



THE URBAN DEVELOPMENT CORPORATION OF TRINIDAD AND TOBAGO LIMITED (UDeCOTT)

REQUEST FOR PROPOSALS PACKAGE 1- UPGRADE OF THE AIR CONDITIONING SYSTEM AT THE NATIONAL ARCHIVES OF TRINIDAD AND TOBAGO

The Urban Development Corporation of Trinidad and Tobago Limited (UDeCOTT) invites suitably qualified and experienced entities to submit proposals for **Package 1- Upgrade of the Air Conditioning System at the National Archives of Trinidad and Tobago**.

Proponents are advised that in light of the proclamation of the Public Procurement and Disposal of Public Property Act, 2015 (as amended) on April 26, 2023 and in keeping with the requirements of the Office of Procurement Regulation (OPR), suppliers of goods, works and services, interested in conducting business with UDeCOTT must be registered on the OPR Procurement Depository. The relevant guidelines for registration can be found on the OPR website via <https://opr.tt.org/procurement-depository/>. Therefore, UDeCOTT is inviting suitably qualified suppliers to register and apply for pre-qualification in the OPR's Procurement Depository under the following category:

Line of Business Code: 72151207-Heating and cooling and air conditioning HVAC installation and maintenance service

The tender process for this project will be conducted via UDeCOTT's E-Tender System. The RFP will be available on **March 15, 2024**. To register or access the E-Tender System go to <https://udecott.etenderworld.tt/login.php>.

Should you encounter any technical difficulties in accessing or using the system, you are to immediately contact our IT Helpdesk at 225-4004 ext. 206 or etenderhelpdesk@udecott.com, carbon copying the Office of the Chief Procurement Officer at tenders@udecott.com.

The successful contractor shall be chosen using a competitive selection process as set out in the Request for Proposal (RFP).

INFORMATION SESSION

An **Online Information Session** will be held via **Microsoft Teams** on **Friday March 22, 2024 at 10:00 a.m.** This will be followed by a **Site Visit** on **Friday March 22, 2024 at 2:30 p.m.**

Participants are required to confirm the **names and preferred email addresses** of their representatives who will be in attendance, via email to tenders@udecott.com.

SUBMISSION

Proponents are informed that submissions **must include ALL the documents as set forth in the RFP** and must be in accordance with the terms therein.

Failure to do so will result in disqualification.

The **deadline date for submissions is April 12, 2024 (AST)**.

Additional information may be requested through email forwarded to the attention of **The Office of the Chief Procurement Officer** at tenders@udecott.com.

UDeCOTT reserves the right to reject any or all proposals for failure to comply with any mandatory requirements stated in the RFP.

THE OFFICE OF THE CHIEF PROCUREMENT OFFICER

FREQUENTLY ASKED QUESTIONS (FAQs)

PACKAGE 1- UPGRADE OF THE AIR CONDITIONING SYSTEM AT THE NATIONAL ARCHIVES OF TRINIDAD AND TOBAGO

What is the purpose of this Request for Proposal?

The purpose of this Request for Proposal is to identify and contract a suitably qualified and experienced Contractor to undertake the Project.

Are Proponents required to purchase the RFP package?

There will be no cost for the RFP package.

When will the RFP be available?

The RFP will be available on UDeCOTT's E-Tender Platform on March 15, 2024.

Are interested parties required to register with the Office of the Procurement Regulator?

Proponents are advised that in light of the proclamation of the Public Procurement and Disposal of Public Property Act, 2015, all proponent interested in conducting business with UDeCOTT must be registered on the OPR Procurement Depository. The relevant guidelines for registration can be found on the OPR website via <https://oprtd.org/procurement-depository/>. Proponents are required to apply for pre-qualification in the OPR's Procurement Depository under the following category:

Line of Business Code: 72151207-Heating and cooling and air conditioning HVAC installation and maintenance service

What is the Location of the site?

The Project Site is the National Archives of Trinidad and Tobago, 105 St. Vincent Street Port of Spain Trinidad and Tobago

Is it mandatory to attend the site visit and online information session?

Attendance to the site visit and online information session is **not** mandatory. It does however provide a greater understanding of the requirements of the RFP.

Are there any eligibility requirements for this Procurement Process?

In order to be eligible for evaluation and/or consideration to provide the Works, Proponents must be able to demonstrate the following:

- Incorporation or otherwise registered to do business in Trinidad and Tobago as evidenced by the Certificate of Incorporation or Registration (as applicable);
- Submission of Statutory Clearance/Compliance Certificates, (for companies incorporated/registered in Trinidad and Tobago) valid as at the tender submission deadline, namely;
 - VAT Clearance Certificate
 - BIR Clearance Certificate
 - NIS Certificate of Compliance
 - Bid Bond valued at One Hundred Thousand Dollars (\$100,000.00)

Are Proponents required to submit a Bid Bond with their Proposals?

Yes, a Bid Bond valued at **One Hundred Thousand Dollars (\$100,000.00)**, is required for this RFP.

Proponents are to note that the responses provided as guidance to these Frequently Asked Questions does not relieve the Proponent of its obligation and responsibility to fulfil and comply with all requirements of the Request for Proposals.

EMPLOYER'S REQUIREMENTS PACKAGE 1 – UPGRADE OF AIR CONDITIONING SYSTEM AT THE NATIONAL ARCHIVES OF TRINIDAD AND TOBAGO

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BACKGROUND

The National Archives of Trinidad and Tobago (“NATT”) is responsible for acquiring, preserving and providing public access to the documentary heritage of the nation (in all formats); and guiding in the management of all government records throughout the public service.

The NATT was established in 1960 and functions as the main repository of over two hundred years of the country’s public and historical records. These records which comprise of documents, bound volumes, microfilm, photographs, digit, audio and video recordings are stored with special climatic conditions for long-term preservation and are currently kept in record storage vaults as well as the main server room which stores the Digital Repository of digitized and born-digital records in Building B located at 105 St. Vincent Street, Port of Spain. On the premises is also the Conservation Building C, which houses the conservation and reprographics labs and other ancillary rooms.

The main Repository Building (Building B), which houses the Public Search Room and Records Storage vaults, was constructed in 2000 and the Conservation Building (Building C) in 2015. Due to an aging system which is nearing the end of its service life, and has been subjected to breakdowns and costly repairs, there is a need to upgrade the current air conditioning system so that it is purpose-built for an archival institution.

OBJECTIVE

The purpose of this Employer’s Requirements is to provide a detailed description of the User to guide Proponents in the preparation of their responses to the Request for Proposal (RFP) for the provision of PACKAGE 1 – UPGRADE OF THE AIR CONDITIONING SYSTEM OF THE NATIONAL ARCHIVES OF TRINIDAD AND TOBAGO (herein referred to as “Project”).

This project shall ensure the air-conditioning system at the NATT is tailored to meet the requisite requirements for the smooth and efficient operations and the long-term preservation of the nation’s valuable archival records (analog and digital) in a climate-

controlled and pollutant free stable environment available 24/7. The Air Conditioning System will be integrated into a Building Management System, inclusive of fire detection and suppression, security and temperature and humidity monitoring.

This Employer's Requirements shall be read in conjunction with the following Appendices and shall be used as a guide by the Proponents in developing their proposals:

	Appendix 1	-	TECHNICAL SPECIFICATION AND DRAWINGS
	Appendix 2	-	BILL OF QUANTITIES

The Project shall be completed within **six (6) months** and is inclusive of, but not limited to: site evaluation, procurement, manufacturing, execution/installation, and project closeout (e.g. testing & commissioning, training, demobilization, etc.), to be followed by a 12-month Defects Notification Period.

The Project shall commence upon issuance of Letter of Award and confirmation of a Commencement Date.

THE SITE

The National Archives of Trinidad and Tobago is located at 105 St. Vincent Street, Port of Spain as depicted in the photo below:



GENERAL NOTES

- a) The General Contractor shall execute i.e. procure, install, test, and commission, the works as per the design drawings and requirements provided in this RFP for the successful completion of the project as per the intent use as mentioned in the objective above.
- b) Duration of each service/works is in calendar days, inclusive of Saturdays, Sundays and public holidays.
- c) Units of system shall be metric, unless otherwise directed by the Client.
- d) All sketches, drawings, calculations, materials list, bills of quantities, methodology, reports, and project schedules shall be submitted in both hard copy and digital format (electronic copy) via USB flash drive or any portable external storage device.

Submittals	Hard Copy	Electronic Copy
Sketches and Shop Drawings	minimum acceptable sheet size is 11" x 17"	AutoCAD 2010 (or above) and PDF
Project Schedules	minimum acceptable sheet size is 11" x 17"	MS Project 2010 (or above) and PDF
Reports, analysis, charts	minimum acceptable sheet size is 8.5" x 11" or as appropriate (colour printed on one side only)	MS Word or/and MS Excel and PDF
Photography	Should be included in the report or as appropriate	JPEG and PDF

Submittals	Hard Copy	Electronic Copy
	(colour printed on one side only)	
Presentation	As appropriate (print on one side only)	MS PowerPoint and PDF

- e) The General Contractor shall execute the works in accordance with, and in compliance with, the guidelines, regulations and statutory requirements of all Governmental Statutory and Regulatory Agencies, as well as the international codes and standards, which include the following at a minimum:
- a) Trinidad and Tobago Electricity Commission (T&TEC)
 - b) Local Health Authorities
 - c) Occupational Safety and Health Authority (OSHA)
 - d) Trinidad and Tobago Fire Services Authority
 - e) Trinidad and Tobago Bureau of Standards
 - f) International Archival Storage Standards e.g. NARA 1571, Archival Storage Standards and ISO 11799: Information and Documentation Storage Requirements for Archival and Library Materials
 - g) Mechanical Engineering Codes & Standards (*whenever applicable*)
 - ASME B16 Standards of Pipes and Fittings
 - ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
 - ICC IC 2007 Supplement to the International Codes
 - ICC IFC 2006 International Fire Code
 - ICC IECC 2006 International Energy Conservation Code
 - h) Electrical Engineering Designs (*whenever applicable*)

TTS-171	Trinidad and Tobago Electrical Wiring Code
ANSI C37.13	Low Voltage AC Breakers
ANSI C37.14	Low Voltage DC Breakers
ANSI C37.16	Low Voltage Breakers and AC Protectors
ANSI C80.3	Electrical Metallic Tubing, Zinc-Coated
NEC	2008 National Electrical Code
NFPA 70	National Electric Code
NFPA 72	National Fire Alarm Code
NFPA 780	Standard for the Installation of Lightning Protection Systems
UL 96A	Lightning Protection
IEEE Std 1100	Powering and Grounding Electronic Equipment

STAGES AND DURATION

SERVICE STAGE	DESCRIPTION OF SERVICES	DURATION	MINIMUM DELIVERABLES
STAGE 1	Site Evaluation, Preliminary Works	- One (1) week upon issuance of Letter of Award and Commencement Letter	<ul style="list-style-type: none"> - Bonds & Insurances (if applicable) - Work Programme Level 4 (min) - QA/QC & HSSE Plan - Cash Flow Projection - Manpower & Equipment Requirements
STAGE 2	Procurement (Manufacturing and Shipping)	<ul style="list-style-type: none"> - Four (4) months is allocated for this stage: <ul style="list-style-type: none"> ▪ One (1) month for submission and approval of all Contractor-Supplied Equipment and Materials (to commence on receipt of Letter of Award); ▪ Three (3) months for procurement, manufacturing, shipping & delivery, Custom clearances and inspection 	<ul style="list-style-type: none"> - Procurement Schedule - Data Sheet / Brochures / Material or Equipment Specification - Evidence of Procurement / Bill of Lading
STAGE 3	Execution Stage (Installation)	- Two (2) months is allocated for Installation works, and will commence as it may be deemed practical, and shall include testing and commissioning (see Stage 4 below)	<ul style="list-style-type: none"> - Monthly Reports - Two Week Look Ahead Schedule - Shop Drawings - Revised Schedule (if required) - Practical Completion

SERVICE STAGE	DESCRIPTION OF SERVICES	DURATION	MINIMUM DELIVERABLES
STAGE 4	Project Close Out and Post-Construction	<ul style="list-style-type: none"> - Project Closeout i.e. Snagging, Testing and Commissioning (one (1) week is allocated for this exercise); - 12 months DNP and will start upon issuance of Taking-Over Certificate, and will end upon issuance of the Performance Certificate to the Contractor. 	<ul style="list-style-type: none"> - Hand Over Documents - O/M Manual - Warranties - Maintenance Dossier - Training Dossier - Marked-Up Drawings - Commissioning Certificates - Rectification of identified defects

PROJECT REQUIREMENTS (EXCERPT FROM THE APPENDICES)

I. SCOPE OF WORK

The requirements for the Package 1 – Upgrade of the Air Conditioning System at the National Archives of Trinidad and Tobago is for supply, installation, commissioning, testing, maintenance & air balancing of Air Cooled Ducted Split Package system, Precision Equipment, Ventilation systems and Mini- Split Systems as detailed in **Appendix 1- Technical Specifications and Drawings**, inclusive of the following:

- a. The desired Space Environmental Conditions:
 - Office Space- 72 F, 55% RH
 - Paper Vault Storage- 68F, 50% RH
 - Audiovisual/Microfilm Vault- 65F, 35-40% RH
 - Server Room- Calculated based on kVA
- b. Infrastructural modifications to accommodate new equipment as per approved design;
- c. Knowledge transfer i.e. conduct of training i.e. operation and maintenance, to End User; and,
- d. Warranty and support – one (1) year full preventative maintenance to be conducted on a monthly basis, and five (5) year warranty on parts and installation. Contractor also be required to provide impromptu on-call services as required in the event of equipment downtime during the one (1) year defects notification period. Additionally, Contractor shall include an extended full preventative maintenance proposal for an additional four (4) years, for a potential engagement by the Client Ministry.

II. TIMELINE

The Project shall be completed within six (6) months upon issuance of Letter of Award and Commencement Letter to the appointed Contractor.

III. TECHNICAL SPECIFICATION

See Appendix 1 – Technical Specification and Drawings and Appendix 2 – Bill of Quantities.

IV. WORKMANSHIP

Unless otherwise described in the Conditions of Contract or below descriptions the terms "**carefully remove**" means the contractor shall give special attention to these works and all works to be included, but not limited to prevent damaging all surrounding work and existing finishing works. If the work comprising deferent component the contactor shall unmount all components separately by using proper tools and equipment. All screws and nails to be removed from each component.

The Contractor shall conduct a joint inspection to analyze the condition of the existing elements, which fall within the working area, and properly protect said elements and same approved by the Engineer and/or Client's Authorized Site Representative, prior to the commencement of the Works. If any damage occurs due to contactor's negligence or carelessness the contactor shall reimburse all losses to the Client.

The contactor shall not allow removing / dismantling / demolishing any element from the building, unless otherwise instructed by the Engineer and /or Client's Authorized Site Representative.

The Contractor shall make sure prior to disposing of any removed items from the site that a joint inspection shall be conducted to analyze the condition of the said items with the Engineer and/or Client's Authorized Site Representative. If any items are determined to be for "salvage or reuse" the contactor is to follow above descriptions and to store properly.

V. PRE-TENDER SITE VISIT

The Proponents are advised to visit and examine the Site and its surroundings and obtain all information necessary for preparing the Tender and entering into a Contract.

The Proponents and any of their personnel or agents will be granted permission by UDeCOTT to enter upon the premises for the purpose of such inspection, but only upon express conditions that the Proponents, their personnel or agents, will release and indemnify UDeCOTT and its personnel and agents from and against all liability in respect thereof and will be responsible for personal injury (whether fatal or otherwise), loss of or damage to property and any other loss, damage, costs and expenses however caused, which, but for the exercise of such permission would not have arisen. Applications to visit the site must be made in the first instance, with UDeCOTT.

The Proponents should show care to existing historical value elements and/or all site properties during the site visit. If any damages occur due to the Proponent's negligence or carelessness the contactor shall reimburse all losses to UDeCOTT.

The Proponents shall ensure that Personal Protective Equipment (PPE) are worn by all their employees at all times during any site visits.

The Proponents, by submitting a tender is deemed to have visited the site and clearly ascertained all the conditions likely to affect the carrying out of the works and allowed for these in his Tender.

VI. OTHER REQUIREMENTS

1. Due to the sensitivity of the nature of work and its location, the Contractor is required to supervise the works at all-times on-site by, at a minimum, a competent supervisor and a qualified Health and Safety Officer;
2. The Contractor shall comply with all applicable Laws and regulations regarding safety including but not limited to those contained in the Occupational Safety and Health Act;
3. The Contractor shall comply with all national health and safety requirements and codes and shall provide the required personal protective equipment for each employee at his expense at all times;
4. The Contractor shall ensure that proper housekeeping is performed at the end of each work day, and all debris disposed of at an approved location off site;
5. The Contractor shall remove and dispose all debris/garbage to an approved dump site. Strictly no compounding of garbage/debris within a 2-day period, including weekends and public holidays;
6. All transportation costs shall be borne by the Contractor, and is deemed to be included in their Tender cost;
7. The Contractor shall ensure that public safety is maintained and monitored at all time. Such safety measures shall include but not be limited to:
 - Caution tape;
 - Barriers;
 - Hazard cones;
 - Trip hazard; and
 - Early warning signs of work zones ahead and/or work areas.
 - and/or any other safety measures as may be deemed necessary in the circumstances.

8. Ensure that appropriate and suitable signage is installed and maintained throughout the clearing exercise, and the general safety of motorists and pedestrians is not jeopardized;
9. If needed, the Contractor shall be ready at all times to perform on-call services for specific tasks, as instructed by the Client;
10. The Contractor shall supply all the necessary materials as new, and shall further supply all necessary tools, equipment and access aids to allow the safe and prompt execution of the clearing exercise;
11. The Contractor shall supply and maintain portable toilet(s) as required, and as per the OSHA requirement;
12. The Contractor shall not permit the use of alcohol or radios on the compound, nor shall he permit horse play or the use of inappropriate language on the compound;
13. Any additional costs not mentioned above, which may be incurred in relation to the successful delivery and completion of works, shall be to the Contractor's account.
14. The Contractor shall exercise care and protection of irreplaceable archival documents when working in storage vaults.
15. The Contractor shall maintain strict confidentiality and not remove any items and/or archival material belonging to the National Archives of Trinidad and Tobago.

NATIONAL ARCHIVES OF TRINIDAD AND TOBAGO

**AIR CONDITIONING & VENTILATION
SPECIFICATION AND DRAWINGS
(Building B and C)**

DECEMBER 2022

NATIONAL ARCHIVES OF TRINIDAD AND TOBAGO

AIR CONDITIONING & VENTILATION SPECIFICATION

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NATIONAL ARCHIVES

AIR CONDITIONING & VENTILATION SPECIFICATION

1. GENERAL

1.0 OVERVIEW

The National Archives of Trinidad and Tobago (NATT) proposes to upgrade their existing facility located in 105 St Vincent Street Port of Spain. Part of these works entails the upgrade to their existing air conditioning systems serving the vaults, administrative, conservation and reprographic areas.

The existing facility comprises of four (4) main buildings:

- Building A – Old Archive Building – DEMOLISHED
- Building B – Main Repository Building – location of vaults containing archival material, administrative offices, etc
- Building C – Conservation and Reprographics.
- Guard Booth

The scope of works detailed in this specification is limited to Building B and Building C. The scope of works as detailed in the specification entails the complete replacement of the air conditioning system serving the Building B and the upgrade to air conditioning system serving Building C.

Building B, the Repository consist of two (2) levels, i.e. Ground Floor and First Floor. Vaults located on the ground and first floors would be served by DX Precision Equipment, while occupied areas would be served by DX Split Packaged equipment.

Areas where archival records are handled or worked on in Building C would be outfitted with DX Precision Equipment, while all other occupied areas would be served by DX split packaged equipment.

Contractors are required to submit along with their tender a proposed schedule for the execution of works. *(A base schedule would be provided by NATT and in coordination with the successful contractor, a final schedule will be agreed on before commencing of works).* The installation works must be done with the minimum inconvenience to the organization and the customers. **All contractors are required to cater in their tender for work being carried out after client working hours, on weekend and night-time as NATT seeks to maintain regular opening hours during the day.**

Contractor to provide temporary cooling as required for vaults while work is being undertaken. At no point in time should archival material be exposed to out-of-range conditions beyond 68 – 72 F, 50 – 55% RH. The contractor is responsible for making their necessary site visits for equipment installation.

The contractor is also to make provisions for the protection of the archival documents and records stored in the vaults during the removal of the existing installations, installation of the new AC System and any other works during the execution of works.

The tenderer should allow for the selection of units which use environmentally friendly refrigerant R410A (or alternative) - which is not scheduled for phaseout under the Montreal Protocol.

Ductwork design and installation shall be in accordance with ASHRAE standards. All Compressor /Condenser units are to be treated against the corrosive atmosphere as specified.

All works must be carried out under the proper Health & Safety standards of Trinidad & Tobago and as advised by the client.

During execution of the required works, where applicable, the following MUST be done:

- a) Strict adherence to national safety standards as outlined in OSHA Act 2004 as well as conformance to international safety standards regarding scaffolding erection and use of pressurized equipment. Employ lock out tag out procedures.
- b) Adequate provision for cordoning off work areas to protect workers and other third parties from injuries.
- c) Employ as far as reasonably possible methods for the reduction of noise, dust and the use of poisonous, abrasive, noxious agents for stripping or cleaning surfaces.
- d) Safe practice in lifting equipment including method & equipment used for lifting.

1.1 SYSTEM DESCRIPTION

Both Buildings B & C are served using DX Equipment, with 100% Redundancy.

Vaults shall be 68 F 50% RH.

Occupied spaces shall be 72 F, 55 % RH.

1.2 SCOPE OF WORK

The requirement is for supply, installation, commissioning, testing, maintenance & air balancing of Air Cooled Ducted Split Packaged systems, Precision Equipment, Ventilation systems and Mini-Split Systems.

Fully experienced AC supervisor shall be assigned at the site and when required.

All air handling equipment is to be wired into the fire detection system to permit shut down in the event of a fire alarm or other emergency signal. AC contractors shall provide a wiring diagram.

All Compressor/Condenser units are to be treated against the corrosive atmosphere as specified. AC contractors shall provide methods of application and type of Treatment. **Please note that a detailed methodology statement of all systems must be accompanied in your return Tender document.**

The AC contractor shall Seal all ductwork and piping penetrations with fire stopping material (as per NFPA 90 Standards), AC contractor shall apply fire stopping as recommended by the manufacturer See as described in Ductwork section Fire Stopping.

The AC contractor shall paint all necessary ductwork, metal frames, pipe supports, and duct supports. The AC contractor shall supply, fabricate and install all metal frames to support all air conditioning and ventilation equipment, shop drawings to be provided. Frame to be painted.

A Post Maintenance Contract Proposal shall be included.

This shall include but shall not be limited to the following:

1	Supply of Shop Drawing, As Built Drawings, Submittals, operation manuals, maintenance manuals associated with all systems installed.
BUILDING B	
2	Supply and installation of Building B - DX Air Cooled Central Split Units, complete, as per Schedule 1.
3	Supply and installation of Building B - DX Air Cooled Precision Units, complete, as per Schedule 2.
4	Supply and installation of Building B – Tempered Air Unit, complete, as per Schedule 3.
5	Supply and installation complete of Building B - DX Mini Split system complete as per Schedule 4.
6	Supply and Installation of Building B - Ventilation Systems complete, as per Schedule 5.
7	Supply and Installation of air distribution systems for Building B as per Schedule 6.
BUILDING C	
8	Supply and installation of Building B - DX Air Cooled Precision Units, complete, as per Schedule 7.
9	Supply and installation complete of Building C - DX Mini Split system complete as per Schedule 8.
10	Supply and Installation of Building C - Ventilation Systems complete, as per Schedule 9.
11	Supply and Installation of air distribution systems for Building C as per Schedule 10.
GENERAL	
12	Decommission, Removal & Relocation of existing equipment as required by the client.
13	Provision of Builders work associated with the air conditioning and ventilation systems. (Painting, cutting and making good of all wall penetrations) Plinths Equipment metal support stands / Equipment Supports of equipment suspended. Provide for Scaffolding as required.
14	Provision of piping supports, sleeves and Fire sealing of penetrations. Include for labelling of equipment. Supply and install Fire-stopping for all penetration associated with the air conditioning and ventilation system as required by NFPA.
15	Provision of all items not otherwise listed but required by the drawings, specifications or the compliance with referenced codes in the specification. Cost breakdown for this Item must be submitted with a quotation.
16	Pre-commissioning and Commissioning of all the air conditioning systems.
17	Lifting associated with locating equipment. Contractor to cater for multiple lifts as required.
18	Provision for all material and labour for the protection of archival documents and records during the installation of works.
19	Provision of maintenance for 12 months as recommended from manufacture / Client from the date of Practical Completion Certificate by the consultants and client. Warranty shall commence from the date of practical completion. Maintenance shall confirm to the maintenance section of the specification document.

1.4 WARRANTIES / GUARANTEES

1. Minimum 5 years warranty on Compressor.
2. Minimum 5 years on coil.
3. Minimum 1-year warranty on other components.
4. Minimum 1-year warranty on workmanship of all installation, ductwork, joints, piping etc

1.5 DRAWINGS

- a) A complete drawing list is given in the Drawing Schedule.
- b) Shop Drawings by AC Contractor.
 - 1. Equipment layout.
 - 2. Plinth layout.
 - 3. Electrical wiring diagrams.
 - 4. Ductwork layout, air handler connections, etc.
 - 5. Piping layouts which identify all valves and fittings, plans and elevations which identify clearances required for maintenance and operation.
- c) As Built Drawings by AC Contractor. (See Record Documents Section of this specification)

1.6 CODES AND STANDARDS

All equipment to be UL Listed and AHRI rated and certified.

Please note that languages such as “Design in accordance with” and “Manufactured to” are not sufficient. The units need to be UL listed and AHRI certified.

AABC	Associated Air Balance Council http://www.aabchq.com
AMCA	Air Movement and Control Association, Inc. http://www.amca.org
ANSI	American National Standards Institute, Inc. http://www.ansi.org
AHRI	Air-Conditioning, Heating and Refrigeration Institute http://www.ari.org
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers http://www.ashrae.org
ASME	American Society of Mechanical Engineers http://www.asme.org
ASSE	American Society of Sanitary Engineering http://www.asse-plumbing.org
AWA	American Welding Society, Inc. http://www.amweld.org
AWWA	American Water Works Association http://www.awwa.org
BOCA	The Building Officials and Code Administrators International http://www.bocai.org
CAGI	Compressed Air and Gas Institute http://www.cagi.org
CGA	Compressed Gas Association, Inc. http://www.cganet.com
CISPI	Cast Iron Soil Pipe Institute http://www.cispi.org
CTI	Cooling Tower Institute http://www.cti.org
ETL	ETL Testing Laboratories, Inc. Industrial Park, Route 11; P.O. Box 2040 Cortland, NY 13045 (607) 753-6711
FM	Factory Mutual Engineering Corporation http://www.fmglobal.com

HI	Hydraulic Institute http://www.cssinfo.com/info/hi.htm/
ICBO	International Conference of Building Officials http://www.icbo.org
IEEE	Institute of Electrical and Electronics Engineers http://www.ieee.org
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry Inc. http://www.mss-hq.com
NAPHCC	National Association of Plumbing-Heating-Cooling Contractors http://www.naphcc.org
NBS	National Bureau of Standards See – NIST
NBBPVI	National Board of Boiler and Pressure Vessel Inspectors http://www.nationboard.org
NEC	National Electric Code See – NFPA National Fire Protection Association
NEMA	National Electrical Manufacturers Association http://www.nema.org
NFPA	National Fire Protection Association http://www.nfpa.org
NIST	National Institute of Standards and Technology http://www.nist.gov
NSF	National Sanitation Foundation http://www.nsf.org
PDI	Plumbing and Drainage Institute http://www.pdioutline.org
PPI	The Plastic Pipe Institute http://www.plasticpipe.org
SMACNA	Sheet Metal and Air-Conditioning Contractors National Association, Inc. http://www.smacna.org
UL	Underwriters' Laboratories Incorporated http://www.ul.com

2. GENERAL CONDITIONS

2.0 DRAWINGS AND SPECIFICATIONS

The Drawings and Specifications are intended to be complete and considered supplementary to one and the other. Materials or workmanship indicated, called for, or implied by one and not the other, shall be furnished and installed as though specifically called for by both. Should any discrepancy appear in either, call such discrepancy to the attention of the Engineer for clarification and correction before submitting a bid.

It is the intent of the Drawings and Specifications to obtain a complete and satisfactory installation. The Mechanical and Electrical drawings are diagrammatic but are to be followed as closely as the actual construction of the building and the work of other trades will permit.

The drawings are diagrammatic and indicate general arrangement of systems and work included in the contract. Contractor shall follow drawing in laying out work; check drawings of all trades to verify spaces in which work will be installed, and maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, the Engineer shall be notified before proceeding with installation. If directed by an Engineer, the contractor shall, without extra charge, make reasonable modifications in layout as needed to prevent conflict with work of various trades or for proper execution of the work. Where variances occur between drawings and specifications, or within either document itself, the item or arrangement of better quality, greater quantity, or higher cost shall be included in contract price. The Engineer shall decide on the item and manner in which the work shall be installed. Prior to fabrication and/or installation, Contractor shall submit detailed shop drawings as indicated in other sections of the specifications.

2.1 PRODUCT SELECTION PROCEDURES

Procedures governing product selection include the following:

1. Proprietary Specification Requirements: Where Specifications name only a single product or manufacturer, provide the product indicated. No substitutions will be permitted.
2. Semi proprietary Specification Requirements: Where Specifications name 2 or more products or manufacturers, provide 1 of the products indicated. No substitutions will be permitted.
3. Where (and only where) Specifications specify products or manufacturers by name, accompanied by the term "or equal" or "or approved equal," comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product. Bid shall be based on the specified product unless prior approval is obtained in writing from the Engineer.
4. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
5. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by the manufacturer for the application indicated.
6. Manufacturer's recommendations may be contained in published product literature or by the manufacturer's certification of performance.
7. Compliance with Standards, Codes, and Regulations: Where Specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes, or regulations specified.
8. Visual Selection: Where specified product requirements include the phrase "... as selected from manufacturer's standard colours, patterns, textures..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect-Engineer will

select the colour, pattern, and texture from the product line selected.

2.2 TENDER SUBMITTAL INFORMATION

Complete information on the following must be submitted at the time of tender in order to assess compliance with the tender documents.

Equipment

1. Direct Expansion Air Handlers
2. Direct Expansion Condensers
3. Direct Expansion Mini-Splits
4. Tempered Air Systems
5. Equipment Protection devices (voltage monitors, phase monitors)
6. Direct Expansion Precision air units
7. Exhaust and Ventilation Fans
8. Electronic Programmable Thermostats
9. Control switch for exhaust fan
10. MERV Air filters
11. UVC Germicidal Lamps
12. Vibration pads

Ductwork & Accessories

13. Supply air diffusers
14. Return air grilles.
15. Exhaust grilles
16. Fresh air grilles
17. Security Grilles
18. Air control devices and other control devices
19. Hangers and supports
20. Fire Dampers
21. Backdraft damper
22. Volume control damper
23. Quadrant dampers
24. Duct Access hatch.
25. Flexible unit connection
26. Flexible Duct
27. Insulation materials (External and Internal) Insulation material for ductwork
28. Duct sealant

2.3 INSTALLATION

A. Accessibility:

Locate valves, thermometers, pressure gauges, clean-out fittings and indicating equipment or specialities requiring reading, adjusting, inspection, repairing, removal or replacement with reference to finished building.

B. Equipment Room Precautions:

1. Electrical Rooms and Elevator Machine Rooms:

- Do not install ductwork or piping for mechanical systems in Electrical Equipment or Elevator Machine Rooms except as related to that work.

2. Mechanical Rooms:

- Provide aluminium or galvanized pans or gutters under pipes, reinforced to prevent sagging where piping runs over the motor control centre, electrical bus

duct, or other electrical equipment. Run drain lines from such devices to floor drains.

C. Sleeves and Sealing:

1. Provide sleeves for piping and ductwork passing through floors, walls, partitions, concrete beams, girders and other construction of adequate diameter to allow 1/2-inch minimum clearance.
2. Lay out work prior to concrete forming.
3. Reinforce sleeves where required with schedule 40 galvanized steel pipe cut to size with flush ends to prevent collapse during forming, pouring, and post tensioning.
4. Extend floor sleeves 2" A.F.F., except as indicated otherwise.
5. Extend sleeves through roof 8" minimum.
6. Seal space between pipe and ductwork and sleeves in exterior walls, foundation walls, pits, etc., watertight with materials applicable to installation. Provide rated fire sealant to match fire rating of wall penetrated. Sealant shall be Dows Corning or approved alternative, as per NFPA.
7. Seal space between pipe and ductwork and sleeves in floors, to be watertight with materials applicable to installation. Provide rated fire sealant. Sealant shall be Dows Corning or approved alternative, as per NFPA.

D. Fire Stopping

- i. Fire-stopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases.
- ii. Through-penetration firestop systems shall have been tested in accordance with ASTM E814 or ANSI/UL 1479.
- iii. All fire-stop systems and materials shall be UL Listed, ETL Semko Listed or FM Approved, and shall conform to the construction type, penetrate type, annular space requirements, and fire rating involved in each separate instance.
- iv. Through-penetration firestop systems shall conform to applicable requirements for flame spread and smoke developed ratings.
- v. Not less than the fire-resistance rating of constructions penetrated.
- vi. Provide components for each penetration fire-stopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration fire-stopping manufacturers and approved by qualified testing and inspecting agencies for fire-stopping indicated.
- vii. Fill Materials
 - i. Cast-in Place Fire-stop Device
 - ii. Latex Sealants
 - iii. Intumescent Composite Sheets
 - iv. Intumescent Putties
 - v. Intumescent Wrap Strips
 - vi. Mortars
 - vii. Pillows/Bags
 - viii. Silicone Foams
 - ix. Silicone Sealants

2.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

1. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, loss and including theft.
2. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.

3. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
4. Deliver products to the site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
5. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
6. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
7. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
8. Store products subject to damage by the elements above ground, undercover in a weather-tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.
9. Protection of equipment from weather, water damage, dust and other trades on site. Contractor to clean all equipment before start up.

3.0 SUBMITTALS

Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:

1. Satisfactory written evidence is presented to, and approved by the Engineer, that manufacturer cannot make scheduled delivery of approved item or;
2. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
3. Other conditions become apparent which indicates approval of such substitute items by the Engineer.
 - Forward submittals in sufficient time to permit proper consideration and approval action by Engineer. Time submission to assure adequate lead time for procurement of contract – required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion.
 - Submittals will be reviewed for compliance with contract requirements by Architect – Engineer.
 - The Engineer reserves the right to require additional submittals, whether or not particularly mentioned in this contract.
 - Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of the Engineer. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The Architect – Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.
 - Submittals must be submitted by Contractor only and shipped prepaid. The Engineer assumes no responsibility for checking quantities or exact numbers included in such submittals.
 - Submit samples required in quadruplicate. Submit other samples in single units unless otherwise specified. Submit shop drawings, schedules, manufacturers', literature and data, and certificates in quadruplicate, except where a greater number is specified.
 - Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall contain the list of items, name of project, name of Contractor, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM NUMBER (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogues shall be marked to indicate specific items submitted for approval.
 - When tabulations, tables of a series of sizes, dimensions etc. are shown on submittals or only part of the submittal is applicable for the intended material, product or construction, the contractor shall highlight the applicable items with a "read-thru" colour accentor,

indelible pencil or similar device to avoid confusion and clarify the intent of the submittal.

- Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
- If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.
- All items submitted shall bear at a convenient location a certification by the contractor that he has reviewed the drawing or item submitted for review and that the material, equipment or product covered by the submittal is correct for the specified application and that it is in compliance with the requirements of the Contract Documents.
- Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.

3.1 VARIANCES/DEVIATIONS FROM CONTRACT DOCUMENTS

If the shop drawing, material, equipment or product submitted for review is at variance or deviates from the construction contract documents because of shop practice or other reasons, the contractor shall submit a written explanation of the nature and/or reason(s) therefore and attach this written explanation to the submittal form.

3.2 ACCEPTANCE OF SUBMITTALS

Incomplete submittals and submittals not in compliance with the requirements of this document and the Contract Documents will not be accepted for processing and returned to the contractor. If a Contractor chooses to proceed with work before acceptance of submittals he does so on an "at-risk" basis and may be required to rework, correct or alter the affected work at his expense, upon final acceptance of the related submittals.

3.3 REVIEW TIME OF SUBMITTALS

Every effort will be made to process submittals promptly and return to the contractor marked-up and stamped items. The Engineer will however require no less than fourteen (14) and no more than twenty-eight (28) working days from the date the submission is received and accepted by the Engineer until return to the contractor.

3.4 REVIEW ACTION STATUS

The Engineer will act as the review authority for all submittals received and affix a stamp with notations and instructions, markings, etc. on submitted drawings or items.

In cases of conflict between the action status designation shown on the stamp of the Engineer and notations on the submittal, the instructions on the stamp shall govern unless the contractor is notified in writing. The action status designations shall be defined as follows:

"No Exceptions Taken" shall mean the fabrication, manufacture and/or construction may proceed providing the work is in compliance with the Contract Documents.

"Note Comments" shall mean that fabrication, manufacture and/or construction may proceed providing the work is in compliance with the notations/corrections and the Contract Documents.

"Re-Submit" shall mean that partial fabrication, manufacture and/or construction may proceed providing the work started is in compliance with the notation/corrections of the Contract Documents, and also provided that the required corrections/modifications of the "Re-Submit" drawings have been resubmitted and have received a "No Exceptions Taken" or "Note Comments" status before the work is completed.

"Rejected" shall mean that No fabrication, manufacture and/or construction may proceed and that the Contractor shall make a new submission. Items marked "Rejected" shall not be used for any purpose at the construction site.

Note: Except as to matters of finish, colour and other aesthetic matters to be specified or approved by the Engineer according to the Contract Documents, submittals returned to the contractor with a "No Exceptions Taken" or "Note Comments" designation do not relieve the contractor from full compliance with the terms and provisions of the Contract.

The Contractor's submittal and the Engineer's acceptance of Shop Drawings, Product Data, or Samples for construction activities not complying with the Contract Documents do not constitute an acceptable or valid request for substitution, nor do they constitute approval.

Space for the Engineer's stamp – Sufficient space should be provided on each drawing submitted for review to accommodate the stamp(s) of the Engineer. An area 3 inches wide and 4 inches long is generally sufficient for this purpose.

Certification – The contractor's certification as described herein shall be clearly legible on the sepia as well as on all prints or copies submitted by the Contractor.

3.5 SUBSTITUTION DEFINITION

Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after award of the Contract are considered to be requests for substitutions. The following are not considered to be requests for substitutions:

1. Substitutions requested during the bidding period, and accepted by Addendum prior to award of the Contract, are included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.
2. Revisions to the Contract Documents requested by the Owner or Architect.
3. Specified options of products and construction methods included in the Contract Documents.
4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

3.6 SUBSTITUTION PROCEDURES

Conditions: The Engineer will receive and consider the Contractor's request for substitution when one or more of the following conditions are satisfied, as determined by the Engineer. If the following conditions are not satisfied, the Engineer will return the requests without action except to record non-compliance with these requirements.

The contractor's attention is directed to the section "PRODUCT SELECTION PROCEDURES" that govern the circumstances in which substitutions will be entertained.

- a) Extensive revisions to the Contract Documents are not required.
- b) Proposed changes are in keeping with the general intent of the Contract Documents.

- c) The request is timely, fully documented, and properly submitted.
- d) The specified product or method of construction cannot be provided within the Contract Time. The Engineer will not consider the request if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
- e) The request is directly related to an "or-equal" clause or similar language in the Contract Documents.
- f) The requested substitution offers the Owner a substantial advantage, in cost, time, Energy conservation, or other considerations, after deducting additional responsibilities the Owner must assume. The Owner's additional responsibilities may include compensation to the Architect-Engineer for redesign and evaluation services, increased cost of other construction by the Owner, and similar considerations.
- g) The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
- h) The specified product or method of construction cannot be provided in a manner that is compatible with other materials and where the Contractor certifies that the substitution will overcome the incompatibility.
- i) The specified product or method of construction cannot be coordinated with other materials and where the Contractor certifies that the proposed substitution can be coordinated.
- j) Where a proposed substitution involves more than one prime contractor, each contractor shall cooperate with the other contractors involved to coordinate the Work, provide uniformity and consistency, and assure compatibility of products.

3.7 SUBMITTALS REQUIRED FOR SUBSTITUTIONS

Substitution Request Submittal: The Engineer will consider requests for substitution if received within 60 days after commencement of the Work. Requests received more than 60 days after commencement of the Work may be considered or rejected at the discretion of the Engineer.

- a) Submit 3 copies of each request for substitution for consideration. Submit requests in the form and according to procedures required for change-order proposals.
- b) Identify the product or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers.
- c) Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
 - 1. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate contractors, that will be necessary to accommodate the proposed substitution.
 - 2. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.
 - 3. Product Data, including Drawings and descriptions of products and fabrication and installation procedures.
 - 4. Samples, where applicable or requested.
 - 5. A Statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
 - 6. Cost information, including a proposal of the net change, if any in the Contract Sum.
 - 7. The Contractor's certification that the proposed substitution conforms to requirements in the Contract Documents in every respect and is appropriate for the applications indicated.
 - 8. The Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

3.8 REVIEW TIME OF SUBSTITUTION SUBMITTALS

If necessary, the Engineer will request additional information or documentation for evaluation within one week of receipt of a request for substitution. The Engineer will notify the Contractor of acceptance or rejection of the substitution within 2 weeks of receipt of the request, or one week of receipt of additional information or documentation, whichever is later. Acceptance will be in the form of a change order.

Use the product specified if the Engineer cannot make a decision on the use of a proposed substitute within the time allocated.

3.9 CONTRACTORS SHOP DRAWINGS

Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements.

These drawings and schedules shall be stamped and signed by Contractor certifying to such check.

- a) Drawings shall be full size. Arch D (24" x 36")
- b) Each drawing shall have marked thereon, proper descriptive title, including project name, location, project number, manufacturer's number, reference to contract drawing number, and Specification Section Number.
- c) A space 120mm by 125mm (4-¾ by 5 inches) shall be reserved on each drawing to accommodate approval or disapproval stamps.
- d) Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.
- e) One reproducible print of approved or disapproved shop drawings will be forwarded to the Contractor.
- f) When work is directly related and involves more than one trade, shop drawings shall be submitted to the Architect – Engineer under one cover.

Equipment final arrangement shall take into account: -

- 1. The orientation and connection points of the specific equipment the Air Conditioning Contractor has undertaken to supply.
- 2. The most efficient use of the given space and most desirable relative position of individual pieces of equipment.
- 3. Operational ease and accessibility for inspection and maintenance.

Equipment plinths for all equipment shall be accurately located and detailed showing all embedded metal such as holding down bolts, pipes and electrical conduit. The equipment final layout drawings or revisions thereof which are approved by the Engineer shall be given to the Main Contractor for provision of Builders' work items.

All of the above to be finalized not later than thirty days after receipt of Consultants Design Drawings.

3.10 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION

- 1. The Contractor shall keep on the work site a copy of the drawings and specifications and shall at all times give the Engineer access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference

between drawings and specifications, the specifications shall govern. In case of discrepancy in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to the Engineer, who shall promptly make a determination in writing. Any adjustment by the Contractor without such a determination shall be at the Contractor's own risk and expense. The Engineer shall furnish from time to time such detailed drawings and other information as considered necessary, unless otherwise provided.

2. Wherever in the specifications or upon the drawings the words "directed", "required", "ordered", "designated", "prescribed", or words of like import are used, it shall be understood that the "direction", "requirement", "order", "designation", or "prescription", of the Engineer is intended and similarly the words "approved", "acceptable", "satisfactory", or words of the like import shall mean "approved by", or "acceptable to", or "satisfactory to" the Engineer, unless otherwise expressly stated.
3. Where "as shown", "as indicated", "as detailed", or words of similar import are used, it shall be understood that the reference is made to the drawings accompanying this contract unless stated otherwise. The word "provided" as used herein shall be understood to mean "provide complete in place", that is "furnished and installed".
4. Shop drawings means drawings, submitted to the Engineer by the Contractor, subcontractor, pursuant to a construction contract, showing in detail (1) the proposed fabrication and assembly of structural elements and (2) the installation (i.e., form, fit, and attachment details) of materials or equipment. It includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the contractor to explain in detail specific portions of the work required by the contract. The Engineer may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.
5. This contract requires shop drawings, the Contractor shall coordinate all such drawings, and review them for accuracy, completeness, and compliance with contract requirements and shall indicate its approval thereon as evidence of such coordination and review. Shop drawings submitted to the Engineer without evidence of the Contractor's approval may be returned for resubmission. The Engineer will indicate an approval or disapproval of the shop drawings and if not approved as submitted shall indicate the Engineer's reasons therefore. Any work done before such approval shall be at the Contractor's risk. Approval by the Engineer shall not relieve the Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this contract, except with respect to variations described and approved in accordance with (f) below.
6. If shop drawings show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the drawings, at the time of submission. If the Engineer approves any such variation, the Engineer shall issue an appropriate contract modification, except that, if the variation is minor or does not involve a change in price or in time of performance, a modification need not be issued.
7. The Contractor shall submit to the Engineer for approval four copies (unless otherwise indicated) of all shop drawings as called for under the various headings of these specifications. Three sets (unless otherwise indicated) of all shop drawings, will be retained by the Engineer and one set will be returned to the Contractor.
8. Upon completing the work under this contract, the Contractor shall furnish a complete set of all shop drawings as finally approved. These drawings shall show all changes and revisions made up to the time the equipment is completed and accepted.

9. The Engineer's interpretation of the drawings and specifications will be final, subject to the dispute's clause.
10. Large scale drawings supersede small scale drawings.
11. Dimensions govern in all cases. Scaling of drawings may be done only for general location and general size of items.
12. Dimensions shown of existing work and all dimensions required for work that is to connect with existing work, shall be verified by the Contractor by actual measurement of the existing work. Any work at variance with that specified or shown in the drawings shall not be performed by the Contractor until approved in writing by the Engineer.

3.11 INSPECTION OF CONSTRUCTION

1. Definition. "Work" includes, but is not limited to, materials, workmanship, manufacture and fabrication of components.
2. The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed under the contract conforms to contract requirements. The Contractor shall maintain complete inspection records and make them available to the Engineer.
3. Engineer's inspections and tests are for the sole benefit of the client and do not -
 1. Relieve the Contractor of responsibility for providing adequate quality control measures;
 2. Relieve the Contractor of responsibility for damage to or loss of the material before acceptance;
 3. Constitute or imply acceptance; or
 4. Affect the continuing rights of the client after acceptance of the completed work.
1. The presence or absence of an inspector does not relieve the Contractor from any contract requirement, nor is the inspector authorized to change any term or condition of the specification without the Engineer's written authorization.
1. The Contractor shall promptly furnish, without additional charge, all facilities, labour, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the Engineer. The client may charge the Contractor any additional cost of inspection or test when work is not ready at the time specified by the Contractor for inspection or test, or when prior rejection makes re inspection or retest necessary. The Engineer shall perform all inspections and tests in a manner that will not unnecessarily delay the work. Special, full size, and performance tests shall be performed as described in the contract.
2. The Contractor shall, without charge, replace or correct work found by the Engineer not to conform to contract requirements, unless in the public interest the Engineer consents to accept the work with an appropriate adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises.
3. If the Contractor does not promptly replace or correct rejected work, the Engineer may (1) by contract or otherwise, replace or correct the work and charge the cost to the Contractor or (2) terminate for default the Contractor's right to proceed.
4. The contractor shall be responsible for coordination of the work of the trades,

subcontractors, and material suppliers. The Contractor shall, in advance of the work, prepare coordination drawings showing the location of openings through slabs, the pipe sleeves and hanger inserts. These drawings, including plans, elevations, and sections as appropriate shall clearly show the manner in which the equipment fit into the available space and how they relate to each other and to building elements. Drawings shall be of appropriate scale to satisfy the previously stated purposes. Drawings may be composite (with distinctive colours for the various trades) or may be separate but fully coordinated drawings (such as sepias or photographic paper reproducible) of the same scale.

Separate drawings shall depict identical building areas or sections and shall be capable of being overlaid in any combination. The submitted drawings for a given area of the project shall show the work of all trades which will be involved in that particular area. Six complete composite drawings or six complete sets of separate reproducible drawings shall be received by the Engineer not less than 20 days prior to the scheduled start of the work in the area illustrated by the drawings, for the purpose of showing the contractor's planned method of installation. The objectives of such drawings are to promote carefully planned work sequence and proper trade coordination, in order to assure the expeditious solutions of problems and the installation of lines and equipment as contemplated by the contract documents.

In the event the contractor, in coordinating the various installations and in planning the method of installation, finds a conflict in location or elevation of any of the systems with themselves, with structural items or with other construction items, the contractor shall bring this conflict to the attention of the Engineer immediately. In doing so, the contractor shall explain the proposed method of solving the problem or shall request instructions as to how to proceed if adjustments beyond those of usual trades coordination are necessary.

Systems installation work will not proceed in any area prior to the submission and completion of the Engineer's review of the coordinated drawings for that area, nor in any area in which conflicts are disclosed by the coordination drawings until the conflicts have been corrected to the satisfaction of the Engineer. It is the responsibility of the contractor to submit the required drawings in a timely manner consistent with the requirements to complete the work covered by this contract within the prescribed contract time.

4: ELECTRICAL

4.0 GENERAL

The electrical supply characteristics available for all air conditioning and ventilation equipment are indicated in the Equipment Schedules. An adequate power supply terminating on the various pieces of equipment shall be made available by others via an isolator.

The Air Conditioning Contractor shall supply all starters, control gear and shall be responsible for terminating all power and control wiring on his equipment.

All electrical wiring performed shall be according to the Trinidad and Tobago Electrical Wiring Code and the requirements of the NEC.

All equipment must be able to self-start after a power failure when power is restored – equipment starts up must be arranged as staggered starting.

The Air Conditioning Contractor Shall Provide equipment grounding, conductors, supports and other non-current conducting metal enclosures for electrical equipment in accordance with NEC. The ground wires shall be copper, insulated and sized as required by NEC. Bond the grounding wires to each of the pull boxes, junction boxes, cabinets and other enclosures through which the wires pass.

4.1 MOTOR STARTERS

- a) All starters for motors up to 1/2 HP (unless otherwise noted): Manual type with running pilot light, Allen-Bradley Bulletin 600 open type, with overload heater.
- b) All starters for 3/4 HP and up (unless otherwise noted): Allen-Bradley Bulletin 712, combination safety switch/starter, control circuit transformer where required.
- c) Manual starters for small 3 phase motors, where indicated, Allen-Bradley Bulletin 609 with toggle operator and three overload heaters.
- d) Provide three phase starters with motor running over current protection in each underground motor feeder conductor (3 manual reset overload relays); under voltage and phase protector H-O-A switch, manual reset and red running pilot light in cover; also provide a minimum of one set of auxiliary contacts each.
- e) Starter enclosure shall be NEMA-1 for inside protected locations and NEMA-3R or 4, for outside locations.
- f) Provide each starter with an overload heater schedule on the inside cover.
- g) Where Allen-Bradley is specified, equivalents of G.E., Westinghouse, and Square D are acceptable.
- h) Starter to be supplied with additional dry contacts and should be linked to the fire alarm system.

5: DUCTWORK SPECIFICATION

5.0. GENERAL

Contractor shall verify all materials and accessories can be installed in accordance with Contract Documents and material manufacturers' recommendations.

Contractor shall verify, by inspecting product labeling, submittal data, and/or certifications which may accompany the shipments, that materials and accessories to be installed on the project comply with applicable specifications and standards and meet specified thermal and physical properties.

Before starting work under this section, the contractor shall carefully inspect the site and install work of other trades and verify that such work is complete to the point where installation of materials and accessories under this section can begin and does not hamper or damage the installed ductwork.

Contractor shall be properly protected during installation of insulation. Protection shall include proper attire when handling and applying insulation materials, and shall include, but not be limited to, disposable dust respirators, gloves, hard hats, and eye protection.

5.1 MATERIALS

Supply air distribution system from Air Handlers shall be galvanized sheet steel constructed in strict accordance with SMACNA Low Pressure Duct Construction Standard.

- a) General: Except for systems specified otherwise, construct ducts, casings, and accessories of galvanized sheet steel, ASTM A527, coating G90; or, aluminium sheet, ASTM B209, alloy 1100, 3003 or 5052.
- b) Specified Corrosion Resistant Systems: Stainless steel sheet, ASTM A167, Class 302 or 304, Condition A (annealed), Finish No. 4 for exposed ducts and Finish No.2B for concealed duct or ducts located in mechanical rooms.

All ductwork to have 2" W.G. Seal Class C construction and stiffeners and metal gauges to meet SMACNA low pressure duct standards.

5.2 FABRICATION

MATERIAL GAGE

Galvanized steel sheeting used for the fabrication of rectangular ducting shall have the following minimum gauge as given in the table below.

SHEET STEEL U.S. GAUGE	
LENGTH OF LONGEST SIDE (mm)	SHEET STEEL U.S. GAUGE
up through 304	26
330 – 762	24
762 – 1219	22
1219 – 2438	20
2438 – over	18

5.3 TRANSITIONS

Unless otherwise specified, the maximum acute angle between the non-parallel sides of any

diverging and converging sections in duct work shall not exceed 20° and 30° respectively. If, because of space limitations, these (maxima) have to be exceeded, then splitters shall be installed in the ductwork.

5.4 ELBOWS AND TURNING VANES

Unless otherwise specified, all elbows in ductwork shall have a minimum inside radius equal to the width of the duct. Where space limitations make necessary the installation of the elbow having an inside radius to width of duct ratio of less than 1.0, turning vanes shall be installed in the elbow.

5.5 DUCT TAKE OFF AND SPLITTER DAMPERS

Duct take-offs may be of the full radius type, tap-in type or the straight take off type. The full radius and the tap-in type shall have splitter dampers. The straight take-off shall be used only where space limitation is critical and shall have turning vanes as per section above.

5.6 JOINT SEALING

Sealant: Elastomeric compound, gun or brush grade, maximum 25 flame spread and 50 smoke developed (dry state) compounded specifically for sealing ductwork as recommended by the manufacturer. Generally, provide liquid sealant, with compatible tape, for low clearance slip joints and heavy, permanently elastic, mastic type where clearances are larger. Oil base caulking and glazing compounds are not acceptable because they do not retain elasticity and bond.

Tape: Use only tape specifically designated by the sealant manufacturer and apply only over wet sealant. Pressure sensitive tape shall not be used on bare metal or on dry sealant. Gaskets in Flanged Joints: Soft neoprene. Approved factory-made joints such as DUCTMATE SYSTEM may be used.

5.7 REGISTERS AND GRILLES

Ceiling diffusers, wall outlets, exhaust grilles return registers and exhaust fans shall be volume adjustable. All diffusers shall be independently supported by the AC contractor.

Acceptable manufactures: Air Guide, Carnes, Krueger, Titus, Metal-Aire, Price. Alternative shall be submitted for approval.

Ceiling Diffusers.

Types shall be assembled aluminium alloy grilles assembled in two parts. One shall be the ceiling diffuser itself with frame and blades extruded from 6063 aluminium alloy, the other to be the aluminium panel in which the diffuser with its extruded frame is mounted. The extruded frame of the diffuser shall be fitted into the inner edge of the panel and crimped. Core to be non-removable. Colour to be confirmed with the Architect before ordering.

Diffusers shall consist of a precision formed back cone of one-piece seamless construction which incorporates a round inlet collar of sufficient length for connecting rigid or flexible duct. An inner plaque assembly shall be incorporated that drops no more than ¼" below the ceiling plane to assure proper air distribution performance. The inner plaque assembly shall be completely removable from the diffuser face to allow full access to any dampers or other ductwork components located near the diffuser neck. Finish shall be confirmed with the Architect before ordering.

Door Grilles

Frames and blades to be 6063 extruded aluminium alloy with 200-R1 satin anodized finish. Blades to be chevron on configuration and to be mounted in a fixed position in a rigid PVC track which is an

integral part of the frame. The core free area of the unit to be 60%. Colour to be confirmed with the Architect before ordering.

Linear slot diffusers

Extruded aluminium with frame type appropriate to installation with diffuser elements being removable from frame. Both air pattern and flow rate adjustment with air pattern adjustment. Coordinate frame & border type with Architectural ceiling / mounting details. Finish shall be confirmed with the Architect before ordering. Flat black diffuser vanes and frame interior. Provide diffusers with uninsulated galvanized steel plenum. Plenum constructed for specific diffuser frame & border type. Provide round or oval inlet collar designed to fit standard flexible duct sizes. Linear slot diffuser plenum is to be externally insulated.

Linear bar diffusers and grilles

Extruded aluminium with frame type appropriate to side wall, sill or ceiling installation as indicated. Coordinate frame, border, and core type with Architectural mounting details. Finish shall be confirmed with the Architect before ordering. Provide alignment strips/wires for end-to-end joining of sections for a continuous appearance when scheduled lengths exceed standard manufacturer lengths.

Security grille

Steel (304 Stainless Steel) 3/16" face plates with 5/16" diameter holes (maximum) on 7/16" staggered centres.

Steel (304 Stainless Steel) 3/16" grille sleeve with welded seams. Sleeve length as shown on the drawings and/or as scheduled.

Finish shall be confirmed with the Architect before ordering.

Side-wall registers and grilles

Aluminium unless otherwise indicated, with frame type appropriate to installation. Double deflection type blade supply registers and supply grilles allow deflection adjustment in all directions. Opposed blade volume control damper supply registers, operable from face. Fixed blade (0-degree, 45 degree) core return and exhaust registers and grilles. Opposed blade volume control damper return registers, operable from face. Finish shall be confirmed with the Architect before ordering. Screw holes on the surface counter sunk to accept recessed type screws.

Egg-crate grille

Aluminium construction with frame type appropriate to installation. Grille faces 1/2" x 1/2" or 1" x 1" grid pattern 1" deep with a minimum of 85% free area. Finish shall be confirmed with the Architect before ordering. Screw holes on the surface counter sunk to accept recessed type screws.

5.8 PAINTING OF DUCTWORK

Any exposed (Internally and externally to building) ductwork is to be etched, primed and given two coats of industrial enamel colour to Architect's specification. Where diffusers, registers and grilles are installed, to avoid seeing inside the duct, paint the inside of the duct with flat black paint to reduce visibility.

After installation, touch up and paint channel iron frames with rust-resistant paint.

5.9 DUCT HANGERS AND SUPPORTS

Refer to SMACNA Standards Section IV. Avoid use of trapeze hangers for round ducts.

5.10 DUCT ACCESS DOORS, PANELS AND SECTIONS

Provide access doors, sized and located for maintenance work, upstream, in the following locations:

- a) Each duct mounted coil and humidifier.
- b) Each fire damper (for link service), smoke damper and automatic control damper.
- c) Each duct mounted smoke detector.
- d) For cleaning the operating room supply air duct and kitchen hood exhaust duct, locate access doors at 6 m (20 feet) intervals and at each change in duct direction.

Openings shall be as large as feasible in small ducts, 300 mm by 300 mm (12 inches by 12 inches) minimum where possible. Access sections in insulated ducts shall be double wall insulated. Transparent shatter-proof covers are preferred for uninsulated ducts.

1. For rectangular ducts: Refer to SMACNA Standards.
2. For round and flat oval duct: Access sections shall be not less than 1.0 mm (20 gauge) housing welded or riveted to a duct section.

5.11 FIRE DAMPERS

Galvanized steel, interlocking blade type, UL listing and label, 1-1/2 hour rating or as indicated on drawings, 70 °C (160 °F) fusible line, 100 percent free opening with no part of the blade stack or damper frame in the air stream. The damper frame may be of design and length as to function as the mounting sleeve, thus eliminating the need for a separate sleeve, as allowed by UL 555. Otherwise provide sleeves and mounting angles, minimum 1.9 mm (14 gauge), required to provide installation equivalent to the damper manufacturer's UL test installation.

Submit manufacturer's installation instructions conforming to UL rating test. Combination fire and smoke dampers: Multi-louver or curtain type units meeting all requirements of both dampers shall be used where shown and may be used at the Contractor's option where applicable. Fire dampers to be provided for all mechanical rooms, electrical rooms, storage rooms, vaults and any other special rooms where required whether or not shown on drawings. Fire dampers in fume hood exhaust or wet air exhaust shall be stainless steel construction, all others may be galvanized steel.

Manufacturers: Air Balance, Advanced Air, American Warming and Ventilating, Greenheck, Phillips-Aire, Prefco, Ruskin, Safe-Air or approved equal.

Static type dampers should be used on systems where the fans shut down during a fire event.

Dynamic type dampers are required (IMC 607.3) for systems where the fans remain on during a fire event. Dynamic dampers are available with various maximum velocity ratings and static pressure ratings.

MOTORIZED FIRE DAMPERS

Motorized Fire dampers shall meet the requirements of UL Standard 555 and UL Standard 555.

The fire closure device shall be linked to the actuator to move the damper to its open or closed position in response to signals from the building control system, fire alarm system, smoke alarm system, or the electric heat responsive sensing device on the damper itself.

Actuator shall be an electric or pneumatic type. Shall be externally mounting for ease of accessing for inspection and to minimize blockage.

- I. Voltage
- II. Electric, 120V AC, 2-position.

- III. Electric, 24V AC, 2-position. (transformer shall be provided by AC Contractor.)
- IV. Electric, 230V AC, 2-position
- V. Pneumatic, 20 psi minimum control pressure, 2 position.

5.12 SMOKE DAMPERS

Maximum air velocity, through free area of open damper, and pressure loss: Low pressure and medium pressure duct (supply, return, exhaust, outside air): 450 m/min (1500 fpm). Maximum static pressure loss: 32 Pa (0.13-inch WG). Maximum air leakage, closed damper: 0.32 cubic meters /min/square meter (4.0cfm per square foot) at 750 Pa (3 inches wg) differential pressure.

Minimum requirements for dampers:

- a) Meet requirements of Table 6-1 of UL 555S, except the Fire Endurance and Hose Stream Test.
- b) Frame: Galvanized steel channel with side, top and bottom stops or seals.
- c) Blades: Galvanized steel, parallel type preferably, 300 mm (12 inch) maximum width, edges sealed with neoprene, rubber or felt, if required to meet minimum leakage. Airfoil (streamlined) type for minimum noise generation and pressure drop are preferred for duct mounted dampers.
- d) Shafts: Galvanized steel.
- e) Bearings: Nylon, bronze sleeve or ball type.
- f) Hardware: Zinc plated.
- g) Operation: Automatic open/close. No smoke damper that requires manual reset or link replacement after actuation is acceptable. See drawings for required control operation.
- h) Motor operator (actuator): Provide pneumatic or electric as required by the automatic control system, externally mounted on stand-offs to allow complete insulation coverage.

5.13 FLEXIBLE AIR DUCT CONNECTORS

General: Factory fabricated, complying with NFPA 90A for connectors not passing through floors of buildings. Flexible ducts shall not penetrate any fire or smoke barrier which is required to have a fire resistance rating of one hour or more. Flexible duct length shall not exceed 1.5 m (5 feet). Provide insulated acoustical air duct connectors in supply air duct systems and elsewhere as shown.

Flexible ducts shall be listed by Underwriters Laboratories, Inc., complying with UL 181. Ducts larger than 200 mm (8 inches) in diameter shall be Class 1. Ducts 200 mm (8 inches) in diameter and smaller may be Class 1 or Class 2.

Insulated Flexible Air Duct: Factory made including mineral fibre insulation with maximum C factor or 0.25 at 24°C (75°F) mean temperature, encased with a low permeability moisture barrier outer jacket, having a puncture resistance of not less than 50 Beach Units. Acoustic insertion loss shall not be less than 3 dB per 300 mm (foot) of straight duct, at 500 Hz, based on 150 mm (6 inch) duct, of 750 m/min (2500 fpm).

Application Criteria:

- 1. Temperature range: -18° to 93°C (0 to 200°F internal).
- 2. Maximum working velocity: 1200 m/min (4000 feet per minute).
- 3. Minimum working pressure, inches of water gauge: 2500 Pa (10 inches) positive, 500 Pa (2 inches) negative.

Duct Clamps: 100 percent nylon strap, 80 kg (175 pounds) minimum loop tensile strength manufactured for this purpose or stainless-steel strap with cadmium plated worm gear tightening device. Apply clamps with sealant and as approved for UL 181, Class 1 installation.

5.14 FLEXIBLE CONNECTIONS

Where duct connections are made to fans and air handling units, install a non-combustible flexible connection of 822 g (29 ounce) neoprene coated fibreglass fabric approximately 150 mm (6 inches)

wide. For connections exposed to sun and weather provide Hypalon coating in lieu of neoprene. Burning characteristics shall conform to NFPA 90A. Securely fasten flexible connections to round ducts with stainless steel or zinc-coated iron draw bands with worm gear fastener. For rectangular connections, crimp fabric to sheet metal and fasten sheet metal to ducts by screws 50 mm (2 inches) in the centre. Fabric shall not be stressed other than by air pressure. Allow at least 25 mm (one inch) slack to ensure that no vibration is transmitted.

5.15 SOUND ATTENUATING UNITS

Casing, not less than 1.0 mm (20 gauge) galvanized sheet steel, or 1.3 mm (18 gauge) aluminium fitted with suitable flanges to make clean airtight connections to ductwork. Sound-absorbent material faced with glass fibre cloth and covered with not less than 0.6 mm (24 gauge) or heavier galvanized perforated sheet steel, or 0.85 mm (22 gauge) or heavier perforated aluminium. Perforations shall not exceed 4 mm (5/32-inch) diameter, approximately 25 percent free area. Sound absorbent material shall be long glass fibre acoustic blanket meeting requirements of NFPA 90A.

Entire unit shall be completely air tight and free of vibration and buckling at internal static pressures up to 2000 Pa (8-inch water gauge) at operating velocities. Pressure drop through each unit: Not to exceed indicated value at design air quantities indicated.

Submit complete independent laboratory test data showing pressure drop and acoustical performance.

Cap open ends of attenuators at factories with plastic, heavy duty paper, cardboard, or other appropriate material to prevent entrance of dirt, water, or any other foreign matter to the inside of the attenuator. Caps shall not be removed until the attenuator is installed in the duct system.

Fabricate and install ductwork and accessories in accordance with referenced SMACNA Standards:

Drawings show the general layout of ductwork and accessories but do not show all required fittings and offsets that may be necessary to connect ducts to equipment, boxes, diffusers, grilles, etc., and to coordinate with other trades. Fabricate ductwork based on field measurements. Provide all necessary fittings and offsets at no additional cost to the government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories on ceiling grid. Duct sizes on the drawings are inside dimensions which shall be altered by Contractor to other dimensions with the same air handling characteristics where necessary to avoid interferences and clearance difficulties.

Provide duct transitions, offsets and connections to dampers, coils, and other equipment in accordance with SMACNA Standards, Section II. Provide a streamliner, when an obstruction cannot be avoided and must be taken in by a duct. Repair galvanized areas with galvanizing repair compounds.

Provide bolted construction and tie-rod reinforcement in accordance with SMACNA Standards, Section VI.

Construct casings, eliminators, and pipe penetrations in accordance with SMACNA Standards, Section VI. Design casing access doors to swing against air pressure so that pressure helps to maintain a tight seal.

5.16 CONTROL DAMPER INSTALLATION

Provide necessary blank-off plates required to install dampers that are smaller than duct size.

Provide necessary transitions required to install dampers larger than duct size.

Assemble multiple sections dampers with required interconnecting linkage and extend required number of shafts through duct for external mounting of damper motors.

Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by experimentation, and affix and seal permanently in place, only after stratification problem has been eliminated.

Install all damper control/adjustment devices on stand-offs to allow complete coverage of insulation.

5.17 FIRE STOPPING

The contractor shall seal all openings around duct penetrations of floors, walls and fire rated partitions with fire stop material as required by NFPA 90A. Contractor to submit method of application. Contractor to ensure space around the duct is adequate for sealing of penetration.

Fire stopping shall be provided for all mechanical rooms, electrical rooms, storage rooms, floors, vaults and any other special rooms where required whether or not shown on drawings.

5.18 DUCTWORK INSTALLATION

INSULATION

Duct insulation shall be of fibreglass foil backed insulation 2" (51mm) thick and shall be thoroughly sealed on the exterior surface to prevent the ingress of moisture. Unless otherwise specified, ducts shall be externally insulated. Insulation shall be Owens-Corning or approved alternative.

SCOPE

The finished duct system shall meet the requirements of NFPA 90A and 90B. Duct wrap insulation shall meet the requirements of ASTM C 1290, Type III, to maximum service temperature of 250°F (121°C). Facing material shall meet the requirements of ASTM C 1136, Type II, when surface burning characteristics are determined in accordance with ASTM E84 with the foil surface of the material exposed to the flame as it is in the final composite. Dimensions shown on the plans are finished inside dimensions. Duct wrap shall be installed in accordance with manufacturer's instructions in such a manner that the insulation will provide the installed R-value as published for the product and printed on the facing, thus assuring specified in-place thermal performance.

DELIVERY AND STORAGE OF MATERIALS

Deliver all insulation materials and fabricated duct sections and fittings to the job site and store in a safe, dry place. Use all means necessary at the job site to protect materials from dust, dirt, moisture and physical abuse before and during installation.

INSULATED DUCT SYSTEM

All supply ducts, return ducts and related fittings shall be insulated with Owens Corning Fibreglass All-Service Duct Wrap or as approved equal: Type 150, 1.5 lb./cu.ft. (24 kg/m³) density: 2" (51mm) thick. The duct wrap insulation shall consist of a blanket of glass fibres factory-laminated to a reinforced foil/ kraft (FRK) vapour retarder facing with a 2" (51mm) (min.) stapling and taping flange on one edge.

ACCESSORIES

Provide accessories per duct insulation system manufacturer's recommendations, including the following:

- a) Pressure sensitive tape.
- b) Staples and fasteners.
- c) Vapor retarders
- d) Duct sealant.

5.19 EXECUTION

INSPECTION

Verify that the duct wrap may be installed in accordance with project drawings and operating performance parameters and limitations.

Contractor shall replace any damaged insulation, which cannot be satisfactorily repaired, including insulation with duct wrap damage and moisture-saturated insulation. The contractor shall advise the requirements for protection of the insulation work during the remainder of the construction period to avoid any damage and deterioration of the finished insulation work.

INSULATION OF STRAIGHT DUCT AND FITTINGS

Before applying duct wrap, air ducts shall be clean, dry and tightly sealed at all joints and seams. All portions of duct designated to receive duct wrap shall be completely covered with duct wrap. To ensure installed thermal performance, duct wrap insulation shall be cut to "stretch-out" dimensions. A 2" (50mm) piece of insulation shall be removed from the facing at the end of the piece of duct wrap to form an overlapping stapling and taping flap. Install duct wrap insulation with facing outside so that the tape flap overlaps the insulation and facing at the other end of the piece of duct wrap. Adjacent sections of duct wrap insulation shall be tightly butted with the 2" (50mm) stapling and taping flap overlapping. If ducts are rectangular or square, install so insulation is not excessively compressed at corners. Seams shall be stapled approximately 6" (150mm) on centre with 1/2" (13mm) (min.) steel outward clinching staples. Seams and joints shall be sealed with pressure-sensitive tape matching the insulation facing (either plain foil or FRK backing stock) or glass fabric and mastic. Cloth duct tape of any colour or finish using reclaimed rubber adhesives is not recommended for use on duct wrap insulation. Adjacent sections of duct wrap shall be tightly butted with the 2" (50mm) tape flap overlapping.

Where rectangular ducts are 24" (600mm) in width or greater, duct wrap insulation shall be additionally secured to the bottom of the duct with mechanical fasteners such as pins and speed clip washers, spaced on 18" (425mm) centres (maximum) to prevent sagging of insulation.

Where a vapour retarder is required, seal all tears, punctures and other penetrations of the duct wrap facing using one of the above methods to provide a vapour tight system.

INSPECTION

Upon completion of installation of duct wrap and before operation is to commence, visually inspect the system and verify that it has been correctly installed. Open all system dampers and turn on fans to blow all scraps and other loose.

5.20 SUPPORTS AND HANGERS

The Air Conditioning Contractor shall supply all ductwork supports as part of his contract.

Support materials and hangers shall be fit for use and submitted for approval prior to installation.

As mentioned in section on Contractor's drawings all relevant information on supports and hangers are to be included on ductwork drawings. The air conditioning contractor shall supply the embedded material for fixing supports i.e. threaded inserts.

6: DIRECT EXPANSION AIR HANDLING UNITS

6.0 GENERAL

This section includes the design, controls, and installation requirements for indoor air handling units. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration. Unit Energy Efficiency Ratio (EER) shall be equal to or greater than that prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings. Unit shall be safety certified by ETL and ETL US listed.

6.1 SUBMITTALS

Product Data: Literature shall be provided that indicates dimensions, operating and shipping weights, capacities, ratings, fan performance, filter information, factory supplied accessories, electrical characteristics, and connection requirements. Installation, Operation and Maintenance manual with start-up requirements shall be provided.

Shop Drawings: Unit drawings shall be provided that indicate assembly, unit dimensions, construction details, clearances, and connection details. Computer generated fan curves for each fan shall be submitted with specific design operation point noted. Wiring diagram shall be provided with details for both power and control systems and differentiate between factory installed and field installed wiring.

6.2 CASING AND CONSTRUCTION

Casing shall be made of heavy gauge galvanized steel and finished with baked enamel paint. Unit construction shall be such that horizontal or vertical discharge may be achieved by relocating the fan section.

- a) Unit insulation shall have a minimum thermal resistance R-value of 6.25. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for a minimum flash ignition temperature of 610°F.
- b) Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel.
- c) Unit shall be designed to reduce air leakage and infiltration through the cabinet. Sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
- d) Access to filters, cooling coil, supply fans, and electrical and controls components shall be provided.
- e) Units with a cooling coil shall include sloped 304 stainless steel drain pan. Drain pan connection shall be on the right-hand side of the unit.
- f) Cooling coils shall be mechanically supported above the drain pan by multiple supports that allow drain pan cleaning and coil removal.

6.3 EVAPORATOR FAN SECTION

Fan section shall have forward curved blades, double inlet fans mounted on a common shaft. Fans shall be statically and dynamically balanced and shall run on permanently lubricated pillow block bearings. Motors shall be premium efficiency ODP with ball bearings with external lubrication points. Fan motors shall be premium efficiency.

6.4 COOLING COILS

Cooling coils shall be of non-ferrous construction with mechanically bonded ripple-edged plate fins. Coils shall have two independent circuits as indicated in the equipment schedules. Coil shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminium fins mechanically bonded to the tubes and galvanized steel end casings. Coil shall have two circuits and interlaced circuitry. Coil shall be hydrogen or helium leak tested. Coil shall be furnished with factory installed thermostatic expansion valves. The sensing bulbs shall be field installed on the suction line immediately outside the cabinet. Liquid and suction connections shall be sweat connection. Coil connections shall be labelled, extend beyond the unit casing, and be factory sealed on both the interior and exterior of the unit casing, to minimize air leakage. Air handling unit and matching condensing unit shall be capable of operation as an R-410A split system air conditioner. Each refrigeration circuit shall be equipped with thermostatic expansion valve type refrigerant flow control.

6.5 FILTERS

Filters shall be standard size and shall be of the high velocity permanent type. Filter shall be MERV-8 washable filter type. Filters shall be protected from the cooling condensate. Temporary filters to be provided during construction and installation.

6.6 THERMOSTAT

All Air Handlers are to be provided with Honeywell Chronotherm Electronic Programmable Thermostat and installed as per manufacturer's recommendations,

The thermostat to have minimum functions: -

- i. Seven-day operational settings
- ii. On / off capability
- iii. Battery backup
- iv. Remote temperature sensor linked to thermostat.

Accessories

- a) Tamper proof guard

Unit shall be provided with an external control panel with separate low voltage control wiring with conduit and high voltage power wiring with conduit between the control panel and the unit. Control panel shall be field mounted.

Unit controllers shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested.

Controller shall be capable of standalone operation with unit configuration, set point adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.

Controller shall have an inboard clock and calendar functions that allow for occupancy scheduling.

Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.

6.7 CONDENSATE LINE

All Air Handlers are to be provided with condensate lines to the nearest floor drain. Horizontal condensate line to be externally insulated. All condensate lines from the air handler to have a condensate trap. Condensate line shall not be less than 25mm (1 Inch).

6.8 UVC EMITTERS

All Air handlers to be supplied with UVC emitters and installed as per manufacturer specifications. The contractor shall supply adequate number and size of UVC emitters as recommended by manufacturer. Sight Glass to be provide for all UVC emitters (Lamps). Power to UVC emitters shall be taken from inside the air handler controls or alternation location. Safety Switch to be provided by supplier. All warning identification to be provided.

7 DIRECT EXPANSION CONDENSING UNITS

7.0 CONDENSER COILS

Condenser coil shall be of non-ferrous construction. Coil shall have aluminium plate fins, mechanically bonded to seamless copper tubes. Coil shall be circuited for sub cooling. SPLIT-FIN coils shall not be accepted.

7.1 CONDENSER MOTORS

Condenser motors shall be directly connected to propeller-type condenser fans arranged for vertical discharge. Condenser fan motors shall have inherent protection and shall be of the permanently lubricated type, resiliently mounted. Each fan shall have a safety guard. Controls shall be included for cycling fans for variable operation.

7.2 COMPRESSORS

Compressors shall be of hermetic or semi-hermetic design as given in the equipment schedule and shall have external vibration isolators and automatically reversible oil pump. Compressor shall be located in a section separated from condenser fans and coil.

7.3 CONTROLS

Controls shall be factory wired and located in a separate enclosure. Safety devices shall consist of high- and low-pressure switches and compressor overload devices. Unit wiring shall incorporate a positive acting timer to prevent short cycling of the compressor if power is interrupted. Timer shall prevent compressor from restarting for approximately 5 minutes after shut-off. All transformers shall be provided for the control circuit.

7.4 CASING AND CONNECTIONS

Casing shall make unit fully weatherproof for outdoor installation. Casing shall be of galvanized steel, zinc phosphatized, and finished with baked enamel. Openings shall be provided for power and refrigerant connections. Panels shall be removable to provide access to all internal components for servicing.

7.5 MOTOR PROTECTION

Motor protection devices are to be provided for all condensing units. Device shall be ICM model 450 or approved alternative.

7.6 CONDENSER COMPRESSOR ENVIRONMENT TREATMENT

Coil Treatment shall be factory treated or applied locally in a control environment.

- Cabinet external surfaces to be treated with two (2) coats of clear coat finish – sprayed on.
- Cabinet internal surfaces including the base to be treated with bitumastic coating.
- Coil fins to be Factory Heresite treated or approved alternative.
- Condenser Coil ends and other copper joints to be epilux coated.

Contractor to submit a complete method statement for application of the above items.

Note: Field applied coatings shall not be acceptable.

7.7 CONDENSER COMPRESSOR WARRANTY

- Compressor minimum warranty 5 years.
- Warranty on treated coil minimum 5 years.

7.8 REFRIGERANT

Equipment must utilize environmentally friendly refrigerant - R410A (or approved alternative) which is not scheduled for phase out under the Montreal protocol

8: DIRECT EXPANSION MINI-SPLIT BLOWERS

8.0 GENERAL

The units shall be rated in accordance with Air-conditioning, Heating, and Refrigeration Institute's (AHRI) Standard 240 and bear the AHRI Certification label.

The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, control circuit board, fan and fan motor.

Refrigerant lines to the indoor units shall be fully insulated.

8.1 COOLING COILS

Cooling coils shall be of non-ferrous construction with mechanically bonded ripple-edged plate fins. The indoor unit shall be charged with dry air before shipment from the factory. The coils shall be pressure tested at the factory.

8.2 EVAPORATOR FAN SECTION

Blower shall be centrifugal type with a direct drive, permanent split capacitor type three speed motor. The indoor fan shall consist of three (3) speeds, High, Mid, and Low and Auto Fan Mode.

8.3 CASING AND CONSTRUCTION

Casing shall be made of heavy-duty plastic. Discharge of units shall be horizontal. A condensate pan and drain shall be provided under the coil.

8.4 FILTER

Return air shall be filtered by means of a standard factory installed return air filter.

8.5 CONTROL

WIRELESS, WALL MOUNTED REMOTE CONTROLLER

The Wireless wall mounted remote controller shall consist of a wireless receiver to the indoor unit and mounting bracket. The controller shall be white in colour with an LCD display and a back-light feature. The controller shall consist of Function buttons below the display, and Increase/Decrease Set Temperature buttons and a Hold button to the right of the display. The controller shall have a built-in temperature sensor and a battery holder, using two AA alkaline batteries supplied by the AC contractor. Temperature shall be displayed in either Fahrenheit (°F) or Celsius (°C), and temperature changes shall be by increments of 1°F (0.5°C). Communication shall be automatically restored after power resumes and after batteries are replaced.

WIRED REMOTE CONTROLLER (FOR SPECIAL ROOMS WHERE REQUIRED)

The Wired Remote Controller white in colour with an LCD display. They shall support English for display information.

- a) There shall be a built-in weekly timer with up to 8 pattern settings per day.
- b) The controller shall consist of an on/Off button,
- c) Increase/Decrease Set Temperature buttons,
- d) Cool/Auto/Fan/Dry mode selector,
- e) Timer Menu button, Timer On/Off button,

- f) Set Time buttons,
- g) Fan Speed selector,
- h) Ventilation button,
- i) The controller shall have a built-in temperature sensor.
- j) Temperature shall be displayed in either Fahrenheit (°F) or Celsius (°C), and Temperature changes shall be by increments of 1°F (0.5°C).

Field wiring shall run directly from the indoor unit to the wired controller with no splices. The control voltage from the wired controller to the indoor unit shall be 12/24 volts, DC. Up to two wired controllers shall be able to be used to control one unit. This control wiring shall be supplied and installed by the AC contractor.

9: DIRECT EXPANSION MINI SPLIT WITH INVERTER COMPRESSORS

9.0 GENERAL

The units shall be rated in accordance with Air-conditioning, Heating, and Refrigeration Institute's (AHRI) Standard 240 and bear the AHRI Certification label.

The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001, which is a set of standards applying to environmental protection set by the International Standard Organization (ISO). System efficiency shall meet or exceed 15 SEER. The outdoor unit shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory.

The air conditioning system shall be a variable capacity mini-split type. The system shall consist of a combination of an indoor unit with a remote controller connected to an outdoor unit which shall be of an inverter driven design.

9.1 CONDENSER COILS

Condenser coil shall be of non-ferrous construction with aluminium plate fins, mechanically bonded to seamless copper tubes. SPLIT-FIN coils shall not be accepted.

The coil shall be protected with an integral guard. Refrigerant flow from the outdoor unit to the indoor units shall be independently controlled by means of individual electronic linear expansion valves for each indoor unit. Outdoor unit shall be pre-charged with sufficient R-410a refrigerant for up to twenty-five (25) feet of refrigerant piping. All refrigerant lines between outdoor and indoor units shall be of annealed, refrigeration grade copper tubing, ARC Type, meeting ASTM B280 requirements, individually insulated in twin-tube, flexible, closed-cell, CFC-free (ozone depletion potential of zero), elastomeric material for the insulation of refrigerant pipes and tubes with thermal conductivity. All refrigerant connections between outdoor and indoor units shall be flare type.

9.2 ELECTRICAL

The unit electrical power shall be 220/230 volts, 3 phase, 60 Hz. The unit shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts.

The outdoor unit shall be controlled by the microprocessors located in the indoor unit and in the outdoor unit communicating system status, operation, and instructions digitally over control, a system directing that the indoor unit be powered directly from the outdoor unit using a 3-wire, 14-gauge connection plus ground.

A 12 to 24-volt DC data stream shall communicate between the units providing all necessary information for full function control.

The outdoor unit shall be equipped with Pulse Amplitude Modulation (PAM) compressor inverter drive control for maximum efficiency with minimum power consumption.

9.3 CONDENSER MOTORS

Condenser motors shall be

- a) The unit shall be furnished with a direct drive, high performance propeller type fan.
- b) The condenser fan motor shall be a variable speed, direct current (DC) motor and shall have permanently lubricated bearings.
- c) Fan speed shall be switch automatically according to the number of operating indoor units and the compressor operating frequency.
- d) The fan motor shall be mounted with vibration isolation for quiet operation.
- e) The fan shall be provided with a raised guard to prevent contact with moving parts.

- f) The outdoor unit shall have horizontal discharge airflow.
- g) Outdoor unit sound level shall not exceed 54 dB(A).

9.4 COMPRESSORS

The compressor shall be a high performance, hermetic, inverter driven, variable speed, dual rotary type. The compressor motor shall be direct current (DC) type equipped with a factory supplied and installed inverter drive package. The outdoor unit shall be equipped with a suction side refrigerant accumulator. The compressor will be equipped with an internal thermal overload. The compressor shall be mounted on vibration isolators.

9.5 CASING AND CONNECTIONS

Casing shall make unit fully weatherproof for outdoor installation. Casing shall be of galvanized steel, zinc phosphatized, and finished with baked enamel. Openings shall be provided for power and refrigerant connections. Panels shall be removable to provide access to all internal components for servicing. Two (2) mild steel mounting feet, traverse mounted across the cabinet base pan, welded mount, providing four (4) slotted mounting holes shall be furnished.

9.6 CONDENSER COMPRESSOR ENVIRONMENT TREATMENT

Treatment shall be done factory treated or applied locally in a control environment.

- Cabinet external surfaces to be treated with two (2) coats of clear coat finish – sprayed on.
- Cabinet internal surfaces including the base to be treated with bitumastic coating.
- Coil fins to be Factory Heresite treated or approved alternative.
- Coil ends to be epilux coated.
- Condenser Coil ends and other copper joints to be epilux coated.

Contractor to submit a complete method statement for application of the above items.

Note: Field applied coatings shall not be acceptable.

9.7 WARRANTY

- a) Compressor minimum warranty 5 years.
- b) Warranty on treated coil minimum 5 years.
- c) All other parts minimum 1 year

9.8 REFRIGERANT

Equipment must utilize environmentally friendly refrigerant - R410A which is not scheduled for phase out under the Montreal protocol (or alternative)

9.9 SUPPORTS

The Air Conditioning Contractor shall supply suspended supports and hangers for all air conditioning equipment supplied as part of his contract. Support materials shall be fit for use and submitted for approval prior to installation. As mentioned in section on Contractor's drawings all relevant information on supports to be included on equipment drawings. The air conditioning contractor shall supply the embedded material for fixing supports i.e. threaded inserts.

10: DIRECT EXPANSION PRECISION AIR CONDITIONING SYSTEMS

10.1 GENERAL CONDITIONS

The return Opening, the display screen and the supply Air Discharge are all on one side for the return opening for both units at the top of the machines display return screen at the front and the Supply Air Discharge at the bottom.

SUMMARY

These specifications describe requirements for a precision environment control system. The system shall be designed to maintain temperature and humidity conditions in the rooms containing electronic equipment. The manufacture shall design and furnish all equipment to be full compatible with heat dissipation requirements of the room.

DESIGN REQUIREMENTS

The precision environment control system shall be a self-contained factory assembled unit with down flow air delivery. The system shall have a total cooling capacity as specified nominal, based on an entering air temperature of 75°F wet bulb. The unit is to be supplied with 230 Volt 3 Ph 60 Hz electrical service.

SUBMITAL

Submittals shall be provided with the proposal and shall include: Single-Lined diagrams; Dimensional, Electrical, and Capacity Data; Piping and Electrical Connection Drawings.

10.2 PRODUCT

CABINET AND FRAME CONSTRUCTION

This frame shall be constructed of mild welded tubular steel. It shall be painted using the auto-phonetic coating process for maximum corrosion protection. The exterior panels shall be insulated with a minimum 1 in. (25.4), 1.5lbs. (.68 kg) density fiber insulation. The main front panel shall have captive ¼ turn fasteners. The main unit colour shall be beige. The accent colour shall be beige. The exterior panels shall be powder coated.

FILTER CHAMBER (Upflow units w/front & bottom return)

The filter chamber shall be an integral part of the system located within the cabinet serviceable from the end of the unit. The filters shall be rated not less than 45% efficiency (based on ASHRAE 52-76).

FAN SECTION

The fan section shall be designed for 8400 cfm nominal at an external static pressure of 1 in wg. (pa). The fans shall be the centrifugal type, double with double inlet, and shall be statically and dynamically balanced as a completed assembly to a maximum vibration level of two mils in any plane. The shaft shall be heavy duty steel with self-aligning ball bearings with a minimum life span of 100,000 hours. The fan motor package shall operate at 1750 RPM and mounted on an adjustable side base. The drive package shall be multi-belted variable speed, sized for 200% of the fan motor horsepower. The fans shall be located to draw air over the A-frame coil to ensure even air distribution and maximum and coil performance.

ELECTRIC HEAT

The electric reheat coil shall be low watt density, 304/304 stainless steel finish tubular construction, protected by the thermal safety switches, shall be controlled in three stages.

METAL STAND

A metal stand for the Precision Units complete with height adjustable legs shall be supplied with the fans.

AUTOMATIC CHANGE OVER SWITCH

An automatic change over switch (A3) shall be supplied to provide uninterrupted change over from the lead unit to the standby unit in the event of a malfunction of the lead unit.

10.3 ADVANCE MICROPROCESSOR CONTROL PROCESSOR

The optional advance control processor shall be microprocessor based with a front monitor dot matrix display panel with graphics and control keys for user inputs.

The control shall be menu driven with on-screen prompts for easy user operation. The system shall allow user review and programming of temperature and humidity setpoints, alarm parameters, and setup selections including choice of control type. A password shall be required to make system changes. For all user selections, the range of acceptable input (temperature, humidity, or time delay) shall be displayed on the monitor screen. The system shall provide monitoring of room conditions, operational status in % of each function, component run times, date and time and four analog inputs from sensors provided by others.

CONTROL

The control system shall allow programming of the following room conditions:

Temperature Setpoint	:	65-85°F (18-29°C)
Temperature Sensitivity	:	+1° to 9.9°F (+0.6-5.6°C) in 0.1°F (.1°C)
Humidity Setpoint	:	20-80% R.H.
Humidity Sensitivity	:	+1% to 30% R.H.

All setpoints shall be adjustable from the individual unit front monitor panel. Temperature and Humidity Sensors shall be capable of being calibrated using the front monitor panel controls to coordinate with other temperature and humidity sensors in the room.

PREDICTIVE HUMIDITY CONTROL

The microprocessor shall calculate the moisture content in the room and prevent unnecessary humidification and dehumidification cycles by responding to changes in dewpoint temperature. In addition, the system shall provide the following internal controls.

COMPRESSOR SHORT – CYCLE CONTROL

The control system shall prevent compressor short-cycling by a 3-minute timer from compressor stop to the next start.

AUTOMATIC COMPRESSOR SEQUENCING

The microprocessor shall automatically change the lead/lag sequence of the compressors after each start to lengthen compressor-on cycles and even compressors wear.

SYSTEM AUTO-RESTART

For start-up after power failure, the system shall provide automatic restart with a programmable (up to 9.9 minutes in 6-second increments) time delay. Programming can be performed either at the unit or from the central site monitoring system.

SEQUENTIAL LOAD ACTIVATION

During start-up, or after power failure, the micro-processor shall sequence operational load activation to minimise in-rush current. System allowing multiple loads start simultaneously are unacceptable.

FRONT MONITOR DISPLAY PANEL

The microprocessor shall provide a front monitor LCD 240×128 dot matrix graphics display panel with backlighting. This display (along with five front mounted control keys) shall be the only operator interface required to obtain all available system information such as room conditions, operational status, alarm, control and alarm setpoints, and all user selections including alarm delays, sensor calibration, DIP switch selections, and diagnostics. All indicators shall be in language form. No symbols or codes shall be acceptable.

ALARMS

The microprocessor shall activate an audible and visual alarm in event of any of the following conditions:

- High Temperature
- Low Temperature
- High Humidity
- Low Humidity
- Short Cycle
- Compressor
- Overload (#1 and #2) Main Fan Overload
- Humidifier Problem
- High Head Pressure (#1 and #2)
- Change Filters
- Loss of Air Flow
- Low Suction Power
- Loss of Power
- Custom Alarm (#1 to #4)

Customs alarms are four customer accessible alarm inputs to be indicated on the front panel. Customs alarm can be identified with prepared (programmable) labels for the following frequently used inputs:

- Water Under Floor
- Smoke Detector
- Standby GC Pump On
- Loss of Water Flow
- Standby Unit on.

User customized text can be entered for all four customs alarms. Each alarm (unit and custom) can be separately enabled or disabled, selected to activate the common alarm, and programmed for a time delay of 0 to 255 seconds.

AUDIBLE ALARM

The audible alarm shall annunciate any alarm that is enabled by the operator.

COMMON ALARM

A programmable common alarm shall be provided to interface user selected alarms with a remote alarm device.

CONTROL ALARM

The user shall be able to select the type of control the advanced microprocessor will use. Selections available shall be intelligent, proportional, and tunable PID (proportional, integral, and derivative gains).

The intelligent control shall incorporate control logic that uses artificial intelligence techniques including “fuzzy logic and “expert systems” methods to maintain precise, stable control. If tunable PID is selected, the user shall be able to program each of the three gains.

ANALOG INPUTS

The system shall include for customer accessible analog inputs for sensor provided by others. The analog inputs shall accept a 4 to 20 mA signal.

The user shall be able to change the input to 0 to 5 vdc if required. The gains for each analog input shall be programmable from the front panel. The analog inputs shall be able to be monitored from the front panel.

DIAGNOSTICS

The control system and electronically circuitry shall be provided with self-diagnostics to aid in

trouble shooting. The microcontroller board shall be diagnosed as reported as pass/not pass. Control inputs shall be indicated as on or off at the front monitor panel. Control outputs shall be able to be turned on or off from the front monitor panel without using jumpers or a service terminal.

DATA COLLECTION

The control system shall maintain accumulative operating hours of compressors, reheats, humidifier, fan motor, Econ-o-coil, and head rejection. The sixty most recent alarms shall also be retained.

GRAPHING

The control shall display the following graphic data:

“temperature, humidity, analog inputs component operating status by hour lead detection floor plan operating status”.

10.4 COMPRESSED SYSTEMS

DUAL REFRIGERANT SYSTEMS

Each refrigerant circuit shall include hot gas mufflers, liquid line filters dryers, refrigerant sight glass with moisture indicator adjustable, externally equalized expansion valves, and liquid line solenoid valves.

The compressors shall be located in a separate compartment so they may be serviced during operation of the equipment. The compressor shall be semi-hermetic with a suction gas cooled motor, vibration isolators, thermal overloads, oil sight glass, manual reset high pressure switch, pump down low pressure switch, suction line strainer, reversible oil pumps for forced feed lubrication, a maximum operating speed of 1750 RPM.

FOUR-STEP REFRIGERANT SYSTEM

The environment control system shall include cylinder unloaders on the semi-hermetic compressors. The unloaders shall be activated by solenoid valves which are controlled from the microprocessor control. In response to the return air temperature, the microprocessor control shall activate the unloader solenoids and the liquid line solenoids such that four stages of refrigerant cooling are obtained.

The stages shall be:

One compressor, partially loaded.

Two compressor partially loaded.

One compressor partially loaded; one compressor fully loaded.

Two compressors fully loaded.

On a call for dehumidification, the microprocessor control shall insure that at least one compressor is on full or proper humidity control.

AIR COOLED SYSTEMS

The air cooled condenser shall be the low profile, slow speed, multiple direct drive, propeller fan type. The condenser shall balance the heat rejection of the compressor at 95°F (°C) ambient. The condenser shall be constructed of aluminum and contain all copper tube, aluminum fin coil arranged for (horizontal) (vertical) air discharge.

10.5 TEMPERATURE AND HUMIDITY RECORDER

Provide a 7-day/24 hour temperature and humidity recorder of the full scope, two pensurface mounted type with 100 recording charts, one red and one blue bottle of Nrecording ink. Recorder shall have an 110 volt, single phase 60 Hz power supply.

SMOKE DETECTOR

The smoke detector shall immediately shut down the environmental control system and activate the alarm system when activated. The smoke detector shall be mounted in the electrical panel with the sensing element in the return air compartment.

10.6 EXECUTION

INSTALLATION OF PRECISION AIR CONDITIONING UNITS

GENERAL

Install precision air conditioning units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated and maintain manufacturer's recommended clearances.

ELECTRICAL WIRING

Install and connect electrical devices furnished by manufacture but not specified to be factory mounted. Furnish copy of manufacturer's electrical connection diagram submittal to electrical contractor.

PIPING CONNECTIONS

Install and connect devices furnished by manufacture but not specified to be factory mounted.

FIELD QUALITY CONTROL

Start up mainframe coolant units in accordance with manufacturer's start up instructions. Test controls and demonstrate compliance with requirements. These specifications describe requirements for a computer room environmental control system. The system shall be designed to maintain temperature and humidity conditions in the rooms containing electronic equipment. The manufacture shall design and furnish all equipment to be fully compatible with heat dissipation requirements.

11: DIRECT EXPANSION SINGLE PACKAGE OUTDOOR TEMPERED AIR UNIT WITH VARIABLE SCROLL COMPRESSORS

11.1 GENERAL DESCRIPTION

This section includes the design, controls and installation requirements for packaged rooftop units / outdoor air handling units.

11.2 MANUFACTURER

Products shall be provided by the following manufacturers: AAON

11.3 EQUIPMENT

- a) Equipment may be considered for approval that includes at a minimum:
 - 1. R-410A refrigerant
 - 2. Variable capacity compressor with 10-100% capacity control
 - 3. Direct drive supply fans
 - 4. Double wall cabinet construction
 - 5. Insulation with a minimum R-value of 13
 - 6. Stainless steel drain pans
 - 7. Hinged access doors with lockable handles
- b) All other provisions of the specifications must be satisfactorily addressed
- c) Single Packaged air-cooled condenser units shall be certified in accordance with ANSI/AHRI Standard 340/360 performance rating of commercial and industrial unitary air-conditioning and heat pump equipment.
- d) Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.
- e) Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.
- f) Unit Energy Efficiency Ratio (EER) shall be equal to or greater than that prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.
- g) Unit shall be safety certified by ETL and ETL US listed.

11.4 SUBMITTALS

- 1. Product Data: Literature shall be provided that indicates dimensions, operating and shipping weights, capacities, ratings, fan performance, filter information, factory supplied accessories, electrical characteristics and connection requirements. Installation, Operation, and Maintenance manual with start-up requirements shall be provided.
- 2. Shop Drawings: Unit drawings shall be provided that indicate assembly, unit dimensions, construction details, clearances and connection details. Computer generated fan curves for each fan shall be submitted with specific design operation point noted. Wiring diagram shall be provided with details for both power and control systems and differentiate between factory installed and field installed wiring.

11.5 DELIVERY, STORAGE, AND HANDLING

- 1. Unit shall be shipped with doors screwed shut and outside air hood closed to prevent damage during transport and thereafter while in storage awaiting installation.
- 2. Follow Installation, Operation, and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.
- 3. Unit shall be stored in a clean, dry place protected from construction traffic in accordance with the Installation, Operation, and Maintenance manual.

11.6 ROOFTOP UNITS

General Description

- a) Packaged rooftop unit shall include compressors, evaporator coils, filters, supply fans, dampers, air-cooled condenser coils, condenser fans, reheat coil, and unit controls.
- b) Unit shall be factory assembled and tested including leak testing of the DX coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. Run test report shall be supplied with the unit in the service compartment's literature pocket.
- c) Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
- d) Unit components shall be labelled, including refrigeration system components and electrical and controls components.
- e) Estimated sound power levels (dB) shall be shown on the unit ratings sheet.
- f) Installation, Operation, and Maintenance manual shall be supplied within the unit.
- g) Laminated colour-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.
- h) Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

Construction

- a) All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
- b) Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for a minimum flash ignition temperature of 610°F.
- c) Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel.
- d) Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
- e) Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.
- f) Access to filters, dampers, cooling coils, reheat coil, compressors, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.
- g) Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
- h) Units with cooling coils shall include double sloped 304 stainless steel drain pans.
- i) Unit shall be provided with side discharge.
- j) Unit shall include lifting lugs on the top of the unit.
- k) Unit shall include interior corrosion protection which shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure. Air tunnel, fans and

dampers shall all include the corrosion protection.

Electrical

- a) Unit shall be provided with standard power block for connecting power to the unit.
- b) Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal. Device shall be ICM model 450 or approved alternative.
- c) Unit shall be provided with remote stop/start terminals which require contact closure for unit operation. When these contacts are open the low voltage circuit is broken and the unit will not operate.

Supply Fans

Unit shall include direct drive, unhooded, backward curved, plenum supply fans.

- 1. Blowers and motors shall be dynamically balance and mounted on rubber isolators.
- 2. Motors shall be standard efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.

Cooling Coils

Evaporator Coils

- a) Coils shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminium fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
- b) Coils shall have interlaced circuitry and shall be standard capacity.
- c) Coils shall be hydrogen or helium leak tested.
- d) Coils shall be furnished with factory installed thermostatic expansion valves.

Refrigeration System

- a) Unit shall be factory charged with R-410A refrigerant.
- b) Compressors shall be scroll type with thermal overload protection, independently circuited and carry a 5 year non-prorated warranty.
- c) Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam injected panels to prevent the transmission of noise outside the cabinet.
- d) Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.
- e) Each refrigeration circuit shall be equipped with thermostatic expansion valve type refrigerant flow control.
- f) Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides and a factory installed replaceable core liquid line filter driers.
- g) Unit shall include a variable capacity scroll compressor on all refrigeration circuits which shall be capable of modulation from 10-100% of its capacity.
- h) Lead refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and over-cooling of the space.

Air-Cooled Condenser

- a) Condenser fans shall be a vertical discharge, axial flow, direct drive fans.
- b) Coils shall be designed for use with R-410A refrigerant. Coils shall be multi-pass and shall be constructed of copper tubes with aluminium fins mechanically bonded to the tubes and aluminium end casings. Fin design of copper tube coils shall be sine wave rippled.
- c) Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.
- d) Coils shall be hydrogen or helium leak tested.
- e) Coils shall have a flexible, epoxy polymer e-coat uniformly applied to all coil surface areas without material bridging between fins. Humidity and water immersion resistance shall be up to a minimum 1,000 and 250 hours respectively (ASTM D2247-92 and ASTM D870-92). Corrosion durability shall be confirmed through testing to no less than 6,000 hours salt spray per ASTM B117-90. Coated coils shall receive a spray-applied, UV-resistant polyurethane topcoat to prevent UV degradation of the e-coat.

Filters

Unit shall include a 2 inch thick, permanent filter frame with replaceable media, upstream of the cooling coil.

Outside Air

Unit shall include 100% outside air opening, without a damper assembly, with bird screen, and outside air hood.

Controls

- a) Factory Installed and Factory Provided Controller
- b) Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested. Controller shall be capable of stand alone operation with unit configuration, set point adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.
- c) Controller shall have an on-board clock and calendar functions that allow for occupancy scheduling.
- d) Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.
- e) Make up Air Controller
 - 1. Unit shall modulate cooling with constant airflow to meet ventilation outside air loads. Cooling capacity shall modulate based on supply air temperature.
 - 2. With modulating hot gas reheat, unit shall modulate cooling and hot gas reheat as efficiently as possible, to meet outside air humidity loads and prevent supply air temperature swings and over-cooling of the space.
- f) Unit configuration, set point adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with connection to interface module with LCD screen and input keypad, interface module with touch screen, or with connection to PC with free configuration software. Controller shall be capable of connection with other factory installed and factory provided unit controllers with individual unit configuration, set point adjustment, sensor status viewing, and occupancy scheduling available from a single unit. Connection between unit controllers shall be with a modular cable. Controller shall be capable of communicating and integrating with a LonWorks or BACnet network.

Accessories

- a) Unit shall be provided with a safety shut-down terminal block for field installation of a smoke detector which shuts off the unit's control circuit.

11.7 WARRANTY

Supplier shall provide warranty for a period of 12 months from the date of equipment start-up. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer's written instructions for Installation, Operation, and maintenance have been followed.

Extended warranty shall be provided for compressors and coils by the Contractor.

- Compressor minimum warranty 5 years.
- Warranty on treated coil minimum 5 years.

11.8 CONDENSER COMPRESSOR ENVIRONMENT TREATMENT

Coil Treatment shall be factory treated or applied locally in a control environment.

- Cabinet external surfaces to be treated with two (2) coats of clear coat finish – sprayed on.
- Cabinet internal surfaces including the base to be treated with bitumastic coating.
- Coil fins to be Factory Heresite treated or approved alternative.
- Condenser Coil ends and other copper joints to be epilux coated.

Contractor to submit a complete method statement for application of the above items. Note: Field applied coatings shall not be acceptable.

11.9 EXECUTION

Installation, Operation, and Maintenance

- a) Installation, Operation, and Maintenance manual shall be supplied with the unit.
- b) The contractor shall install unit, including field installed components, in accordance with Installation, Operation, and Maintenance manual instructions as recommended by the manufacturer.
- c) Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.

11.10 CONDENSATE LINE

- a) All Air Handlers are to be provided with condensate line to nearest floor drain.
- b) Horizontal condensate line to be externally insulated.
- c) All air handler to have a condensate trap.

12: PIPE HANGERS AND SUPPORTS

12.0 GENERAL

SUMMARY

The work covered under this section consists of the furnishing of all necessary labour, supervision, materials, equipment, and services to completely execute the pipe hanger and supports as described in this specification.

REFERENCES

- a) ASTM B633 – Specification for Electro deposited Coatings of Zinc on Iron and Steel
- b) ASTM A123 – Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip.
- c) ASTM A653 – Specification for Steel Sheet, Zinc-Coated by the Hot-Dip Process.
- d) ASTM A1011 – Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability (Formerly ASTM A570)
- e) MSS SP58 – Manufacturers Standardization Society: Pipe Hangers and Supports- Materials, Design, and Manufacture
- f) MSS SP69 – Manufacturers Standardization Society: Pipe Hangers and Supports- Selection and Application
- g) NFPA 13 – Standard for the Installation of Sprinkler Systems

QUALITY ASSURANCE

- a) Hangers and supports used in fire protection piping systems shall be listed and labelled by Underwriters Laboratories.
- b) Steel pipe hangers and supports shall have the manufacturers name, part number, and applicable size stamped in the part itself for identification.
- c) Hangers and supports shall be designed and manufactured in conformance with MSS SP 58.
- d) Supports for sprinkler piping shall be in conformance with NFPA 13.

SUBMITTALS

Submit product data on all hangers and support devices, including shields and attachment methods. Product data to include, but not limited to materials, finishes, approval, load ratings, and dimensional information.

12.1 PRODUCTS

ACCEPTABLE MANUFACTURERS

- a) Manufacturer: Subject to compliance with these specifications, pipe hanger and support systems shall be as manufactured by Cooper B-Line, Inc. [or engineer approved equal].

PIPE HANGERS AND SUPPORTS

- a) Hangers
 - 1. Uninsulated pipes 2 inch and smaller:
 - I. Adjustable steel swivel ring (band type) hanger, B-Line B3170.
 - II. Adjustable steel swivel J-hanger, B-Line B3690.
 - III. Malleable iron ring hanger, B-Line B3198R or hinged ring hanger, B3198H.

- IV. Malleable iron split-ring hanger with eye socket, B-Line B3173 with B3222.
- V. Adjustable steel clevis hanger, B-Line B3104 or B3100.
- 2. Uninsulated pipes 2-1/2 inch and larger:
 - I. Adjustable steel clevis hanger, B-Line B3100.
 - II. Pipe roll with sockets, B-Line B3114.
 - III. Adjustable steel yoke pipe roll, B-Line B3110.
- 3. Insulated pipe- Hot or steam piping:
 - I. 2 inch and smaller pipes: use adjustable steel clevis with galvanized sheet metal shield. B-Line B3100 with B3151 series.
 - II. 2-1/2 inch and larger pipes:
 - i. Adjustable steel yoke pipe roll with pipe covering protection saddle. B-Line B3110 with B3160-B3165 series.
 - ii. Pipe roll with sockets with pipe covering protection saddle, B-Line B3114 with B3160-B3165 series.
- 4. Insulated pipe- Cold or chilled water piping:
 - I. 5 inch and smaller pipes: use adjustable steel clevis with galvanized sheet metal shield. B-Line B3100 with B3151 series.
 - II. 6 inch and larger pipes:
 - i. Pipe roll with sockets with pipe covering protection saddle, B-Line B3114 with B3160-B3165 series.
 - ii. Adjustable steel yoke pipe roll with pipe covering protection saddle. B-Line B3110 with B3160-B3165 series.
- b) Pipe Clamps
 - 1. When flexibility in the hanger assembly is required due to horizontal movement, use pipe clamps with weldless eye nuts, B-Line B3140 or B3142 with B3200. For insulated lines use double bolted pipe clamps, B-Line B3144 or B3146 with B3200.
- c) Multiple or Trapeze Hanger
 - 1. Trapeze hangers shall be constructed from 12-gauge roll formed ASTM A1011 SS Grade 33 structural steel channel, 1-5/8 inch by 1-5/8-inch minimum, B-Line B22 strut or stronger as required.
 - 2. Mount pipes to trapeze with 2-piece pipe straps sized for outside diameter of pipe, B Line B2000 Series.
 - 3. For pipes subjected to axial movement:
 - I. Strut mounted roller support, B-Line B3126. Use a pipe protection shield or saddles on insulated lines.
 - II. Strut mounted pipe guide, B-Line B2417.
- d) Wall Supports
 - 1. Pipes 4 inch and smaller:
 - I. Carbon steel hook, B-Line B3191.
 - II. Carbon steel J-hanger, B-Line B3690.
 - 2. Pipes larger than 4 inches:
 - I. Welded strut bracket and pipe straps, B-Line B3064 and B2000 series.
 - II. Welded steel brackets, B-Line B3066 or B3067, with roller chair or adjustable steel yoke pipe roll. B-Line B3120 or B3110. Use a pipe protection shield or saddles on insulated lines.
- e) Floor Supports
 - 1. Hot piping under 6 inch and all cold piping:
 - I. Carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation. B-Line B3093 and B3088T or B3090 and B3088. Pipe saddles shall be screwed or welded to the appropriate base stand.
 - 2. Hot piping 6 inch and larger:
 - I. Adjustable Roller stands with base plate, B-Line B3117SL [or B3118SL].
 - II. Adjustable roller support and steel support sized for elevation, B-Line B3124.
- f) Vertical Supports

1. Steel riser clamp sized to fit outside diameter of pipe, B-Line B3373.
- g) Copper Tubing Supports
 1. Hangers shall be sized to fit copper tubing outside diameters.
 - I. Adjustable steel swivel ring (band type) hanger, B-Line B3170CT.
 - II. Malleable iron ring hanger, B-Line B3198RCT or hinged ring hanger B3198HCT.
 - III. Malleable iron split-ring hanger with eye socket, B-Line B3173CT with B3222.
 - IV. Adjustable steel clevis hanger, B-Line B3104CT.
 - i. For supporting vertical runs use epoxy painted or plastic-coated riser clamps, B-Line B3373CT or B3373CTC.
 - ii. For supporting copper tubes to strut use epoxy painted pipe straps sized for copper tubing, B-Line B2000 series, or plastic inserted vibration isolation clamps, B-Line BVT series.
- h) Plastic Pipe Supports
 1. V-Bottom clevis hanger with galvanized 18-gauge continuous support channel, B-Line B3106 and B3106V, to form a continuous support system for plastic pipe or flexible tubing.
- i) Supplementary Structural Supports
 1. Design and fabricate supports using structural quality steel bolted framing materials as manufactured by Cooper B-Line. Channels shall be roll formed, 12-gauge ASTM A1011 SS Grade 33 steel, 1-5/8 inch by 1-5/8 inch or greater as required by loading conditions. Submit designs for pipe tunnels, pipe galleries, etc., to engineer for approval. Use clamps and fittings designed for use with the strut system.

UPPER ATTACHMENTS

- a) Beam Clamps
 1. Beam clamps shall be used where piping is to be suspended from building steel. Clamp type shall be selected on the basis of load to be supported, and load configuration.
 2. C-Clamps shall have locknuts and cup point set screws, B-Line B351L, or B3036L. Top flange c-clamps shall be used when attaching a hanger rod to the top flange of structural shapes, B-Line B3034 or B3033. Refer to manufacturer's recommendation for set screw torque. Retaining straps shall be used to maintain the clamps position on the beam where required.
 3. Centre loaded beam clamps shall be used where specified. Steel clamps shall be B Line B3050, or B3055. Malleable iron or forged steel beam clamps with cross bolt shall be B-Line B3054 or B3291-B3297 Series as required to fit beams.
- b) Concrete Inserts
 1. Cast in place spot concrete inserts shall be used where applicable; either steel or malleable iron body, B-Line B2500 or B3014. Spot inserts shall allow for lateral adjustment and have means for attachment to forms. Select inserts to suit threaded hanger rod sizes, B-Line N2500 or B3014N series.
 2. Continuous concrete inserts shall be used where applicable. Channels shall be 12 gauge, ASTM A1011 SS Grade 33 structural quality carbon steel, complete with Styrofoam inserts and end caps with nail holes for attachment to forms. The continuous concrete insert shall have a load rating of 2,000 lbs/ft. in concrete, B-Line B22I, 32I, or 52I. Select channel nuts suitable for strut and rod sizes.

VIBRATION ISOLATION AND SUPPORTS

- a) For refrigeration, air conditioning, hydraulic, pneumatic, and other vibrating system applications, use a clamp that has a vibration dampening insert and a nylon insert locknut. For copper and steel tubing use B-Line BVT series Vibraclamps, for pipe sizes use BVP series.
- b) For larger tubing or piping subjected to vibration, use neoprene or spring hangers as required.
- c) For base mounted equipment use vibration pads, molded neoprene mounts, or spring mounts as required.
- d) Vibration isolation products as manufactured by B-Line, Vibratrol systems.

ACCESSORIES

- i. Hanger Rods shall be threaded both ends, or continuous threaded rods of circular cross section. Use adjusting lock nuts at upper attachments and hangers. No wire, chain, or perforated straps are allowed.
- ii. Shields shall be 180-degree galvanized sheet metal, 12inch minimum length, 18-gauge minimum thickness, designed to match the outside diameter of the insulated pipe, B-Line B3151.
- iii. Pipe protection saddles shall be formed from carbon steel, 1/8-inch minimum thickness, sized for insulation thickness. Saddles for pipe sizes greater than 12 inch shall have a centre support rib.

FINISHES

- a) Indoor Finishes
 - i. Hangers and clamps for support of bare copper piping shall be coated with copper coloured epoxy paint, B-Line Dura-Copper®. Additional PVC coating of the epoxy painted hanger shall be used where necessary.
 - ii. Hangers for other than bare copper pipe shall be zinc plated in accordance with ASTM B633 OR shall have an electro-deposited green epoxy finish, B-Line Dura-Green®.
 - iii. Strut channels shall be pre-galvanized in accordance with ASTM A653 SS Grade 33 G90 OR have an electro-deposited green epoxy finish, B-Line Dura-Green®.
- b) Outdoor and Corrosive Area Finishes: This also applies to plant rooms.
 - i. Hangers and strut located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A123. All hanger hardware shall be hot dip galvanized or stainless steel. Zinc plated hardware is not acceptable for outdoor or corrosive use.
 - ii. Hangers and strut located in corrosive areas shall be type 304 [316] stainless steel with stainless steel hardware.

12.2 EXECUTION

PIPE HANGERS AND SUPPORTS

- a) Pipe shall be adequately supported by pipe hanger and supports specified in PART 2 PRODUCTS. Hangers for insulated pipes shall be sized to accommodate insulation thickness.
- b) Horizontal steel piping shall be supported in accordance with MSS SP-69 Tables 3 and 4, excerpts of which follow below:

Nominal Pipe Size (Inches)	Rod Diameter (inches)	Maximum spacing (Feet)
½ to 1¼	3/8	7
1½	3/8	9
2	3/8	10
2½	½	11
3	½	12
3½	½	13
4	5/8	14
5	5/8	16
6	¾	17
8	¾	19
10	7/8	22
12	7/8	23

14	1	25
16	1	27
18	1	28
20	1¼	30
24	1¼	32

- c) Horizontal copper tubing shall be supported in accordance with MSS SP-69 Tables 3 and 4, excerpts of which follow below:

Nominal Pipe Size (inches)	Rod Diameter (inches)	Maximum Spacing (Feet)
½ to ¾	3/8	5
1	3/8	6
1¼	3/8	7
1½	3/8	8
2	3/8	8
2 ½	½	9
3	½	10
3 ½	½	11
4	½	12
5	½	13
6	5/8	14
8	¾	16

- d) Provide means of preventing dissimilar metal contact such as plastic-coated hangers, copper coloured epoxy paint, or non-adhesive isolation tape- B-Line Iso-pipe. Galvanized felt isolators sized for copper tubing may also be used, B-Line B3195CT.
- e) Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- f) Install hangers to provide a minimum of 1/2 inch space between finished covering and adjacent work.
- g) Place a hanger within 12 inches of each horizontal elbow.
- h) Support vertical piping independently of connected horizontal piping. Support vertical pipes at every [other] floor. Wherever possible, locate riser clamps directly below pipe couplings or shear lugs.
- i) Where several pipes can be installed in parallel and at the same elevation, provide trapeze hangers as specified in section 2.02 C. Trapeze hangers shall be spaced according to the smallest pipe size, or install intermediate supports according to schedule in section 3.01B.
- j) Do not support piping from other pipes, ductwork or other equipment that is not building structure.

CONCRETE INSERTS

1. Provide inserts for placement in foam work before concrete is poured.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Where concrete slabs form finished ceilings, provide inserts to be flush with slab surface.
4. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

13: PAINTING AND IDENTIFICATION

13.0 GENERAL

The air conditioning contractor shall paint and identify all items furnished under their contract as noted in this section.

This section gives the requirements for the identification of all mechanical and electrical services installation, the air conditioning contractor is to reference this document for all items furnished under the air conditioning contract.

Colours and identification to be according to the American National Standards Institute (ANSI): ANSI-A13.1-81 Scheme for the Identification of Piping Systems.

13.1 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE

- i. Field painting of mechanical and electrical work, consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.
- ii. Paint after tests have been completed.
- iii. Omit prime coat from factory prime-coated items.
- iv. Finish painting of mechanical and electrical equipment is not required when located in interstitial spaces, above suspended ceilings, in concealed areas such as pipe and electric closets, pipe basements, pipe tunnels, trenches, attics, roof spaces, shafts and furred spaces. Pipework is to be identified throughout.
- v. Colour:

Paint colours as specified

- i. White.....Exterior unfinished surfaces of enamelled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drum-heads, oil heaters, condensate tanks and condensate piping.
- ii. Grey.....Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces). Water and sewage treatment equipment and sewage ejection equipment.
- iii. Aluminium Colour.....Ferrous metal on the outside of boilers and in connection with boiler settings including supporting doors and door frames and fuel oil burning equipment. Steam generation system (bare piping, fittings, hangers, supports, valves, traps and miscellaneous iron work in contact with pipe).
- iv. Federal Safety Red.....Exposed fire protection piping hydrants, post indicators, electrical conducts containing fire alarm control wiring, and fire alarm equipment.

13.2 IDENTITY PAINTING SCHEDULE

- a) Identify designated service in accordance with ANSI A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels.
 - a) Legend may be identity marker options or stencil applied painted on.
 - b) Apply legends adjacent to changes in direction, on branches, where pipes pass through walls or floors, adjacent to operating accessories such as valves, regulators, strainers and clean outs a minimum of 12 000 mm (40 feet) apart on straight runs of piping. Identification next to plumbing fixtures is not required.
 - c) Locate Legends clearly visible from the operating position.
 - d) Use an arrow to indicate direction of flow.

- e) Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazards. Insert working pressure shown on drawings where asterisk appears for High, Medium, and Low-Pressure designations as follows:
- High Pressure - 414 kPa (60 psi) and above
Medium Pressure - 104 to 413 kPa (15 to 59 psi).
Low Pressure - 103 kPa (14 psi) and below
Add Fuel oil grade numbers.
- f) Legend name in full or in abbreviated form as follows:

PIPING	COLOUR OF EXPOSED PIPING	COLOUR OF BACKGROUND	COLOUR OF LETTERS	LEGEND ABBREVIATIONS
Blow-off		Yellow	Black	Blow-off
Boiler Feedwater		Yellow	Black	Bir. Feed
A/C Condenser Water Supply		Green	White	A/C Cond. W. Sup.
A/C Condenser Water Return		Green	White	A/C Cond. W. Ret.
Chilled Water Supply		Green	White	Ch. W. Sup.
Chilled Water Return		Green	White	Ch. W. Ret.
Shop Compressed Air		Yellow	Black	S. Air
Air-Instrument Controls		Green	White	Air-Inst. Cont.
Drain Line		Green	White	Drain
Emergency Shower		Green	White	Emg. Shower
High Pressure Steam		Yellow	Black	H.P. _____*
High Pressure Condensate Return		Yellow	Black	H.P. Ret. _____*
Medium Pressure Steam		Yellow	Black	M. P. Stm. _____*
Medium Pressure Condensate Return		Yellow	Black	M.P. Ret. _____*
Low Pressure Steam		Yellow	Black	L.P. Stm. _____*
Low Pressure Condensate Return		Yellow	Black	L.P. Ret. _____*
High Temperature Water Supply		Yellow	Black	H. Temp. W. Sup.
High Temperature Water Return		Yellow	Black	H. Temp. W. Ret.
Hot Water Heating Supply		Yellow	Black	H. W. Htg. Sup.
Hot Water Heating Return		Yellow	Black	H. W. Htg. Ret.
Gravity Condensate Return		Yellow	Black	Gravity Cond. Ret.
Pumped Condensate Return		Yellow	Black	Pumped Cond. Ret.
Vacuum Condensate Return		Yellow	Black	Vac. Cond. Ret.
Fuel Oil – Grade		Green	White	Fuel Oil-Grade _____*
Boiler Water Sampling		Yellow	Black	Sample
Chemical Feed		Yellow	Black	Chem.
Continuous Blow Down		Yellow	Black	Cont. B. D.
Condensate Pumped			Black	Cond. - Pump
Pump Recirculating		Yellow	Black	Pump-Recirc.
Vent Line		Yellow	Black	Vent.
Alkali		Yellow	Black	Alk
Bleach		Yellow	Black	Bleach
Detergent		Yellow	Black	Det.
Liquid Supply		Yellow	Black	Liq. Sup.
Reuse Water		Yellow	Black	Reuse Wtr.
Cold Water (Domestic)	White	Green	White	C. W. Dom.
Hot Water (Domestic)				
PIPING	COLOUR OF EXPOSED	COLOUR OF BACKGROUND	COLOUR OF	LEGEND ABBREVIATIONS

	PIPING		LETTERS	
Supply	White	Yellow	Black	H.W. Dom.
Return	White	Yellow	Black	H.W. Dom. Ret
Tempered Water	White	Yellow	Black	Temp. Wat.
Ice Water				
Supply	White	Green	White	Ice W.
Return	White	Green	White	Ice W. Ret.
Reagent Grade Water		Green	White	RG
Reverse Osmosis		Green	White	RO
Sanitary Waste		Green	White	San. Waste
Sanitary Vent		Green	White	San. Vent.
Storm Drainage		Green	White	St. Drain
Pump Drainage		Green	White	Pump Disc.
Chemical Pipe				
Waste		Yellow	Black	Acid Waste
Vent		Yellow	Black	Acid Vent
Atmospheric Vent		Green	White	ATV
Silver Recovery		Green	White	Sil. Rec.
Oral Evacuation		Green	White	Oral Evac.
Fuel Gas		Yellow	Black	Gas
Fire Protection Water				
Sprinkler		Red	White	Auto. Spr.
Standpipe		Red	White	Stand.
Sprinkler		Red	White	Drain

13.3 PROTECTION CLEAN UP, AND TOUCH-UP.

- Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.
- Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
- Before final inspection, touch-up or refinished in a manner to produce solid even colour and finish texture, free from defects in work which was damaged or discoloured.

14: INSTALLATION AND COMMISSIONING

14.0 CONTRACTORS INSTALLATION PERSONNEL

Apart from installation Technicians and Workmen the Air Conditioning Contractor shall at all times during the construction of the work have on site a suitably qualified representative of "Project Engineer" status who is fully knowledgeable about the job.

This representative must be authorized to act on the Contractor's behalf in matters pertaining to:

- i. the coordination with other trades
- ii. the site instructions given by the Engineer during site inspections.
- iii. the organization of such a test as the Engineer may require.
- iv. the updating of drawings to "As Built" status.

14.1 EQUIPMENT DATA AND MAINTENANCE MANUALS

The Air Conditioning Contractor shall supply to the Engineer, Manufacturers certified factory tests on the specific Equipment. The Air Conditioning Contractor shall supply all manufacturers' literature on start-up procedure and testing together with a proposed schedule of tests and commissioning procedures.

Manuals:

Maintenance and operating manuals (four copies each) for each separate piece of equipment shall be delivered to the Resident Engineer coincidental with the delivery of the equipment to the job site. Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.

14.2 TESTS

The Air Conditioning Contractor shall carry out at his own cost, all necessary tests and commissioning procedures on components and the whole of the Air Conditioning System to the satisfaction of the Engineer.

BALANCING

On completion of installation of ductwork and equipment installation, the Contractor is required to perform a complete balancing of the air distribution system. An air balancing report signed and approved by the user is to be submitted at the end of the project.

Contractor shall balance the air distribution system to the user's comfort. Contractor shall provide an air balancing report at the end of the project.

MINIMUM TEST REQUIREMENTS & PROCEDURES

1. Pumping circuit start-up with fine mesh temporary strainers.
2. Refrigeration system trial run – testing of safety devices – mechanical and electrical.
3. Load test on complete system monitoring flows, temperatures, pressures, ammeter readings.
4. Air Handler control system response tests.
5. Complete air balancing of air distribution systems zone by zone.
6. Performance testing on complete system
7. Ventilation system tests.
8. Smoke exhaust system test.

15: MAINTENANCE

15.0 GENERAL

Maintenance of all Air conditioning and ventilation systems includes large central air conditioning systems, ducted constant-flow rate and variable-flow rate air conditioning systems, packaged and split air conditioning, pumps, supply and extract ventilation systems, fume ventilation, and industrial ventilation systems. Chilled water system includes plain water, brine, and glycol systems.

The AC Contractor shall refer to manufacture operational & maintenance procedures. These include site safety procedures, equipment operating procedures, job procedures, quality assurance, and procedures for the purchase, handling and disposal of equipment and components.

The AC contractor shall provide all service dates during the maintenance period.

15.1 DOCUMENTS

The Air Conditioning Contractor provided Information on all operations checks and testing should be documented and handed over to the Engineer. Sample operations log/ test sheets shall be provided. This shall include maintenance contract documentation, system drawings and specifications, operating procedures, maintenance procedures, and manufacturers' specifications.

Start-up checklists and operations and troubleshooting check lists shall be provided on permanent heat sealed forms so as to be unaffected by handling, water or oils.

Lubrication and other schedules should be provided in a similar permanent fashion.

The contractor's scope shall also include the submission of a "Post Maintenance Contract Proposal " for the equipment supplied, with a list of spares and source of supply for them.

15.2 MONITORING OF SYSTEM

The Air Conditioning Contractor shall monitor the plants/equipment performance by periodic checks to be performed at intervals of not more than 2 weeks for the remainder of the twelve months maintenance period.

Water system strainers should be cleaned once a week for the first month of operation, once every two weeks for the second month of operation and then once a month for the remaining months of operation.

15.3 CORRECTION, REPAIR AND SERVICING

Any defect, faulty workmanship or short fall of the equipment (which was not evident during commissioning) to meet the specification shall be corrected by the Air Conditioning Contractor free of any cost to the Client. This cost shall include materials and labour.

Equipment or parts replacement must not be limited to the 12 months maintenance period. Such parts as covered by manufacturers' standard warranties or guarantees shall be listed and the period stated.

This maintenance period shall extend 12 months after certification by the Engineer that the Air Conditioning equipment is acceptable. This acceptance shall not be unreasonably withheld.

The end of this maintenance period shall be documented by the Engineer and copied to the Client.

15.4 SERVICE LITERATURE

Four (4) bounded copies and a disc (CD) of all Maintenance Service Literature, Catalogues, Schedules of each equipment and materials used and first twelve months maintenance records to be given to the client.

15.5 CONSUMABLES

The Air Conditioning Contractor shall list and supply as part of his contract all required parts, lubricants, chemicals and filter changes, for the plant/equipment for the twelve months maintenance period.

16: RECORD DOCUMENTS

16.0 PROVISION OF RECORD DOCUMENTS

The Contractor is to supply as a prerequisite to Practical Completion of the Engineering Services, comprehensive record documents in uniform indexed bonds sets. The Contractor is advised that great importance will be placed upon the quality, accuracy, clarity and completeness of the record documents and upon their being made available promptly.

The Contractor is to demonstrate from time to time, as required by the Engineer throughout the execution of the Engineering Services, that adequate and accurate records are being kept such as will ensure the ultimate completeness and accuracy of the record documents and that the record documents are themselves being progressively compiled as the work on site proceeds.

16.1 SCOPE OF RECORD DOCUMENTS

Record documents are to comprise, all as described in this Specification and the following:

1. Operation and maintenance documentation
2. Record Drawing and Diagrams.
3. Schedules (Equipment listing size, model, serial, location, serving, voltage...etc.)
4. Operating and Maintenance Instructions.

The AC Contractor shall provide Initially one hard-copy record document for review. Upon review and comments, the AC contractor shall prepare Five sets of Final record documents, Drawings and Schedules, Operating and Maintenance instructions.

Drawings and diagrams are to be provided in CAD format. (Auto CAD 2004, DWG format and PDF format) and copies of discs are to be made available.

The record documents are to be adequate for the following purposes:

- a) To provide a comprehensive reference source about each installation.
- b) To provide a basis for the correct and efficient operation of the installed plant and systems.
- c) To serve as an information base and detailed guide for the effective and efficient maintenance of each installation.
- d) To make the most economical use of energy when operating each installation.
- e) To provide maximum utilization of each installation at minimum cost.
- f) To serve as a basis for staff training in the operation and maintenance of each installation.
- g) To serve as a basis for safety awareness.

The record documents are to be correlated as that the terminology and the numerical and/or other references used therein are consistent with those used in the physical identification of component parts of the Engineering Services.

16.2 OPERATION AND MAINTENANCE DOCUMENTS

Contractor shall prepare a single, comprehensive directory of emergency, operation, and maintenance materials. Include a section in the directory for each of the following:

1. List systems alphabetically. Including references to operation and maintenance manuals that contain information about each system.
2. List equipment for each system, organized alphabetically by system.
3. Include a table of contents for each emergency, operation, and maintenance manual.

Organize each manual into a separate section for each system. Each manual shall contain the following materials, in the order listed:

1. Title page. Include the following information
 - a) Name and address of Project.
 - b) Date of submission.
 - c) Name and contact information for Contractor.
 - d) Name and contact information for Servicing.
 - e) Name and contact information for emergencies.
 - f) Names and contact information for major consultants.
2. Table of contents.
3. Manual contents.

Organize into sets of manageable size. Arrange contents alphabetically by system and equipment. If possible, assemble instructions for equipment and components of one system into a single binder.

Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Use electronic files prepared by the manufacturer where available. Where scanning of paper documents is required, configure the scanned file for minimum readable file size.
2. Enable bookmarking of individual documents based on file names. Name document files to correspond to system and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files.

Submit manuals in the form of hard copy, bound and labelled volumes.

1. Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2 by 11 inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - h) If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross reference other binders if necessary, to provide essential information for proper operation or maintenance of equipment or system.
 - i) Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, subject of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
2. Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include a typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Transparent protective plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2 by 11 inch paper; white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a) If oversize drawings are necessary, fold drawings to the same size as text pages and use them as fold-outs.
 - b) If drawings are too large to be used as fold-outs, fold and place drawings in labelled envelopes and bind envelopes in the rear of the manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

OPERATION MANUALS

In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System and equipment descriptions indicated on Contract Documents. Include the following, as applicable
 - a) Product name and model number. Use designations for products indicated on Contract Documents.
 - b) Manufacturer's name.
 - c) Equipment identification with serial number of each component.
 - d) Equipment function.
 - e) Operating characteristics.
 - f) Performance curves.
 - g) Engineering data and tests.
 - h) Complete nomenclature and number of replacement parts.
9. Operating procedures & standards. Include the following, as applicable
 - a) Start-up procedures.
 - b) Equipment or system break-in procedures.
 - c) Routine and normal operating instructions.
 - d) Regulation and control procedures.
 - e) Instructions on stopping.
 - f) Normal shut-down instructions.
 - g) Required sequences for electric, electronic, pneumatic and/or hydraulic systems or other systems where shut down and start/restart sequence is important.
 - h) Special operating instructions and procedures.
10. Wiring diagrams.
11. Control diagrams.
12. Piped system diagrams.
13. Precautions against improper use.
14. License requirements including inspection and renewal dates.
15. Describe the sequence of operation, and diagram controls as installed.
16. Diagram piping as installed, and identify colour-code where required for identification.

PRODUCT MAINTENANCE MANUALS

Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

List each product included in the manual, identified by product name and arranged to match the manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Colour, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

Include manufacturer's written recommendations and the following:

1. Inspection and test procedures.

2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

Include lists of materials and local sources of repair materials and related services.

Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds. Include procedures to follow and required notifications for warranty claims.

SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

Include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty information, as described below.

List each system and piece of equipment included in the manual identified by product name and arranged to match the manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including dis-assembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended or required to be stocked as spare parts.

Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

Maintenance and Service Schedules:

Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semi-annual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

Spare Parts List and Source Information:

Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

Maintenance Service Contracts:

Include copies of maintenance agreements with the name and telephone number of the service agent.

Warranties

Include copies of warranties and lists of circumstances and conditions that would affect validity of warranties. Include procedures to follow and required notifications for warranty claims.

15.3 RECORD / AS-BUILT DRAWINGS AND DIAGRAMS

1. The record drawings and diagrams provided by the Contractor are to comprise the documents listed in the following paragraphs, as applicable. All such documents are to clearly be endorsed AS-BUILT DRAWING near to the title block.
2. Drawings or sets of drawings to a scale consistent with that used for the Bid Drawings which are to show the "as fitted" location of the following:
 - a) The location, including level if buried, of Public Services connections incorporated in the Engineering Services, whether carried out by the Contractor or by the appropriate Authority, together with points of origin and termination, size and material of pipes and cables, line pressure, voltage, and/or other relevant information.
 - b) The layout, location and extent of all pipe's services showing sizes of all pipes together with valves for regulating, isolating, draining, venting and other purposes.
 - c) Main and sub-main cables showing origin, route, termination size and type of each.
 - d) Conduits and/or cables for single and three-phase power circuits, lighting circuits and sub-circuits and all miscellaneous services. The drawings are to indicate the origin, route termination and size of each conduit together with the number and size of each cable therein. Further the route of each conduit or cable is to be described, i.e. surface, concealed, in wall chase, in floor screed, cast in-site, above false ceiling etc.
 - e) Locations of switchboards, distribution boards, switches draw-in boxes, joint boxes, etc.
 - f) The location, identify, size and details of all apparatus served by or associated with each of the various services. (Information with respect to size and details may be presented in schedule form subject to the prior consent of the Engineer.)
 - g) The layout, location and extent of all air ducts, (including those formed in Builders' work or otherwise but forming part of the system) showing all dampers and associated equipment, silencers, grilles, diffusers or other terminal components. Each duct and each terminal component is to be marked with its size and the air quantity flowing, as actually measured after correct regulation of the system, or as computed by the addition of such measured quantities.
 - h) The location of all test points on water and air systems.
 - i) The location and identify of each room or space housing plant, machinery and apparatus.
 - j) Location of all earth tapes, earth electrodes and test points.
 - k) Lighting conductor air terminals, conductors, each electrode and test clamps.
3. Drawings or sets of drawings to an appropriate scale which are to show the following as installed:
 - a) The details general arrangement of all boiler houses, switch rooms, machinery spaces, air handling plants, tank rooms and/or other plant or apparatus, including the location, identify, size and details of each piece of apparatus. (Information with respect to size and detail may be presented in schedule form subject to the prior consent of the Engineer.)
 - b) The detailed general arrangement of service subways, trenches, ducts, meter rooms,

- or other special sections of the Engineering Services where, in the opinion of the Engineer, the small-scale drawings cannot provide an adequate record.
- c) Manufacturers drawings or sets of drawings which are to show:
 - i. The general arrangement and assembly of component parts of all machines and equipment which may require servicing.
 - ii. The internal wiring of each piece of electrical equipment incorporates the Engineering Services together with physical arrangement drawings, where necessary, to locate and identify the component parts.
 - iii. In conjunction with schedules of location the detail and reference, voltage and wattage of all lighting fittings.
 - d) Comprehensive diagrams or sets of diagrams which are to show:
 - i. The principles of the arrangement and operating of each of the various services as related to central plant, other principal components and zoning of distribution etc.
 - ii. The principles of application of automatic controls and instrumentation, presented in combination with item (a) foregoing or separately as agreed with the Engineer.
 - iii. All power and control wiring and/or pneumatic or other control piping including size, type of conductor or pipes used and identifying the terminal points of each.
 - e) System diagrams, circuit diagrams, wiring diagrams and interconnection diagrams which are to show:
 - i. How each installation or item of equipment operates.
 - ii. The interconnections between items of equipment, including those provided by others to which the Contractor is required to carry out connection.
 - iii. The size, type and length (to the nearest meter) of each LV cable, together with the measured earth fault loop impedance.
 - iv. The terminal numbering and cable core identification for all alarm and control circuits.

16.4 SCHEDULES

1. The Schedules provided by the Contractor are to comprise:
 - a) Comprehensive schedules illustrating procedures for fault finding and for action in the event of equipment or system failure.
 - b) Comprehensive schedules of spare parts, lubrication, identification numbers and sources of supply.

16.5 OPERATING AND MAINTENANCE INSTRUCTIONS

1. Operating and Maintenance Instructions are to be provided by the Contractor and are to comprise the following, as applicable (all contained in volumes strongly bound in flexible covers and suitable for heavy usage over a long period) written to be read in conjunction with the Record Drawings, Diagrams and Schedules:
 - a) A general description of the scope, propose and manner of working of each system or apparatus forming part of the Engineering Services.
 - b) A detailed description of the scope, purpose and manner of working of each system of automatic controls and/or monitoring instruments.
 - c) Data on general design parameters and associated normal operating temperatures, pressures etc. based on the commissioning activity.
 - d) Testing and commissioning records clearly cross referenced to system components.
 - e) Clear and comprehensive instructions for the starting up, running and shut down of each system or apparatus.
 - f) Clear and comprehensive instructions for dealing with emergency conditions for each

system or apparatus.

- g) Instructions in respect of any precautionary measures from time to time necessary.
- h) Instructions in respect of the care of apparatus normally subject to seasonal disuse.
- i) Instructions as to the nature, extent and frequency of servicing necessary properly to maintain the Engineering Services in safe and efficient condition and to the materials to be used for the purpose. This information may be supported in detail, but not replaced by, maintenance instructions provided by the suppliers of particular component apparatus.
- j) The names and addresses of suppliers of all major components of the Engineering Services may potentially be required to obtain spare parts or replacements.

Copies of manufacturer's data are to be supplied with respect to the nature, type and method of operation of individual pieces of equipment, together with their detailed maintenance instructions. Such data in the form of individual booklets and the like, is to be indexed and cross referenced to the Operating and Maintenance Instructions and present suitably protected in box files or folders.

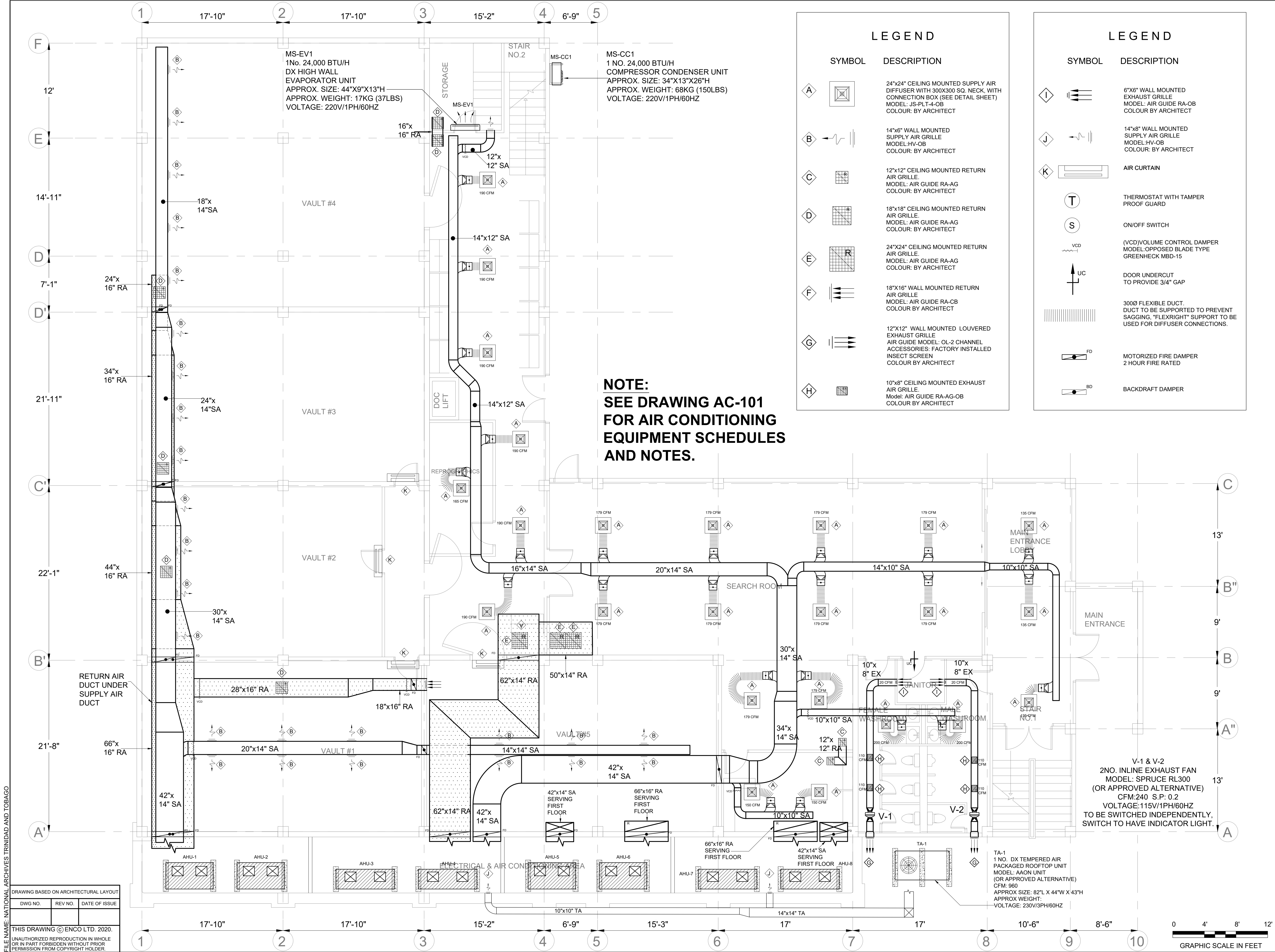
NATIONAL ARCHIVES

AIR CONDITIONING & VENTILATION SPECIFICATION

AIR CONDITIONING DRAWING SCHEDULE

Job No.:NATT/Y2022

ITEM	DRAWING NO.	DESCRIPTION	REVISION NO.
BUILDING B			
1.	AC-100	Building B - Ground Floor Air conditioning and Ventilation Layout	-
2.	AC-101	Building B – Ground Floor Air Conditioning and Equipment Schedules and Notes	-
3.	AC-200	Building B - First Floor Air conditioning and Ventilation Layout	-
4.	AC-201	Building B – First Floor Air Conditioning and Equipment Schedules and Notes	-
5.	AC-D1	General Detail Sheet 1	-
6.	AC-D2	General Detail Sheet 2	-
BUILDING C			
7.	AC-100	Building C - Ground Floor Air conditioning and Ventilation Layout	-
8.	AC-200	Building C - First Floor Air conditioning and Ventilation Layout	-
9.	AC-201	Building C – Ground and First Floor Air Conditioning and Equipment Schedules and Notes	-
10.	AC-D1	General Detail Sheet 1	-
11.	AC-D2	General Detail Sheet 2	-



NOTE:
SEE DRAWING AC-101
FOR AIR CONDITIONING
EQUIPMENT SCHEDULES
AND NOTES.

LEGEND	
SYMBOL	DESCRIPTION
	24"x24" CEILING MOUNTED SUPPLY AIR DIFFUSER WITH 300X300 SQ. NECK, WITH CONNECTION BOX (SEE DETAIL SHEET) MODEL: JS-PLT-4-OB COLOUR: BY ARCHITECT
	14"x6" WALL MOUNTED SUPPLY AIR GRILLE MODEL: HV-OB COLOUR: BY ARCHITECT
	12"x12" CEILING MOUNTED RETURN AIR GRILLE MODEL: RA-AG COLOUR: BY ARCHITECT
	18"x18" CEILING MOUNTED RETURN AIR GRILLE MODEL: RA-AG COLOUR: BY ARCHITECT
	24"x24" CEILING MOUNTED RETURN AIR GRILLE MODEL: RA-AG COLOUR: BY ARCHITECT
	18"x16" WALL MOUNTED RETURN AIR GRILLE MODEL: RA-CB COLOUR: BY ARCHITECT
	12"x12" WALL MOUNTED LOUVERED EXHAUST GRILLE AIR GUIDE MODEL: OL-2 CHANNEL ACCESSORIES: FACTORY INSTALLED INSECT SCREEN COLOUR: BY ARCHITECT
	10"x8" CEILING MOUNTED EXHAUST AIR GRILLE Model: RA-AG-OB COLOUR: BY ARCHITECT

LEGEND	
SYMBOL	DESCRIPTION
	6"x6" WALL MOUNTED EXHAUST GRILLE MODEL: RA-OB COLOUR: BY ARCHITECT
	14"x8" WALL MOUNTED SUPPLY AIR GRILLE MODEL: HV-OB COLOUR: BY ARCHITECT
	AIR CURTAIN
	THERMOSTAT WITH TAMPER PROOF GUARD
	ON/OFF SWITCH
	(VCD)VOLUME CONTROL DAMPER MODEL:OPPOSED BLADE TYPE GREENHECK MBD-15
	DOOR UNDERCUT TO PROVIDE 3/4" GAP
	3000 FLEXIBLE DUCT. DUCT TO BE SUPPORTED TO PREVENT SAGGING. "FLEXRIGHT" SUPPORT TO BE USED FOR DIFFUSER CONNECTIONS.
	MOTORIZED FIRE DAMPER 2 HOUR FIRE RATED
	BACKDRAFT DAMPER

THE AIR-CONDITIONING CONTRACTOR SHALL:

- VERIFY ALL DIMENSIONS ON SITE AND WILL BE HELD RESPONSIBLE FOR FITTING HIS WORK TO THE BUILDING IN A WORKMANLIKE MANNER SUBJECT TO ACCEPTANCE BY THE ENGINEER.
- CO-ORDINATE WITH THE OTHER CONTRACTORS ON THE JOB TO ALLOW FOR FREE PASSAGE OF DUCTS PROPER PLACEMENT OF DIFFUSERS, GRILLES, ETC. AND GIVE FULL APPRECIATION TO ALL TRADES ON THE JOB.
- PROVIDE ALL OFFSETS REQUIRED TO KEEP DUCTS CLOSE TO WALLS, BEAMS, COLUMNS AND OR SOFFIT OF SLAB AS MAY BE REQUIRED TO AVOID ANY OBSTRUCTIONS.
- THIS DRAWING TO BE READ IN ACCORDANCE WITH THE ARCHITECTURAL AND STRUCTURAL DRAWINGS.

GENERAL NOTES

- THE A/C CONTRACTOR- MUST SUPPLY SHOP DRAWINGS SHOWING EQUIPMENT LAYOUT, PIPING ROUTE, SIZING, DUCTWORK LAYOUT INCLUDING ASSOCIATED ACCESSORIES FOR APPROVAL BEFORE INSTALLATION.
- TOILET PERIPHERY WALLS TO BE FULL HEIGHT TO SEAL OFF THE AREA FROM THE GENERAL AIR CONDITIONED SPACE. IN CONDITIONS WHERE FULL HEIGHT WALLS CANNOT MEET THE SOFFIT OF SLAB, ALTERNATIVE SEALING ARRANGEMENT SHALL BE DESIGNED BY THE ARCHITECT.
- FLOOR OF AIR HANDLER ROOM TO HAVE A DUST FREE FINISH BY MAIN CONTRACTOR.
- FLOOR TO BE PROPERLY SCREED TO FALL TO FLOOR DRAIN BY MAIN CONTRACTOR.
- DOORWAY TO THE AIR HANDLER ROOM TO HAVE 100MM HIGH CURB BY MAIN CONTRACTOR.
- AIR HANDLER ROOM TO HAVE A 50MM DIA. FLOOR DRAIN BY MAIN CONTRACTOR.
- CONDENSATE DRAIN TO BE TRAPPED AND ROUTED TO NEAREST FLOOR OR BUILDING DRAIN.
- DUCT TO BE SUSPENDED FROM SOFFIT OF SLAB, PURLINS, BEAMS, RAFTERS, ETC. WHICHEVER IS POSSIBLE. CEILING SUSPENSION TO BE INDEPENDENT OF DUCT SUPPORT.
- UNLESS OTHERWISE INDICATED ALL CONCEALED DUCTWORK TO BE EXTERNALLY INSULATED WITH 2" DUCT WRAP AND APPLIED ACCORDING TO THE MANUFACTURERS SPECIFICATIONS.
- EXPOSED DUCTWORK TO BE INTERNAL INSULATED WITH 1" THICK LINACoustic AND APPLIED ACCORDING TO THE MANUFACTURER'S SPECIFICATIONS.
- ANY EXPOSED DUCTED TO BE ETCHED, PRIME AND PAINTED BY ARCHITECT COLOUR:-----
- ALL FLOOR PENETRATIONS MUST HAVE 100MM HIGH CURB ON ALL SIDES.
- LEAKING JOINTS ARE NOT ACCEPTABLE AND SHALL BE REPAIRED AT NO COST TO THE CLIENT.
- RETURN AIR LOOP TO BE INTERNALLY WITH 1" THICK LINACoustic AND APPLIED ACCORDING TO THE MANUFACTURERS SPECIFICATIONS.
- ALL SUPPORTS TO BE PROPERLY TREATED AGAINST RUSTING.
- ALL DUCT JOINTS TO BE PROPERLY SEALED WITH MANUFACTURER'S APPROVED SILICONE OR ON-HARDENING COMPOUND.
- THE A/C CONTRACTOR- MUST SUPPLY AS-BUILT DRAWINGS SHOWING ALL EQUIPMENT AND THE AIR DISTRIBUTION SYSTEM AT THE END OF THE PROJECT.

REV #	BY	DATE	DESCRIPTION
REVISIONS:			
FOR TENDER			
ISSUE DATE: 29TH MAY 2023			
TITLE			
BUILDING B GROUND FLOOR AIR CONDITIONING AND VENTILATION LAYOUT			
SCALE@12x18:		DESIGNED BY: -	
SCALE@24x36: 3/16"=1'-0"		DRAWN BY: J.HART	
ENGINEER:		DATE: APRIL, 2023	
ARCHITECT			
JOB			
NATIONAL ARCHIVES OF TRINIDAD AND TOBAGO			
JOB NO.	DRAWING NO.	REV	
NATT/72022	AC-100	-	

ENCO Ltd
112A Edward St, POS, Trinidad
T 1 868 625 4294 F 1 868 625 2788
info@enco.co.tt

CONDENSER/COMPRESSOR
ENVIRONMENT TREATMENT.

COIL TREATMENT SHALL BE FACTORY TREATED OR APPLIED LOCALLY IN A CONTROL ENVIRONMENT.

- 1. CABINET EXTERNAL SURFACES TO BE TREATED WITH TWO (2) COATS OF CLEAR COAT FINISH-SPRAYED ON.
- 2. CABINET INTERNAL SURFACES INCLUDING THE BASE TO BE TREATED WITH BITUMASTIC COATING.
- 3. COILS FINS TO BE FACTORY HERESITE TREATED OR APPROVED ALTERNATIVE.
- 4. CONDENSER COIL ENDS AND OTHER COPPER JOINTS TO BE EPILux COATED.
- 5. CONTRACTOR TO SUBMIT A COMPLETE METHOD STATEMENT FOR APPLICATION OF THE ABOVE ITEMS.

NOTES:

- 1. DETAIL LAYOUT OF AIR HANDLER TO BE SUBMITTED BY CONTRACTOR FOR APPROVAL.
- 2. EXACT LOCATION OF COMPRESSOR/CONDENSERS TO BE VERIFIED ON SITE BY CONTRACTOR.
- 3. EXACT LOCATION OF TEMPERED AIR UNIT TO BE VERIFIED ON SITE BY CONTRACTOR
- 4. EXACT ROUTE OF REFRIGERANT PIPING TO BE VERIFIED ON SITE BY CONTRACTOR
- 5. EXACT LOCATION OF DUCTWORK TO BE VERIFIED ON SITE.
- 9. EXACT SIZE, WEIGHT OF ALL AIR CONDITIONING EQUIPMENT, LOCATION, PLINTHS, UPSTANDS AND SUPPORTS TO BE CONFIRM WHEN MANUFACTURER IS KNOWN.
- 10. THE A/C CONTRACTOR- MUST SUPPLY SHOP DRAWINGS SHOWING EQUIPMENT LAYOUT, PIPING ROUTE AND SIZING, INCLUDING ASSOCIATED ACCESSORIES AND MAIN DUCT CONNECTION FROM AIR HANDLER FOR APPROVAL BEFORE INSTALLATION.
- 11. EXACT LOCATION OF DIFFUSER, CEILING GRILLES AND AIR HANDLER TO BE CONFIRM ON SITE.
- 12. EQUIPMENT MUST BE INSTALL IN ACCORDANCE WITH MANUFACTURERS SPECIFICATION
- 13. ALL AIR HANDLER UNITS / FAN DUCT CONNECTIONS MUST HAVE FLEXIBLE CONNECTIONS.
- 14. AC EQUIPMENT SHOULD HAVE DELAYED START, TO AVOID ALL THE EQUIPMENT STARTING AT THE SAME TIME.
- 15. AC EQUIPMENT SHOULD RESTART AUTOMATICALLY AFTER POWER FAILURE WHEN POWER IS RESTORED.
- 16. THE A/C CONTRACTOR MUST ENSURE THAT ALL EQUIPMENT CONFORM TO BUILDING VOLTAGE.
- 17. FLEXIBLE DUCTS MUST NOT EXCEED SIX FEET (6'-0"). FLEXIBLE DUCT SIZE TO BE 12"Ø.
- 18. ALL DUCT JOINTS TO BE PROPERLY SEALED AND TAPED, WITH APPROVED MANUFACTURE DUCT SEALANT AND TAP BY A/C CONTRACTOR.
- 19. ALL DUCTWORK THROUGH WALLS AND FLOORS TO BE SEALED WITH A FIRE RESISTANT SEALANT BY A/C CONTRACTOR
- 20. ALL HORIZONTAL CONDENSATE LINES TO BE EXTERNALLY INSULATED WITH CLOSED CELL ELASTOMERIC THERMAL INSULATION.
- 21. CONDENSATE DRAIN TO BE TRAPPED AND ROUTED TO NEAREST FLOOR DRAIN.

AH-AIR HANDLER UNITS								
ITEM	TAG	CAPACITY SIZE	MODEL	VOLTAGE	APPROXIMATE SIZE	APPROXIMATE WEIGHT	SUPPORTS	ADDITIONAL INFORMATION
1	AH-1 DX DUCTED INDOOR AIR COOLED PRECISION UNIT (UP FLOW)	12.5TON / 45 KW	DATAAIRE G-FORCE ULTRA (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	73"L x41"W x 84"H	LBS	FLOOR MOUNTED	TO BE SUPPLIED WITH DAP4 CONTROL SYSTEM, MERV 13 FILTERS, UV LIGHTS
2	AH-2 DX DUCTED INDOOR AIR COOLED PRECISION UNIT (UP FLOW)	12.5TON / 45 KW	DATAAIRE G-FORCE ULTRA (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	73"L x 41"W x 84"H	LBS	FLOOR MOUNTED	TO BE SUPPLIED WITH DAP4 CONTROL SYSTEM, MERV 13 FILTERS, UV LIGHTS
3	AH-3 DX DUCTED SPLIT PACKAGE UNIT	12.5 TON	CARRIER (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	89"L x 30"W x 56"H	695 LBS	FLOOR MOUNTED	TO BE SUPPLIED WITH BACNET COMPATIBLE THERMOSTATS, MERV 13 FILTERS, UV LIGHTS
4	AH-4 DX DUCTED SPLIT PACKAGE UNIT	12.5 TON	CARRIER (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	89"L x 30"W x 56"H	695 LBS	FLOOR MOUNTED	TO BE SUPPLIED WITH BACNET COMPATIBLE THERMOSTATS, MERV 13 FILTERS, UV LIGHTS
5	AH-5 DX DUCTED INDOOR AIR COOLED PRECISION UNIT (UP FLOW)	12.5TON / 45 KW	DATAAIRE G-FORCE ULTRA (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	73"L x 41"W x 84"H	LBS	FLOOR MOUNTED	TO BE SUPPLIED WITH DAP4 CONTROL SYSTEM, MERV 13 FILTERS, UV LIGHTS
6	AH-6 DX DUCTED INDOOR AIR COOLED PRECISION UNIT (UP FLOW)	12.5TON / 45 KW	DATAAIRE G-FORCE ULTRA (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	73"L x41"W x 84"H	LBS	FLOOR MOUNTED	TO BE SUPPLIED WITH DAP4 CONTROL SYSTEM, MERV 13 FILTERS, UV LIGHTS
7	AH-7 DX DUCTED SPLIT PACKAGE UNIT	12.5 TON	CARRIER (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	89"L x 30"W x 56"H	695 LBS	FLOOR MOUNTED	TO BE SUPPLIED WITH BACNET COMPATIBLE THERMOSTATS, MERV 13 FILTERS, UV LIGHTS
8	AH-8 DX DUCTED SPLIT PACKAGE UNIT	12.5 TON	CARRIER (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	89"L x 30"W x 56"H	695 LBS	FLOOR MOUNTED	TO BE SUPPLIED WITH BACNET COMPATIBLE THERMOSTATS, MERV 13 FILTERS, UV LIGHTS

THE AIR-CONDITIONING CONTRACTOR SHALL:

1. VERIFY ALL DIMENSIONS ON SITE AND WILL BE HELD RESPONSIBLE FOR FITTING HIS WORK TO THE BUILDING IN A WORKMANLIKE MANNER SUBJECT TO ACCEPTANCE BY THE ENGINEER.
2. CO-ORDINATE WITH THE OTHER CONTRACTORS ON THE JOB TO ALLOW FOR FREE PASSAGE OF DUCTS PROPER PLACEMENT OF DIFFUSERS, GRILLES, ETC. AND GIVE FULL APPRECIATION TO ALL TRADES ON THE JOB.
3. PROVIDE ALL OFFSETS REQUIRED TO KEEP DUCTS CLOSE TO WALLS, BEAMS, COLUMNS AND OR SOFFIT OF SLAB AS MAY BE REQUIRED TO AVOID ANY OBSTRUCTIONS.
4. THIS DRAWING TO BE READ IN ACCORDANCE WITH THE ARCHITECTURAL AND STRUCTURAL DRAWINGS.

GENERAL NOTES

1. THE A/C CONTRACTOR- MUST SUPPLY SHOP DRAWINGS SHOWING EQUIPMENT LAYOUT, PIPING ROUTE, SIZING, DUCTWORK LAYOUT INCLUDING ASSOCIATED ACCESSORIES FOR APPROVAL BEFORE INSTALLATION.
2. TOILET PERIPHERY WALLS TO BE FULL HEIGHT TO SEAL OFF THE AREA FROM THE GENERAL AIR CONDITIONED SPACE. IN CONDITIONS WHERE FULL HEIGHT WALLS CANNOT MEET THE SOFFIT OF SLAB, ALTERNATIVE SEALING ARRANGEMENT SHALL BE DESIGNED BY THE ARCHITECT.
3. FLOOR OF AIR HANDLER ROOM TO HAVE A DUST FREE FINISH BY MAIN CONTRACTOR.
4. FLOOR TO BE PROPERLY SCREED TO FALL TO FLOOR DRAIN BY MAIN CONTRACTOR.
5. DOORWAY TO THE AIR HANDLER ROOM TO HAVE 100MM HIGH CURB BY MAIN CONTRACTOR.
6. AIR HANDLER ROOM TO HAVE A 50MM DIA. FLOOR DRAIN BY MAIN CONTRACTOR.
7. CONDENSATE DRAIN TO BE TRAPPED AND ROUTED TO NEAREST FLOOR OR BUILDING DRAIN.
8. DUCT TO BE SUSPENDED FROM SOFFIT OF SLAB, PURLINS, BEAMS, RAFTERS, ETC. WHICHEVER IS POSSIBLE. CEILING SUSPENSION TO BE INDEPENDENT OF DUCT SUPPORT.
9. UNLESS OTHERWISE INDICATED ALL CONCEALED DUCTWORK TO BE EXTERNALLY INSULATED WITH 2" DUCT WRAP AND APPLIED ACCORDING TO THE MANUFACTURERS SPECIFICATIONS.
- 10.EXPOSED DUCTWORK TO BE INTERNAL INSULATED WITH 1" THICK LINACOUSTIC AND APPLIED ACCORDING TO THE MANUFACTURER'S SPECIFICATIONS.
- 11.ANY EXPOSED DUCTED TO BE ETCHED, PRIME AND PAINTED BY ARCHITECT COLOUR.-----
12. ALL FLOOR PENETRATIONS MUST HAVE 100MM HIGH CURB ON ALL SIDES.
- 13.LEAKING JOINTS ARE NOT ACCEPTABLE AND SHALL BE REPAIRED AT NO COST TO THE CLIENT.
- 14.RETURN AIR LOOP TO BE INTERNALLY WITH 1" THICK LINACOUSTIC AND APPLIED ACCORDING TO THE MANUFACTURERS SPECIFICATIONS.
15. ALL SUPPORTS TO BE PROPERLY TREATED AGAINST RUSTING.
16. ALL DUCT JOINTS TO BE PROPERLY SEALED WITH MANUFACTURER'S APPROVED SILICONE OR ON-HARDENING COMPOUND.
- 17.THE A/C CONTRACTOR- MUST SUPPLY AS-BUILT DRAWINGS SHOWING ALL EQUIPMENT AND THE AIR DISTRIBUTION SYSTEM AT THE END OF THE PROJECT.

REV #	BY	DATE	DESCRIPTION
REVISIONS:			
FOR TENDER ISSUE DATE: 29TH MAY 2023			
TITLE BUILDING B - GROUND FLOOR AIR CONDITIONING AND VENTILATION EQUIPMENT SCHEDULES AND NOTES			
SCALE@12x18:		DESIGNED BY: -	
SCALE@24x36: NTS		DRAWN BY: J.HART	
ENGINEER:		DATE: APRIL, 2023	
ARCHITECT			
JOB NATIONAL ARCHIVES OF TRINIDAD AND TOBAGO			
JOB NO. NATT/Y2022		DRAWING NO. AC-101	
		REV -	

FILE NAME: NATIONAL ARCHIVES TRINIDAD AND TOBAGO

DRAWING BASED ON ARCHITECTURAL LAYOUT

DWG NO.	REV NO.	DATE OF ISSUE

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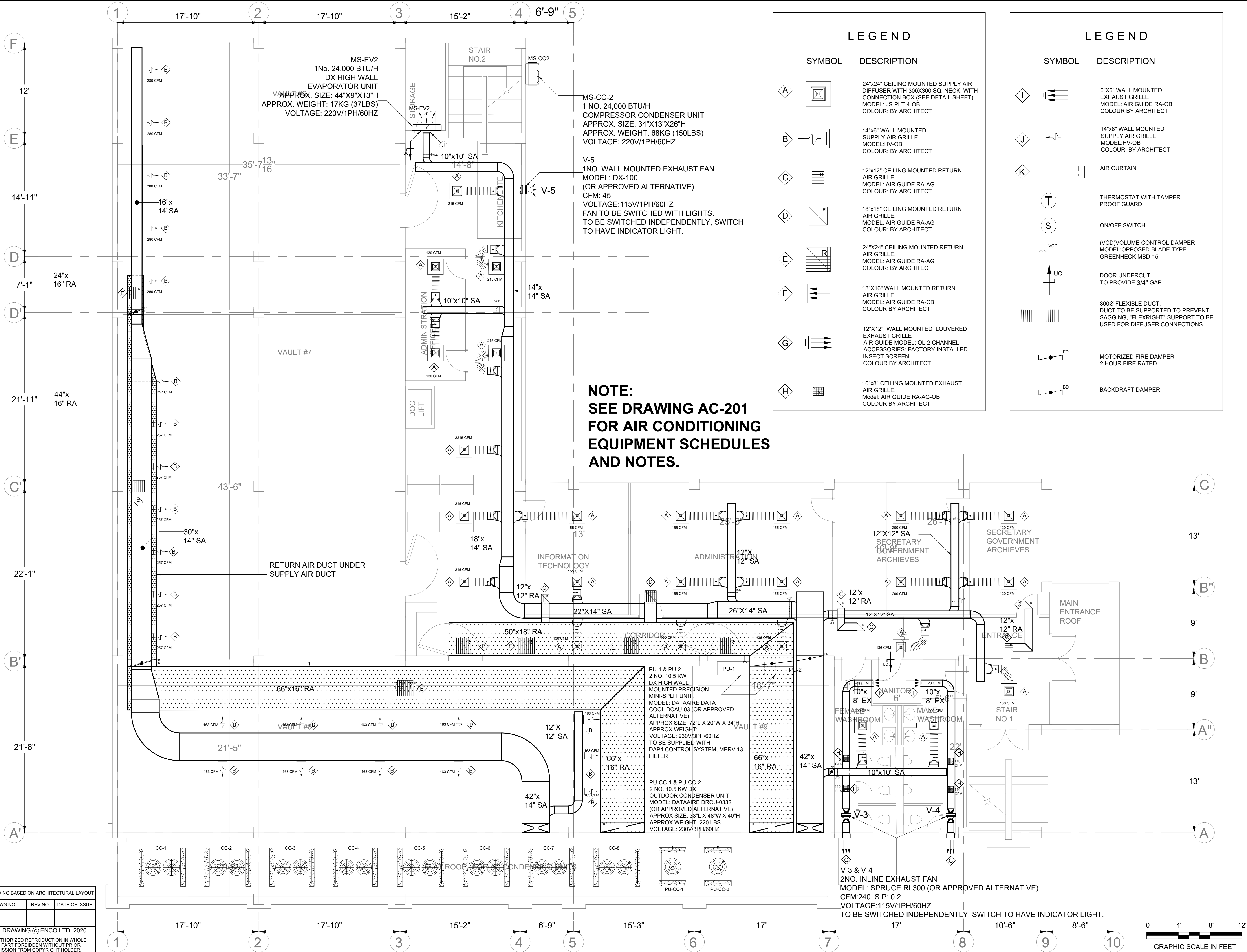
FILE NAME: NATIONAL ARCHIVES TRINIDAD AND TOBAGO

DRAWING BASED ON ARCHITECTURAL LAYOUT

DWG NO.	REV NO.	DATE OF ISSUE

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LEGEND

SYMBOL	DESCRIPTION
	24"x24" CEILING MOUNTED SUPPLY AIR DIFFUSER WITH 300X300 SQ. NECK, WITH CONNECTION BOX (SEE DETAIL SHEET) MODEL: JS-PLT-4-OB COLOUR: BY ARCHITECT
	14"x6" WALL MOUNTED SUPPLY AIR GRILLE MODEL:HV-OB COLOUR: BY ARCHITECT
	12"x12" CEILING MOUNTED RETURN AIR GRILLE MODEL: AIR GUIDE RA-AG COLOUR: BY ARCHITECT
	18"x18" CEILING MOUNTED RETURN AIR GRILLE MODEL: AIR GUIDE RA-AG COLOUR: BY ARCHITECT
	24"x24" CEILING MOUNTED RETURN AIR GRILLE MODEL: AIR GUIDE RA-AG COLOUR: BY ARCHITECT
	18"x16" WALL MOUNTED RETURN AIR GRILLE MODEL: AIR GUIDE RA-CB COLOUR: BY ARCHITECT
	12"x12" WALL MOUNTED LOUVERED EXHAUST GRILLE AIR GUIDE MODEL: OL-2 CHANNEL ACCESSORIES: FACTORY INSTALLED INSECT SCREEN COLOUR BY ARCHITECT
	10"x8" CEILING MOUNTED EXHAUST AIR GRILLE Model: AIR GUIDE RA-AG-OB COLOUR BY ARCHITECT

LEGEND

SYMBOL	DESCRIPTION
	6"x6" WALL MOUNTED EXHAUST GRILLE MODEL: AIR GUIDE RA-OB COLOUR BY ARCHITECT
	14"x8" WALL MOUNTED SUPPLY AIR GRILLE MODEL:HV-OB COLOUR: BY ARCHITECT
	AIR CURTAIN
	THERMOSTAT WITH TAMPER PROOF GUARD
	ON/OFF SWITCH
	(VCD)VOLUME CONTROL DAMPER MODEL:OPPOSED BLADE TYPE GREENHECK MBD-15
	DOOR UNDERCUT TO PROVIDE 3/4" GAP
	3000 FLEXIBLE DUCT. DUCT TO BE SUPPORTED TO PREVENT SAGGING. "FLEXRIGHT" SUPPORT TO BE USED FOR DIFFUSER CONNECTIONS.
	MOTORIZED FIRE DAMPER 2 HOUR FIRE RATED
	BACKDRAFT DAMPER

NOTE:
SEE DRAWING AC-201
FOR AIR CONDITIONING
EQUIPMENT SCHEDULES
AND NOTES.

THE AIR-CONDITIONING CONTRACTOR SHALL:

- VERIFY ALL DIMENSIONS ON SITE AND WILL BE HELD RESPONSIBLE FOR FITTING HIS WORK TO THE BUILDING IN A WORKMANLIKE MANNER SUBJECT TO ACCEPTANCE BY THE ENGINEER.
- CO-ORDINATE WITH THE OTHER CONTRACTORS ON THE JOB TO ALLOW FOR FREE PASSAGE OF DUCTS PROPER PLACEMENT OF DIFFUSERS, GRILLES, ETC. AND GIVE FULL APPRECIATION TO ALL TRADES ON THE JOB.
- PROVIDE ALL OFFSETS REQUIRED TO KEEP DUCTS CLOSE TO WALLS, BEAMS, COLUMNS AND OR SOFFIT OF SLAB AS MAY BE REQUIRED TO AVOID ANY OBSTRUCTIONS.
- THIS DRAWING TO BE READ IN ACCORDANCE WITH THE ARCHITECTURAL AND STRUCTURAL DRAWINGS.

GENERAL NOTES

- THE A/C CONTRACTOR- MUST SUPPLY SHOP DRAWINGS SHOWING EQUIPMENT LAYOUT, PIPING ROUTE, SIZING, DUCTWORK LAYOUT INCLUDING ASSOCIATED ACCESSORIES FOR APPROVAL BEFORE INSTALLATION.
- TOILET PERIPHERY WALLS TO BE FULL HEIGHT TO SEAL OFF THE AREA FROM THE GENERAL AIR CONDITIONED SPACE. IN CONDITIONS WHERE FULL HEIGHT WALLS CANNOT MEET THE SOFFIT OF SLAB, ALTERNATIVE SEALING ARRANGEMENT SHALL BE DESIGNED BY THE ARCHITECT.
- FLOOR OF AIR HANDLER ROOM TO HAVE A DUST FREE FINISH BY MAIN CONTRACTOR.
- FLOOR TO BE PROPERLY SCREED TO FALL TO FLOOR DRAIN BY MAIN CONTRACTOR.
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- AIR HANDLER ROOM TO HAVE A 50MM DIA. FLOOR DRAIN BY MAIN CONTRACTOR.
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- DUCT TO BE SUSPENDED FROM SOFFIT OF SLAB, PURLINS, BEAMS, RAFTERS, ETC. WHICHEVER IS POSSIBLE. CEILING SUSPENSION TO BE INDEPENDENT OF DUCT SUPPORT.
- UNLESS OTHERWISE INDICATED ALL CONCEALED DUCTWORK TO BE EXTERNALLY INSULATED WITH 2" DUCT WRAP AND APPLIED ACCORDING TO THE MANUFACTURERS SPECIFICATIONS.
- EXPOSED DUCTWORK TO BE INTERNAL INSULATED WITH 1" THICK LINACOUSTIC AND APPLIED ACCORDING TO THE MANUFACTURER'S SPECIFICATIONS.
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- LEAKING JOINTS ARE NOT ACCEPTABLE AND SHALL BE REPAIRED AT NO COST TO THE CLIENT.
- RETURN AIR LOOP TO BE INTERNALLY WITH 1" THICK LINACOUSTIC AND APPLIED ACCORDING TO THE MANUFACTURERS SPECIFICATIONS.
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- THE A/C CONTRACTOR- MUST SUPPLY AS-BUILT DRAWINGS SHOWING ALL EQUIPMENT AND THE AIR DISTRIBUTION SYSTEM AT THE END OF THE PROJECT.

REV #	BY	DATE	DESCRIPTION
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REVISIONS:

FOR TENDER
ISSUE DATE: 29TH MAY 2023

TITLE
BUILDING B
FIRST FLOOR
AIR CONDITIONING
AND VENTILATION LAYOUT

SCALE@12"x18:	DESIGNED BY: -
SCALE@24"x36: 3/16"=1'-0"	DRAWN BY: J.HART
ENGINEER:	DATE: APRIL, 2023
ARCHITECT	

ENCO Ltd
112A Edward St, POS, Trinidad
T 1 868 625 4294 F 1 868 625 2788
info@enco.co.tt

JOB
NATIONAL ARCHIVES OF
TRINIDAD AND TOBAGO

JOB NO.	DRAWING NO.	REV
NATT/2022	AC-200	-

FILE NAME: NATIONAL ARCHIVES TRINIDAD AND TOBAGO

CONDENSER/COMPRESSOR
ENVIRONMENT TREATMENT.

COIL TREATMENT SHALL BE FACTORY TREATED OR APPLIED LOCALLY IN A CONTROL ENVIRONMENT.

1. CABINET EXTERNAL SURFACES TO BE TREATED WITH TWO (2) COATS OF CLEAR COAT FINISH-SPRAYED ON.
2. CABINET INTERNAL SURFACES INCLUDING THE BASE TO BE TREATED WITH BITUMASTIC COATING.
3. COILS FINS TO BE FACTORY HERESITE TREATED OR APPROVED ALTERNATIVE.
4. CONDENSER COIL ENDS AND OTHER COPPER JOINTS TO BE EPILUX COATED.
5. CONTRACTOR TO SUBMIT A COMPLETE METHOD STATEMENT FOR APPLICATION OF THE ABOVE ITEMS.

NOTES:

1. DETAIL LAYOUT OF AIR HANDLER TO BE SUBMITTED BY CONTRACTOR FOR APPROVAL.
2. EXACT LOCATION OF COMPRESSOR/CONDENSERS TO BE VERIFIED ON SITE BY CONTRACTOR.
3. EXACT LOCATION OF TEMPERED AIR UNIT TO BE VERIFIED ON SITE BY CONTRACTOR
4. EXACT ROUTE OF REFRIGERANT PIPING TO BE VERIFIED ON SITE BY CONTRACTOR
5. EXACT LOCATION OF DUCTWORK TO BE VERIFIED ON SITE.
9. EXACT SIZE, WEIGHT OF ALL AIR CONDITIONING EQUIPMENT, LOCATION, PLINTHS, UPSTANDS AND SUPPORTS TO BE CONFIRM WHEN MANUFACTURER IS KNOWN.
10. THE A/C CONTRACTOR- MUST SUPPLY SHOP DRAWINGS SHOWING EQUIPMENT LAYOUT, PIPING ROUTE AND SIZING, INCLUDING ASSOCIATED ACCESSORIES AND MAIN DUCT CONNECTION FROM AIR HANDLER FOR APPROVAL BEFORE INSTALLATION.
11. EXACT LOCATION OF DIFFUSER, CEILING GRILLES AND AIR HANDLER TO BE CONFIRM ON SITE.
12. EQUIPMENT MUST BE INSTALL IN ACCORDANCE WITH MANUFACTURERS SPECIFICATION
13. ALL AIR HANDLER UNITS / FAN DUCT CONNECTIONS MUST HAVE FLEXIBLE CONNECTIONS.
14. AC EQUIPMENT SHOULD HAVE DELAYED START, TO AVOID ALL THE EQUIPMENT STARTING AT THE SAME TIME.
15. AC EQUIPMENT SHOULD RESTART AUTOMATICALLY AFTER POWER FAILURE WHEN POWER IS RESTORED.
16. THE A/C CONTRACTOR MUST ENSURE THAT ALL EQUIPMENT CONFORM TO BUILDING VOLTAGE.
17. FLEXIBLE DUCTS MUST NOT EXCEED SIX FEET (6'-0"). FLEXIBLE DUCT SIZE TO BE 12"Ø.
18. ALL DUCT JOINTS TO BE PROPERLY SEALED AND TAPED, WITH APPROVED MANUFACTURE DUCT SEALANT AND TAP BY A/C CONTRACTOR.
19. ALL DUCTWORK THROUGH WALLS AND FLOORS TO BE SEALED WITH A FIRE RESISTANT SEALANT BY A/C CONTRACTOR
20. ALL HORIZONTAL CONDENSATE LINES TO BE EXTERNALLY INSULATED WITH CLOSED CELL ELASTOMERIC THERMAL INSULATION.
21. CONDENSATE DRAIN TO BE TRAPPED AND ROUTED TO NEAREST FLOOR DRAIN.

CC- CONDENSER/ COMPRESSOR UNITS							
ITEM	TAG	CAPACITY SIZE	MODEL	VOLTAGE	APPROXIMATE SIZE	APPROXIMATE WEIGHT	SUPPORTS
1	CC-1 DX OUTDOOR CONDENSER UNIT	12.5TON / 45 KW	DATAAIRE GHRC 053 (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	63"L x 48"W x 40"H	359 LBS	FLOOR MOUNTED
2	CC-2 DX OUTDOOR CONDENSER UNIT	12.5TON / 45 KW	DATAAIRE GHRC 053 (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	63"L x 48"W x 40"H	359 LBS	FLOOR MOUNTED
3	CC-3 DX AIR COOLED CONDENSING UNIT	12.5 TON	CARRIER (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	60"L x 46"W x 50"H	431 LBS	FLOOR MOUNTED
4	CC-4 DX AIR COOLED CONDENSING UNIT	12.5 TON	CARRIER (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	60"L x 46"W x 50"H	431 LBS	FLOOR MOUNTED
5	CC-5 DX OUTDOOR CONDENSER UNIT	12.5TON / 45 KW	DATAAIRE GHRC 053 (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	63"L x 48"W x 40"H	359 LBS	FLOOR MOUNTED
6	CC-6 DX OUTDOOR CONDENSER UNIT	12.5TON / 45 KW	DATAAIRE GHRC 053 (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	63"L x 48"W x 40"H	359 LBS	FLOOR MOUNTED
7	CC-7 DX AIR COOLED CONDENSING UNIT	12.5 TON	CARRIER (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	60"L x 46"W x 50"H	431 LBS	FLOOR MOUNTED
8	CC-8 DX AIR COOLED CONDENSING UNIT	12.5 TON	CARRIER (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	60"L x 46"W x 50"H	431 LBS	FLOOR MOUNTED

DRAWING BASED ON ARCHITECTURAL LAYOUT		
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THE AIR-CONDITIONING CONTRACTOR SHALL:

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REV #	BY	DATE	DESCRIPTION
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REVISIONS:

FOR
TENDER

ISSUE DATE: 29TH MAY 2023

TITLE

BUILDING B - FIRST FLOOR
AIR CONDITIONING AND VENTILATION
EQUIPMENT SCHEDULES AND NOTES

SCALE@12x18:	DESIGNED BY:	-
SCALE@24x36:	NTS	DRAWN BY: J.HART
ENGINEER:	DATE:	APRIL, 2023

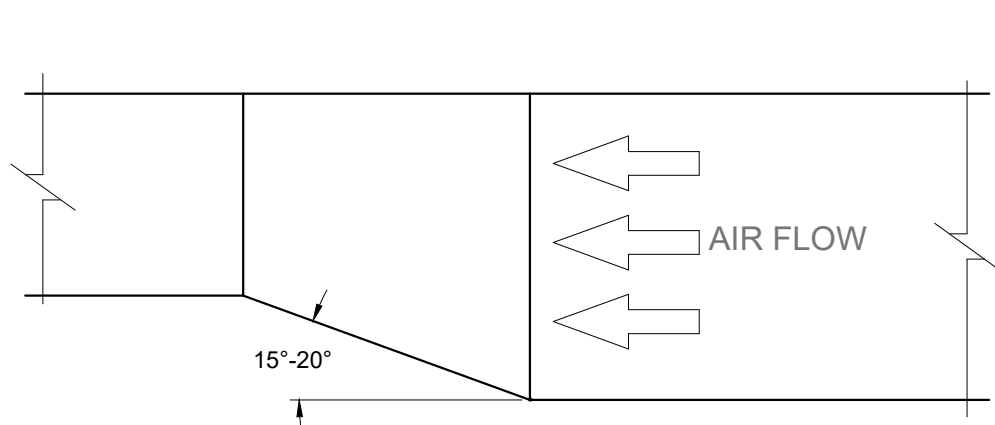
ARCHITECT

ENCO Ltd
112A Edward St, POS, Trinidad
T 1 868 625 4294 F 1 868 625 2788
info@enco.co.tt

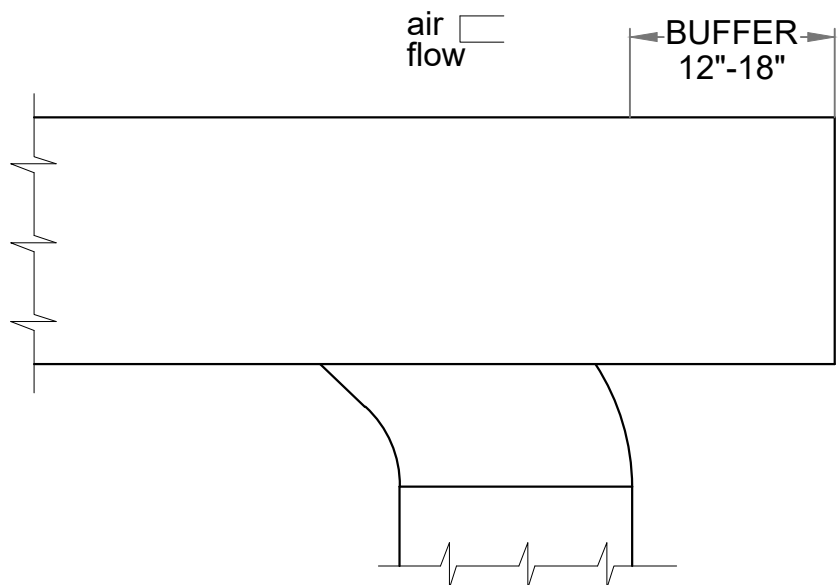
JOB

NATIONAL ARCHIVES OF
TRINIDAD AND TOBAGO

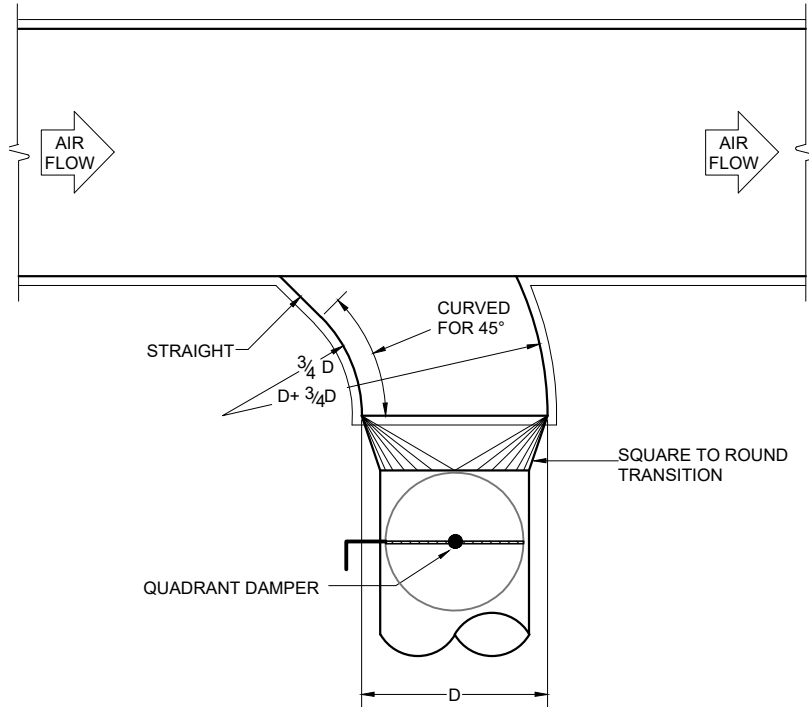
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TYPICAL DUCT
TRANSITION DETAIL
Scale - N.T.S.

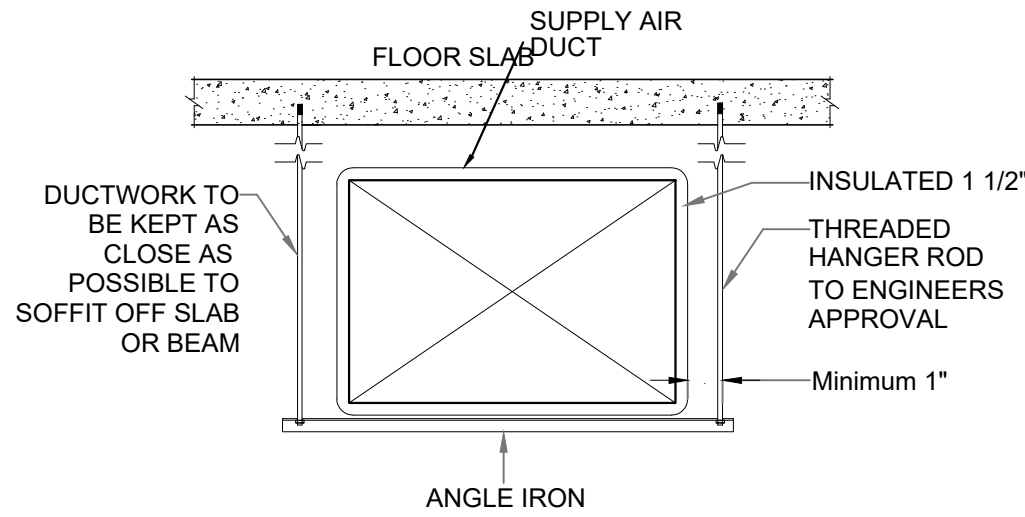


TYPICAL SUPPLY AIR
SPUR DETAIL
SCALE - N.T.S.

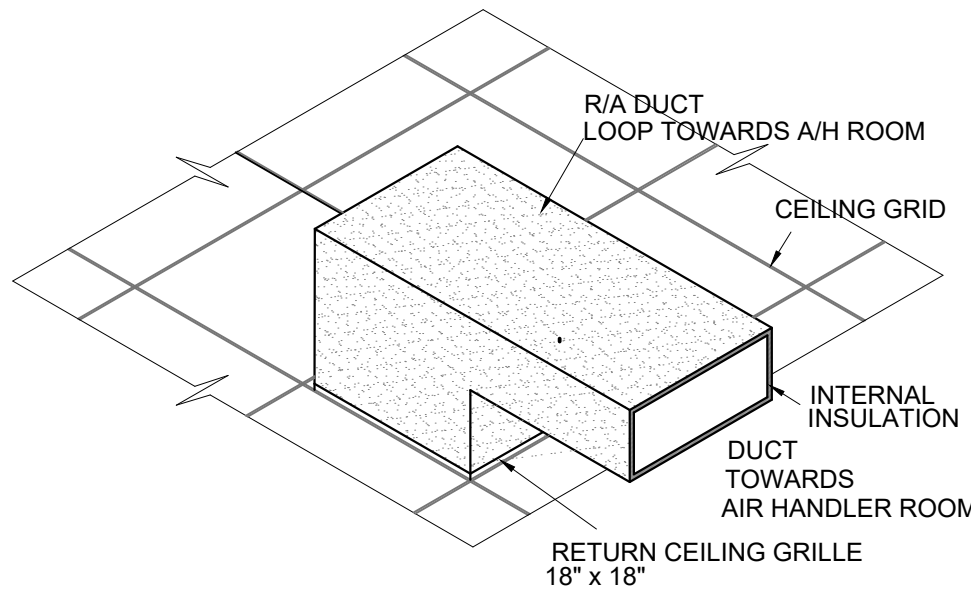


TYPICAL SUPPLY AIR SPUR DETAIL
WITH QUADRANT DAMPER

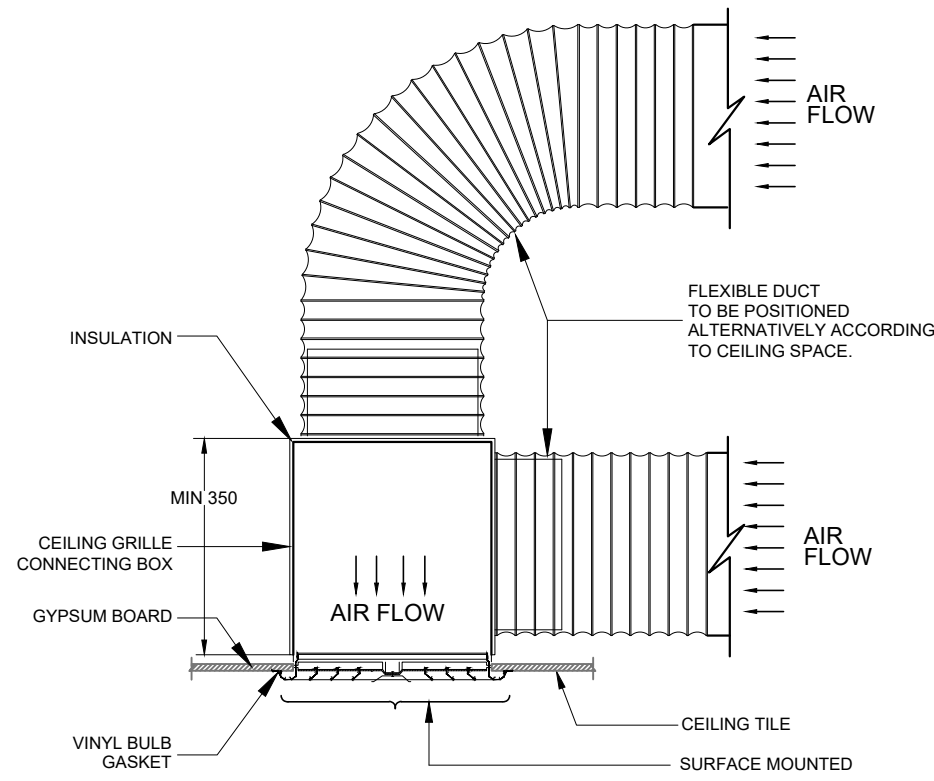
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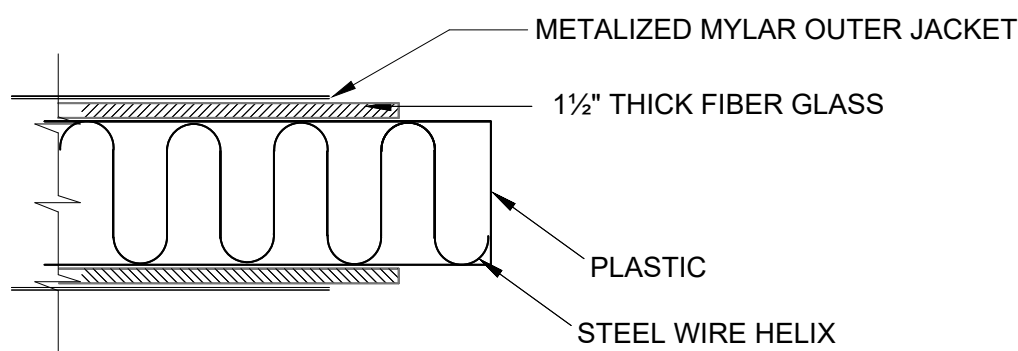
TYPICAL DUCT
SUPPORT DETAIL
SCALE - N.T.S.



Return air duct
detail with 1No.
90° bend
Scale - N.T.S.

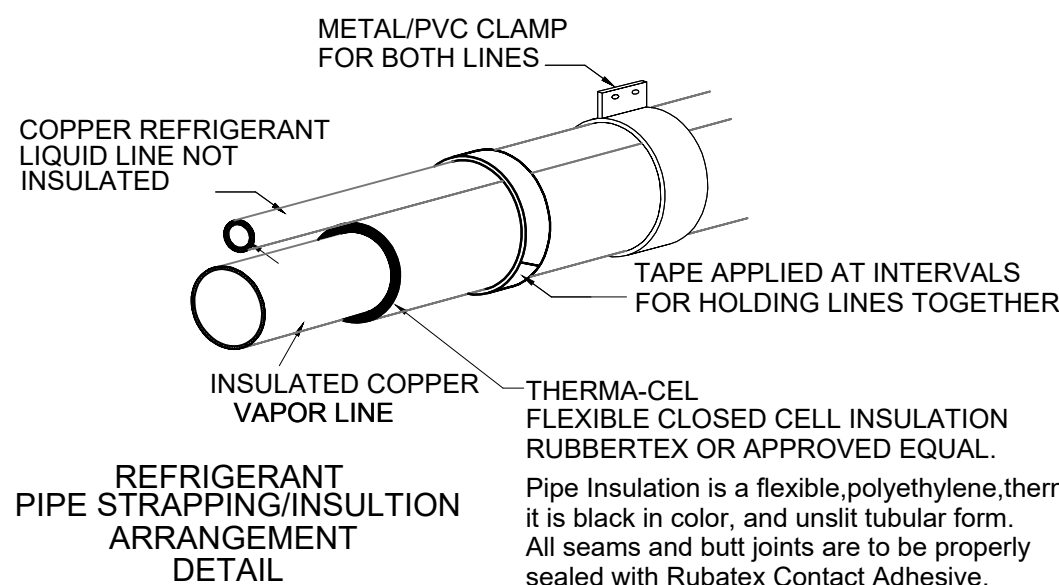


SURFACE MOUNTED DIFFUSER
AND FLEX DETAIL
Scale - N.T.S.



CERTANTEED CERTAFLEX
INSULATED FLEXIBLE
AIR DUCT OR EQUAL
SCALE - N.T.S

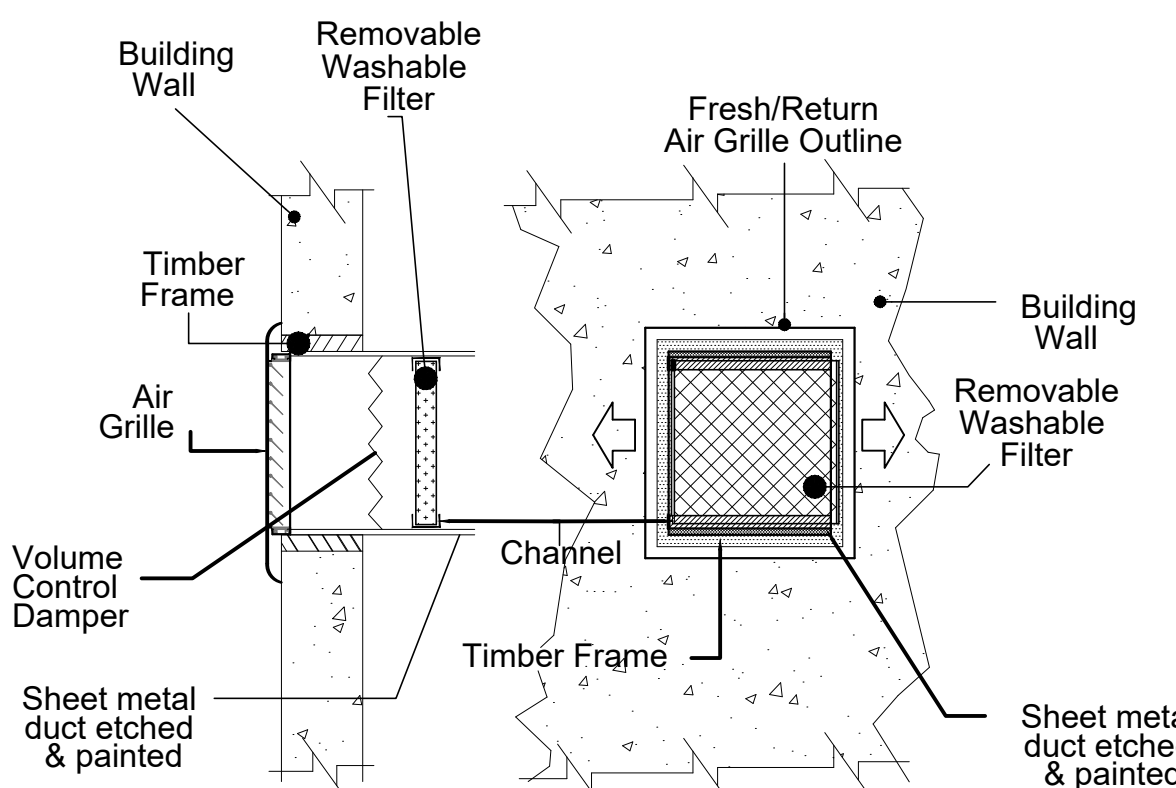
INSULATED FLEXIBLE ROUND AIR DUCT WITH A REINFORCED METALIZED MYLAR OUTER JACKET ENCLOSING A 1 1/2" THICK FIBER GLASS INSULATION WRAPPED AROUND A CONTINUOUS INNER AIR BARRIER OF DOUBLE-LAYER POLYESTER REINFORCED WITH AN ENCAPSULATED STEEL WIRE HELIX.



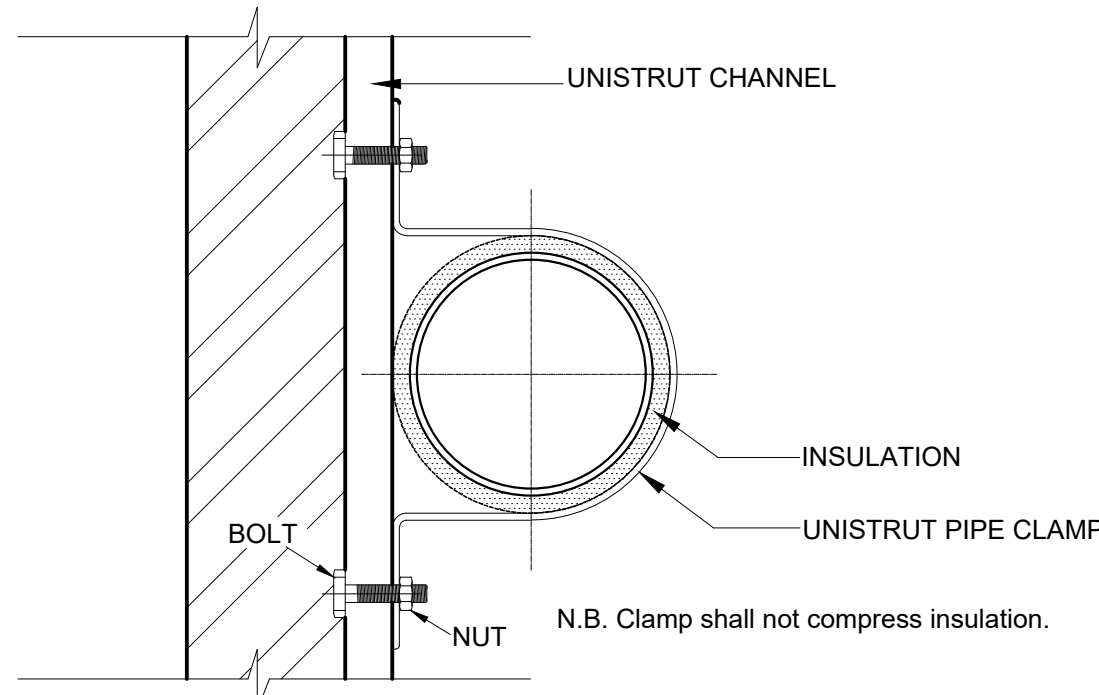
REFRIGERANT
PIPE STRAPPING/INSULATION
ARRANGEMENT
DETAIL

PIPE INSULATION is a flexible, polyethylene, thermal insulation. it is black in color, and unsilt tubular form. All seams and butt joints are to be properly sealed with Rubatex Contact Adhesive. recommended by manufacture.

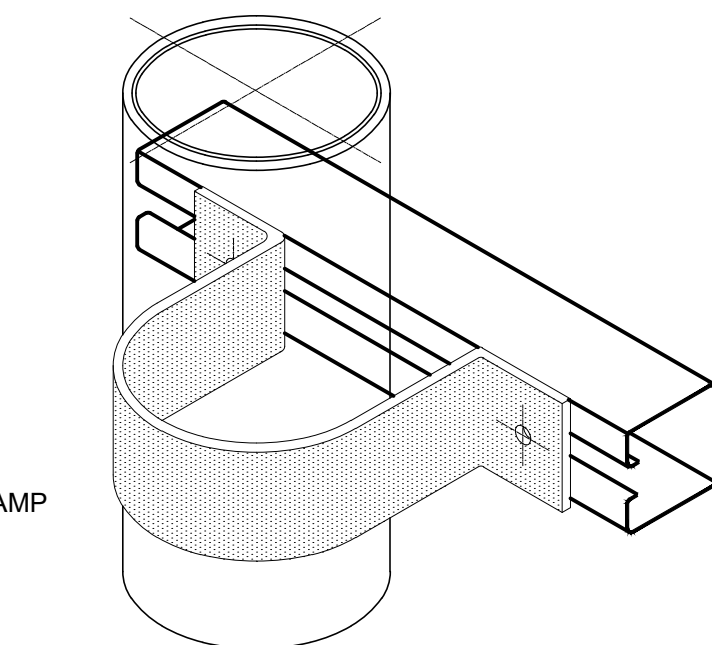
SLITTING OF INSULATION IS NOT ACCEPTABLE



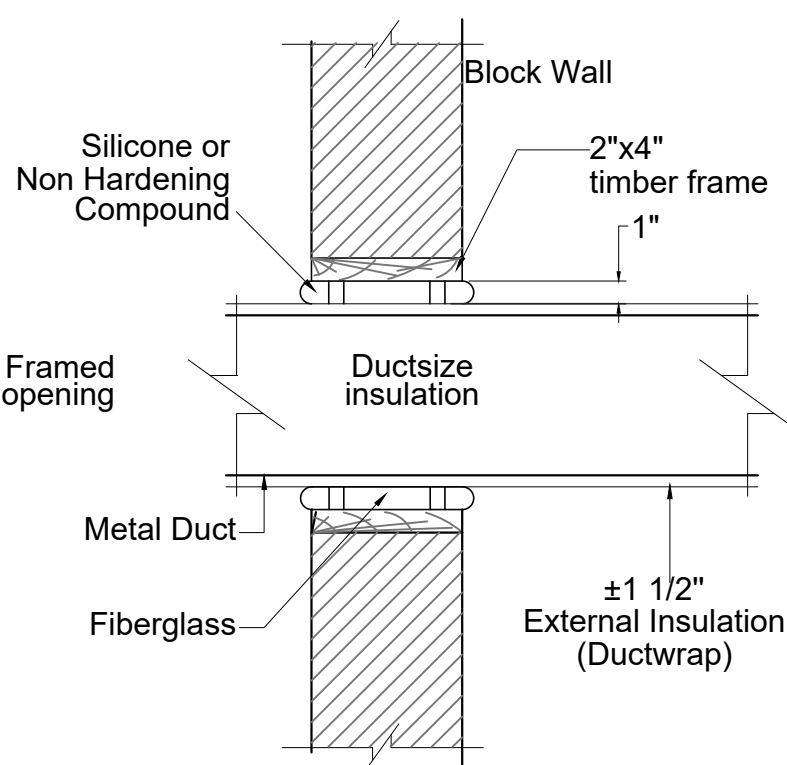
RA & FA FRAMING & DUCT DETAIL
SCALE - N.T.S



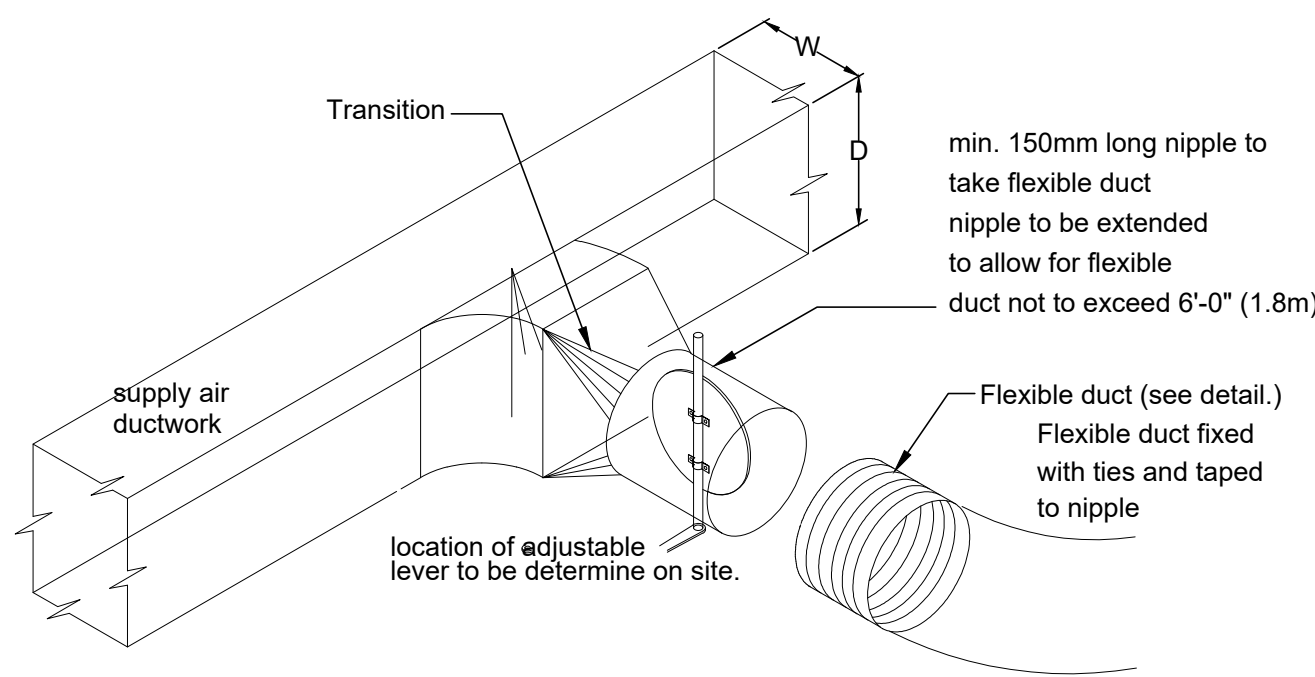
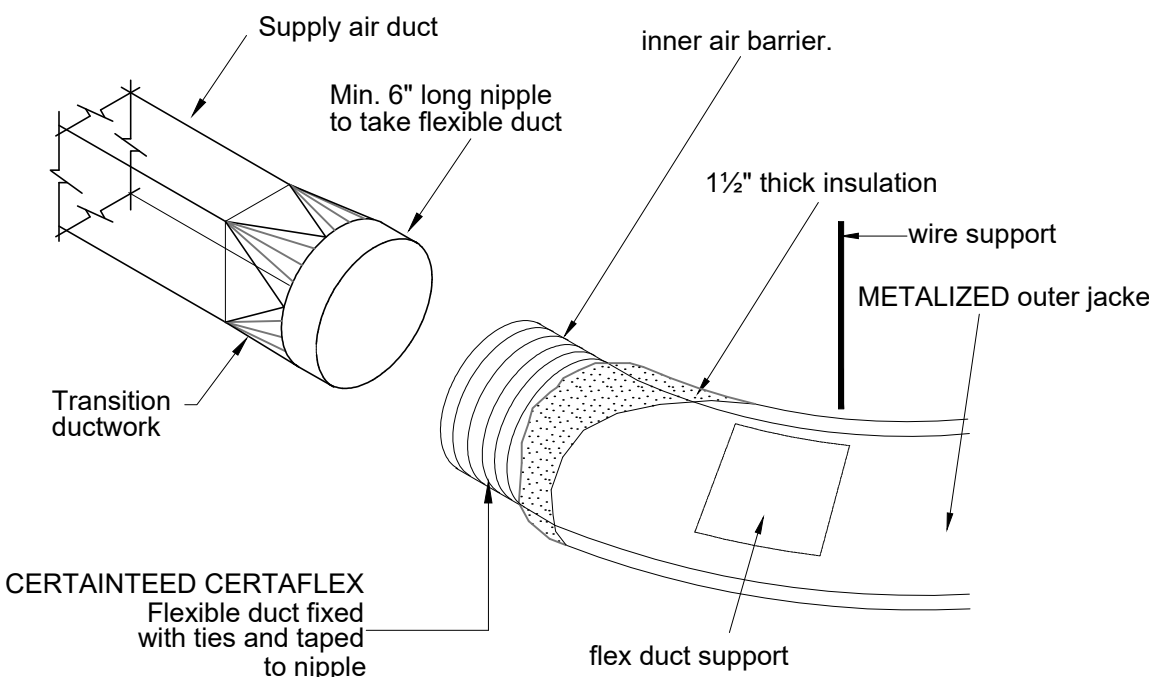
TYPICAL VERTICAL
PIPE SUPPORT DETAIL



TYPICAL PENETRATION
DETAIL FOR DUCTWORK

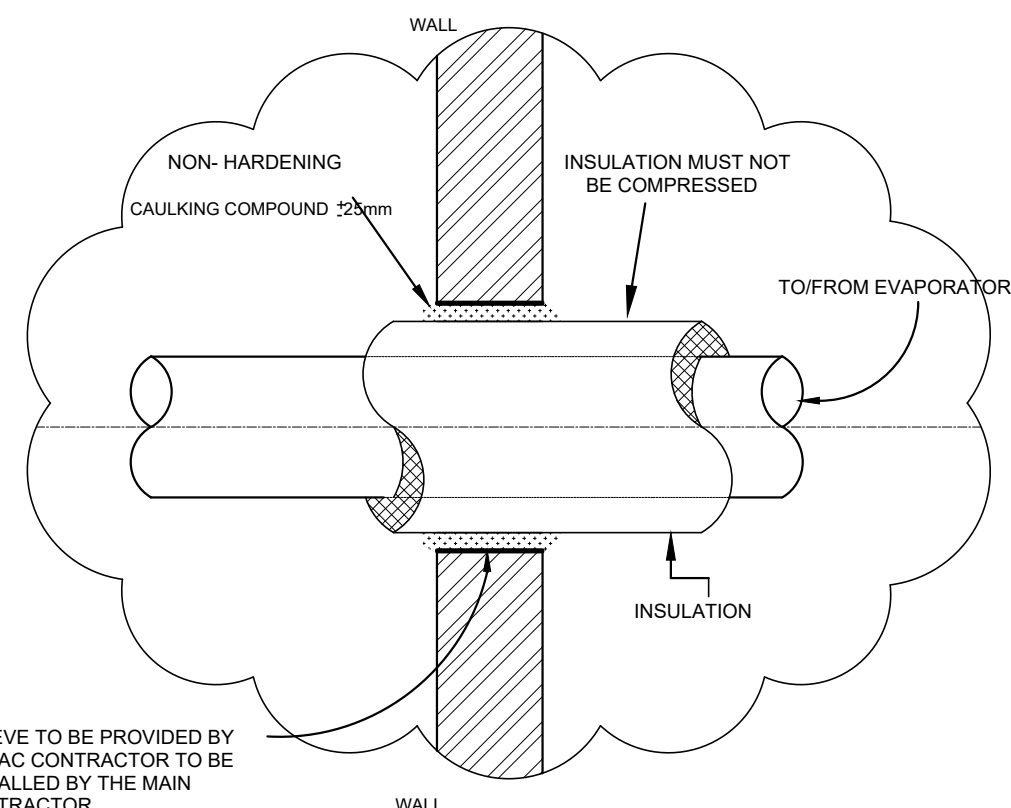


TRANSITION DETAIL FOR FLEX FEEDS
AT END OF DUCT
Scale - N.T.S.

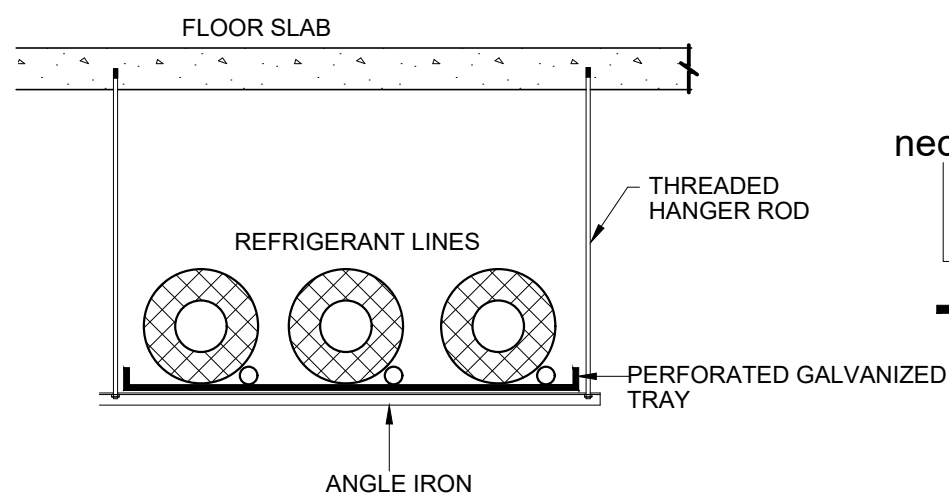


TYPICAL SUPPLY AIR
SPUR DETAIL

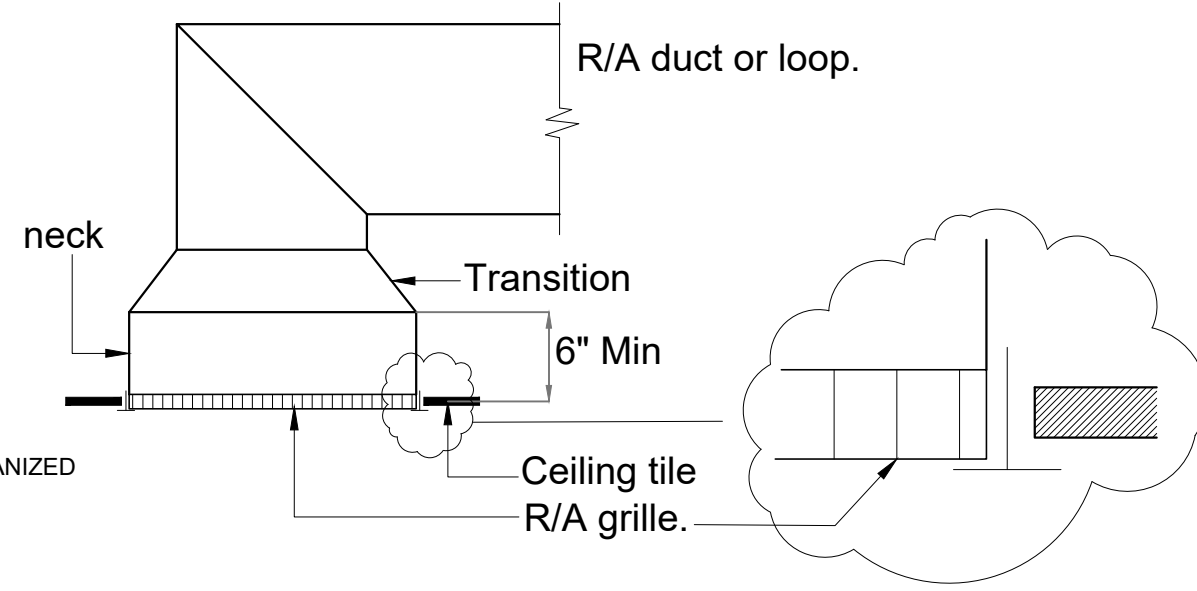
Scale - N.T.S.



TYPICAL DETAIL FOR
PIPING THROUGH WALL.
Scale - N.T.S.



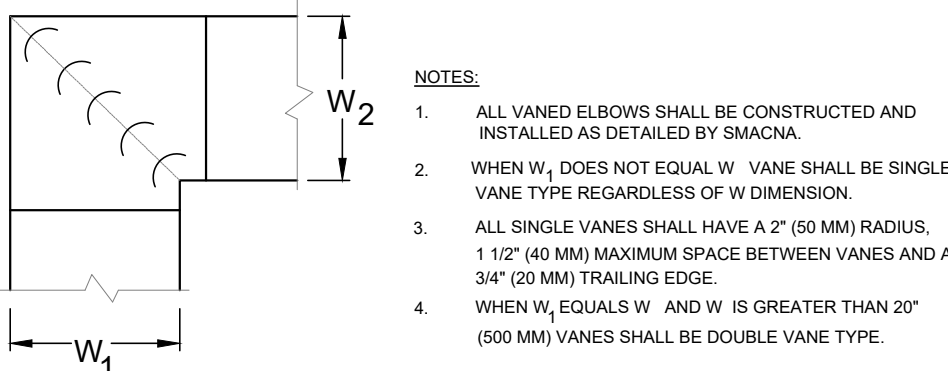
TYPICAL SUSPENDED
CABLE TRAY
SUPPORT DETAIL
Scale - N.T.S.



DUCT RETURN AIR GRILLE INSTALLATION DETAIL

NOTES:

1. ALL DUCT JOINTS TO BE PROPERLY SEALED WITH MANUFACTURER'S APPROVED SILICONE OR NON-HARDENING COMPOUND
2. LEAKING JOINTS ARE NOT ACCEPTABLE AND SHALL BE REPAIRED AT NO COST TO THE CLIENT.
3. SLITTING OF INSULATION SHALL NOT BE ACCEPTED.



NOTES:

1. ALL VANED ELBOWS SHALL BE CONSTRUCTED AND INSTALLED AS DETAILED BY SMACNA.
2. WHEN W1 DOES NOT EQUAL W2 VANE SHALL BE SINGLE VANE TYPE REGARDLESS OF W DIMENSION.
3. ALL SINGLE VANES SHALL HAVE A 2" (50 MM) RADIUS, 1 1/2" (40 MM) MAXIMUM SPACE BETWEEN VANES AND A 3/4" (20 MM) TRAILING EDGE.
4. WHEN W1 EQUALS W2 AND W2 IS GREATER THAN 20" (500 MM) VANES SHALL BE DOUBLE VANE TYPE.

DUCTWORK SQUARE VANED ELBOWS

Scale - N.T.S.

DUCTWORK SPECIFICATION:- FABRICATION		
LENGTH OF LONGEST SIDE (mm)	(inches)	SHEET STEEL U.S. GAUGE
up through 304	12	26
330-762	13-30	24
762-1219	30-48	22
1219-2438	48-95	20
2438-over	95- ~	18

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REV #	BY	DATE	DESCRIPTION
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REVISIONS:

FOR
TENDER
ISSUE DATE: 29TH MAY 2023



TITLE
**BUILDING B
GENERAL DETAILS
SHEET 1**

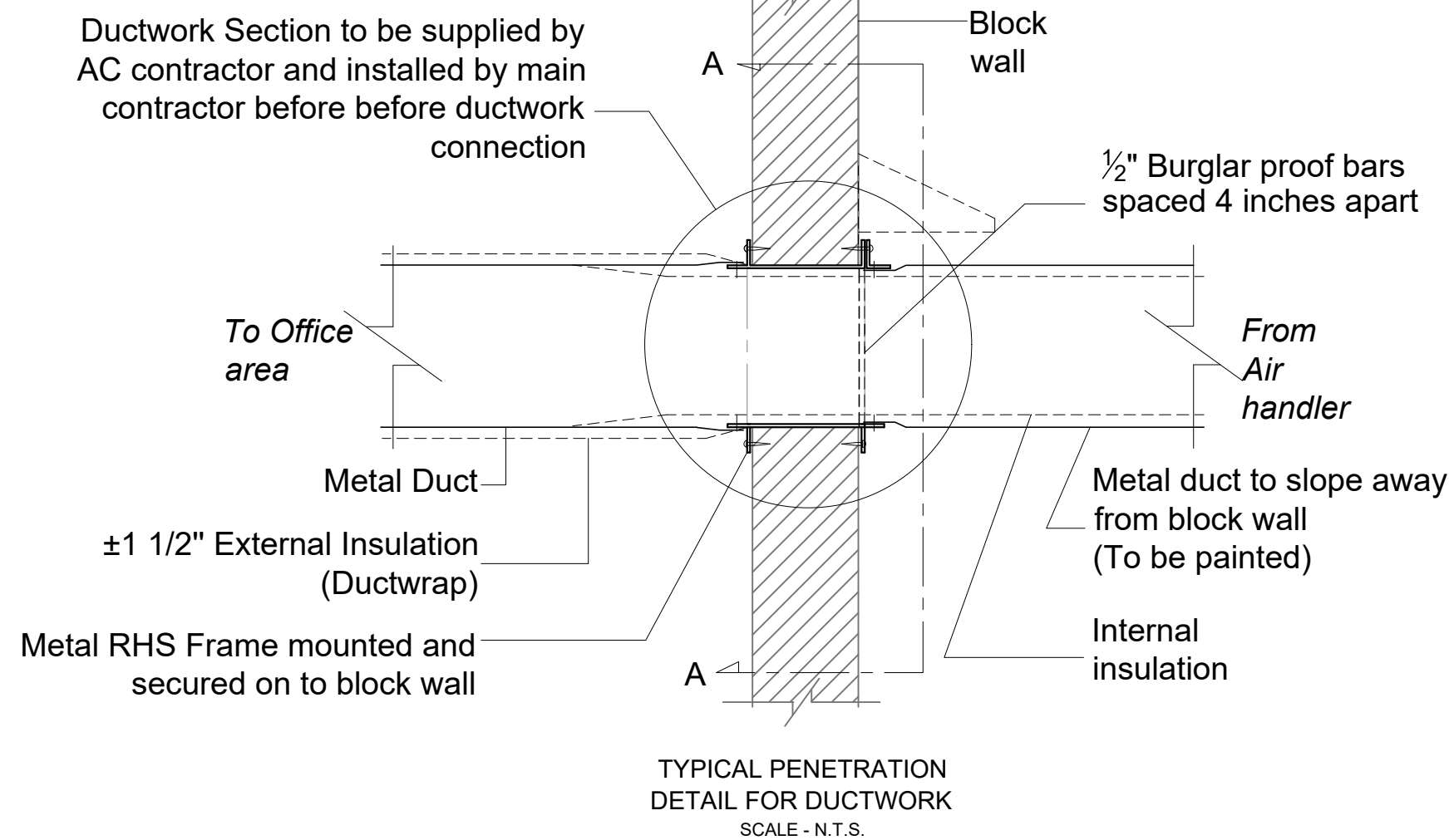
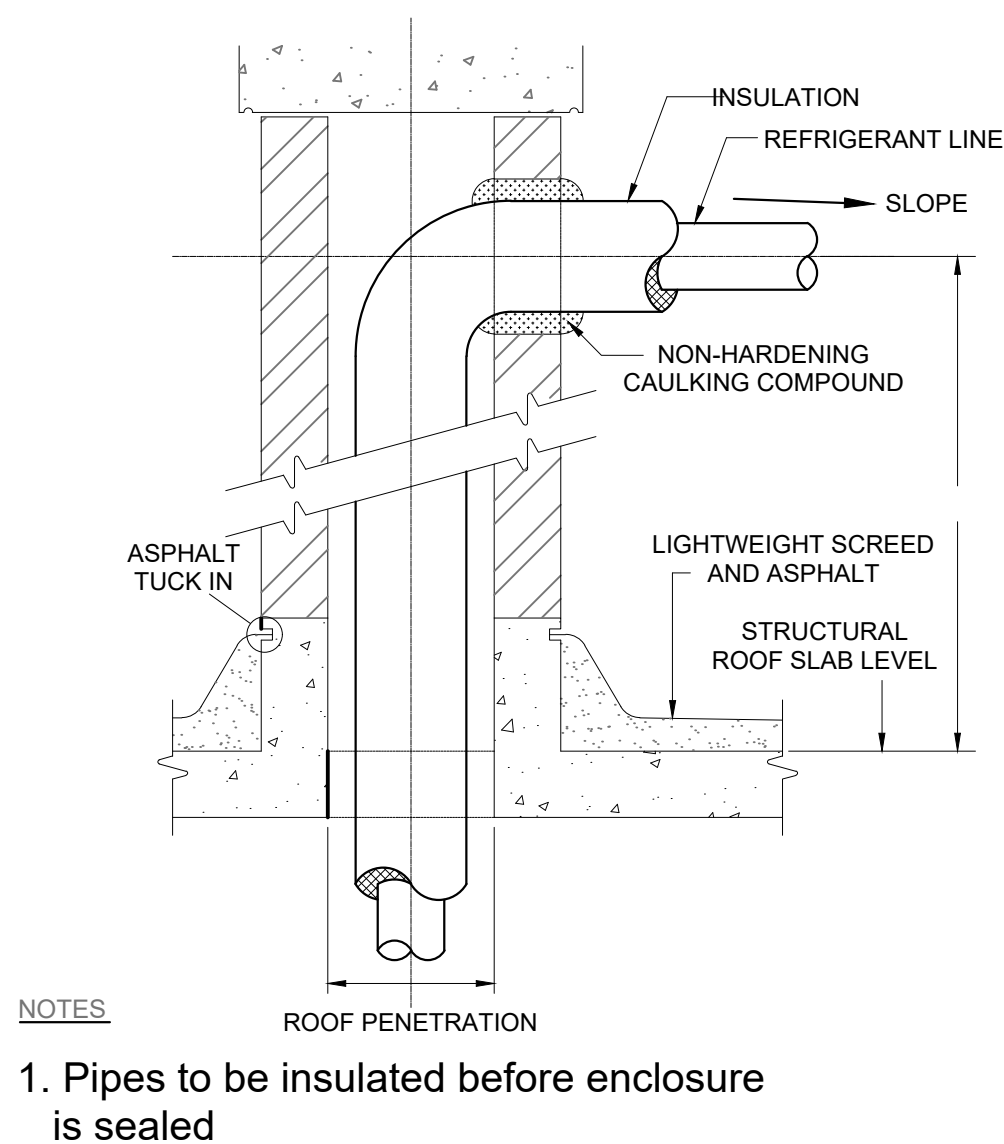
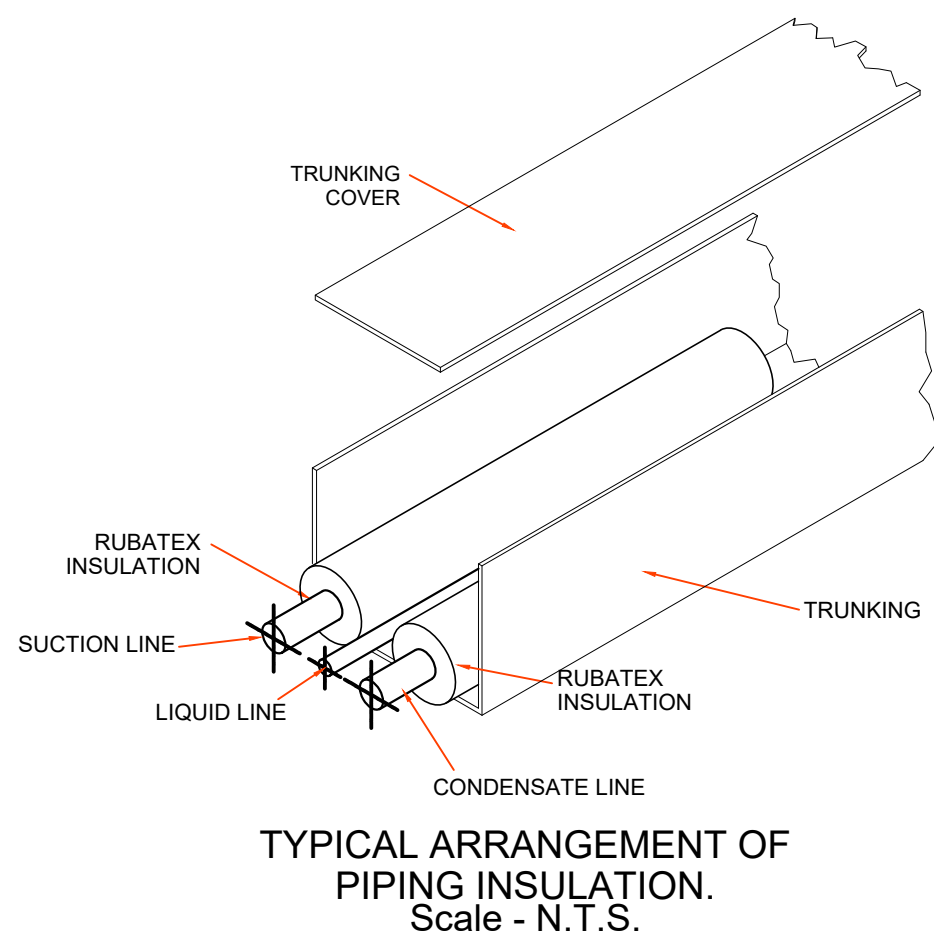
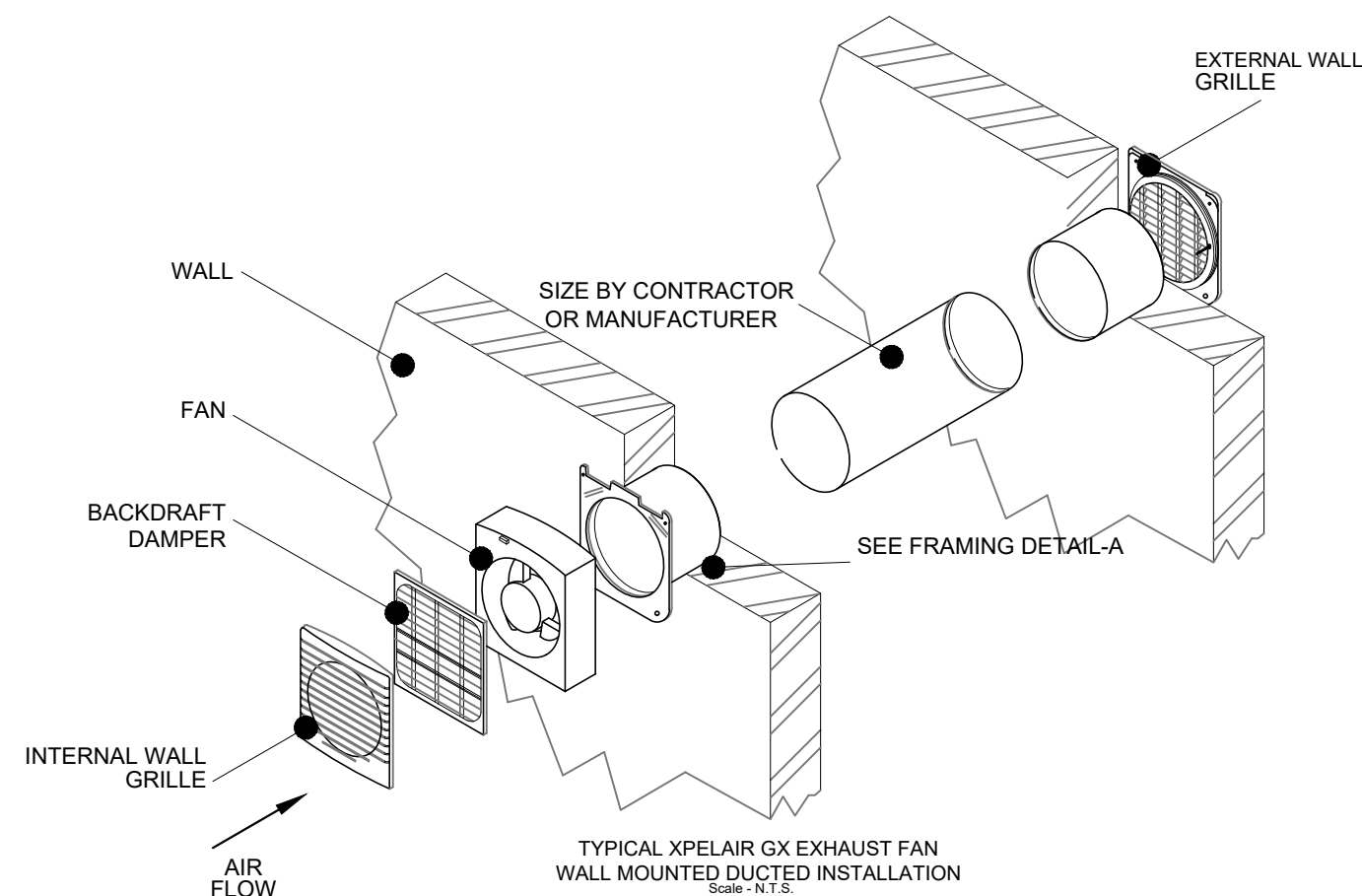
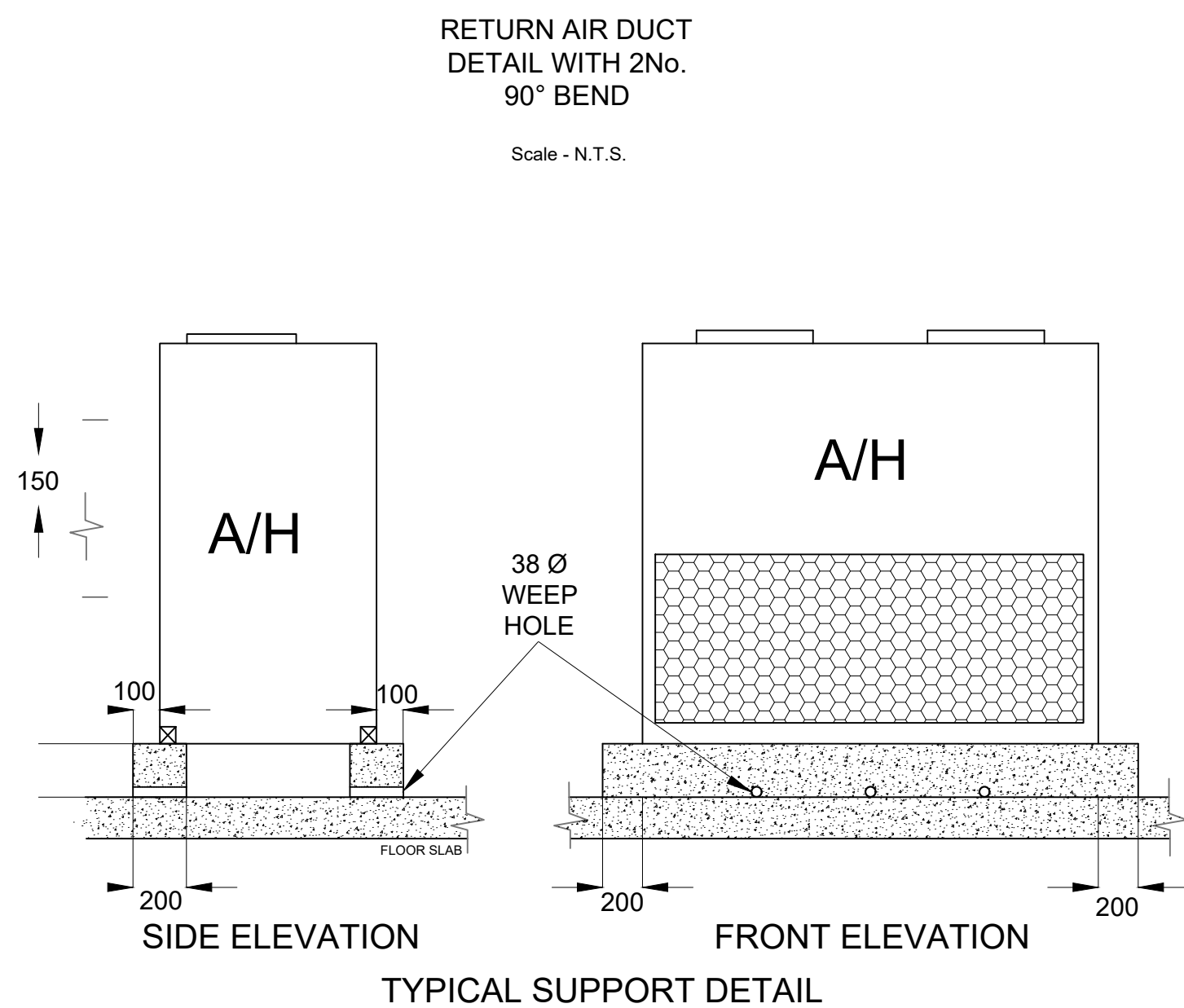
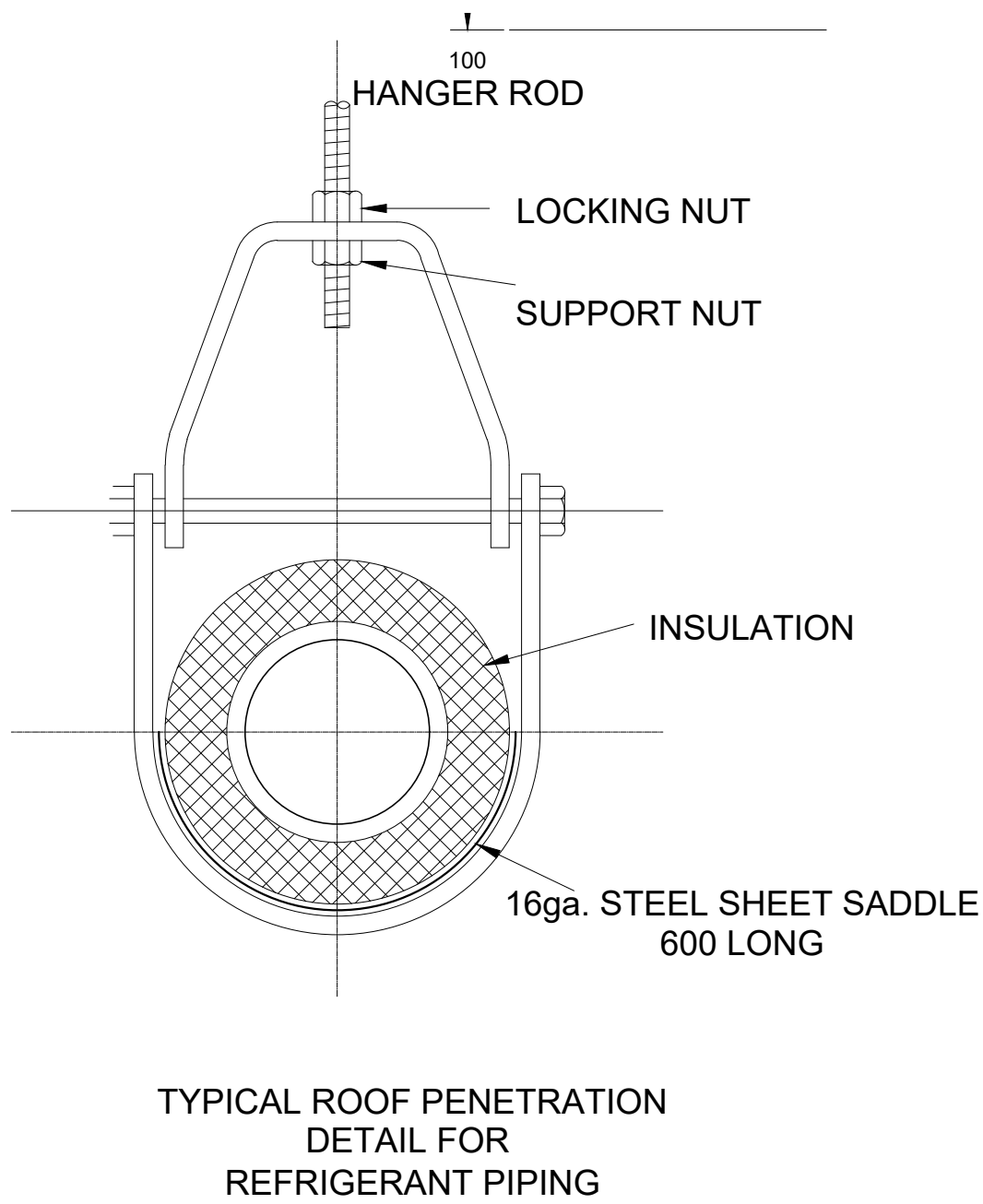
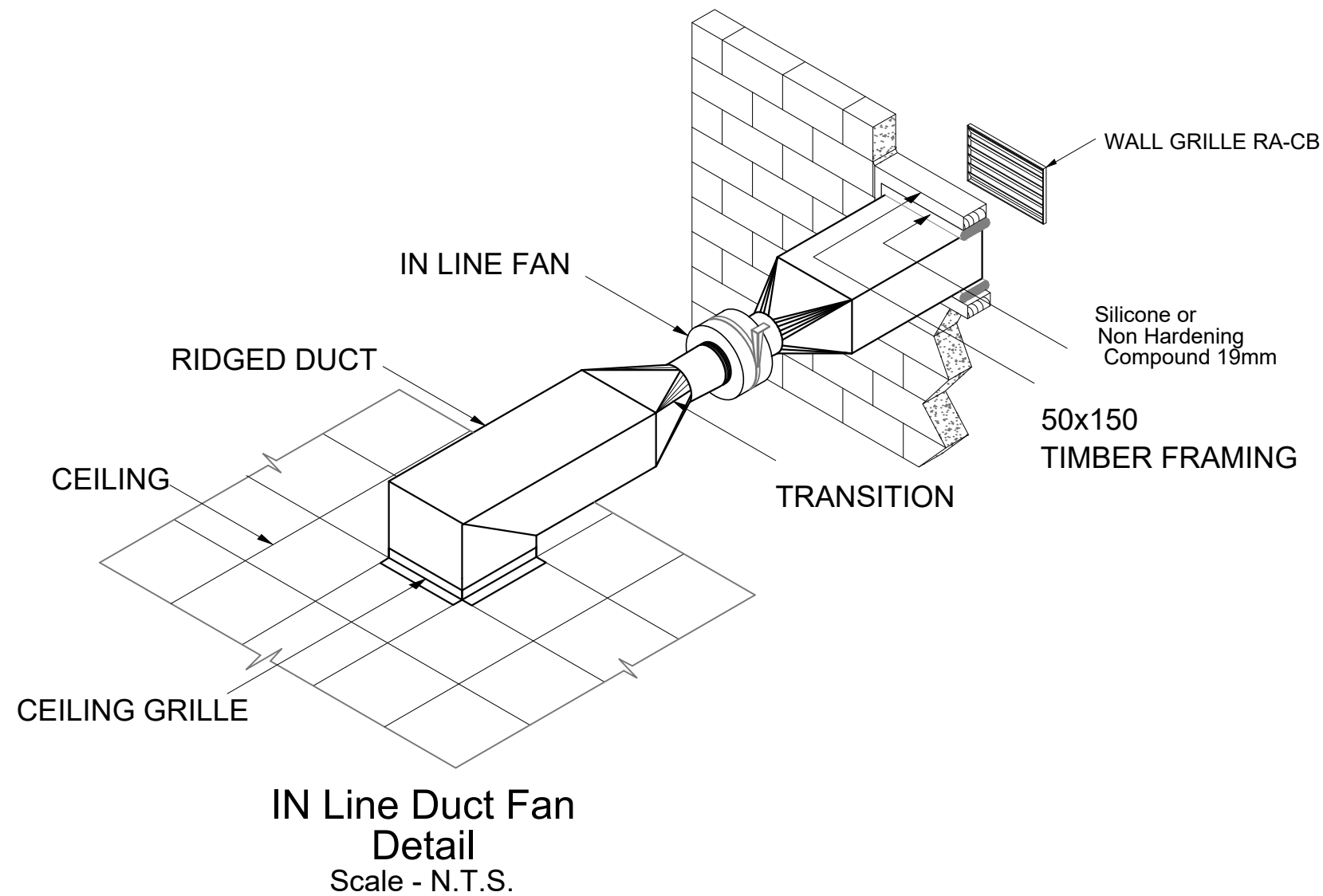
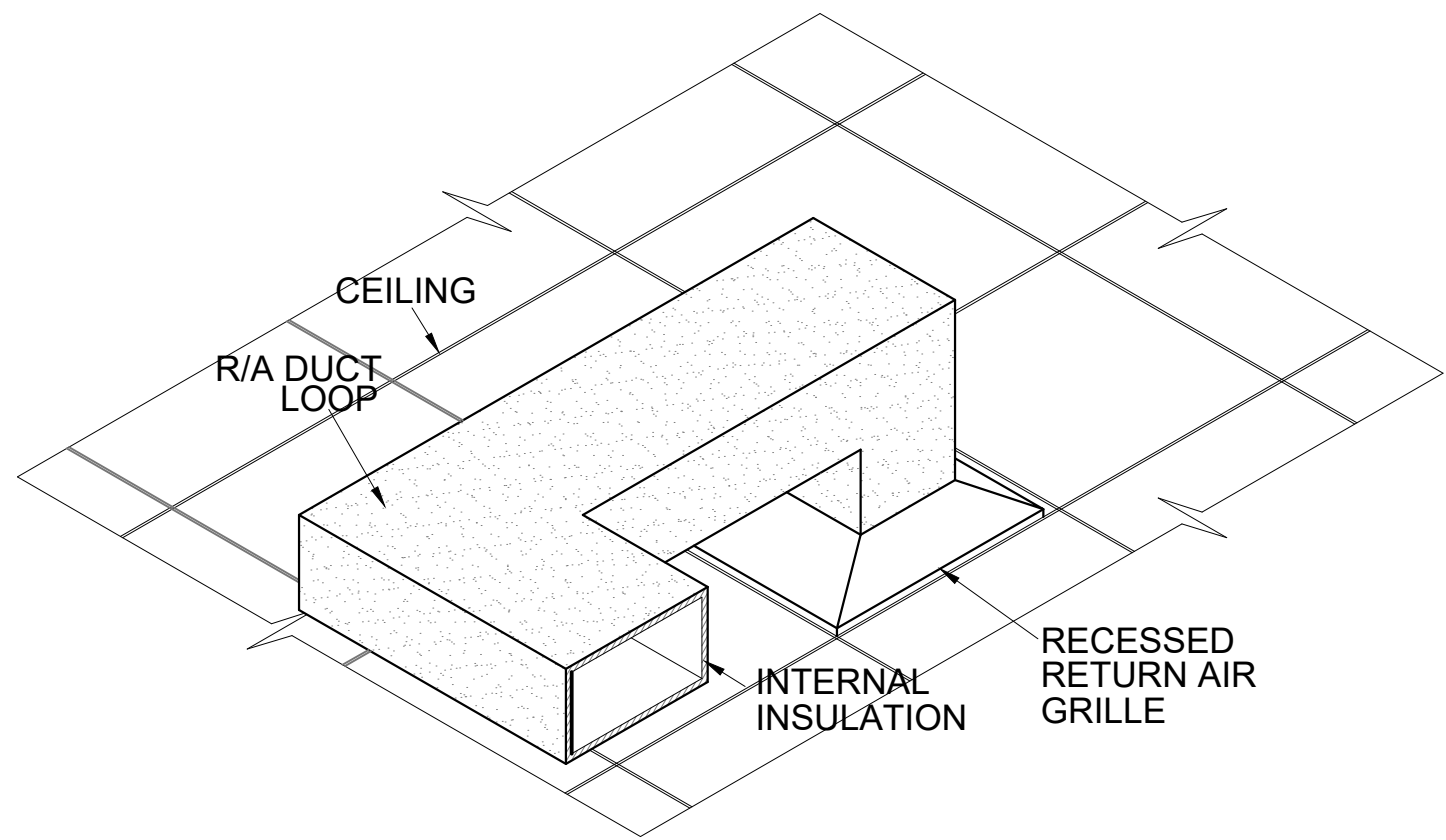
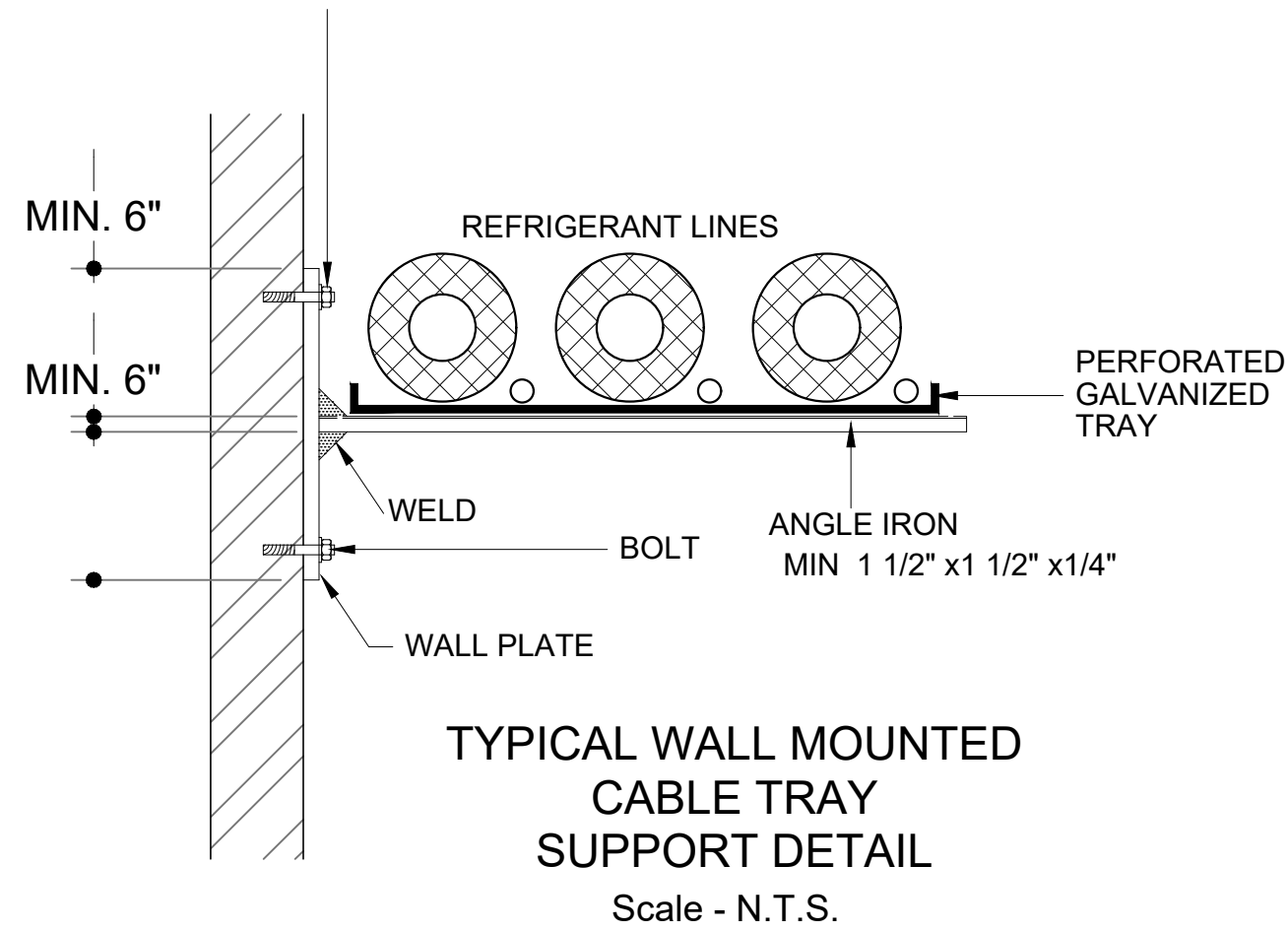
SCALE@12x18:	DESIGNED BY:
SCALE@24x36: NTS	DRAWN BY: J.H
ENGINEER:	DATE: APRIL, 2023
ARCHITECT	

ENCO ENCO Ltd
112A Edward St, POS, Trinidad
T 1 868 625 4294 F 1 868 625 2788
info@enco.co.tt

JOB
**NATIONAL ARCHIVES OF
TRINIDAD AND TOBAGO**

JOB NO.	DRAWING NO.	REV
NATT/Y2022	AC-D1	-

DRAWING BASED ON ARCHITECTURAL LAYOUT		
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THE AIR-CONDITIONING CONTRACTOR SHALL:

1. VERIFY ALL DIMENSIONS ON SITE AND WILL BE HELD RESPONSIBLE FOR FITTING HIS WORK TO THE BUILDING IN A WORKMANLIKE MANNER SUBJECT TO ACCEPTANCE BY THE ENGINEER.
2. CO-ORDINATE WITH THE OTHER CONTRACTORS ON THE JOB TO ALLOW FOR FREE PASSAGE OF DUCTS PROPER PLACEMENT OF DIFFUSERS, GRILLES, ETC. AND GIVE FULL APPRECIATION TO ALL TRADES ON THE JOB.
3. PROVIDE ALL OFFSETS REQUIRED TO KEEP DUCTS CLOSE TO WALLS, BEAMS, COLUMNS AND OR SOFFIT OF SLAB AS MAY BE REQUIRED TO AVOID ANY OBSTRUCTIONS.

GENERAL NOTES

1. THE A/C CONTRACTOR- MUST SUPPLY SHOP DRAWINGS SHOWING EQUIPMENT LAYOUT, PIPING ROUTE, SIZING, DUCTWORK LAYOUT INCLUDING ASSOCIATED ACCESSORIES FOR APPROVAL BEFORE INSTALLATION.
2. TOILET PERIPHERY WALLS TO BE FULL HEIGHT TO SEAL OFF THE AREA FROM THE GENERAL AIR CONDITIONED SPACE. IN CONDITIONS WHERE FULL HEIGHT WALLS CANNOT MEET THE SOFFIT OF SLAB, ALTERNATIVE SEALING ARRANGEMENT SHALL BE DESIGNED BY THE ARCHITECT.
3. FLOOR OF AIR HANDLER ROOM TO HAVE A DUST FREE FINISH BY MAIN CONTRACTOR.
4. FLOOR TO BE PROPERLY SCREED TO FALL TO FLOOR DRAIN BY MAIN CONTRACTOR.
5. DOORWAY TO THE AIR HANDLER ROOM TO HAVE 100MM HIGH CURB BY MAIN CONTRACTOR.
6. AIR HANDLER ROOM TO HAVE A 50MM DIA. FLOOR DRAIN BY MAIN CONTRACTOR.
7. CONDENSATE DRAIN TO BE TRAPPED AND ROUTED TO NEAREST FLOOR OR BUILDING DRAIN.
8. DUCT TO BE SUSPENDED FROM SOFFIT OF SLAB, PURLINS, BEAMS, RAFTERS, ETC. WHICHEVER IS POSSIBLE. CEILING SUSPENSION TO BE INDEPENDENT OF DUCT SUPPORT.
9. UNLESS OTHERWISE INDICATED ALL CONCEALED DUCTWORK TO BE EXTERNALLY INSULATED WITH 2" DUCT WRAP AND APPLIED ACCORDING TO THE MANUFACTURERS SPECIFICATIONS.
10. EXPOSED DUCTWORK TO BE INTERNAL INSULATED WITH 1" THICK LINACOUSTIC AND APPLIED ACCORDING TO THE MANUFACTURER'S SPECIFICATIONS.
11. ANY EXPOSED DUCTED TO BE ETCHED, PRIME AND PAINTED BY ARCHITECT COLOUR.-----
12. ALL FLOOR PENETRATIONS MUST HAVE 100MM HIGH CURB ON ALL SIDES.
13. LEAKING JOINTS ARE NOT ACCEPTABLE AND SHALL BE REPAIRED AT NO COST TO THE CLIENT.
14. RETURN AIR LOOP TO BE INTERNALLY WITH 1" THICK LINACOUSTIC AND APPLIED ACCORDING TO THE MANUFACTURER'S SPECIFICATIONS.
15. ALL SUPPORTS TO BE PROPERLY TREATED AGAINST RUSTING.
16. ALL DUCT JOINTS TO BE PROPERLY SEALED WITH MANUFACTURER'S APPROVED SILICONE OR ON-HARDENING COMPOUND.
17. THE A/C CONTRACTOR- MUST SUPPLY AS-BUILT DRAWINGS SHOWING ALL EQUIPMENT AND THE AIR DISTRIBUTION SYSTEM AT THE END OF THE PROJECT.

REV #	BY	DATE	DESCRIPTION
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REVISIONS:

FOR
TENDER
ISSUE DATE: 29TH MAY 2023



TITLE
**BUILDING B
GENERAL DETAILS
SHEET 2**

SCALE@12x18:	DESIGNED BY:
SCALE@24x36:	NTS
ENGINEER:	DRAWN BY: J.H
	DATE: APRIL, 2023

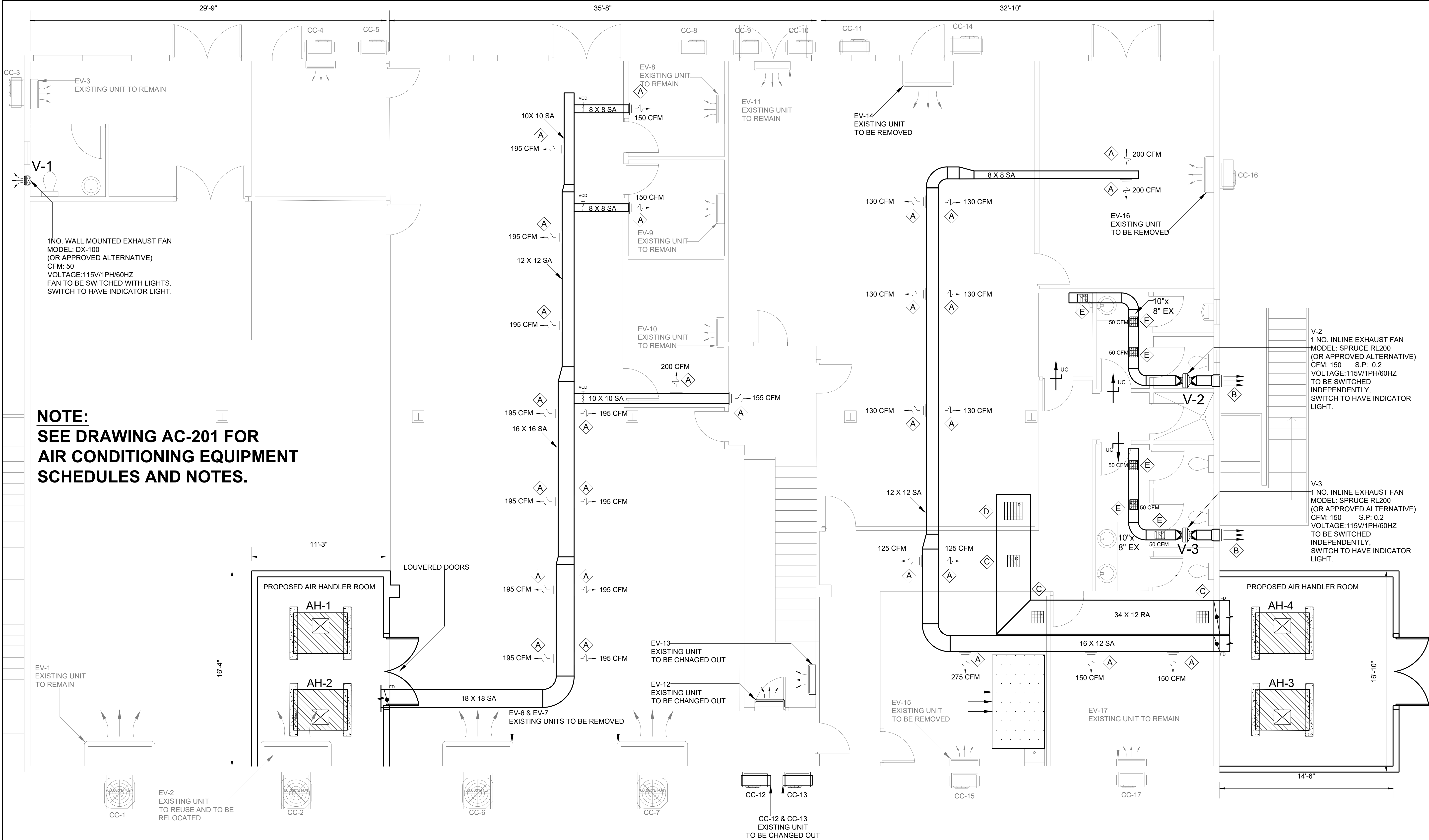
ARCHITECT

ENCO ENCO Ltd
112A Edward St, POS, Trinidad
T 1 868 625 4294 F 1 868 625 2788
info@enco.co.tt

JOB
**NATIONAL ARCHIVES OF
TRINIDAD AND TOBAGO**

JOB NO. NATT/Y2022	DRAWING NO. AC-D2	REV -
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NOTE:
SEE DRAWING AC-201 FOR
AIR CONDITIONING EQUIPMENT
SCHEDULES AND NOTES.

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GENERAL NOTES

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3. FLOOR OF AIR HANDLER ROOM TO HAVE A DUST FREE FINISH BY MAIN CONTRACTOR.
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17. THE A/C CONTRACTOR- MUST SUPPLY AS-BUILT DRAWINGS SHOWING ALL EQUIPMENT AND THE AIR DISTRIBUTION SYSTEM AT THE END OF THE PROJECT.

REV #	BY	DATE	DESCRIPTION
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REVISIONS:

**FOR
TENDER**
ISSUE DATE: 29TH MAY 2023



TITLE
BUILDING C
GROUND FLOOR
AIR CONDITIONING
AND VENTILATION LAYOUT

SCALE@12x18:	DESIGNED BY:
SCALE@24x36: 1/4"=1'-0"	DRAWN BY: J.HART
ENGINEER:	DATE: APRIL, 2023

ARCHITECT

ENCO Ltd
112A Edward St, POS, Trinidad
T 1 868 625 4294 F 1 868 625 2788
info@enco.co.tt

JOB
NATIONAL ARCHIVES OF
TRINIDAD AND TOBAGO

JOB NO. NATT/2022	DRAWING NO. AC-100	REV -
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LEGEND

SYMBOL DESCRIPTION

10"x6" WALL MOUNTED
SUPPLY AIR GRILLE
MODEL:HV-OB
COLOUR: BY ARCHITECT

12"x12" WALL MOUNTED
LOUVERED EXHAUST GRILLE
MODEL: AIR GUIDE MODEL:
OL-2 CHANNEL
COLOUR BY ARCHITECT

LEGEND

SYMBOL DESCRIPTION

12"x12" CEILING MOUNTED
RETURN AIR GRILLE.
MODEL: AIR GUIDE RA-AG
COLOUR: BY ARCHITECT

18"x18" CEILING MOUNTED
RETURN AIR GRILLE.
MODEL: AIR GUIDE RA-AG
COLOUR: BY ARCHITECT

LEGEND

SYMBOL DESCRIPTION

10"x8" CEILING MOUNTED
EXHAUST AIR GRILLE.
Model: AIR GUIDE
RA-AG-OB
COLOUR BY ARCHITECT

THERMOSTAT WITH
TAMPER PROOF GUARD

BACKDRAFT DAMPER

LEGEND

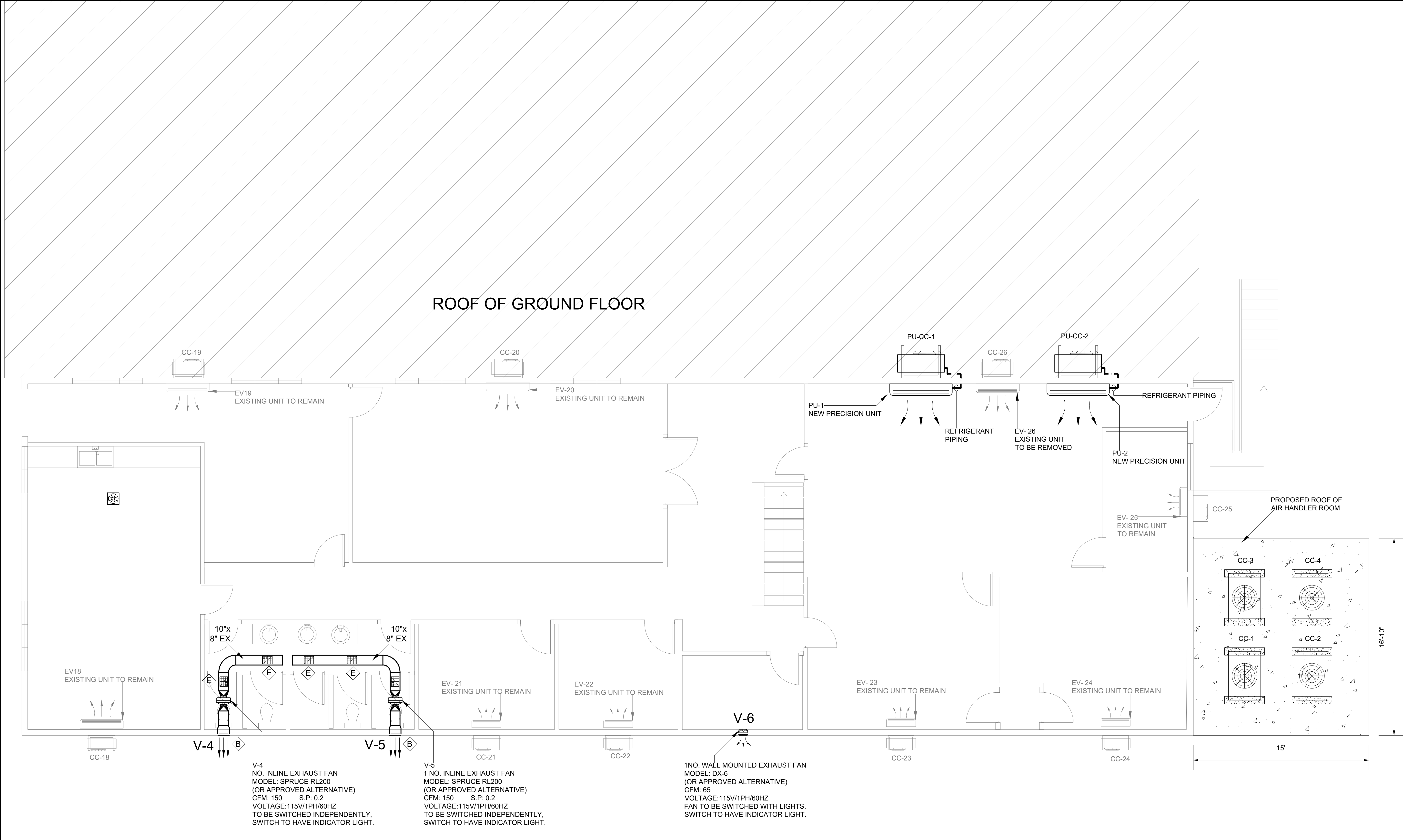
SYMBOL DESCRIPTION

(VCD)VOLUME CONTROL DAMPER
MODEL:OPPOSED BLADE TYPE
GREENHECK MBD-15

DOOR UNDERCUT
TO PROVIDE 3/4" GAP

MOTORIZED FIRE DAMPER
2 HOUR FIRE RATED





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GENERAL NOTES

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- THE A/C CONTRACTOR- MUST SUPPLY AS-BUILT DRAWINGS SHOWING ALL EQUIPMENT AND THE AIR DISTRIBUTION SYSTEM AT THE END OF THE PROJECT.

REV #	BY	DATE	DESCRIPTION
REVISIONS:			
<div>FOR TENDER</div> <div>ISSUE DATE: 29TH MAY 2023</div>			
<div></div>			
TITLE <div>BUILDING C</div> <div>FIRST FLOOR</div> <div>AIR CONDITIONING</div> <div>AND VENTILATION LAYOUT</div>			
SCALE@12x18:		DESIGNED BY: -	
SCALE@24x36: 1/4"=1'-0"		DRAWN BY: J.HART	
ENGINEER:		DATE: APRIL, 2023	
ARCHITECT			
<div><div>ENCO</div><div>ENCO Ltd 112A Edward St, POS, Trinidad T 1 868 625 4294 F 1 868 625 2788 info@enco.co.tt</div></div>			
JOB <div>NATIONAL ARCHIVES OF TRINIDAD AND TOBAGO</div>			
JOB NO. NATT/Y2022		DRAWING NO. AC-200	
		REV -	

CONDENSER/COMPRESSOR ENVIRONMENT TREATMENT.

COIL TREATMENT SHALL BE FACTORY TREATED OR APPLIED LOCALLY IN A CONTROL ENVIRONMENT.

- CABINET EXTERNAL SURFACES TO BE TREATED WITH TWO (2) COATS OF CLEAR COAT FINISH-SPRAYED ON.
- CABINET INTERNAL SURFACES INCLUDING THE BASE TO BE TREATED WITH BITUMASTIC COATING.
- COILS FINS TO BE FACTORY HERESITE TREATED OR APPROVED ALTERNATIVE.
- CONDENSER COIL ENDS AND OTHER COPPER JOINTS TO BE EPIUX COATED.
- CONTRACTOR TO SUBMIT A COMPLETE METHOD STATEMENT FOR APPLICATION OF THE ABOVE ITEMS.

LEGEND

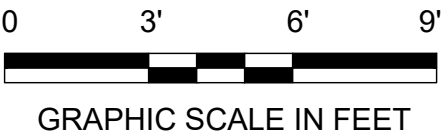
SYMBOL DESCRIPTION

- B

12"X12" WALL MOUNTED LOUVERED EXHAUST GRILLE
MODEL: AIR GUIDE MODEL: OL-2 CHANNEL
COLOUR BY ARCHITECT
- E

10"x8" CEILING MOUNTED EXHAUST AIR GRILLE.
Model: AIR GUIDE RA-AG-OB
COLOUR BY ARCHITECT

NOTE:
SEE DRAWING AC-201 FOR AIR CONDITIONING EQUIPMENT SCHEDULES AND NOTES.



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FILE NAME: NATIONAL ARCHIVES TRINIDAD AND TOBAGO

FILE NAME: NATIONAL ARCHIVES TRINIDAD AND TOBAGO

NOTES:

1. DETAIL LAYOUT OF AIR HANDLER TO BE SUBMITTED BY CONTRACTOR FOR APPROVAL.
2. EXACT LOCATION OF COMPRESSOR/CONDENSERS TO BE VERIFIED ON SITE BY CONTRACTOR.
3. EXACT ROUTE OF REFRIGERANT PIPING TO BE VERIFIED ON SITE BY CONTRACTOR
4. EXACT LOCATION OF DUCTWORK TO BE VERIFIED ON SITE.
9. EXACT SIZE, WEIGHT OF ALL AIR CONDITIONING EQUIPMENT, LOCATION, PLINTHS, UPSTANDS AND SUPPORTS TO BE CONFIRM WHEN MANUFACTURER IS KNOWN.
10. THE A/C CONTRACTOR- MUST SUPPLY SHOP DRAWINGS SHOWING EQUIPMENT LAYOUT, PIPING ROUTE AND SIZING, INCLUDING ASSOCIATED ACCESSORIES AND MAIN DUCT CONNECTION FROM AIR HANDLER FOR APPROVAL BEFORE INSTALLATION.
11. EXACT LOCATION OF DIFFUSER, CEILING GRILLES AND AIR HANDLER TO BE CONFIRM ON SITE.
12. EQUIPMENT MUST BE INSTALL IN ACCORDANCE WITH MANUFACTURERS SPECIFICATION
13. ALL AIR HANDLER UNITS / FAN DUCT CONNECTIONS MUST HAVE FLEXIBLE CONNECTIONS.
14. AC EQUIPMENT SHOULD HAVE DELAYED START, TO AVOID ALL THE EQUIPMENT STARTING AT THE SAME TIME.
15. AC EQUIPMENT SHOULD RESTART AUTOMATICALLY AFTER POWER FAILURE WHEN POWER IS RESTORED.
16. THE A/C CONTRACTOR MUST ENSURE THAT ALL EQUIPMENT CONFORM TO BUILDING VOLTAGE.
17. FLEXIBLE DUCTS MUST NOT EXCEED SIX FEET (6'-0"). FLEXIBLE DUCT SIZE TO BE 12"Ø.
18. ALL DUCT JOINTS TO BE PROPERLY SEALED AND TAPED, WITH APPROVED MANUFACTURE DUCT SEALANT AND TAP BY A/C CONTRACTOR.
19. ALL DUCTWORK THROUGH WALLS AND FLOORS TO BE SEALED WITH A FIRE RESISTANT SEALANT BY A/C CONTRACTOR
20. ALL HORIZONTAL CONDENSATE LINES TO BE EXTERNALLY INSULATED WITH CLOSED CELL ELASTOMERIC THERMAL INSULATION.
21. CONDENSATE DRAIN TO BE TRAPPED AND ROUTED TO NEAREST FLOOR DRAIN.

CONDENSER/COMPRESSOR
ENVIRONMENT TREATMENT.

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CC- CONDENSER/ COMPRESSOR UNITS							
ITEM	TAG	CAPACITY SIZE	MODEL	VOLTAGE	APPROXIMATE SIZE	APPROXIMATE WEIGHT	SUPPORTS
1	CC-1 DX OUTDOOR CONDENSER UNIT	6TON / 22 KW	DATAAIRE GHRC (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	33"L x 49"W x 40"H	195 LBS	FLOOR MOUNTED
2	CC-2 DX OUTDOOR CONDENSER UNIT	6TON / 22 KW	DATAAIRE GHRC (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	33"L x 49"W x 40"H	195 LBS	FLOOR MOUNTED
3	CC-3 DX OUTDOOR CONDENSER UNIT	5TON / 18 KW	DATAAIRE GHRC (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	33"L x 49"W x 40"H	195 LBS	FLOOR MOUNTED
4	CC-4 DX OUTDOOR CONDENSER UNIT	5TON/ 18 KW	DATAAIRE GHRC (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	33"L x 49"W x 40"H	195 LBS	FLOOR MOUNTED

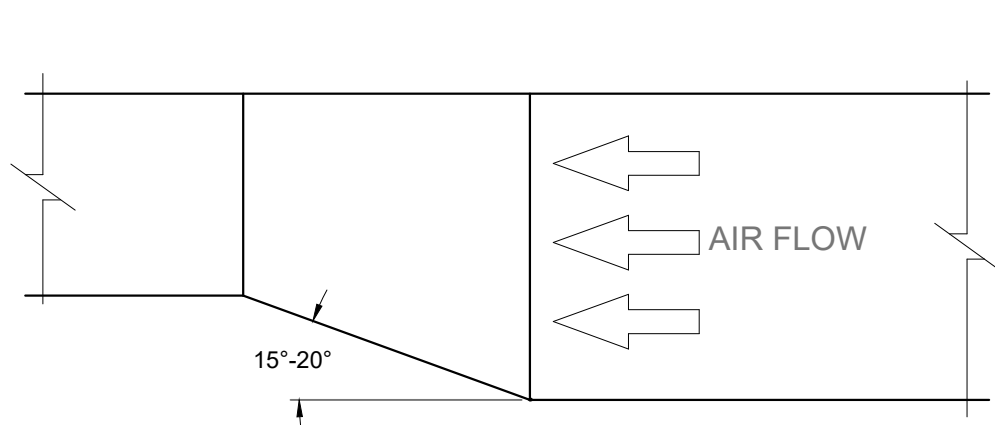
EVAPORATOR UNIT AND CONDENSER/COMPRESSOR TO BE CHANGED OUT						
ITEM	TAG	CAPACITY SIZE	VOLTAGE	APPROXIMATE SIZE	APPROXIMATE WEIGHT	SUPPORTS
1	EV-12	12,000 BTU/h	230V/1Ph/60Hz	30"x8"x10"	19lbs	WALL MOUNTED
	CC-12	12,000 BTU/h	230V/3Ph/60Hz	30"x10"x21"	77lbs	WALL MOUNTED
2	EV-13	12,000 BTU/h	230V/1Ph/60Hz	30"x8"x10"	19lbs	WALL MOUNTED
	CC-13	12,000 BTU/h	230V/3Ph/60Hz	30"x10"x21"	77lbs	WALL MOUNTED

AH-AIR HANDLER UNITS									
ITEM	TAG	CAPACITY SIZE	MODEL	VOLTAGE	APPROXIMATE SIZE	APPROXIMATE WEIGHT	SUPPORTS	ADDITIONAL INFORMATION	
1	AH-1 DX DUCTED INDOOR AIR COOLED PRECISION UNIT (UP FLOW)	6TON / 22 KW	DATAAIRE G-FORCE ULTRA (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	54"L x 41"W x 78"H	LBS	FLOOR MOUNTED	TO BE SUPPLIED WITH DAP4 CONTROL SYSTEM, MERV 13 FILTERS, UV LIGHTS	
2	AH-2 DX DUCTED INDOOR AIR COOLED PRECISION UNIT (UP FLOW)	6TON / 22 KW	DATAAIRE G-FORCE ULTRA (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	54"L x 41"W x 78"H	LBS	FLOOR MOUNTED	TO BE SUPPLIED WITH DAP4 CONTROL SYSTEM, MERV 13 FILTERS, UV LIGHTS	
3	AH-3 DX DUCTED INDOOR AIR COOLED PRECISION UNIT (UP FLOW)	5TON / 18 KW	DATAAIRE G-FORCE ULTRA (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	54"L x 41"W x 78"H	LBS	FLOOR MOUNTED	TO BE SUPPLIED WITH DAP4 CONTROL SYSTEM, MERV 13 FILTERS, UV LIGHTS	
4	AH-4 DX DUCTED INDOOR AIR COOLED PRECISION UNIT (UP FLOW)	5TON / 18 KW	DATAAIRE G-FORCE ULTRA (OR APPROVED ALTERNATIVE)	230v/3Ph/60Hz	54"L x 41"W x 78"H	LBS	FLOOR MOUNTED	TO BE SUPPLIED WITH DAP4 CONTROL SYSTEM, MERV 13 FILTERS, UV LIGHTS	

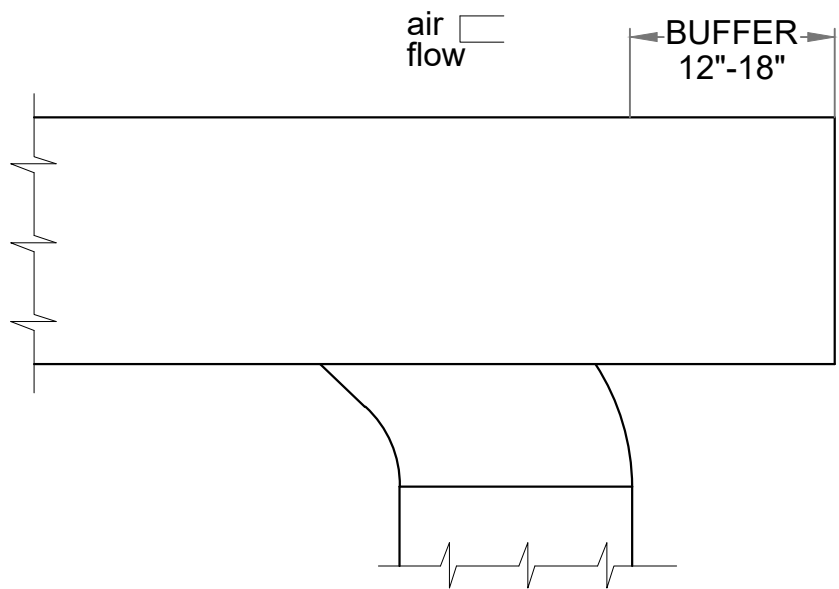
MINI SPLIT - EVAPORATOR UNIT AND CONDENSER/COMPRESSOR PRECISION UNITS								
ITEM	TAG	CAPACITY SIZE	MODEL	VOLTAGE	APPROXIMATE SIZE	APPROXIMATE WEIGHT	SUPPORTS	ADDITIONAL INFORMATION
1	PU-1	6.35 Kw	LIBERT DATAMATE DME027E	230V/1Ph/60Hz	64"x12"x32"(H)	330 lbs	WALL MOUNTED	PRECISION UNIT 6.35 Kw at 72°F 50% RH
	PU-CC-1	6.35 Kw	LIBERT DATAMATE PFH027A	230V/3Ph/60Hz			FLOOR MOUNTED	PRECISION UNIT COMPRESSOR/ CONDENSER
2	PU-2	6.35 Kw	LIBERT DATAMATE DME027E	230V/1Ph/60Hz	64"x12"x32"(H)	330 lbs	WALL MOUNTED	PRECISION UNIT 6.35 Kw at 72°F 50% RH
	PU-CC-2	6.35 Kw	LIBERT DATAMATE PFH027A	230V/3Ph/60Hz			FLOOR MOUNTED	PRECISION UNIT COMPRESSOR/ CONDENSER

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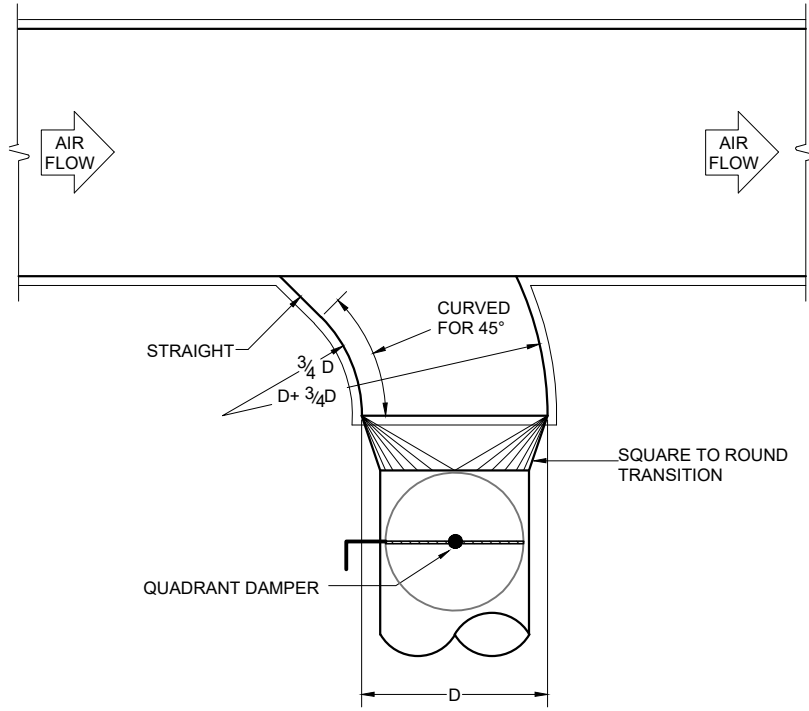
REV #	BY	DATE	DESCRIPTION
REVISIONS:			
FOR TENDER ISSUE DATE: 29TH MAY 2023			
TITLE BUILDING C AIR CONDITIONING AND VENTILATION EQUIPMENT SCHEDULES AND NOTES			
SCALE@12x18:		DESIGNED BY: -	
SCALE@24x36: NTS		DRAWN BY: J.HART	
ENGINEER:		DATE: APRIL, 2023	
ARCHITECT			
JOB NATIONAL ARCHIVES OF TRINIDAD AND TOBAGO			
JOB NO. NATT/Y2022		DRAWING NO. AC-201	
		REV -	



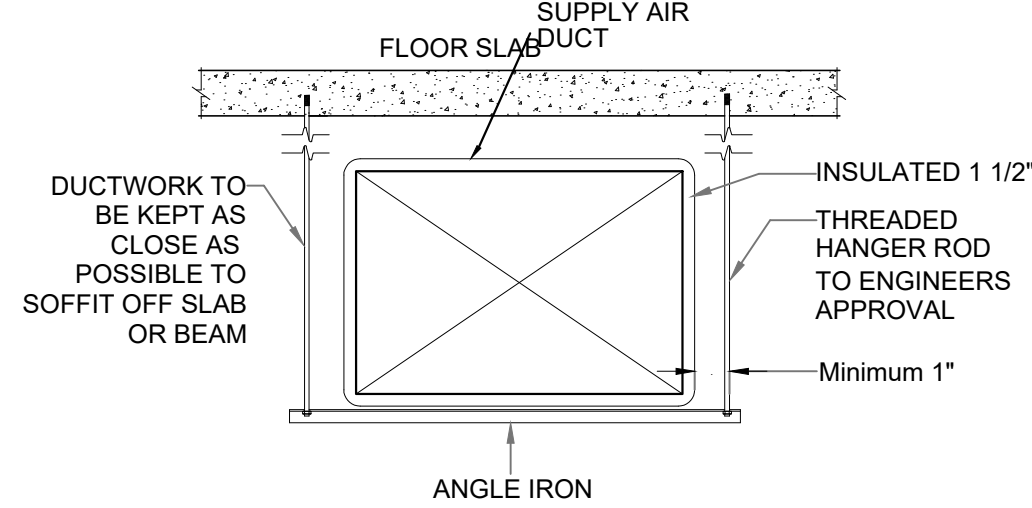
TYPICAL DUCT
TRANSITION DETAIL
Scale - N.T.S.



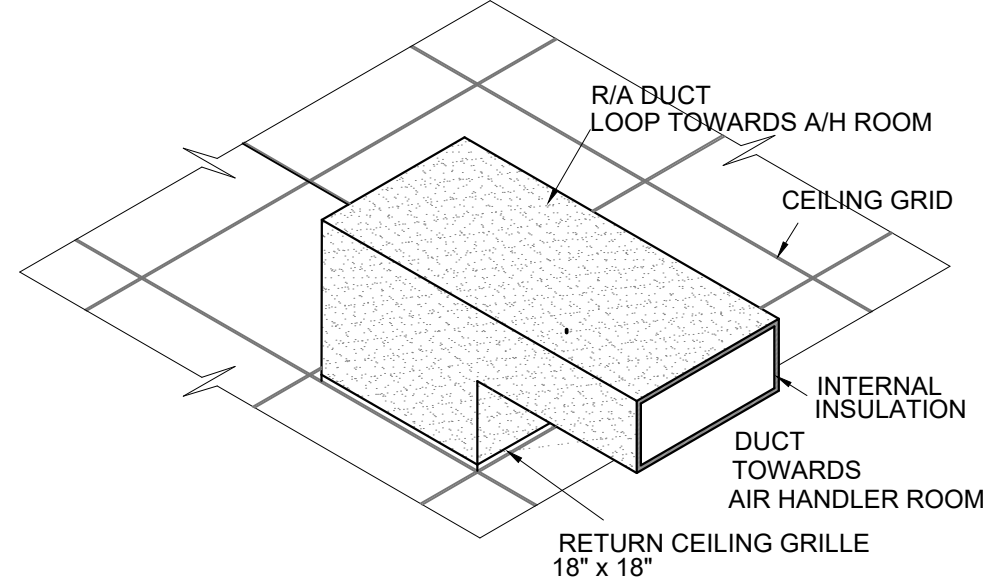
TYPICAL SUPPLY AIR
SPUR DETAIL
SCALE - N.T.S.



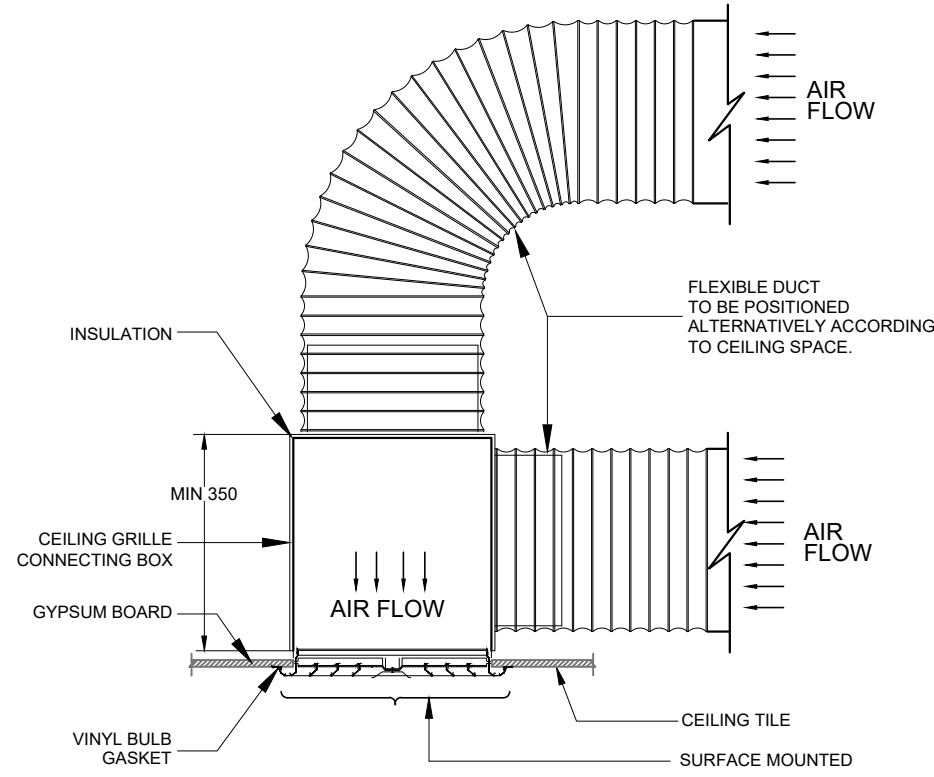
TYPICAL SUPPLY AIR SPUR DETAIL
WITH QUADRANT DAMPER
Scale - N.T.S.



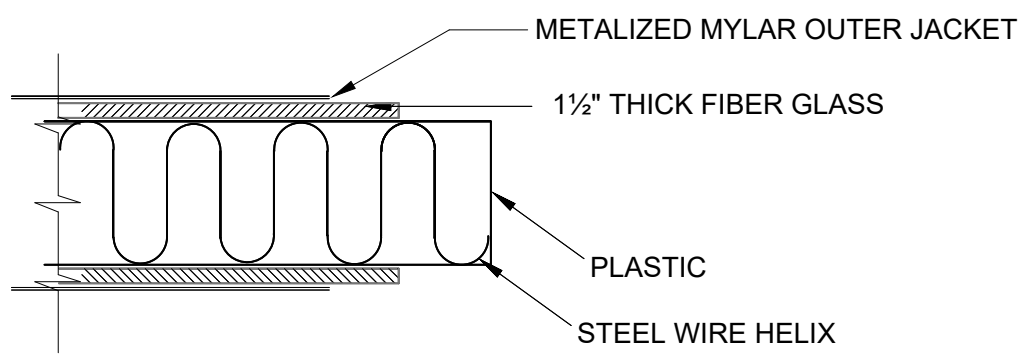
TYPICAL DUCT
SUPPORT DETAIL
SCALE - N.T.S.



Return air duct
detail with 1No.
90° bend
Scale - N.T.S.

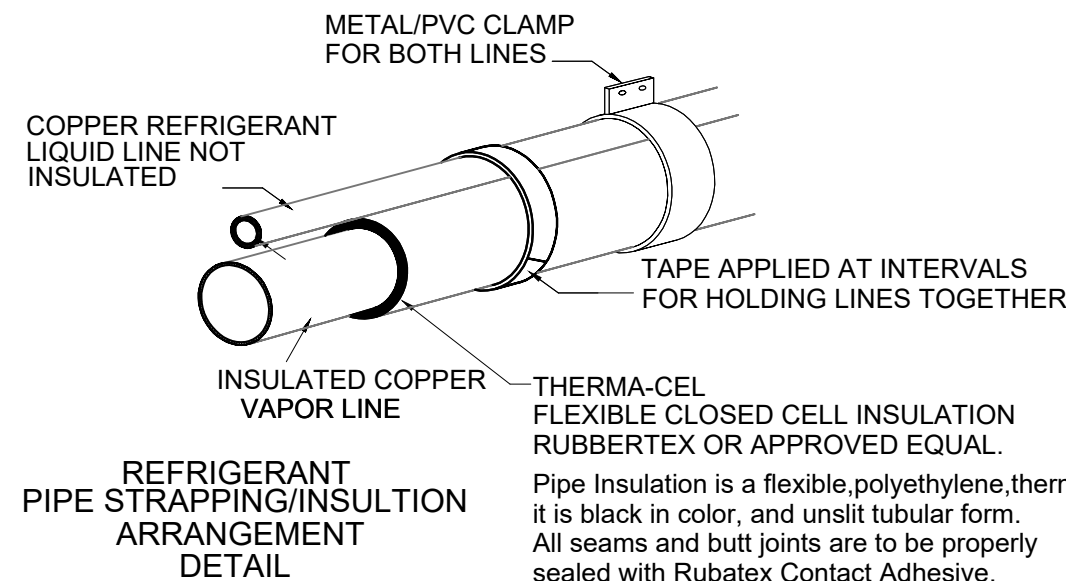


SURFACE MOUNTED DIFFUSER
AND FLEX DETAIL
Scale - N.T.S.



CERTANTEED CERTAFLEX
INSULATED FLEXIBLE
AIR DUCT OR EQUAL
SCALE - N.T.S

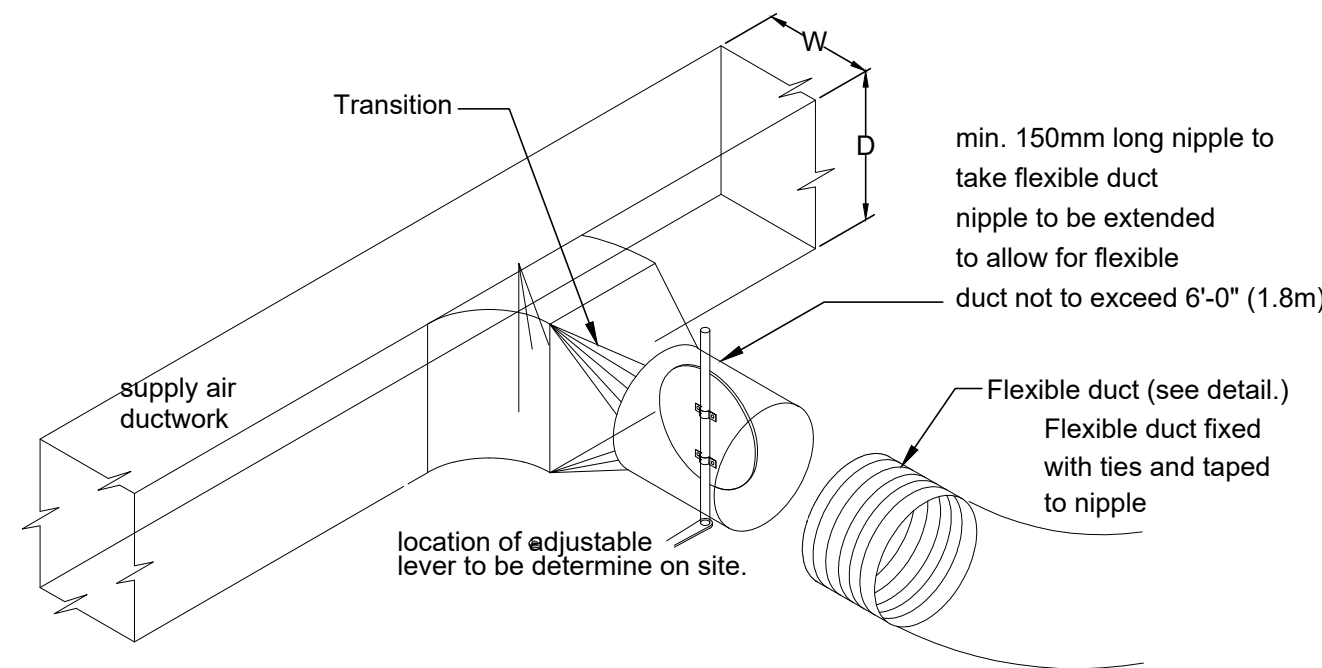
INSULATED FLEXIBLE ROUND AIR DUCT WITH A REINFORCED METALIZED MYLAR OUTER JACKET ENCLOSING A 1 1/2" THICK FIBER GLASS INSULATION WRAPPED AROUND A CONTINUOUS INNER AIR BARRIER OF DOUBLE-LAYER POLYESTER REINFORCED WITH AN ENCAPSULATED STEEL WIRE HELIX.



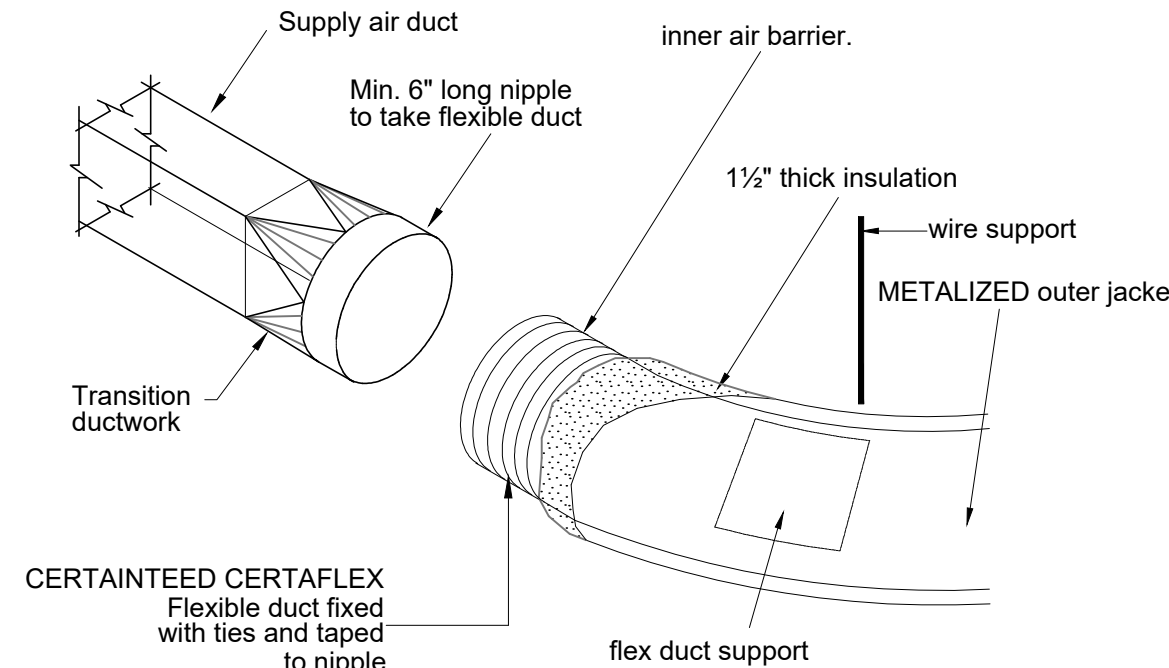
REFRIGERANT
PIPE STRAPPING/INSULATION
ARRANGEMENT
DETAIL

Therma-Cel Flexible closed cell insulation RUBBERTEX or APPROVED EQUAL.
Pipe Insulation is a flexible, polyethylene, thermal insulation. It is black in color, and unsilt tubular form. All seams and butt joints are to be properly sealed with Rubatex Contact Adhesive, recommended by manufacture.

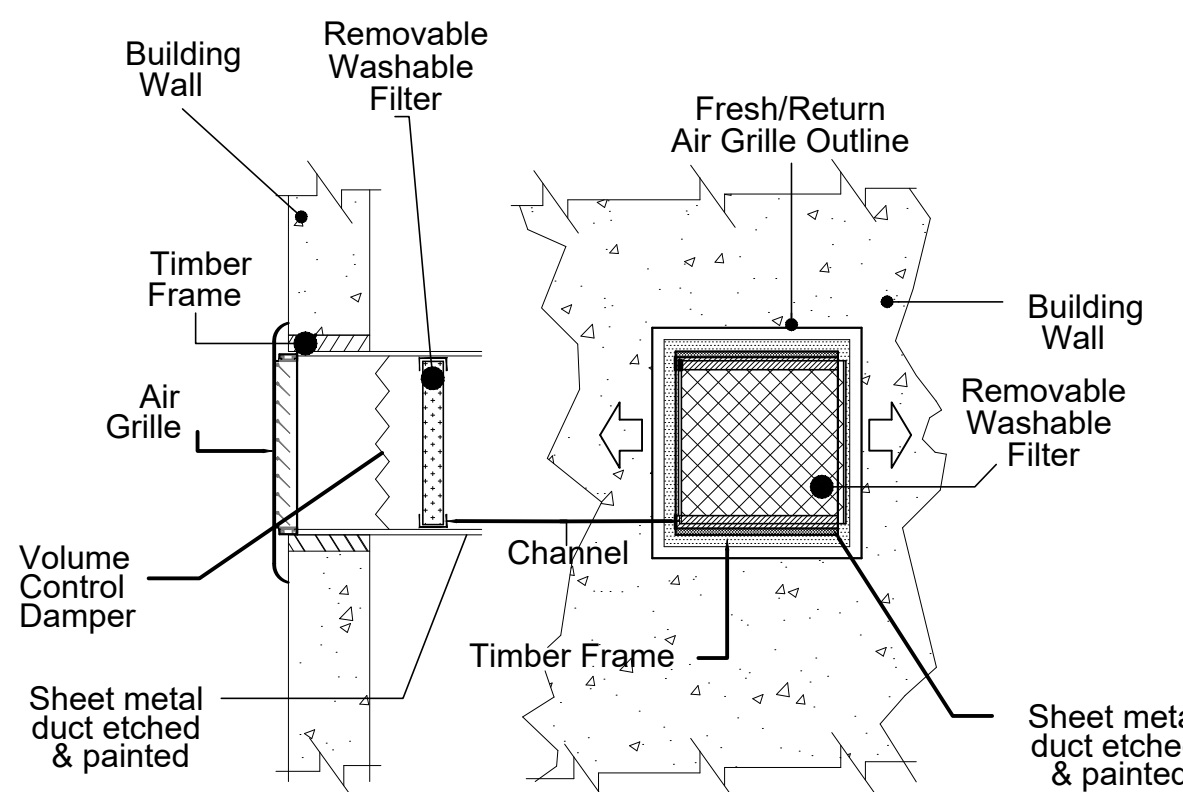
SLITTING OF INSULATION IS NOT ACCEPTABLE



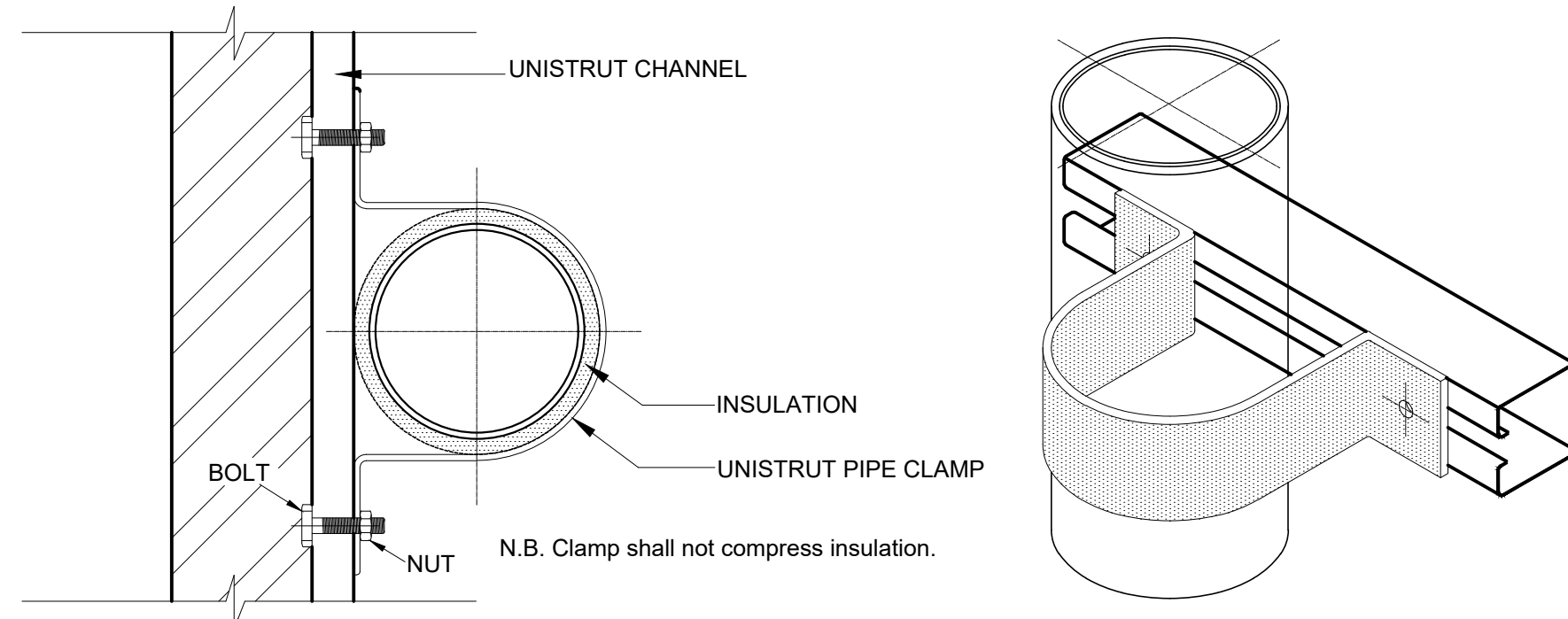
TYPICAL SUPPLY AIR
SPUR DETAIL
Scale - N.T.S.



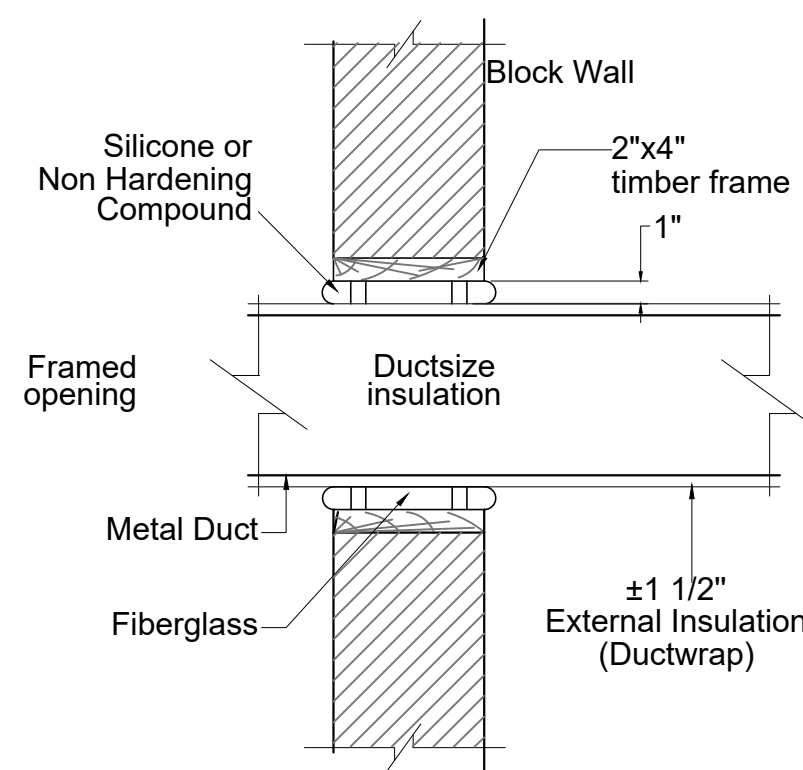
TRANSITION DETAIL FOR FLEX FEEDS
AT END OF DUCT
Scale - N.T.S.



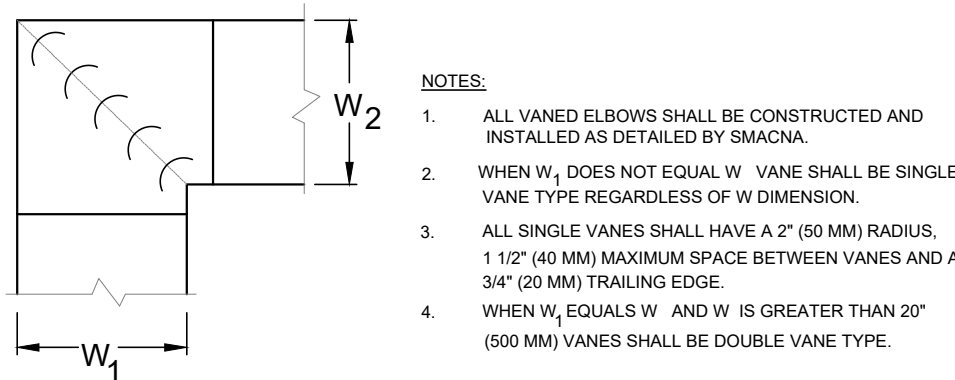
RA & FA FRAMING & DUCT DETAIL
SCALE - N.T.S



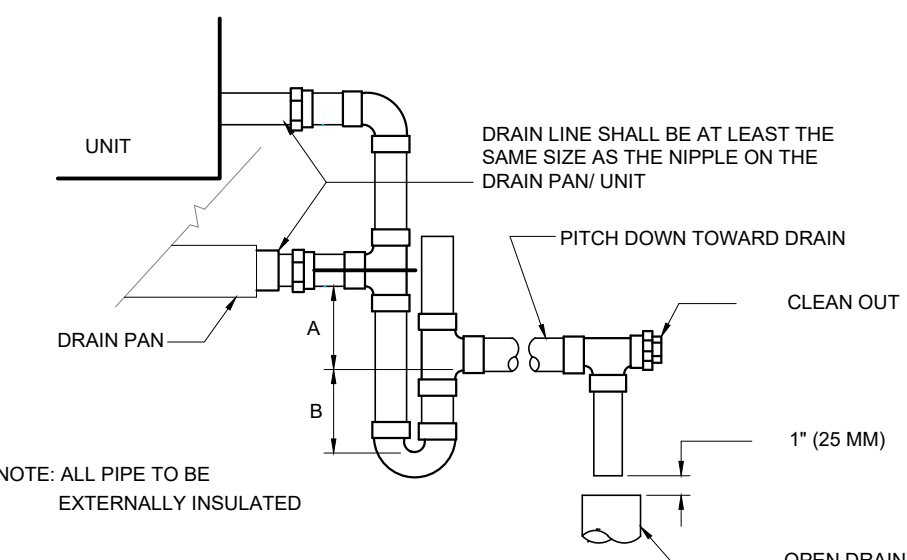
TYPICAL VERTICAL
PIPE SUPPORT DETAIL



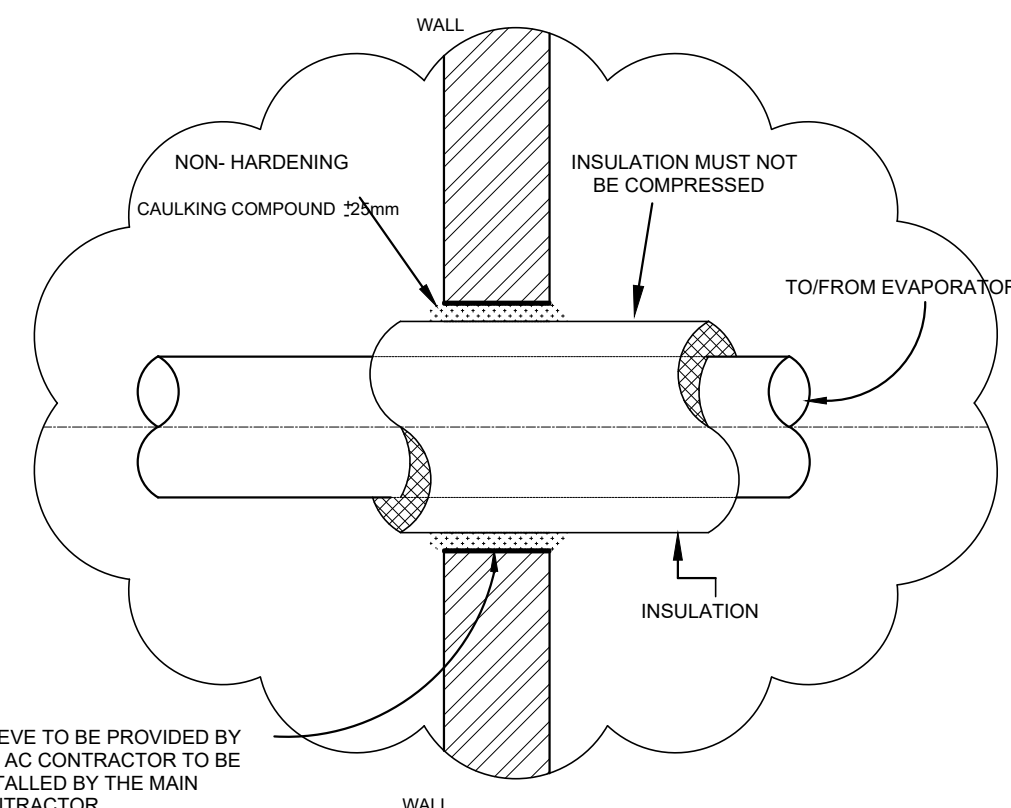
TYPICAL PENETRATION
DETAIL FOR DUCTWORK



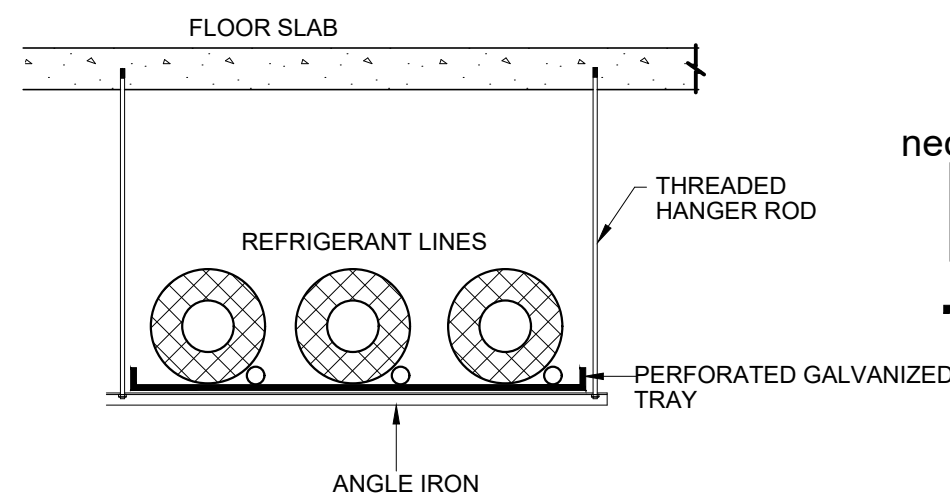
DUCTWORK SQUARE VANED ELBOWS
Scale - N.T.S.



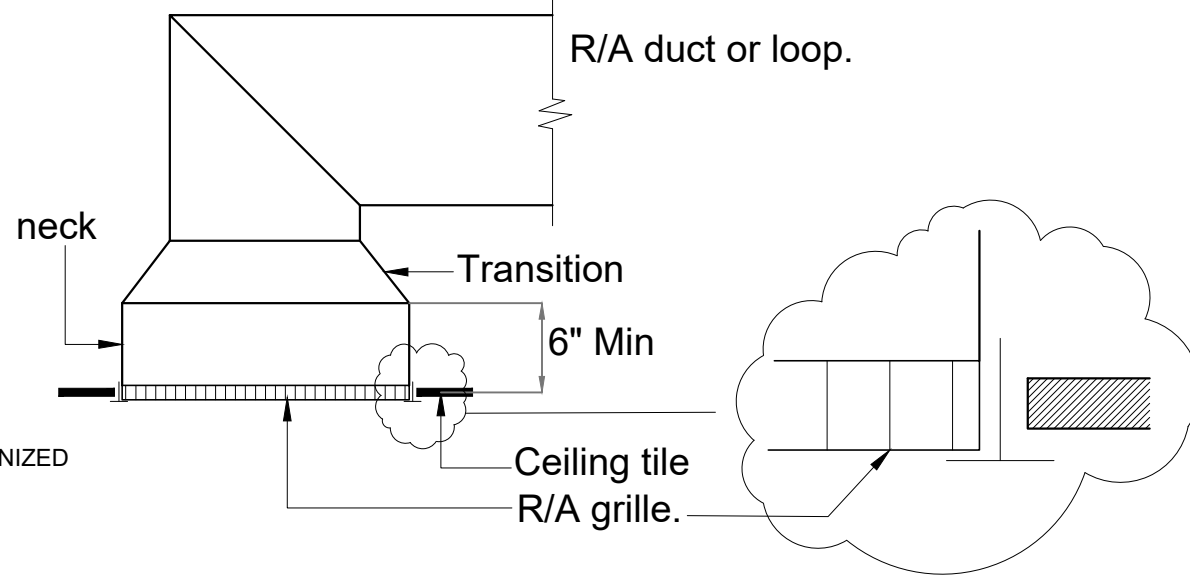
AIR HANDLING UNIT DRAIN TRAP DETAIL
Scale - N.T.S.



TYPICAL DETAIL FOR
PIPING THROUGH WALL.
Scale - N.T.S.



TYPICAL SUSPENDED
CABLE TRAY
SUPPORT DETAIL
Scale - N.T.S.



DUCT RETURN AIR GRILLE INSTALLATION DETAIL

- NOTES:
1. ALL DUCT JOINTS TO BE PROPERLY SEALED WITH MANUFACTURER'S APPROVED SILICONE OR NON-HARDENING COMPOUND
 2. LEAKING JOINTS ARE NOT ACCEPTABLE AND SHALL BE REPAIRED AT NO COST TO THE CLIENT.
 3. SLITTING OF INSULATION SHALL NOT BE ACCEPTED.

DUCTWORK SPECIFICATION:- FABRICATION		
LENGTH OF LONGEST SIDE (mm)	(inches)	SHEET STEEL U.S. GAUGE
up through 304	12	26
330-762	13-30	24
762-1219	30-48	22
1219-2438	48-95	20
2438-over	95- ~	18

THE AIR-CONDITIONING CONTRACTOR SHALL:

1. VERIFY ALL DIMENSIONS ON SITE AND WILL BE HELD RESPONSIBLE FOR FITTING HIS WORK TO THE BUILDING IN A WORKMANLIKE MANNER SUBJECT TO ACCEPTANCE BY THE ENGINEER.
2. CO-ORDINATE WITH THE OTHER CONTRACTORS ON THE JOB TO ALLOW FOR FREE PASSAGE OF DUCTS PROPER PLACEMENT OF DIFFUSERS, GRILLES, ETC. AND GIVE FULL APPRECIATION TO ALL TRADES ON THE JOB.
3. PROVIDE ALL OFFSETS REQUIRED TO KEEP DUCTS CLOSE TO WALLS, BEAMS, COLUMNS AND OR SOFFIT OF SLAB AS MAY BE REQUIRED TO AVOID ANY OBSTRUCTIONS.

GENERAL NOTES

1. THE A/C CONTRACTOR- MUST SUPPLY SHOP DRAWINGS SHOWING EQUIPMENT LAYOUT, PIPING ROUTE, SIZING, DUCTWORK LAYOUT INCLUDING ASSOCIATED ACCESSORIES FOR APPROVAL BEFORE INSTALLATION.
2. TOILET PERIPHERY WALLS TO BE FULL HEIGHT TO SEAL OFF THE AREA FROM THE GENERAL AIR CONDITIONED SPACE. IN CONDITIONS WHERE FULL HEIGHT WALLS CANNOT MEET THE SOFFIT OF SLAB, ALTERNATIVE SEALING ARRANGEMENT SHALL BE DESIGNED BY THE ARCHITECT.
3. FLOOR OF AIR HANDLER ROOM TO HAVE A DUST FREE FINISH BY MAIN CONTRACTOR.
4. FLOOR TO BE PROPERLY SCREED TO FALL TO FLOOR DRAIN BY MAIN CONTRACTOR.
5. DOORWAY TO THE AIR HANDLER ROOM TO HAVE 100MM HIGH CURB BY MAIN CONTRACTOR.
6. AIR HANDLER ROOM TO HAVE A 50MM DIA. FLOOR DRAIN BY MAIN CONTRACTOR.
7. CONDENSATE DRAIN TO BE TRAPPED AND ROUTED TO NEAREST FLOOR OR BUILDING DRAIN.
8. DUCT TO BE SUSPENDED FROM SOFFIT OF SLAB, PURLINS, BEAMS, RAFTERS, ETC. WHICHEVER IS POSSIBLE. CEILING SUSPENSION TO BE INDEPENDENT OF DUCT SUPPORT.
9. UNLESS OTHERWISE INDICATED ALL CONCEALED DUCTWORK TO BE EXTERNALLY INSULATED WITH 2" DUCT WRAP AND APPLIED ACCORDING TO THE MANUFACTURERS SPECIFICATIONS.
10. EXPOSED DUCTWORK TO BE INTERNAL INSULATED WITH 1" THICK LINACOUSTIC AND APPLIED ACCORDING TO THE MANUFACTURER'S SPECIFICATIONS.
11. ANY EXPOSED DUCTED TO BE ETCHED, PRIME AND PAINTED BY ARCHITECT COLOUR.
12. ALL FLOOR PENETRATIONS MUST HAVE 100MM HIGH CURB ON ALL SIDES.
13. LEAKING JOINTS ARE NOT ACCEPTABLE AND SHALL BE REPAIRED AT NO COST TO THE CLIENT.
14. RETURN AIR LOOP TO BE INTERNALLY WITH 1" THICK LINACOUSTIC AND APPLIED ACCORDING TO THE MANUFACTURER'S SPECIFICATIONS.
15. ALL SUPPORTS TO BE PROPERLY TREATED AGAINST RUSTING.
16. ALL DUCT JOINTS TO BE PROPERLY SEALED WITH MANUFACTURER'S APPROVED SILICONE OR ON-HARDENING COMPOUND.
17. THE A/C CONTRACTOR- MUST SUPPLY AS-BUILT DRAWINGS SHOWING ALL EQUIPMENT AND THE AIR DISTRIBUTION SYSTEM AT THE END OF THE PROJECT.

REV #	BY	DATE	DESCRIPTION
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REVISIONS:

FOR
TENDER
ISSUE DATE: 29TH MAY 2023

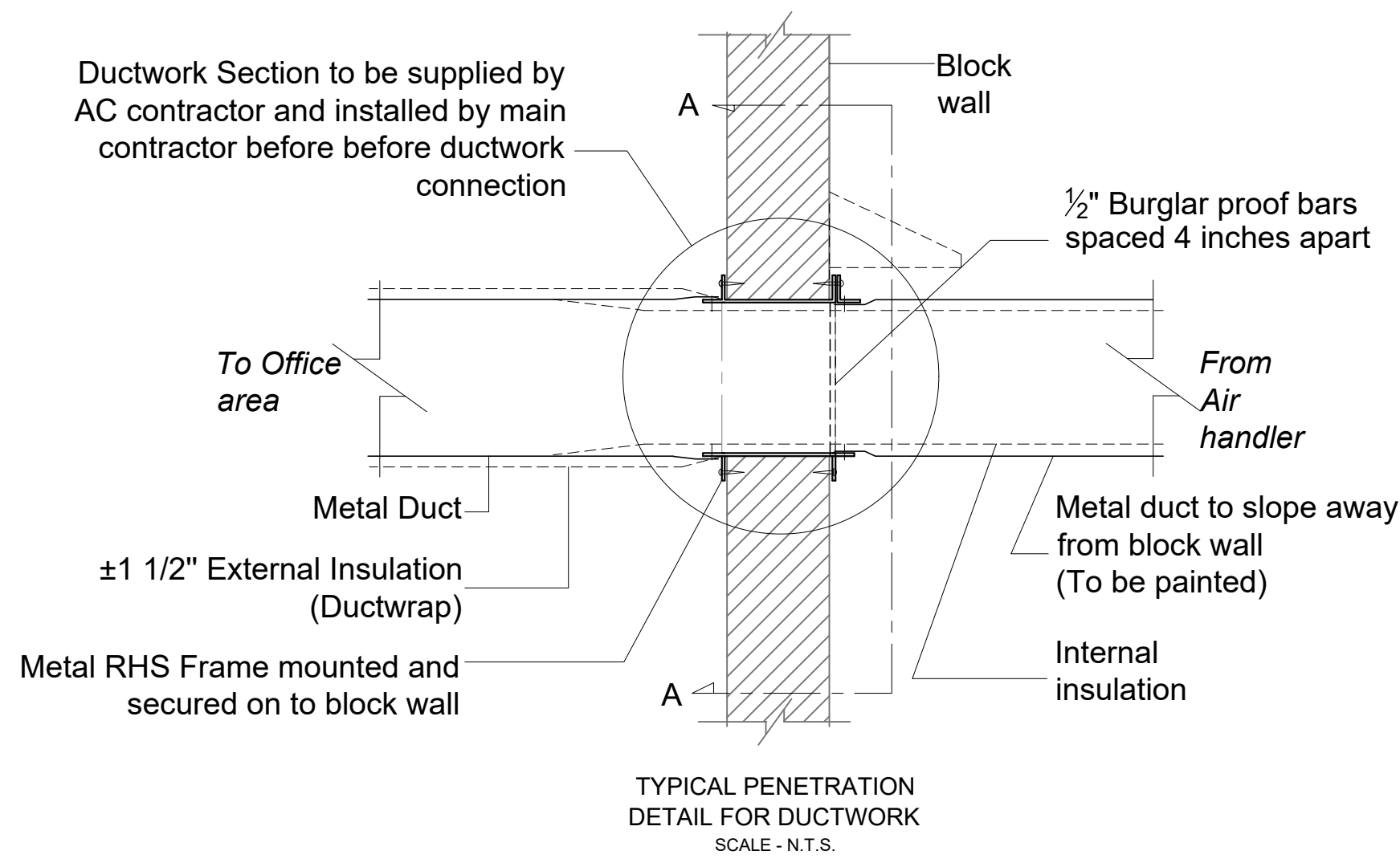
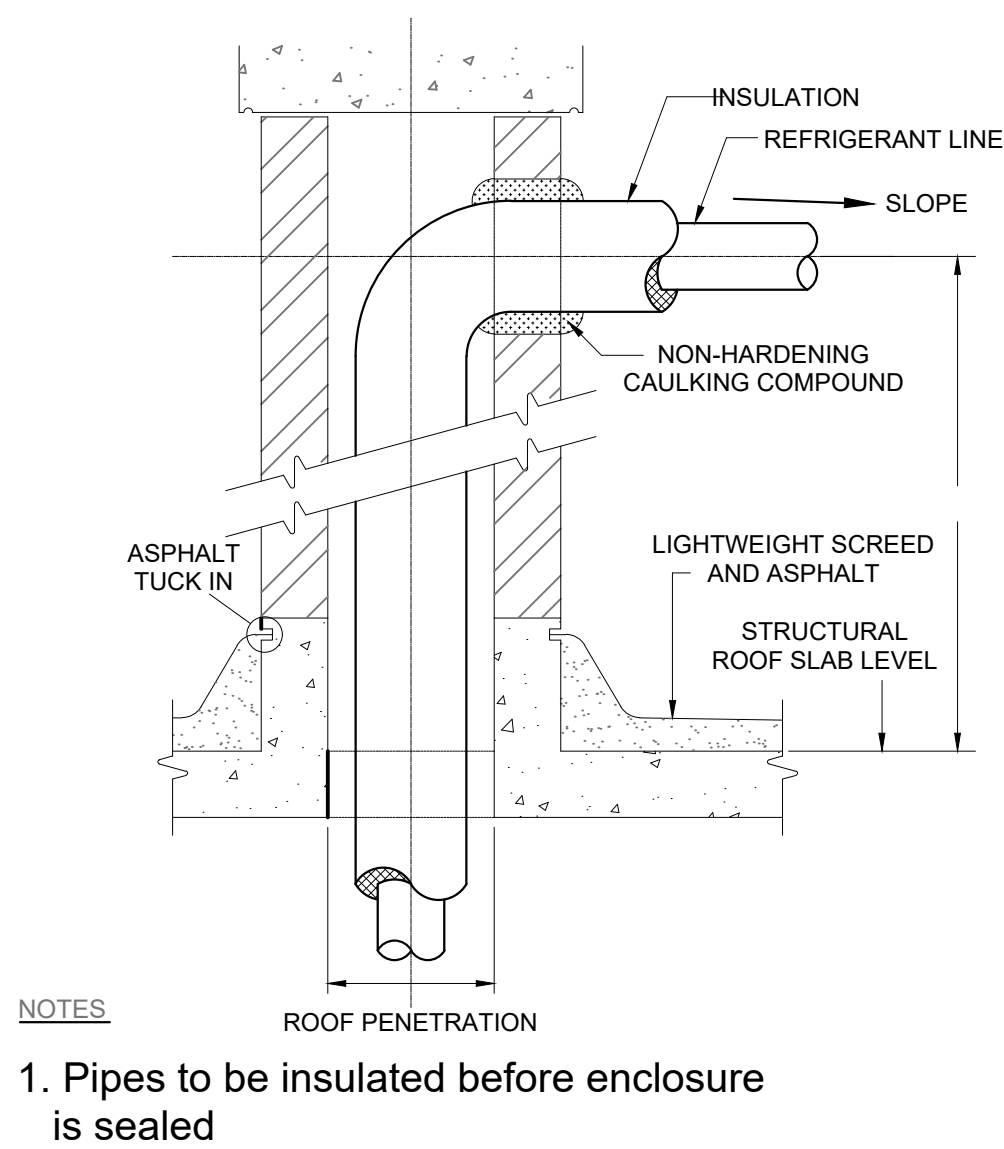
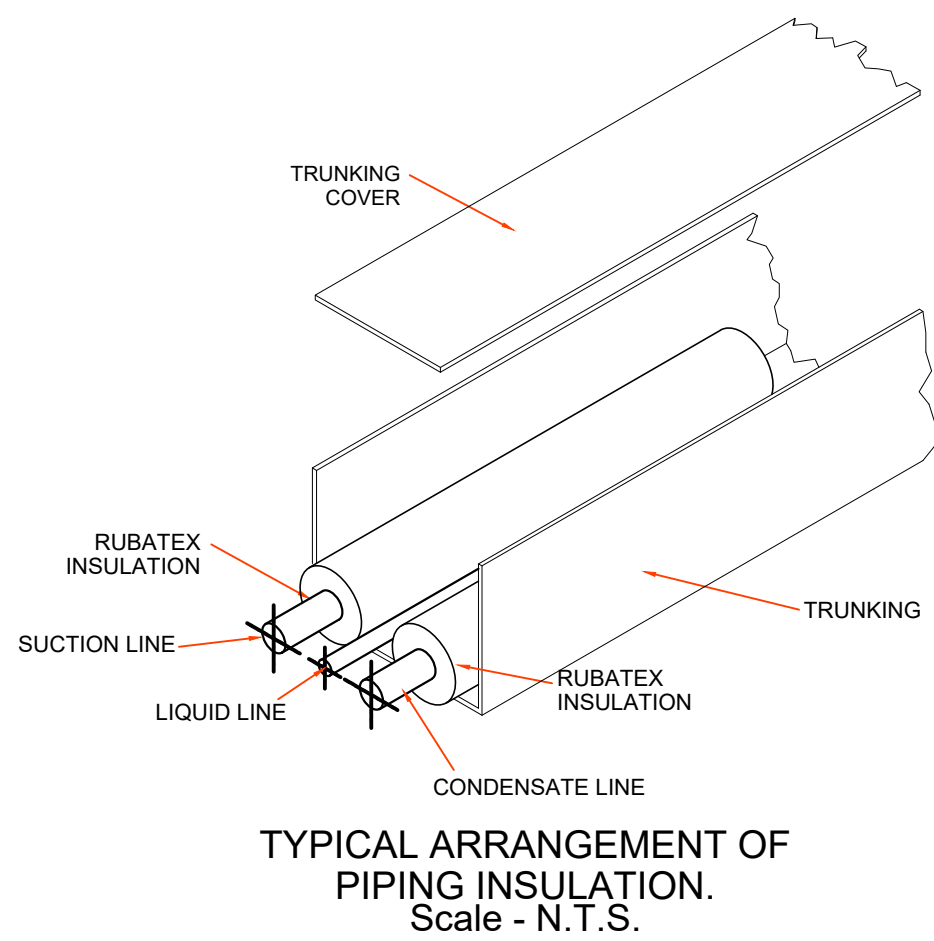
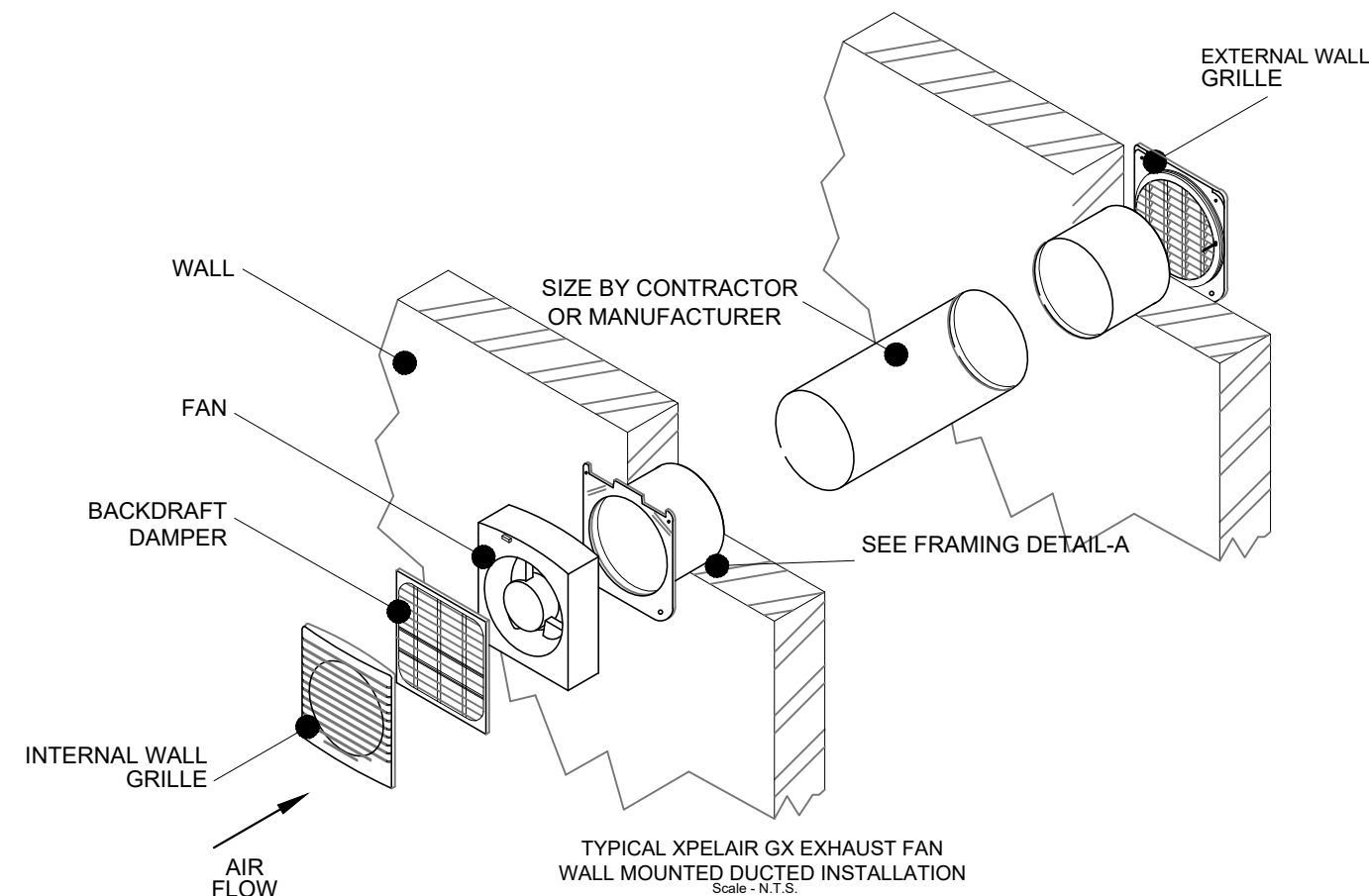
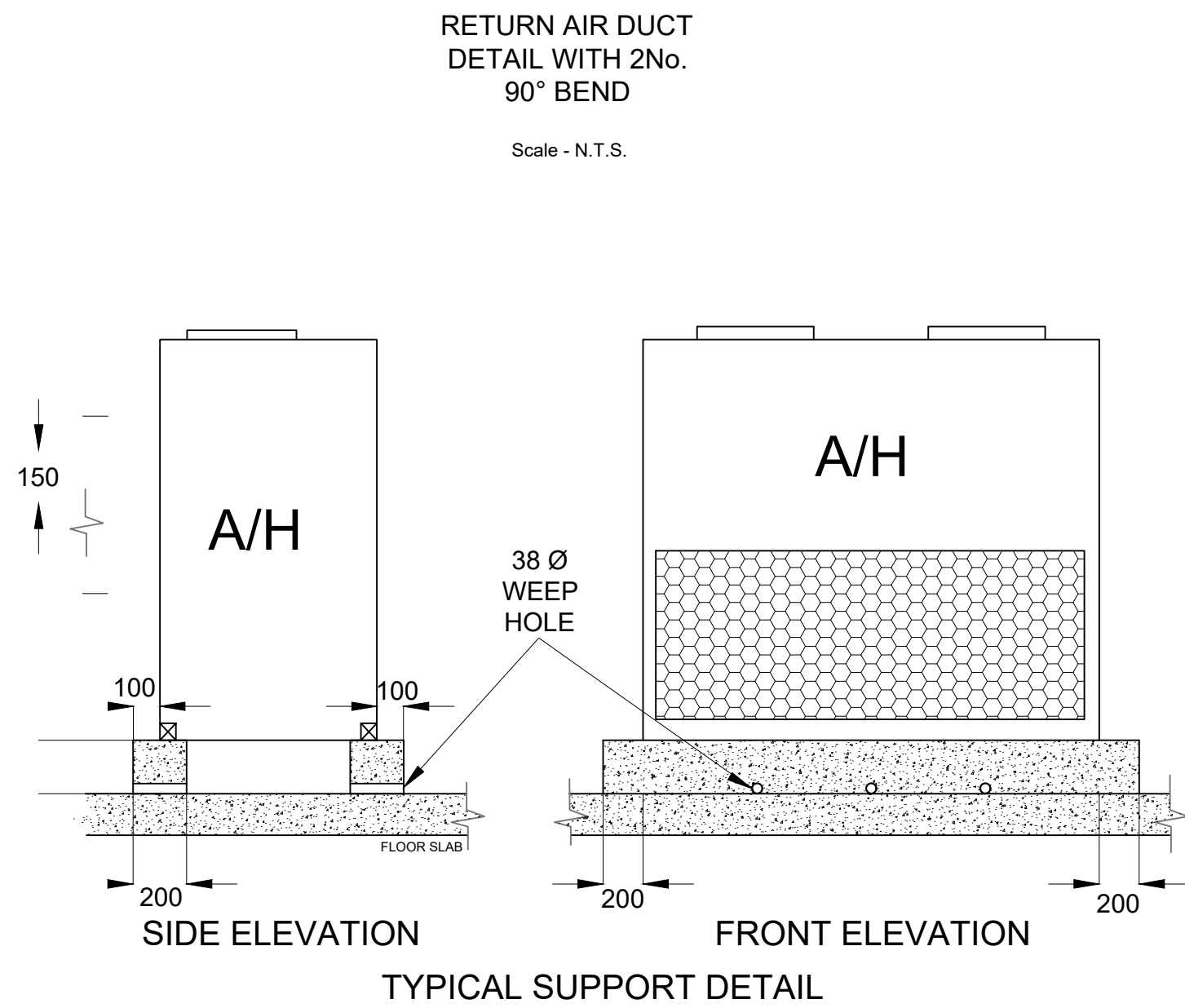
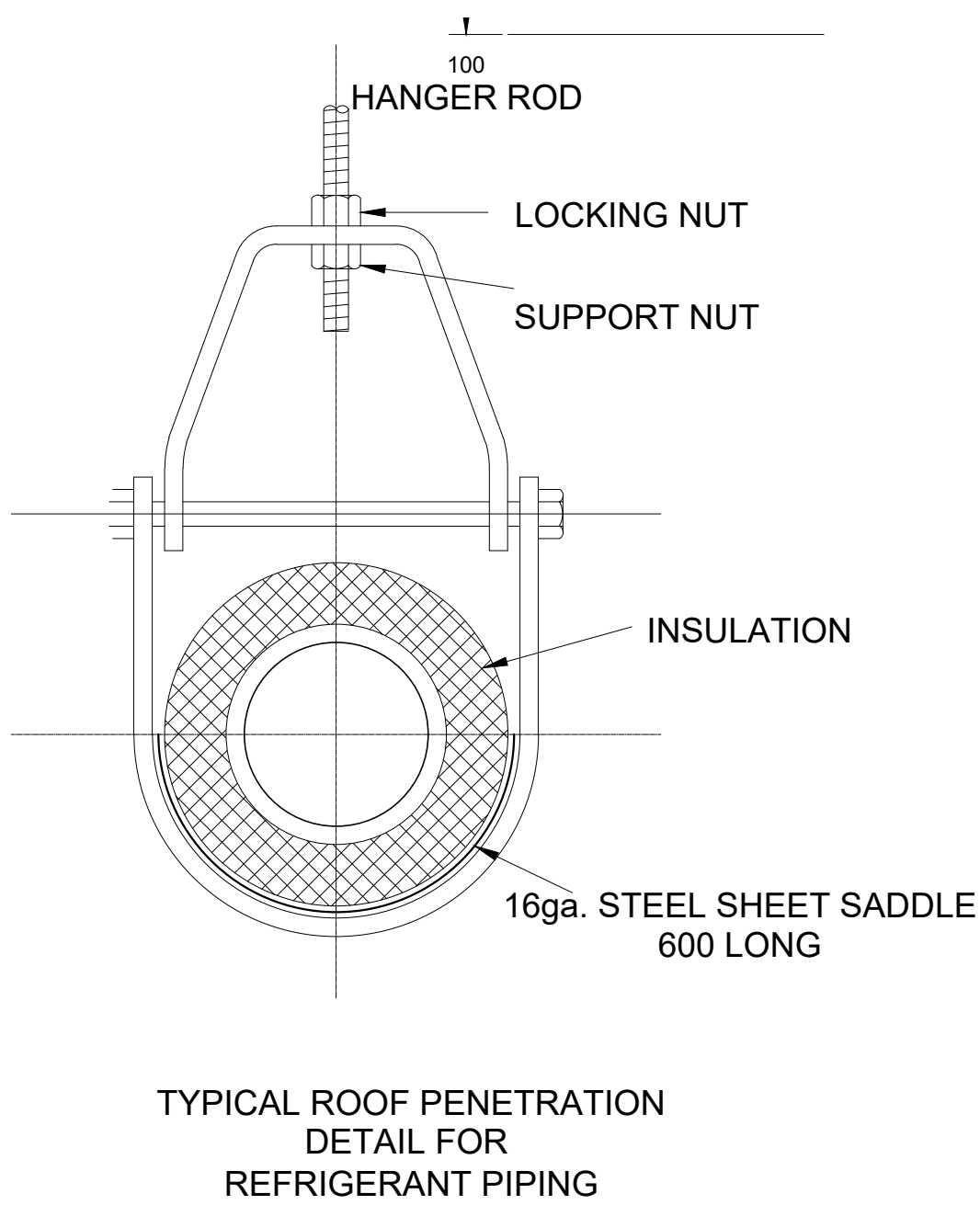
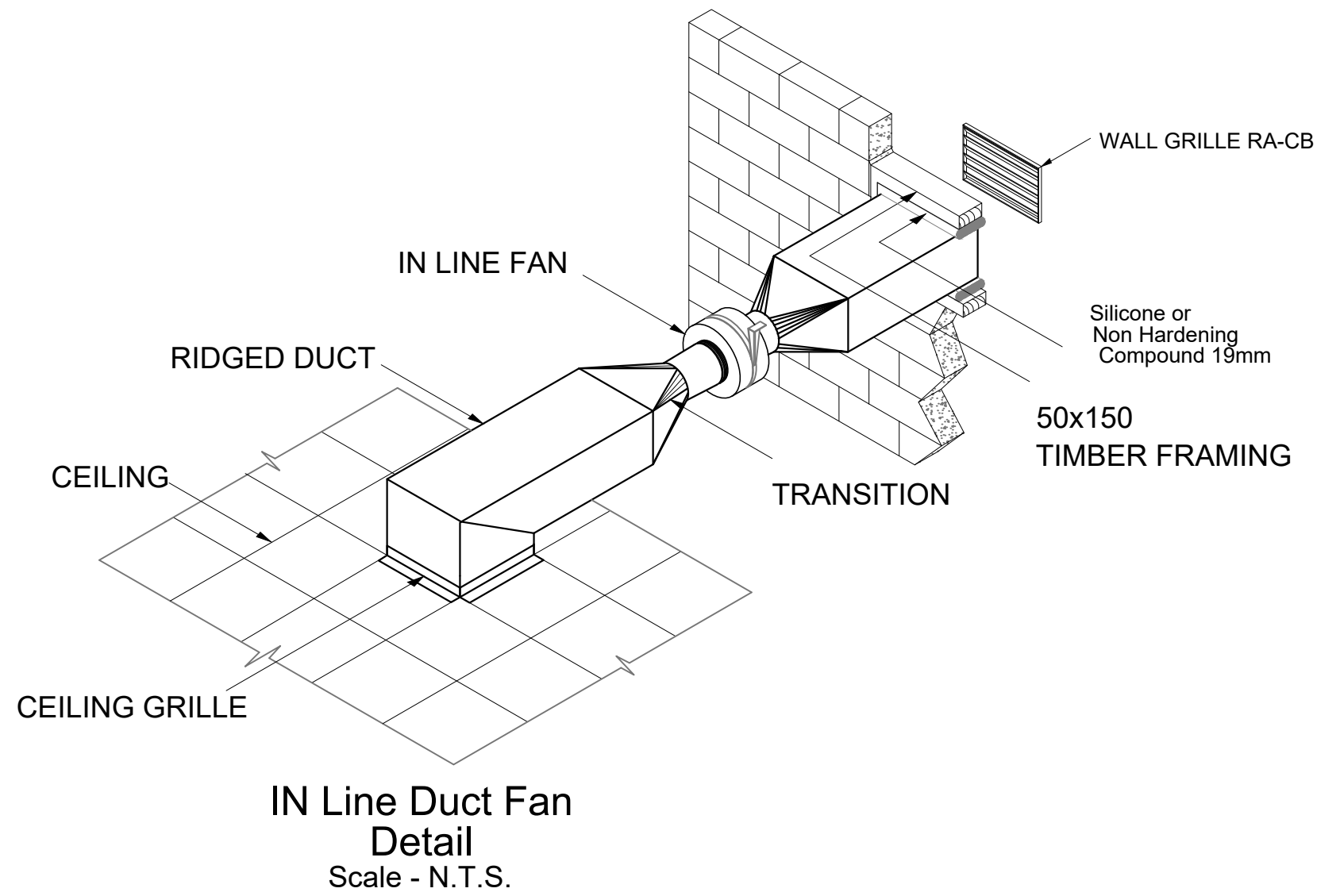
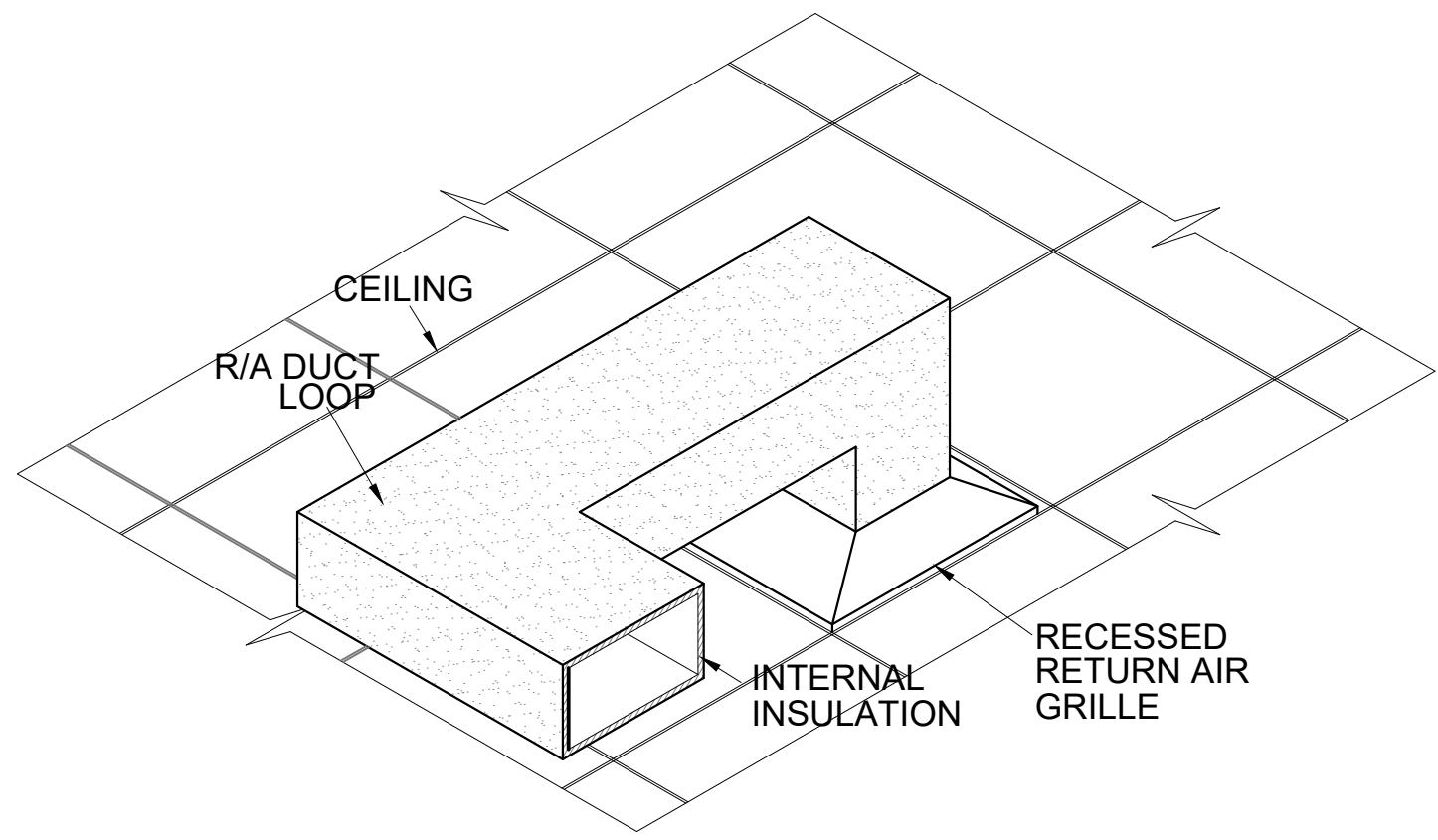
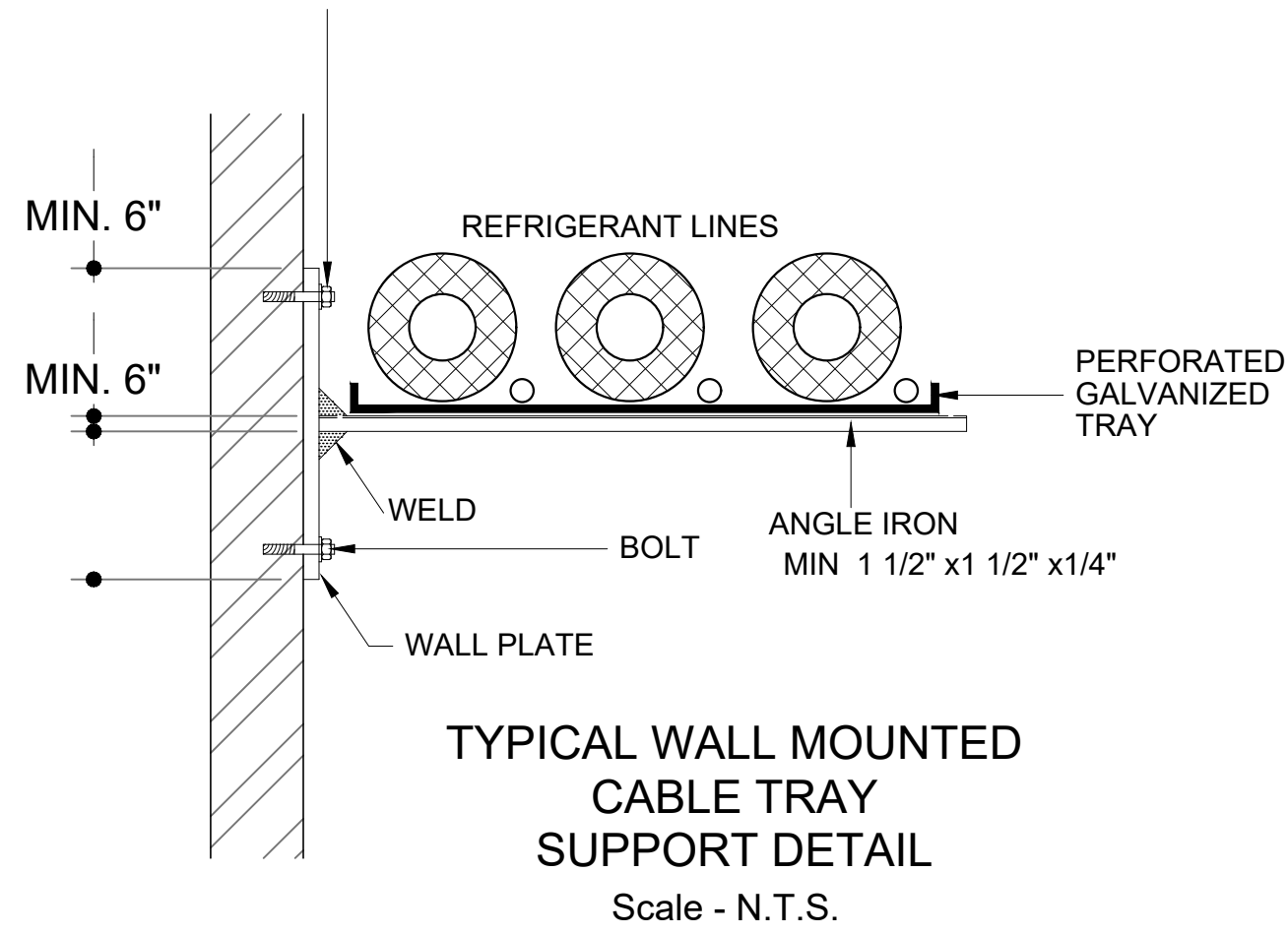
TITLE
**BUILDING C
GENERAL DETAILS
SHEET 1**

SCALE@12x18:	DESIGNED BY:
SCALE@24x36: NTS	DRAWN BY: J.H
ENGINEER:	DATE: APRIL, 2023
ARCHITECT	

ENCO ENCO Ltd
112A Edward St, POS, Trinidad
T 1 868 625 4294 F 1 868 625 2788
info@enco.co.tt

JOB
**NATIONAL ARCHIVES OF
TRINIDAD AND TOBAGO**

JOB NO. NATT/Y2022	DRAWING NO. AC-D1	REV -
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REV #	BY	DATE	DESCRIPTION
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REVISIONS:

FOR TENDER
ISSUE DATE: 29TH MAY 2023

BUILDING C
GENERAL DETAILS
SHEET 2

SCALE@12x18:	DESIGNED BY:
SCALE@24x36:	NTS
ENGINEER:	DRAWN BY: J.H
ARCHITECT	DATE: APRIL, 2023

ENCO ENCO Ltd
112A Edward St, POS, Trinidad
T 1 868 625 4294 F 1 868 625 2788
info@enco.co.tt

NATIONAL ARCHIVES OF TRINIDAD AND TOBAGO

JOB NO.	DRAWING NO.	REV
NATT/Y2022	AC-D2	-