how to set up

1. Press and hold K2 to enter the option setting. (Only available when the operation is stopped)
   -- If you enter the option setting, display will show the following. (If you have set the 'Emergency operation for compressor malfunction', 1 or 2 will be displayed on Seg 4.)

   -- Seg 1 and Seg 2 will display the number for selected option.
   -- Seg 3 and Seg 4 will display the number for set value of the selected option..

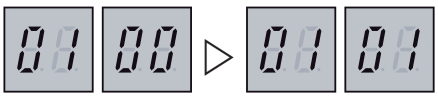
2. If you have entered option setting, you can shortly press the K1 switch to adjust the value of the Seg 1, Seg 2 and select the desired option. (Refer to pages 71~73 for the Seg number of the function for each option)

   Example)



3. If you have selected desired option, you can shortly press the K2 switch to adjust the value of the Seg 3, Seg 4 and change the function for the selected option.

   Example)



4. After selecting the function for options, press and hold the K2 switch for 2 seconds. Edited value of the option will be saved when entire segments blinks and tracking mode begins.

   ● Edited option will not be saved if you do not end the option setting as explained in above instruction.

※ While you are setting the option, you may press and hold the K1 button to reset the value to previous setting.

※ If you want to restore the setting to factory default, press and hold the K4 button while you are in the option setting mode.
   – If you press and hold the K4 button, setting will be restored to factory default but it doesn't mean that restored setting is saved.
   Press and hold the K2 button. When the segments shows that tracking mode is in progress, setting will be saved.

How to set the key function of the outdoor unit (cont.)

■ AM140/160/180/200/220/240/260/280/300KXV✳✳✳✳

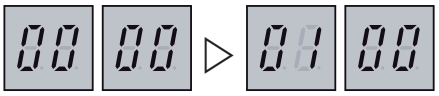
Setting the option

1. Press and hold K2 to enter the option setting. (Only available when the operation is stopped)
   - If you enter the option setting, display will show the following.
     (If you have set the 'Emergency operation for compressor malfunction', 1 or 2 will be displayed on Seg 4 .)

   -- Seg 1 and Seg 2 will display the number for selected option.
   -- Seg 3 and Seg 4 will display the number for set value of the selected option..

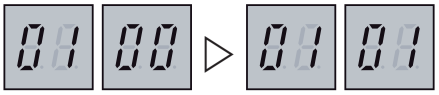
2. If you have entered option setting, you can shortly press the K1 switch to adjust the value of the Seg 1, Seg 2 and select the desired option. (Refer to pages 76~78 for the Seg number of the function for each option.)

   Example)



3. If you have selected desired option, you can shortly press the K2 switch to adjust the value of the Seg 3, Seg 4 and change the function for the selected option. (Refer to pages 76~78 for the Seg number of the function for each option.)

   Example)



4. After selecting the function for options, press and hold the K2 switch for 2 seconds.
   Edited value of the option will be saved when entire segments blinks and tracking mode begins.

   ⚠ Edited option will not be saved if you do not end the option setting as explained in above instruction.

※ While you are setting the option, you may press and hold the K1 button to reset the value to previous setting.

※ If you want to restore the setting to factory default, press and hold the K4 button while you are in the option setting mode.
   -- If you press and hold the K4 button, setting will be restored to factory default but it doesn't mean that restored setting is saved Press and hold the K2 button When the segments shows that tracking mode is in progress, setting will be saved.

How to set the key function of the outdoor unit (cont.)

■ AM080~260✳XV✳✳✳

Optional item	Input unit	SEG1	SEG2	SEG3	SEG4	Function of the option	Remarks
Emergency operation for compressor malfunction	Individual	0	0	0	0	Disabled (Factory default)	E560 will occur when all the compressors are set as malfunction state.
				0	1	Set compressor 1 as malfunction state	
				0	2	Set compressor 2 as malfunction state	
Capacity correction for cooling	Main	0	1	0	0	7-9 (Factory default)	Targeted evaporation temperature [?C] (When low temperature value is set, discharged air temperature of the indoor unit will decrease)
				0	1	5-7	
				0	2	9-11	
				0	3	10-12	
				0	4	11-13	
				0	5	12-14	
				0	6	13-15	
Capcity correction for heating	Main	0	2	0	0	3.0 (Factory default)	Targeted high pressure [MPa] (When low pressure value is set, discharged air temperature of the indoor unit will decrease)
				0	1	2.5	
				0	2	2.6	
				0	3	2.7	
				0	4	2.8	
				0	5	2.9	
				0	6	3.1	
				0	7	3.2	
				0	8	3.3	
Current restriction rate	Individual	0	3	0	0	100% (Factory default)	When restriction option is set, cooling and heating performance may decrease
				0	1	0.95	
				0	2	0.9	
				0	3	0.85	
				0	4	0.8	
				0	5	0.75	
				0	6	0.7	
				0	7	0.65	
				0	8	0.6	
				0	9	0.55	
				1	0	0.5	
				1	1	No restriction	
Oil collection interval	Main	0	4	0	0	Factory default	
				0	1	Shorten the interval by 1/2	
Temperature to trigger defrost operation	Main	0	5	0	0	Factory default	
				0	1	Apply setting when the product is being installed in humid area such as near river or lake	
Fan speed correction for outdoor unit	Individual	0	6	0	0	Factory default	
Silent mode for night-time	Main	0	7	0	0	Disabled (Factory default)	Enable the silent mode for night-time (Itoperates automatically depending on the temperrature.) However, if the external contact ineterface module(MIM-B14) is used, entering the silent mode is available with contact signal
				0	1	LEVEL 1/Auto	
				0	2	LEVEL 2/Auto	
				0	3	LEVEL 3/Auto	
				0	4	LEVEL 1/External contact	
				0	5	LEVEL 2/External contact	
				0	6	LEVEL 3/External contact	
Long-piping condition setting (Setting is unnecessary if high-head condition is set)	Main	0	9	0	0	Disabled (Factory default)	
				0	1	LEVEL 1	When equivalent length of farthest indoor unit from the outdoor unit is between 100~170m
				0	2	LEVEL 2	When equivalent length of farthest indoor unit from the outdoor unit is over 170m
Energy saving setting	Main	1	0	0	0	Disabled (Factory default)	
				0	1	Enabled	Energy saving mode triggers when the room temperature reaches desired temperature while operating in heating mode.

How to set the key function of the outdoor unit (cont.)

■ AM080/100/120/200FXWA✳✳

Optional item	Input unit	SEG1	SEG2	SEG3	SEG4	Function of the option	Remarks
Rotation defrost (HR only)	Main	1	1	0	0	Disabled (Factory default)	
				0	1	Enabled	When enabled, continuous heating operation is possible but heating performance will decrease during rotation defrost operation
Expand operational temperature range for cooling operation	Main	1	2	0	0	Disabled (Factory default)	
				0	1	Enabled	When enabled, continuous cooling operation is possible even in low temperature condition up to -15?C, but noise of the MCU will increase
Channel address	Main	1	3	A	U	Automatic setting (Factory default)	Address for classifying the product from upper level controller (DMS, S-NET 3, etc.)
				0~15		Manual setting for channel 0~15	
Snow accumulation prevention control	Main	1	4	0	0	Enabled (Factory default)	During snow accumulation prevention, the fan mayspin even when the unit is not in operation
				0	1	Disabled	
Unused option	Main	1	5	0	0	Unused option	Unused option option by this model
Unused option	Main	1	6	0	0	Unused option	Unused option option by this model
Speed operatin	Main	1	7	0	0	Disabled(Factory default)	Enabling this setting will command the air conditioner to cool/heat faster at initial start-up However this function will not wortk when High-head conditionsetting or Long-piping condition setting is enabled.
				0	1	Enable	
Current restriction rate	Individual	0	3	0	0	100% (Factory default)	When restriction option is set, cooling and heating performance may decrease.
				0	1	95 %	
				0	2	90 %	
				0	3	85 %	
				0	4	80 %	
				0	5	75 %	
				0	6	70 %	
				0	7	65 %	
				0	8	60 %	
				0	9	55 %	
				1	0	50 %	
				1	1	No restriction	
Oil collection interval	Main	0	4	0	0	Factory default	
				0	1	Shorten the interval by 1/2	
Disable	Main	0	5	0	0	Disable	This function is not applicable for this model
				0	1	Disable	
Disable	Individual	0	6	0	0	Disable	This function is not applicable for this model
				0	1	Disable	
Disable	Main	0	7	0	0	Disable	This function is not applicable for this model
				0	1	Disable	
				0	2	Disable	
				0	3	Disable	
Setting highhead condition	Main	0	8	0	0	Disable (Factory default)	
				0	1	Level 1 of height difference type 1 (Indoor unit is lower than outdoor unit)	When outdoor unit is over 40 ~ 80 m above the indoor unit
				0	2	Level 2 of height difference type 1 (Indoor unit is lower than outdoor unit)	When outdoor unit is over 80 m above the indoor unit
				0	3	Height difference type 2 (Outdoor unit is lower than indoor unit)	When indoor unit is over 30 m above the outdoor unit

How to set the key function of the outdoor unit (cont.)

■ AM080/100/120/200FXWA✳✳

Optional item	Input unit	SEG1	SEG2	SEG3	SEG4	Function of the option	Remarks
Setting longpiping condition (Setting is unnecessary if high-head condition is set.)	Main	0	9	0	0	Disable (Factory default)	
				0	1	Long piping level 1	When equivalent length of farthest indoor unit from the outdoor unit is between 100~170 m
				0	2	Long piping level 2	When equivalent length of farthest indoor unit from the outdoor unit is over 170 m
Energy saving setting	Main	1	0	0	0	Disable (Factory default)	
				0	1	Enable	Energy saving mode triggers when the room temperature reaches desired temperature while operating in heating mode.
Disable	Main	1	1	0	0	Disable	This function is not applicable for this model
				0	1	Disable	
Expand operational temperature range for cooling operation	Main	1	2	0	0	Disable	
				0	1	Enable	
Channel address	Main	1	3	A	U	Automatic setting (Factory default)	Address for classifying the product from upper level controller (DMS, S-NET 3, etc)
				0 ~ 15		Manual setting for channel 0~15	
Disable	Main	1	4	0	0	Disable	This function is not applicable for this model
				0	1	Disable	
Circulation water flow control	Individual	1	5	0	0	Disable (Factory default)	
				0	1	7-10 V	When variable flow control valve is applied
				0	2	5-10 V	
				0	3	3-10 V	

How to set the key function of the outdoor unit (cont.)

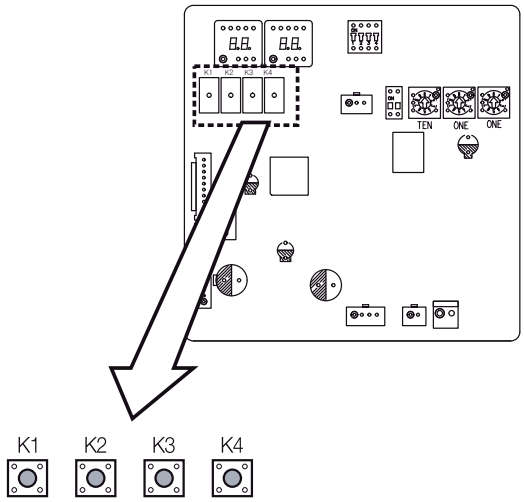
■ AM140/160/180/200/220/240/260/280/300KXV✳✳✳✳

Optional item	Input unit	SEG1	SEG2	SEG3	SEG4	Function of the option	Remarks
Emergency operation for compressor malfunction	Individual	0	0	0	0	Disabled (Factory default)	E560 will occur when all the compressors are set as malfunction state.
				0	1	Set compressor 1 as malfunction state	
				0	2	Set compressor 2 as malfunction state	
Cooling capacity correction	Main	0	1	0	0	7~9	Targeted evaporation temperature [℃] (When low temperature value is set, discharged air temperature of the indoor unit will decrease)
				0	1	5~7(Factory default)	
				0	2	9~11	
				0	3	10~12	
				0	4	11~13	
				0	5	12~14	
				0	6	13~15	
Capcity correction for heating	Main	0	2	0	0	3 0 (Factory default)	Targeted high pressure [MPa] (When low pressure value is set, discharged air temperature of the indoor unit will decrease)
				0	1	2 5	
				0	2	2 6	
				0	3	2 7	
				0	4	2 8	
				0	5	2 9	
				0	6	3 1	
				0	7	3 2	
				0	8	3 3	
Current restriction rate	Individual	0	3	0	0	100% (Factory default)	When restriction option is set, cooling and heating performance may decrease.
				0	1	95 %	
				0	2	90 %	
				0	3	85 %	
				0	4	80 %	
				0	5	75 %	
				0	6	70 %	
				0	7	65 %	
				0	8	60 %	
				0	9	55 %	
				1	0	50 %	
				1	1	No restriction	
Oil collection interval	Main	0	4	0	0	Factory default	
				0	1	Shorten the interval by 1/2	
Temperature to trigger defrost operation	Main	0	5	0	0	Factory default	
				0	1	Apply setting when the product is being installed in humid area such as near river or lake	
Fan speed correction for outdoor unit	Individual	0	6	0	0	Factory default	
				0	1	Increase fan speed	Increase the outdoor unit's fan speed to maximum value.
Silent mode for night-time	Main	0	7	0	0	Disabled (Factory default)	Enables the silent mode for night-time (It operates automatically depending on the temperature) However, if the external contact interface module (MIM-B14) is used, entering the silent mode is available with contact signal
				0	1	LEVEL 1 / Auto	
				0	2	LEVEL 2 / Auto	
				0	3	LEVEL 3 / Auto	
				0	4	LEVEL 1 / External contact	
				0	5	LEVEL 2 / External contact	
				0	6	LEVEL 3 / External contact	
High-head condition setting	Main	0	8	0	0	Disabled (Factory default)	
				0	1	Level 1 of height difference type 1 (Indoor unit is lower than outdoor unit)	When outdoor unit is located 40~80m above the indoor unit
				0	2	Level 2 of height difference type 1 (Indoor unit is lower than outdoor unit)	When outdoor unit is located over 80m above the indoor unit
				0	3	Height difference type 2 (Outdoor unit is lower than indoor unit)	When indoor unit is over 30 m above the outdoor unit

■ AM140/160/180/200/220/240/260/280/300KXV✳✳✳✳

Optional item	Input unit	SEG1	SEG2	SEG3	SEG4	Function of the option	Remarks
Long-pipng condition setting (Setting is unnecessary if high-head condition is set)	Main	0	9	0	0	Disabled (Factory default)	
				0	1	LEVEL 1	When equivalent length of farthest indoor unit from the outdoor unit is between 100~170m
				0	2	LEVEL 2	When equivalent length of farthest indoor unit from the outdoor unit is over 170m
Energy control Operaton	Individual	1	0	0	0	Basic (Factory default)	Energy control option of designated operation sequence. ※ Operating in energy saving mode, capacity might decrease compared to normal operation mode.
				0	1	Energy saving	
				0	2	Power	
Rotation defrost (HR only)	Main	1	1	0	0	Disabled (Factory default)	
				0	1	Enabled	When enabled, continuous heating operation is possible but heating performance will decrease during rotation defrost operation.
Expand operational temperature range for cooling operation (HR only)	Individual	1	2	0	0	Disabled (Factory default)	
				0	1	Enabled	When enabled, continuous cooling operation is possible even in low temperature condition up to -15°C, but noise of the MCU will increase.
Channel address	Main	1	3	A	U	Automatic setting (Factory default)	Address for classifying the product from upper level controller. (DMS, S-NET 3, etc)
				0 ~ 15		Manual setting for channel 0~15	
Snow accumulation prevention control	Main	1	4	0	0	Enabled (Factory default)	During snow accmulation , the fan may spin even when the unit is not in operation.
				0	1	Disabled	
Unused option	Main	1	5	0	0	Unused option	Unused option by this model.
Unused option	Main	1	6	0	0	Unused option	Unused option by this model.
Speed operation	Main	1	7	0	0	Disabled (Factory default)	Enabling this setting will command the air conditioner to cool/ heat faster at initial start-up. However, this function will not work when High-head condition setting or Longpiping condition setting is enabled.
				0	1	Enabled	
Max capacity restriction	Main	1	8	0	0	Enabled (Factory default)	Restrict excessive capacity increase when operating indoor units with small capacity.
				0	1	Disabled	
Gasleak Pumpdown	Main	1	9	0	0	Disabled (Factory default)	If the gas leak occurred it should be entered in the pumpdown operation.
				0	1	Enabled	

8-3 How to check the view mode using a tact switch



■ AM080~260✳XV✳✳✳

K3 (Number of press)	Key operation	Display on segment
1 time	Intialize (Reset) setting	Same as initial state

K4 (Number of press)	Key operation	Display on segment	
		SEG 1	SEG 2, 3, 4
1 time	Outdoor unit model	1	AM160FXV✳✳✳✳ → 0ff, 1, 6
2 times	Order frequency of the compressor 1	2	120 Hz → 1, 2, 0
3 times	Order frequency of the compressor 2	3	120 Hz → 1, 2, 0
4 times	High pressure (MPa)	4	1.52 MPa → 1, 5, 2
5 times	Low pressure (MPa)	5	0.43 MPa → 0, 4, 3
6 times	Discharge temperature (Compressor 1)	6	87 °C → 0, 8, 7
7 times	Discharge temperature (Compressor 2)	7	87 °C → 0, 8, 7
8 times	IPM temperature (Compressor 1)	8	87 °C → 0, 8, 7
9 times	IPM temperature (Compressor 2)	9	87 °C → 0, 8, 7
10 times	CT sensor value (Compressor 1)	A	2 A → 0, 2, 0
11 times	CT sensor value (Compressor 2)	B	2 A → 0, 2, 0
12 times	Suction temperature	C	-42 °C → -, 4, 2
13 times	COND OUT temperautre	D	-42 °C → -, 4, 2
14 times	Temperature of liquid pipe	E	-42 °C → -, 4, 2
15 times	TOP temperature (Compressor 1)	F	87 °C → 0, 8, 7
16 times	TOP temperature (Compressor 2)	G	87 °C → 0, 8, 7
17 times	Outdoor temperature	H	-42 °C → -, 4, 2
18 times	EVI inlet temperature	I	-42 °C → -, 4, 2
19 times	EVI outlet temperature	J	-42 °C → -, 4, 2
20 times	Main EEV1 step	K	2000 → 2, 0, 0
21 times	Main EEV2 step	L	2000 → 2, 0, 0
22 times	EVI EEV step	M	300 → 3, 0, 0
23 times	HR EEV step	N	300 → 3, 0, 0
24 times	Fan step (SSR or BLDC)	O	13 STEP → 0, 1, 3
25 times	Current frequency (Compressor 1)	P	120 Hz → 1, 2, 0
26 times	Current frequency (Compressor 2)	Q	120 Hz → 1, 2, 0
27 times	Suction 2 temperature (HR Only)	R	-42 °C → -, 4, 2
28 times	Master Indoor Unit Address	S	master indoor unit not selected → BLANK, N, D if indoor unit no.1 is selected as the master unit → 0, 0, 1

❉ When you install the product, optional function for outdoor unit must be set in compliance with installation conditions.

❉ Press and hold the K4 button for 5 seconds to check the SW version and address of the indoor units. (Information will be displayed in following order; Main-Hub-INV1-INV2-FAN1-FAN2-EEP-Automatically assigned address - Manually assigned address)

❉ Display method of automatically assigned addresses in K4 View mode (Ex: "AUTO" → "A001" → "AUTO" → "A002" → "AUTO" → "A003")

Page1	Display		
	Page2		
AUTO	SEG1	SEG2	SEG3,4
	Indoor unit: "A" MCU: "C"	Indoor unit: "0" MCU: "1"	Address (No. 1 → 0,1)

❉ Display method of manually assigned addresses in K4 View mode (Ex: "MANU" → "A004" → "MANU" → "A005" → "MANU" → "A006")

Page1	Display		
	Page2		
MANU	SEG1	SEG2	SEG3,4
	Indoor unit: "A"	Indoor unit: "0"	Address (No. 1 → 0,1)

■ AM080/100/120/200FXWA✳✳

K3 (Number of press)	KEY operation	Display on segment
1 time	Intialize (Reset) setting	Same as initial state

K4 (Number of press)	KEY operation	Display on segment	
		SEG 1	SEG2, 3, 4
1 time	Outdoor unit model	1	AM120FXW✳ → Off, 1, 2
2 times	Target frequency (Compressor 1)	2	120 Hz → 1, 2, 0
3 times	Target frequency (Compressor 2)	3	120 Hz → 1, 2, 0
4 times	High pressure (MPa)	4	1.52 MPa → 1, 5, 2
5 times	Low pressure (MPa)	5	0.43 MPa → 0, 4, 3
6 times	Discharge temperature (Compressor	6	87 ℃ → 0, 8, 7
7 times	Discharge temperature (Compressor	7	87 ℃ → 0, 8, 7
8 times	IPM temperature (Compressor 1)	8	87 ℃ → 0, 8, 7
9 times	IPM temperature (Compressor 2)	9	87 ℃ → 0, 8, 7
10 times	CT sensor value (Compressor 1)	A	2 A → 0, 2, 0
11 times	CT sensor value (Compressor 2)	B	2 A → 0, 2, 0
12 times	Suction temperature	C	-42 ℃ → -, 4, 2
13 times	COND OUT temperautre	D	-42 ℃ → -, 4, 2
14 times	Temperature of liquid pipe	E	-42 ℃ → -, 4, 2
15 times	TOP temperature (Compressor 1)	F	-42 ℃ → -, 4, 2
16 times	TOP temperature (Compressor 2)	G	-42 ℃ → -, 4, 2
17 times	Water temperature	H	-42 ℃ → -, 4, 2
18 times	EVI inlet temperature	I	-42 ℃ → -, 4, 2
19 times	EVI outlet temperature	J	-42 ℃ → -, 4, 2
20 times	Main EEV 1 step	K	2000 steps → 2, 0, 0
21 times	Main EEV2 step	L	2000 steps → 2, 0, 0
22 times	EVI EEV step	M	300 steps → 3, 0, 0
23 times	HR EEV step	N	2000 steps → 2, 0, 0
24 times	-	O	-
25 times	Current frequency of the compressor	P	120 Hz → 1,2,0
26 times	Current frequency of the compressor	Q	120 Hz → 1,2,0
27 times	Suction 2 temperature	R	-42 ℃ → -, 4, 2
28 times	Address of master indoor unit	S	When master indoor unit is not set → BLANK, N, D When indoor unit No.1 is set as master indoor unit →0, 0, 1
29 times	Temperature of control box	T	-42 ℃ → -, 4, 2

- When you install the product, optional function for outdoor unit must be set in compliance with installation conditions.
- SW version, View mode 2 and address of the indoor unit, press and hold for three seconds to enter the K4.
  (Information will be displayed in following order. Main-Hub-INV1-INV2 FAN1-FAN2-EEP-Automatically assigned address - manually assigned address.)

View mode 2

K4 (Number of press)	KEY operation	KEY operation	Display on Page		
			Page 1	Page 2	
1 TIME	Main version	Main version	Main	Version(ex. 1412)	
2 TIMES	HUB version	HUB version	HUB	Version(ex. 1412)	
3 TIMES	Water HUB version	Water HUB version	HUB2	Version(ex. 1412)	
4 TIMES	Inverter1 version	Inverter1 version	INV1	Version(ex. 1412)	
5 TIMES	Inverter2 version	Inverter2 version	INV2	Version(ex. 1412)	
6 TIMES	EEPROM version	EEPROM version	EEPROM	Version(ex. 1412)	
7 TIMES	The device receives automatic address	The device receives automatic address	AUTO	SEG1,2	SEG3,4
				Indoor unit : "A","0" MCU : "C","1"	Adress(ex. 07)
8 TIMES	The device receives a manual address	The device receives a manual address	MANU	SEG1,2	SEG3,4
				Indoor unit : "A","0"	Adress(ex. 15)

□ Display method of automatically assigned address in K4 View mode. (EX : "AUTO"→ "A001" →"AUTO" →"A003")

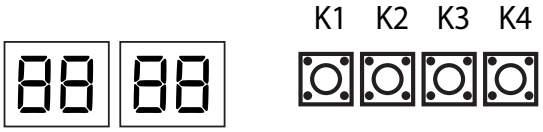
Page 1	Display		
	Page 2		
AUTO	SEG 1	SEG 2	SEC 3,4
	Indoor unit : "A" MCU : "C"	Indoor unit : "0" MCU : "C"	Address (No. 1→01)

□ Display method of automatically assigned address in K4 View mode. (EX : "MANU"→ "A004" →"MANU" →"A005" →"MANU" →"A006")

Page 1	Display		
	Page 2		
MANU	SEG 1	SEG 2	SEC 3,4
	Indoor unit : "A"	Indoor unit : "0"	Address (No. 1→01)

How to check the view mode using a tact switch (cont.)

■ AM140/160/180/200/220/240/260/280/300KXV✳✳✳✳



K1 control	KEY operation	Display on segment
Press and hold 1 time	Auto trial operation	"K" "K" "BLANK" "BLANK"

K1 (Number of press)	KEY operation	Display on segment
1 time	Refrigerant charging in Heating mode	"K" "1" "BLANK" "BLANK"
2 times	Trial operation in Heating mode	"K" "2" "BLANK" "BLANK"
3 times	Pump out in Heating mode (Outdoor unit address 1)	"K" "3" "BLANK" "1"
4 times	Pump out in Heating mode (Outdoor unit address 2)	"K" "3" "BLANK" "2"
5 times	Pump out in Heating mode (Outdoor unit address 3)	"K" "3" "BLANK" "3"
6 times	Pump out in Heating mode (Outdoor unit address 4)	"K" "3" "BLANK" "4"
7 times	Vacuumig (Outdoor unit address 1)	"K" "4" "BLANK" "1"
8 times	Vacuumig (Outdoor unit address 2)	"K" "4" "BLANK" "2"
9 times	Vacuumig (Outdoor unit address 3)	"K" "4" "BLANK " "3"
10 times	Vacuumig (Outdoor unit address 4)	"K" "4" "BLANK" "4"
11 times	Vacuuming (All outdoor units)	"K" "4" "BLANK" "A"
12 times	End Key operation	-

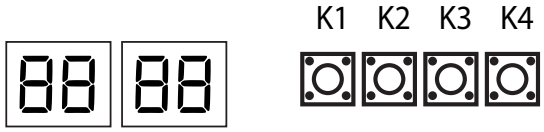
K2 (Number of press)	KEY operation	Display on segment
1 time	Refrigerant charging in Cooling mode	"K" "5" "BLANK" "BLANK"
2 times	Trial operation in Cooling mode	"K" "6" "BLANK" "BLANK"
3 times	Pump down all units in Cooling mode	"K" "7" "BLANK" "BLANK"
4 times	H/R: Checking the pipe connection H/P: Automatic setting of operation mode (Cooling/Heating) for trail operation	"K" "8" "BLANK" "BLANK"
5 times	Checking the amount of refrigerant	"K" "9" X X (Display of last two digits may differ depending on the progress)
6 times	Discharge mode of DC link voltage	"K" "A" "BLANK" "BLANK"
7 times	Forced defrost operation	"K" "B" "BLANK" "BLANK"
8 times	Forced oil collection	"K" "C" "BLANK" "BLANK"
9 times	Inverter compressor 1 check	"K" "D" "BLANK" "BLANK"
10 times	Inverter compressor 2 check	"K" "E" "BLANK" "BLANK"
11 times	Fan 1 check	"K" "F" "BLANK" "BLANK"
12 times	Fan 2 check	"K" "G" "BLANK" "BLANK"
13 times	End Key operation	-

※ During "Discharge mode of DC link voltage", voltage of INV1 and INV2 will be displayed alternately.
※ Even when the outdoor unit power is off, it is dangerous when you come in contact with inverter PCB and fan PCB since they are charged with high DC voltage.
※ When replacing/repairing the PCB, cut-off the power and wait until the DC voltage is discharged before replacing/ repairing them. (Wait for more than 15 minutes to allow it to discharge naturally.)
※ When there were error, 'Dicharge mode of DC link voltage' may not have been effective Especialy if error E464 and E364 have been occured, power element might be damaged by fire and therefore, do not use the 'Discharge mode of DC link voltage'.

K3 (Number of press)	KEY operation	Display on segment
1 time	Intialize (Reset) setting	Same as initial state

How to check the view mode using a tact switch (cont.)

■ AM140/160/180/200/220/240/260/280/300KXV✳✳✳✳



K4 (Number of press)	KEY operation	Display on segment	
		Outdoor unit model	SEG2, 3, 4
1 time	Order frequency (Compressor 1)	1	AM160FXV✳✳✳✳ → Off, 1, 6
2 times	Order frequency (Compressor 2)	2	120 Hz → 1, 2, 0
3 times	High pressure (MPa)	3	120 Hz → 1, 2, 0
4 times	Low pressure (MPa)	4	1 52 MPa → 1, 5, 2
5 times	Discharge temperature (Compressor 1)	5	0 43 MPa → 0, 4, 3
6 times	Discharge temperature (Compressor 2)	6	87 ℃ → 0, 8, 7
7 times	IPM temperature (Compressor 1)	7	87 ℃ → 0, 8, 7
8 times	IPM temperature (Compressor 2)	8	87 ℃ → 0, 8, 7
9 times	CT sensor value (Compressor 1)	9	87 ℃ → 0, 8, 7
10 times	CT sensor value (Compressor 2)	A	2 A → 0, 2, 0
11 times	Suction temperature	B	2 A → 0, 2, 0
12 times	COND OUT temperautre	C	-42 ℃ → -, 4, 2
13 times	Temperature of liquid pipe	D	-42 ℃ → -, 4, 2
14 times	TOP temperature (Compressor 1)	E	-42 ℃ → -, 4, 2
15 times	TOP temperature (Compressor 2)	F	-42 ℃ → -, 4, 2
16 times	Outdoor temperature	G	-42 ℃ → -, 4, 2
17 times	EVI inlet temperature	H	-42 ℃ → -, 4, 2
18 times	EVI outlet temperature	I	-42 ℃ → -, 4, 2
19 times	Main EEV1 step	J	-42 ℃ → -, 4, 2
20 times	Main EEV2 step	K	2000 steps → 2, 0, 0
21 times	EVI EEV step	L	2000 steps → 2, 0, 0
22 times	HR EEV step	M	300 steps → 3, 0, 0
23 times	Fan step (SSR or BLDC)	N	300 steps → 3, 0, 0
24 times	Current frequency (Compressor 1)	O	13 steps → 0, 1, 3
25 times	Current frequency (Compressor 2)	P	120 Hz → 1,2,0
26 times	Suction 2 temperature (H/R)	Q	120 Hz → 1,2,0
27 times	Master indoor unit address	R	-42 ℃ → -, 4, 2
28 times	Address of master indoor unit	S	Master indoor unit not selected → BLANK, N, D If indoor unit No 1 is selected as the master unit → 0, 0, 1

K4 (Number of press) Press and hold the K4 to enter the setting	Displayed content	Display on segment			
		page1	page2		
1 time	Main version	MAIN	Version (ex 1412)		
2 times	Hub version	HUB	Version (ex 1412)		
3 times	Inverter 1 version	INV1	Version (ex 1412)		
4 times	Inverter 2 version	INV2	Version (ex 1412)		
5 times	Fan 1 version	FAN1	Version (ex 1412)		
6 times	Fan 2 version	FAN2	Version (ex 1412)		
7 times	EEP version	EEP	Version (ex 1412)		
8 times	Automatically assigned address of the units	AUTO	SEG1	SEG2	SEG3
			Indoor unit: "A" MCU: "C"	Indoor unit: "0" MCU: "1"	Address (ex: 07)
9 times	Manually assigned address of the units	MANU	SEG4	SEG5	SEG6
			Indoor unit: "A"	Indoor unit: "0"	Address (ex: 15)

9. Test Operation

9-1 Auto Trial Operation

9-1-1 Auto Trial Operation Synopsis

1) What is the Auto Trial Operation?

DVM S main components defective check and check the status of the installation, provide guidelines that can promptly and accurately resolve the problems that may occur in the field.
If does not end the Auto Trial Operation, normal operation is impossible to enter, it should protect the system from the abnormal state. ("UP")

2) Auto Trial Operation Preliminary checking.

(1) Check the Power cable of Indoor / Outdoor Unit and communication wire.

(2) Turn on the power 6 hours before to start the Auto Trial Operation.
(Crankcase heater to be heated sufficiently.)

(3) Check before applying power voltage and phase using a phase tester and voltmeter.
- R, S, T, N Terminal : Check the between the wire, 380V (R-S, S-T, T-R) / phase-to-phase, 220V (R-N, S-N, T-N).

(4) Power on, perform the tracking. (Outdoor Unit inspects Indoor Unit and optional.)

(5) Card to verify the installation of the control box front : must be record the installation details.

※ Necessarily turn on the power 6 hours before to start the Auto Trial Operation.

3) How to use the Auto Trial Operation.

(1) If does not complete the Auto Trial Operation, normal operation is prohibited.

- If does not complete the Auto Trial Operation, Display the "UP"(Unprepared) on the LED after checking communication.
(Compressor to operate normal operation is prohibited.)

※ UP Mode will be turned off automatically at finished the Auto Trial Operation.

- Auto Trial Operation is carried out by the operating conditions.
(From 20 minutes to maximum 2 hours)
- During Auto Trial Operation due to the valve check, the noise can be generated.
(Sustained abnormal noise occurs, check it)

(2) When an error occurs during the Auto Trial Operation, check the error code in the product and then service it.

(3) Shut down the Auto Trial Operation, resulting report will be issued using the S-NET or S-CHECKER.

- The resulting report of the "Undetermined"item, troubleshoot the accordance with the service manual.
- Troubleshoot all the items of "Undetermined" and then restart the Auto Trial Operation.

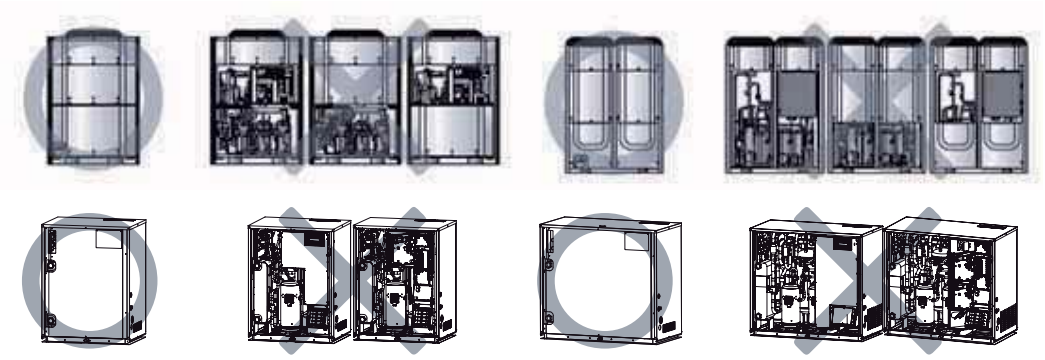
(4) Check the following as Trial Operation. (Heating / Cooling)

- Check the Cooling and Heating operation is progressing well.
- Individual Indoor Unit control : check the wind direction, wind speed.
- Check the Indoor and Outdoor abnormal noise.
- Check the drainage of the Indoor Unit cooling operation.
- More operation : Checking status by using the S-NET.

(5) Refer to manual and explain air conditioner usage to user.

※ If out of warranty coverage and bounds, installation, operation according to the conditions the some of items displayed as "Undetermined" and judgment is not.
Ex) system that module installed : If the outdoor unit is not operation by the load on the indoor and outdoor, corresponding Sub Outdoor Unit does not judge the inspection entries. (However, Indoor / Outdoor Temperature sensor and Pressure sensor judgment is available.)

※ Operation must close the upper and lower cabinets on the front of the Outdoor Unit.
If the cabinet opened while operation : Can cause damage to the product and can not get the exact S-NET data.



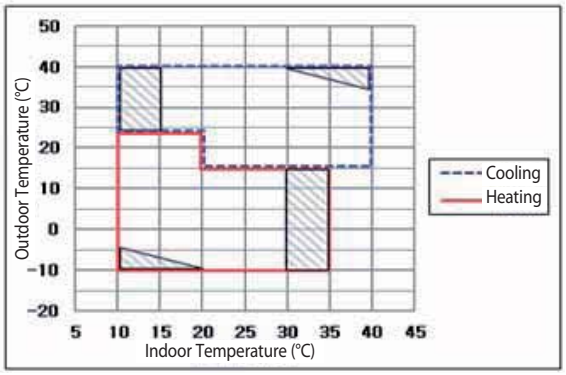
4) Inspection item of the Auto Trial Operation

During the Auto Trial Operation of the DVM S, defect check items are as follows.

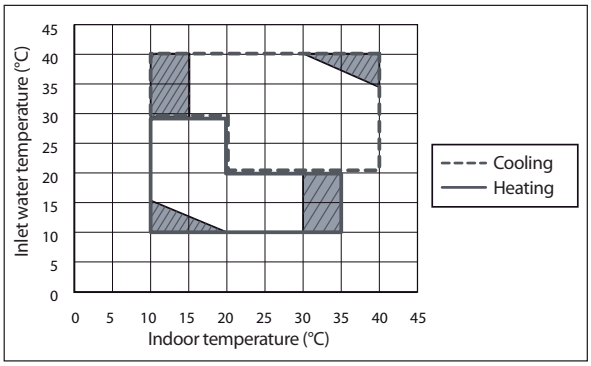
- Indoor Unit Temperature sensor (Indoor temperature of each Indoor Unit, EVA In/Out Temperature sensor)
- Outdoor Unit Temperature sensor
  (Outdoor temperature of each Outdoor Unit, Cond_Out, EVI In/Out, Suction, Liquid Pipe Temperature sensor)
- Outdoor Unit High Pressure sensor & Low Pressure sensor
- Outdoor Unit Service Valve : judgment of the Open/Closed
- Outdoor Unit Compressor : Judgment of the operation current
- Cycle state judgment of the Outdoor Unit
- Outdoor Unit 4Way Valve : Judgment of the operation
- Outdoor Unit EVI EEV : Judgment of the operation
  (※ The operation mode of the Auto Trial Operation : "Heating" only if the detection.)

5) Warranty Coverage of the Auto Trial Operation

As follows, in order to accurately measure Indoor / Outdoor temperature conditions in the Auto Trial Operation is carried out.



<AM080/100/120/200FXWA✳✳>



<AM080/100/120/140/160/180/200FXV✳✳✳>

- Heating / Cooling mode is automatically selected of Auto Trial Operation .
- Oblique line marked area in the during operation of the system can be protection control.
  (Auto Trial Operation of normal judgment can be difficult by the protection control operation.)
- If out of warranty coverage and the boundary area : Auto Trial Operation judgment accuracy may be reduced.

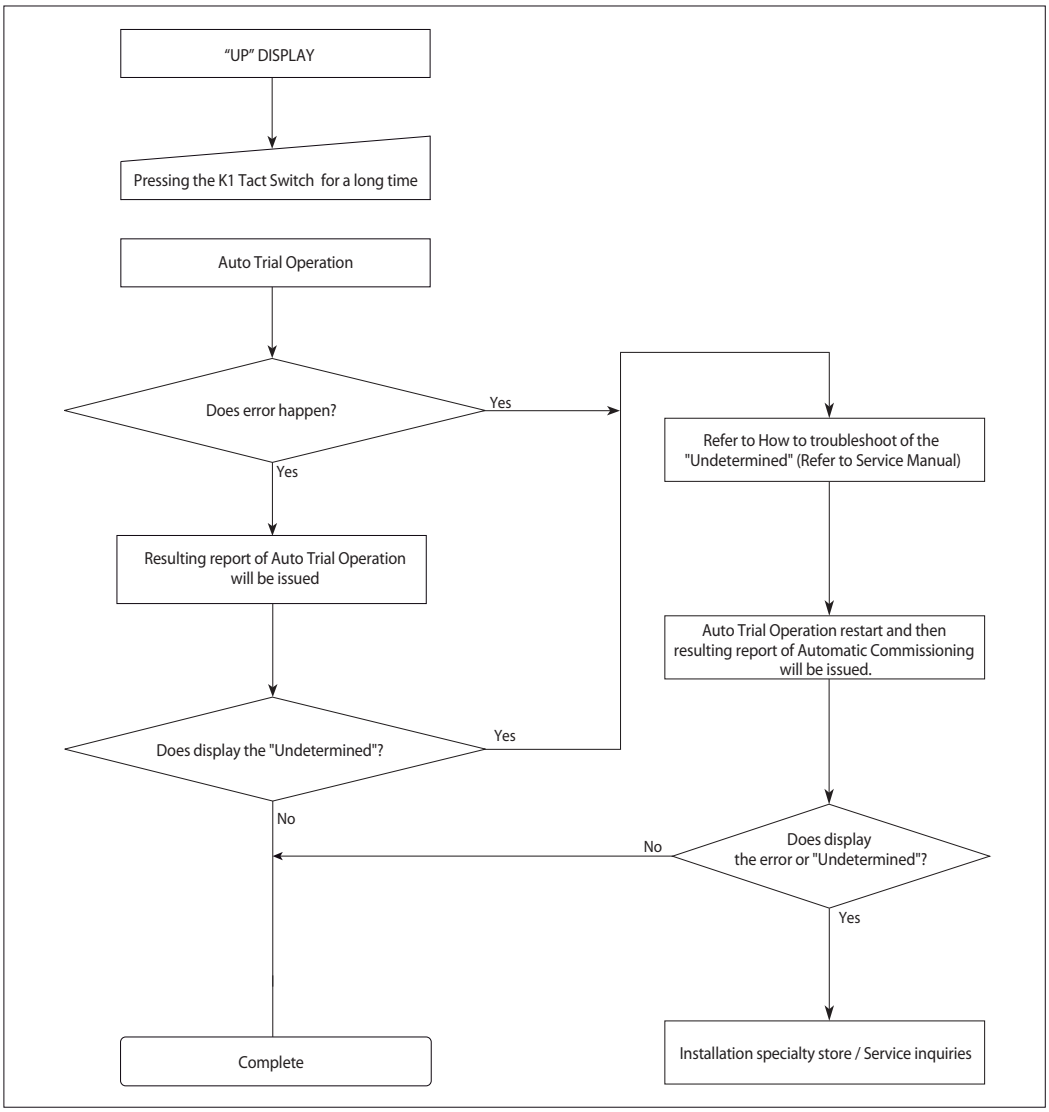
9-1-2 Auto Trial Operation functions

1)Preliminary checking and Auto Trial Operation flow chart

(1) Preliminary checking

- Check the installation status : Outdoor and Indoor Unit piping, Communication, Power, Amount of refrigerant added, etc.

(2) Auto Trial Operation methods



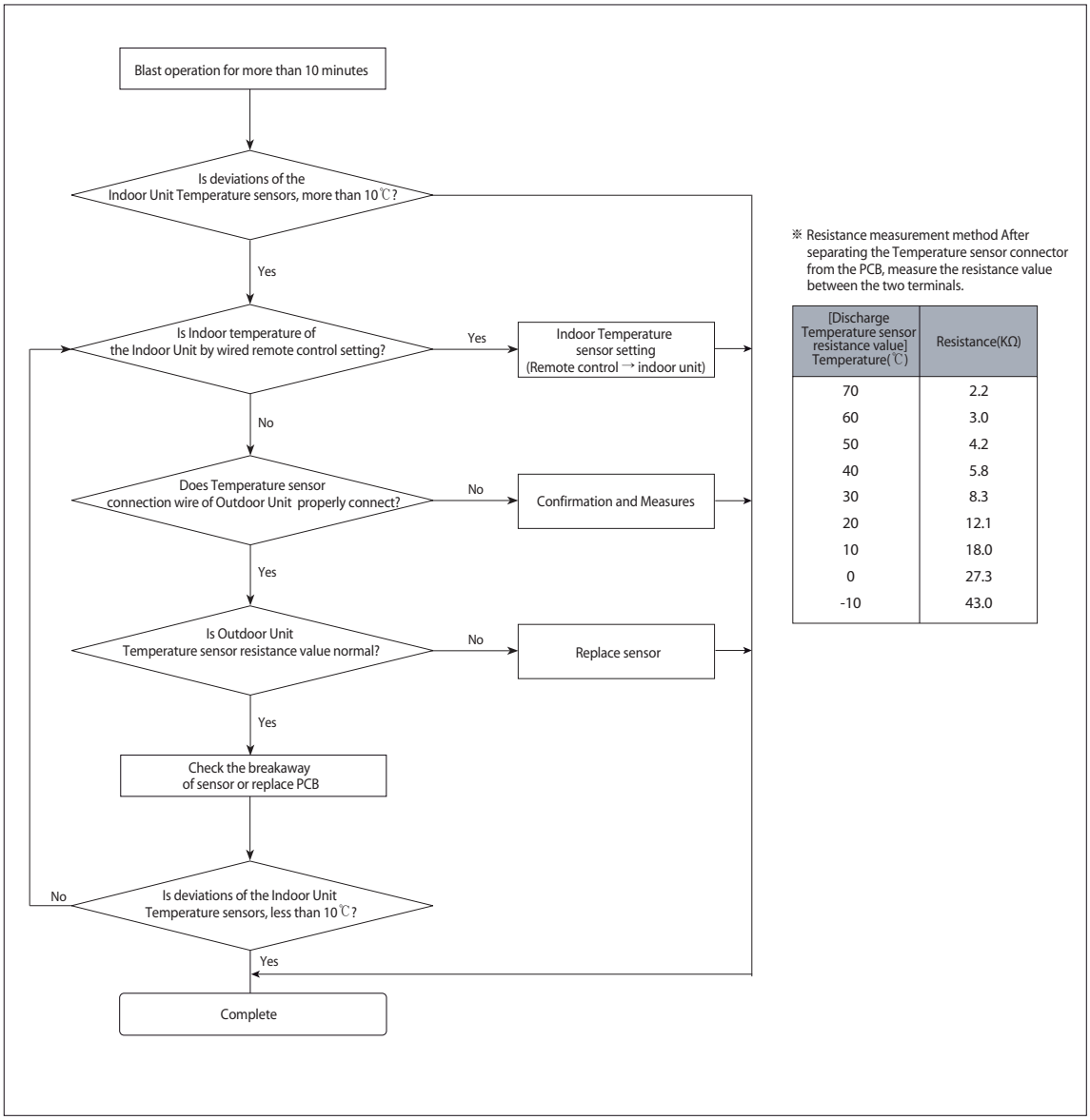
(3) Other Precautions

- If the problem of more than one components at the same time occurs, accurate decisions can be difficult.
- If stop the Sub outdoor during the Auto Trial Operation by load conditions in status of module combination, Outdoor Unit does not judge. (Undetermined)
- If the Outdoor Unit with a history of operation (Auto Trial Operation inclusion) : Must be carried out Auto Trial Operation after 1 hour from final operation stopped. (In this case, the vacuum mode of the air must maintain for more than 5 minutes.)
- Restart of Auto Trial Operation after troubleshoot the item that "Undetermined"

9-1-3 How to troubleshoot of the "Undetermined"

1) Indoor Unit Temperature sensor

- ■ Inspection item : Indoor temperature of each Indoor Unit, EVA In / Out Temperature sensor
- ■ Error code: None (The resulting report "Undetermined")
- ■ Determine the status of the Temperature sensor of the Indoor Unit installed before the compressor start.
- ■ If the judgment of Indoor Unit temperature sensor is "Undetermined" : Checking in accordance with the following order.



※ Resistance measurement method After separating the Temperature sensor connector from the PCB, measure the resistance value between the two terminals.

[Discharge Temperature sensor resistance value] Temperature(℃)	Resistance(KΩ)
70	2.2
60	3.0
50	4.2
40	5.8
30	8.3
20	12.1
10	18.0
0	27.3
-10	43.0

[Caution]

- If the Outdoor Unit with a history of operation (Auto Trial Operation inclusion) :
  Must be carried out Auto Trial Operation after 1 hour from final operation stopped.
- If the Indoor temperature setting by wired remote control :
  Carried out the Auto Trial Operation after setting the Temperature sensor of Indoor Unit.
- Indoor Unit of outdoor air introduction : Will be excluded from the Indoor air temperature, EVA In / Out Temperature sensor checking.

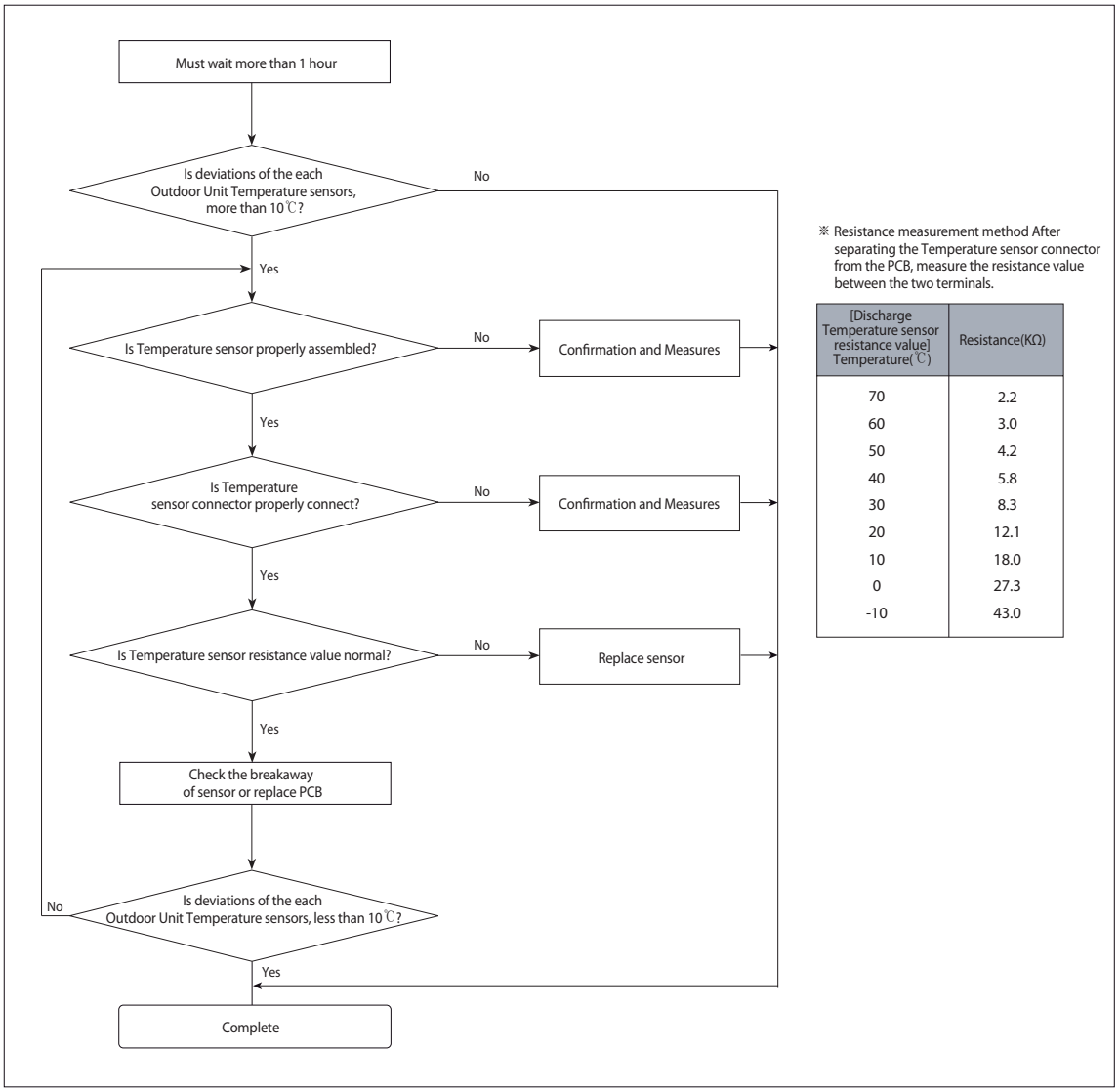
2) Outdoor Unit Temperature sensor

■ Inspection item : Outdoor temperature of each Outdoor Unit, Cond_Out, EVI In / Out, Suction, Liquid pipe temperature sensor

■ Error code: None (The resulting report "Undetermined")

■ Determine the status of the Temperature sensor of the each Outdoor Unit installed before the compressor start.

■ If the judgment of Outdoor Unit Temperature sensor is "Undetermined" : Checking in accordance with the following order.



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[Discharge Temperature sensor resistance value] Temperature(℃)	Resistance(KΩ)
70	2.2
60	3.0
50	4.2
40	5.8
30	8.3
20	12.1
10	18.0
0	27.3
-10	43.0

[Caution]

- If the Outdoor Unit with a history of operation (Auto Trial Operation inclusion) : Must be carried out Auto Trial Operation after 1 hour from final operation stopped.

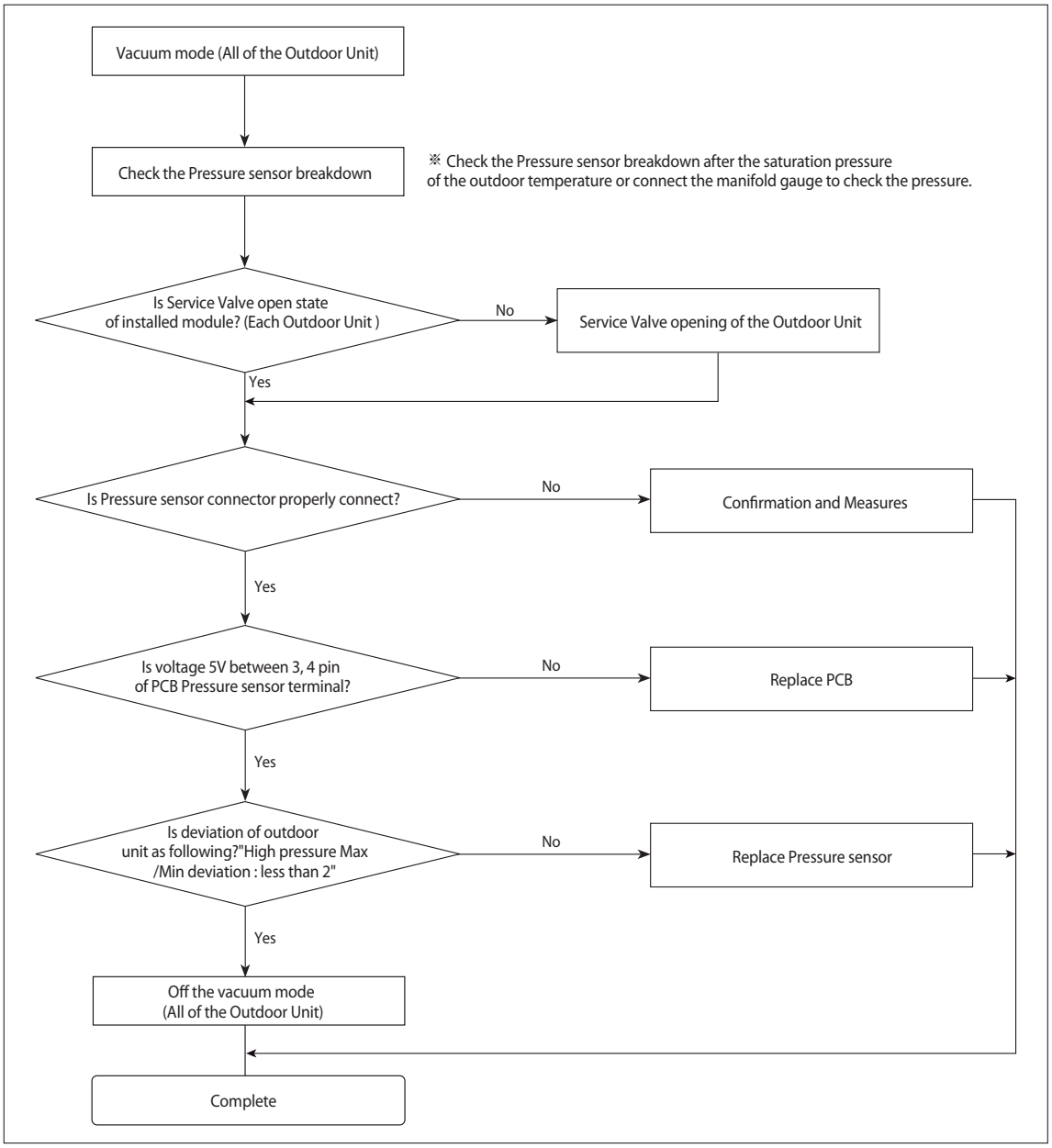
3) High / Low pressure sensor (Module installed)

■ High/Low Pressure sensor of each of the outdoor unit that module is installed.

■ Error code of High Pressure sensor : E505 (The resulting report "Undetermined")
Error code of Low Pressure sensor : E506 (The resulting report "Undetermined")

■ Determine the status of the High/Low Pressure sensor of the each Outdoor Unit installed before the compressor start.

■ If the judgment of Outdoor Unit High/Low Pressure sensor is "Undetermined" : Checking in accordance with the following order.



[Caution]

- If the judgment of Pressure sensor "Undetermined" :
  Display the error to all of the Outdoor Unit and then Auto Trial Operation is exited. (Stop the overall system)

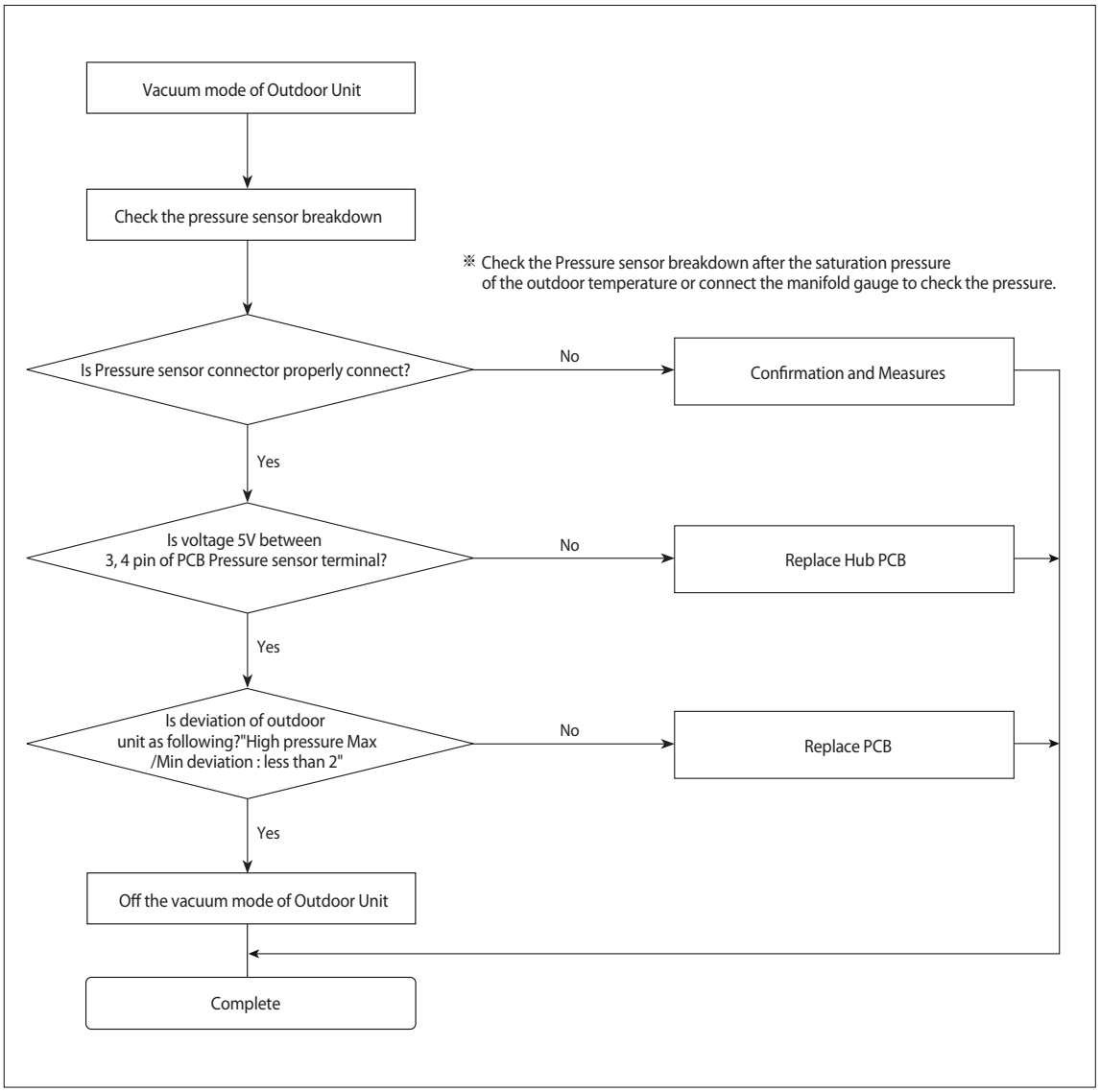
4) Pressure sensor (Independent installation)

■ Inspection item : High/Low Pressure sensor of the independent installed Outdoor Unit.

■ Error code: None (The resulting report "Undetermined")

■ Determine the status of the Pressure sensor of the independent installed Outdoor Unit before the compressor start.

■ If the judgment of Outdoor Unit Pressure sensor is "Undetermined" : Checking in accordance with the following order.



[Caution]

- If the Outdoor Unit with a history of operation (Auto Trial Operation inclusion) : Maintain the vacuum mode for more than 5 minutes.

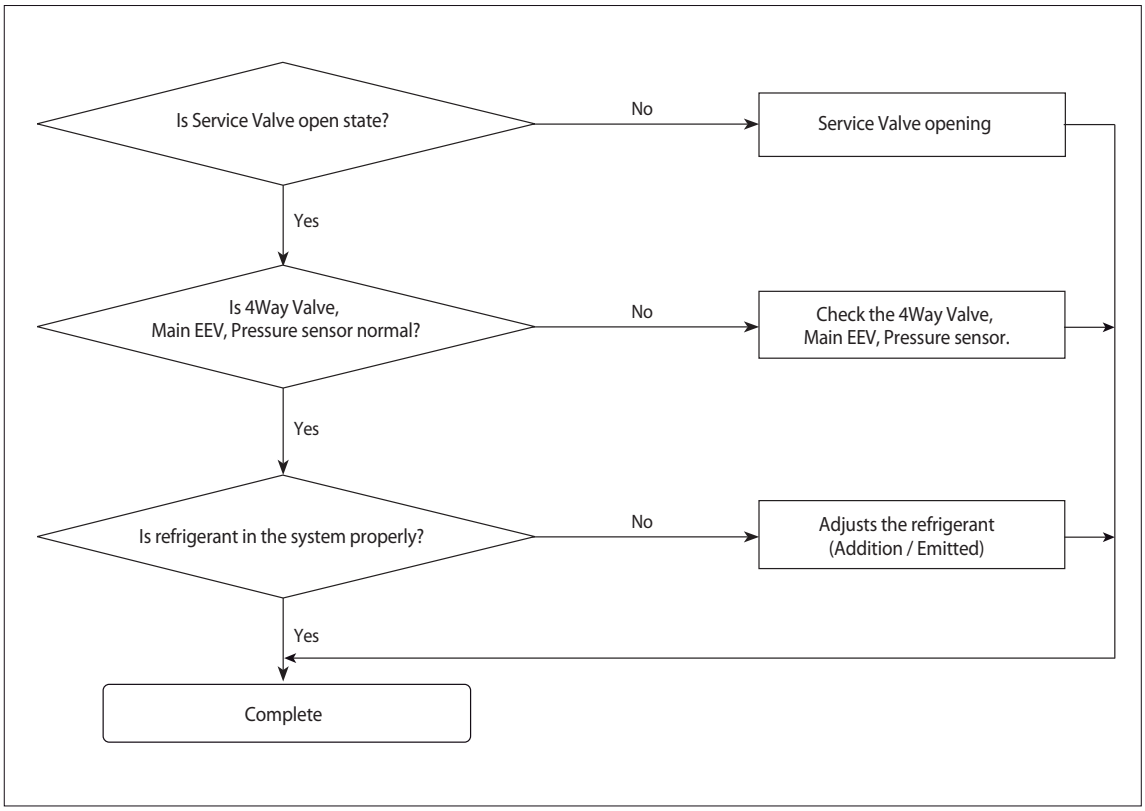
5) Service Valve

■ Inspection item : Outdoor Unit Service Valve is open / closed

■ Error code: E503 (The resulting report "Undetermined")

■ Determine the status of the Service Valve open / closed of the each Outdoor Unit.

■ If the judgment of Outdoor Unit Service Valve is "Undetermined" : Checking in accordance with the following order.



[Caution]

- If the judgment of Service Valve "Undetermined" : Display the error to corresponding Outdoor Unit and then Auto Trial Operation is exited. (Stop the overall system)
- If inspect service valve : Check the Liquid pipe and Gas pipe, Service Valve.
- If the frost formation of Outdoor Heat exchanger, continue Trial Operation until defrost operation begins.
  And then complete after add more than 1 hour operation after end of defrost operation.
  (Execute checking of 4Way Valve and Main EEV together.)
- 4Way Valve abnormal symptoms
  1) Strange noise of compressor to operate.
  2) Indoor unit EVA In/Out maintain the temperature below zero (Less than -0℃)
  3) 4Way Valve : Refer to the Service Manual.
- Main EEV abnormal symptoms
  1) When closed Main EEV opening : Compressor suction degree of overheat impossible to ensure and less than DSH 20K.
  2) When opened Main EEV opening : Compressor suction degree of overheat is high status.
  3) Main EEV : Refer to the Service Manual.
- Pressure sensor abnormal symptoms : Refer to the Service Manual.

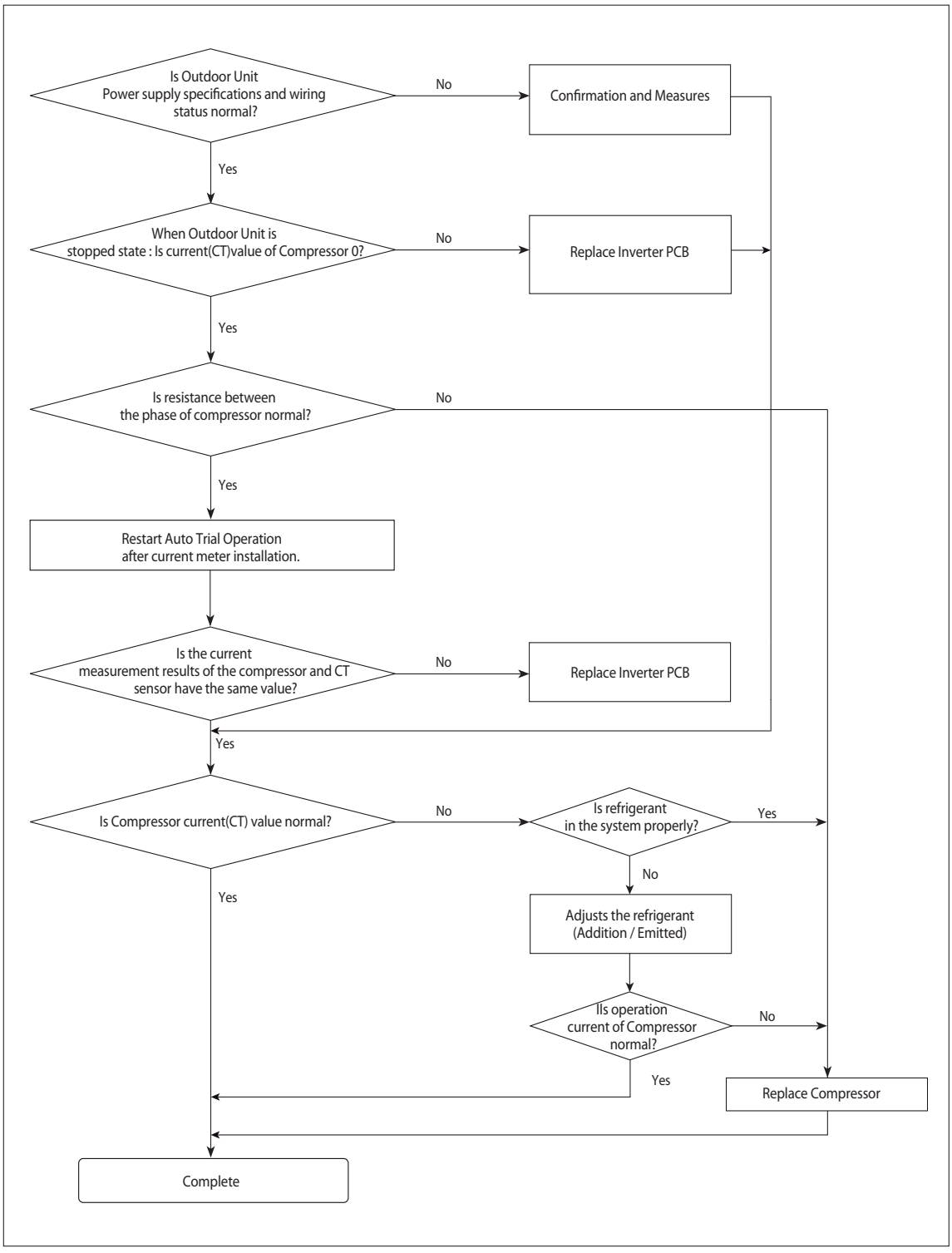
6) Abnormal operation of the Compressor

■ Inspection item : Operation current of Outdoor Unit Compressor.

■ Error code: None (The resulting report "Undetermined")

■ Determine the status of the operating current of the each Outdoor Unit Compressor.

■ If the judgment of operation current of Outdoor Unit Compressor is "Undetermined" :
Checking in accordance with the following order.



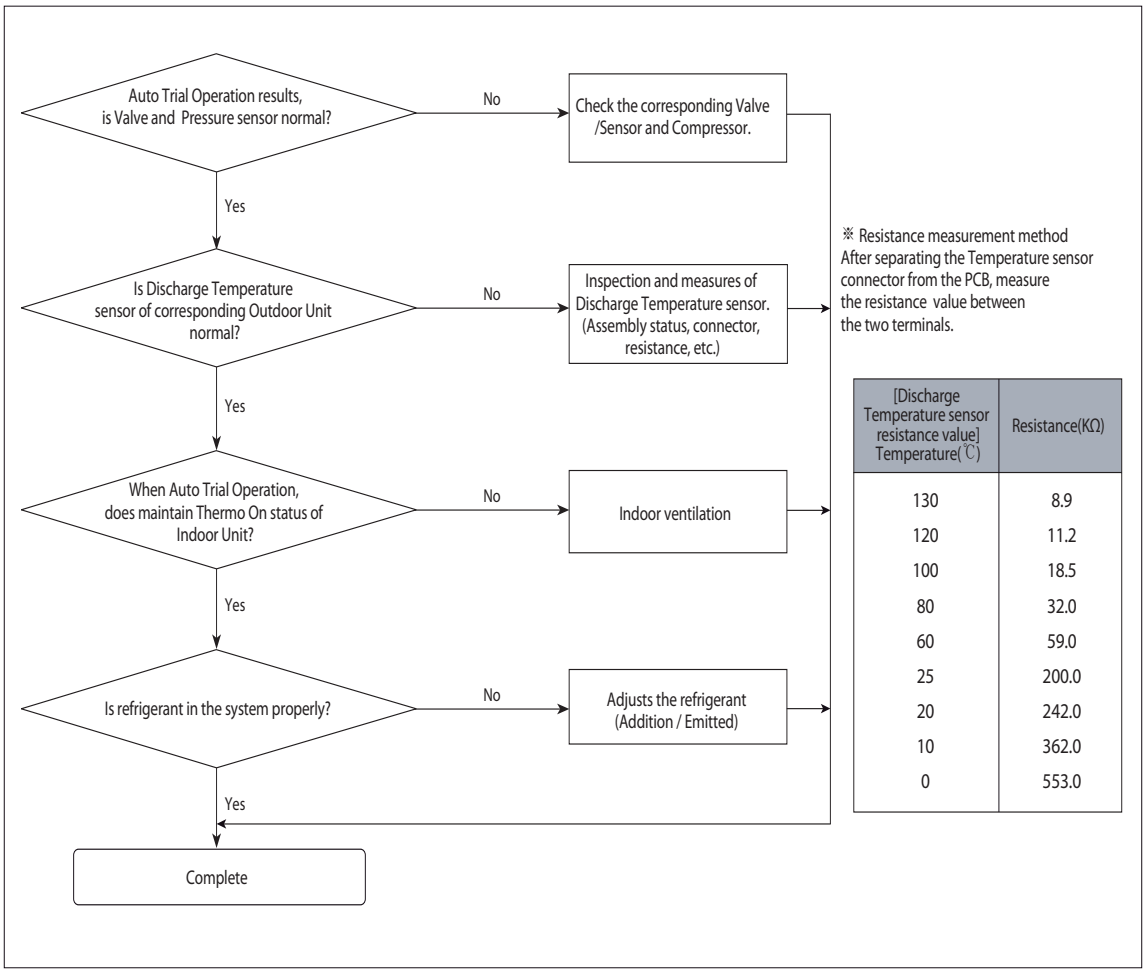
7) Cycle status

■ Inspection item : Cycle status of Outdoor Unit.

■ Error code: None (The resulting report "Undetermined")

■ Determine the Cycle status of the each Outdoor Unit.

■ If the judgment of Cycle status is "Undetermined" : Checking in accordance with the following order.



[Discharge Temperature sensor resistance value] Temperature(℃)	Resistance(KΩ)
130	8.9
120	11.2
100	18.5
80	32.0
60	59.0
25	200.0
20	242.0
10	362.0
0	553.0

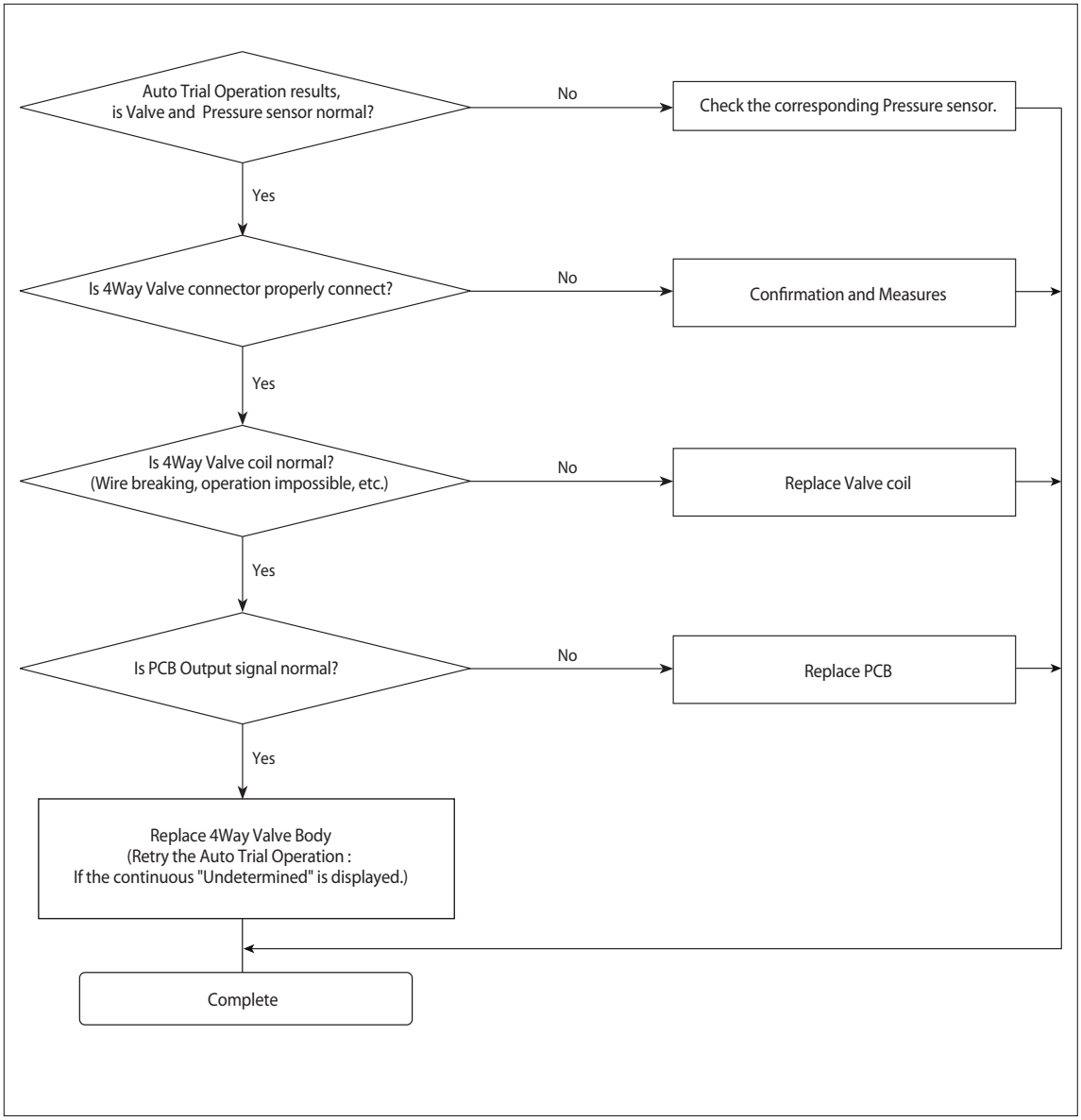
8) 4Way Valve

■ Inspection item : 4Way Valve of Outdoor Unit.

■ Error code: None (The resulting report "Undetermined")

■ Determine the 4Way Valve operation status of the each Outdoor Unit.

■ If the judgment of 4Way Valve is "Undetermined" : Checking in accordance with the following order.



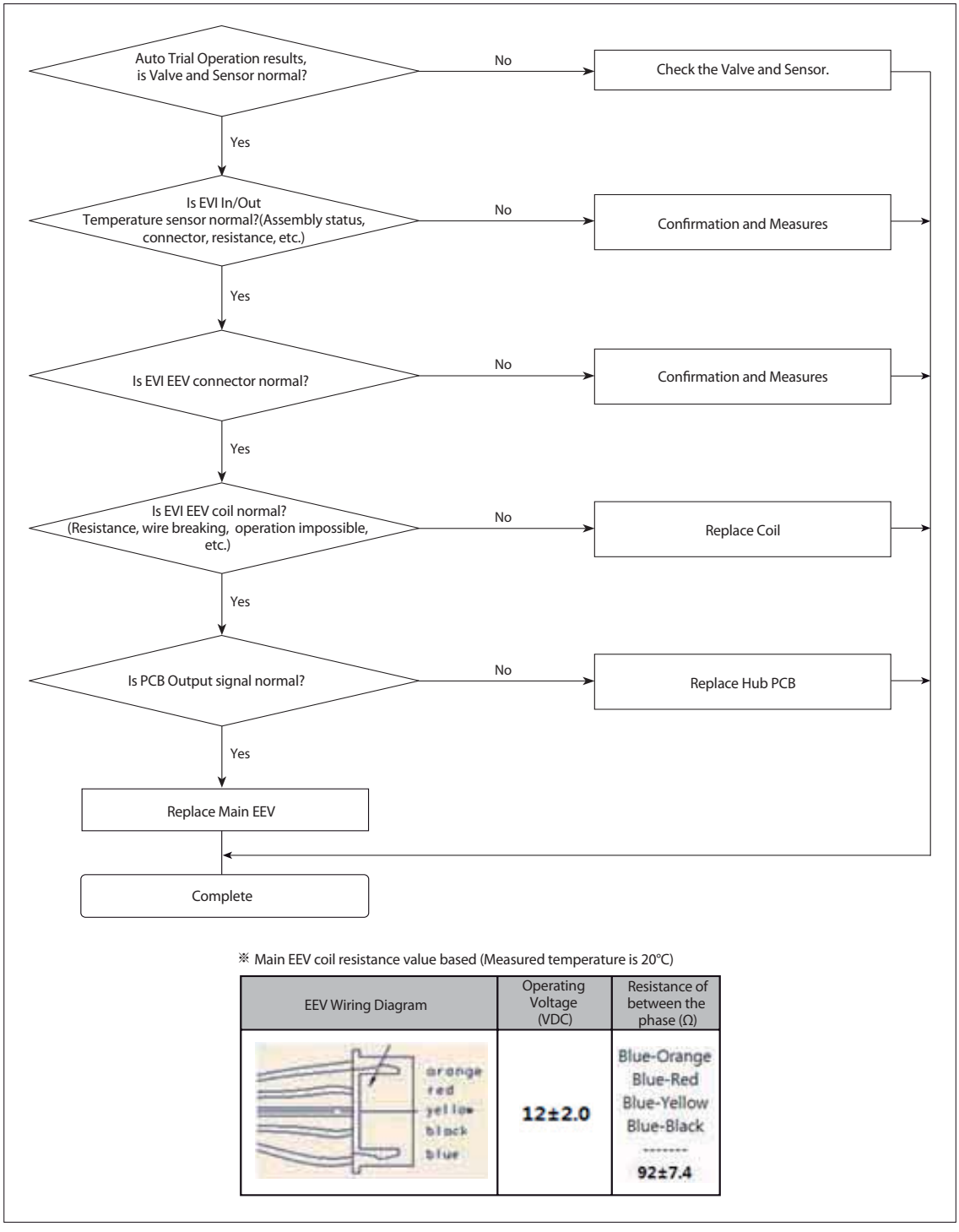
9) EVI EEV

■ Inspection item : EVI EEV of Outdoor Unit.

■ Error code: None (The resulting report "Undetermined")

■ Determine the EVI EEV operation status of the each Outdoor Unit.

■ If the judgment of EVI EEV is "Undetermined" : Checking in accordance with the following order.



※ Main EEV coil resistance value based (Measured temperature is 20°C)

EEV Wiring Diagram	Operating Voltage (VDC)	Resistance of between the phase (Ω)
	12±2.0	Blue-Orange Blue-Red Blue-Yellow Blue-Black ------- 92±7.4

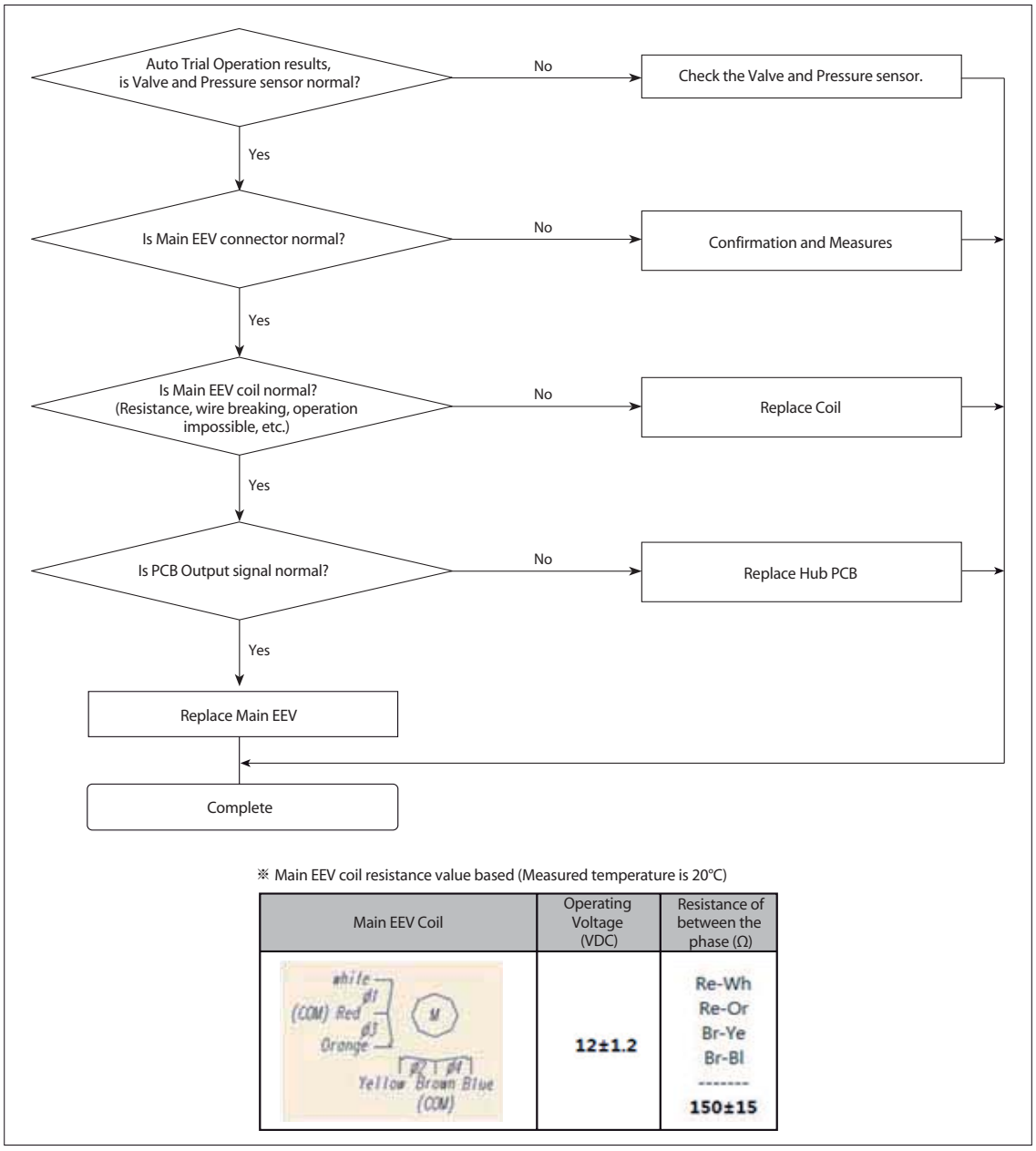
10) Main EEV

■ Inspection item : Main EEV of Outdoor Unit.(Auto Trial Operation : Heating only)

■ Error code: None (The resulting report "Undetermined")

■ Determine the Main EEV operation status of the each Outdoor Unit.

■ If the judgment of Main EEV is "Undetermined" : Checking in accordance with the following order.



※ Main EEV coil resistance value based (Measured temperature is 20℃)

Main EEV Coil	Operating Voltage (VDC)	Resistance of between the phase (Ω)
	12±1.2	Re-Wh Re-Or Br-Ye Br-Bl ------- 150±15

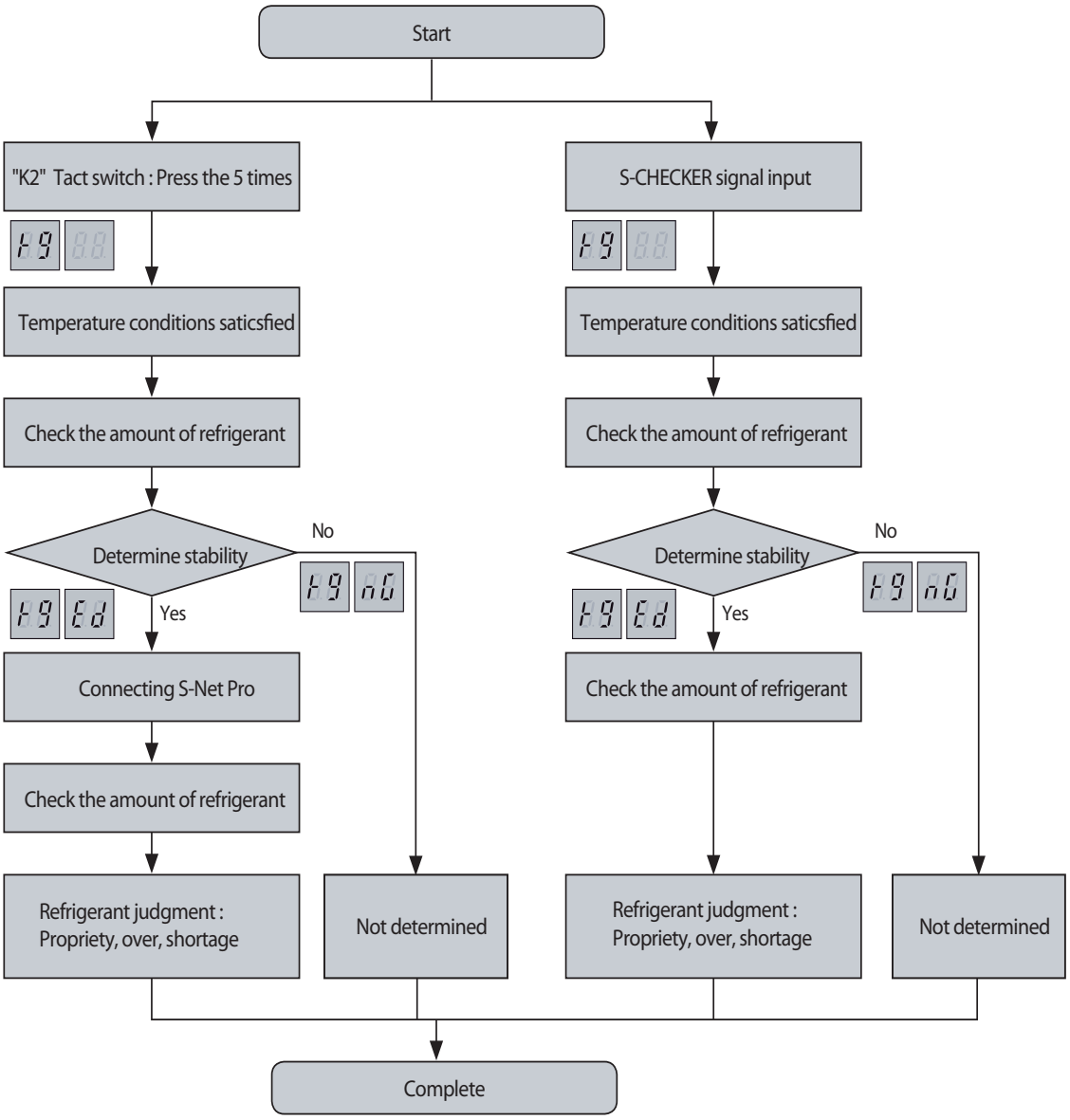
9-1-4 Auto Trial Operation Error Code

Division	Error Code	Description	Remark
Dedicated Error Code	E503	Service Valve is closed	Refer to "Service Valve"
	E505	High pressure sensor breakdown	Refer to "High / Low pressure sensor (Module installed)"
	E506	Low pressure sensor breakdown	

※ Other error codes : Refer to Service Manual.

9-2 Amount of refrigerant automatically checking

Through the detect operation is the ability to verify automatically for the amount of refrigerant.



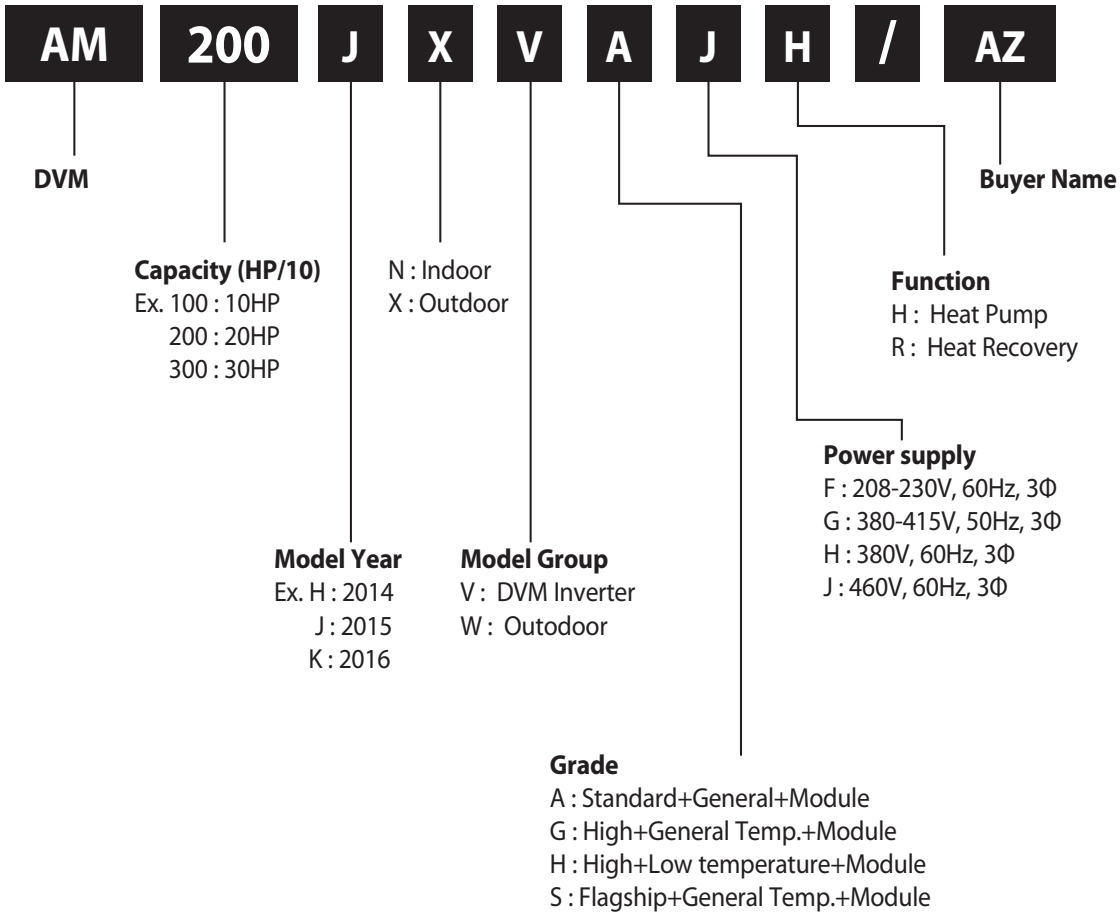
[Caution]

- If escape the warranty temperatures, can not get the accurate results.
  - Indoor : 20~30°C
  - Outdoor : 5~43°C
- If operation cycle is not stable, Checking the amount of refrigerant can be forced to shut down.
- If did not operation for a long time, or when running the heating operation, the accuracy may be lower. Therefore carried out for more than 30 minutes cooling operation.
- Depending on the installation environment, system protection operation is performed, in this case, the check result may be inaccurate.

[How to troubleshoot the judged results]

- Excessive of refrigerant amount : After the 5% emissions of calculated total refrigerant amount, retry Checking the amount of refrigerant.
- Deficiency of refrigerant amount : After the 5% addition of calculated total refrigerant amount, retry Checking the amount of refrigerant.
- Deficiency of Over-cooling : After the 10% addition of calculated total refrigerant amount, retry Checking the amount of refrigerant.
- Undetermined : Checking the amount of refrigerant confirms that is performed in warranty temperatures area. Ensure that there is no other problems in the system by Test Operation.

9-3 Model Naming



SAMSUNG

GSPN (GLOBAL SERVICE PARTNER NETWORK)

Area	Web Site
Europe, CIS, Mideast & Africa	gspn1.samsungcsportal.com
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North & Latin America	gspn3.samsungcsportal.com
China	china.samsungportal.com

Printed in Korea.
Code No. AC-00003E_9

BRT Peshawar

Mechanical AS Built Drawings

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REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
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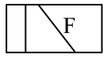
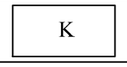
LEGEND AND ABBREVIATIONS

S.NO	SYMBOLS	DESCRIPTION
1		PHASE INDICATION NEON LAMP
2		DIGITAL TYPE VOLTMETER
3		DIGITAL TYPE AMMETER
4		SELECTOR SWITCH
5		FUSE
6		BRASS CABLE GLAND
7		Volt S.S
8		Amp S.S
9		TP Moulded Case Circuit Breaker
10		Single pole Breaker
11		Pvc Duct
12		BusBar with Insulator
13		Motor Protection Circuit Breaker
14		Overload Relay
15		Surge Protector
16		Magnetic Contactor

S.NO	ABBREVIATIONS	DESCRIPTION
1		CURRENT TRANSFORMERS
2		KILO VOLT AMPERE
3		KILO WATT
4		KILO AMPERE
5		ADJUSTABLE
6		AMPERE SINGLE POLE
7		AMPERE DOUBLE POLE
8		AMPERE FOUR POLE
9		EARTH CONNECTING POINT
10		METER PANEL BOARD
11		DISTRIBUTION BOARD
12		LIGHT & POWER
13		RUPTURING CAPACITY
14		MINIATURE CIRCUIT BREAKER
15		MOULDED CASE CIRCUIT BREAKER
16		MOTOT PROTECTION CIRCUIT BREAKER

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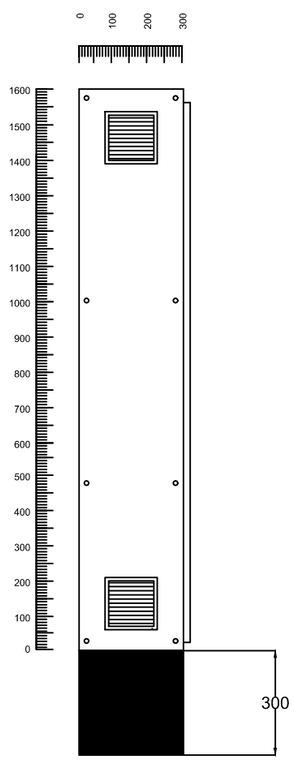
Client: **BRT Peshawar**

TITLE: **Electrical Drawings**

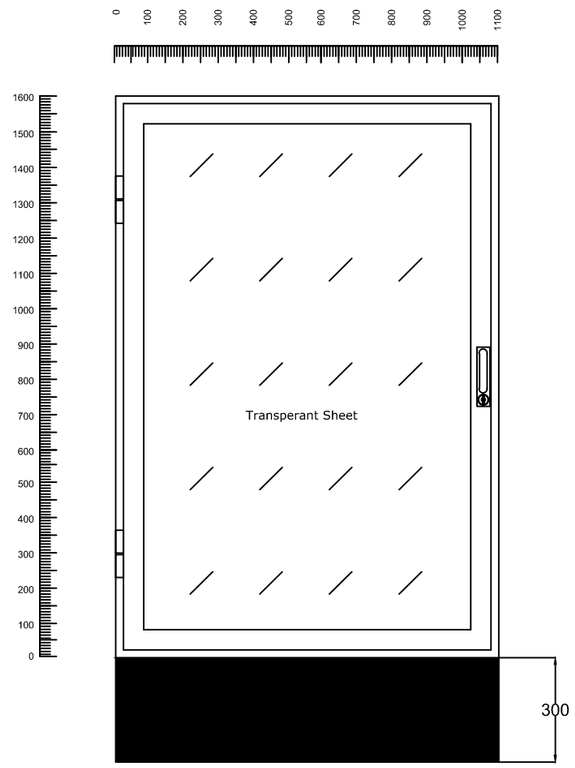
PROJECT NO.	DWG NO.	REV
18/3WS/ABM/WWTP/04/AMA-397/00	ABM/18/WWTP/397/F/03	A

SCALE	NONE	SHEET	1 OF 16

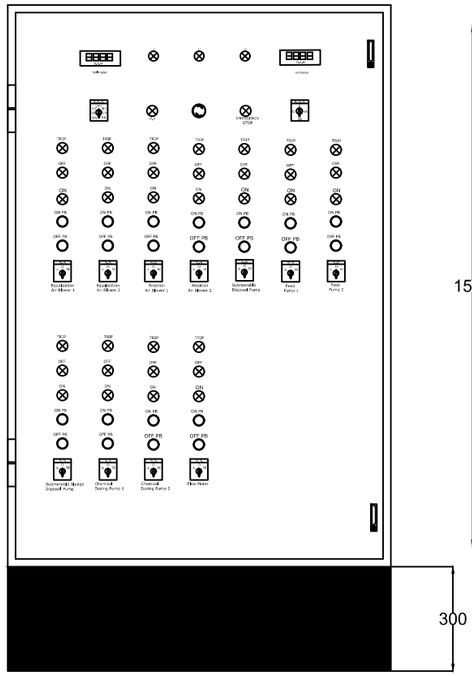
REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
A	Issued for Construction	23-12-2019	MIN	MAB	MSR



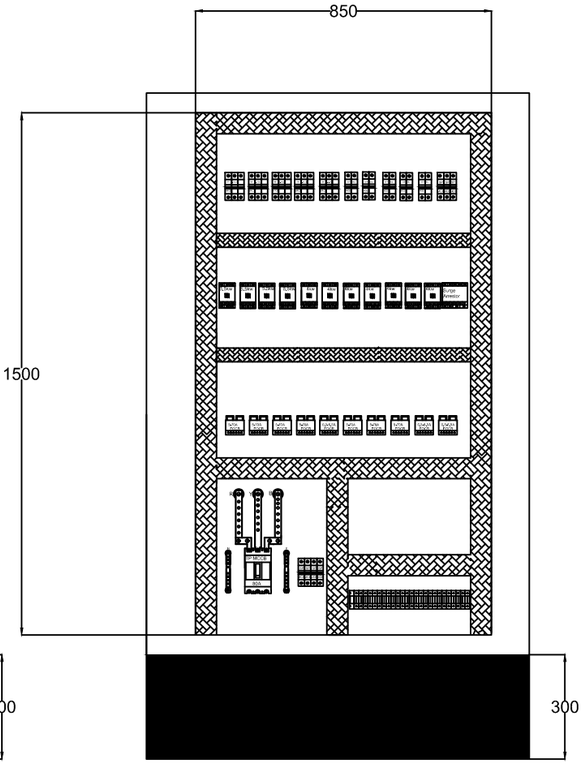
Panel Side View



DOOR VIEW



Panel Door View



Panel Internal View

ENCLOSURE SPECIFICATIONS

ENCLOSURE	= 14 SWG MS SHEET
COLOR	= RAL 7032
PROTECTION CLASS	= IP 55
INCOMING	= BOTTOM
OUTGOING	= BOTTOM
INDOOR	= FLOOR MOUNTED

ELECTRICAL PANEL SPECIFICATIONS

1. All Dimension Are In MM Otherwise Mansion.
2. Paint Of Enclosure Should Be INDOOR RAL 7032.
3. Manufacturing Tolerance +10mm.
4. Distribution Board Shall Be Front Access.
5. System Voltage 415V/220V , 3Phase,1Phase, 4Wire, 50Hz AC System.
6. Distribution Board Shall Be Welded & Bolted Type.
7. Drawing Pocket will on Panel Door.
8. Distribution Board Shall be Form 2a specifications.

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Client

BRT Peshawar

TITLE

Electrical Drawings

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SCALE	NONE	SHEET	2 OF 16

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
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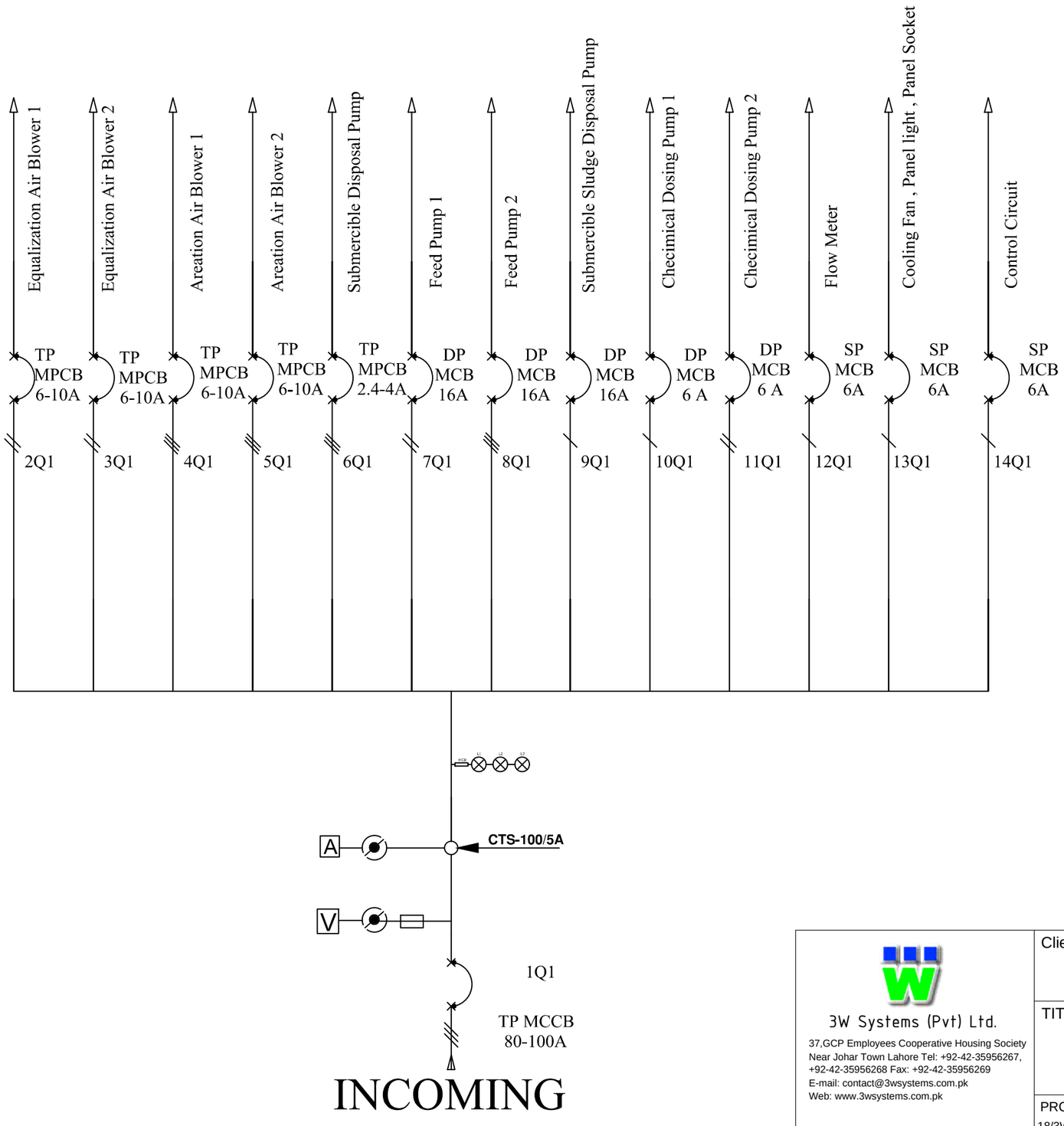

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TITLE
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PROJECT NO.	DWG NO.	REV
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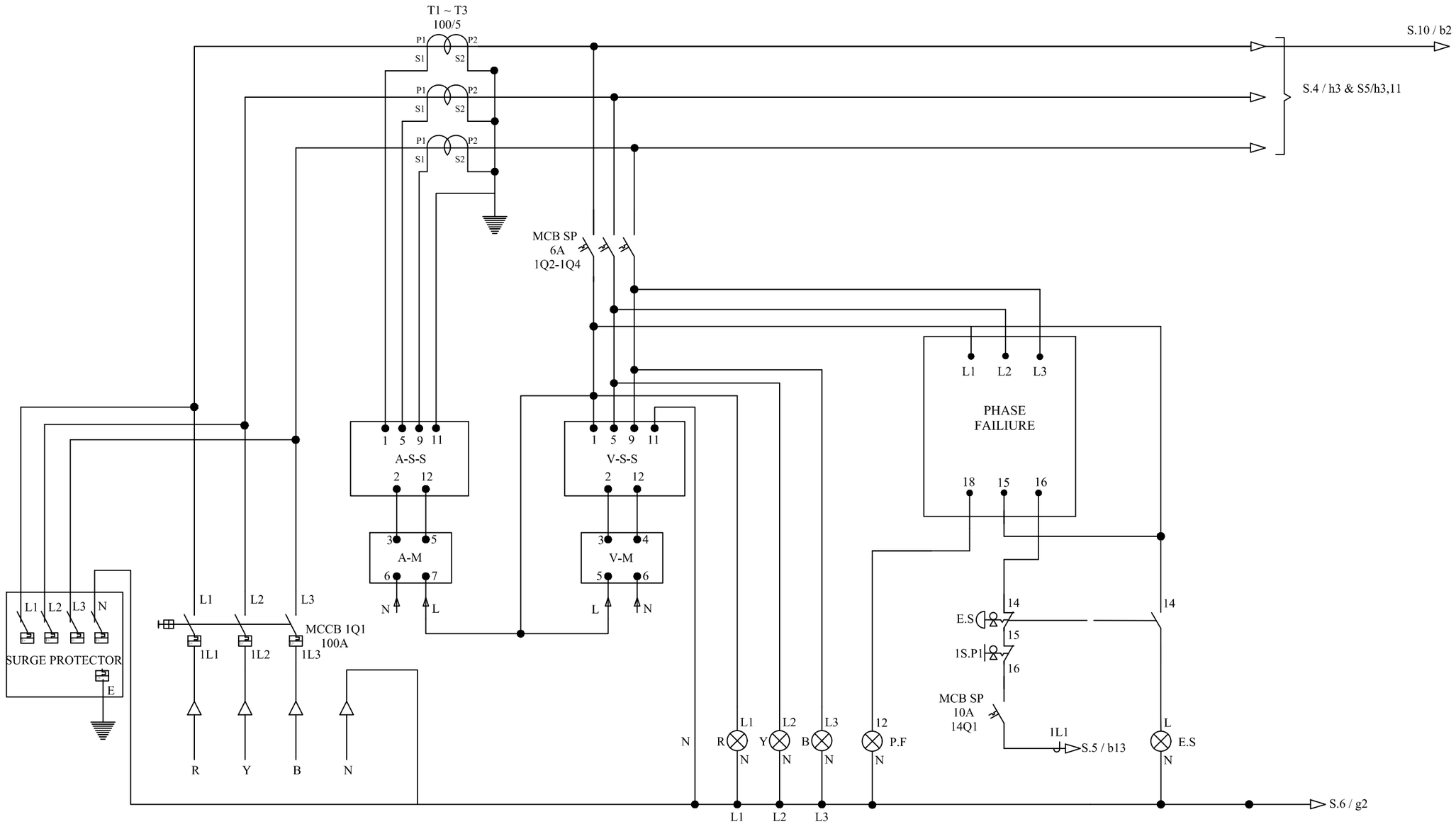
SCALE	NONE	SHEET	3 OF 16

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
A	Issued for Construction	23-12-2019	MIN	MAB	MSR



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Client

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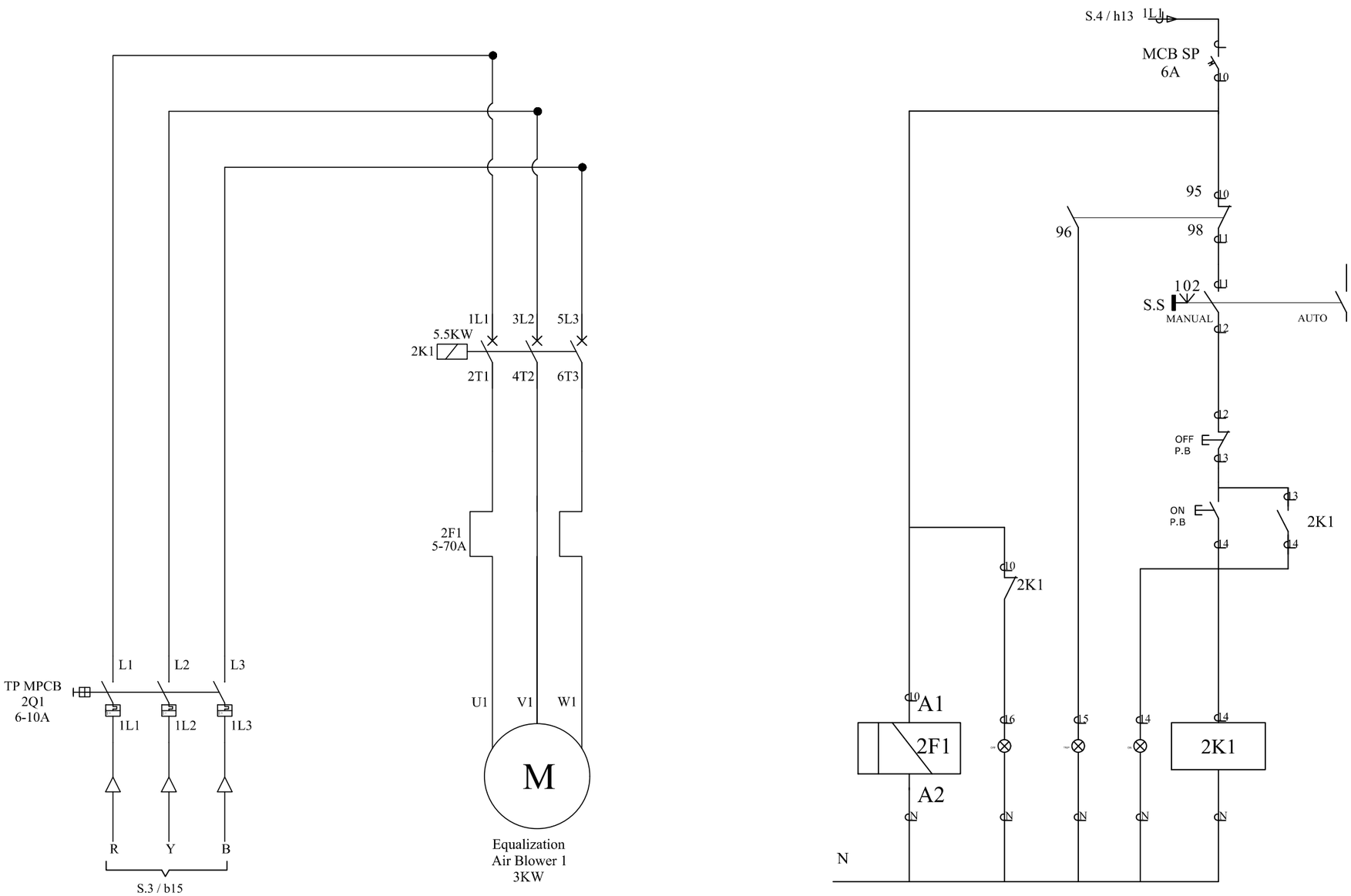
TITLE

Electrical Drawings

PROJECT NO.	DWG NO.	REV
18/3WS/ABM/WWTP/04/AMA-397/00	ABM/18/WWTP/397/F/03	A

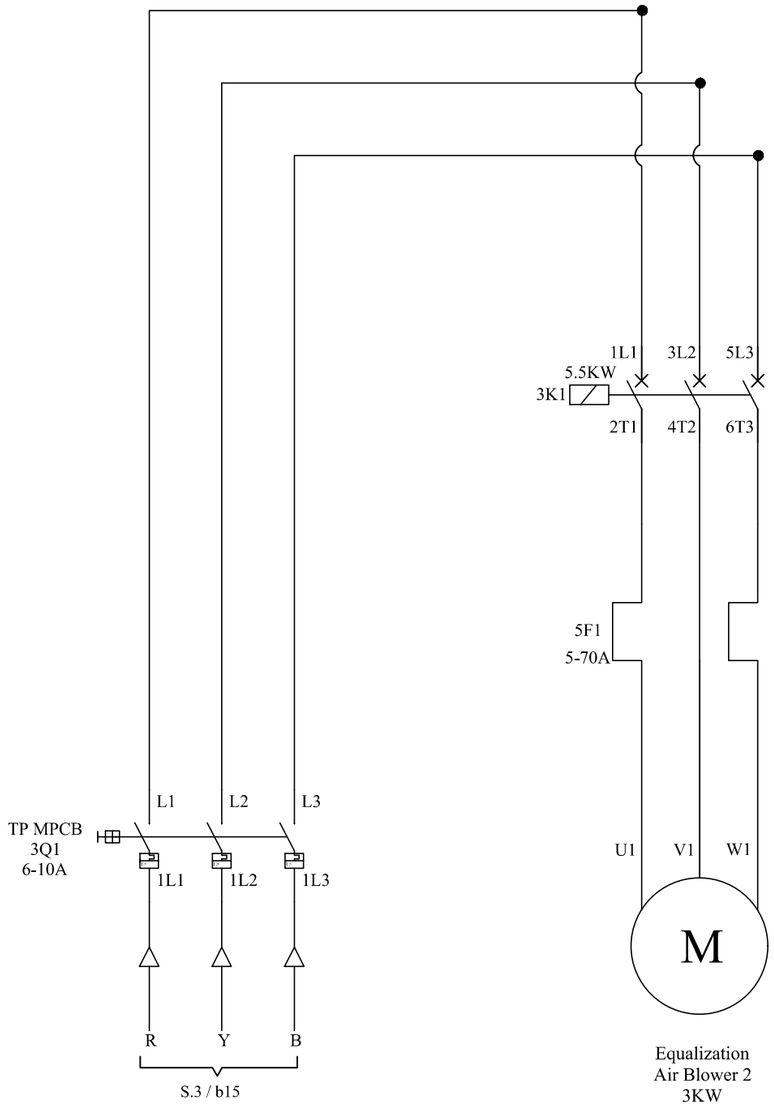
SCALE	NONE	SHEET	4 OF 16

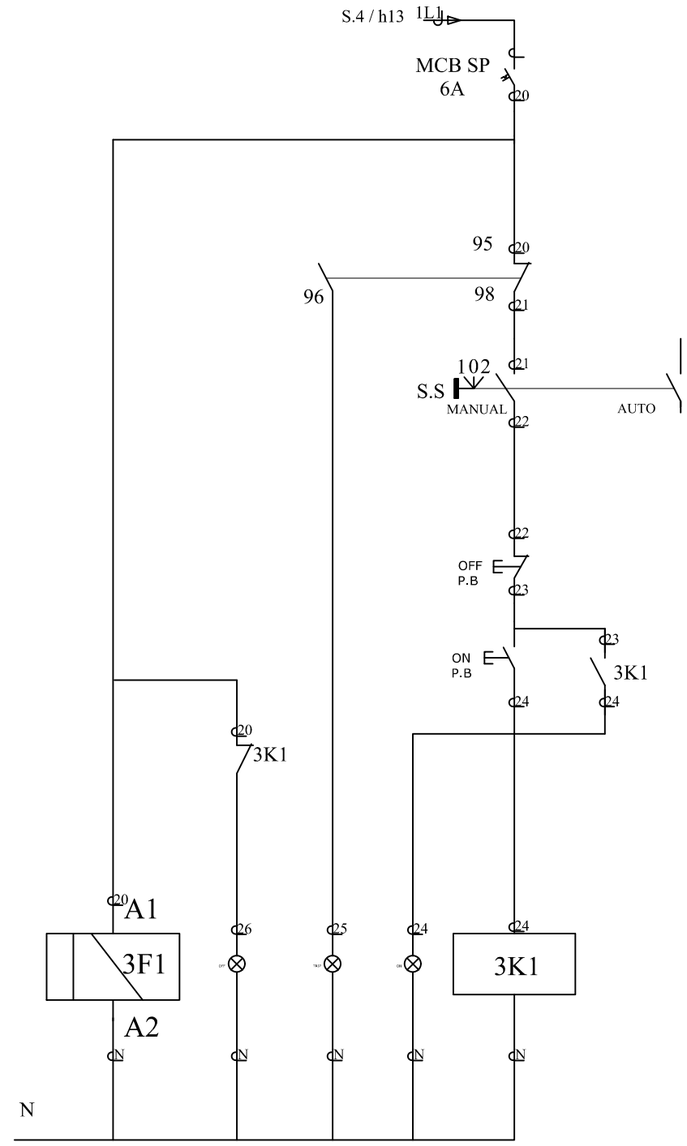
REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
A	Issued for Construction	23-12-2019	MIN	MAB	MSR



3W Systems (Pvt) Ltd.	Client: **BRT Peshawar**
37,GCP Employees Cooperative Housing Society Near Johar Town Lahore Tel: +92-42-35956267, +92-42-35956268 Fax: +92-42-35956269 E-mail: contact@3wsystems.com.pk Web: www.3wsystems.com.pk	TITLE: **Electrical Drawings**
PROJECT NO.: 18/3WS/ABM/WWTP/04/AMA-397/00	DWG NO.: ABM/18/WWTP/397/F/03 — REV: **A**
SCALE: **NONE**	SHEET: **5 OF 16**

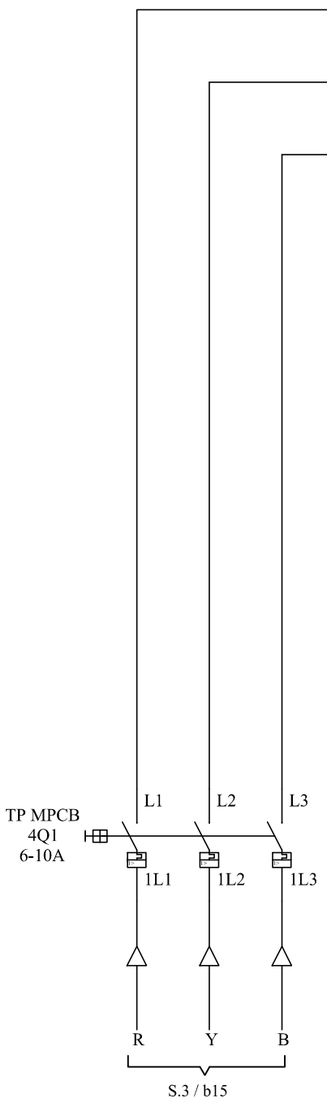
REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
A	Issued for Construction	23-12-2019	MIN	MAB	MSR

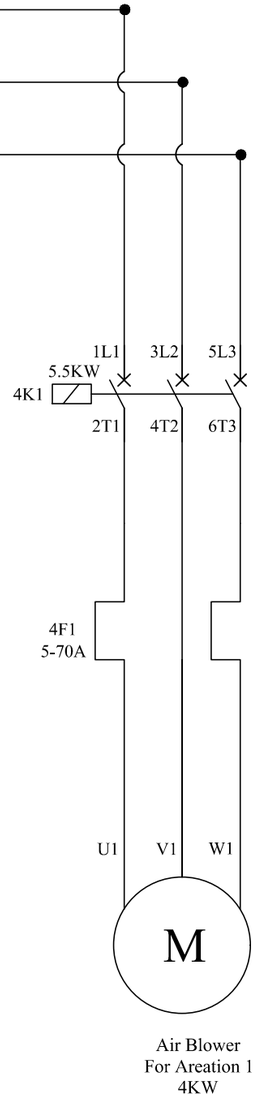


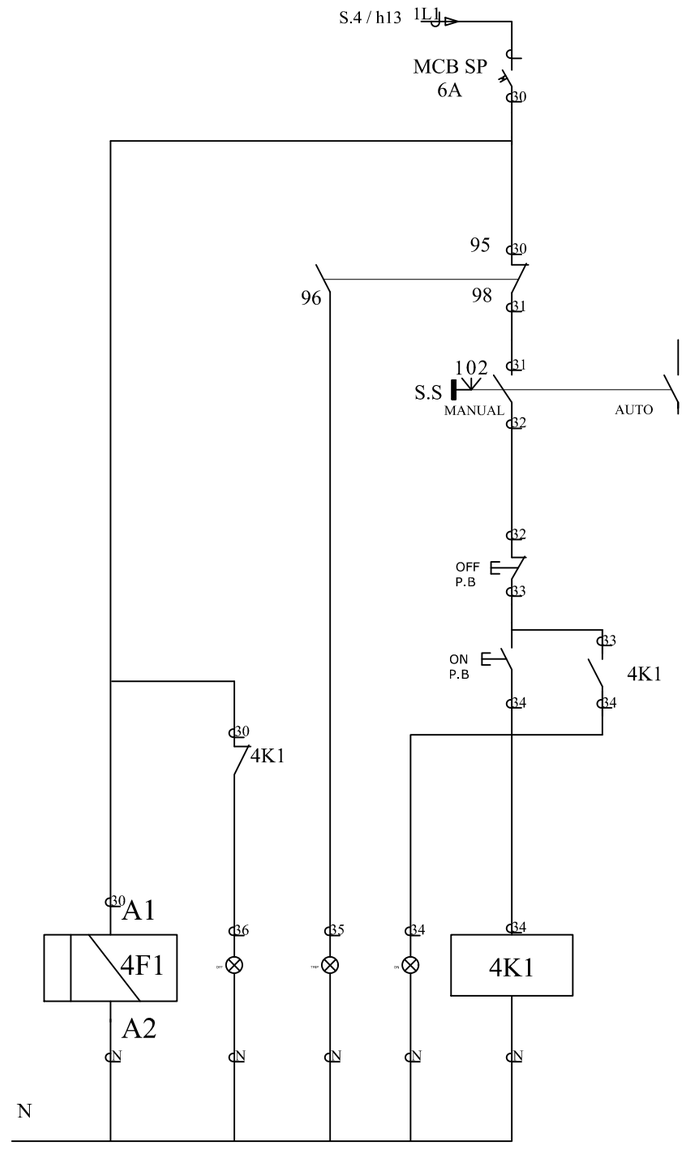


3W Systems (Pvt) Ltd. 37,GCP Employees Cooperative Housing Society Near Johar Town Lahore Tel: +92-42-35956267, +92-42-35956268 Fax: +92-42-35956269 E-mail: contact@3wsystems.com.pk Web: www.3wsystems.com.pk	Client: **BRT Peshawar**	
	TITLE: **Electrical Drawings**	
	PROJECT NO.: 18/3WS/ABM/WWTP/04/AMA-397/00	DWG NO.: ABM/18/WWTP/397/F/03 — REV: **A**
	SCALE: **NONE**	SHEET: **6 OF 16**

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
A	Issued for Construction	23-12-2019	MIN	MAB	MSR

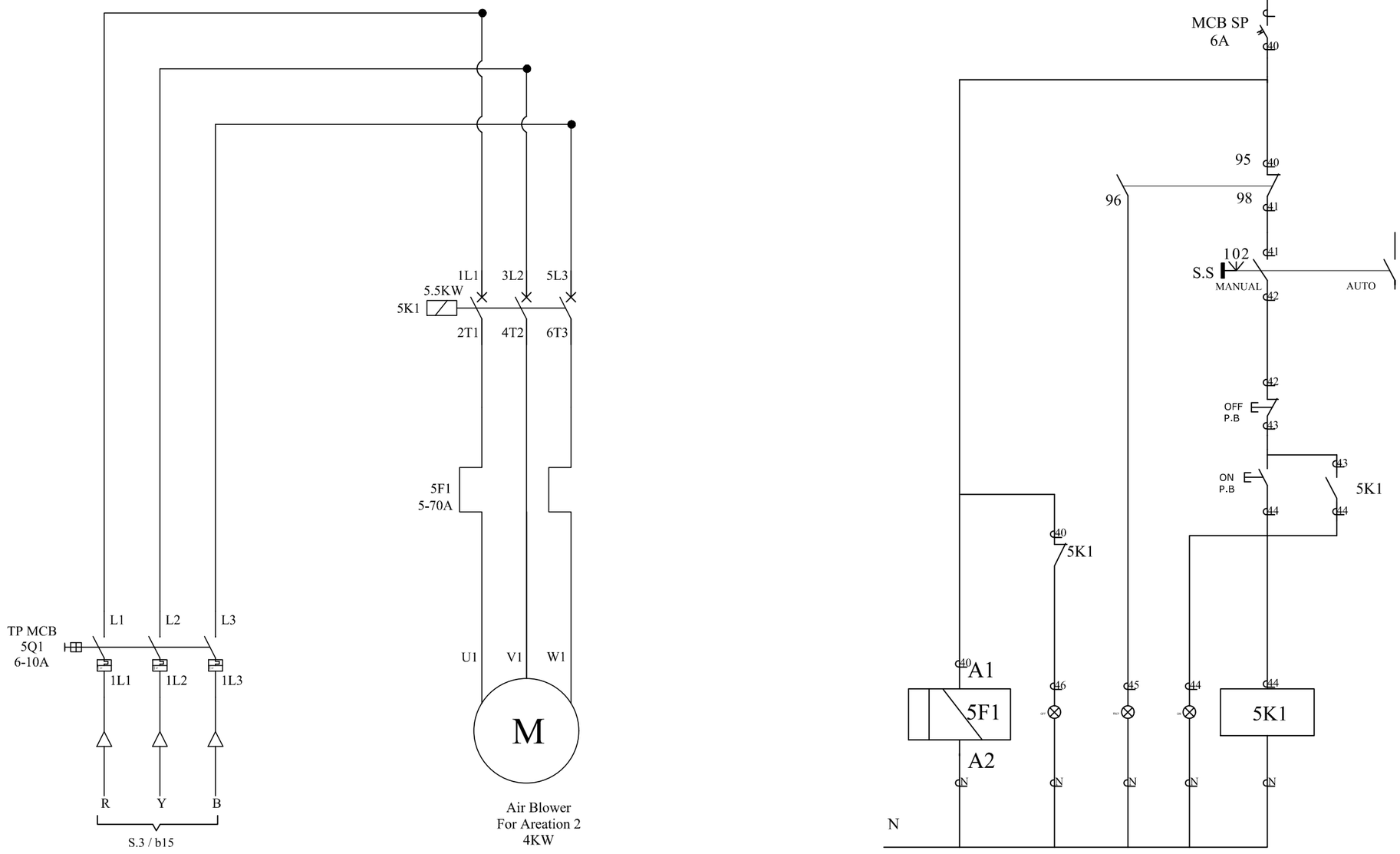






3W Systems (Pvt) Ltd. 37,GCP Employees Cooperative Housing Society Near Johar Town Lahore Tel: +92-42-35956267, +92-42-35956268 Fax: +92-42-35956269 E-mail: contact@3wsystems.com.pk Web: www.3wsystems.com.pk	Client: **BRT Peshawar**		
	TITLE: **Electrical Drawings**		
	PROJECT NO.: 18/3WS/ABM/WWTP/04/AMA-397/00	DWG NO.: ABM/18/WWTP/397/F/03	REV: **A**
	SCALE: **NONE**	SHEET: **7 OF 16**	

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
A	Issued for Construction	23-12-2019	MIN	MAB	MSR



3W Systems (Pvt) Ltd.

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Web: www.3wsystems.com.pk

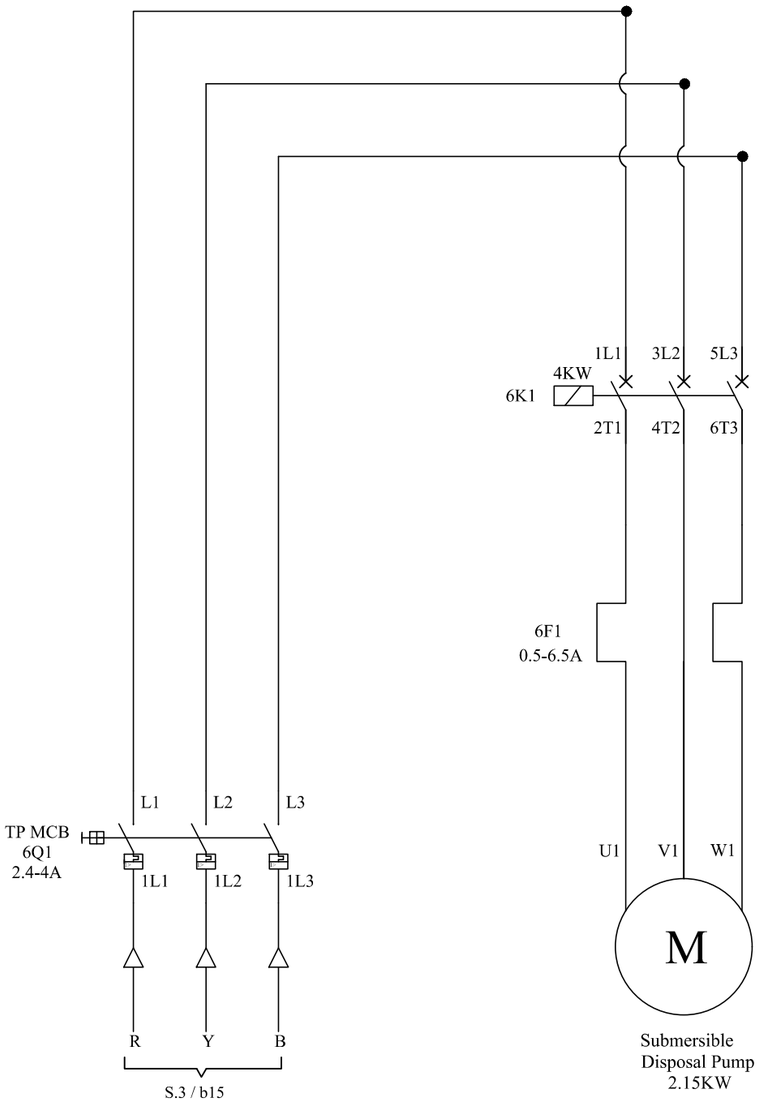
Client
BRT Peshawar

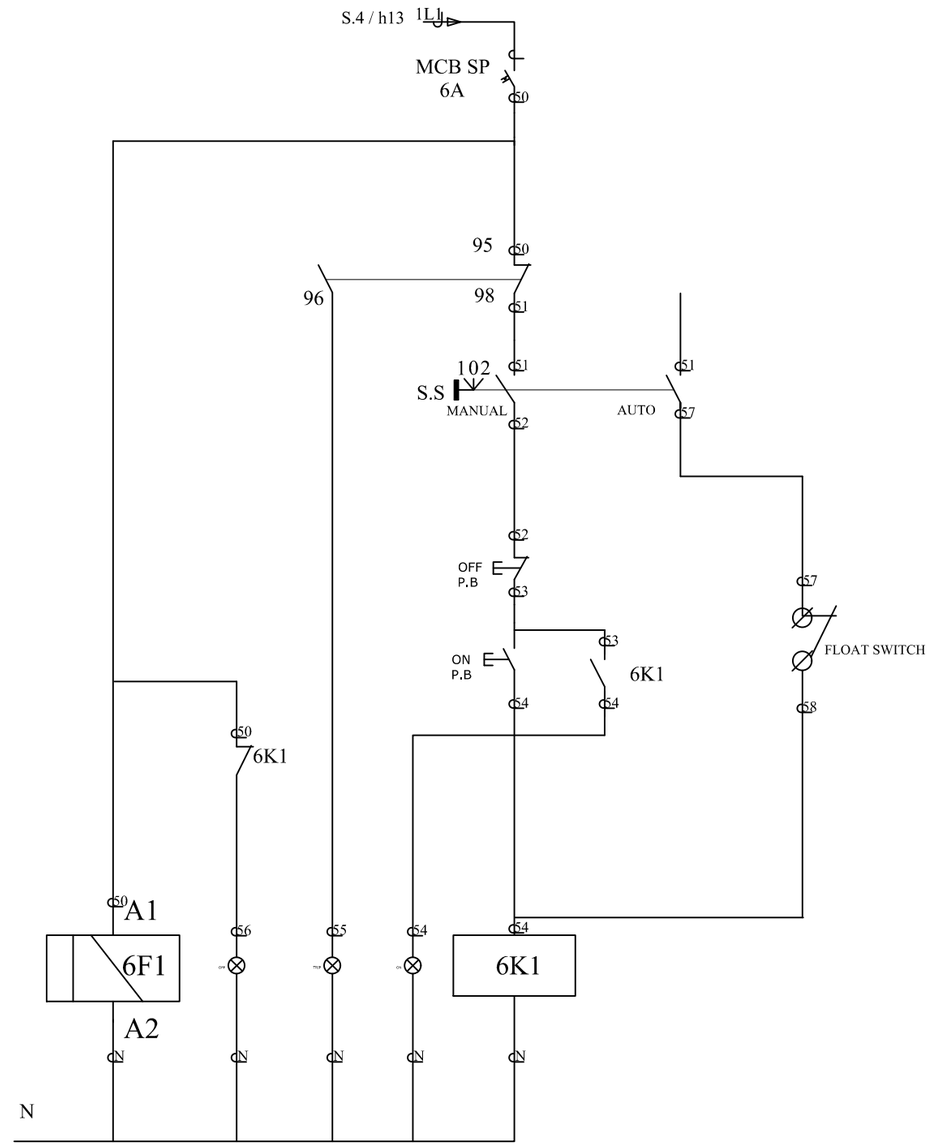
TITLE
Electrical Drawings

PROJECT NO.	DWG NO.	REV
18/3WS/ABM/WWTP/04/AMA-397/00	ABM/18/WWTP/397/F/03	A

SCALE	NONE	SHEET	8 OF 16

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
A	Issued for Construction	23-12-2019	MIN	MAB	MSR





3W Systems (Pvt) Ltd.

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Web: www.3wsystems.com.pk

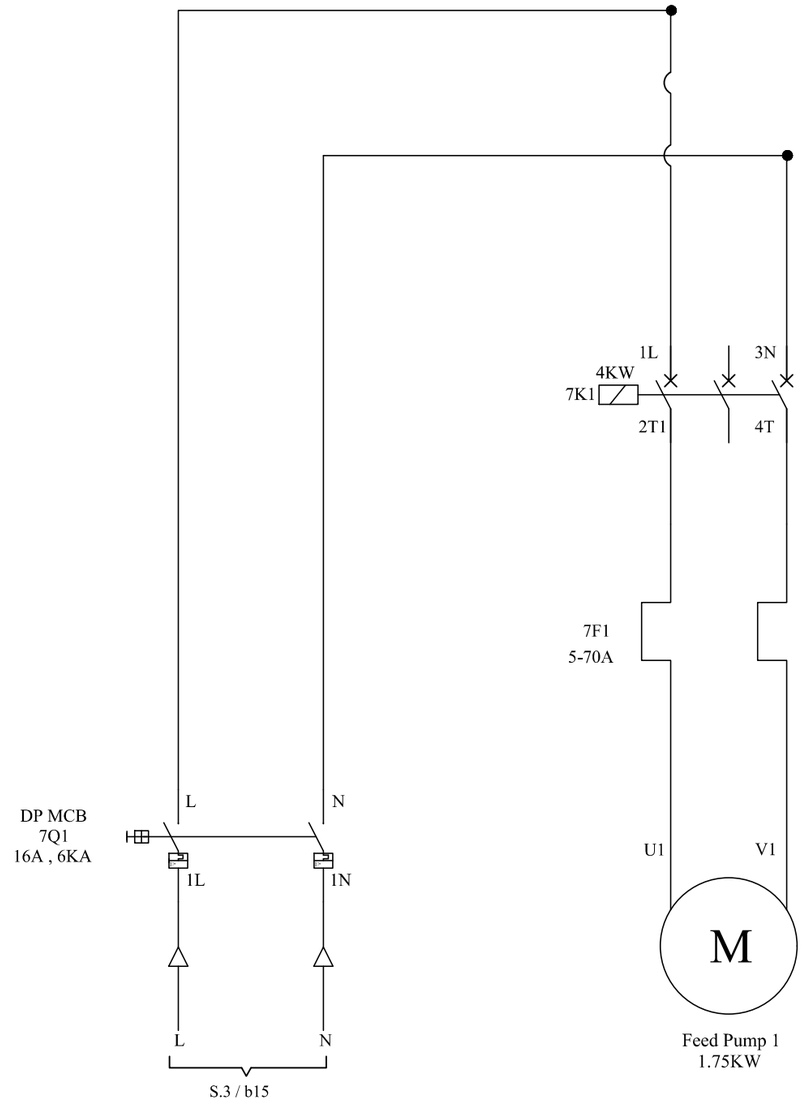
Client
BRT Peshawar

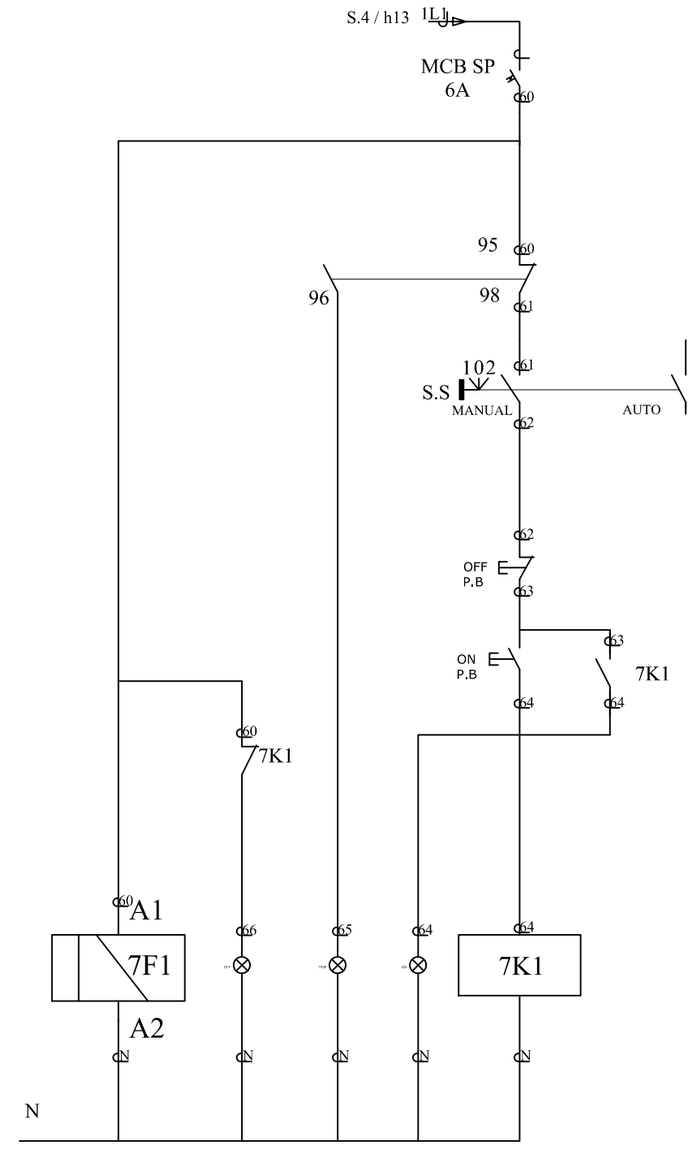
TITLE
Electrical Drawings

PROJECT NO.	DWG NO.	REV
18/3WS/ABM/WWTP/04/AMA-397/00	ABM/18/WWTP/397/F/03	A

SCALE	NONE	SHEET	9 OF 16

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
A	Issued for Construction	23-12-2019	MIN	MAB	MSR





3W Systems (Pvt) Ltd.
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Web: www.3wsystems.com.pk

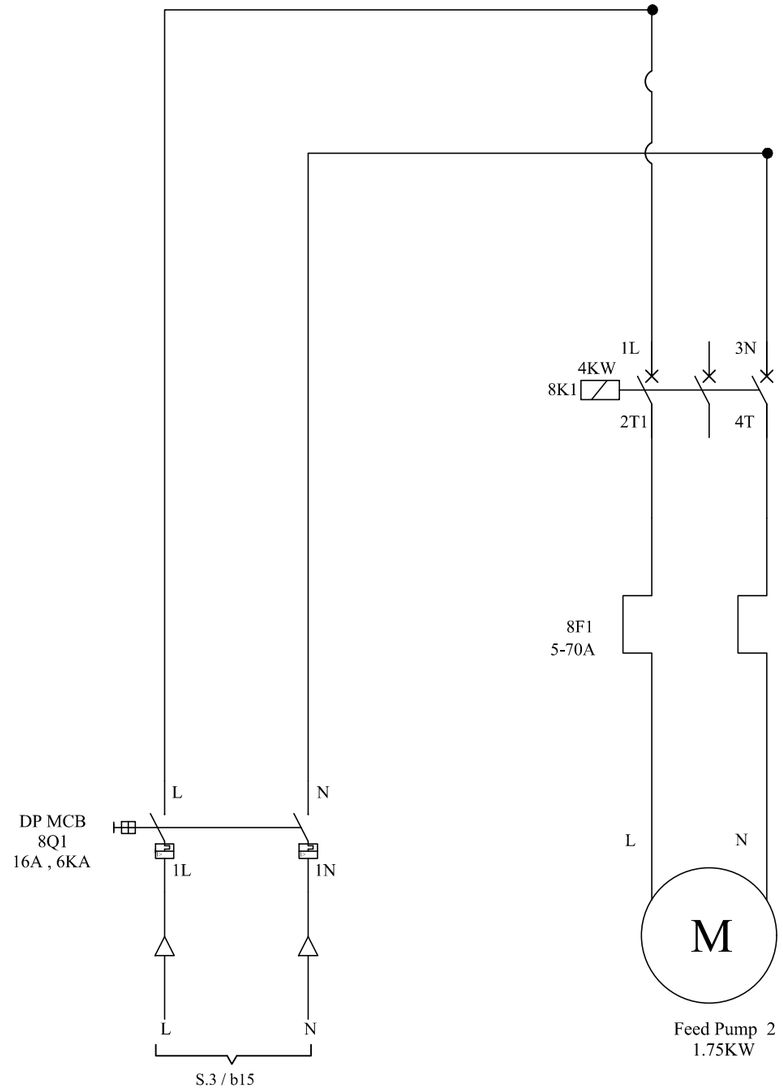
Client
BRT Peshawar

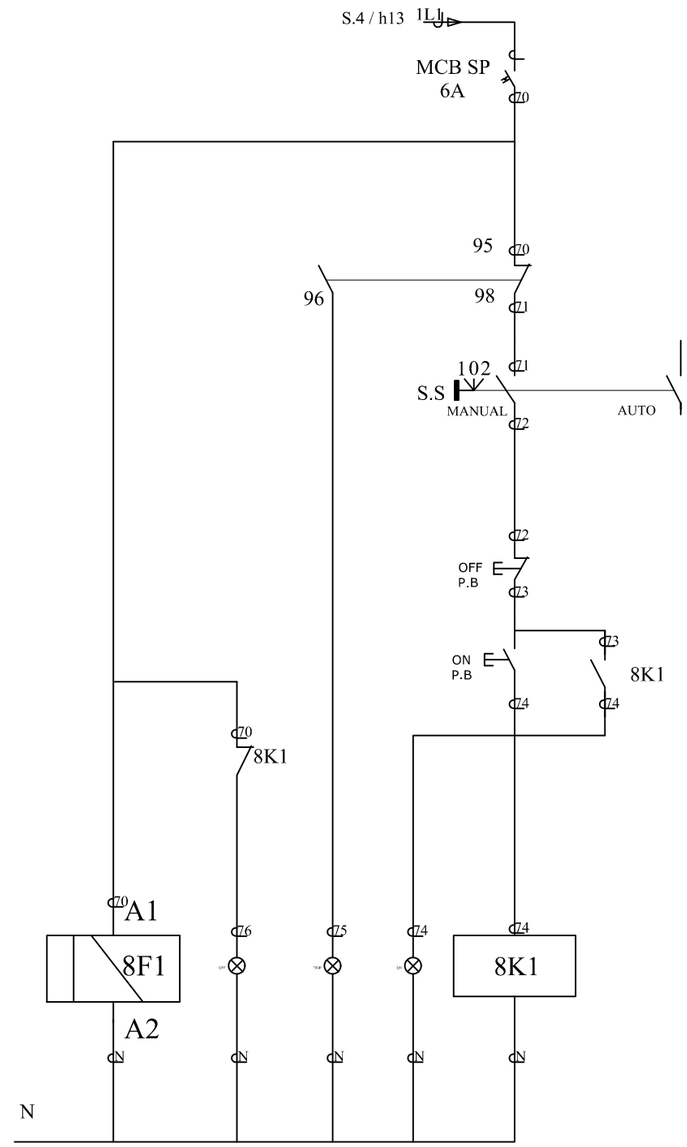
TITLE
Electrical Drawings

PROJECT NO.	DWG NO.	REV
18/3WS/ABM/WWTP/04/AMA-397/00	ABM/18/WWTP/397/F/03	A

SCALE	NONE	SHEET	10 OF 16

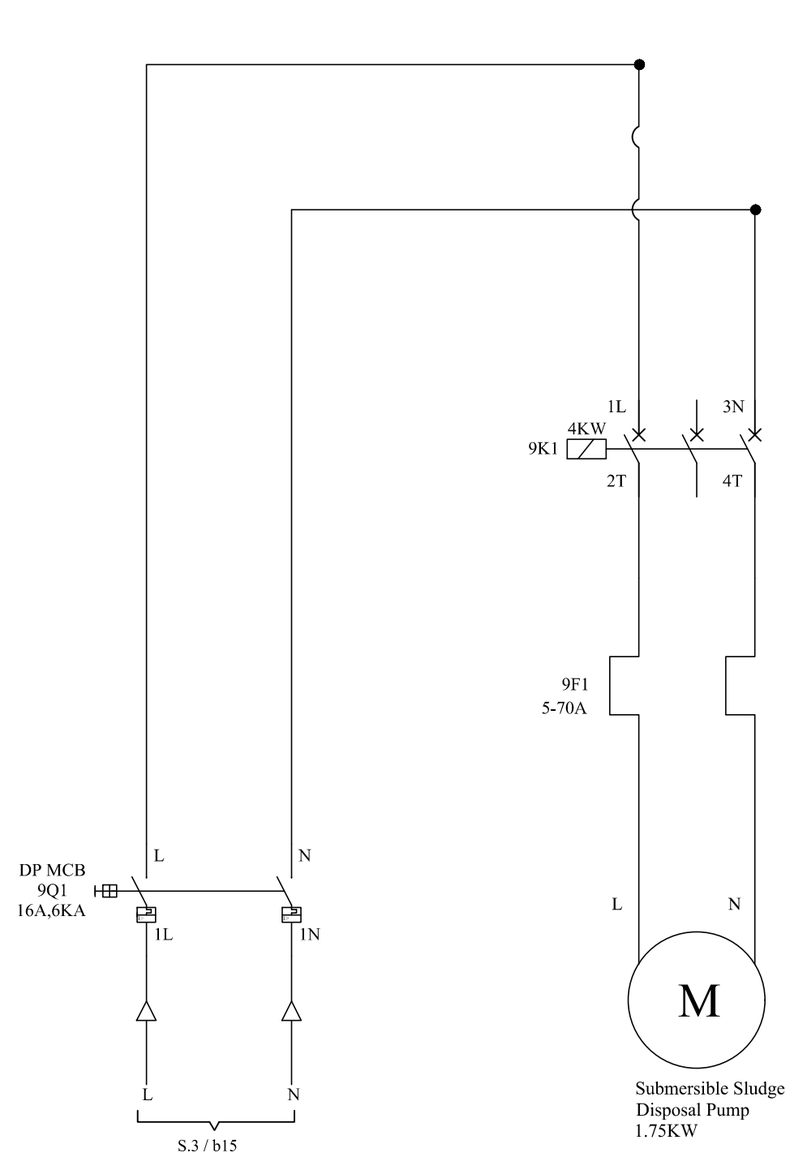
REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
A	Issued for Construction	23-12-2019	MIN	MAB	MSR

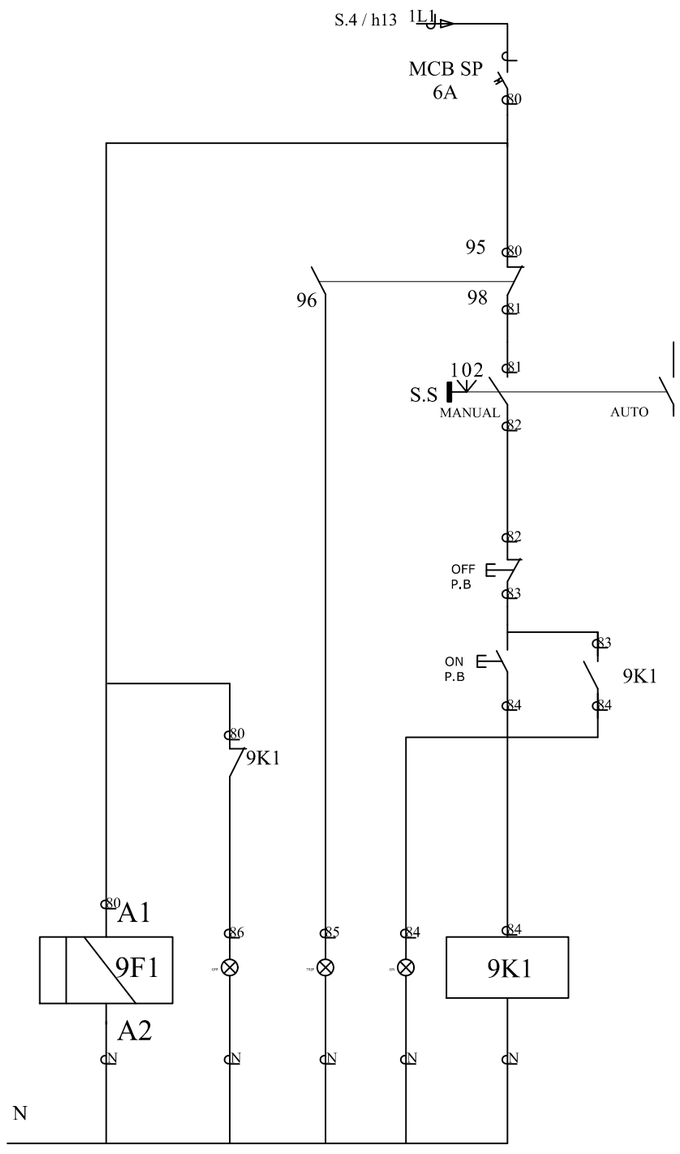




3W Systems (Pvt) Ltd. 37,GCP Employees Cooperative Housing Society Near Johar Town Lahore Tel: +92-42-35956267, +92-42-35956268 Fax: +92-42-35956269 E-mail: contact@3wsystems.com.pk Web: www.3wsystems.com.pk	Client	**BRT Peshawar**	
	TITLE	**Electrical Drawings**	
	PROJECT NO. 18/3WS/ABM/WWTP/04/AMA-397/00	DWG NO. ABM/18/WWTP/397/F/03	REV **A**
	SCALE **NONE**	SHEET **11 OF 16**	

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
A	Issued for Construction	23-12-2019	MIN	MAB	MSR





3W Systems (Pvt) Ltd.

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Web: www.3wsystems.com.pk

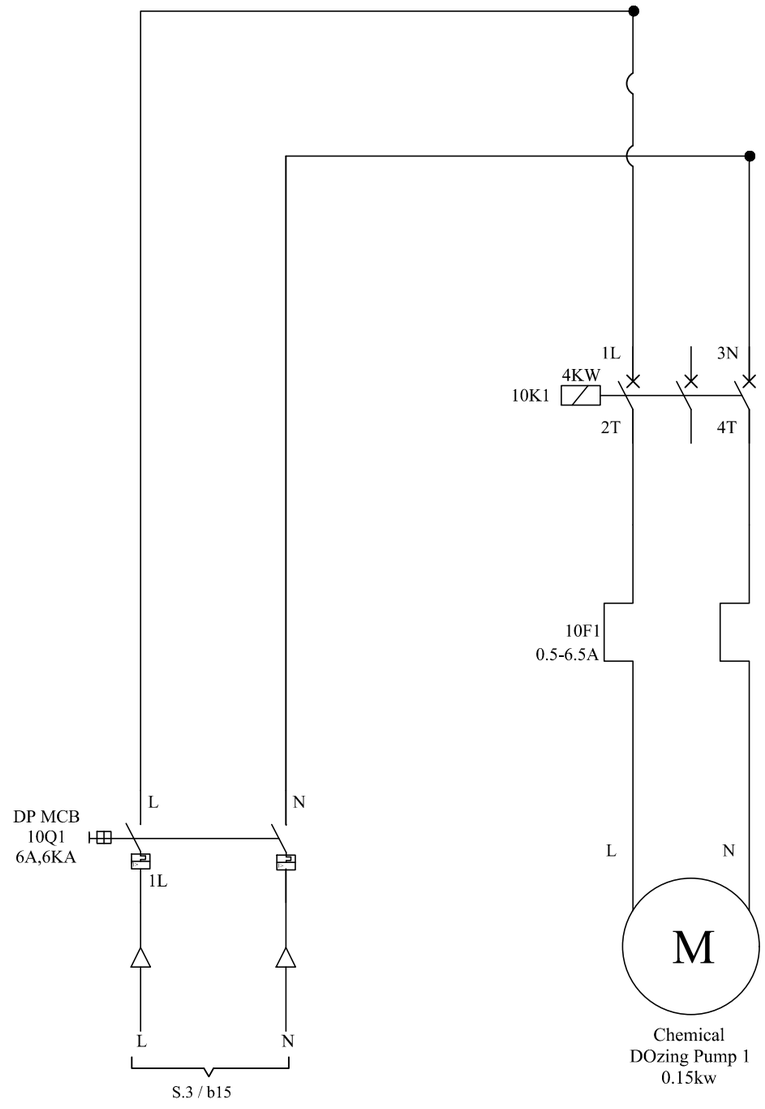
Client: **BRT Peshawar**

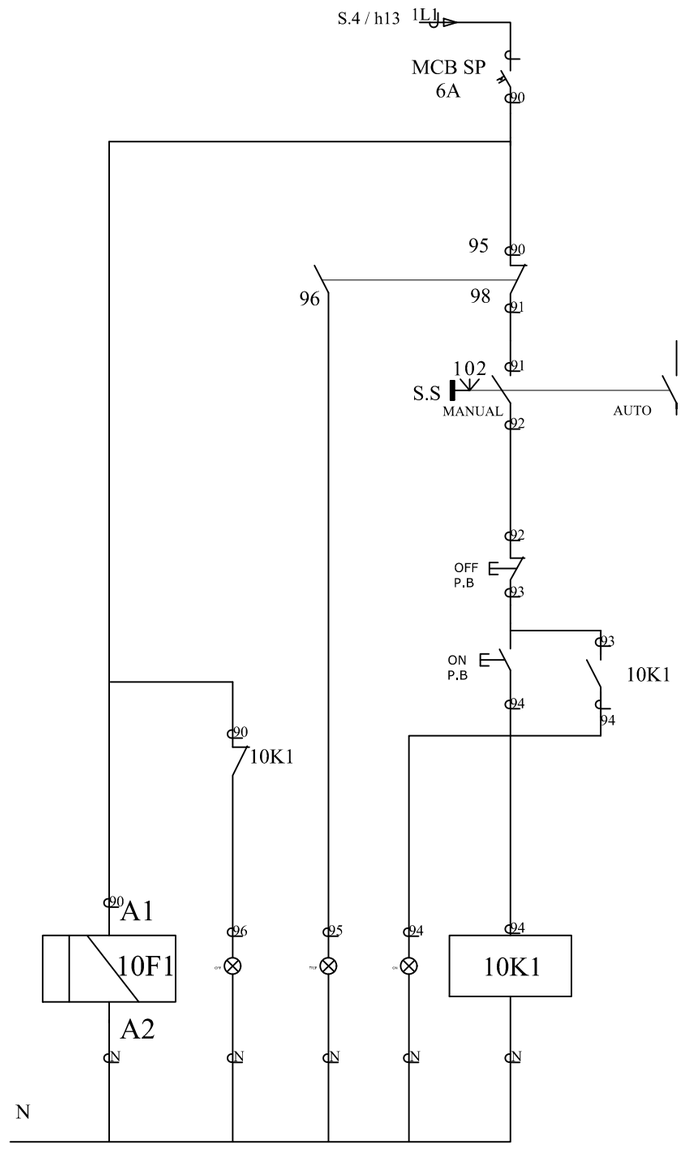
TITLE: **Electrical Drawings**

PROJECT NO.	DWG NO.	REV
18/3WS/ABM/WWTP/04/AMA-397/00	ABM/18/WWTP/397/F/03	A

SCALE	NONE	SHEET	12 OF 16

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
A	Issued for Construction	23-12-2019	MIN	MAB	MSR





3W Systems (Pvt) Ltd.
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Web: www.3wsystems.com.pk

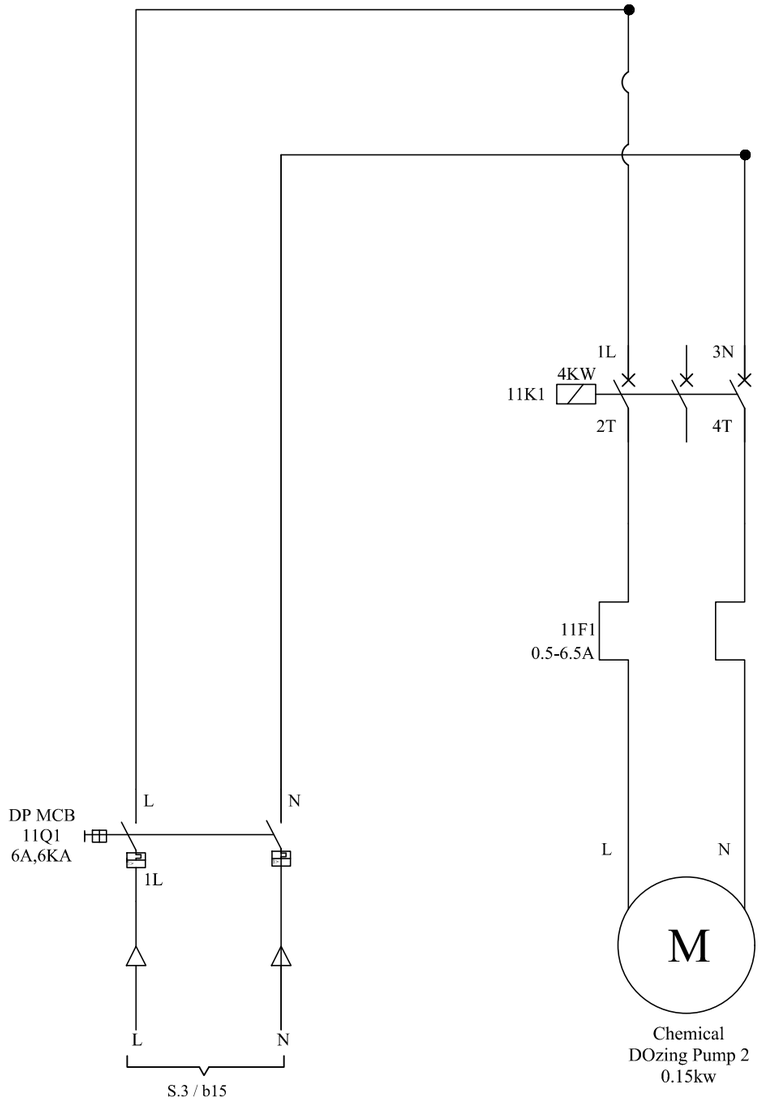
Client
BRT Peshawar

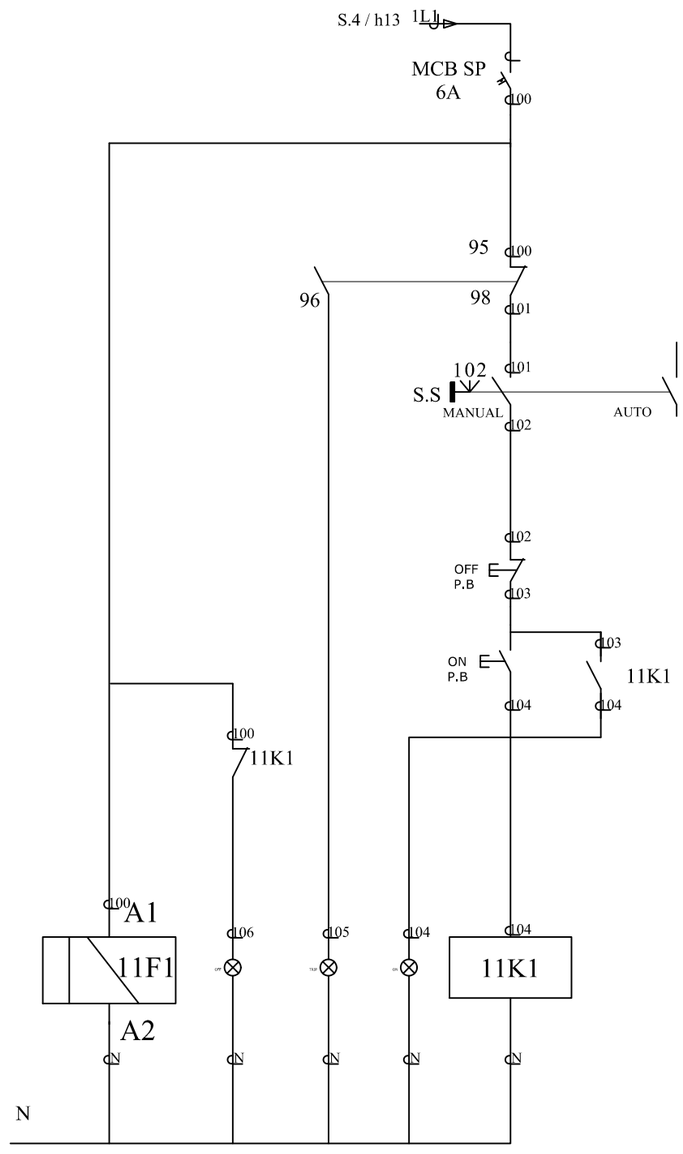
TITLE
Electrical Drawings

PROJECT NO.	DWG NO.	REV
18/3WS/ABM/WWTP/04/AMA-397/00	ABM/18/WWTP/397/F/03	A

SCALE	NONE	SHEET	13 OF 16

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
A	Issued for Construction	23-12-2019	MIN	MAB	MSR





3W Systems (Pvt) Ltd.

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Web: www.3wsystems.com.pk

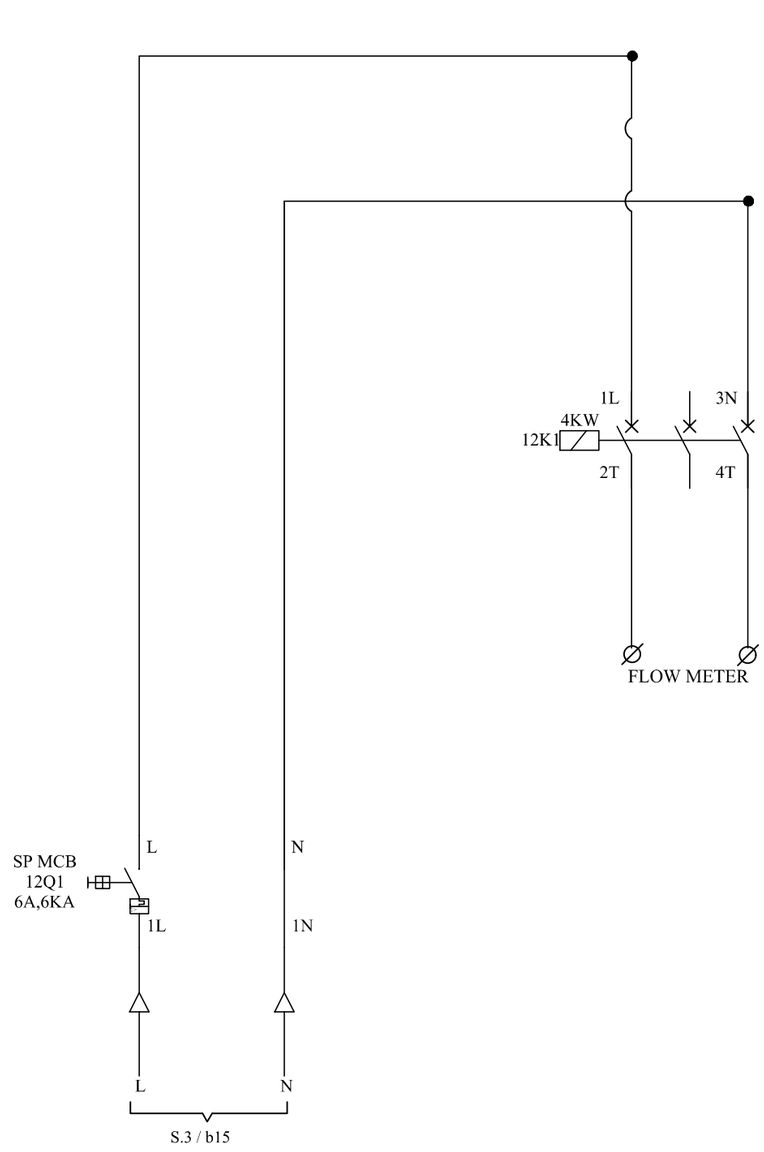
Client
BRT Peshawar

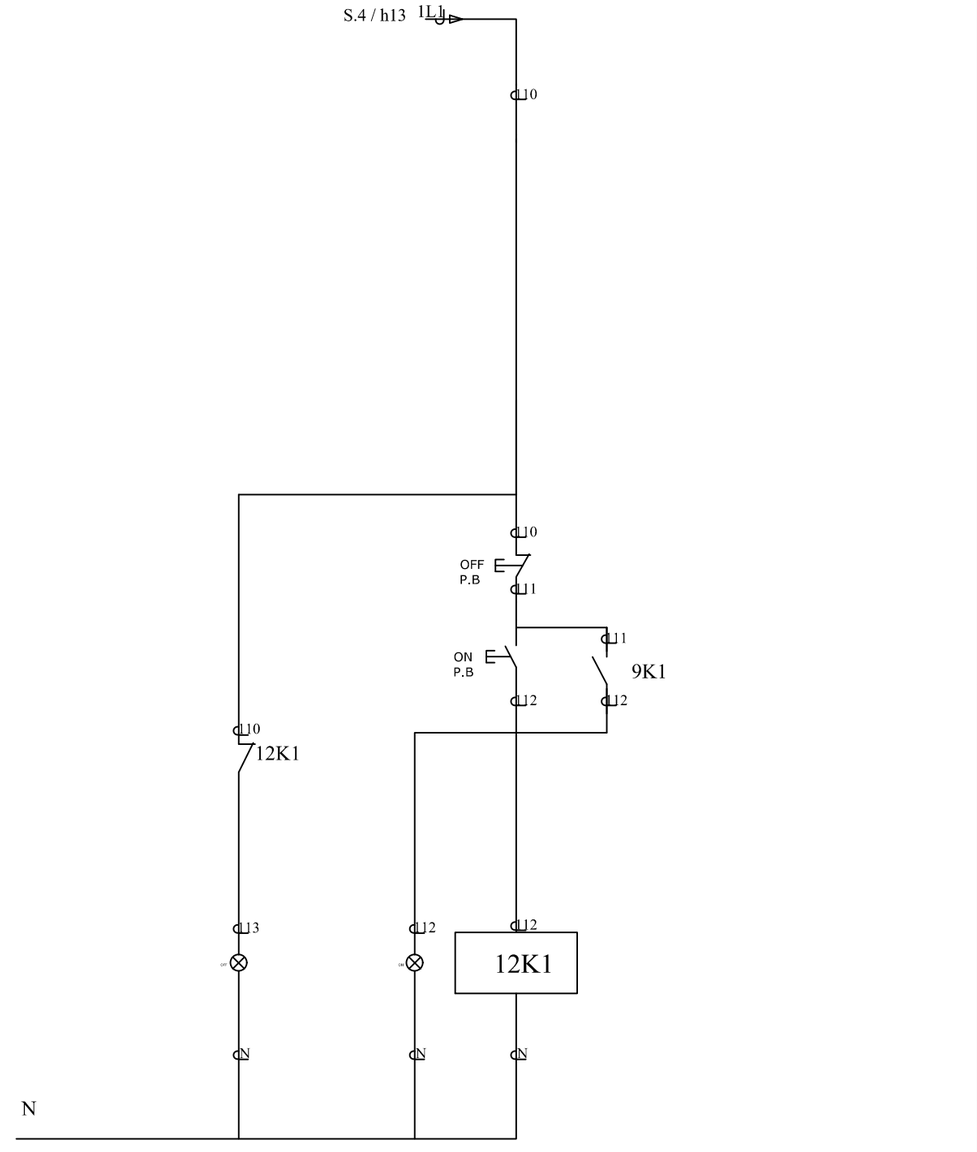
TITLE
Electrical Drawings

PROJECT NO.	DWG NO.	REV
18/3WS/ABM/WWTP/04/AMA-397/00	ABM/18/WWTP/397/F/03	A

SCALE	NONE	SHEET	14 OF 16

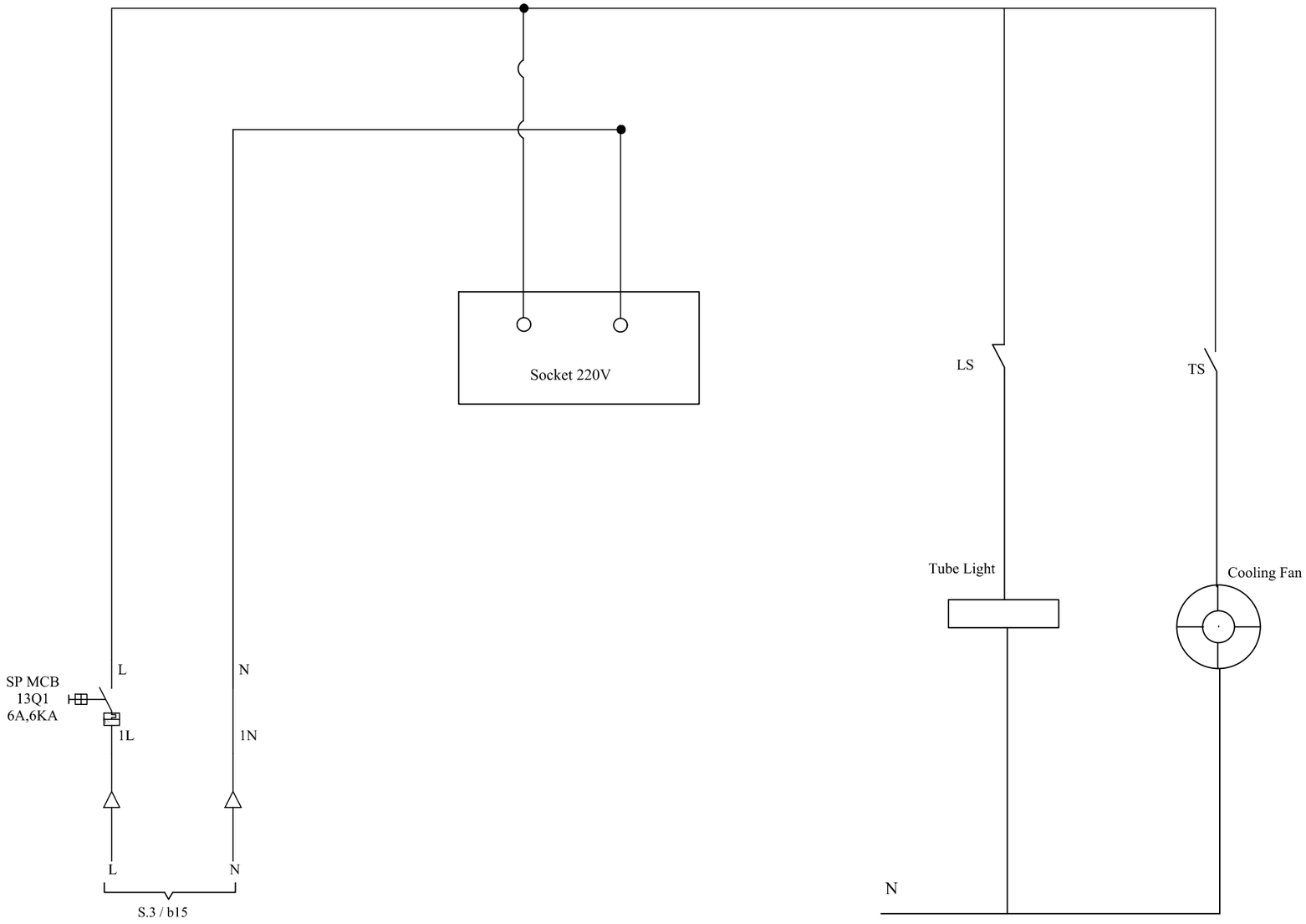
REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
A	Issued for Construction	23-12-2019	MIN	MAB	MSR





3W Systems (Pvt) Ltd. 37,GCP Employees Cooperative Housing Society Near Johar Town Lahore Tel: +92-42-35956267, +92-42-35956268 Fax: +92-42-35956269 E-mail: contact@3wsystems.com.pk Web: www.3wsystems.com.pk	Client **BRT Peshawar**		
	TITLE **Electrical Drawings**		
	PROJECT NO. 18/3WS/ABM/WWTP/04/AMA-397/00	DWG NO. ABM/18/WWTP/397/F/03	REV **A**
	SCALE **NONE**	SHEET **15 OF 16**	

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
A	Issued for Construction	23-12-2019	MIN	MAB	MSR



3W Systems (Pvt) Ltd.
37,GCP Employees Cooperative Housing Society
Near Johar Town Lahore Tel: +92-42-35956267,
+92-42-35956268 Fax: +92-42-35956269
E-mail: contact@3wsystems.com.pk
Web: www.3wsystems.com.pk

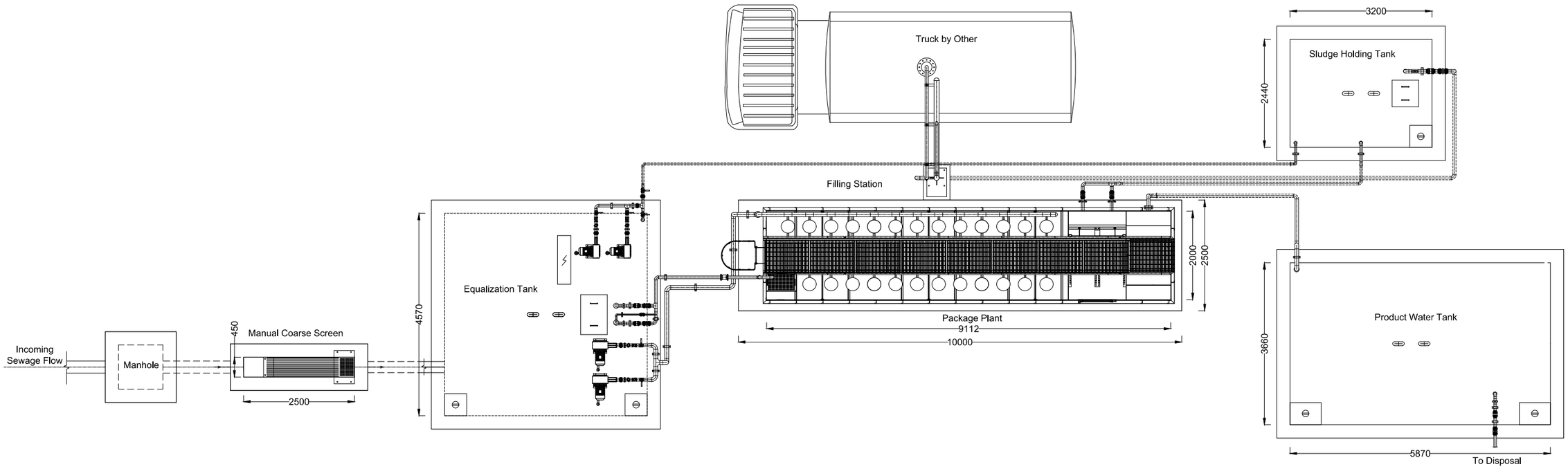
Client
BRT Peshawar

TITLE
Electrical Drawings

PROJECT NO.	DWG NO.	REV
18/3WS/ABM/WWTP/04/AMA-397/00	ABM/18/WWTP/397/F/03	A

SCALE	NONE	SHEET	16 OF 16

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
B	AS Built Drawing.	17-03-2020	MAM	MAB	MSR



Layout Plan

3W Systems (Pvt) Ltd.
37,GCP Employees Cooperative Housing Society
Near Johar Town Lahore Tel: +92-42-35956267,
+92-42-35956268 Fax: +92-42-35956269
E-mail: contact@3wsystems.com.pk
Web: www.3wsystems.com.pk

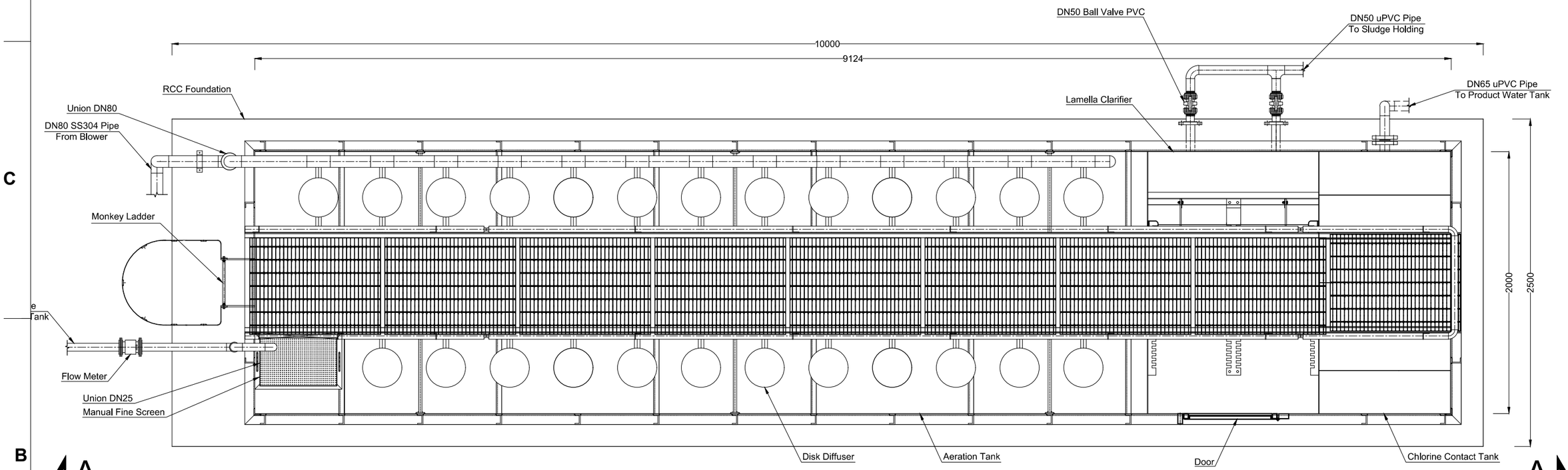
Client: **BRT Peshawar**

TITLE: 150 m³/day Sewage Treatment Plant (Layout Plan)

PROJECT NO.	DWG NO.	REV
19/3WS/BRTP/STP/04/AMA-482/00	BRTP/19/STP/482/L/02	B

SCALE	NONE	SHEET	1 OF 1

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
B	AS Built Drawing.	17-03-2020	MI	MAB	MSR



Plan

3W Systems (Pvt) Ltd.

37,GCP Employees Cooperative Housing Society
Near Johar Town Lahore Tel: +92-42-35956267,
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Web: www.3wsystems.com.pk

Client

BRT Peshawar

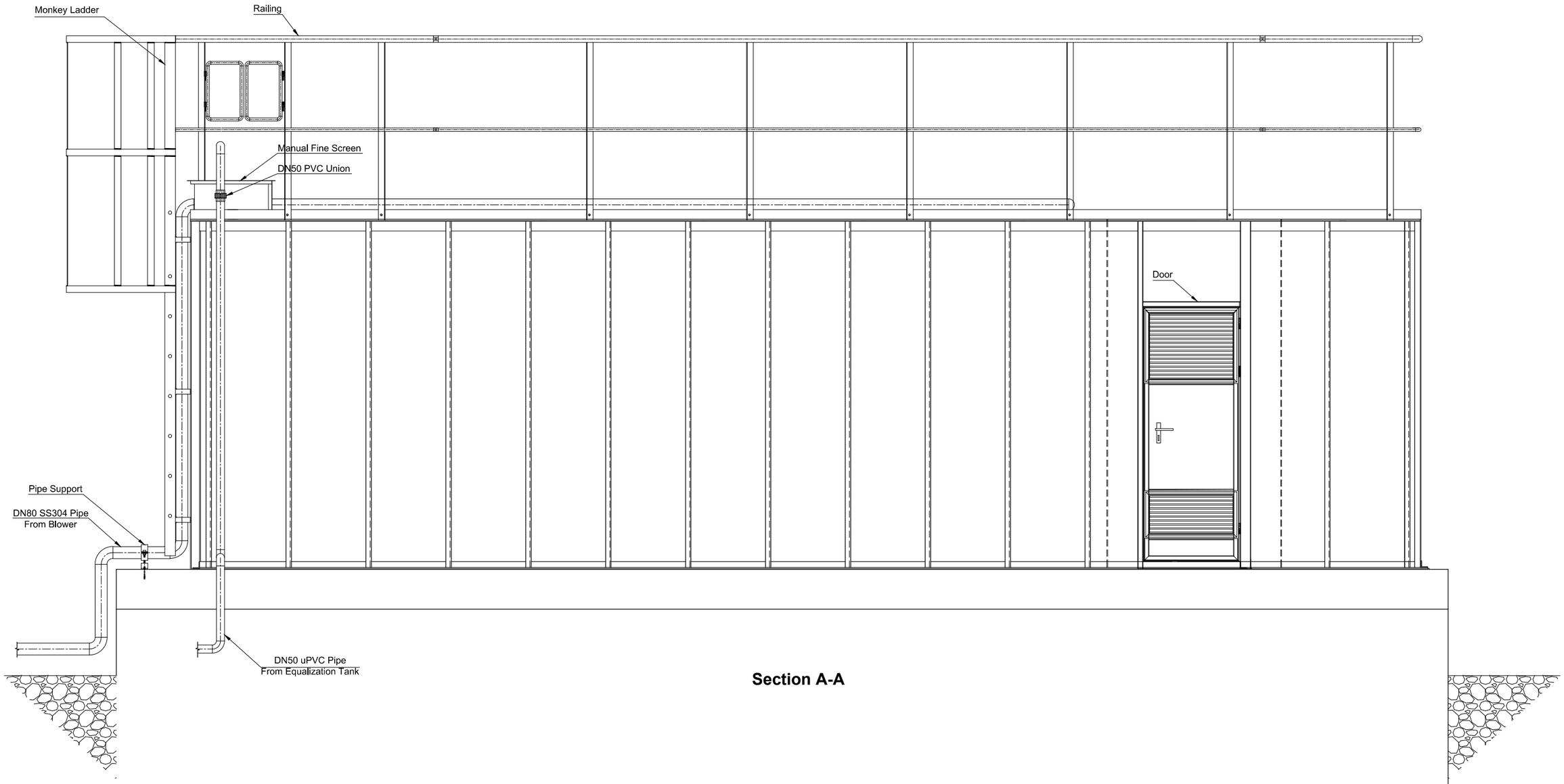
TITLE

150 m³/day Sewage Treatment Plant
Domestic Package Plant (Plan)

PROJECT NO.	DWG NO.	REV
19/3WS/BRTP/STP/04/AMA-482/00	BRTP/19/STP/482/L/05	B

SCALE	NONE	SHEET	1 OF 2

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
B	AS Built Drawing.	17-03-2020	MI	MAB	MSR



Section A-A

3W Systems (Pvt) Ltd.
37,GCP Employees Cooperative Housing Society
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+92-42-35956268 Fax: +92-42-35956269
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Web: www.3wsystems.com.pk

Client

BRT Peshawar

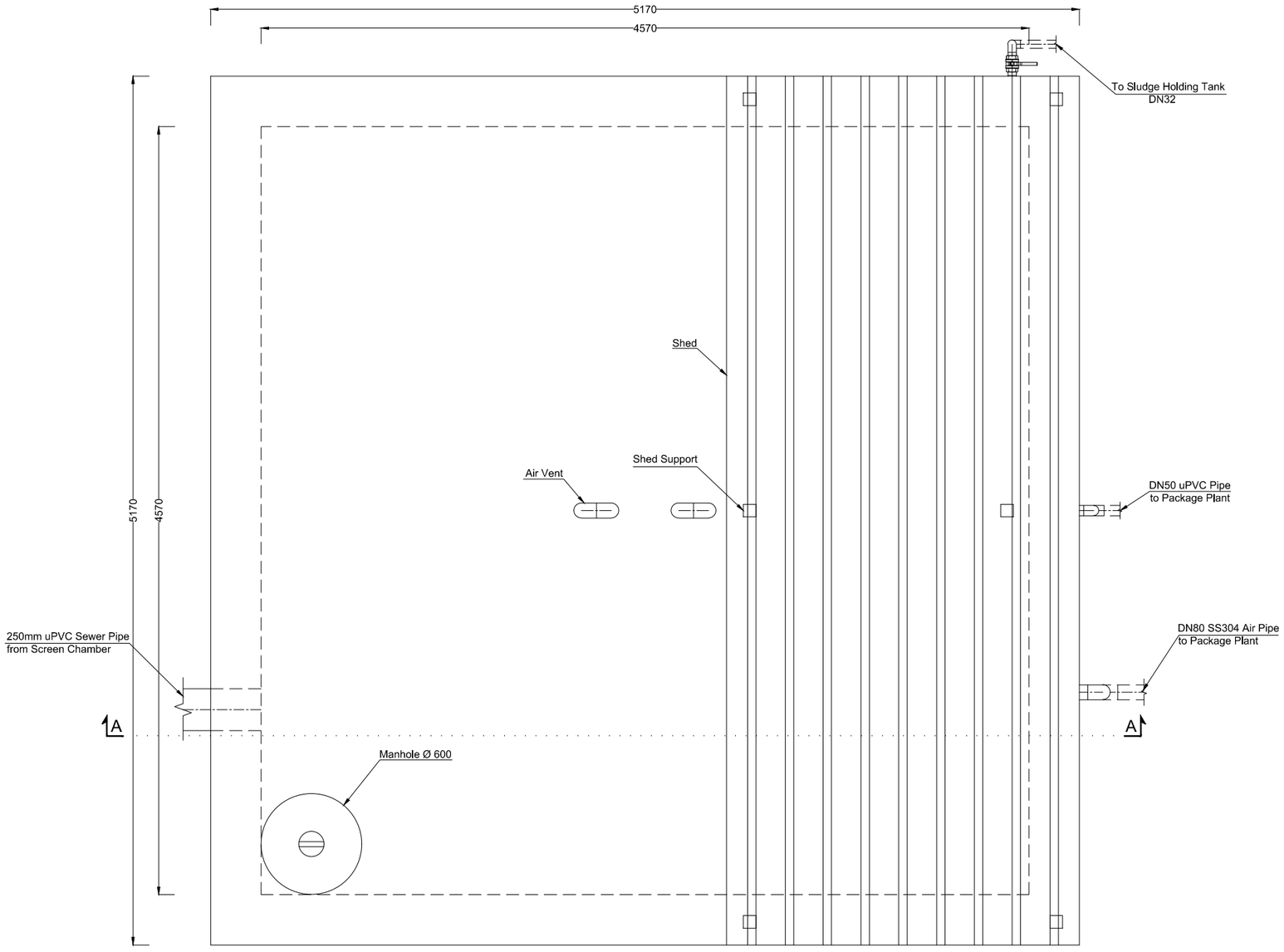
TITLE

150 m³/day Sewage Treatment Plant
Domestic Package Plant (Section A-A)

PROJECT NO.	DWG NO.	REV
19/3WS/BRTP/STP/04/AMA-482/00	BRTP/19/STP/482/L/05	B

SCALE	NONE	SHEET	2 OF 2

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
B	AS Built Drawing	17-03-2020	MAM	MAB	MSR



Plan

3W Systems (Pvt) Ltd.

37,GCP Employees Cooperative Housing Society
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Web: www.3wsystems.com.pk

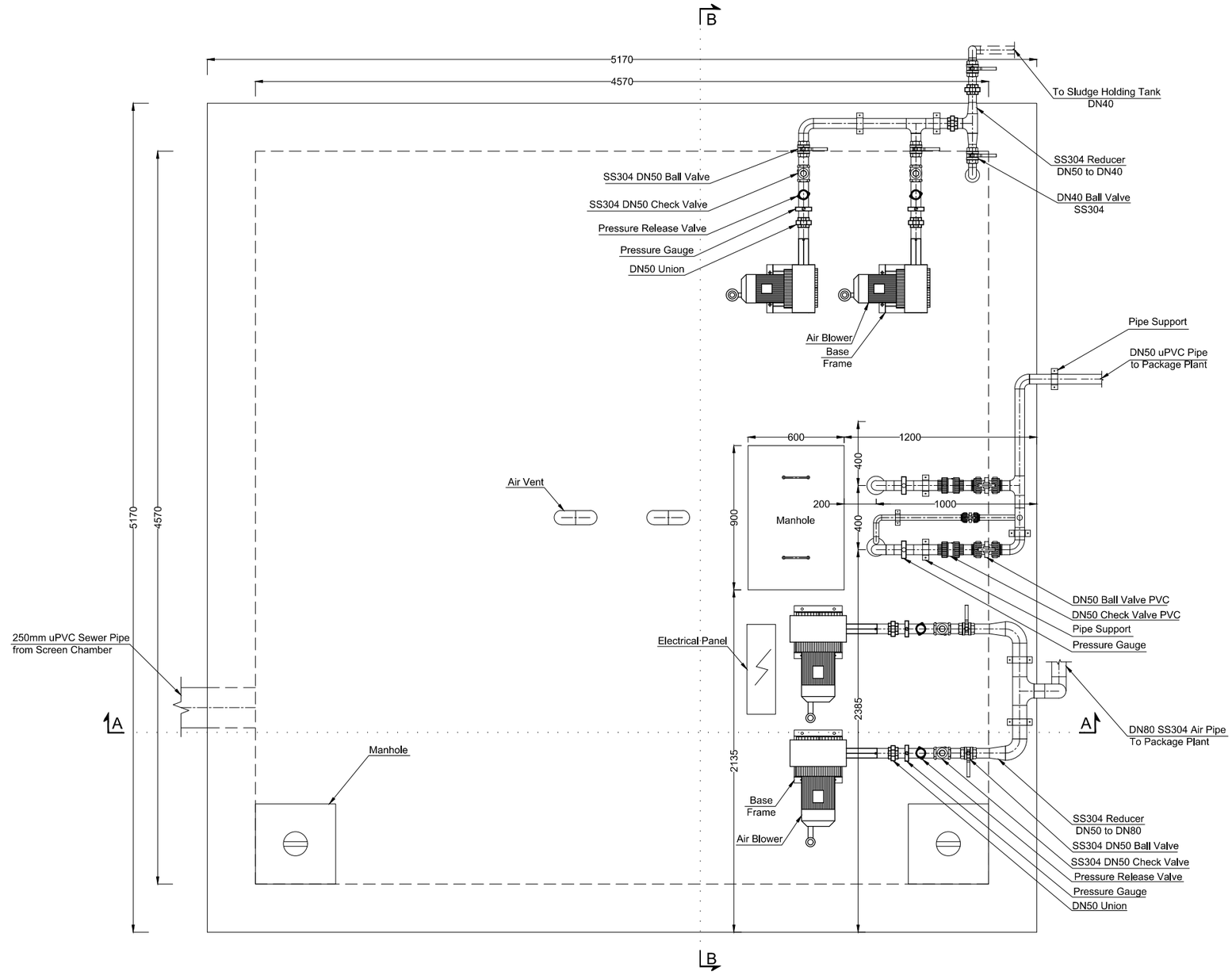
Client **BRT Peshawar**

TITLE
150 m³/day Sewage Treatment Plant
Equalization Tank (Plan)

PROJECT NO.	DWG NO.	REV
19/3WS/BRTP/STP/04/AMA-482/00	BRTP/19/STP/482/L/04	B

SCALE	NONE	SHEET	1 OF 6

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
B	AS Built Drawing	17-03-2020	MAM	MAB	MSR



Plan I-I

3W Systems (Pvt) Ltd.

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Web: www.3wsystems.com.pk

Client

BRT Peshawar

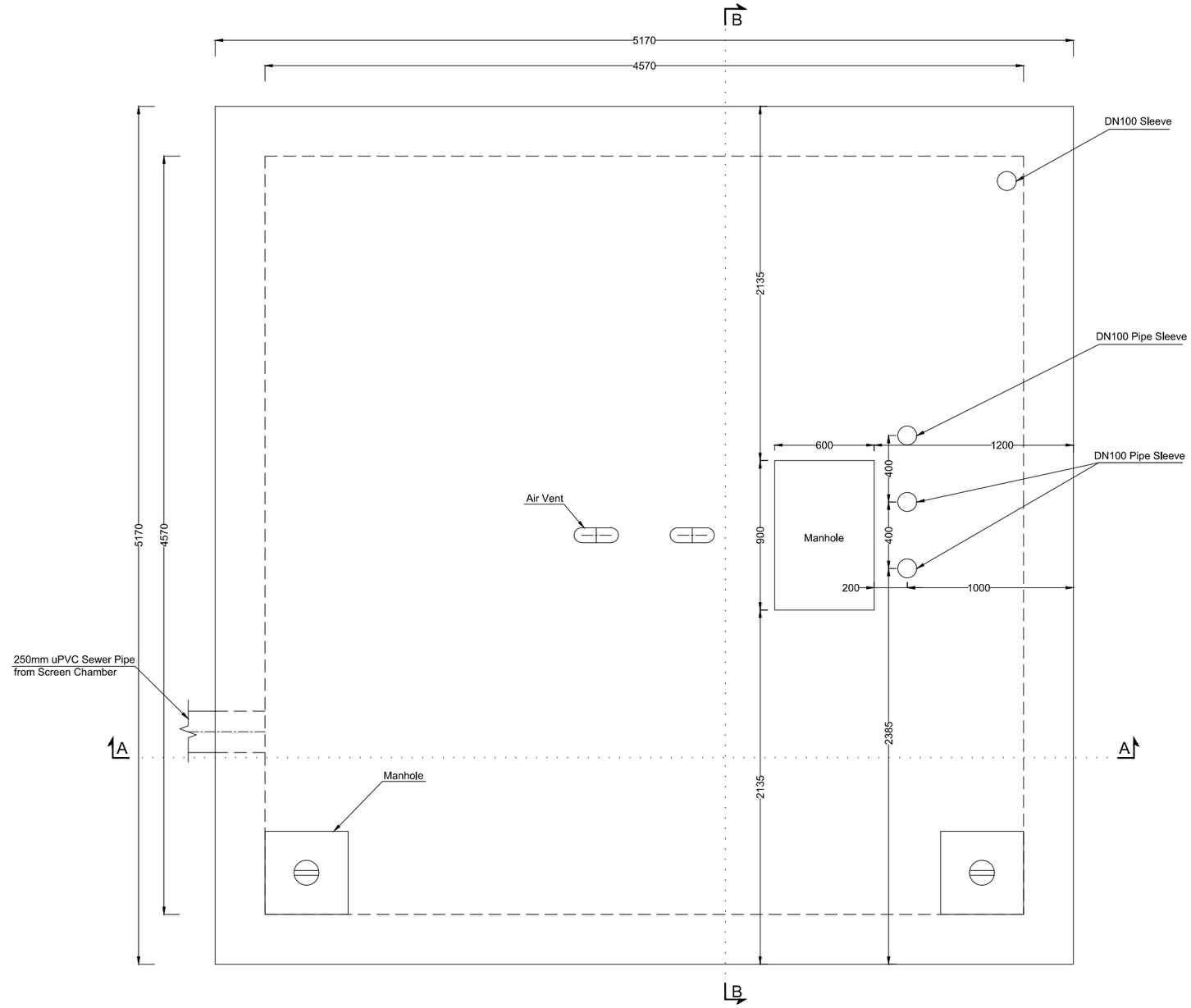
TITLE

150 m³/day Sewage Treatment Plant
Equalization Tank (Plan I-I)

PROJECT NO.	DWG NO.	REV
19/3WS/BRTP/STP/04/AMA-482/00	BRTP/19/STP/482/L/04	B

SCALE	NONE	SHEET	2 OF 6

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
B	AS Built Drawing	17-03-2020	MAM	MAB	MSR



Civil Plan

3W Systems (Pvt) Ltd.

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Near Johar Town Lahore Tel: +92-42-35956267,
+92-42-35956268 Fax: +92-42-35956269
E-mail: contact@3wsystems.com.pk
Web: www.3wsystems.com.pk

Client

BRT Peshawar

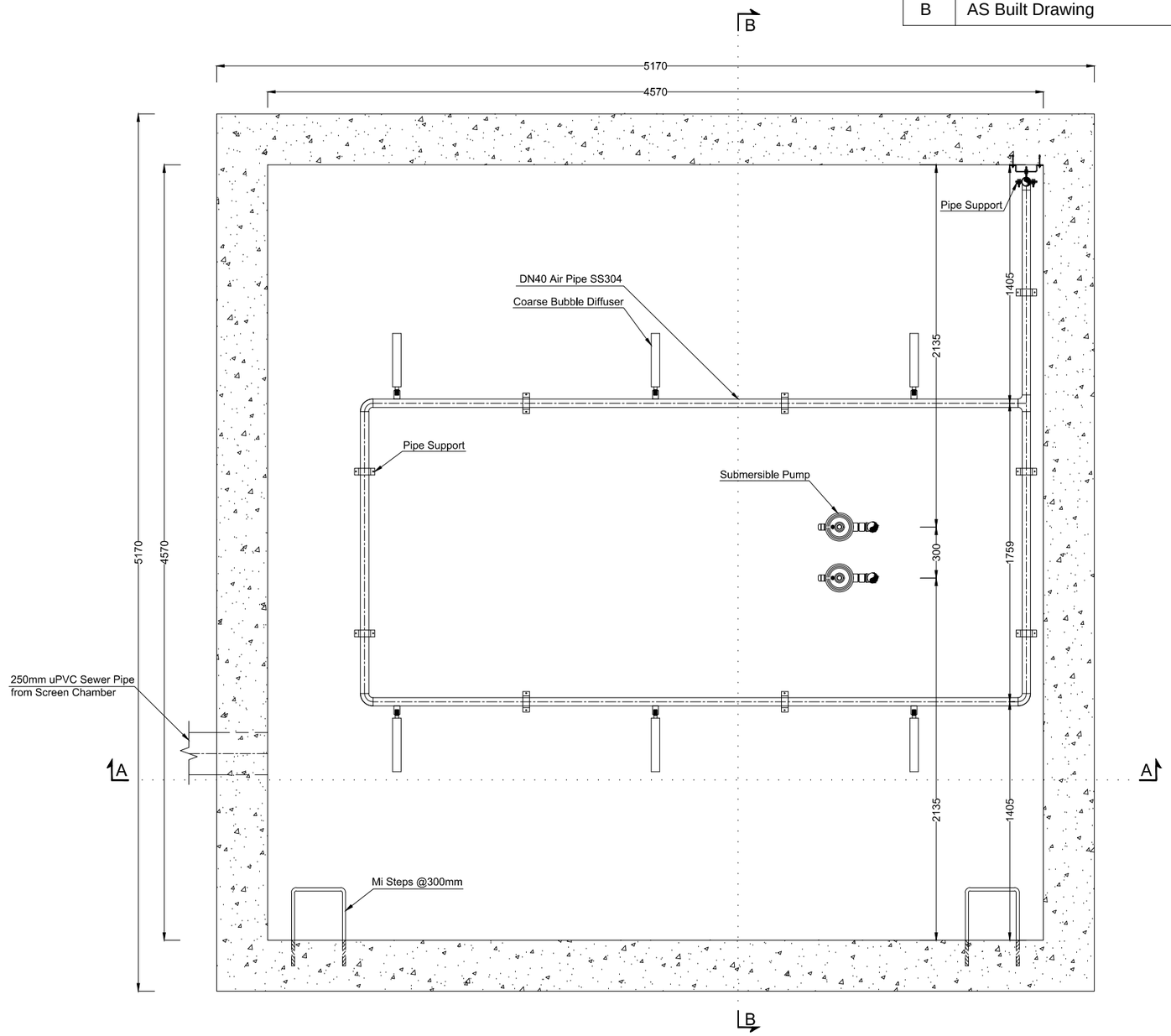
TITLE

150 m³/day Sewage Treatment Plant
Equalization Tank (Civil Plan)

PROJECT NO.	DWG NO.	REV
19/3WS/BRTP/STP/04/AMA-482/00	BRTP/19/STP/482/L/04	B

SCALE	NONE	SHEET	3 OF 6

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
B	AS Built Drawing	17-03-2020	MAM	MAB	MSR



Plan X-X

3W Systems (Pvt) Ltd.

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+92-42-35956268 Fax: +92-42-35956269
E-mail: contact@3wsystems.com.pk
Web: www.3wsystems.com.pk

Client

BRT Peshawar

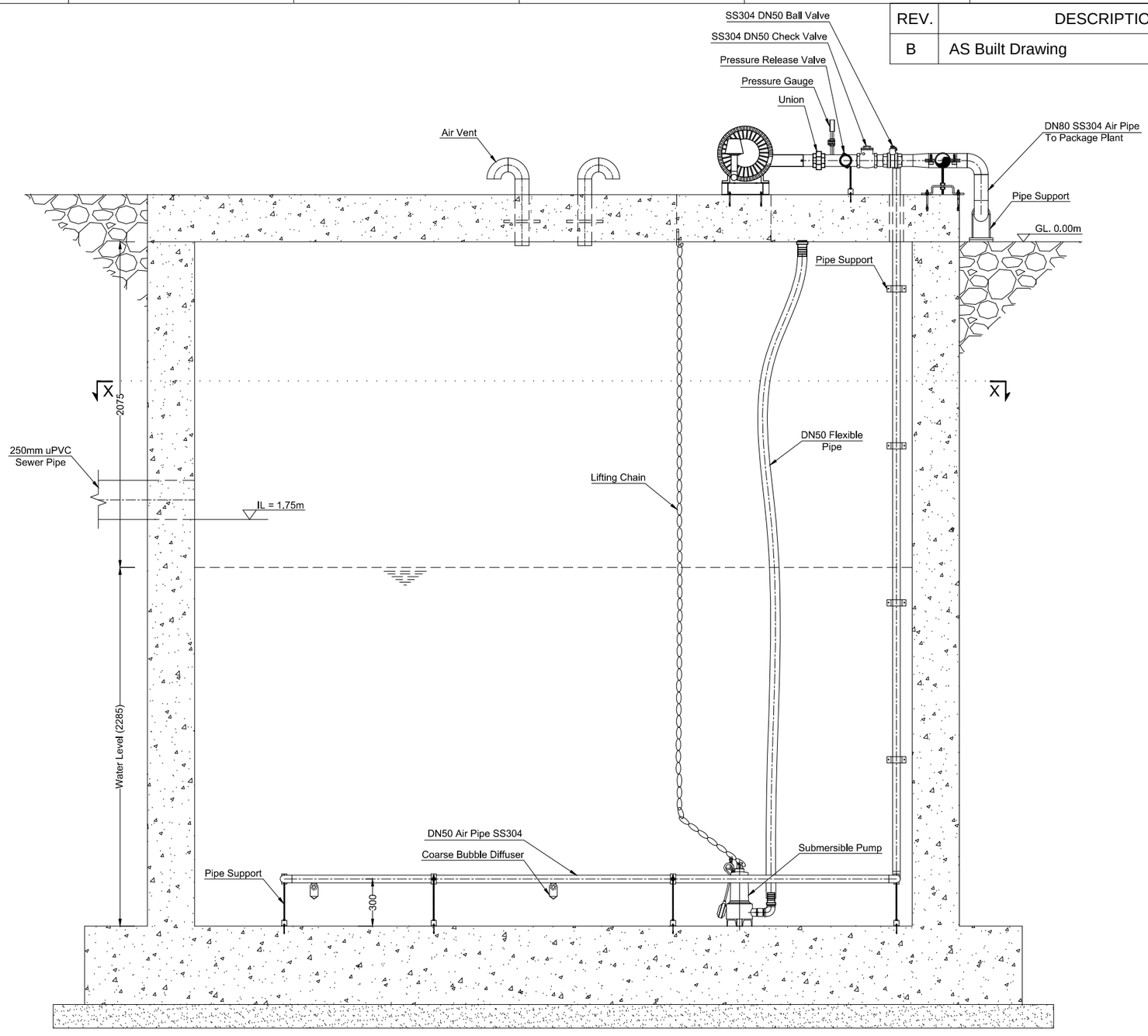
TITLE

150 m³/day Sewage Treatment Plant
Equalization Tank (Plan X-X)

PROJECT NO.	DWG NO.	REV
19/3WS/BRTP/STP/04/AMA-482/00	BRTP/19/STP/482/L/04	B

SCALE	NONE	SHEET	4 OF 6

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
B	AS Built Drawing	17-03-2020	MAM	MAB	MSR



Section A-A

3W Systems (Pvt) Ltd.

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E-mail: contact@3wsystems.com.pk
Web: www.3wsystems.com.pk

Client

BRT Peshawar

TITLE

150 m³/day Sewage Treatment Plant
Equalization Tank (Section A-A)

PROJECT NO.	DWG NO.	REV
19/3WS/BRTP/STP/04/AMA-482/00	BRTP/19/STP/482/L/04	B

SCALE	NONE	SHEET	5 OF 6

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
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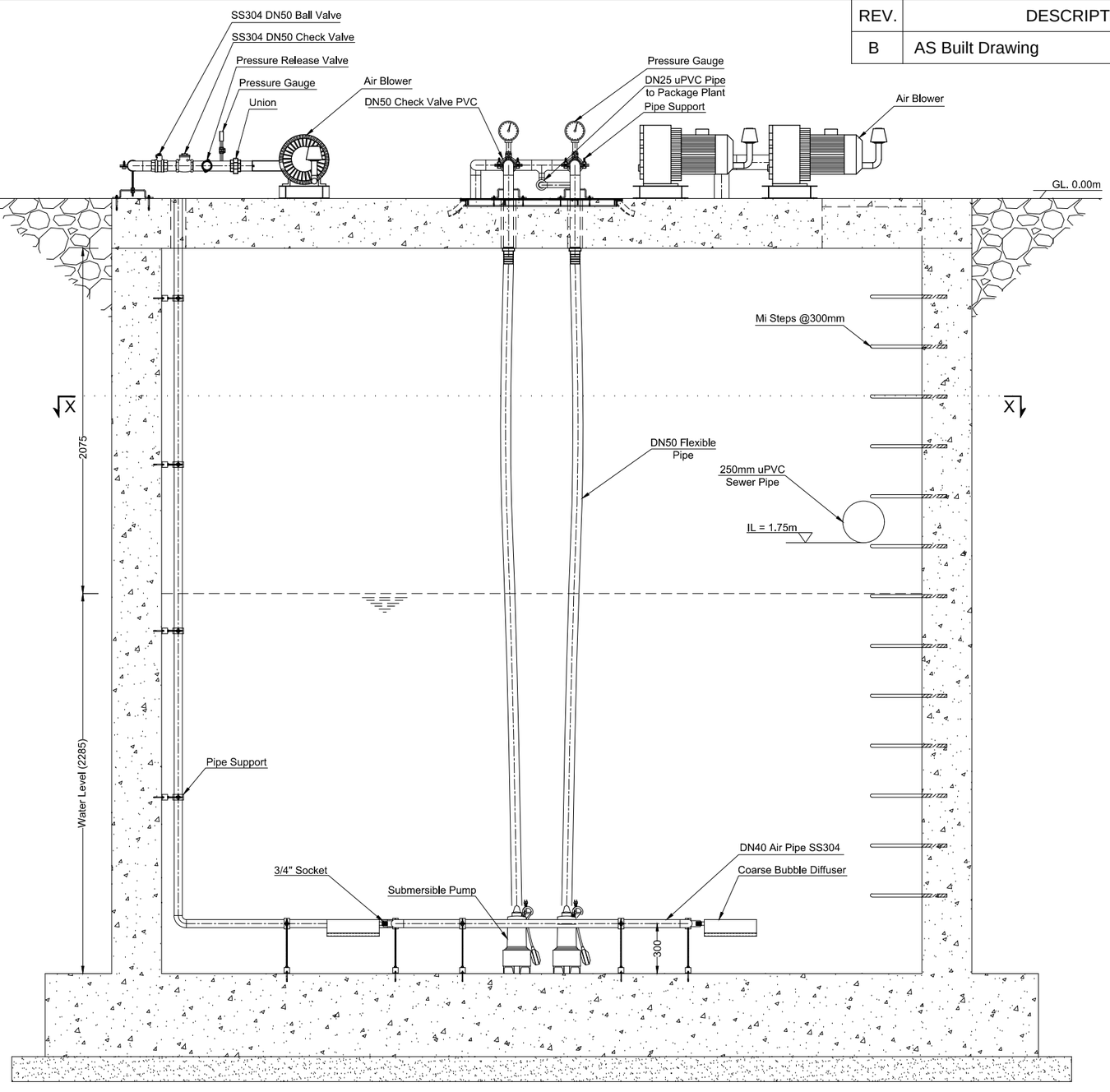

Section B-B

3W Systems (Pvt) Ltd.

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+92-42-35956268 Fax: +92-42-35956269
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Web: www.3wsystems.com.pk

Client

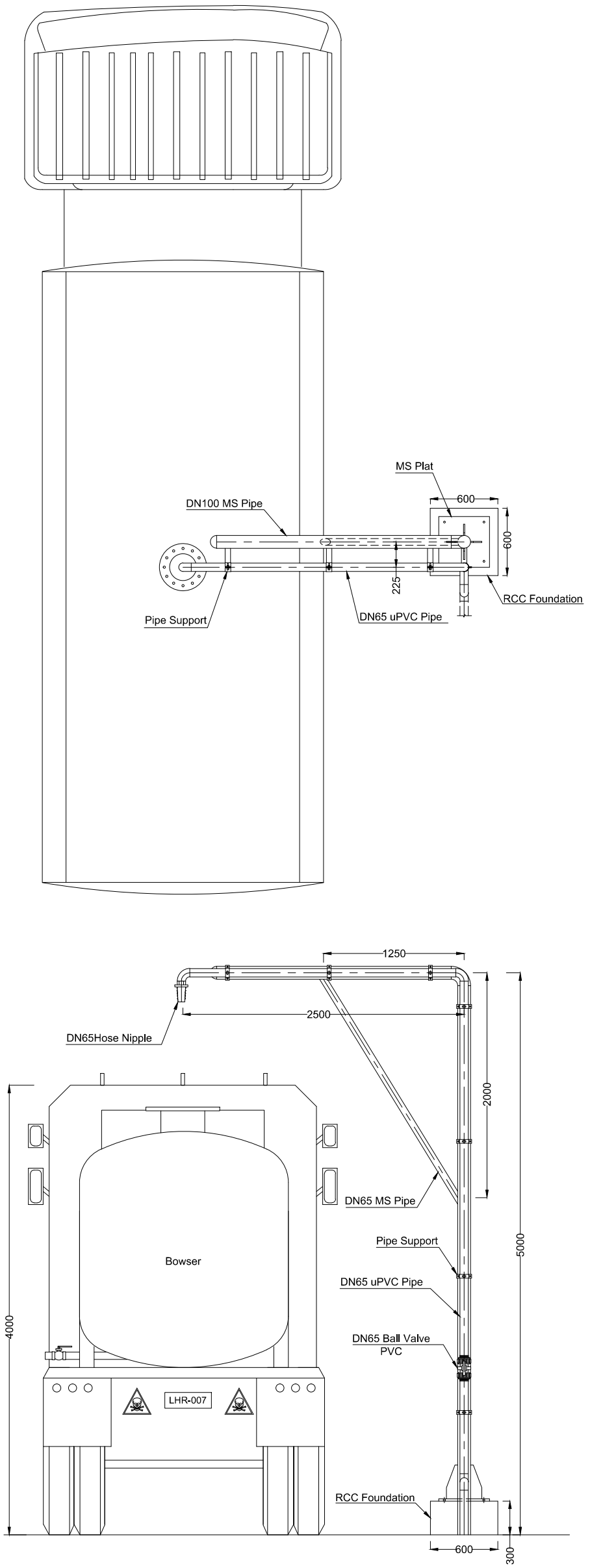
BRT Peshawar

TITLE

150 m³/day Sewage Treatment Plant
Equalization Tank (Section B-B)

PROJECT NO.	DWG NO.	REV
19/3WS/BRTP/STP/04/AMA-482/00	BRTP/19/STP/482/L/04	B

SCALE	NONE	SHEET	6 OF 6



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A	AS Built Drawing.	17-03-2020	MAM	MAB	MSR

3W Systems (Pvt) Ltd.
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Web: www.3wsystems.com.pk

Client
BRT Peshawar

TITLE
150 m³/day Sewage Treatment Plant
Filling Station

PROJECT NO.	DWG NO.	REV
19/3WS/BRTP/STP/04/AMA-482/00	BRTP/19/STP/482/L/08	B

SCALE	NONE	SHEET	1 OF 1

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
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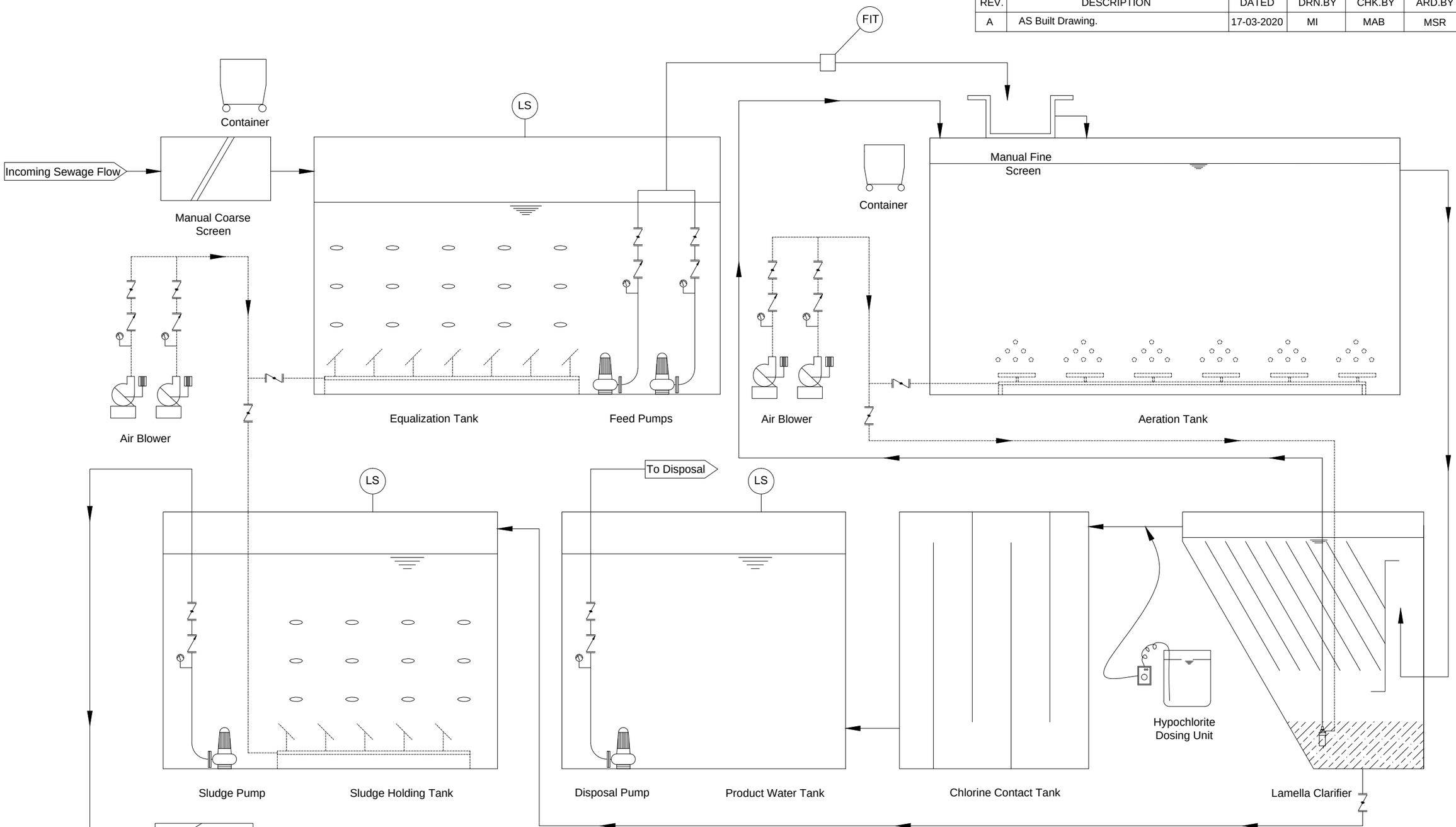

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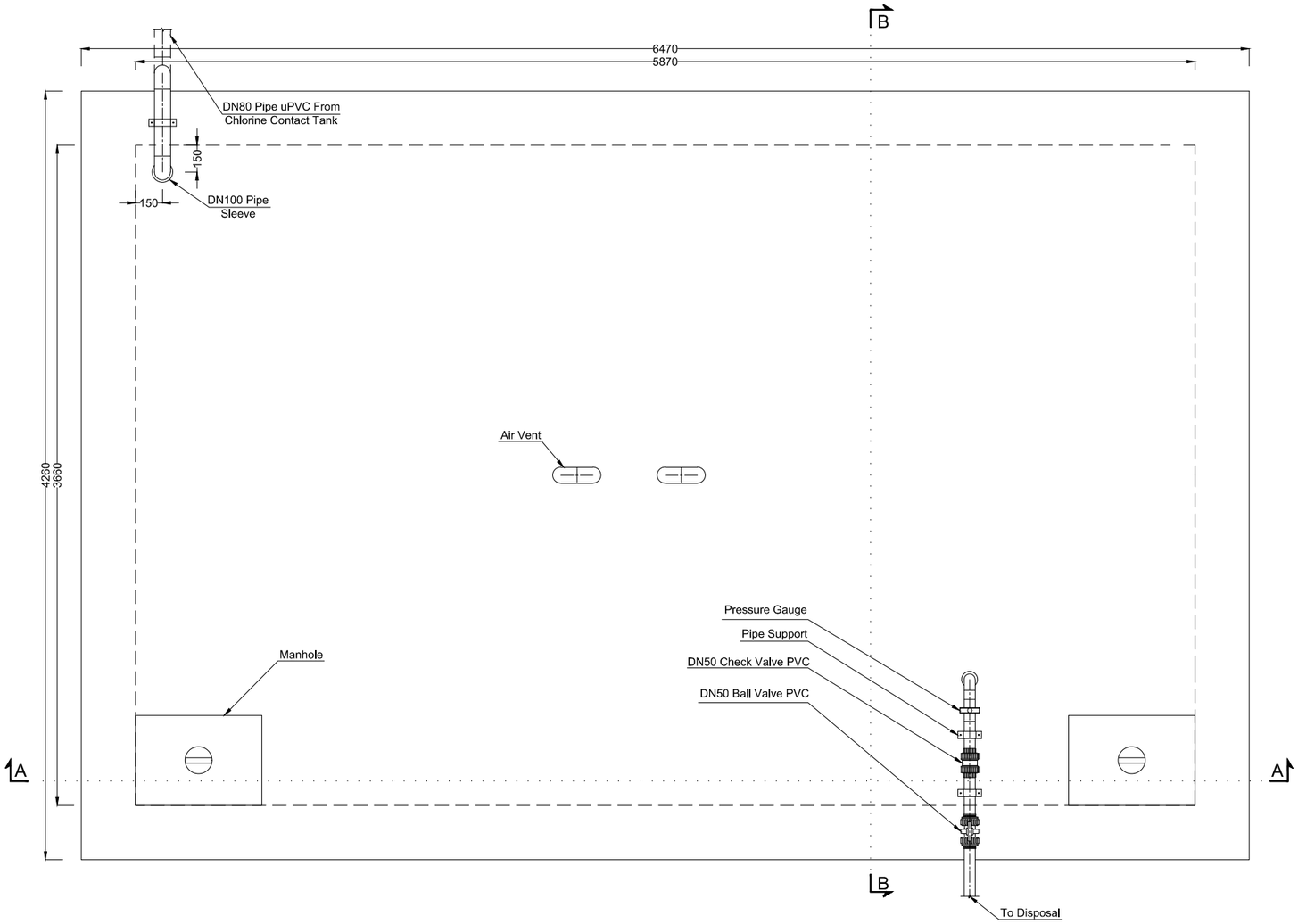
Client: **BRT Peshawar**

TITLE: 150 m³/day Sewage Treatment Plant
Process Flow Diagram (PFD)

PROJECT NO.	DWG NO.	REV
19/3WS/BRTP/STP/04/AMA-482/00	BRTP/19/STP/482/PFD/01	A

SCALE	NONE	SHEET	1 OF 1

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
B	AS Built Drawing.	17-03-2020	MAM	MAB	MSR



Plan

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Client **BRT Peshawar**

TITLE
150 m³/day Sewage Treatment Plant
Product Water Tank (Plan)

PROJECT NO.	DWG NO.	REV
19/3WS/BRTP/STP/04/AMA-482/00	BRTP/19/STP/482/L/06	B

SCALE	NONE	SHEET	1 OF 5

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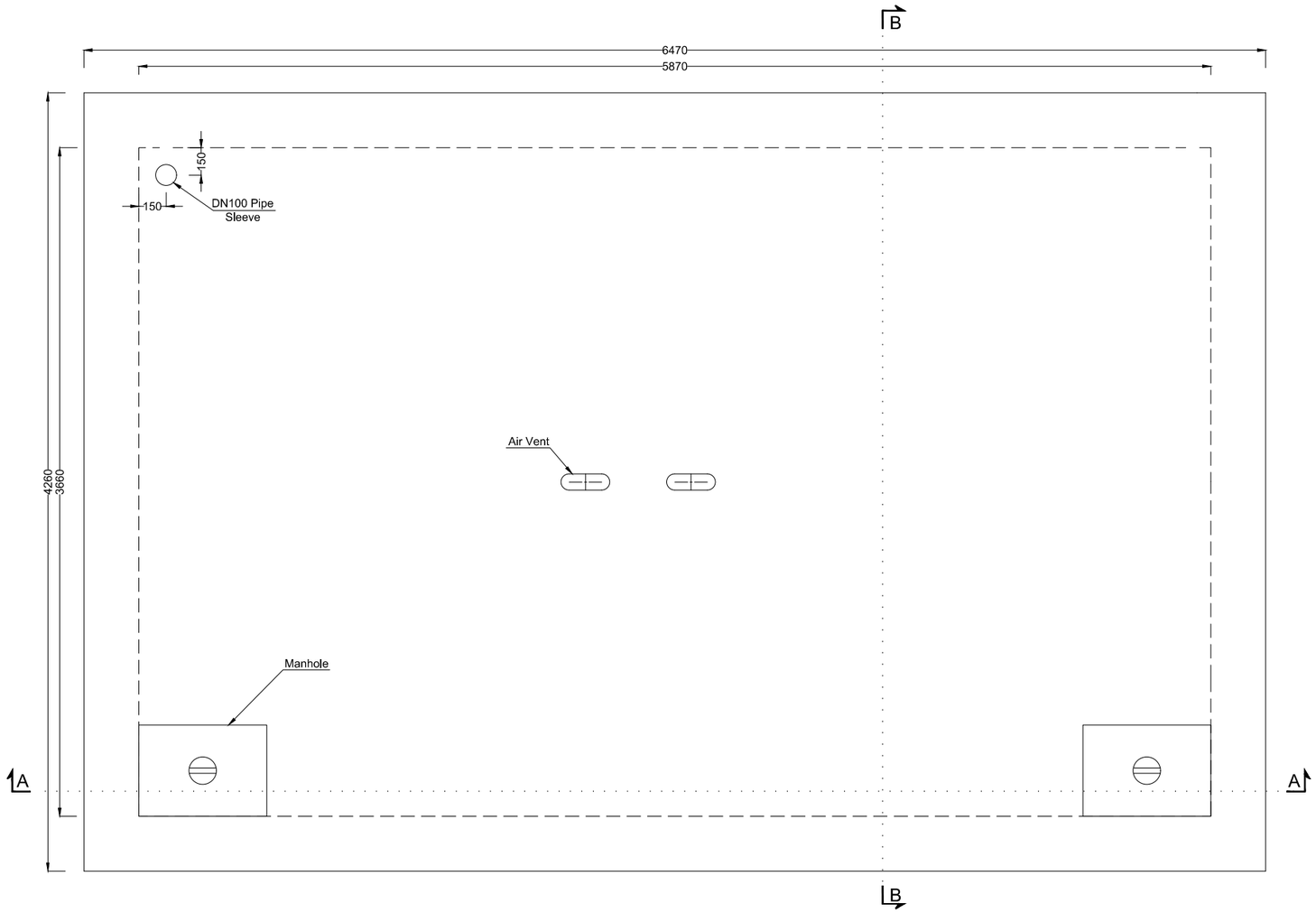

Civil Plan

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Client
BRT Peshawar

TITLE
150 m³/day Sewage Treatment Plant
Product Water Tank (Civil Plan)

PROJECT NO.	DWG NO.	REV
19/3WS/BRTP/STP/04/AMA-482/00	BRTP/19/STP/482/L/06	B

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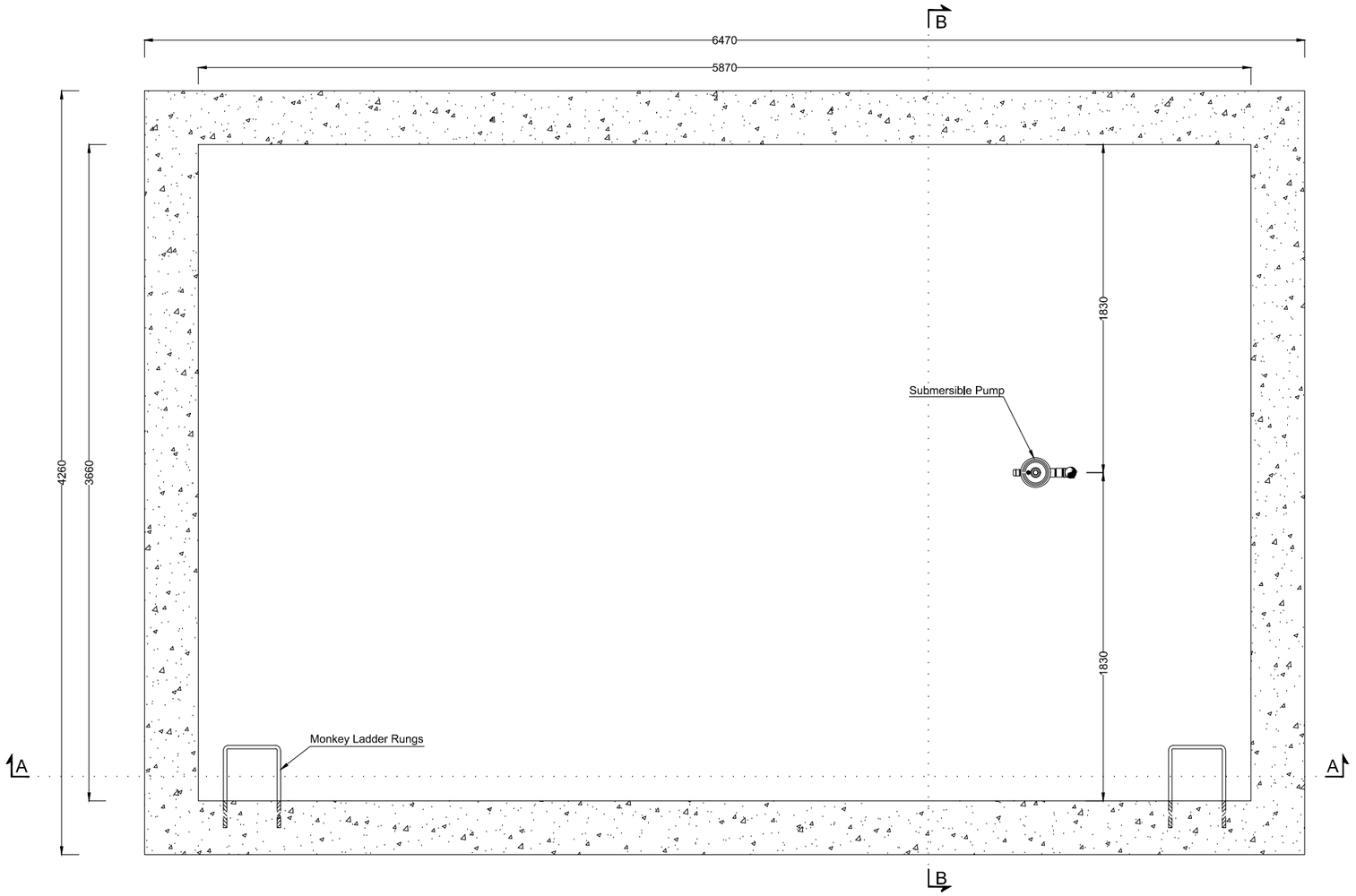

Plan I-I

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Client

BRT Peshawar

TITLE

150 m³/day Sewage Treatment Plant
Product Water Tank (Plan I-I)

PROJECT NO.	DWG NO.	REV
19/3WS/BRTP/STP/04/AMA-482/00	BRTP/19/STP/482/L/06	B

SCALE	NONE	SHEET	3 OF 5

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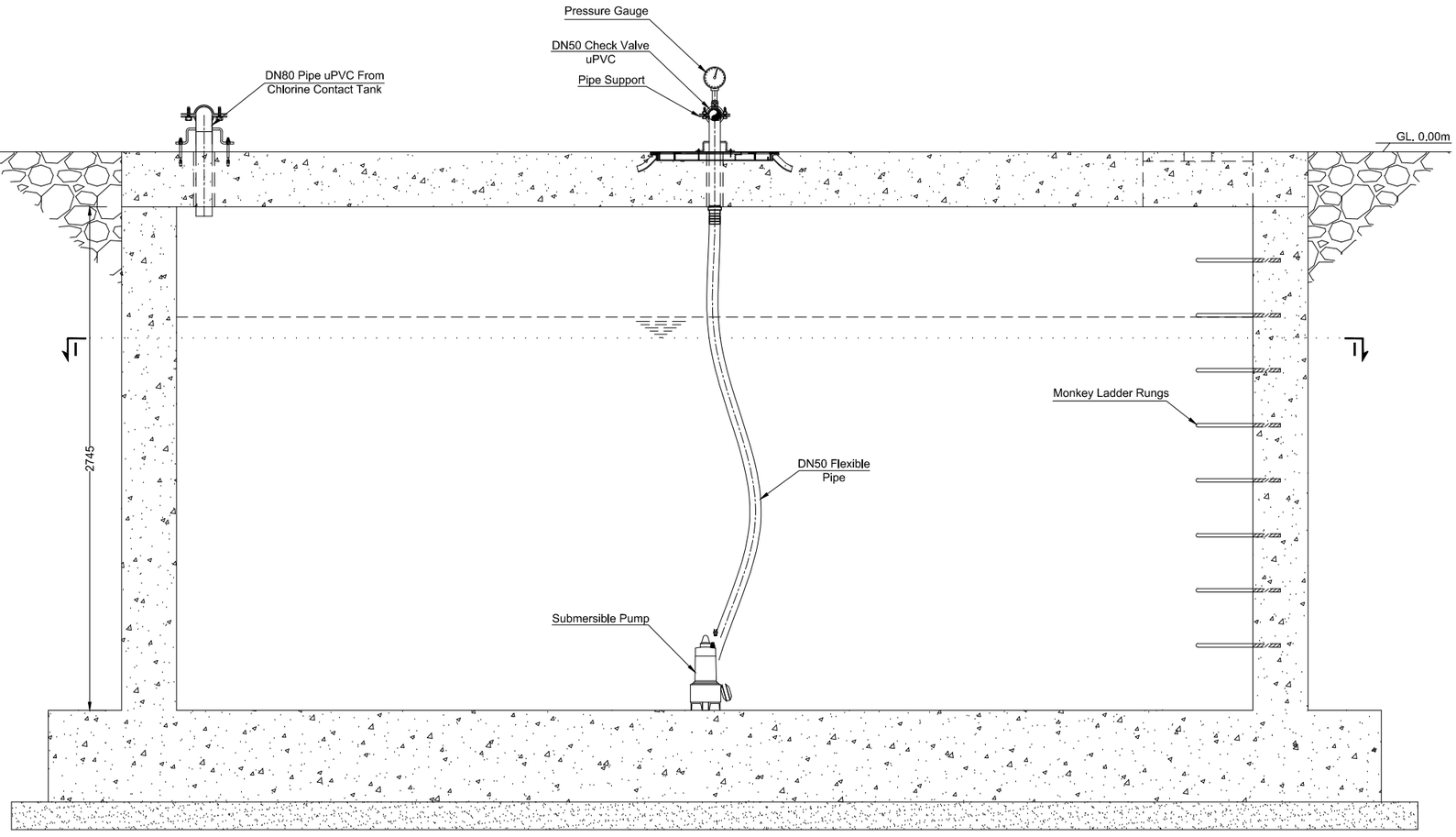
B	AS Built Drawing.	17-03-2020	MAM	MAB	MSR



Section A-A

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Client

BRT Peshawar

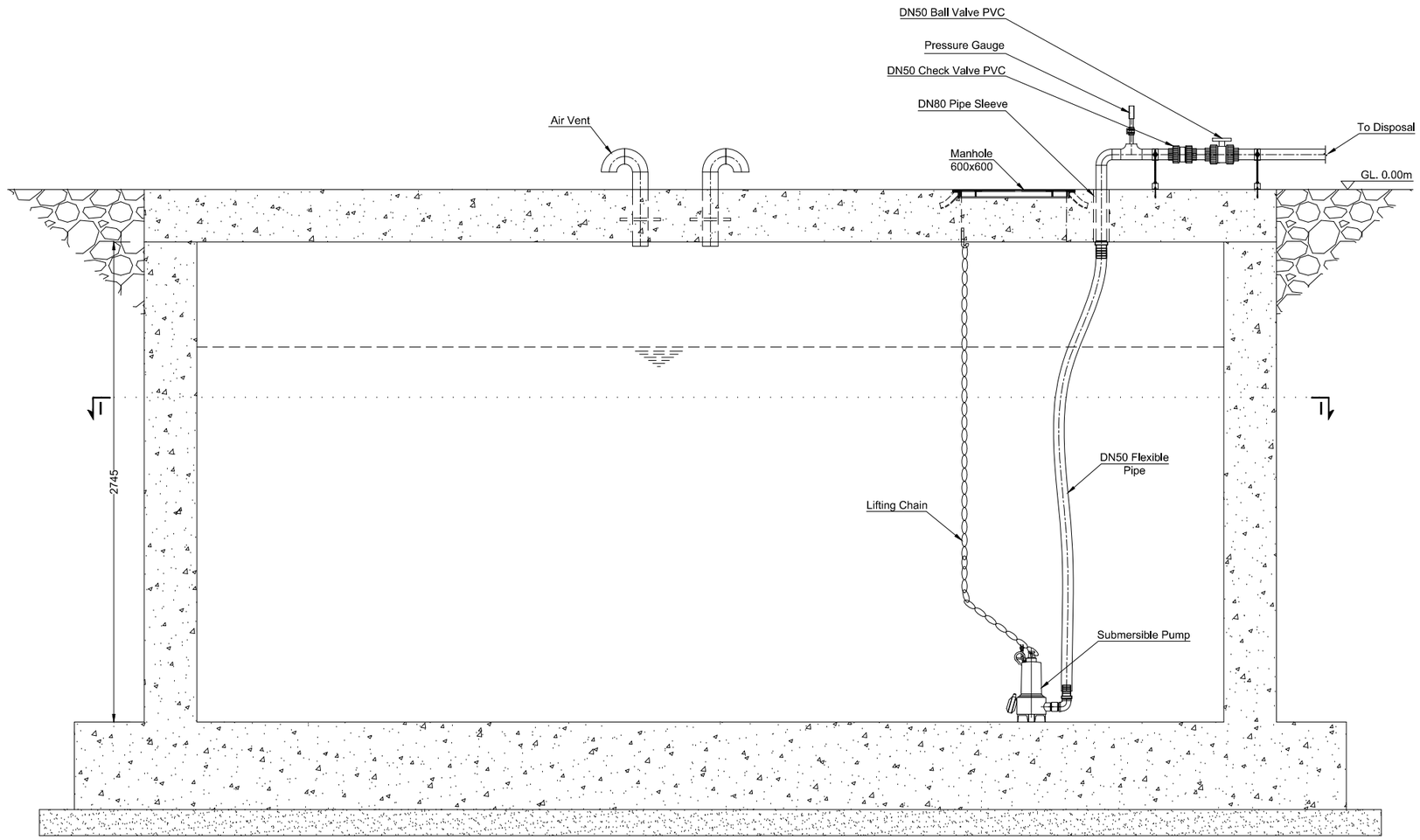
TITLE

150 m³/day Sewage Treatment Plant
Product Water Tank (Section A-A)

PROJECT NO.	DWG NO.	REV
19/3WS/BRTP/STP/04/AMA-482/00	BRTP/19/STP/482/L/06	B

SCALE	NONE	SHEET	4 OF 5

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
B	AS Built Drawing.	17-03-2020	MAM	MAB	MSR



Section B-B

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Client

BRT Peshawar

TITLE

150 m³/day Sewage Treatment Plant
Product Water Tank (Section A-A)

PROJECT NO.	DWG NO.	REV
19/3WS/BRTP/STP/04/AMA-482/00	BRTP/19/STP/482/L/06	B

SCALE	NONE	SHEET	5 OF 5

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
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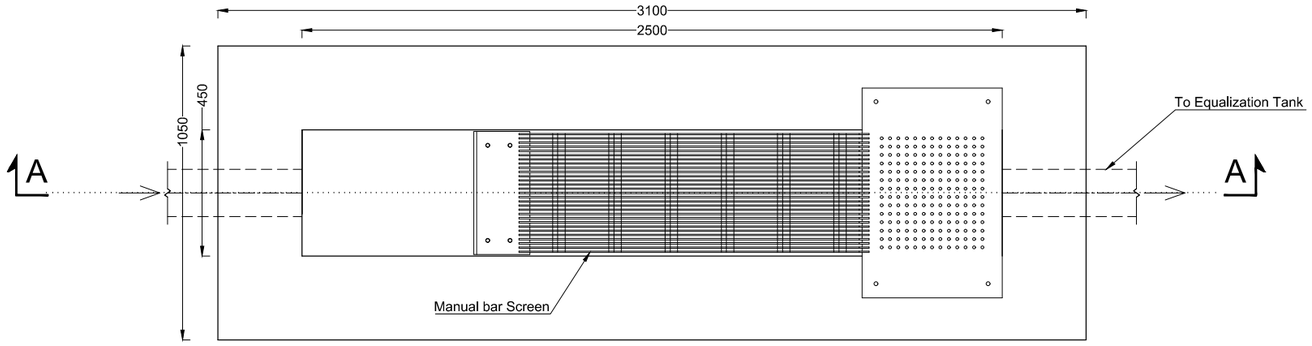
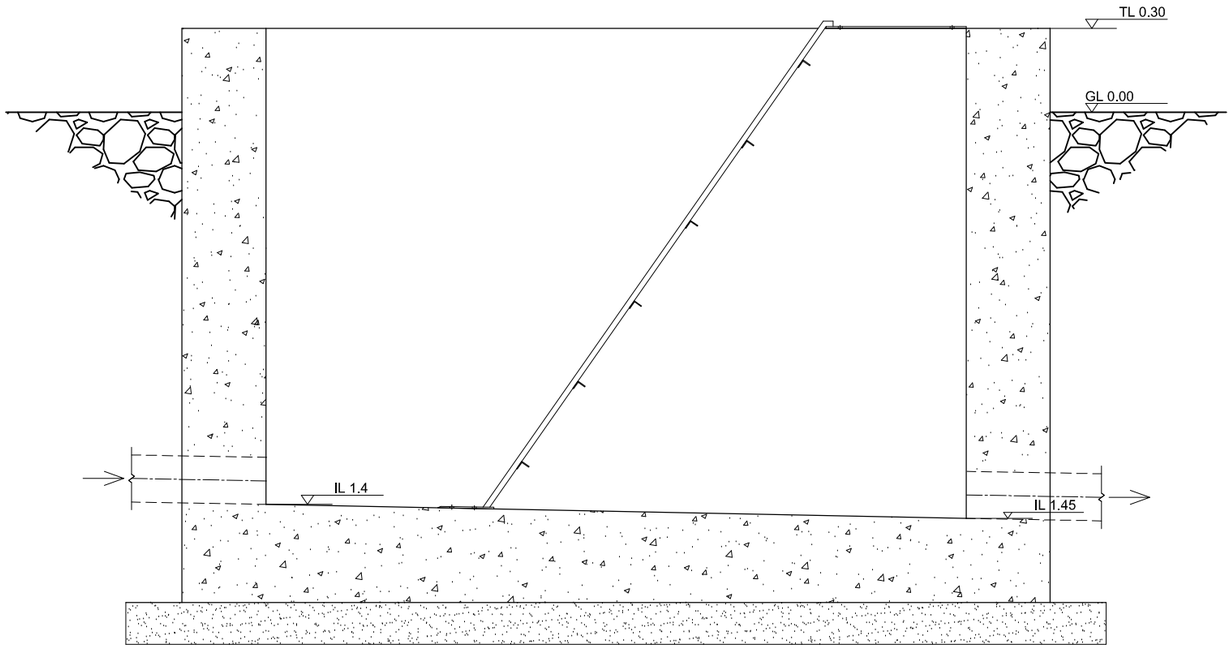


Plan



Section A-A

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Client

BRT Peshawar

TITLE

150 m³/day Sewage Treatment Plant
Screen Chamber (Plan , Section A-A)

PROJECT NO.	DWG NO.	REV
19/3WS/BRTP/STP/04/AMA-482/00	BRTP/19/STP/482/M/03	B

SCALE	NONE	SHEET	1 OF 1

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
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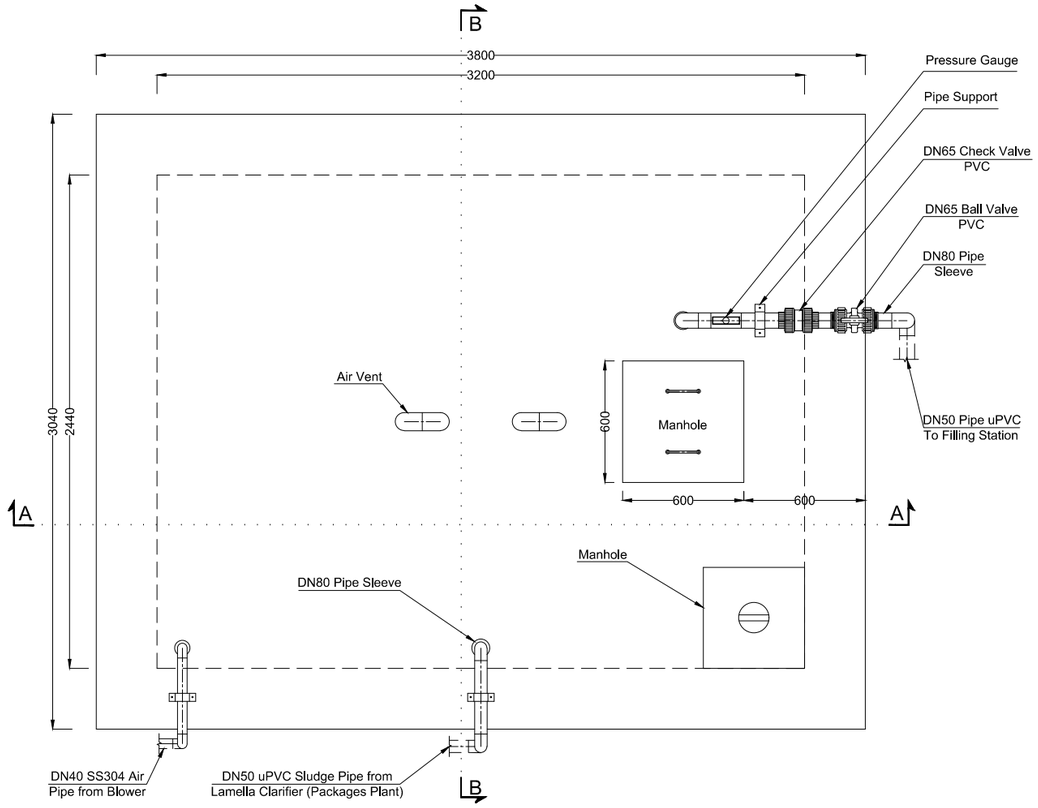
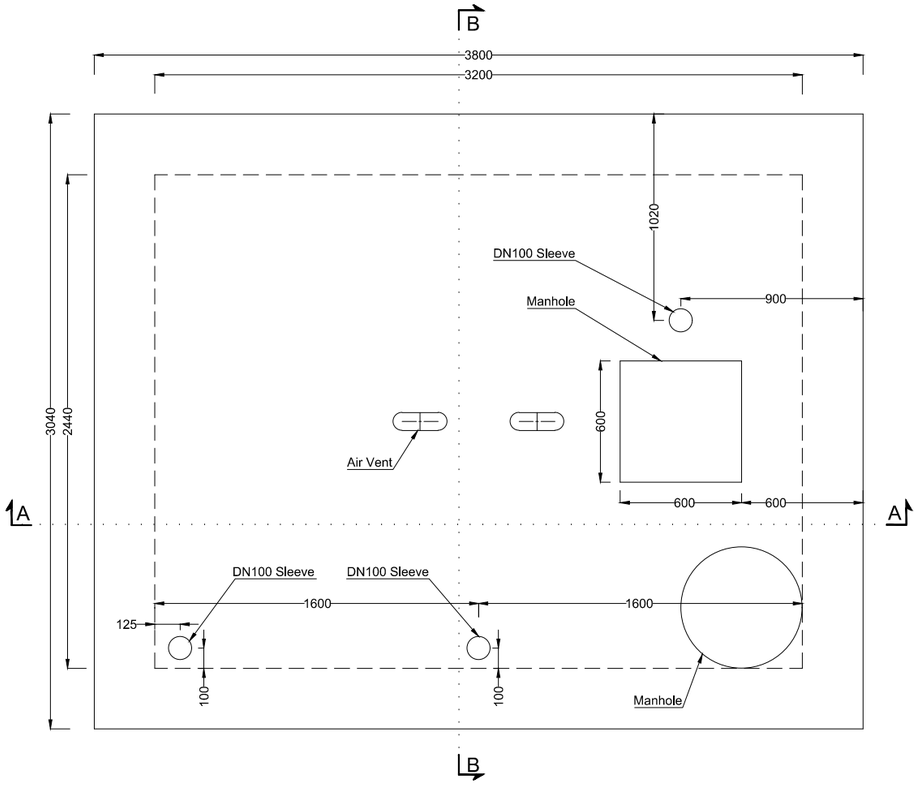


Plan



Civil Plan

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Client **BRT Peshawar**

TITLE
150 m³/day Sewage Treatment Plant
Sludge Holding Tank (Plan & Civil Plan)

PROJECT NO.	DWG NO.	REV
19/3WS/BRTP/STP/04/AMA-482/00	BRTP/19/STP/482/L/07	B

SCALE	NONE	SHEET	1 OF 2

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
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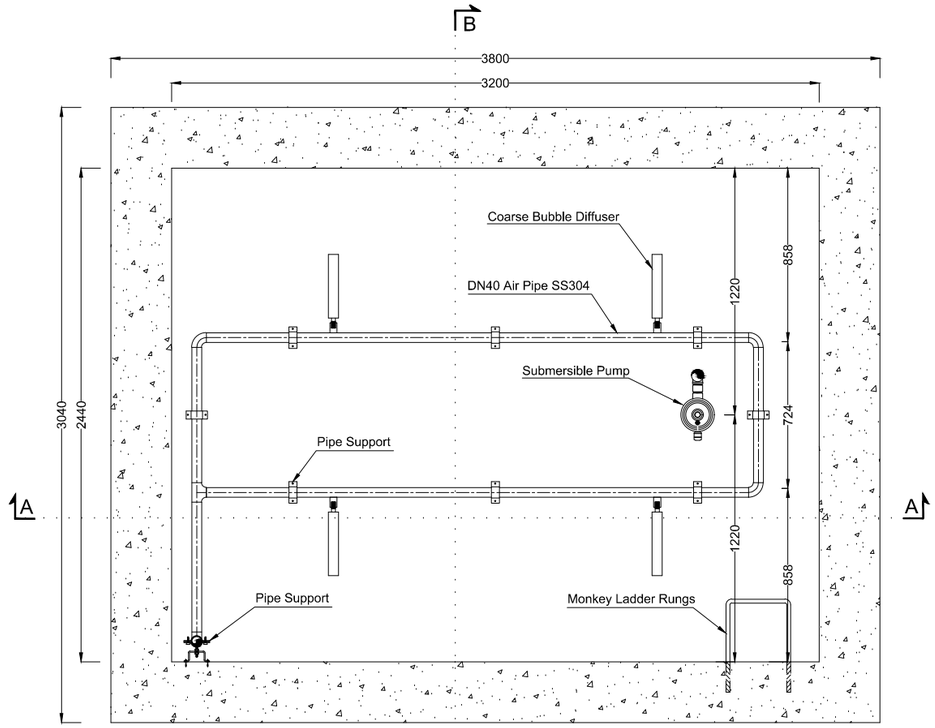
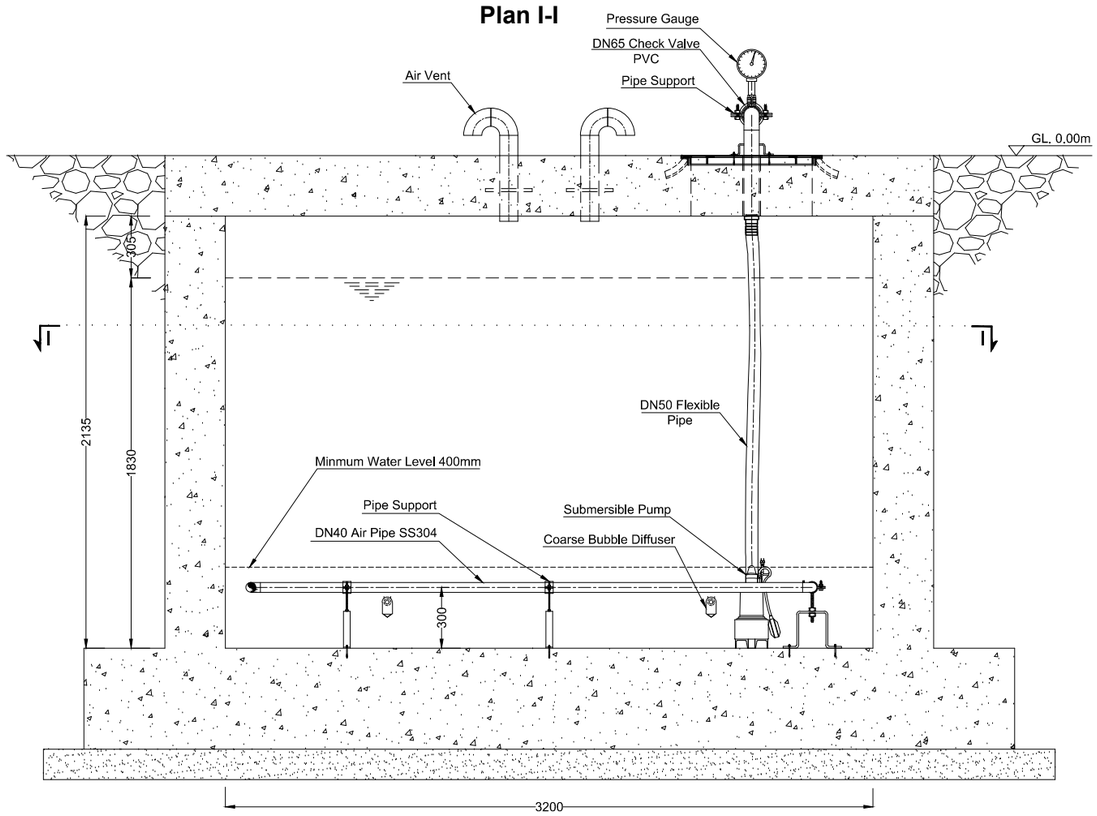
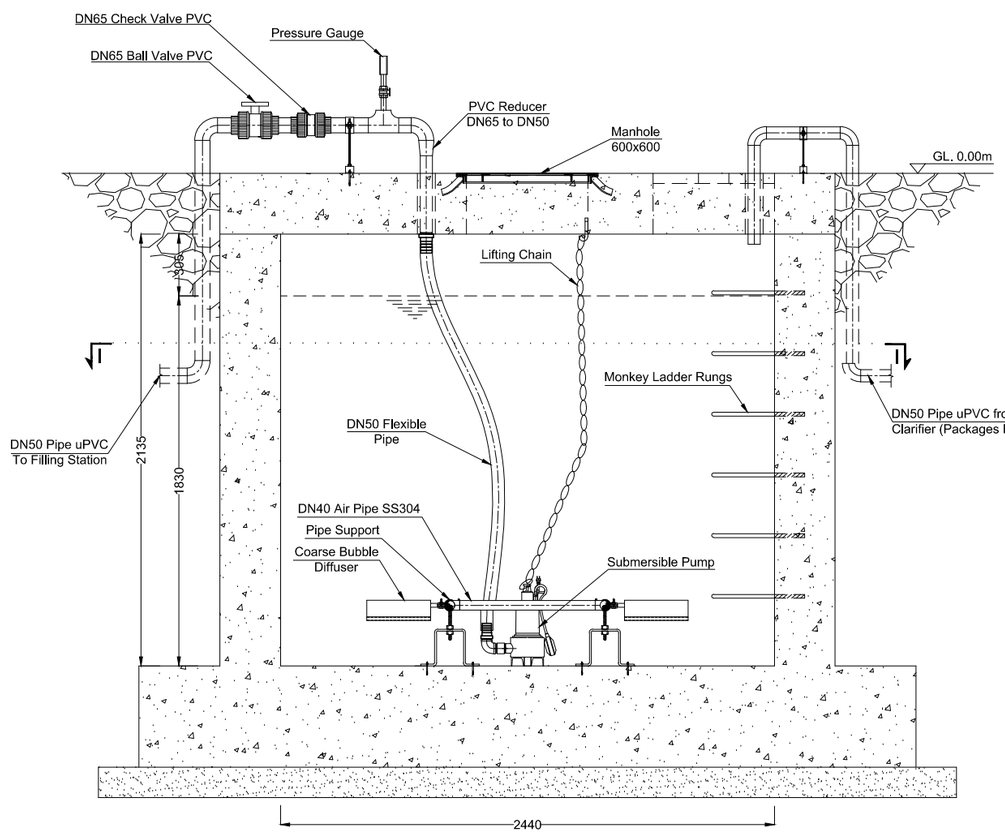


Plan I-I



Section A-A



Section B-B

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Client

BRT Peshawar

TITLE

150 m³/day Sewage Treatment Plant
Sludge Holding Tank (Plan I-ISection A-A & Section B-B)

PROJECT NO.	DWG NO.	REV
19/3WS/BRTP/STP/04/AMA-482/00	BRTP/19/STP/482/L/07	B

SCALE	NONE	SHEET	2 OF 2

3W Systems (Pvt.) Limited

Operation & Maintenance Manual Package Type Sewage Treatment Plant

Table of Contents

List of tables

List of Appendices

1 General Information

1.1 Foreword

This operation and maintenance (O&M) manual is prepared for packaged type domestic wastewater treatment plant in steel construction at BRT Peshawar. It is the basic reference for the operation and maintenance of the equipment and processes in Package Sewage Treatment Plant. It includes the maintenance schedules and cleaning services of all the equipment. Wastewater treatment plant must be kept in a way to produce quality effluent. A key to fulfilling this criterion is a sound maintenance-management program. Maintenance programs fall generally under one or two major categories:

1. **Preventive maintenance** refers to regular, routine maintenance to help keep equipment up and running, preventing any unplanned downtime and expensive costs from unanticipated equipment failure. It requires careful planning and scheduling of maintenance on equipment before there is an actual problem as well as keeping accurate records of past inspections and servicing reports. This type of maintenance is performed to circumvent equipment failure or malfunction. It generally consists of lubrication, cleaning, adjusting, replacement of worn parts, housekeeping, equipment service requirements, and sensual (including visual, audio, feel and smell) observations which can be accomplished with the tools provided at the plant and by technician having an average understanding of the operation of the machinery and plant.

2. **Corrective maintenance** is the maintenance performed whenever there is an equipment failure or malfunction. Corrective maintenance often is of an emergency nature requiring immediate performance; hence, it is usually more costly than preventive maintenance and often times require skilled technicians.

2 Introduction

2.1 Brief Description of the Project

The package type wastewater treatment plant is designed for domestic wastewater from the BRT Peshawar project facility. The system was designed based on average daily flow of 150 m^3/day (6.25 m^3/hr). The Package Sewage Plant is designed to effectively treat raw domestic wastewater by biologically digesting the majority of the organic waste and other major constituents, thereby producing a treated wastewater within NEQs discharge limits. This system depends on physical and biological processes to treat domestic wastewater.

2.2 General

This manual has been written to ensure the safe use, performance and longevity of the equipment, and is intended for use by engineers and properly trained technical personnel. The use of the manual is to properly operate and maintain the package type domestic wastewater treatment plant. Operation, maintenance, repair work or commissioning should only be carried out by appropriately qualified and properly trained technical personnel. The users are responsible for ensuring their suitability. Any risks or hazards relating to the system, including during operation and maintenance, should be identified by a competent health and safety representative who is responsible for introducing effective control measures.

2.3 Intended Use

The purpose of package type wastewater treatment plant is for the treatment of domestic wastewater only. Any other, or further, application is not considered for the intended purpose. Operation of the equipment in the intended manner requires that all the information in this operation manual be observed.

3 Operator and Management Responsibility

3.1 Operator's Responsibilities

Operators at the Package Sewage Treatment Plant (PSTP) include a responsible charge operator, a substitute responsible charge operator and several system technicians. The responsible charge operator directly supervises operation of the PSTP, including directing personnel employed at the same system. The responsible charge operator has an active daily onsite and on-call presence at the PSTP. The substitute responsible charge operator replaces and performs the same duties when the responsible charge operator is not available. All operators' responsibilities include, but are not limited to, the following:

- Beware of all operational aspects outlined in this manual
- Familiar with applicable government requirements, monitoring, reporting and record forms that must be completed concerning STP operations
- Maintaining complete and accurate operation records
- Have knowledge of the hazards connected with the treatment plant
- Knowing the capabilities of the PSTP and how to best operate the system with changing loading and climate conditions
- Notifying managers of potential problems of a significant nature.
- Hands-on STP operators must be trained and familiar with the equipment and processes of the STP.
- System operators are onsite to perform continuous routine operations and respond to emergency or upset events 24 hr/day, 7 days/week. They must have the ability to operate STP equipment, collect, compile, and evaluate operating information, and to plan necessary actions and maintenance procedures to achieve continuous proper operation of the plant.
- Operation and maintenance of units such as screens (coarse / fine screens, manually operated), side channel blowers, equalization tank and feed pumps, motors and panels (centrifugal submersible / chemical dosing pumps), valves (ball valve, non-return), pipes and pipe joints, sludge withdrawal, sludge holding tank, sludge pumps, aeration tank, secondary lamella settling tank, secondary sludge air pump, etc.
- Identification of flaws and troubles with treatment process and its trouble shooting, such as bulking of sludge in the lower layers and floating of sludge lumps in a settling

tank, foul smelling in Aeration Tank, passing of undue flocs in the settled effluent from settling tanks, disruption of operation by failure of main power supply etc.

- Segregation of a motor and pump / blower from the manifold at suction and delivery, its disconnection from the panel, dissembling of the pump / blower, reassembly of the pump / blower, check motor for its characteristics, haul back to the mounting location, couple up / connect the pump and motor and reconnect power and rejoin with suction and delivery manifold.
- Importance of quality and plant performance parameters e.g. pH, TSS, TDS, BOD, COD, DO, Temperature, MLSS, MLVSS and SVI including methods of determination.
- Preparing sampling schedule (locations, numbers, frequency, grab/composite), sample preservation methods, statistical tools

3.2 Management Responsibilities

Management support of the PSTP is an essential element of the properly conducted operation and maintenance program. Responsibilities of management include, but are not limited to, the following:

- Having knowledge of the operation, function and purpose of the system and each major element of the system, including awareness of significant or frequently recurring issues associated with the system and specific elements
- Ensuring the operators are provided with current and appropriate technical manuals, and ensuring funds are available in the operation budget
- Understanding the elements of periodic reports required by government agencies; ensuring that required operation and maintenance tasks are properly done, and ensuring the reports are accurate and submitted in a timely manner.

4 Description of Treatment Plant

4.1 Flow Scenario

Sewage treatment plant design capacity is given below:

Average daily wastewater flow rate	=	150	m^3/day
Average hourly flow	=	6.25	m^3/hr
Peak Factor (assumed)	=	3	
Peak hourly flow	=	19	m^3/hr
Plant Type	=	Package treatment plant	

4.2 Influent Characteristics

Sewage treatment plant is designed for following influent characteristics:

pH	=	6~9	
Chemical Oxygen Demand (COD)	=	400	mg/L
Biological Oxygen Demand (BOD_5)	=	200	mg/L
Total Suspended Solids (TSS)	=	250	mg/L
Temperature	=	20	^oC

4.3 Effluent Characteristics

Wastewater characteristics to be achieved after treatment are:

pH	=	6 – 9	
Chemical Oxygen Demand (COD)	≤	150	mg/L
Biological Oxygen Demand (BOD_5)	≤	80	mg/L
Total Suspended Solids (TSS)	≤	200	mg/l
Temperature	=	20	^oC

5 Plant Treatment Processes

All the domestic wastewater generated from the buildings at BRT Peshawar, is collected and transported to screen chamber of domestic wastewater treatment plant.

5.1 Screen Chamber

A screen is a device with openings, generally of uniform size, that is used to retain solids found in the raw wastewater. The principle role of screening is to remove coarse materials from the flow stream that could damage subsequent process equipment, reduce overall treatment process reliability and effectiveness or contaminate waterways/piping.

Screen is generally the first unit operation of a wastewater treatment plant (WWTP). It is used to remove large objects of unwanted size such as rags, paper, plastic, metals etc. to protect the downstream processes. The screen chamber is equipped with (01) manual bar screen having 10 mm bar opening for blocking any large size material. The screen is capable of handling the maximum hourly flow rate. Bar screen will be cleaned manually on periodic basis for removal of the screening. Screening will be collected into a storage container with capacity of 100 liters and disposed on daily basis to avoid any odors and attraction for insects. For a typical domestic wastewater, per day screenings volume is estimated as 15~25 L/day.

Table 5-1: Screen Chamber

Description	Value	unit
Length	2.5	m
Width	0.45	m
Quantity	1	No.
Construction	Brick works	

Table 5-2: Technical Specifications of Manual Bar Screen

Description	**Value**	**Units**
Type	Manual Bar Screen	
Manufacturer	3W	
Model No.	3W-MBS-20	
Bar Spacing	10	mm
Quantity	01	No.
Operating	01	No.
Material	Stainless Steel, SS304	

5.2 Equalization Tank

Equalization is a method used to overcome the operational problems caused by flow rate variations and shock loads of wastewater, to improve the performance of downstream processes and to reduce the size & cost of downstream treatment facilities. Due to changing in flows during the day, wastewater treatment plant usually encounters high loading at peak flow and very low loading a low flow, which significantly deteriorates the plant performance during the diurnal surges. One of the best possible approaches to handle such inefficiencies is the use of equalization tanks for all such applications. The principle benefits are:

i. Biological treatment is enhanced because shock loadings are eliminated or can be minimized, inhibiting substances can be diluted and pH can be stabilized.
ii. The effluent quality and thickening performance of secondary sedimentation tanks following the biological treatment is improved through improved consistency in solids loading.

The design of equalization tank is based on reducing the maximum and minimum flow difference to achieve a nearly constant flow to the downstream processes for maximum efficiency operation. The water level in the equalization tank is changing around the clock and excess water is buffered for future use. When inflow to treatment plant will be minimum the excess water stored in the equalization tank will be used by the downstream process

components to operate as close to the average flows as possible to maintain the optimum efficiency of the system. The equalization tank volume is based on providing a constant average hourly flow throughout the day.

To keep aerobic conditions and to avoid settlement of solids in the equalization tank, air will be supplied at a suitable rate. A coarse air bubble tube diffuser system will be installed at the bottom of the tank and air will be supplied by the side channel blowers. Same blower will be used to fulfill the oxygen demand of Sludge Holding Tank.

Table 5-3: Equalization Tank

Description	**Value**	**unit**
HRT	7.6	hours
Volume	47.7	m^3
Length	4.57	m
Width	4.57	m
Water Depth	2.285	m
Total Depth	2.7	m
Quantity	1	No.
Construction	RCC	

Table 5-4: Blowers of Equalization Tank & Sludge Holding Tank

Type	Side Channel Blower	
Manufacturer	Seko	
Model No.	BL52000203000	
Description	**Value**	**Unit**
Total Flowrate	70	m^3/hr
Air Flowrate for Equalization Tank	40	m^3/hr

Air Flowrate for Sludge Holding Tank	30	m^3/hr
Pressure	350	mbar
Quantity	02	Nos.
Operating	01	Nos.
Standby	01	Nos.
Power	3	kW
Voltage	400	volts
Frequency	50	Hz
Phase	3	-
IP	55	-

Table 5-5: Diffusers of Equalization Tank

Type	Coarse Bubble Tube Diffusers	
Manufacturer	3W	
Model No.	3W-TD-10	
Description	**Value**	**Unit**
Quantity	6	No’s
Flowrate	10	m^3/hr
Connection Type	3/4	inches
MOC	SS304	-

Two (02) submersible feed pumps are provided in the equalization tank to pump the sewage to the aeration tank after passing through the fine screen.

Table 5-6: Pumps for Equalization Tank

Type	Submersible Pump	
Manufacturer	Grundfos	
Model No.	Unilift AP50B.50.11.A1.V	
Description	**Value**	**Unit**
Flow rate	6.25	m^3/h
Head	10	m
Quantity	02	Nos.
Operating	01	Nos.
Standby	01	Nos.
Power, P1	1.75	kW
Voltage	230	volts
Frequency	50	Hz
Phase	1	-
IP	68	-

5.3 Package Type Domestic Wastewater Treatment Plant

One package type domestic wastewater treatment plant in steel construction is provided which consists of aeration tank, secondary clarifier and chlorine contact tank. The overall size of package plant is 9.1 m x 2 m x 2.6 m.

5.3.1 Fine Screen

One fine screen in stainless steel SS304 construction is provided at top of aeration tank with 5 mm punch-hole size. Raw sewage from the equalization tank will be collected and pass through fine screen. It is designed to handle average flow rate of 6.25 m^3/hr and will be cleaned periodically manually. The fine screen will effectively remove particles bigger than 5 mm. Screenings will be deposited in a screening container from which it will be disposed on

periodic basis. There will be one screening container with a capacity of 100 liters to contain one day maximum screening. For a typical domestic wastewater, per day screenings volume is estimated as 10~15 L/day.

Table 5-7: Technical Specifications of Manual Fine Screen

Description	Value	Units
Type	Manual Fine Screen	
Manufacturer	3W	
Model No.	3W-MFS-10	
Hole Size	5	mm
Quantity	01	No.
Operating	01	No.
Material	Stainless Steel, SS304	

5.3.2 Aeration Tank

The removal of dissolved and particulate carbonaceous BOD and stabilization of organic matter found in wastewater is accomplished biologically using a variety of microorganisms, particularly bacteria. Micro-organisms are used to oxidize the dissolved and particulate carbonaceous organic matter into simple end products and additional biomass.

$$\text{Organic Matter} + O_2 + NH_3 + PO_4^{3-} \xrightarrow{\text{microorganisms}} CO_2 + H_2O + \text{New cells}$$

In the above equation, oxygen (O_2), ammonia (NH_3) and phosphate (PO_4^{3-}) are used to represent the nutrients needed for the conversion of the organic matter to simple end products (i.e. carbon dioxide and water). The term new cells are used to represent biomass produced as a result of the oxidation of the organic matter.

The basic components of biological treatment are (1) a reactor in which the microorganisms responsible for treatment are kept in suspension and aerated, (2) liquid-solids separation usually in a sedimentation tank and (3) a recycle system for returning solids removed from liquid-solids separation unit back to aeration tank.

One aeration tank is provided with an effective volume of 31 m^3 calculated based on 5 hours hydraulic retention time. The aeration tank is equipped with diffused aeration system to provide air for the treatment of wastewater. The fine bubble disc diffusers are provided made of EPDM membrane mounted on air distribution pipes at aeration tank bottom.

In the aeration tank, atmospheric air is bubbled through wastewater combined with organisms to develop a biological floc which reduces the organic content of the wastewater. The combination of raw wastewater and biological mass is commonly known as Mixed Liquor. In all activated sludge plants, once the wastewater has received sufficient treatment, excess mixed liquor is discharged into settling tank and the treated supernatant is disposed. Part of the settled material, the sludge, is returned to the head of the aeration system to re-seed the new wastewater entering the tank. This fraction of the floc is called Return Activated Sludge (R.A.S.). Excess sludge which eventually accumulates beyond what is returned is called Waste Activated Sludge (W.A.S.). W.A.S is removed from the treatment process to keep the ratio of biomass to food supplied (wastewater) in balance. This is called the F: M ratio.

The aeration system comprises of diffused aeration through side channel air blowers. There are two air blowers, one operational and one standby. The size and equipment details are given as under:

Table 5-8: Aeration Tank

Description	Range	Unit
Size	6.8 x 2 x 2.6	m
Water depth	2.3	m
Total depth	2.6	m
HRT	5	hrs.
Effective Volume	31	m^3
Quantity	01	No.
Construction	Steel	

Table 5-9: Diffusers of Aeration Tank

Type	Fine Bubble Disc Diffusers	
Manufacturer	EDI	
Model No.	FlexAir	
Description	**Value**	**Unit**
Quantity	39	No’s
Flowrate	0~5	m^3/hr
Connection Type	3/4	inches
Membrane MOC	EPDM	-
Body MOC	PP	-

Table 5-10: Air Blowers for Aeration Tank

Type	Side Channel Blower	
Manufacturer	Seko	
Model No.	BL62000204000	
Description	**Value**	**Unit**
Flow rate	160	m^3/hr
Pressure	350	mbar
Power	4	kW
Quantity	02	Nos.
Operating	01	Nos.
Standby	01	Nos.
Voltage	400	volts
Frequency	50	Hz
Phase	3	-

IP	55	-

5.3.3 Secondary Clarifier

Secondary clarifier is used to settle MLSS from aeration chamber for recycling and wasting. One (01) secondary clarifier is provided with dimensions 1.3 x 2 x 2.6 m. The MLSS from aeration tank will flow to the secondary clarifier by gravity and solids will settle down at the bottom of secondary clarifier.

The sludge from the bottom is returned back at the inlet of aeration tank though air lift pump. The supernatant from the top layer of the Secondary clarifier is directed into chlorine contact tank where water is disinfected using liquid sodium hypochlorite before disposal. The size and equipment details are given as follows:

Table 5-11: Secondary Clarifier

Description	Value	Unit
Size	1.3 x 2 x 2.6	m
Quantity	01	No's
Construction	Steel	

5.3.4 Chlorine Contact Tank

The purpose of disinfection is to kill the pathogenic microorganisms. Chlorination is one of the most commonly used method of disinfection. Sodium hypochlorite solution is used for chlorine dosing due to safety concerns related to transport, storage and feeding of chlorine gas. Sodium hypochlorite hydrolyze to form hypochlorous acid (HOCl) as follows:

$$NaOCl + H_2O \longrightarrow HOCl + NaOH$$

$$HOCl \longleftrightarrow H^+ + OCl^-$$

One chlorine contact tank is provided with an effective volume of 4 m^3. Sodium hypochlorite solution is dosed in the chlorine contact tank to maintain residual chlorine of 1 mg/l. Sodium Hypochlorite dosing unit is installed for chlorination and liquid solution (10~12%) will be injected via dosing pump at the rate of 0.5~1 L/hr. The dosing pump has a maximum flowrate of 8 L/hr and flow will be adjusted at site during commissioning to maintain residual chlorine of 1 mg/l in the effluent.

Table 5-12: Chlorine Contact Tank

Description	**Value**	**unit**
Volume	4	m^3
Channel Total Length	16	m
Width	1	m
Water Depth	0.25	m
Quantity	1	No.
Construction	Steel	

The chlorine dosing system has following characteristics:

Table 5-13: Sodium Hypochlorite Dosing Pump

Type	Diaphragm Type Dosing Pump	
Manufacturer	Etatron	
Model No.	DLX-MA/AD	
Description	**Value**	**Unit**
Flow rate	8	L/h
Pressure	1	bar
Quantity	02	Nos.
Operating	01	Nos.
Standby	01	Nos.

5.4 Product Water Storage Tank:

A Product water storage tank is provided in RCC construction. A submersible pump with a flow capacity of 10 m^3/hr is installed in the product water tank for disposal.

Table 5-14: Product Water Tank

Description	Value	unit
HRT	7.37	hours
Volume	46	m^3
Length	5.87	m
Width	3.66	m
Water Depth	2.145	m
Total Depth	2.745	m
Quantity	1	No.
Construction	RCC	

Table 5-15: Disposal Pumps

Type	Submersible Pump	
Manufacturer	Grundfos	
Model No.	Unilift AP50B.50.15.3.V	
Description	**Value**	**Unit**
Flow rate	10	m^3/h
Head	13	m
Quantity	01	Nos.
Operating	01	Nos.
Power, P1	2.15	kW
Voltage	400	volts
Frequency	50	Hz

Phase	3	-
IP	68	-

5.5 Sludge Holding Tank

Excess sludge from the bottom of secondary clarifier will be wasted by gravity and stored in the sludge holding tank. It is equipped with an aeration system which consists of coarse bubble tube diffusers to maintain aerobic conditions and avoid settlement of solids in the tank. Air is supplied to diffusers through side channel blower installed at equalization tank.

One sludge holding tank is provided with an effective volume of 14.3 m^3 calculated based on 3.5-days of sludge storage time.

Table 5-16: Sludge Holding Tank

Description	Value	unit
Sludge storage time	3.5	days
Volume	14.3	m^3
Length	3.2	m
Width	2.44	m
Water Depth	1.83	m
Total Depth	2.135	m
Quantity	1	No.
Construction	RCC	

Table 5-17: Diffusers for Sludge Holding Tank

Type	Coarse Bubble Tube Diffusers
Manufacturer	3W

Model No.	3W-TD-10	
Description	**Value**	**Unit**
Quantity	04	No's
Flowrate	10	m^3/hr
Connection Type	3/4	inches
MOC	SS304	-

Table 5-18: Sludge Disposal Pumps

Type	Submersible Pump	
Manufacturer	Grundfos	
Model No.	Unilift AP50B.50.11.A1.V	
Description	**Value**	**Unit**
Flow rate	10	m^3/h
Head	10	m
Quantity	01	Nos.
Operating	01	Nos.
Power, P1	1.75	kW
Voltage	230	volts
Frequency	50	Hz
Phase	1	-
IP	68	-

6 Plant Operation Procedures

6.1 Manual Bar Screen

The manual bar screen is equipment of an equally spaced inclined bars installed at screen channel, cleaning is performed periodically by operator with a rake to remove the waste material and placed it in a screening container for subsequent disposal. The operator must continuously observed the bar screen and if it is approximately 50% blocked with screening material then operator must clean the bar screen or at least clean the screen 2~3 times a day.

6.2 Equalization Tank

Equalization tank is equipped with 2 Nos. submersible feed pumps (1 operating + 1 standby). While in normal operation mode, one pump should be in operation all the time and feed average sewage flow rate to biological secondary treatment system. Operational time of feed pump is 24 hours/day. Float switch is installed in the equalization tank for the purpose of dry running protection of pumps. If low water level reaches in the equalization tank, pumps will automatically switch off. After every day, lead pump will be changed so that each pump shall run equal number of hours per day. Each pump is provided with its individual on/off switch for manual operation of the pumps.

Equalization tank is also provided with coarse bubble tube diffusers and air is supplied from side channel air blower installed in blower room. Aeration valve (for equalization tank) must be adjusted by operator manually and ensure that sufficient amount of air is provided all the time in the equalization tank to keep the solids in suspension and to avoid septic conditions.

6.3 Fine Screen

Fine screen is provided with manual operation. The plant operator will intermittently visually check the fine screen and if screening material covers half of the perforated area of screen then operator should initiate the cleaning operation and manually remove all the screening material. Operator must ensure that all the incoming sewage is falling down in the bucket of fine screen. The operator must clean the screen at least 2~3 times a day. The screening material will be placed in a screening container for subsequent disposal.

6.4 Aeration Tank

In the aeration tank, atmospheric air is bubbled through sewage combined with organisms to develop a biological floc which reduces the organic content of the wastewater. The combination of raw wastewater and biological mass is commonly known as Mixed Liquor. Two side channel air blowers (1 operating + 1 standby) are provided. While in normal mode, one side channel air blower must be in operation all time. Operational time of air blower is 24 hours/day. After every day, lead blower will be changed so that each blower shall run equal number of hours per day.

Aeration valves (for aeration tank) must be adjusted by operator manually and ensured that sufficient amount of air is uniformly distributed and provided all the time in the aeration tank to keep the MLSS in suspension and to avoid septic conditions. Oxygen is mandatory requirement in all aerobic activated sludge processes for the growth of microorganism. If color of MLSS in aeration is light to medium dark brown and there is no septic odor and settling of bacterial is good then biomass is in healthy condition and enough amount of oxygen, substrate and nutrient are available. But if color of MLSS is changing to black and odor is a problem then operator must immediately check the operation record of blower/feed pump, check the aeration valves position and visual check the aeration tank for aeration or chocking of diffusers. Required DO concentration range in aeration tank is 1~3 mg/l. Set point DO concentration is 2 mg/l.

Blower and pumps are provided with their individual on/off switch for manual operation.

6.5 Secondary Clarifier

The sludge from the bottom of secondary clarifier is returned back at the inlet of aeration tank though air lift pump which is operated through air flow rate. Sludge flow rate is proportional to air flow rate. If aeration valve of air lift pump is opened slowly then sludge from the bottom of clarifier will be lifted by air pump and returned back to aeration tank. Required return activated sludge flow rate is 1 Q (6.25 m^3/h). Operator must adjust the aeration valve of air pump to return the sludge flow close to required value. Operational time of air pump is 24 hours/day.

6.6 Chlorine Contact Tank

The purpose of disinfection is to kill the pathogenic microorganisms. Sodium hypochlorite solution is used for chlorine dosing. Two chemical dosing pumps (1 operating + 1 standby) are provided at chlorine contact tank. While in normal mode, one chemical pump must be in operation all time. Operational time of pump is 24 hours/day. After every day, lead pump will be changed so that each pump shall run equal number of hours per day. Required residual chlorine value in effluent is 1 mg/l. Chemical dose must be adjusted by operator to get required residual chlorine value.

6.7 Product Water Tank

The product water tank is provided to store the treated water. A submersible pump is provided in the product water tank for disposal of treated water to nearest disposal point (Nullah). While in normal mode, submersible pump must be in operation through float switch which is installed in the product water tank for the purpose of dry running protection of pumps. If low water level reaches in the product water tank, pumps will automatically switch off. Pump is provided with its individual on/off switch for manual operation of the pump.

6.8 Sludge Holding Tank

The wasting of the excess sludge to the sludge holding tank must be planned to keep the required MLSS value in the aeration tank. Excess sludge wasting volume must be calculated by operator based on optimal MLSS. If desired Mixed Liquor Suspended Solids (MLSS) for treatment plant is known, WAS can be determined by taking the difference between the actual MLSS and the desired MLSS. The range of MLSS concentration in the aeration tank is 3000~4000 mg/l and the desired value is 4000 mg/l.

Sludge holding tank is equipped with one submersible pump. While in normal operation mode, once sludge holding tank is filled, the sludge will be disposed through third party via filling station. A bowser from third party will be filled through filling station by manual operation of submersible pump by operator. Float switch is installed in the sludge holding tank for automatic stoppage of submersible pump. Pump is provided with its individual on/off switch for manual operation of the pump.

7 Plant Performance Monitoring

The following parameters are an essential part of analysis.

- pH
- Total Suspended Solids (TSS)
- Total Dissolved Solids (TDS)
- Biochemical Oxygen Demand (BOD_5)
- Chemical Oxygen Demand (COD)
- Dissolved Oxygen (DO)
- Temperature
- Residual Chlorine
- Mixed Liquor Suspended Solids (MLSS)
- Mixed Liquor Volatile Suspended Solids (MLVSS)
- Sludge Volume Index(SVI)

The location of sampling and the parameters that are required to be tested for are also given in the table below.

Table 7-1 Testing Schedule for Various Parameters

Parameters / Location	Equalization Tank	Aeration Tank	Discharge from Chlorine Contact Tank	Frequency
pH	✓	✓	✓	Daily
TSS	✓		✓	Weekly
TDS	✓		✓	Weekly
DO		✓		Daily
Temperature	✓	✓	✓	Daily
BOD_5	✓		✓	Monthly
COD	✓		✓	Weekly
Residual Chlorine			✓	Weekly
MLSS		✓		Daily

Parameters / Location	**Equalization Tank**	**Aeration Tank**	**Discharge from Chlorine Contact Tank**	**Frequency**
MLVSS		✓		Weekly
SVI		✓		Daily
Any specific	As required			

8 System Maintenance Procedures

8.1 General

Clear documentation of system and equipment maintenance is helpful in understanding equipment operating costs, preventive and corrective maintenance. It is recommended that for each piece of equipment in the plant, equipment identification and maintenance log sheets should be maintained. An example of a log sheet is shown in the appendices of this document.

It is important to perform preventive maintenance procedures periodically and regularly. Once a month, it is primordial to check the entire system for signs of wear, deterioration and damage. These symptoms include excessive vibration, excessive or unusual noise, corrosion, pipes or loose connections and leaks.

During the inspection period, it is important to remove dust, sand, oil, moisture or other contaminants from the external surfaces of pumps, blowers, pipes etc.

1. Before performing maintenance, isolate or drain all piping connected to equipment.

2. Before performing maintenance on any rotating or powered equipment item, ensure the item is brought to a zero energy state and complete all lock−out, tag−out procedures required by government regulations, plant−specific procedures, and those recommendations in this manual's section on safety.

3. Perform maintenance service using manufacturer's manuals as a guide.

4. After completing maintenance, re-install any guards or other safety components removed during the procedure. Personnel working on pumps used to transfer chemicals must be familiar with the safe−handling procedures associated with the chemicals involved.

5. When working with diaphragm pumps or other chemical transfer pumps, be aware that some media may remain within the pump's diaphragm chamber even after the pump has been drained and ensure proper PPE is worn during this work.

6. In general, motors should be inspected at regular intervals; approximately every 500 hours of operation or every 3 months, whichever occurs first. Keep the motor clean and

the ventilation openings clear. Electrical connectors should be tight. Meter readings of motor insulation should be taken and recorded to monitor for issues.

8.1.1 Scheduling

Preventive maintenance must be performed on a periodic basis. For plant equipment, the manufacturer's maintenance manuals must be consulted and a schedule of maintenance required shall be listed. For plant facilities other than equipment, inspections of items and/or plant history will provide information for putting together a schedule.

Corrective maintenance must be scheduled immediately upon occurrence. A history of corrective maintenance problems will greatly contribute to scheduling future work of similar nature.

Some type of maintenance must be scheduled for the once a year opportunity when the plant load normally is at its lowest (if possible). This may be the time to drain, check, repair, and re-paint tanks and certain underwater items of equipment.

8.1.2 Inventory

A central storeroom for spare parts, equipment and supplies should be maintained. The storeroom should be kept neat and orderly at all times to facilitate finding inventory items.

Spare Parts/Components Inventory

It is recommended that adequate quantities of spare parts and equipment components be kept on hand to permit maintenance schedules to be met. Too many parts are many times as bad as too few parts.

Inventory Quantities

Following is a list of inventory item quantities recommended for this package wastewater treatment plant:

Description	**Maximum**	**Minimum**
Pump		
Pump Bearings	2 Sets (each size)	1 Set (each size)

Pump Mechanical Seal	4 Sets (each size)	2 Set (each size)
Pump Elastomers	2 Sets (each size)	1 Set (each size)
Pump Shaft Sleeves	2 Sets (each size)	1 Set (each size)
Pump impeller	1 Sets (each size)	1 Set (each size)
Pressure Gauges	3 (each range)	1 (each range)
Pump Diaphragm	1 Sets (each size)	1 Set (each size)
Blower		
Blower Bearings	2 Sets (each size)	1 Set (each size)
Blower Impeller	1 Sets (each size)	1 Set (each size)
Paper Seal Kit	1 Sets (each size)	1 Set (each size)
Silencer and Filter Cartridge	2 Sets (each size)	1 Set (each size)
Pipe and Fittings	1 Sets (each size)	1 Set (each size)
Valves	1 Sets (each size)	1 Set (each size)

8.1.3 Housekeeping

Housekeeping of area around package plant, tanks, equipment and grounds must be performed to produce a neat appearance, and to have sanitary and safe working conditions for employees.

8.1.4 Painting

Touch up painting must be scheduled as the need arises. Whenever equipment undergoes corrective maintenance touch-up painting will be required to restore the equipment to its original condition. Weathering and normal wear will also deteriorate painting such that touching up will be required. It is recommended that five (5) days be scheduled each year for touch-up painting work.

8.1.5 Lubrication

Each equipment manufacturer's manual of operation and maintenance contains information regarding lubrication of the equipment. Excessive lubrication is just as dangerous as not enough lubrication in many cases. Caution must be exercised in not over greasing motors and overfilling oil wells.

Lubrication of Electric Motors

Grease the bearings on the electrical motors of the pumps every six months (if necessary). The procedure is as follows:

1. Stop the electric motor.
2. Use a grease gun containing high quality grease that has a wide temperature range.
3. Remove the upper and lower caps of the grease ports of the shaft bearings. If a lubricant fitting is not permanently installed, install a grease gun fitting in the upper port.
4. Pump new grease into the bearing by upper port until the new clean grease appears at the drain port (lower port).
5. Roll the engine briefly until grease stops flowing through the port of the drain. Replace the cap of lower port (drain) and the cap of the upper port.

Caution: Do not over−lubricate the engine, as excessive lubrication can damage the bearing seals.

8.1.6 Leaking of Mechanical Seals

It is important to check for leaks from the mechanical seals after the first twenty−four (24) hours of operation. Thereafter, check the seals weekly. A leak is considered acceptable when it is not more than a drop every three or four minutes. If the leak rate increases, the seal should be repaired/replaced.

8.2 Maintenance

Maintenance keeps operating systems functional and performing at their required levels. Preventive maintenance is a term used to denote maintenance that prevents failure of systems.

The suggestions in this section guide maintenance personnel as they service the PSTP equipment, more details of maintenance are presented in equipment manufacturer's manuals and in vendor data submittals and maintenance personnel must consult all the equipment manufacturer provided operational and maintenance manual. Though the operator is encouraged to use this list as a performance checklist, it is not to be considered all inclusive. The list must be flexible and is subject to review and updating as additional operating experience is obtained or the facilities are modified.

8.2.1 Manual Bar Screen

- Check and clean the bar screen at frequent intervals
- Do not allow solids to overflow / escape from the screen
- Ensure no large gaps are formed due to corrosion of the screen
- Replace corroded / unserviceable bar/mesh screen immediately
- Check the alignment of bar screen every month

Table 8-1 Troubleshooting in Manual Bar Screen

Problem	Cause
Large particles pass through, and choke the pumps	Poor operation / screen damaged
Excessive collection of trash on screen	Poor operation
Excessive odor	Poor operation / trash disposal practices

8.2.2 Equalization Tank

- One raw sewage feed submersible pump out of two, should remain in running condition all the time and operate through float switch installed in the equalization tank
- Pump shall transfer the domestic sewage to aeration tank of package plant
- Check daily regularly the operation of raw sewage feed pump
- Check daily regularly the water level within the equalization tank
- Switch between the main and standby pump every 24 hours (approximately)

- Check condition of pump and replace damaged parts immediately after every month
- Check for vibrations or any abnormal sound after every day
- Follow the LOTO safety principles while performing maintenance activities
- Keep aeration on all the time in the equalization tank to avoid any septic conditions and settlement of solids.
- It must be prevented and avoided to throw any foreign solid particle. It may damage the feed pumps
- Manually evacuate settled muck/sediments at least once in a year

Daily Inspection

Check current and ammeter fluctuation every day. If ammeter fluctuation is significant uneven but it is within the limit of pump rating, the pump may have caught foreign matter.

If the discharge rate showed a sudden decrease, foreign matter may have clogged the suction opening.

Regular Inspection

Once a month

Measure the insulation resistance, if the insulation resistance is 1 MΩ or more, there occurs no problem on operating the pump. If, however, a sudden drop appeared in the insulation resistance even if the value is at above 1 MΩ, the phenomenon is abnormal, and repair of the pump is required.

Once every six months

Replace oil in the mechanical seal chamber at every six months (if applicable). If water enters the oil to give significant cloudiness, replace the mechanical seal. The oil shall be added in a specified quantity while the oiling plug faces upright and the pump is positioned horizontally. After the oiling, fully tighten the plug with a seal washer.

Once a year

Replace mechanical seal at the interval of one year or 6000 hours of total operation hours, either shorter one. By the replacement, the pump life extends.

Once every two to five years

Overhaul of the pump assures safe and long period of operation. For the case of high frequency of operation, early overhaul is requested.

Precaution during non-operation

When the pump is left underwater in non-operating state, measure the insulation resistance of motor intermittently. If there is no abnormality in the insulation resistance, operate the pump to prevent the sliding section of the pump from rusting. When the pump is stored on ground, clean the pump and then store it at dry site. (Temperature of storage: -5~40°C).

Consumables

Replace the parts when they enter the following described condition.

Table 8-2 Conditions for replacement of Pump Parts

Consumable parts	**Mechanical Seal**	**Sheet packing**	**Seal washer**	**Lubrication oil**	**O-ring**
Symptoms or approximate period for replacement	Oil in the mechanical seal chamber becomes cloudy.	At every disassembly for inspection	At every oil replacement	Lubrication becomes cloudy or blackish,	At every disassembly for inspection
Expected replacement time	One year or 6000 hours of total operating hours, either of shorter one.	____	____	Once every six months.	____

More detailed maintenance procedures are given in the Grundfos pump manufacturer's manual, operators and all plant related personnel must keep a copy and follow all the instructions given in the manual.

8.2.3 Fine Screen

- Check and clean the fine screen manually at frequent intervals
- Do not allow solids to overflow/ escape from the screen
- Ensure no large gaps are formed due to corrosion of the screen
- Replace corroded / unserviceable mesh screen immediately

8.2.4 Aeration Tank

- Operation considerations include maintaining the correct design level of MLSS (biomass concentration) in the aeration tank. Problems arise both in the case of excess or shortage of biomass, causing an imbalance, leading to failure of the process.
- The design value of the MLSS in the aeration tank is 3000~4000 mg/l.
- Visual observation will indicate if there is uniform aeration and mixing over the entire area of the tank. Local violent boiling/bubbling is indicative of ruptured membranes. Dead zones on the wastewater surface indicate that membranes are blocked from the air side. The condition call for immediate attention, by cleaning or replacing the membranes/diffuser.
- Cleaning of disc diffuser membrane is generally carried out and scouring out the adhering materials by high-pressure hosing.
- Scrubbing with mild acid solution may also be resorted to in case of stubborn encrustation.
- Foaming in the aeration tank may be caused by excessive inflow of detergent-like substances. In a great majority of cases, the cause may be traced to an imbalance in the aeration tank recipe (Food: Microorganisms: Air: Nutrients), and corrective measures may be taken as indicated. In the initial startup of the plant, formation of foam is not unusual.
- The dissolve oxygen (DO) level in the aeration tank shall be minimum of 1 mg/l and required set level of DO is 2 mg/l for good treatment of wastewater. The maximum DO concentration in the aeration tank is 3 mg/l.

Side Channel (SC) Air Blowers

SC blowers shall be used exclusively for the specified duty and within the limitations.

Improper use of SC blowers can cause serious injuries. Danger is due to:

- Suction: side channel blowers have a very high suction power. Objects, clothing and hair can be easily sucked into the fan and cause injuries.
- Discharge side: there is a very powerful stream of air from the discharge side. Foreign objects, which might have been sucked into the fan, can be expelled at high speed and cause injuries.
- Temperature: when the machine operates the temperature of the housing can exceed 100°C. The machine has to be prevented from any contact in order to avoid burns.
- Rotating parts
- Over-pressure and vacuum
- Motor fan
- Defective or missing silencers

In case of failure, check that all protection and safety devices are functioning and activated, disconnect the electric power supply and inform the personnel responsible for operation.

All SC blowers are made of aluminum alloy. Since there is no contact between the static and rotating components, no oil lubrication is needed. Before starting the air blower please check the following:

- Electrical connections must be carried out by trained, specialized and authorized electricians only.
- Check that the motor nameplate data matches with the local power supply in terms of voltage, frequency, phase and absorbed current.
- In case of three phase power supply, check that the voltage of all phases is identical.
- Connect the motor earthing properly.
- Remove the terminal box cover by loosening the fixing screws; connect the wires as indicated in the instructions or on the inside of the cover and then reposition the terminal box cover and fix it by tightening the dedicated screws.
- The start-up must be in compliance with the indicated purpose of use, with the listed values and after having considered prohibitions, obligations and residual risks.

- Make sure that the machine is not connected to the power supply before operating.
- Make sure that neither the inlet silencer nor the outlet silencer are clogged or dirty.
- Check the direction of rotation of blowers
- Check that the discharge pipe is not blocked
- In the event of detecting any leak in the safety valve, check any blockage in the discharge pipe, valves.

At machine start-up, it's necessary:

- To check the operating pressure by a pressure gauge
- To check the calibration of the safety valve
- To measure the power absorption and compare it with the value on the nameplate
- To set the thermal motor protection accordingly
- After one hour, check that the absorbed power doesn't exceed the accepted values.
- SC blowers are designed for continuous operation. In case of many starts (6 times per hour with regular stop) or inlet gas or ambient temperatures increasing, the max temperature of the motor winding can be exceeded.

Maintenance

It is necessary that qualified personnel periodically check the machine in order to avoid possible failures

All maintenance activities must be carried out by authorized and specialized personnel wearing personal safety equipment

Cleaning

- Make sure that the machine is shut down and locked against inadvertent start-up
- Clean the external part of the machine with compressed air
- Deposit of dust on external blower surface avoid an adequate thermal exchange and can cause an overheating of the interior
- Clean the ventilation grid of the motor fan cover
- Dirt on motor fan cover reduces the air flow and causes motor overheating
- Every 10/15 days during operation it is advisable to clean the filter cartridge
- If the machine operate in a high dusty environment it is necessary to replace it frequently

- A dirt cartridge increases the pressure differential, the absorbed power and the operating temperature.
- If the machine doesn't produce any differential pressure, or too low pressure, or gas flow decreases, it is necessary to clean the inside of the machine.

Dirt inside the machines can cause:

- Change of running performances
- Clogging due to clearance
- Rotor displacement
- Excessive vibrations

Cleaning Process

If it is necessary to clean the machine inside, follow the instructions here below:

- Loosen the screws and remove washers and o-rings
- Loosen the screw and remove the base
- Remove the cover hitting with a plastic mallet and use levers, if necessary
- Remove the screw, the washers and slide the ball bearing, if necessary using an extractor
- Remove the impeller if necessary using release pincers. (For two stage machines after having removed the first impeller, remove the intermediate case and the second impeller)
- Clean with compressed air and smooth with sandpaper if necessary.
- Reassemble the machine, reversing the disassembly procedures.

Silencer Elements Replacement

When the machine generates an excessive noise, it is necessary to replace the silencer elements

Sealing Rings and Bearings Replacement

The sealing rings lose the sealing capacity when exceeding their lifetime (max 2 years), thus allowing fluid losses. At that extend, sealing rings must be replaced.

Early wearing of sealing rings may be due to:

- Handling fluid polluted

- Running conditions over the limits of the nameplate causing temperature increase and lubrication grease damage.

Malfunctioning occurs when the bearings exceed their lifetime (max 2 years) causing excessive noise. At that extend, bearings must be replaced.

Early wearing of bearings may be due to:

- Mechanical shocks during running or stop that can damage the ball rolling track
- Running conditions over the limit of the nameplate causing temperature increase lubrication grease damage

Operating Problems and Troubleshooting

All actions carried out in order to recover from the malfunctioning problems reported in the below table must be performed in full safety conditions and, depending on the type of action required.

Table 8-3 Troubleshooting in Blowers

Malfunctioning	Possible Cause	Remedy
The motor is switched on but does not turn and makes no noise	at least two wires are cut off	Check the fuses, terminal or power supply cables.
The motor is switched on but does not turn and makes some buzzing noise	At least one wire is cut off The impeller is clogged The impeller is defective Ball bearing is defective	Check the wiring to the terminals of the terminal box Open the cover, remove foreign objects and clean Replace the impeller Replace the ball bearing
The motor protection device activates just after start up Absorbed current exceeds the rated value	Short cut in the motor winding Motor overload The compressor is clogged	Check and replace the motor reduce throttling. If necessary clean filters, silencer and connection pipes

stated on the motor nameplate		
The machine does not deliver differential pressure or the pressure is too low	Leak in system Wrong sense of rotation Wrong frequency Shaft seal defective Change in blade profile due to dirt	Seal the leak. Reverse direction of rotation by interchanging two connecting leads. Correct frequency Replace shaft seal Clean the impeller, check wear and replace if necessary
Unusual flow noise	Flow speed too high Dirty silencer	Clean pipes, use pipes with larger cross-section, if necessary Clean silencer insert and replace if necessary
Unusual operating noise	Ball bearing defective or without grease	Re-grease the ball bearing and replace if necessary
Compressor leaks	Gaskets are not granting seal	Replace the gaskets

Shut Down Period

When a relatively long shut down period is foreseen (more than 2 months), or whenever required, it is necessary to:

- Disconnect the machine from power supply
- Close suction and discharge line
- Release pressure
- Remove pipes
- Close inlet and outlet side with sealing plugs

8.2.5 Secondary Clarifier

There is no moving or rotating parts in secondary clarifier so maintenance requirement of secondary clarifier is minimal. Routine maintenance is related to cleaning;

- V-notch weir box must be cleaning on daily basis and avoid built up of solids.
- Avoid any activity that may create turbulence in the clarifier.
- Only provided air lift pump shall be used for the sludge pumping from the bottom of secondary clarifier.
- The sludge return rate or return activated sludge (RAS) rate is important in controlling and maintaining an adequate MLSS concentration in the aeration tank to achieve the desired degree of treatment.
- Inadequate RAS pumping rates can result in a rising sludge blanket in the secondary clarifier. The return-sludge flow rate should be adjusted to maintain the sludge blanket as low as possible.
- Air lift pump must be operated all the time and transfer the settled sludge at the inlet of aeration tank with a flow rate of 1~1.5 time of average plant flow.
- Ensure discharge of sludge recirculation into the aeration tank is visible
- The sludge return pump shall not be stopped during the plant operation
- Floating solids on the clarifier surface are an indication of a problem called “rising sludge.” This problem occurs when the DO concentration in the secondary clarifier drops resulting in an anoxic, or oxygen deficient, condition. Under anoxic conditions, nitrifying bacteria convert nitrate to nitrogen gas. The nitrogen gas bubbles adhere to floc particles, causing them to rise up to the surface.

Excess Sludge Handling

The wasting of the excess sludge to the sludge holding tank must be planned to keep the required MLSS value in the aeration tank.

- If large amount of sludge is wasted then value of MLSS will decrease in the aeration tank and lower the performance of the plant.
- If small amount of sludge is wasted then value of MLSS will increase in the aeration tank and clarifier may fail at high sludge loading rate.

Sludge wasting is an integral process in activated sludge treatment. Solids in waste activated sludge (WAS) come from the growth of new bacterial cells in the aeration tank. In simplistic terms, bacteria in properly functioning aeration tanks use available energy, carbon, and nutrient sources to grow and reproduce. The second source is from organic and inorganic solids in the raw wastewater

Sludge is wasted to maintain the desired mass of microorganisms in the aeration tank. It is typically wasted when the actual MCRT or sludge age is higher than the target value.

Typical secondary clarifiers at activated sludge plants thicken the activated sludge to two to three times the concentration in the aeration tank. This can result in WAS (and return activated sludge, RAS) MLSS concentration from 4,000 to 10,000 mg/l (0.4 to 1.0 percent).

Calculating the Sludge Wasting Rate Based on Optimal MLSS

If we have a desired Mixed Liquor Suspended Solids (MLSS) for treatment plant, we can determine WAS by taking the difference between the actual MLSS and the desired MLSS.

WAS suspended solids, (kg) = Actual MLSS, (kg) – optimal MLSS, (kg)

WAS suspended solids, (kg) = [Actual MLSS, (g/m^3) – optimal MLSS, (g/m^3)] x PSTP Aeration tank volume (m^3)/1000

= [Actual MLSS, (g/m^3) – optimal MLSS, (g/m^3)] x 31 (m^3)/1000

WAS volume, (m^3) = WAS suspended solids, (kg) / Concentration of sludge at bottom of secondary clarifier (kg/m^3)

9 Safety

For your own protection and that of your co−workers, please pay particular attention to this section. These safety precautions are intended to protect operators and equipment from risk of physical harm and damage that may arise from the operation and maintenance of this treatment system.

9.1 Personal Protective Equipment

Personal Protective Equipment (PPE) is required to operate this system safely. The following items should be readily available and properly fitted for operators of this system:

1. Hardhat
2. Safety boots
3. Safety glasses with side shields
4. Face shields
5. Rubber aprons
6. Ear plugs
7. Fall protection equipment (lanyard, harness)
8. Housekeeping equipment (brooms, mops, spill kits, rags)

9.2 Key Safety Warnings

- Do not mix sodium hypochlorite solution with any acidic solution. This mixture will generate toxic chlorine gas which is lethal. Common acidic solutions include citric acid, sulfuric acid, hydrochloric acid, sodium bisulfate (but are not limited to these).
- Working on or servicing electrical equipment or mechanical equipment powered by electricity can cause severe injury or death if the electrical source is not completely disconnected and locked out by the service person. Following a documented lock−out, tag−out program is highly recommended for working on equipment in this system.
- Air (or other gasses) trapped in PVC piping or conveyed by PVC piping can cause severe injury or death. PVC material shatters if the piping is subject to abnormal stresses when

compressed air is present inside. Pieces of piping become projectiles in this case. Ensure air is completely bled with non−compressible fluids from all systems that use PVC piping.

- Operating equipment can get hot. To avoid burns, please use caution when touching operating equipment and piping in the plant.

9.3 Safety Guidelines

There are a number of general guidelines that can greatly improve the safety of operators and visitors to a wastewater treatment plant:

1. Personal Protective Equipment (PPE): Wear the appropriate PPE for the job or task being conducted which applies to bystanders as well. Generally speaking, when in the plant environment, safety boots and safety glasses are highly recommended as a minimum.

2. Housekeeping: Maintaining a clean plant is key for minimizing the risk of accidents. Ensure that all tools and loose items are placed in the correct location and that spills are quickly cleaned up.

3. Routine maintenance: Maintaining equipment in good running order and conducting preventative maintenance regularly can help prevent situations where safety risks are elevated.

4. Personal hygiene: With any wastewater treatment system pathogens can be concentrated in the waste stream. Regular personal hygiene (like washing hands) is important to prevent illness and spread of contamination. If operators are exposed to sewage and treated water not suitable for human consumption, eyes should be immediately rinsed at an eye wash station and exposed skin should be cleaned thoroughly with soap and warm water, particularly before eating, drinking or smoking.

5. Vaccinations: Due to pathogenic risk at wastewater treatment facilities, it is recommended that operators and maintenance staff be vaccinated against tetanus and Hepatitis A and Hepatitis B. Seek medical advice from a licensed physician before exposure to water at the plant and also if you may have been exposed to potential sources of biological hazards. This is particularly important in wastewater systems.

6. Fall protection: The risk of falling into a tank or off an elevated platform can be present. A fall of any height can hurt operators and maintenance staff. Follow the local work environment regulations with respect to falls and fall prevention. Safety harnesses, lanyards and engineered anchor points may be required. Note that fall arrest and fall restraint are distinct and in general fall restraint is preferred due to the lower risk of injury.

7. Equipment specific safety recommendations: Refer to the provided equipment safety manuals. These instructions manuals must be followed for safe operation and maintenance of the system as a whole.

8. Chemical showers and eyewash stations: Safety showers and eyewash systems are installed. Operators need to be trained in their effective use and monitoring systems installed such that assistance can be provided in the case that somebody uses one of these systems.

9. Chemical spills: Spill clean−up kits and neutralization chemicals should be readily available and operators trained in how to use these systems.

10. High pressure equipment: Some pumps, compressors and blowers are capable of generating very high pressures which creates the risk of rupture or major damage if safety devices are bypassed or not maintained. Pressure relief valves should be checked regularly, and tubing or piping used to convey pressurized fluids, such as air lines, should be regularly inspected for cracks and damage.

11. Material Safety Data Sheets (MSDS): MSDS' need to be present and available for quick reference for each chemical in use in the plant and operators should read these before doing any work involving these chemicals. The supplier of the chemical is responsible for providing the end user with MSDS sheets. Each chemical in use in the plant must have an MSDS present. All chemical containers must be labeled accurately with the chemical name such that the chemical can be readily cross−referenced with the MSDS.

12. Lighting: Ensuring that work areas are well light and it is important for minimizing risks to operators and also for ease of operations and maintenance.

13. Confined spaces: Many workplaces contain areas that are confined spaces. While they are not necessarily designed for people, they are large enough for workers to enter and perform certain jobs. A confined space also has limited or restricted means for entry or exit

and is not designed for continuous occupancy. Confined spaces include, but are not limited to, tanks, vessels, silos, storage bins, hoppers, vaults, pits, manholes, tunnels, equipment housings, ductwork, pipelines, etc. OSHA uses the term "permit−required confined space" to describe a confined space that has one or more of the following characteristics: contains or has the potential to contain a hazardous atmosphere; contains a material that has the potential to engulf an entrant; has walls that converge inward or floors that slope downward and taper into a smaller area which could trap or choke an entrant; or contains any other recognized safety or health hazard, such as unguarded machinery, exposed live wires, or heat stress. Ensure workers are trained to recognize confined spaces and that only trained personnel are permitted to enter confined spaces when the appropriate safeguards are in place. A means of worker extraction and atmosphere control are normally used when workers are exposed to confined spaces.

14. Lock-out, tag-out (LOTO): There are guidelines that address the practices and procedures necessary to disable machinery or equipment, thereby preventing the release of hazardous energy while employees are performing service and maintenance activities. Their standards outline measures for controlling hazardous energies — electrical, mechanical, hydraulic, pneumatic, chemical, thermal, and other energy sources. Employees servicing or maintaining machines or equipment may be exposed to serious physical harm or death if hazardous energy is not properly controlled. A documented LOTO system is highly recommended for all operating wastewater treatment facilities.

15. Safety culture: An environment where safety discussions happen before all maintenance operations, where operators are free to raise safety concerns without retribution and one where safety reports are openly shared is highly recommended for this wastewater treatment plant. Safety should be built into all routine work and standard operating procedures at the plant and all maintenance work should be prefaced with a discussion on safety for the work at hand. This builds a culture where safety is a top priority and helps ensure all workers go home healthy at the end of their day.

Appendix A

Wastewater Treatment Process Parameters and Terminology

Activated Sludge: The term “activated sludge” refers to a brownish flocculent culture of organisms developed in aeration tanks under controlled conditions. Activated sludge is normally brown in color.

Activated Sludge Process: A common method of disposing of pollution in wastewaters. In the process, large quantities of air are bubbled through wastewaters that contain dissolved organic substances in open aeration tanks. Bacteria and other types of micro-organisms present in the system need oxygen to live, grow, and multiply in order to consume the dissolved organic “food” or pollutants in the waste. After several hours in a large holding tank, the water is separated from the sludge of bacteria and discharged from the system. Most of the activated sludge is returned to the treatment process, while the remainder is disposed of.

Aeration: The process or method of bringing about intimate contact between air and a liquid.

Aeration Tank: A chamber for injecting air into water.

Aerobic Bacteria: Bacteria that requires free (elementary) oxygen for growth.

Bacteria: Bacteria are microscopic living organisms. They are a group of universally distributed, rigid, essentially unicellular, microscopic organisms. They are characterized as spheroids, rod-like, or curved entities, but occasionally appearing as sheets, chains, or branched filaments.

Biological Oxidation: The process by which bacteria and other types of micro-organisms consume dissolved oxygen and organic substances in waste water, using the energy released to convert organic carbon into carbon dioxide and cellular material.

Biochemical Oxygen Demand (BOD): A quantitative measure of the oxygen needed by bacteria and micro-organisms for the biological oxidation of organic wastes in a unit volume of waste water. BOD is generally measured in milligrams per liter (mg/l) of oxygen consumed over a five day period. Although complete biological decomposition of organic waste requires about 20 days, the five day BOD is about two-thirds of the total oxygen required and, therefore, is a practical measure of waste concentration. In waste treatment language, BOD is most frequently stated as the percentage removed during treatment, or remaining after treatment.

Bulking Sludge: A phenomenon that occurs in activated sludge plants whereby the sludge occupies excessive volumes and will not concentrate readily. This condition refers to a decrease in the ability of the sludge to settle and consequent loss over the settling tank weir. Bulking in activated sludge aeration tanks is caused mainly by excess suspended solids (SS) content. Sludge bulking in the final settling tank of an activated sludge plant may be caused by improper balance of the BOD load, SS concentration in the mixed liquor, or the amount of air used in aeration.

Chemical Oxygen Demand (COD): A quantitative measure of the amount of oxygen required to oxidize all organic compounds in a unit volume on waste water – non-biodegradable as well as the BOD. The COD level can be determined more readily than BOD, but this measurement does not indicate how much of the waste can be decomposed by biological oxidation.

Coliform Organisms: A group of bacteria recognized as indicators of fecal pollution (see also Escherichia coliform).

Denitrification :A biological process by which nitrate is converted to nitrogen gas.

Dissolved Oxygen (DO): The oxygen dissolved in water, wastewater, or other liquid. DO is measured in milligrams per liter.

Dissolved Solids: Solids physically suspended in sewage that cannot be removed by proper laboratory filtering.

Effluent: The liquid that comes out of a treatment plant after completion of any treatment process.

Escherichia Coliform: A species of bacteria found in large numbers in the intestinal tract of warm-blooded animals.

Extended Aeration: A modification of the activated sludge process which provides for aerobic sludge digestion within the aeration system.

Inorganic Material: Material that will not respond to biological action (sand, cinders, stone). Non-volatile fraction of solids.

Micro-Organisms: Microscopic plants and animals such as bacteria, molds, protozoa, algae, and small metazoan.

Nitrification: The conversion of nitrogen matter into nitrates by bacteria.

Nitrogen: Nitrogen is present in wastewater in many forms: total Kjeldahl nitrogen, ammonia nitrogen, organic nitrogen.

Nutrient: Any substance assimilated by organisms that promotes growth and replacement of cellular constituents.

Organic Material: Material that can be broken down by bacteria (fats, meats, plant life).

Oxidation: The conversion of organic material to a more stable form using bacteria, chemicals, or oxygen.

Raw Wastewater: Wastewater before it receives any treatment.

Return Sludge: Settled activated sludge returned to mix with incoming raw or primary settled wastewater. When the return sludge rate in the activated sludge process is too low, there will be insufficient organisms to meet the waste load entering the aerator.

Return Activated Sludge: Activated return sludge is normally returned continuously to the aeration tank. Recycling of activated sludge back to the aeration tank provides bacteria for incoming wastewater. It should be brown in color with no obnoxious odor. Settled activated sludge is generally thinner than raw sludge. Some activated sludge will be wasted to prevent excessive solids build up.

Sedimentation Tanks (clarifier): Provide a period of quiescence during which suspended material or activated sludge flocs settle to the bottom of the tank and is scraped into a hopper and pumped out for disposal.

Sewage: Largely the water supply of a community after it has been fouled by various uses. From the standpoint of course, it may be a combination of the liquid or water-carried wastes from residences, business buildings, and institutions, together with those from industrial establishments, and with such ground water, surface water, and storm water as may be present.

Sludge: The accumulated suspended solids of sewage deposited in tanks or basins.

Sludge Age: In the activated sludge process, a measure of the length of time a particle of suspended solids has been undergoing aeration, expressed in day. It is usually computed by dividing the weight of the suspended solids in the aeration tank by the weight of excess activated sludge discharged from the system per day.

Sludge Index: Properly called sludge volume index (SVI). It is the volume in millimeters occupied by 1 g of activated sludge after settling of the aerated liquid for 30 minutes.

Suspended Solids: Solids physically suspended in sewage that can be removed by proper laboratory filtering.

Total Solids: The total amount of solids in solution and suspension.

Waste Activated Sludge: That portion of sludge from the secondary clarifier in the activated sludge process that is wasted to avoid a buildup of solids in the system.

Wastewater: Domestic wastewater is 99.9% water and 0.1% solids. Fresh wastewater is usually slightly alkaline.

Appendix B

Monitoring Log Sheets

Preventive Maintenance Record Sheet

Sr. No.	Equipment ID	Activity Date	Activity Performed	Activity Performed By

Corrective Maintenance Record Sheet

Sr. No.	Equipment ID	Activity Date	Activity Performed	Activity Performed By

Appendix C

Equipment List

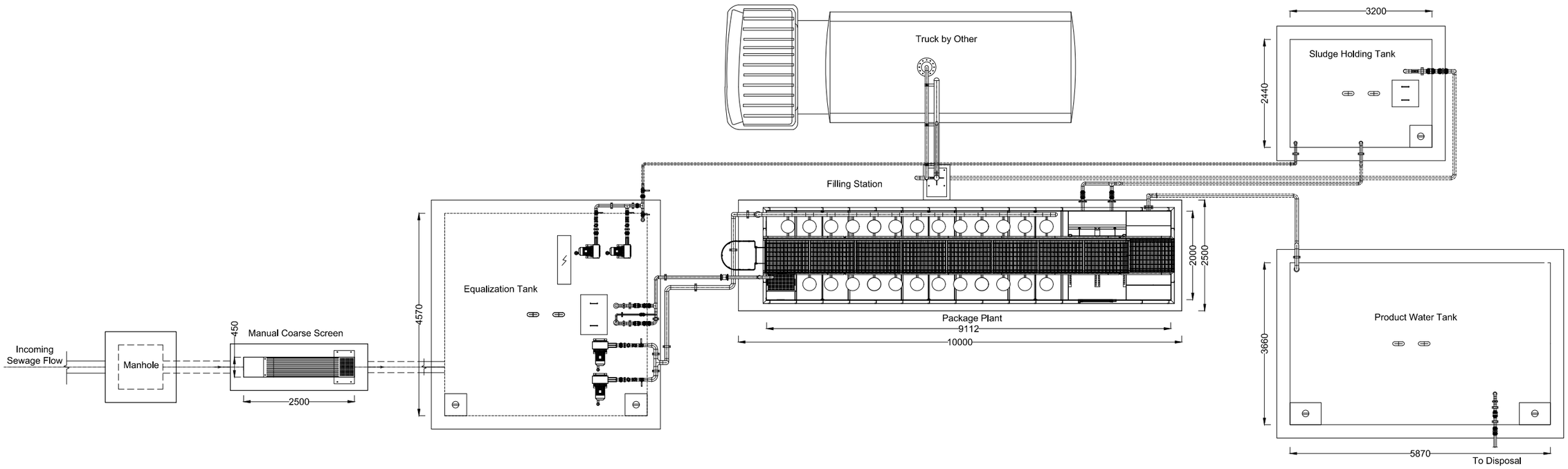
Sr. No.	Equipment	Description	Unit	Quantity	Manufacture	Model No.
1.	Manual Bar Screen	Bar Spacing: 10 mm	No.	1	3W	3W-MBS-20
2.	Screen Container	Capacity 100 liters, Material: Plastic	No.	1	Local	
3.	Feed Pump for Equalization tank	Type: Submersible Wastewater Pump	No.	2	Grundfos	Unilift AP50B.50.11.A1.V
4.	Blower	Type: Side Channel Blower	No.	2	Seko	BL52000203000
5.	Diffusers	Type: Coarse bubble tube diffuser, Material: SS304	No.	10	3W	3W-TD-10
6.	Manual Fine Screen	Mesh screen hole size 5mm Material SS304	No.	1	3W	3W-MFS-10
7.	Domestic Package Plant	Type: Package type to handle max. flow rate of 150 m^3/day Consists of Aeration tank, Clarifier and Chlorine contact Tank, Overall Plant Size: 9.1 m x 2 m x 2.6 m	No.	1	3W	3W-PP-150
8.	Blower	Type: Side Channel Blower	No.	2	Seko	BL62000204000
9.	Diffusers	Type: Fine bubble disc diffuser	No.	39	EDI	FlexAir
10.	Lamella Clarifier plastic plates		No.	-	3W	
11.	NaOCl Dosing Tank	Chemical Dosing Tank	No.	1	Local	-
12.	NaOCl Dosing Pump	Type: Diaphragm type dosing Pump	No.	2	Etatron	DLX-MA/AD
13.	Sludge Disposal Pump for SHT	Type: Submersible Wastewater Pump	No.	1	Grundfos	Unilift AP50B.50.11.A1.V

Sr. No.	Equipment	Description	Unit	Quantity	Manufacture	Model No.
14.	Treated water Disposal Pump	Type: Submersible Wastewater Pump	No.	1	Grundfos	Unilift AP50B.50.15.3.V
15.	Filling Station	MS construction	No.	1	3W	

Appendix D

Drawings

REV.	DESCRIPTION	DATED	DRN.BY	CHK.BY	ARD.BY
B	AS Built Drawing.	17-03-2020	MAM	MAB	MSR



Layout Plan

3W Systems (Pvt) Ltd.
37,GCP Employees Cooperative Housing Society
Near Johar Town Lahore Tel: +92-42-35956267,
+92-42-35956268 Fax: +92-42-35956269
E-mail: contact@3wsystems.com.pk
Web: www.3wsystems.com.pk

Client: **BRT Peshawar**

TITLE: 150 m³/day Sewage Treatment Plant (Layout Plan)

PROJECT NO.	DWG NO.	REV
19/3WS/BRTP/STP/04/AMA-482/00	BRTP/19/STP/482/L/02	B

SCALE	NONE	SHEET	1 OF 1

Annex-2 150 m3/day STP				
Sr. No.	**Description**	**Components**	**Quantity**	**Make**
1	**Bucket Screen**	Screen (20 mm) SS304	1	Manufactured by 3W Systems
		Screening Container (200 L)	1	Plastic, Local
2	**Lift Pump Station**	Submersible Feed Pumps (20 m^3/hr @ 5-10 m head)	2 (1 Operational 1 Standby)	Ebara, KSB, Grundfos, CNP or equivalent
3	**Equalization Tank**	Submersible Pumps (6.25 m^3/hr @ 10 m head)	2 (1 Operational 1 Standby)	Ebara, KSB, Grundfos, CNP or equivalent
		Fine bubble disc diffusers (EPDM, Base material : PVC / Polypropylene, Ø 300 mm)	10	EDI/SEKO
		Air Blower (20 m3/hr @ 400 mbar) 50cmh	2 (1 Operational 1 Standby)	SEKO/DACHENG
4	**Aeration Tank**	Fine Screen (5mm) SS304	1	Manufactured by 3W Systems
		Air Blowers (150 m^3/hr @ 350 mbar)	2 (1 Operational 1 Standby)	SEKO/DACHENG
		Fine bubble disc diffusers (EPDM, Base material : PVC / Polypropylene, Ø 300 mm)	36	EDI/SEKO
5	**Lamella Clarifier**	Air Lift pump 2.1m3/h	1	Manufactured by 3W Systems
		Lamella Clarifier mild steel	1	Manufactured by 3W Systems
6	**Chlorine Contact Tank**	Sodium Hypochlorite Dosing Pump	1	ETATRON / MILTONROY
		Sodium Hypochlorite Dosing Tank HDPE construction, 5 m^3	1	Local
7	**Fabrication of Containorized Package Plant**	Mild Steel with steel thickness of 6 mm with Epoxy coating upto 250 microns	1	Manufactured by 3W Systems
	Product Water Tank	Disposal Pumps (6.25 m^3/hr @ 15-20 m head)	2	Ebara, KSB, Grundfos, CNP or equivalent
		Air Blower (20 m3/hr @ 300 mbar)	1	SEKO/DACHENG

8	**Sludge Holding Tank**	Coarse diffusers (Base material : SS)	6	EDI/SEKO
		Sludge Submersible Feed Pumps (5 m^3/day @ 10 m head)	2 (1 Operational 1 Standby)	Ebara, KSB, Grundfos, CNP or equivalent
9	**All piping inside Water**	SS 304	LS	GALIB International
	All piping outside Water	UPVC	LS	DADEX/JAMAL/BETA/IIL
	All Required Valves	PVC/CAST IRON	LS	ERA / SCON

AGREEMENT FOR OPERATION AND MAINTENANCE OF VRF SYSTEM AND SEWERAGE TREATMENT PLANT IN KPUMA BUILDING

between

TransPeshawar Company

and

[SERVICE PROVIDER]

Date: XX.XX. 2026

CONTENTS

THIS OPERATION AND MAINTENANCE OF VRF SYSTEM AND SEWERAGE TREATMENT PLANT SYSTEM AGREEMENT IN KPUMA BUILDING (the "**Agreement**") is made on [••••••••••] 2025

BETWEEN

1. **TRANSPESHAWAR (THE URBAN MOBILITY COMPANY)**, a company incorporated with Security Exchange Commission of Pakistan on February 09, 2017 with company registration no.0105691 and whose registered address is at KPUMA Building, Chamkani, GT Road, Peshawar, KPK, Pakistan ("**TPC**"); and

2. <***Insert name of the Company***>, a company incorporated in [••••••••••••], with company registration no. [•••••••••] and whose registered address is at [••••••••••••] (the "**Service Provider**").

TPC and the Service Provider are individually referred to herein as a "**Party**" and collectively as the "**Parties**".

WHEREAS:

A. TPC is a corporate entity established by the Government of Khyber Pakhtunkhwa, Pakistan responsible for design, procurement, implementation and ongoing BRT operations in the Peshawar BRT System.

B. TPC intends to enter into long-term agreements based on output based or performance-based parameter with suitable Service Provider (selected through a competitive bidding process) who will provide operation and maintenance of VRF system and sewerage treatment plant system in KPUMA building.

C. The Service Provider is a company/ Joint Venture entering into and performing this Agreement.

D. TPC wishes to appoint the Service Provider on a non-exclusive basis to provide the Services and the Service Provider wishes to accept such appointment and carry out the Services, in accordance with the terms and conditions of this Agreement.

NOW THE AGREEMENT PROVIDES THE FOLLOWING GENERAL CONDITIONS OF CONTRACT:

PART A - GENERAL

1. Preliminary Matters

1.1 Definitions and Interpretation

1.1.1 The defined words and expressions set out in Clause 1 of Annex A [*Definitions and Interpretation*] hereof and the provisions relating to the construction and interpretation of the Agreement set out in Clause 2 of Annex A [*Definitions and Interpretation*] hereof shall apply to the Agreement.

1.1.2 In the event of any inconsistency between the provisions of the body of this Agreement and the Annexes, or between any of the Annexes, the conflict shall be resolved according to the following descending order of priority:

(a) the body of this Agreement, including Annex A and Particular Condition;

(b) Annex B [Letter of Award];

(c) Annex C [Schedule of Requirements];

(d) Annex D [Payment Calculation Schedule];

(e) Annex E [Performance Guarantee],

(f) Annex F [Request for Proposal and Proposal of Service Provider]

(g) Annex G [Integrity Pact]

1.2 Effect of this Agreement

The Parties hereby agree that this Agreement shall immediately be binding on them as of the Effective Date.

1.3 Conditions Precedent

TPC shall issue a Service Notice to Service Provider indicating the date upon which the Services are to commence subject to conditions precedent are met.

2. Appointment of Service Provider

2.1 Appointment

2.1.1 TPC's signing this Agreement shall indicate its appointment of the Service Provider to provide the Services. Such appointment shall only be effective as of the Effective Date.

2.1.2 The Service Provider hereby accepts the appointment by TPC and agrees to provide the Services in accordance with the terms and conditions of this Agreement.

2.2 Commencement of the Services and Term

2.2.1 The Service Provider shall provide the Services from the Commencement Date until the Termination Date.

2.2.2 Unless this Agreement is earlier terminated, the Service Provider shall continuously provide the Services contemplated under this Agreement (as may be amended pursuant to its terms) for a term as mentioned in Particular Condition **(PC**) commencing from the Commencement Date. After initial term, Agreement may be extended subject to satisfactory performance and approval of TPC for a period as mentioned in **PC**.

3. Performance Guarantee

3.1 The Service Provider shall ensure that it maintains with TPC a valid and enforceable Performance Guarantee until the Service Provider has fulfilled all its obligations under the Agreement. The Service Provider shall have delivered to TPC as a Condition Precedent the duly executed Performance Guarantee in the specified form and in the amount as mentioned as **PC**. The Performance Guarantee shall have a term of one (01) year and shall be renewed or replaced and delivered to TPC no later than thirty (30) days before its expiry. TPC shall return the previously provided Performance Guarantee to the Service Provider within fourteen (14) days of the receipt of the replacement of Performance Guarantee.

3.2 Subsequent to the delivery of the initial Performance Guarantee, the Service Provider shall thereafter ensure that the amount of the renewed or replacement Performance Guarantee is of amount mentioned in **PC**.

3.3 If the Service Provider fails to provide TPC with a replacement Performance Guarantee as required under this Agreement, TPC may (without prejudice to its other remedies) immediately liquidate all or part of the Performance Guarantee.

3.4 If the Performance Guarantee is partially liquidated, the Service Provider is obliged to replenish the Performance Guarantee in full within seven (7) days of the date of any liquidation thereof. If the Service Provider fails to replenish the Performance Guarantee in accordance with this clause, this shall constitute a material breach of this Agreement and TPC shall be entitled to liquidate the remainder of the Performance Guarantee and terminate this Agreement pursuant to clause 27.1.

3.5 Subject to the fulfilment by the Service Provider of all of its obligations under this Agreement, the Performance Guarantee shall be released by TPC within thirty (30) days after the Termination Date.

3.6 All fees, taxes and expenses associated with preparing, providing, issuing, extending, replacing, replenishing or stamping (if applicable) of the Performance Guarantee shall be borne by the Service Provider.

4. Payment for Services

4.1 Payment to the Service Provider for the provision of the Services shall be made in accordance with procedure mentioned in **PC**.

4.2 TPC shall be entitled to adjust any amount in upcoming payment which are due to either Party.

4.3 Any payment to the Service Provider shall not constitute a waiver of any right held by TPC in respect of a breach of this Agreement by the Service Provider.

5. Tax

5.1 To the extent that the Services or any additional activities and/or services offered by the Service Provider pursuant to this Agreement are taxable, the Service Provider agrees to bear all Applicable taxes, charges, duties and/or tariffs by itself and, upon request from TPC, provide proof that such obligations have been satisfied in full.

5.2 Withholding of all taxes will be made as per applicable law. Services or goods exempt from withholding of taxes, the Service Provider shall at all times be in possession of a valid tax exemption certificate and shall provide the same to TPC along with each invoice / bill for payment. In case the services are exempt from sales tax, the service provider shall furnish a valid reference of exemption from the applicable tax law.

5.3 TPC may cease all payments to the Service Provider in respect of any period during which the Service Provider is not in compliance with the provisions of clauses 5.1 and 5.2 above. Upon such compliance by the Service Provider, TPC shall affect payment of all amounts that had been withheld pursuant to this clause.

5.4 TPC may require the service provider to provide sufficient evidence to ensure compliance with the applicable laws of services tax, provincial tax, income tax or any other laws pertaining to taxation.

PART B - THE EQUIPMENTS

6. The Equipment

6.1 TPC shall hand over Equipment as mentioned in SoR to Service Provider for Operation and Maintenance. Equipment is defined in SoR and **PC**.

6.2 The Equipment shall be handed over to the Service Provider at locations with details given in Schedule of Requirement (SoR) within duration as mentioned in **PC** from date of Commencement.

6.3 For the duration of this Agreement, unless agreed otherwise in writing by the Parties, the Service Provider shall use the Equipment solely for the provision of the Services in accordance with this Agreement.

6.4 Legal title to and ownership of the Equipment (including all associated tools and equipment) shall remain with TPC.

6.5 The Service Provider shall not create or allow the creation of any Burden in any manner of any or all of the Equipment without the prior written consent of TPC.

6.6 TPC shall not hold Service Provider responsible to provide services outside the capability of the Equipment furnished, installed and commissioned unless mentioned in SoR.

7. Delivery, Care and Ownership of the Equipment

7.1 TPC shall handover the Equipment allocated to the Service Provider on the relevant Equipment Date(s) and the Service Provider shall be obliged to accept such handover in accordance with this Agreement.

7.2 The Equipment shall be properly maintained by the Service Provider in accordance with the manufacturer's standards and/or requirements.

7.3 TPC shall be entitled to conduct unscheduled inspections of each Equipment to ensure that it continues to be in compliance with the Schedule of Requirements and in satisfactory operational condition (fair wear and tear excluded). If any Equipment is found not to be in compliance with the SOR or in unsatisfactory condition, TPC shall immediately inform the Service Provider and the Service Provider shall, within a reasonable time or a time determined by TPC, effect the required repairs/replacement at its own cost.

7.4 If an Equipment requires repair/replacement and is not so repaired/replaced by the Service Provider within a reasonable time or the time determined by TPC, TPC shall be entitled to either liquidate a part or all of the Performance Guarantee for purposes of effecting such repairs/replacement for purposes of effecting such repairs/replacement.

PART C - SERVICE PROVIDER RESPONSIBILITIES

8. General Obligations – Equipment and Operations

8.1 The Service Provider shall abide by all the terms, rules and regulations in accordance with this Agreement (including the SoR) and the Applicable Law.

8.2 The Service Provider shall employ and engage trained and skilled staff (within 07 days of the award of contract) reasonably required to complete the duties of this contract to the satisfaction of TPC. The Service Provider shall provide the list of Service provider's personnel working on in KPUMA building, along with their basic information, to TPC for security clearance. The list to be shared on monthly basis or at time when changes occur.

8.3 The Service provider shall maintain vigilant supervision over its staff at all times. Dress code is to be applied with their service I.D for their distinct recognition. Apart from generally applied moral code the personnel of the service provider shall avoid to use any kind of toxic and narcotics.

8.4 The Service Provider be responsible, at all times, for the conduct of its personnel and take prompt and strict disciplinary action against any conduct not in compliance with TPC's rules, regulations and instructions issued from time to time.

8.5 The Service Provider shall ensure presence of its skilled/specialized authorized representative(s) at TPC office all the time along with additional human resource in during emergency on a reasonable notice when required by TPC and respond to queries of TPC in a timely manner.

8.6 The Service Provider shall be responsible for the medical and accidental insurance of its staff, payment of all dues like Social Security, EOBI & minimum wage in accordance with the Applicable Law. The Service Provider shall not engage staff below minimum wage as notified under Applicable Law. TPC shall not accept any responsibility of the designated personnel in the event of death, injury, disability, kidnapping or illness that may take place while performing/executing services required under the scope of this contract. Any compensation or expenditure towards the treatment of such injury/disability or loss of life shall be the sole responsibility of the Service provider.

8.7 The Service Provider shall be responsible that it does not engage or continue to engage any person having a criminal record/ conviction or otherwise undesirable persons.

8.8 TPC requires all Employees who are required to fulfil their duties in view of the public to wear uniforms at all relevant times during the rendering of the Services. The Service Provider shall ensure that its Employees are appropriately attired in the prescribed Uniforms. The Service Provider shall comply with the specification and/or design provided by TPC from time to time.

8.9 The Service Provider shall take prompt and reasonable action for resolution of each complaint and maintain a Log book, containing details regarding Turnaround Time (TAT), parts repaired/replaced, Service person etc, of each complaint received and resolved. TPC if necessary may prescribe a format of the Log book or established an electronic system, which shall be mandatory for the Service Provider to adopt.

8.10 Agree to remove from the site, whenever required to do so by the TPC, any personnel considered by TPC to be unsatisfactory or undesirable.

8.11 Be liable to the penalty and Liquidated Damages for any loss incurred or suffered/any damage caused to movable or immovable property of TPC, on account of delayed, deficient or inadequate Services, or any actions adversely affecting warranty of the Equipment, or interruption in the smooth operations of BRT Bus Service for reasons directly and solely attributable to the Service provider.

8.12 Report immediately to TPC any kind of material incident (to the extent of scope of Service Provider required as per this Contract) including but not limited to damage to TPC property and provide photographs of the incident.

8.13 The Service Provider shall ensure that the Equipment at all times are in compliance with the SoR, the requirements of any applicable specifications and the Applicable Law.

8.14 The Service Provider shall maintain detailed Equipment maintenance and repair records for the duration of this Agreement. TPC shall be entitled to audit such records upon giving the Service Provider no less than twenty-four (24) hours' notice. The Service Provider shall also provide these records (or any portions thereof) as may be reasonably requested by TPC.

8.15 Unless expressly specified in this Agreement, the Service Provider shall solely be responsible for all cost and/or expenses associated with the fit-out, furnishing, administration, office space and/or any and all operational costs associated with its operations until the Termination Date.

9. Operations and Maintenance of the Equipment

9.1.1 The Service Provider shall provide the Services strictly in accordance with the SoR and any further instructions of TPC given pursuant to this Agreement.

9.1.2 The Service Provider shall be obliged to log a report with TPC within fifteen (15) minutes of the occurrence (or as soon as practicable thereafter) of any incident/accident, detailing the nature and location of the incident and where applicable, details of the parties involved.

9.1.3 From the Commencement Date and for the duration of the Agreement, the Service Provider shall be entitled to operate the Equipment and provide services in accordance with SoR.

9.2 Temporary interruptions, delays or deviation from Services

9.2.1 The cancellation of Services by the Service Provider shall only be permitted if such cancellation is due to:

(a) weather conditions (subject to prior agreement with TPC), or any Event of Force Majeure; or

(b) immediate danger to life and/or personal injury and/or serious damage to property,

in which event, TPC and the Service Provider shall meet in good faith on an urgent basis, to agree upon the deviation from the Services to be allowed and the expected date and/or time of recommencement of the Services, or if the Parties fail to reach agreement within one (1) hour after having met for the first time, TPC's decision shall be final and binding on the Parties.

9.2.2 Where the Service Provider is of the opinion that Services should be cancelled due to boycott action, intimidation, violence, strike action or any threats of the foregoing, either against the Service Provider or generally, the Service Provider shall refer the matter to TPC for its decision, which shall be final and binding and not be subject to the provisions of clause 28. Should TPC decide that such cancellation is justified, no Liquidated Damages shall apply. However, should TPC decide that such cancellation is not justified and the Service Provider nevertheless fails to render the Services for any period of time whilst the action or threats contemplated above continue, the Service Provider shall be penalised in accordance with clause 24 and the SOR and no payment shall be made in respect of such cancelled Services.

9.2.3 The Service Provider shall inform TPC immediately of any proposed cancellation of any Services pursuant to clause 9.2.1(a) and/or clause 9.2.1(b) and the Parties shall meet on an urgent basis to agree upon the deviation to be allowed and the recommencement of the Services, or if they fail to reach agreement within a reasonable time as determined by TPC, TPC's decision shall be final and binding on the Parties and clause 28 shall not apply in relation to TPC's decision.

9.3 Skill and care in rendering uninterrupted Services

9.3.1 The Service Provider shall exercise the highest degree of skill, care and diligence in the provision of the Services to the reasonable satisfaction of TPC.

9.3.2 Without limiting the generality of a foregoing, the Service Provider shall provide the Services at a standard which would reasonably avoid the incurring of Liquidated Damages as contemplated in the SoR.

9.3.3 The Service Provider acknowledges and accepts that it is imperative for the success of the System that the Services are rendered without interruption or delay and undertakes to do all things reasonably necessary to ensure such uninterrupted, prompt and efficient service.

9.4 Compliance with standard operating and control procedures and requirements

9.4.1 The Service Provider shall at all times comply with any standard operating and control procedures and requirements for the day-to-day administration, monitoring, control and performance of this Agreement as may be reasonably determined by TPC from time to time and the specific circumstances under which the System operates from time to time, which shall include the SoR.

10. Operating Licenses

10.1 The Service Provider shall maintain the validity of all Operating Licences required for the business, if required under Applicable Law, for the duration of this Agreement and shall ensure that the terms or conditions of such Operating Licenses are not contravened.

11. Technical Staff

11.1 No later than 30 days before the Commencement Date, the Service Provider shall engage one or more Supervisor for coordination with TPC and dealing of day-to-day matters. They shall be fluent in the language for day-to-day communications. His name, duty, authority and any changes therein shall be communicated in writing to TPC.

11.2 The Service Provider shall hire Technical Staff who are suitably qualified and shall ensure that all Technical Staff for duration of the Services remain suitably qualified, trained and meet the requirements set out in the SoR and any Applicable Laws. TPC may implement their attendance system in their biometric system for monitoring.

11.3 Notwithstanding any Liquidated Damages that may be applied pursuant to this Agreement, in relation hereto, where a Technical Staff operates an Equipment in contravention of any Applicable Law and/or the requirements of the SoR, TPC shall be entitled to demand (and the Service Provider shall be obliged to promptly comply with such demand) that such Technical Staff is immediately removed from the System and replaced with another Technical Staff who is suitably qualified.

12. Co-operation with Other Contractors

12.1 Where interaction between the Service Provider and any Other Contractors/Service Providers is required in accordance with this Agreement, in practice or in accordance with a Service Notice or Protocol, for the efficient and effective operation of the BRT system, the Service Provider shall co-operate with Other Contractors/Service Providers and shall take such reasonable steps as may be required to formulate the necessary operating procedures and practices by agreement with Other Contractors, in accordance with the Service Notice or Protocol, as the case may be.

12.2 Should the Service Provider and Other Contractors fail to reach an agreement as contemplated in clause 12.1, TPC shall be entitled to issue a Protocol to regulate their interaction or make a final determination in the event of a dispute between them, as the case may be.

12.3 In any event, notwithstanding the provisions above, TPC shall at all times be entitled to issue Protocols regulating the interaction between the Service Provider and Other Contractors/Service Providers.

12.4 The Service Provider shall be obliged to follow such Protocols, which, in the event of a conflict, shall supersede any agreement between the Service Provider and Other Contractors in accordance with clause 12.1 above.

13. Uniforms

13.1 The Service Provider shall ensure that its Employees are appropriately attired in the Uniforms prescribed in the Schedule of Requirements (as may be amended from time to time).

14. Monitoring of the Services

14.1 TPC shall be entitled to require regular written reports from the Service Provider in such reasonable form, detail and frequency as may be determined by TPC or to call meetings with the Authorised Representative of the Service Provider on reasonable notice, for any purposes regarding the performance of the Services and/or the implementation of this Agreement.

14.2 An Authorised Representative of TPC shall at all reasonable times be given access to the Equipment, Employees and any place where the Services (or any portion thereof) are being performed to satisfy itself as to the Service Provider's compliance with its obligations under this Agreement and for purposes of assessing the Service Provider's performance against agreed KPIs. TPC shall be entitled to conduct random or schedule inspections of any Equipment, its component or its subsystems.

15. Incident Reporting

15.1 Should the Service Provider become aware of events or circumstances which have prevented, are preventing or will prevent the Service Provider from providing the Services, the Service Provider shall immediately after becoming so aware, advise TPC of such events or circumstances and also indicate the manner in which the provision of the Services was, are or are going to be impacted.

15.2 In addition to any obligations under Applicable Law, the Service Provider shall immediately after its occurrence notify TPC or its Authorised Representative of any accident relating to the Services (whether or not a Equipment has been involved) in which persons have been injured or killed.

15.3 The Service Provider shall be required to report all other incidents as may be further defined by a Protocol, excluding such incidents as described in clause 15.2 above, to TPC in writing within two (2) Business Days of the Service Provider becoming aware or where a prudent Service Provider should have reasonably become aware of the incident.

15.4 The Service Provider shall report any acts of damage to Equipment to TPC within one (1) day of becoming aware of their occurrence.

16. Other responsibilities

16.1 The Service Provider shall be responsible for the safe disposal of waste, oil, lubricant or water containing any variation of such lubricant in accordance with the Applicable Law.

16.2 The Service Provider shall at its own cost comply with all labour, employment, occupational health and safety regulations and standards applicable to the Services.

16.3 The Service Provider shall be liable to compensate, replace, repair (whatever the case may be) as per original specification or as per work order issued by TPC for any damage caused to the property of TPC.

PART D - MAINTENANCE OF EQUIPMENT

17. General Obligations

17.1 The Service Provider shall, at all times during the term of this Agreement, ensure that all Equipment utilised in rendering of the Services are kept in a state of good repair and maintained in accordance with the Equipment Supplier requirements and/or recommendations and the provisions of this Agreement. Notwithstanding anything to the contrary contained in this Agreement, the Service Provider shall:

17.1.1 be liable for any damage caused to the Equipment in accordance with its obligations under this Agreement; and

17.1.2 at all times, unless expressly stated otherwise in this Agreement, be responsible for the service, maintenance and upkeep of the Equipment, including during the Defect Liability Period.

18. Maintenance

18.1 The Service Provider shall at all times be required to service, maintain and repair the Equipment at its own cost and in strict accordance with the manuals, specifications, requirement and/or recommendations of the Equipment Supplier as notified to the Service Provider from time to time. The Service Provider shall not do anything which has the effect of voiding any warranty provided by an Equipment Supplier in respect of any of the Equipment. The Service Provider shall do all things required to ensure that TPC does not in any way breach its obligations under the Equipment Sale Agreement.

18.2 The Service Provider shall, at its own cost, ensure that each Equipment undergoes an Equipment Inspection Test according to Applicable Law and the results and other records relating to such tests shall be maintained and made available to TPC at its request. TPC may, in its discretion, request that the results of each such test be forwarded to TPC within seven (7) days of the completion of each such test.

18.3 If at any time Equipment is in need of service, maintenance and/or repair and the Service Provider fails to make such repair within a reasonable time, TPC shall notify the Service Provider of such failure and shall indicate in that notice the type of service, maintenance and/or repair that is required and the period within which such service, maintenance and/or repair must be completed. If such service, maintenance and/or repair is not completed within the time specified in TPC's notice, TPC shall be entitled to effect such service, maintenance and/or repair at the cost and expense of the Service Provider in which case TPC may, in its discretion, liquidate partially or fully the Performance Guarantee.

18.4 The Service Provider shall maintain a complete and detailed record of all service, maintenance and/or repairs (including the cost of any such service) for each Equipment and shall, upon reasonable notice, make such records available to TPC for audit and/or inspection.

19. Reserve Fund

19.1 The Service Provider shall establish the Reserve Fund which shall be maintained by TPC as security against amounts which may become due and payable to TPC during the term of this Agreement, is so mentioned in **PC**.

19.2 The Reserve Fund shall be built up from amounts retained by TPC from payments to be made to the Service Provider. TPC shall retain no more than three percent (3**%**) of each payment due to the Service Provider, up to the amount mentioned in **PC**. The Service Provider shall not withdraw from the account/ Reserve Fund without written permission of TPC.

19.3 Subject to clause 19.4, TPC shall be entitled to, in accordance with the express terms of this Agreement, make withdrawals from the Reserve Fund at any time after the Commencement Date.

19.4 The Service Provider shall name TPC as a co-beneficiary on the Reserve Fund account and execute all documents and do all things necessary to ensure that the bank or other financial institution with whom the Reserve Fund is established is authorized and empowered to, upon first written demand from TPC, immediately withdraw and/or transfer the demanded amounts to TPC with or without objection from the Service Provider.

19.5 Prior to making any withdrawal from the Reserve Fund, TPC shall have notified the Service Provider of the Service Provider's breach of a specific obligation under the Agreement, and shall also provide relevant details in respect of the breach (including the details of the Service Provider's failure to remedy the breach within the time agreed and/or specified by TPC).

19.6 TPC shall, prior to making a withdrawal or as soon as practicable following a withdrawal from the Reserve Fund, provide details of the amount to be withdrawn or the amount that has been withdrawn, and purpose of use. Following a withdrawal, the Service Provider shall, within the period specified by TPC or agreed between the Parties, replenish the Reserve Fund in a manner prescribed in clause 19.2. Failure of the Service Provider to replenish the Reserve Fund following a withdrawal pursuant to this clause shall constitute a material breach of this Agreement. TPC has the right to withdraw from Reserve Fund, if the Equipment are not made operational by Service Provider in a time specified by TPC or in case of loss of passenger revenue.

19.7 If, upon the expiry of the term of the Agreement or its earlier termination or the termination of the Service Provider's employment under the Agreement, no amounts are due and/or payable to TPC under this Agreement, then the Service Provider shall (within fourteen (14) days of such expiry or termination), be entitled to liquidate the Reserve Fund and retain any and all amounts remaining therein.

20. Spare Parts

20.1 The Service Provider is required to stock and secure spare parts store (at his own cost) as well as provide suitably qualified staff members to manage such store in accordance with the SoR.

20.2 To the extent any spare part is required for the performance of the Services, the Service Provider shall be responsible for providing the same at its own cost and expense.

21. Tools and equipment

21.1 The Service Provider is required to provide the required tools and equipment to maintain the Equipment and/or otherwise to provide the Services in accordance with the SoR.

PART E - AUTHORISED REPRESENTATIVES, PROTOCOLS AND SERVICES NOTICES

22. Authorised Representative

22.1 TPC and the Service Provider shall notify each other, by no later than five (5) days after the Effective Date, of the identity and contact details of their Authorised Representatives. Each Party shall be entitled to replace such Authorized Representative by notice to the other Party.

22.2 In addition to TPC's Authorized Representative, TPC shall, by written notice to the Service Provider, be entitled to engage a System Controls Service Provider and/or otherwise delegate from time to time certain of its obligations under this Agreement. TPC shall clearly specify the responsibility(ies) and/or authority(ies) of such delegate in the notice to the Service Provider. The Service Provider agrees to cooperate fully with any such delegate as a representative of TPC.

22.3 Unless it is stated otherwise in the notice of a Party, a Party's Authorized Representative shall be entitled to bind such Party for any and all purposes connected with this Agreement.

22.4 All Service Notices and other notices required under or pursuant to this Agreement, unless expressly stated otherwise in this Agreement (or instructed in writing by the Party to whom notice is to be given) shall be directed to the Authorised Representative of such Party.

22.5 Without derogating from the generality of this clause 22, TPC and the Service Provider, as the case may be, shall be entitled to appoint further Authorised Representatives for specific matters as detailed in its notification of such Authorized Representative.

23. Service Notices, Protocols and Amendments

23.1 TPC shall be entitled to issue Protocols under this Agreement or for interaction with other Services Provider/Contractors or use of common facilities within KPUMA building.

23.2 TPC shall be entitled to issue reasonable Protocols or amend previously issued Protocols on twenty-four (24) hours' notice to the Service Provider in the case of urgent matters and on seven (7) days' notice in respect of all other matters.

PART F – LIQUIDATED DAMAGES

24. Liquidated Damages

24.1 TPC shall be entitled to impose Liquidated Damages on the Service Provider in accordance with the provisions of this clause 24 and the Schedule of Requirements for the Service Provider's failure to achieve certain KPIs as indicated in the SoR.

24.2 The Parties agree that the amounts specified in this clause 24.2 and the SOR for the Service Provider's failure to achieve certain KPIs represent the likely loss to TPC as a result of any failure of the Service Provider to meet the KPIs and are reasonable and constitute liquidated damages and not a penalty. The Service Provider further waives, to the extent permitted by Applicable Law, any defence as to the validity and quantum of Liquidated Damages set out in this Agreement on the grounds that such Liquidated Damages are void as penalties or otherwise.

24.3 TPC shall be entitled to conduct audits of the Service Provider's operations at any time without notice in order to ensure the continued compliance with this Agreement and that the Service Provider continues to achieve the various indicated KPIs. Such audits may be conducted in relation to the Equipment, the Services, Service Provider's staff, Service Provider's offices (including service and performance records) and any other place where any element of the Service is being performed.

24.4 To the extent that TPC discovered an instance of the Service Provider's failure to achieve a particular KPI, TPC shall notify the Service Provider with details of the particular KPI, the details of the failure and the applicable Liquidated Damages as indicated in the SOR. TPC may at its discretion specify period and type of certain failure which should be cured/rectified in specific period.

24.5 If Liquidated Damages are imposed, then TPC shall be entitled to withhold and/or deduct the imposed amounts from the Service Provider's next payable invoice, any subsequent invoice or in increments from several subsequent invoices.

24.6 The maximum amount of Liquidated Damages that may be imposed on the Service Provider in any given month is as indicated in the SOR.

PART G – WARRANTIES AND CHANGE IN OWNERSHIP

25. Warranties, Undertakings and Indemnities

25.1 Service Provider Warranties

25.1.1 The Service Provider acknowledges that TPC has entered into this Agreement relying on the strength of the warranties given to TPC by the Service Provider and that the warranties are given with the intention of inducing TPC (which has been so induced) to enter into this Agreement on the basis that such warranties are and shall be correct for the duration of this Agreement.

25.1.2 Each Service Provider Warranty shall be a separate Warranty and in no way limited or restricted by any reference to, or inference from, the terms of any other Warranty or by any other provision in this Agreement.

25.1.3 The Service Provider accordingly warrants and undertakes that:

(a) it is properly constituted and incorporated in accordance with the Applicable Law;

(b) it has conducted site inspection and examined the functionality and condition of all Equipment;

(c) it has thorough knowledge of the Equipment, brand, model, performance and its quality and have did site inspection of all Equipment;

(d) It has examined the specification of Equipment and made all due diligence in estimation of all operation and maintenance costs of Equipment and services under the Agreement;

(e) Satisfied himself with all the economic, financial and legal variables including but not limited to foreign exchange rates, inflation rates, minimum wage rates, customs and tax rates and all related labor and legal obligations;

(f) Satisfied himself of all conditions and circumstances affecting Contract price;

(g) it has the power, authority and legal capacity to enter into and exercise its rights and perform its obligations under this Agreement;

(h) it has taken all necessary action to authorise the execution, delivery and performance of this Agreement;

(i) the obligations expressed to be assumed by the Service Provider under this Agreement are legal, valid, binding and enforceable to the extent permitted by Applicable Law;

(j) it will on operation date hold, in cash, an amount equivalent to the acquisition cost of all required tools, equipment, furniture and other basic business materials required for the operating of its business, plus the necessary working capital required during the pre-operational and initial operational period;

(k) it is and will be in compliance with all Applicable Laws;

(l) no claim is presently being assessed and no litigation, arbitration or administrative proceedings are presently in progress or, to the best of the knowledge of the Service Provider, pending or threatened against it (including its shareholders) or any of its assets which will or might have a material adverse effect on the ability of the Service Provider to perform its obligations under this Agreement;

(m) it is not the subject of any other obligation, compliance with which will or is likely to have a material adverse effect on the ability of the Service Provider to perform its obligations under this Agreement;

(n) no proceedings or other steps have been taken and not discharged (nor threatened) for its winding-up or dissolution or for the appointment of a receiver, administrative receiver, administrator, liquidator, trustee or similar officer in relation to any of its assets or revenues;

(o) all information disclosed by or on behalf of the Service Provider to TPC is true, complete and accurate in all material respects and the Service Provider is not aware of any material facts or circumstances not disclosed to TPC which would, if disclosed, be likely to have an adverse effect on TPC's decision (acting reasonably) to award this Agreement to the Service Provider;

(p) all insurance premiums in respect of insurance obligations placed on the Service Provider in accordance with this Agreement have been timely paid and none are in arrears.

25.2 Service Provider Undertakings

The Service Provider undertakes with TPC that:

25.2.1 it will give TPC immediate notice upon becoming aware that any judicial or court proceedings, mediation, litigation, arbitration, administrative or adjudication by or against the Service Provider before any court or Regulatory Authority may be threatened or pending;

25.2.2 it will not without the prior written consent of TPC (and whether by a single transaction or by a series of transactions whether related or not) sell, transfer, lend, encumber or otherwise dispose of the whole or any part of its business;

25.2.3 it shall not without the prior written consent of TPC make any loans or grant any credit or give any guarantee or indemnity to or for the benefit of any person or otherwise voluntarily or for consideration assume any liability (whether actual or contingent) in respect of any obligation of any other person except as contemplated by this Agreement;

25.2.4 it shall immediately notify TPC of any discussions and/or negotiations that may result in a change in the ownership structure of the Service Provider or its ultimate parent company (if applicable).

25.3 TPC and Service Provider Indemnities

25.3.1 The Service Provider indemnifies and agrees to hold TPC harmless against all claims, demands, suits, proceedings, judgments, damages, loss, costs, charges, fines, penalties, taxes and expenses, of whatsoever nature incurred by either of the Parties, or by any third party, in consequence of a failure by the Service Provider to comply with the terms of this Agreement or any Applicable Law.

25.3.2 Nothing contained in this clause 25.3 shall be deemed to render the Service Provider liable for, or require it to indemnify TPC against, any compensation or damages with respect to injuries or damage to persons or property resulting from any negligent act or omission of TPC or its agents or employees in respect of any claims, demands, lawsuits, damages, costs, charges and expenses in respect thereof or pertaining thereto and each Party hereby indemnifies the other against any claims, demands, lawsuits, damages, costs, charges and expenses incurred by such other Party in consequence of the negligent acts or omissions of the other Party's agents or employees.

25.4 All warranties, representations, undertakings, indemnities and other obligations made, given or undertaken by the Service Provider in this Agreement are cumulative and none shall be given a limited construction by reference to any other.

PART H - FORCE MAJEURE, NECESSARY ACTION, BREACH, TERMINATION AND DISPUTE RESOLUTION

26. Force Majeure

26.1 If either Party is prevented in whole or in part from discharging its obligations pursuant to this Agreement as a result of an Event of Force Majeure, such Party shall, as soon as reasonably practicable, notify the other Party accordingly. The aforementioned notice shall contain the following information:

26.1.1 the obligations which are affected and the extent to which the relevant Party cannot perform those obligations;

26.1.2 a detailed description of the Event of Force Majeure;

26.1.3 an estimate of the time period which the Event of Force Majeure is envisaged to continue; and

26.1.4 the measures proposed to be adopted to remedy or minimise the effects of and costs arising from the Event of Force Majeure. If the Service Provider is the Party prevented from discharging its obligations as a result of the Event of Force Majeure and TPC is of the opinion that the measures proposed are not adequate, it shall advise the Service Provider by Service Notice. Such Service Notice may propose alternate or additional measures which in the opinion of TPC may curtail the Event of Force Majeure and/or the costs arising therefrom. Notwithstanding the provisions of this clause 26.1.4, the Service Provider shall be obliged to take all proactive steps as may be reasonably possible in anticipation of Events of Force Majeure so as to enable the Service Provider to mitigate the financial effects thereof, including but not limited to, the entering into of appropriate contractual arrangements with its Employees.

26.2 The Party prevented from discharging its obligations pursuant to this Agreement as a result of an Event of Force Majeure shall:

26.2.1 use all reasonable endeavours to preparation or minimise the effects of the Event of Force Majeure; and

26.2.2 take all reasonable and necessary steps available to it as contemplated in clause 26.1.4 to mitigate any loss suffered by such Party or the other Party or any passengers as a result of that Party's failure to discharge its obligations pursuant to this Agreement.

26.3 In the event that an Event of Force Majeure affects the Service Provider's ability to perform any of its obligations under this Agreement and to the extent that the Services, or any part thereof, are suspended, the Service Provider shall not be entitled to claim payment from TPC for such suspended Services, or any additional costs incurred by the Service Provider as a result of the Event of Force Majeure or in relation to any steps taken by the Service Provider in mitigating the effects of the Event of Force Majeure.

26.4 In the event that the Service Provider is the Party affected by an Event of Force Majeure, TPC may, in response to the notice issued by the Service Provider in accordance with clause 26.1, issue a Service Notice to the Service Provider indicating any part of the Services which should nonetheless be performed by the Service Provider for the period during which the Event of Force Majeure subsists. TPC shall in such event make payment to the Service Provider for such Services in accordance with the Payment Calculation Schedule.

26.5 If an Event of Force Majeure no longer prevents the Service Provider from performing its obligations under this Agreement, the Service Provider shall be entitled to a reasonable period, taking into account the extent to which it has wound down its operations during the period of Force Majeure, to re-establish the Services in compliance with its obligations under this Agreement.

26.6 If an Event of Force Majeure continues uninterrupted for more than one hundred eighty (180) days and continues to prevent a Party from performing all of its obligations under this Agreement, either Party shall be entitled to terminate this Agreement upon fourteen (14) days' notice to the other Party, provided that before doing so the Parties shall first have met to find a mutually satisfactory solution for remedying such Event of Force Majeure and no Party shall terminate this Agreement unless the Parties are unable to agree on a solution.

26.7 Neither Party shall have any liability to the other in respect of the termination of this Agreement as a consequence of an Event of Force Majeure or as a result of any failure to carry out any of its obligations hereunder resulting from an Event of Force Majeure.

27. Breach and Termination

27.1 If the Service Provider commits a material breach of this Agreement and fails to remedy the breach within ten (10) Business Days after receipt from TPC of a notice calling upon it to do so or such other time as specified by TPC then TPC shall be entitled, in addition to and without prejudice to any other right it may have under Applicable Law or in accordance with this Agreement, to seek specific performance of this Agreement or to terminate this Agreement forthwith on notice to the Service Provider and in either event, to recover such damages as it may have sustained.

27.2 For purposes of this Agreement, a material breach shall include but not be limited to the foregoing if the Service Provider:

27.2.1 fails to provide or maintain the Performance Guarantee; or

27.2.2 in the opinion of TPC, commits a Prohibited Act; or

27.2.3 goes into liquidation, whether provisionally or finally (other than a voluntary liquidation for the purpose of amalgamation or reconstruction to which TPC has given its prior written consent); or

27.2.4 has judgment of a material nature taken against it likely to affect the Service Provider's status as a going concern and fails to satisfy or apply to have the same set aside within seven (7) days of becoming aware thereof; or

27.2.5 delegates, cedes or sub-contracts this Agreement or part thereof in contravention of the provisions hereof without having obtained TPC's prior written consent; or

27.2.6 contravenes the provisions of SOR; or

27.2.7 fails to obtain or maintain as required any of the necessary Operating Licences/permits to be used in the rendering of the Services or has such necessary Operating Licences withdrawn, cancelled, suspended or revoked; or

27.2.8 acts or attempts to act in a fraudulent or otherwise illegal manner in obtaining or executing a contract with any government department, provincial administration, municipality, public body, company or person; or

27.2.9 violates or attempts to violate any Applicable Law or otherwise commits any criminal act; or

27.2.10 enters into any agreement or arrangement, whether legally binding or not, with any other person, firm or company to refrain from formally responding to TPC's calls for proposals or the entering into of any negotiations with TPC in relation to this Agreement; or

27.2.11 Abandons, suspend services or otherwise repudiates the Services or any of its obligations under this Agreement; or

27.2.12 consistently fails to observe any provision of this Agreement or the Schedule of Requirements (despite being given notice in relation thereto), whether or not Liquidated Damages have been imposed, with the result that the Services may be regarded by TPC as being materially defective; or

27.2.13 incurs Liquidated Damages equal to or exceeding the maximum amount of Liquidated Damages as indicated in the SOR consecutively for few months.

27.3 If TPC:

27.3.1 commits a material breach of this Agreement (other than a breach of payment obligations) and fails to remedy the breach within ten (10) Business Days after receipt from the Service Provider calling upon it to do so; or

27.3.2 commits a breach of any payment obligation in accordance with this Agreement and fails without justification to make payment within thirty (30) Business Days after receipt from the Service Provider of a notice calling upon it to do so,

then the Service Provider shall be entitled, in addition to and without prejudice to any other right it may have under Applicable Law or under the terms of this Agreement, to seek specific performance of the terms of this Agreement or to terminate this Agreement upon sixty (60) days' notice to TPC and in either event, to recover such costs, losses and damages as it may have sustained.

27.4 In the event of termination of this Agreement:

27.4.1 TPC shall be entitled to immediately take possession of all Equipment and Service Provider shall transfer other assets required for the performance of the Services to TPC; and

27.4.2 TPC may immediately appoint auditors to check and verify all relevant books, records and other data of the Service Provider and the Service Provider shall give full cooperation in that regard and make all such information available to TPC on request.

28. Dispute resolution

28.1 Disputes

28.1.1 For the purposes of this clause 28, the term "dispute" shall be interpreted in its widest sense and shall include any dispute or difference in connection with or in respect of the conclusion or existence of this Agreement, the carrying into effect of this Agreement, the interpretation or application of the provisions of this Agreement, the Parties' respective rights and obligations in accordance with and arising out of this Agreement or the validity, enforceability, rectification, termination or cancellation, whether in whole or in part, of this Agreement.

28.1.2 Save as otherwise provided for in this Agreement, any dispute between the Parties arising in connection with this Agreement shall be resolved in accordance with the provisions of this clause 28.

28.2 Resolution by Chief Executives

28.2.1 Any dispute arising in connection with this Agreement may be referred by either Party to the Chief Executive of the Service Provider and the Chief Executive of TPC (or such other senior executives as the relevant Parties may determine) who shall attempt to resolve the matter within ten (10) Business Days of the dispute being so referred to them or within such other time as may be agreed between the Parties.

28.3 Arbitration

28.3.1 If the Parties are unable to resolve the dispute pursuant to clause 28.2, either Party shall be entitled to refer a dispute to arbitration in accordance with this clause 28 by notifying the other Party in writing of its intention to do so.

28.3.2 The arbitration proceedings shall be carried out under the procedures, rules and regulations of Arbitration Act, 1940 and its successors, and such procedures, rules and regulations shall be deemed to be incorporated into this clause 28.3 by reference. Any such arbitration shall be subject to the Applicable Law.

28.3.3 The seat of the arbitration shall be Pakistan and all arbitration hearings shall be held in Peshawar unless otherwise agreed in writing by the Parties.

28.3.4 Unless otherwise required by TPC, such arbitration shall be conducted in the English language and the award of any arbitrator or arbitral panel, together with the reasons for the determination, shall be written in the English language.

28.3.5 Unless otherwise required by TPC, all evidence, submissions or documents presented at the arbitration in a language other than in the English language shall be accompanied by a simultaneous English language translation thereof, if oral, or if written, a certified English language translation.

28.3.6 The arbitrator or arbitral panel shall have full power to open up, review and revise any determinations, decisions or findings in relation to the dispute.

28.3.7 The obligations of the Parties shall not be altered by reason of the arbitration being conducted during the term of the Agreement.

28.3.8 Any monetary award in any arbitration shall be denominated and payable in PKR.

28.3.9 The Parties agree that all interim or final decisions and/or awards of the arbitrator or arbitral panel shall:

a) be binding on the Parties and shall be given effect and implemented forthwith by them; and

b) be subject to the confidentiality restrictions in this Agreement and except as provided by agreement between the Parties, may not be publicised or otherwise disclosed provided always that nothing in this clause shall prevent either Party from applying to any court of competent jurisdiction to enforce the award.

28.3.10 The Parties hereby expressly agree irrevocably to waive all rights and recourse to appeal or challenge, and neither Party shall request the local courts to open up, revise or review, the final award of the arbitrator or arbitral panel save and except in the specific instances set out in Arbitration Act, 1940.

28.3.11 Reference of a dispute to arbitration shall not in any way vitiate nor invalidate the Agreement neither shall it be grounds for the Service Provider to cease performing its obligations nor for TPC to terminate the engagement of the Service Provider under the Agreement and the Service Provider shall proceed with its obligations with all due diligence.

PART I - MISCELLANEOUS MATTERS

29. Hazardous Substances

29.1 The Service Provider shall ensure that any hazardous materials or equipment used or intended to be used in the provision of the Services are stored safely and in safe keeping in accordance with all Applicable Law, ensure that all such materials are properly and clearly labelled on their containers, promptly inform TPC of all such materials being used or stored and comply with any other reasonable requirement of TPC in respect of such materials and equipment.

30. Intellectual Property

30.1 The Service Provider acknowledges that it shall not acquire any right, title or interest in or to the Intellectual Property of TPC and that all Intellectual Property developed pursuant to this Agreement (other than Intellectual Property belonging to the Service Provider or any third party) shall vest exclusively in TPC, save to the extent that the Parties otherwise agree in writing.

30.2 Should the Service Provider acquire title to any Intellectual Property of TPC or which is developed pursuant to this Agreement by operation of law (thus, where TPC in effect pays for its development) such Intellectual Property (other than Intellectual Property belonging to the Service Provider or any third party) shall be deemed to have been assigned by the Service Provider to TPC.

31. Insurance

31.1 The Service Provider agree to, at their own costs, establish and maintain no less than the minimum types and levels of insurances that are required by Applicable Law. The Service Provider shall be responsible for insurances against operations and maintenance risks at its own cost if required by the Applicable law.

PART J - FINAL PROVISIONS

32. Addresses and notices

32.1 The Parties choose for the purposes of this Agreement the following addresses:

TPC: TransPeshawar (The Urban Mobility Company), KPUMA Building, Chamkani GT Road, Peshawar, Pakistan.

The Service Provider: [•].

32.2 Any legal process to be served on any of the Parties may be served on it at the physical address specified for it in clause 32.1 and it chooses that address for all purposes under this Agreement.

32.3 Any notice required by this Agreement to be given in writing shall, if given by telefax, email or cell phone-based short message service (“sms”), be regarded as having been given in writing for purposes of this Agreement, provided that the Parties may only utilise sms notification for operational authorisations in circumstances where operational action is required immediately and other changes to operations contemplated in this Agreement due to an emergency or such similar urgent operational matters.

32.4 Where operational authorisations are required, TPC will issue and log an authorisation number and any relevant notice in accordance with this clause 32 shall quote such authorisation number.

32.5 A notice to any of the Parties which is sent by registered post in a correctly addressed envelope to the address specified for it in clause 32.1 shall be deemed to have been received (unless the contrary is proved) within fourteen (14) days from the date it was posted, or which is delivered to the Party by hand at the physical address specified for it in clause 32.1, shall be deemed to have been received on the day of delivery, provided it was delivered to a responsible person during ordinary business hours.

32.6 Each notice by telefax to a Party at the telefax number specified for it in accordance with clause 32.1 shall be deemed to have been received (unless the contrary is proved) within four (4) hours of transmission if it is transmitted during normal business hours of the receiving Party or within four (4) hours of the beginning of the next Business Day after it is transmitted, if it is transmitted outside those business hours.

32.7 Any notice by email to a Party at the email addresses of its Authorised Representatives shall be deemed to have been received (unless the contrary is proved) within twenty (20) minutes of transmission if transmitted at any time during which the Services are ordinarily rendered and if transmitted outside such time, within ten (10) minutes of recommencement of the rendering of the Services.

32.8 Any notice by sms to a Party at the mobile numbers of its Authorised Representatives shall be deemed to have been received (unless the contrary is proved) within twenty (20) minutes of transmission if transmitted at any time during which the Services are ordinarily rendered and if transmitted outside such time, within twenty (20) minutes of recommencement of the rendering of the Services.

32.9 Any notice in accordance with this clause 32 given by sms shall be followed by a telefax or email confirming the contents and date of transmission of such sms.

32.10 Notwithstanding anything to the contrary in this clause 32, a notice or other communication actually received by any of the Parties (and for which written receipt has been obtained) shall be adequate notice or communication to it notwithstanding that the notice was not sent to or delivered at its chosen address.

32.11 Any Party may by a notice to the other Parties change its physical or postal address, telefax number, email address or mobile number for the purposes of this clause 32 to any other physical or postal address, telefax number, email address or mobile number provided that the change shall become effective on the seventh (7^{th}) day after the receipt of the notice.

33. Change in Law

33.1 The Operator acknowledges and agrees that it shall take full risk and responsibility for a Change in Law occurring. Notwithstanding the foregoing, if a Change in Law occurs or is imminent that affects the rights and obligations of the Operator under this Agreement, the Operator shall notify TPC within fourteen (14) days of the date of such Change in Law occurring or (if earlier) coming to the attention of the Operator.

34. Remedies

34.1 No remedy conferred by this Agreement is intended to be exclusive of any other remedy which is otherwise available at law, by statute or otherwise. Each remedy shall be cumulative and in addition to every other remedy given hereunder or now or hereafter existing at law, by statute or otherwise. The election of any one or more remedy by any of the Parties shall not constitute a waiver by such Party of the right to pursue any other remedy.

35. Confidentiality

35.1 Each Party shall at all times keep in confidence the Confidential Information of the other Party which it may acquire for the purposes of or in connection with this Agreement (whether prior to or after the Commencement Date) and shall not use or permit the use of such Confidential Information and shall procure that its employees shall not use the Confidential Information, for any other purpose and shall not disclose such Confidential Information to any third party.

35.2 Notwithstanding clause 35.1, a Party may disclose the Confidential Information of the other Party to such former Party's employees or Authorised Representatives to the extent that such employees or Authorised Representatives need to know the Confidential Information and shall ensure that such employees or Authorised Representatives are aware of and comply with, the confidentiality obligations contained in this clause 35.2.

35.3 Each Party shall take all such steps as may be reasonably necessary to prevent the Confidential Information of the other Party from falling into the hands of an unauthorised third party.

35.4 The Service Provider shall not make any comments to the media relating to this Agreement and any related matter nor shall it respond to any queries from the media without the prior written approval of TPC.

36. Severance

36.1 In the event that any provision of the Agreement is held by any judicial or other competent authority to be illegal, invalid or unenforceable that provision shall be severed to the extent necessary to make the Agreement enforceable, and it shall not affect or impair the validity, legality or enforceability of any of the other provisions of the Agreement.

37. No agency

37.1 No provision of this Agreement shall be construed as constituting an agency, partnership, or joint venture between the Parties and neither Party shall have any express or implied TPC to bind the other Party in any way or to represent the other Party unless specifically provided to the contrary in this Agreement, and, for the avoidance of doubt, this clause 37.1 shall not affect or otherwise derogate from the obligations and powers of the Service Provider in relation to handing over of the Equipment to other authorised parties as contemplated in this Agreement.

37.2 The Service Provider is an independent contractor performing the Agreement. The Service Provider is not an employee or agent of TPC.

38. Corruption and Fraud

38.1 The Service Provider warrants that in entering into the Agreement it has not committed any Prohibited Act.

38.2 In the event that the Service Provider is contacted by a Public Official requesting or suggesting that the Service Provider act in a manner which would constitute a Prohibited Act, the Service Provider shall immediately provide TPC in writing with full details of the request (including the identity of the Public Official making the request).

38.3 Without prejudice to clause 38.2, the Service Provider shall ensure that its staff undertaking activities in connection with the Agreement are subject to similar obligations to those set out in this clause 38 and the Service Provider shall enforce such obligations.

38.4 In the event that the Service Provider fails to comply with the requirements of this clause 38 TPC shall be entitled to terminate the Agreement pursuant to clause 27.1.

38.5 The Service Provider shall sign affidavit of Integrity Pact attached as Schedule 8 in Request for Proposal.

39. Entire Agreement

39.1 This Agreement constitutes the entire agreement between the Parties in relation to all matters contained herein, including all understandings, rights, responsibilities, duties and obligations and supersedes all prior arrangements, representations, communications, negotiations, agreements and contracts (whether written or oral) made between or entered into by the Parties with respect thereto prior to the Effective Date. None of the Parties shall have any claim or right of action arising from any undertaking, representation or warranty not included in this Agreement.

40. No stipulation for the benefit of a third person

40.1 Save as is expressly provided for in this Agreement, no provision of this Agreement constitutes a stipulation for the benefit of a third person which, if accepted by the person, would bind any Party in favour of that person.

41. No representations

41.1 A Party may not rely on any representation which allegedly induced that Party to enter into this Agreement, unless the representation is provided in this Agreement.

42. Amendment

42.1 Except as set out elsewhere in this Agreement, no modification, amendment, addendum or variation to the Agreement shall be effective or binding, unless it:

42.1.1 is made in writing; and

42.1.2 expressly sets out the modification, amendment, addendum or variation to the accordance with the Agreement; and

42.1.3 refers to the Agreement; and

42.1.4 is signed and dated by a representative of each Party.

43. Indulgences

43.1 The grant of any indulgence, extension of time or relaxation of any provision by a Party under this Agreement shall not constitute a waiver of any right by the grantor or prevent or adversely affect the exercise by the grantor of any existing or future right of the grantor.

44. General co-operation

44.1 The Parties shall co-operate with each other and shall each execute and deliver to the other Party such other instruments and documents and take such other actions as may be reasonably requested from time to time in order to carry out, evidence and confirm their rights and the intended purpose of this Agreement.

44.2 Each of the Parties undertake at all times to do all such things, perform all such acts and take all such steps within its power and control, as may be necessary for and incidental to the putting into effect or maintenance of the terms, conditions and import of this Agreement and ensuring that the Services are rendered consistently at the highest possible standard expected by TPC.

44.3 Each Party agrees to provide all information reasonably requested by the other in the exercise of their respective rights and performance of their obligations under this Agreement, subject to the confidentiality provisions of clause 35 of this Agreement.

45. Governing law

45.1 This Agreement is to be governed, interpreted and construed in accordance with the laws of the Islamic Republic of Pakistan.

46. Language

46.1 Unless expressly notified in advance by TPC, the primary language of the Agreement shall be English. All documents and communications issued between the Parties shall be in English. Unless expressly notified in advance by TPC, all minutes of meetings shall be issued in English.

47. Independent advice

47.1 Each of the Parties hereby respectively agrees and acknowledges that:

47.1.1 it has been free to secure independent legal advice as to the nature and effect of each provision of this Agreement and that it has either taken such independent legal advice or has dispensed with the necessity of doing so; and

47.1.2 each provision of this Agreement (and each provision of the Annexes) is fair and reasonable in all the circumstances and is part of the overall intention of the Parties in connection with this Agreement.

48. Good faith

48.1 The Parties shall, at all times, act in good faith towards each other and shall not bring the other Party into disrepute.

49. Survival of rights, duties and obligations

49.1 The Surviving Provisions will survive termination or completion of the Agreement.

49.2 In the event that the Agreement is terminated or completed, neither Party shall be liable to the other Party except:

49.2.1 under the Surviving Provisions; or

49.2.2 in respect of any breach of the Agreement occurring before such termination or completion; or

49.2.3 any rights or liabilities between the Parties that were pre-existing as at the date of termination or completion.

50. Assignment

50.1 The Service Provider shall not cede, assign, delegate or transfer any of its rights or obligations under the Agreement, or any part of it, or any benefit or interest therein, to any third party or Entity without the prior written consent of TPC.

50.2 Notwithstanding anything to the contrary stated in this Agreement, TPC shall be entitled, without requiring the consent of the Service Provider, to cede, assign, delegate or transfer any rights and/or obligations under this Agreement to any third party.

51. Waiver

51.1 Subject to clause 51.2, no relaxation, forbearance or delay by a Party in enforcing the Agreement will prejudice, affect or restrict the rights, responsibilities, obligations, powers or remedies of that Party nor shall any waiver by either Party of any such rights, responsibilities, obligations, powers or remedies, or of any breach of the Agreement, be deemed to be a waiver of any other right, responsibility, obligation, power or remedy, or of any later or continuing breach of, the Agreement.

51.2 Any waiver of a Party's rights, responsibilities, obligations, power or remedies arising out of, under or in connection with the Agreement shall be in writing, dated and signed by the representative of the Party granting such waiver, and shall specify the right, responsibility, obligation, power or remedy and the extent to which it is being waived. No waiver of a breach of a term of the Agreement operates as a waiver of any other breach of that term, or of a breach of any other term, of the Agreement.

52. Costs

52.1 Any costs, including all legal costs of an attorney and own client basis and taxes, incurred by a Party arising out of or in connection with a breach by another Party shall be borne by the Party in breach.

Signed on ……. 2025

Witnesses

for TransPeshawar (The Urban Mobility Company)

……

……

duly authorised and warranting such TPC

Name: .....

Position: _____

Signed on …….. 2025

Witnesses

for [Service Provider Company]

.....

.....

duly authorised and warranting such [ ]

Name: .....

Position: _____

ANNEX A
DEFINITIONS AND INTERPRETATION

1. Definitions

1.1 In the Agreement, the following words and expressions shall have the meanings set out below:

1.1.1 "**Abandon**" means wholly or substantially cease to carry out the Services for ten (10) consecutive days or during thirty (30) days (whether consecutive or not) in any year, except when relieved of the obligation to do so by the express provisions of this Agreement;

1.1.2 "**Agreement**" means this agreement as amended from time to time and including the Annexes;

1.1.3 **"Allied Facilities"** means subsystems or subcomponent or other equipment or services which are required to operate Equipment for its intended purposes;

1.1.4 "**Annexes**" means the annexes attached to this Agreement;

1.1.5 "**Applicable Law**" means any constitution, statute, ordinance, treaty, decree, proclamation, rules, regulations or subordinated legislation or other legislative measure, as amended from time to time, including all national and provincial statutes and legislation and all municipal by-laws, as well as the common law and customary law and any judgment, decision, order or rule of any court or tribunal with relevant jurisdiction and any decision made by judicial or administrative bodies in accordance with any of the aforegoing;

1.1.6 "**Authorised Representatives**" means persons authorised in writing by TPC and the Service Provider respectively, as contemplated in accordance with clause 22;

1.1.7 "**BRT System**" means the bus rapid transit system in Peshawar known as Peshawar Sustainable BRT.

1.1.8 "**Business Day**" means any day other than weekend or public holiday in Pakistan as notified by Government of KPK;

1.1.9 "**Commencement Date**" means the date on which the Services shall commence as notified by TPC by way of a Service Notice referred to in clause 2.2;

1.1.10 "**Contract Price**" The Total Proposal Price quoted by the Service Provider in Letter of Financial Proposal for complete scope of services for the Term of the contract including sales tax on services and price adjustment made in accordance with the contract.

1.1.11 "**Confidential Information**" means all information, without limitation, of whatsoever nature:

(a) relating to the Disclosing Party's business, operations, processes, drawings, sketches, plans, models, product information, know-how, market opportunities, customers and business affairs;

(b) relating to the relationship of the Disclosing Party with its customers and suppliers; or

(c) relating to the contents of this Agreement and any other information received pursuant to this Agreement,

but excludes information which:

(a) constitutes an Operational Data; or

(b) is required to be disclosed under any law or regulation, or by any Regulatory Body, including any stock exchange on which a Receiving Party may be listed, provided that the Receiving Party in question shall first consult with the Disclosing Party before making any such disclosure, statement or announcement; or

(c) is in the public domain or enters into the public domain in any way, provided that the entry of such information into the public domain did not entail a breach of this Agreement by the Receiving Party; or

(d) the Receiving Party can show it was within its possession or knowledge, such information being in its use or having been recorded in its files, computers or other recording media, prior to receipt thereof from the Disclosing Party and which information was not previously acquired by the Receiving Party under any obligations of confidence or unlawfully; or

(e) is disclosed by the Receiving Party with the prior written approval of the Disclosing Party; or

(f) was disclosed by the Disclosing Party to a third party without restriction on disclosure or use, including without limitation, by way of a patent specification; or

(g) is hereafter disclosed or made available in good faith to the Receiving Party from a source other than the Disclosing Party, without breach by the Receiving Party of any obligation of confidentiality or non-use owed to the Disclosing Party or without breach by such other source who, to the knowledge of the Disclosing Party, is not subject to an obligation of confidentiality or non-use owed to the Disclosing Party; or

(h) is developed independently by the Receiving Party without reference to the Confidential Information;

1.1.12 "**Disclosing Party**" means the Party disclosing Confidential Information to the Receiving Party;

1.1.13 "**Effective Date**" means when this Agreement has been signed by each Party, the latest of the dates upon which this Agreement was signed by any Party;

1.1.14 "**Employees**" means the employees of the Service Provider, or of any subcontractor contracted by the Service Provider to perform a part of the Service and include Technical Staff who maintain and operate equipment;

1.1.15 "**Encumbrance**" means:

(i) any mortgage, pledge, lien, assignment or cession conferring security, hypothecation, security interest, preferential right or trust arrangement or other encumbrance securing any obligation of any person or any other charge (whether equitable or otherwise) of whatsoever nature or howsoever described; or

(j) any arrangement under which money or claims to, or for the benefit of, a bank or other account may be applied, set off or made subject to a combination of accounts so as to effect discharge of any sum owed or payable to any person; or

(k) any other type of preferential agreement or arrangement (including any title transfer and retention arrangement), the effect of which is the creation of a security interest;

1.1.16 "**Entity**" means association, business, close corporation, company, concern, enterprise, joint venture, trust, undertaking, voluntary association, body corporate and any similar entity;

1.1.17 "**Event of Force Majeure**" means an act of God or public enemy, fire, explosion, earthquake, perils of the sea, flood, storm or other adverse weather conditions, war declared or undeclared, act of terrorism, civil war, revolution, civil commotion or other civil disorder, sabotage, riot, blockade, embargo, strikes (excluding strikes by Service Provider staff), lock-outs or other labour disputes, sanctions, epidemics, act of any Government, compliance with law, regulations or lawful demands of any Government or Governmental agency;

1.1.18 "**Equipment Sale Agreement**" means the agreement of sale and/or supply entered into, or to be entered into, between Peshawar Development Authority, on the one hand, and an Equipment Supplier/manufacturer/Civil Work Contractor, on the other hand, in relation to Equipment;

1.1.19 "**Equipment Supplier**" means such entity which sells or otherwise supplies Equipment to TPC or supplied to Peshawar Development Authority (PDA) in accordance with an Equipment Sale Agreement;

1.1.20 "**Financial Year**" means, at any time, the financial year of the Service Provider starting on January and ending on 31 December;

1.1.21 "**Intellectual Property**" means any and all intellectual property rights of any nature anywhere in the world whether registered, registerable or otherwise, including patents, utility models, trademarks, registered designs and domain names, applications for any of the foregoing, trade or business names, goodwill, copyright and rights in the nature of copyright, design rights, rights in databases, moral rights, know-how, trade secrets and any other intellectual property rights which subsist in computer software, computer programs, websites, documents, information, techniques, business methods, drawings, logos, instruction manuals, lists and procedures and particulars of customers, marketing methods and procedures and advertising literature, including the "look and feel" of any websites;

1.1.22 "**Invoice**" means a valid tax invoice as contemplated in clause 4;

1.1.23 "**KPI**" means the key performance indicator;

1.1.24 "**Liquidated Damages**" means the amounts to be deducted from the monthly payments for the Service Provider pursuant to particular service level failures

as set out in the Schedule of Requirements and in accordance with clause 24 or otherwise paid by the Service Provider to TPC;

1.1.25 "**Month**" or "**Monthly**" means a calendar month;

1.1.26 "**Operating Licence**" means any licence, consent or permit required by the Service Provider to enable it to provide the Services under this Agreement;

1.1.27 "**Operational Data**" means any operational data defined as such in the SIR or identified as "Operational Data" by TPC, which shall include, among others, location of Equipment, running hours, and which will be available to the Service Provider, Other Service Providers and the System Control Service Provider;

1.1.28 "**Schedule of Requirements**" means the schedule annexed hereto explaining scope of services and also called Operational Specification Schedule;

1.1.29 "**Other Contractors**" means collectively, the System Control Service Provider or any subcontractor of the System Control Service Provider (or any member of the consortium making up the System Control Service Provider) and/or Service Provider of PSDs, Generator, Elevator, Escalator and Allied Services (excluding Other Service Providers) appointed by TPC in connection with the BRT System;

1.1.30 "**Other Service Provider**" means any other Equipment Service Provider appointed by PDA to install Equipment or appointed by TPC to operate public transport services as a part of the BRT System or Service Provider of TPC;

1.1.31 **"Other System"** means system other than VRF, FFS, FAS and Sewerage Treatment Plant mentioned in Operation Specification Schedule

1.1.32 "**Party**" means a party to this Agreement;

1.1.33 "**Payment Calculation Schedule**" means the payment calculation schedule detailed in **PC**;

1.1.34 "**Performance Guarantee**" means the unconditional, irrevocable on-demand performance guarantee in the specimen form attached as explained in **PC**;

1.1.35 "**PKR**" means Pakistani rupee;

1.1.36 "**Prohibited Act**" means:

(a) offering, giving or agreeing to give to a Public Official a gift or consideration of any kind as an inducement or reward for:

(i) doing or not doing (or for having done or not having done) any act; or

(ii) showing or not showing (or for having shown or not shown) favour or disfavour to any person,

in relation to the award or performance of the Agreement or any other agreement with TPC; or

(b) entering into an agreement for which commission has been paid or has been agreed to be paid by the Service Provider or on its behalf, or to its knowledge, unless before the relevant agreement is entered into, particulars of any such commission and of the terms of any such agreement for the payment thereof have been disclosed in writing to TPC; or

(c) committing any offence under the Applicable Law creating offences in respect of fraudulent acts; or

(d) defrauding, attempting to defraud or conspiring to defraud TPC;

1.1.37 "**Project**" means the Peshawar Sustainable BRT Corridor System project carried out by TPC;

1.1.38 "**Protocol**" means a protocol and/or a standard operating procedure issued from time to time by TPC indicating how, among other things, Services are to be rendered, the manner in which the Service Provider and Other Service Providers should work together, the exact procedures to be followed in order to comply with service level requirements set out in the Schedule of Requirements and any other ancillary matters;

1.1.39 "**Public Official**" means an official or employee of a government owned or controlled enterprise or any Regulatory Body and shall include any individual defined as a public official in an Applicable Law;

1.1.40 "**Quarter**" or "**Quarterly**" means a consecutive period of three (3) Months commencing from the start of a Financial Year or calendar year, as the case may be;

1.1.41 "**Receiving Party**" means the Party receiving Confidential Information from the Disclosing Party;

1.1.42 "**Regulatory Body**" means any governmental, semi-governmental, administrative, fiscal or judicial ministry, department, commission, authority, tribunal, agency, municipality or body, and shall include the provider of electricity, gas, water, wastewater, telecoms and other such public services, and anybody with a regulatory function under the Applicable Law;

1.1.43 "**Service Notice**" means a notice given to the Service Provider by TPC in accordance with this Agreement;

1.1.44 "**Surviving Provisions**" means clauses 1 (Preliminary Matters); 27 (*Breach and Termination*); 28 (*Dispute resolution*); 30 (*Intellectual Property*); 32 - 52 (*Part J - Final Provisions*) and this Annex A;

1.1.45 "**Termination Date**" means the fifth (5^{th}) anniversary of the Commencement Date or the date on which an earlier termination pursuant to the terms of the Agreement takes effect;

1.1.46 "**Uniform**" means the uniform to be worn by those Employees of the Service Provider required to fulfil their duties in view of members of the public, as

prescribed in the Schedule of Requirements and includes the name tag issued to each Employee by Service Provider;

1.1.47 "**Warranty**" means the warranties and undertakings given to TPC by the Service Provider, set out in clause 25;

1.1.48 "**Week**" or "**Weekly**" means the period commencing at 00h00 on Monday and ending at 24h00 on Sunday each calendar week;

2. Interpretation

2.1 In the Agreement:

2.1.1 in the event of conflict between the Annexes and the provisions of this Agreement (excluding the Annexes), the provisions of the Agreement shall prevail;

2.1.2 any definition in this Agreement, shall bear the same meaning and apply throughout this Agreement including Annexes hereto, unless otherwise stated or inconsistent with the context in which it appears;

2.1.3 the singular includes the plural and vice versa;

2.1.4 a reference to a statutory provision includes any subordinate legislation made from time to time under that provision and includes those provisions as amended, consolidated, re-enacted or replaced from time to time;

2.1.5 a reference to a document includes the document as modified from time to time and any document replacing it, in each case in the manner permitted by the Agreement;

2.1.6 a reference to a gender includes the other genders;

2.1.7 a reference to any government agency or body, if that agency or body ceases to exist or is reconstituted, renamed or replaced or has its powers or functions removed ("defunct body"), means the agency or body that performs most closely the functions of the defunct body;

2.1.8 a reference to an "agent" shall mean any person with a contractual relationship with a Party and carrying out activities or obligations on behalf of that Party;

2.1.9 a reference to a "subsidiary" shall be a reference to a subsidiary as defined in the Companies Act, 2017;

2.1.10 references in this Agreement to "clauses" or to "Annexes", are to clauses of and Annexes to this Agreement;

2.1.11 references to notices or requests made or received by any of the Parties shall, unless expressly provided otherwise in this Agreement, refer to notices or requests in writing;

2.1.12 references to "agree" or "agreed" shall require the agreement to be recorded in writing and signed by the authorised representatives of the Parties;

2.1.13 no rule of construction shall be applied to the disadvantage of a Party to this Agreement because that Party was responsible for or participated in the preparation of this Agreement or any part of it;

2.1.14 unless otherwise provided, any number of days prescribed shall be determined by excluding the first and including the last day or, where the last day falls on a day that is not a Business Day, the next succeeding Business Day;

2.1.15 references to day/s, month/s or year/s shall be construed as Gregorian calendar day/s, month/s or year/s, as the case may be;

2.1.16 if a definition imposes substantive rights and obligations on a Party, such rights and obligations shall be given effect to and shall be enforceable, notwithstanding that they are contained in a definition;

2.1.17 a reference to a Party includes that Party's successors and permitted assigns;

2.1.18 the use of the word "including" followed by a specific example/s shall not be construed as limiting the meaning of the general wording preceding it and it shall be construed as if it were followed by "without being limited to".

PARTICULAR CONDITION OF THE CONTRACT

Definitions	"**Equipment**" means the Equipment purchased by Peshawar Development (procured, furnished, installed and commissioned) in accordance with the Equipment Sale Agreement(s), for purposes of rendering the Services and specified in the Schedule of Requirements; and Equipment includes all equipment and allied services required to provide the Services as contemplated in this Agreement (and for the avoidance of doubt shall include the VRF.. **"Sewerage Treatment Plant or STP"** means assembly collection and distribution system, inlet chamber, screen chamber, equalization tank, drain channel, aeration tank, secondary clarifier, chlorine contact tank, sand filter, pumps, submersible pumps, chlorine pump, sludge pump, blowers, electric motors, pressure gauges, valves, filter water tank, shed, control panels/ DBs, sludge tank, product tank, civil tanks and manholes etc installed outside KPUMA building and allied components which are required for its intended use and operations; "**Variable Refrigerant Flow System or VRF**" means complete assembly, indoor ceiling mounted cassette units, outdoor condensing units (CU), Compressors, Sensors, Control panels/ DBs, breakers, Condenser fans, Drain Pumps, Copper pipes, Insulation, Software and Fan coil units, filters, Remotes, electrical wirings/ cables, communication cables, cards, ducting system installed at KPUMA building and allied components which are required for its intended use and operations.
2.2.2	The Term of Agreement is three (03) years, unless otherwise terminated earlier in accordance with terms and conditions of the contract and may be extended for other term (s) with mutual consent of the parties.
3.1	The performance guarantee shall be ten (10%) of Total Proposal Price quoted by the Service Provider in Letter of Financial Proposal for complete scope of services for the Term of the contract including sales tax on services. Performance Security shall be in one of the following forms: i. Bank Guarantee from a schedule bank of Pakistan in the Form as provided under **Section 8** of the RFP; or ii. In shape of CDR/DD from a schedule bank of Pakistan in the name of CEO TransPeshawar.
3.2	Ten (10%) of Total Proposal Price quoted by the Service Provider in Letter of Financial Proposal for complete scope of services for the Term of the contract.
4.1	Payment Calculation Schedule attached as **Appendix-I** to Particular Condition of the Contract
6.2	The handover of Equipment is within 7 days from the Date of Commencement.
19.1	The Reserve Fund shall be deducted.
19.2	The maximum amount of Reserve Fund is PKR. 5 million.

Appendix-I to Particular Condition of the Contract

PAYMENT CALCULATION SCHEDULE

1. The TPC shall pay the Service Provider according to the manner specified below.

For each Month (m) following Services Commencement Notice, the Service Provider shall be entitled to a payment (**Monthly Payment**) calculated in accordance with the following formula:

Monthly Payment $_m$ = (**Fixed Fee) (1- Performance Payout Percentage x Performance Deduction Percentage** $_m$**)**

Where:

Fixed Fee means the monthly fee/bid value.

Performance Payout Percentage means ten percent (10%).

Performance Deduction Percentage $_m$ means the Performance Deduction Percentage applicable to the Service Provider for Month (m).

The Service Provider shall raise an invoice to the TPC for an amount equivalent to the Monthly Payment for Month (m) (plus any applicable Sales Tax on Services). The Monthly Payment for Month (m) shall be made by the TPC within twenty (20) Business Days of receiving such copy. TPC will notify Performance Deduction Percentage for Month (m) in accordance with the provisions of Schedule of Requirement to the Service Provider for deduction from the Monthly payment in first 10 Business days of the Month. Service Provider will have right to defend the Performance Deduction Percentage to TPC. Monthly payment will be paid in local currency only.

2. Deduction for non-service

i. STP system which is non-operated due to whatsoever reason continuously for more than one-month period will be considered as non-service. This will not constitute as Liquidated Damages and deduction per month will be made as per following details:

Non-Service deduction per month for STP = PKR: 15% of the monthly invoice

ii. No non-service deduction per month will be applied or liquidated damages will be imposed if any system partially or fully (other than above) were not provisioned temporarily by TPC for operation and maintenance and installation / commissioning is not scope of service provider.

Section 8 - Contract Forms

This section contains forms which, once completed, will form part of the Contract. The forms for Performance Security, when required, shall only be completed by the successful Service Provider after contract award.

Table of Forms

Notification of Award

[*on letterhead paper of the Procuring Entity*]

[*date*]

To: [*Name and address of Service Provider*]

Subject: [*Notification of Award Contract No.*]

This is to notify you that your Proposal dated ---------- for [*name of the contract and identification number, as given in the Data Sheet*] for a Contract Price of [*amount in words and figures and name of currency*] is hereby accepted by TransPeshawar (The Urban Mobility Company) as per breakup provided in the proposal on terms and conditions mentioned in the Agreement.

2. Further, as per Clause --- of the Agreement, the Service Provider shall maintain with TransPeshawar a valid and enforceable Performance Security to the amount of -------% of contract price in shape and form prescribe in the Agreement.

3. You are therefore, required to deliver to TransPeshawar, within 14 days of issuance of this Notification of Award, the duly executed Performance Security to the amount of ------% of the total contract price i.e., PKR -------. In case of Bank Guarantee it shall have for a term of one (01) year renewable.

Authorized Signature: .....

Name and Title of Signatory: .....

Name of Procuring Entity: .....

Attachment: Contract Agreement

Performance Security

[*Bank's name, and address of issuing branch or office*]

(To be printed on Judicial Stamp Paper of Prescribed Fee and duly notarized)

This Performance Guarantee No. <Insert No.> is made on <Insert date> 2025 (the "Guarantee")
Ref: Request for Proposal for (insert title of the procurement) advertised on <Insert date> and Notification/Letter of Award <Insert date>

Beneficiary: TRANSPESHAWAR (THE URBAN MOBILITY COMPANY), a company incorporated with Security Exchange Commission of Pakistan in February 09, 2017, with company registration No.0105691 and whose registered address is at TransPeshawar Building, Second Floor, Near Chamkani BRT Depot Peshawar, KPK, Pakistan.

1. GUARANTEE

1.1 We <Insert name of Bank> Bank (the "Guarantor") have been informed that <Insert name of Winning Bidder> has been declared Winning bidder in reference tender.

1.2 The Winner bidder, <Insert name of the company> hereinafter called (the "Service Provider") has to provide services for (insert title of the procurement). The <Insert name of the company> is obligated to sign agreement for (insert title of the procurement) (the "Agreement") with TPC relating to the (insert title of the procurement) as part of the Agreement.

1.3 The Guarantor hereby irrevocably and unconditionally undertakes to pay to TPC on its first demand for payment, without regard to any objections or defenses to TPC's demand from the Service Provider or any other person, an amount or amounts not exceeding in total. PKR xxxx (xxxxx Pakistani Rupees).

2. **TIME FOR PAYMENT**

2.1 Any amount demanded by TPC shall be paid by Guarantor to TPC within three (03) calendar days of receipt of the TPC's demand for payment stating that the Service Provider is in breach of its obligations arising under, out of or in connection with the Agreement and the Guarantor shall have neither the right nor the duty or obligation to challenge the accuracy or sufficiency of such statement or the amount specified in the demand.

3. VALIDITY OF GUARANTEE

3.1 This Guarantee shall come into force on the date hereof and shall remain valid until <insert date> whereupon this Guarantee shall expire and be returned to the Guarantor.

4. PAYMENT FREE OF DEDUCTIONS AND WITHHOLDINGS

4.1 Any payment under this Guarantee shall be made free and clear of, and without deduction for or on account of, any present or future taxes, levies, imposts, duties, charges, fees, deductions or withholdings of any nature whatsoever and by whomsoever imposed.

5. Notices and Demands for Payment

5.1 Any demand for payment made under this Guarantee shall be delivered by hand or registered courier and be deemed to be duly made at the time of, and on the date of, delivery to the contact details of the addressee stated in Schedule (the “Contact Details).

5.2 Any notice given under this Guarantee shall be deemed to be duly given:

i. in the case of email:

a) at the time of receipt by the sender of an email acknowledgement from the intended addressee’s information system showing that the email has been delivered to the email address of that addressee; or
b) if no email acknowledgement is received, then at the time the email enters an information system which is under the control of the intended addressee (and the addressee shall make available at the request of the sender, evidence of such time); and

ii. in the case of delivery by hand or registered courier, at the time of and on the date of delivery.

5.3 Any notice or demand given or made by TPC or the Guarantor relating to this Guarantee shall be in English.

EXECUTED for and on behalf of
[GUARANTOR]
……
(signed) ……
Name

Witnesses:

SCHEDULE TO THE PERFORMANCE GUARANTEE

Contact Details
For TPC:
TransPeshawar Company (The Urban Mobility Company)
TransPeshawar Building, First Floor Near Chamkani Depot, Peshawar
KPK, Pakistan
Tel: 0092-91-xxxxxxxxxx
Email: info@transpeshawar.pk
For the Attention of Chief Executive Officer, TransPeshawar (The Urban Mobility Company)

For the Guarantor:
<Insert Guarantor’s Name>
<Address line1>
<Address line2>
<Address line3>
Tel: <Insert Guarantor’s telephone number>
Email:<Insert Guarantor’s email address>
For the Attention of <_____>