METROLINX

GO Transit Signals & Communications Standards – Aluminum House Specification

Specification 34 42 01

Revision: 0
Date: April 2020

Aluminum House Specification

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Preface

This is the first edition of the Aluminum House Specification. It specifies the requirements for Aluminum Houses to be supplied to Metrolinx.

This document was developed by the Signals & Communications Office, Engineering and Asset Management Division, Capital Projects Group, Metrolinx.

Suggestions for revision or improvements can be sent to the Metrolinx Signals and Communications office, Attention: Director of Signals and Communications who shall introduce the proposed changes to the Metrolinx Signals and Communications office. The Director of the Signals and Communications office ultimately authorizes the changes. Be sure to include a description of the proposed change, background of the application and any other useful rationale or justification. Be sure to include your name, company affiliation (if applicable), e-mail address, and phone number.

April 2020

Amendment Record

Revision	Date (DD/MM/YYYY)	Description of Changes

CONTENTS

1. SCOPE

1.1.1 This Specification defines the minimum requisites for Aluminum Houses to which the Contractor shall comply. The terms Aluminum Houses and Houses are used synonymously in this Specification.

1.1.2 The Contractor shall supply Aluminum Houses that are fit for the intended purpose to safely and reliably enclose the various types of relays, electronic, and software-based systems used in wayside Signals & Communications applications under all weather conditions.

2. ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute
AREMA	American Railway Engineering and Maintenance-of-Way Association
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASTM	American Society for Testing and Materials
AWG	American Wire Gauge
CHBDC	Canadian Highway Bridge Design Code
CSA	Canadian Standards Association
CWB	Canadian Welding Bureau
DPDT	Double Pole Double Throw Switch
ESA	Electrical Safety Authority
GFI	Ground Fault Interrupter
HVAC	Heating Ventilation and Air Conditioning
LED	Light Emitting Diode
LIGP	Low Impedance Ground Plane
OESC	Ontario Electrical Safety Code
OHSA	Occupational Health and Safety Act
UL	Underwriters Laboratory
USRC	Union Station Rail Corridor

3. GENERAL

3.1 SUBMITTALS

3.1.1 The Contractor shall provide engineering drawings and design calculations of the House that depict the general assembly and material requirements in sufficient detail to confirm compliance with this Specification. Any exception to this Specification shall be clearly indicated on the drawings, with a justification and explanation of why the exception should be deemed acceptable.

3.1.2 The engineering drawings shall include plans, grid lines, structural members, connection details, bearing details, anchorage details, roof decking, wall cladding, framed openings, accessories, schedule of materials, finishes, camber, loadings, fasteners and welds.

3.1.3 The engineering drawings shall include detailed descriptions of mechanical, electrical, drainage and other systems.

3.1.4 The engineering drawings shall indicate dimensions of products and the clearance dimensions in front of products.

3.1.5 The engineering drawings shall be submitted for approval to Metrolinx prior to manufacturer.

3.1.6 The engineering drawings shall bear the seal of the appropriate qualified Professional Engineer registered in the Province of Ontario.

3.1.7 Engineering drawings shall also be provided in electronic format (AutoCAD and PDF).

3.2 PROTOTYPE

3.2.1 The Contractor shall provide a prototype House for inspection by Metrolinx prior to acceptance of the design. The design of the prototype shall not be changed without prior approval by Metrolinx. All changes to the prototype shall be submitted in writing and be accompanied by certified drawings.

3.2.2 Subsequent random inspections on production may be carried out at Metrolinx's discretion as to frequency and time.

3.3 HOUSE CONSTRUCTION

3.3.1 The House shall be designed and constructed to the following criteria:

a) Structural design of the Aluminum House shall be based on Ontario Building Code 2012, Part 4 - Structural Design.

b) Aluminum design shall be based on CAN/CSA S157-15 – Strength Design in Aluminum.

c) Steel design shall conform to CAN/CSA S16-14 – Design of Steel Structures.

d) Concrete design shall conform to CAN/CSA A23.3-14 – Design of Concrete Structures.

e) The structure shall be designed to withstand wind loads corresponding to a reference velocity pressure of 12.5 lbs. per sq. ft.

f) The structure shall be designed using a wind Gust factor of 2.5.

g) The roof shall be designed to withstand snow loads of 100 lbs. per sq. ft.

h) Roof deflections shall not exceed L/360, where L represents the span length.

i) All joints and seams of the House assembly shall be welded in accordance with approved CSA standards by CWB certified welders.

j) All exterior seams shall be weatherproof ensuring that no moisture or dust can enter the House under all weather conditions.

k) The overall insulation performance of the House shall meet 30-degree Celsius delta gradient.

l) The House assembly shall form part of the Signals and Communications grounding system and shall guarantee a low electrical impedance path.

m) The House shall comply with the environmental qualification requirements of AREMA C&S Manual Part 11.5.1 (Recommended Environment Requirements for Electrical and Electronic Railroad Signal System Equipment).

n) The Contractor shall provide instructions for securing equipment racks to the floor and ladder trays.

o) The House shall be designed as a faraday cage and equipped with a LIGP that separates the cable entrance from the area in which equipment will be installed.

3.4 SIZE OF HOUSE

3.4.1 Table 3-1 provides a list of outside dimensions of the Houses for typical application. The Contractor shall provide a House of a size designed to accommodate the intended equipment.

Table 3-1: HOUSE DIMENSIONS

House Type	Width (ft)	Length (ft)	Height (in)	Typical Application
A	6	6	102	Intermediate / Repeater / Wayside Inspection (Single Track)
B	8	8	102	Crossing (With Test Switch Box)
C	8	8	108	End of Siding / Crossover
D	8	12	108	Interlocking / Universal Crossover
E	8	16	108	Interlocking
F	8	20	108	Interlocking

3.4.2 The inside "clear" vertical wall height shall not be less than 86 inches at the outer

perimeter, with sufficient additional clearance to permit the installation of 86" x 24" x 22" railway equipment rack(s) and to allow suitable access to the overhead cable troughs.

3.5 MATERIAL

3.5.1 The House shall be constructed of aluminum in accordance with ASTM Specification ASTM B209-14 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

3.5.2 Aluminum panels, used in the construction of House, shall be standard 3003-H14 or better, one-side bright finish sheet. The aluminum shall be a minimum of 0.100 inches thick.

3.5.3 Formed aluminum shall be used for the House frame construction including all floor joists, base frame, wall/roof panel joints and corner posts. The quality and engineering of formed aluminum sections shall be to high commercial standards and shall afford the same tolerances and overall quality of finish which would otherwise be provided if extrusions were used.

3.5.4 All external hardware used in the assembly of the House shall be stainless or galvanized steel.

3.5.5 All internal hardware used in the assembly of the House shall be stainless or zinc plated steel.

3.5.6 All exposed aluminum surfaces shall be clean and free from any dents. All welds shall be uniform and clean. All exterior joints and seams shall be caulked with a compatible silicone sealing compound and form a completely air and watertight seal.

3.5.7 Plywood shall be ¾" 7 ply fir, painted with two coats of white or light gray fire-retardant paint on both sides. Termite resistance plywood or an equivalent material shall be used.

3.5.8 Rigid foam insulation shall be provided on ceilings.

3.5.9 Wall insulation shall be rigid foam or fiberglass batt. The minimum insulation value shall be R-12.

3.6 FLOOR

3.6.1 The framework for the floor shall consist of an all-aluminum base frame and a sub-floor consisting of interlocking aluminum panels. The design and construction shall be such that it will provide adequate support for equipment point loading of 500 lbs. per linear ft., and an average area loading not less than 150 lbs. per sq. ft.

3.6.2 The underside of the floor shall be insulated with fiberglass pink insulation with a minimum R value of 12. The insulation shall be covered with 0.05-inch thick aluminum panel, sufficient to support the loads specified in section 3.6.1. This outside skin shall be sealed especially in the corners so that rodents cannot get into the House from

underneath the floor.

3.6.3 The floor shall be completely covered with a black, 3/16"-inch thick, canvas backed, non-slip, rubber safety matting. The liquid absorption rate of the matting shall be of sufficient capacity to prevent excess accumulation of water in order to minimize splashing and possible contamination of equipment installed near floor level. The matting shall not be glued or permanently affixed to the sub floor.

3.6.4 For Houses without the angle type foundation, the House shall be equipped with exterior base plate and the steel foundation shall be supplied by the Contractor. Exterior base plates complete with 1 1/2-inch wide slotted holes shall be provided in each anchoring point of the House. They shall extend no farther than 3 3/4-inches beyond the exterior surface of the wall and be no longer than 12-inches in length. Additional base plates shall be provided as required along the sides depending on the length of the House and the design load requirements.

3.6.5 Floor mats inside the pre-engineered structures shall meet OHSA requirements and ANSI/ASTM D-178 Standard Specification for Rubber Insulating Matting.

3.7 WALLS

3.7.1 All interior walls shall be covered with material in accordance with section 3.5.7.

3.7.2 If the walls adjacent to the battery trays are plywood, a 4-foot high section to the rear and side of the battery tray shall be painted with two coats of battery acid resistant paint.

3.7.3 The Contractor shall ensure the walls are capable of supporting the wall-mounted equipment loads with a nominal loading of 300 lbs. per linear ft.

3.8 ROOF

3.8.1 The interior side of the roof shall be insulated in accordance with section 3.5.8. The insulation shall be covered with fire retardant material of enough thickness and strength to mechanically protect the insulation from any incidental damage.

3.9 MAIN CABLE ENTRANCE

3.9.1 The House shall be equipped with 4"X 12" cable chutes. The chute(s) shall be constructed of 1/8 inch thick, formed sheet aluminum, or galvanized steel, and be designed to fit snugly in the cable slots from below the floor of the House. The chute(s) shall have 1 3/16" inch formed lips designed to permit securing the chute(s) to the House floor. The bottom of the chute edges shall be folded back to provide a smooth edge and to prevent possible damage to entering cables. The height of the chute(s) shall be 17 inches.

3.9.2 The floor of the main cable entrance shall include as many slots (4 ¼" X 12 ¼") as practical to accommodate the cable chutes. The slot(s) shall be located directly under each LIGP panduit and be blocked with a removable cover(s).The bottom of this chute shall be sealed with sealing compound.

3.9.3 Cable entrance conduits and fittings shall be provided with cable entrance bushings and be secured to the housings. They shall be sealed with a sealing compound which is fire resistant.

3.9.4 All cable entrances shall be made to not allow water, dust or wildlife to enter inside the House.

3.10 LOW IMPENDENCE GROUND PLANE (LIGP)

3.10.1 The House shall be equipped with Low Impendence Ground Planes (LIGPs) installed between the main cable chutes and the cable entrance door and welded to the House floor. The LIGPs shall be constructed of 0.100" aluminum.

3.10.2 The structure of each LIGP frame shall support the total weight of surge arrestor panels, AAR terminals strips, and associated mounting hardware, as well as the internal and external signal cable connections.

3.10.3 A 2" x 3" panduit shall be provided on the front side of each LIGP per the drawings contained in Appendix A.

3.10.4 Each LIGP entrance rack shall accommodate multiple surge arrestor panels that, together with the interconnecting frame, form a continuous floor to ceiling, wall to wall, electrically conductive panel, fully and continuously electrically connected to the bungalow walls, floor and ceiling, with no gaps.

3.10.5 Each LIGP shall be electrically bonded to the aluminum skin of the House in at least 2 places using exothermically welded electrical connections.

3.10.6 Any openings to accommodate surge arrestor panels that are not required for a surge arrestor panel shall be covered with aluminum cover of the same thickness as the frame to ensure that there are no gaps.

3.10.7 Each LIGP shall be equipped with Bakelite through-hole terminals.

3.10.8 Each LIGP shall be equipped with aluminum strips, tack welded to the center (ground) positions. The aluminum strips shall be provided with AREMA terminal posts which are directly bonded to the strips.

3.10.9 All AREMA terminal strips, equalizer blocks, arrestors, equalizers, test links, washers, nuts, gold nuts, and other miscellaneous hardware to be contained within each LIGP shall be supplied and installed at the time of field installation.

3.10.10 Each LIGP shall be connected to the external grounding network by copper conductors. The conductor size shall be in accordance with the OESC standards, but not less than #6 AWG.

3.10.11 Refer Appendix A, Drawings 4, 5 & 6, for further information on LIGP's.

3.11 DOORS

3.11.1 The House shall be equipped with two different types of doors, an entrance door and

a cable access door.

a) Section 3.11.2 to 3.11.10 applies to both door types.

b) Section 3.11.11 to 3.11.17 applies to entrance door only.

3.11.2 Door frames shall be equipped with an oil-resistant neoprene gasket to form a weatherproof seal around the door on all sides when closed. A plate shall be furnished to cover the gasket at the bottom to prevent damage to the gasket from foot traffic.

3.11.3 The size of doors shall be a minimum 24 inches wide by 75 inches high.

3.11.4 All doors shall close properly, without difficulty, and have a snug fit. All moving parts of the locking mechanism shall move with precision and strike the lock points accurately.

3.11.5 All doors shall be equipped with a retaining hook, such as a 3/8-inch diameter rod with a retaining clip to permit holding the door open 90 degrees. The retaining hook shall be located at the top of each door.

3.11.6 The doors and frames shall be constructed of aluminum, the specifications for which equal or exceed the specification for the materials used for the walls. The doors shall have the same insulation as the wall system. Doors shall be provided with suitable stiffeners and sheeting on the inside of the door to cover and prevent damage to the insulation.

3.11.7 An aluminum channel rain gutter, constructed of a 1.5-inch wide by 1.5-inch high by a length a minimum of 4-inches longer than the width of the door, shall be provided over each door.

3.11.8 Each door, and adjacent inside wall, shall be provided with a ground stud for the attachment of a #6 (or larger) bonding wire of a short length (less than 4").

3.11.9 Houses 12-feet and longer shall be equipped with one additional cable access door located on the opposite wall of the House.

3.11.10 All doors shall be equipped with a door position monitoring switch. The door switch circuit shall be closed when the door is closed and open when the door is open. The failure mode of the switch shall be to fail open.

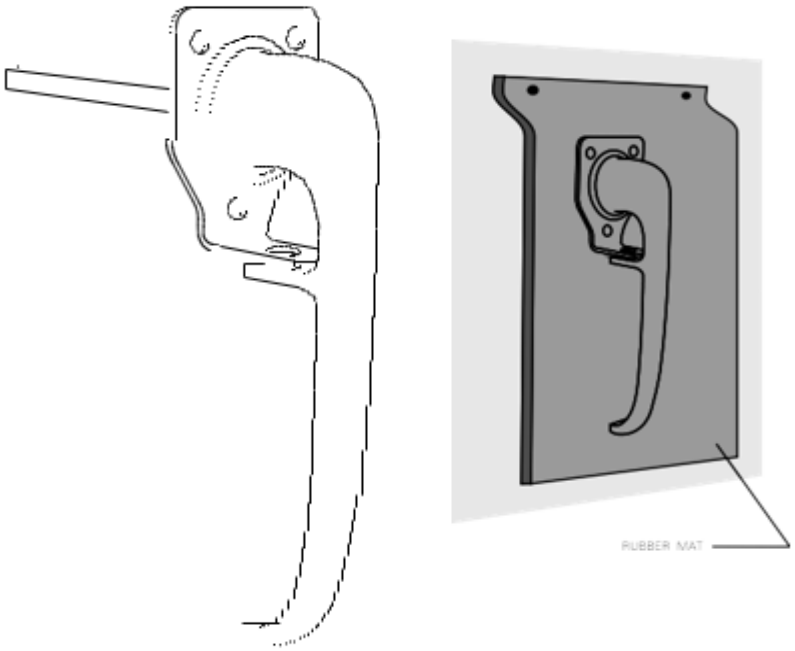
3.11.11 The entrance door(s) shall be hung on the right-hand side and swing out when facing the door from the outside.

3.11.12 The entrance door frame and hinges shall be capable of supporting a dead weight of 250 lbs. applied at the edge of the door furthest from the hinges plus the weight of the door itself. Door hinges shall be aluminum 8 inches in length with non-removable stainless hinge pins so that the pins cannot be removed to open the door. The door hinges shall be permanently lubricated. The door hinges shall not be removable from the outside.

3.11.13 The lower portion of the entrance door(s) shall be equipped with an air vent; refer to the section 3.12 of this Specification on "Ventilation".

3.11.14 The entrance door(s) and frame(s) shall be equipped with a vandal-resistant latch assembly. A heavy-duty exterior steel door handle shall be provided similar to Figure 3-1 below and with a ½" diameter padlock hole. The door handle shall be covered with a rubber mat to protect it from ice. The handle cover shall be flexible to -40° Celsius without cracking. The door handle shall have the equivalent strength of a steel bar not less than 1-1/4 inch x 1/4 inch thick. The door handle assembly shall have an interior and exterior handle. The door latch shall have a security release feature which will permit the opening of the door from the inside without tools even if the door is locked from the outside.

Figure 3-1: Door Handle and Door Handle Rubber Mat Cover



3.11.15 A three-point ramping type latch mechanism with heavy-duty door handle shall be provided to engage the door side frame at three places. The latching mechanism shall be riveted or bolted to the door. The latch locking system shall have a vandal resistant 1/2-inch hole to allow for the insertion of a padlock into the handle and locking hasp. The padlock will be supplied by Metrolinx.

3.11.16 Stainless steel plates (3) or other approved devices shall be installed at the points where the door closing assembly makes contact with the doorframe in order to reduce abrasion of aluminum or rubber.

3.11.17 The cable access door(s) shall lock using two (2) ½" hex bolts located at approximately 1/3 from the top and bottom of the door. A stainless steel plate shall be provided on the door to prevent the bolt, when tightened, from damaging the door. The bottom bolt shall be equipped with a padlock locking assembly.

3.12 HEATING, VENTILATION AND AIR CONDITIONING (HVAC)

3.12.1 The House shall be equipped with a natural ventilation system in accordance with the following:

a) a lower ventilation component that shall consist of louvered vents located in the bottom portion of each entrance door not less than 12 inches above the floor, designed to provide total free air space of not less than 60 square inches on the door;

b) an upper ventilation component that shall consist of louvered vents located in the gable portions of the roof at both ends of the House. If no gables exist, the top of the louvered vents shall be located within 12" of the top of each door; and

c) the frame and blades of the vents shall be constructed with a minimum of 0.100-inch thick aluminum and shall resist rain ingress and damage due to impact.

3.12.2 The natural convection ventilation system shall provide for a minimum of two (2) air changes per hour. The system shall be designed on the basis of ensuring a 16-degree Celsius temperature difference assuming a wind velocity of 15 mph at a deflection factor of 0.25.

3.12.3 Ventilators shall be equipped with removable dust filters and retainers.

3.12.4 Aluminum #80 grid wire mesh (bird screen) or equivalent shall be provided on the interior side of all vent assemblies.

3.12.5 Each air vent shall be equipped with a manually adjustable damper which shall be designed to provide a minimum natural air circulation rate at all times. The manual damper shall be designed to totally close off the vent opening during transportation of the House, or to minimize House heat loss during winter operating periods in site-specific applications in which a minimum air circulation rate is not necessary.

3.12.6 All vent hardware and fastening devices shall be stainless steel or equivalent corrosion-resistant materials.

3.12.7 The House shall be equipped with an external wall mounted Heating and Air Conditioning (HVAC) unit that shall be configurable for either or both winter and summer climate controls.

3.12.8 The HVAC shall provide forced air ventilation that:

a) Works in conjunction with the natural air ventilation; and

b) provides a minimum of thirty (30) air changes per hour and a minimum of 500 cubic feet per minute; and

3.12.9 HVAC unit shall maintain the interior temperature of the House between 18° Celsius and 23° Celsius in accordance with OHSA and ASHRAE 55 standards.

3.12.10 A wall mounted thermostat shall be provided to control the HVAC to maintain the

interior temperature of the House within the adjustable temperature range.

3.12.11 Air conditioner unit shall be sized based on house size, standard ambient conditions with 99% confidence interval for the greater Toronto region as per ASHRAE HANDBOOK, and thermal loads, including structural heat gains, equipment and room lighting heat emissions.

3.12.12 Heater unit shall be sized based on house size, standard ambient conditions with 99% confidence interval for the greater Toronto region as per ASHRAE hand book and structural heat loss but excluding any equipment and room lighting heat emissions.

3.12.13 Calculations shall be submitted, complete and detailed for both Air Conditioning and Heating unit.

3.12.14 The HVAC shall be controlled such that the air conditioning is only activated if the force air ventilation is insufficient to achieve the thermostat setting.

3.12.15 The HVAC unit shall be protected from vandalism by suitable metallic cage.

3.12.16 The HVAC unit shall provide configurable alarms and support an interface with an external monitoring system.

3.13 WIRE TRAYS

3.13.1 Where needed, overhead wire trays shall be provided to carry electrical wiring between equipment boards, wiring entrance boards, and relay racks. These shall be ladder-type trays with wire accessible from the bottom, both sides, and top. All edges shall be rounded finish free of any burrs or sharp edges which could damage the wire insulation. The inside corner where two wire trays meet shall have a 2″ to 4″ radius. Protection against wire chaffing shall be provided.

3.13.2 Wire trays shall be in accordance with AREMA, CSA, OESC and ESA standards.

3.13.3 Wire trays shall be constructed of aluminum and shall be electrically bonded to each other and to the House skin at both ends using a bracket. The size of the bracket shall be a minimum of 2 inches deep by 8 inches wide.

3.13.4 Wire trays shall be installed so as to provide free access to all possible terminations. Wire trays shall be far enough from the roof and walls to provide easy access to the wires. Wire trays shall not interfere with the installation of any equipment racks, terminal boards or other equipment. The tray shall support a dead weight of 250 pounds at any point without any distortion of the assembly or detachment from its mounting.

3.14 BATTERY TRAYS

3.14.1 Each House shall be supplied with battery trays to accommodate the intended battery bank.

3.14.2 The frame of the battery tray shall be of formed aluminum or wood. The frame shall be supported by stainless steel or aluminum brackets. The bottom shall be covered with

the House floor covering. Alternatively, polyethylene battery trays may be acceptable.

3.15 ELECTRICAL REQUIREMENTS

3.15.1 All AC power electrical boxes, fixtures, circuits associated with the lighting, heating, ventilation and convenience receptacles shall be installed and connected by the Contractor. All AC 120V convenience electrical boxes shall be GFI protected. Wiring methods and materials shall be in accordance with National Electrical Code or CSA Electrical Codes and this Specification.

3.15.2 A suitable type AC load center shall be installed and wired by the Contractor.

3.15.3 A metal enclosed Primary Surge Suppression Device (SSD) complete with enclosure shall be mounted in accordance with the manufacturer's instructions, and in such a way as to minimize the impedance to the ground plane in the event of a power surge. The unit shall be located directly adjacent to the AC load center.

3.15.4 Two power-off indication lights shall be provided, one on the entrance door side (viewable to road users) and the other on the track side (viewable to train crew) outer wall of the grade crossing bungalow type B. Power off indication light shall be mounted at a height of 84". A metal enclosure shall be provided to house the electrical wires.

3.15.5 Surface mounted LED lighting fixtures shall be installed. The number of lighting fixtures shall depend on the size of the House.

3.15.6 The House grounding connection shall consist of four (4) external ground wires welded to the outside skin on opposing corners of the House.

3.15.7 The House shall be equipped with a generator connection assembly consisting of:

a) One (1) outdoor receptacle box Bryant 71430MBWP or Woodhead 68W74 4 wire 120/240 configuration or equivalent. The box shall be connected to the bottom of the AC load center by means of a threaded fitting and suitable attachment;

b) One suitable design rating A and 240V disconnect breaker inside the service box; and

c) One Square D PK4DTIM4LA manual transfer equipment kit or equivalent to secure two dual circuit breakers to the interior of the panel when used as back-fed mains.

3.15.8 Grade Crossing Houses (type B) shall be equipped with a test box mounted on the outside wall adjacent to the cable access door, approximately 48-inches from the bottom of the House. The test box shall be provided with a DPDT switch. A 1-inch diameter hole shall be provided through the wall, to the rear side of the test box.

3.15.9 Each House shall be supplied with a 2" x 4.5" threaded nipple complete with galvanized conduit lock nuts, installed through the wall to the inside of the load centers.

3.15.10 Each House shall be supplied with minimum two (2) electrical ground lugs, located

adjacent to the load center. These ground lugs shall serve as safety grounds for wall and rack mounted equipment.

3.15.11 Low voltage cables and wires shall be in accordance with CSA C22.2 No.75-17.

3.16 OTHER CONSIDERATIONS

3.16.1 The House shall have a shelf suitable to store documentation and drawings.

3.16.2 The Contractor shall ensure the House is properly engineered and assembled to accommodate the shipment and "hoisting" of the House when fully equipped. The Contractor shall consider 500 lbs. per linear ft. (times the House length) for the approximate weight of the equipment in the House. The Contractor shall make proper allowances in its design to address any additional loads, stresses and vibration that may be applicable both in shipping and in the anticipated service environment of the House.

3.16.3 The maximum weight, loading and "hoisting" specifications shall be forwarded six (6) weeks prior to shipment of the House. Specific hoisting or lifting equipment (such as spreader bars) shall be supplied by the Contractor.

3.16.4 A data plate shall be mounted on the exterior wall of the House, with the following information:

a) Gross weight

b) House serial number

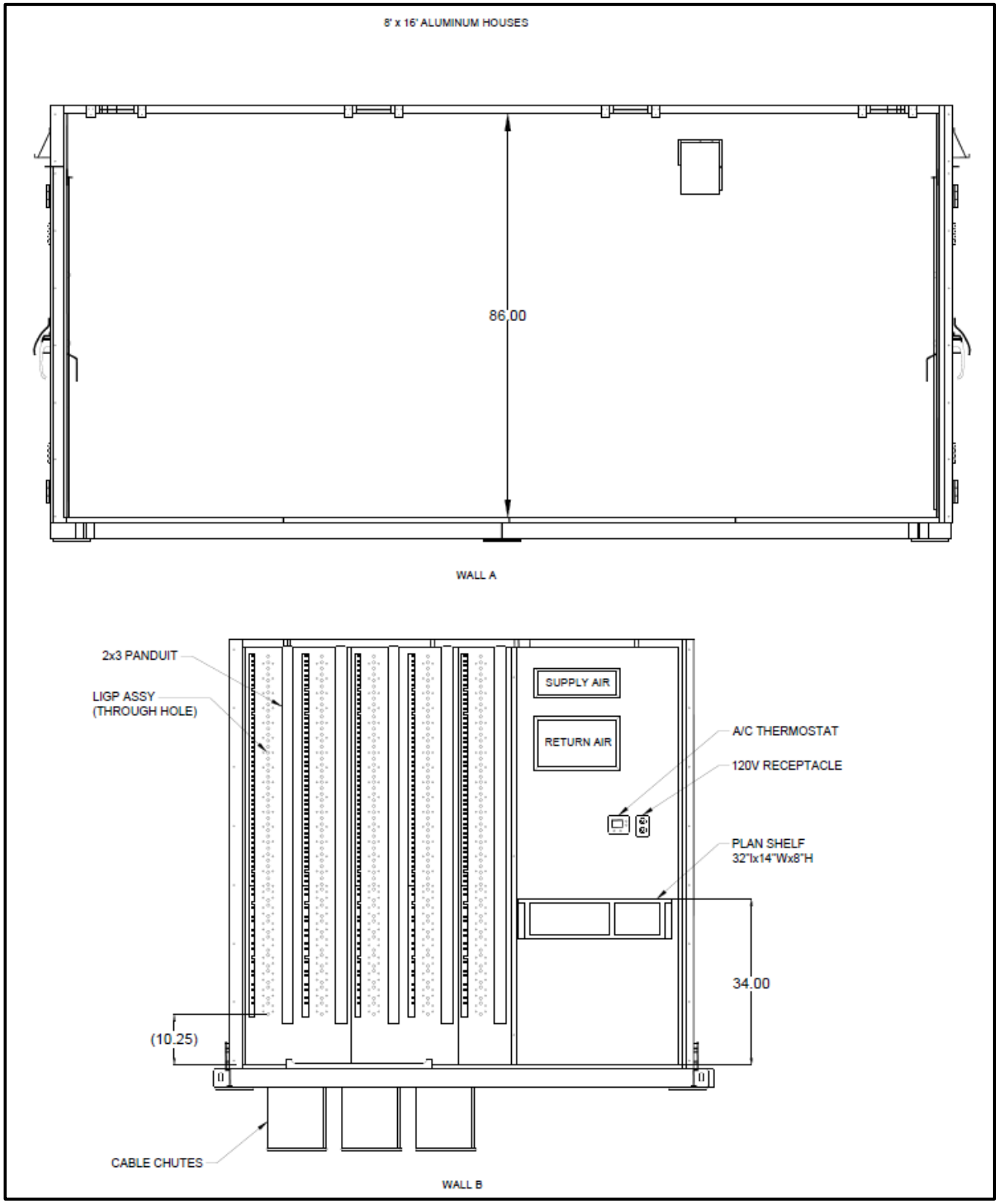
c) Contractor's name

d) Fabrication date

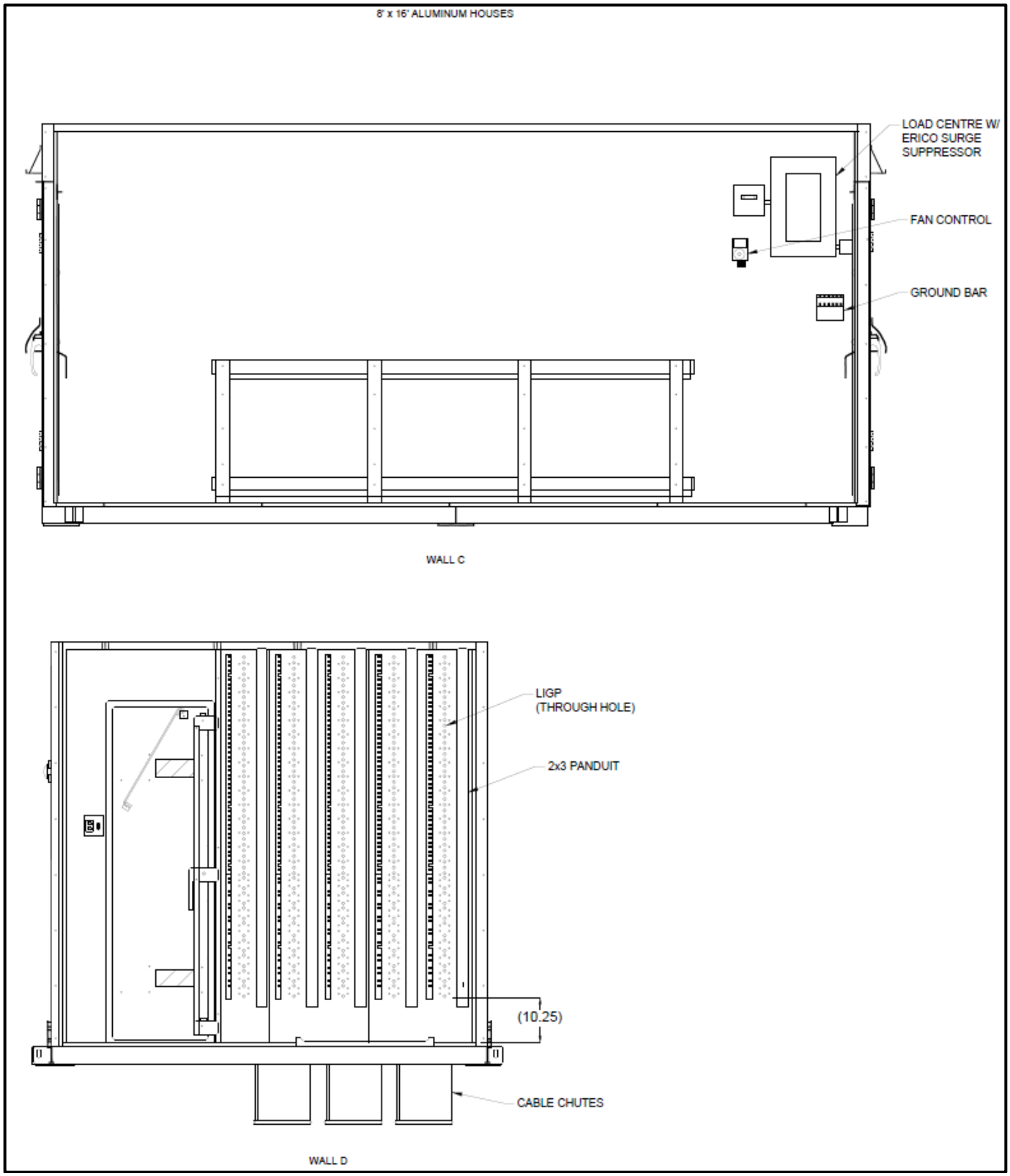
3.16.5 Any equipment shipped in the House shall be properly secured to prevent damage to the equipment and the House.

APPENDIX A: BUNGALOW DESIGN TYPICAL DRAWINGS

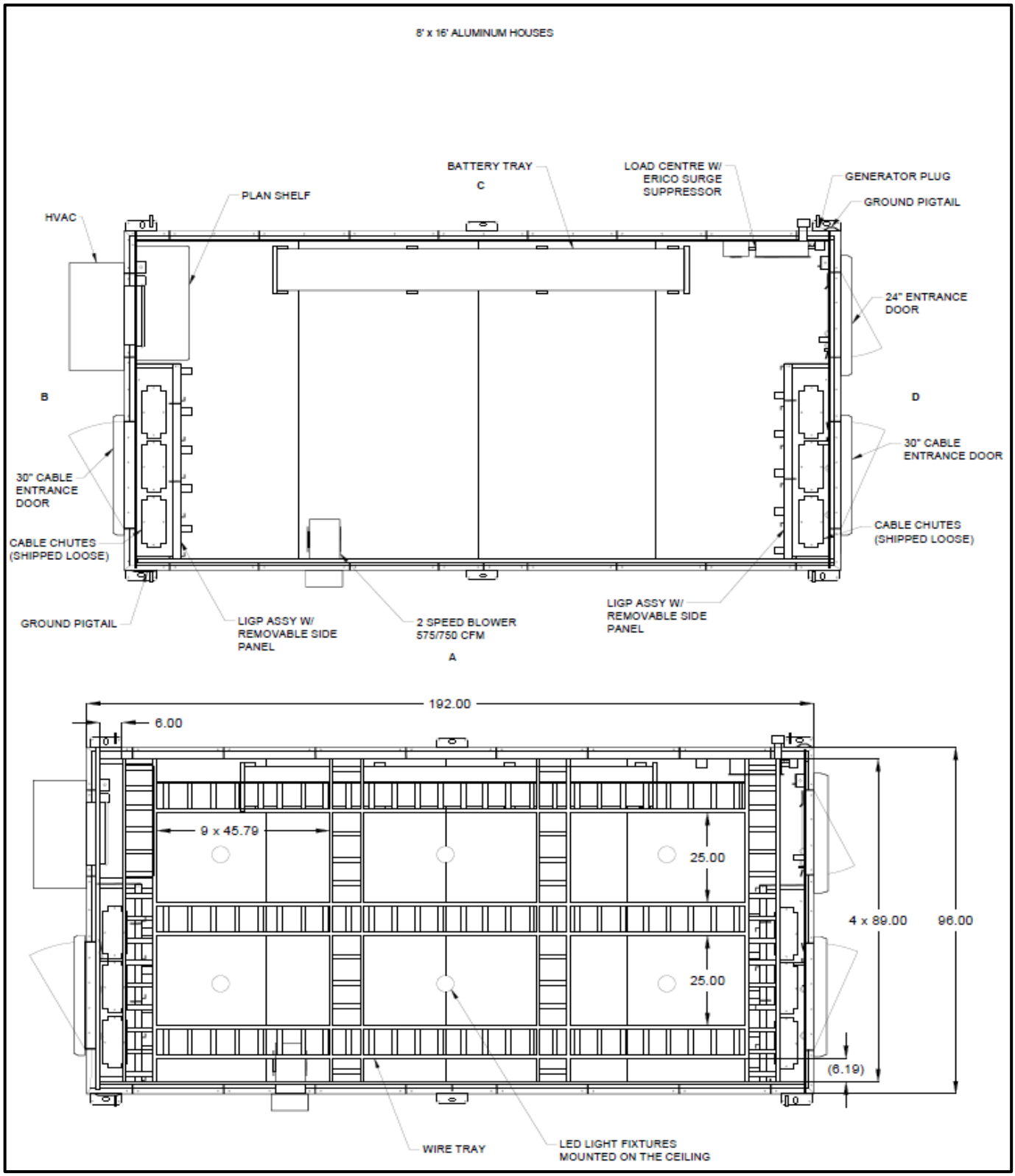
DRAWING 1 - ALUMINUM HOUSE WALL A/WALL B VIEW



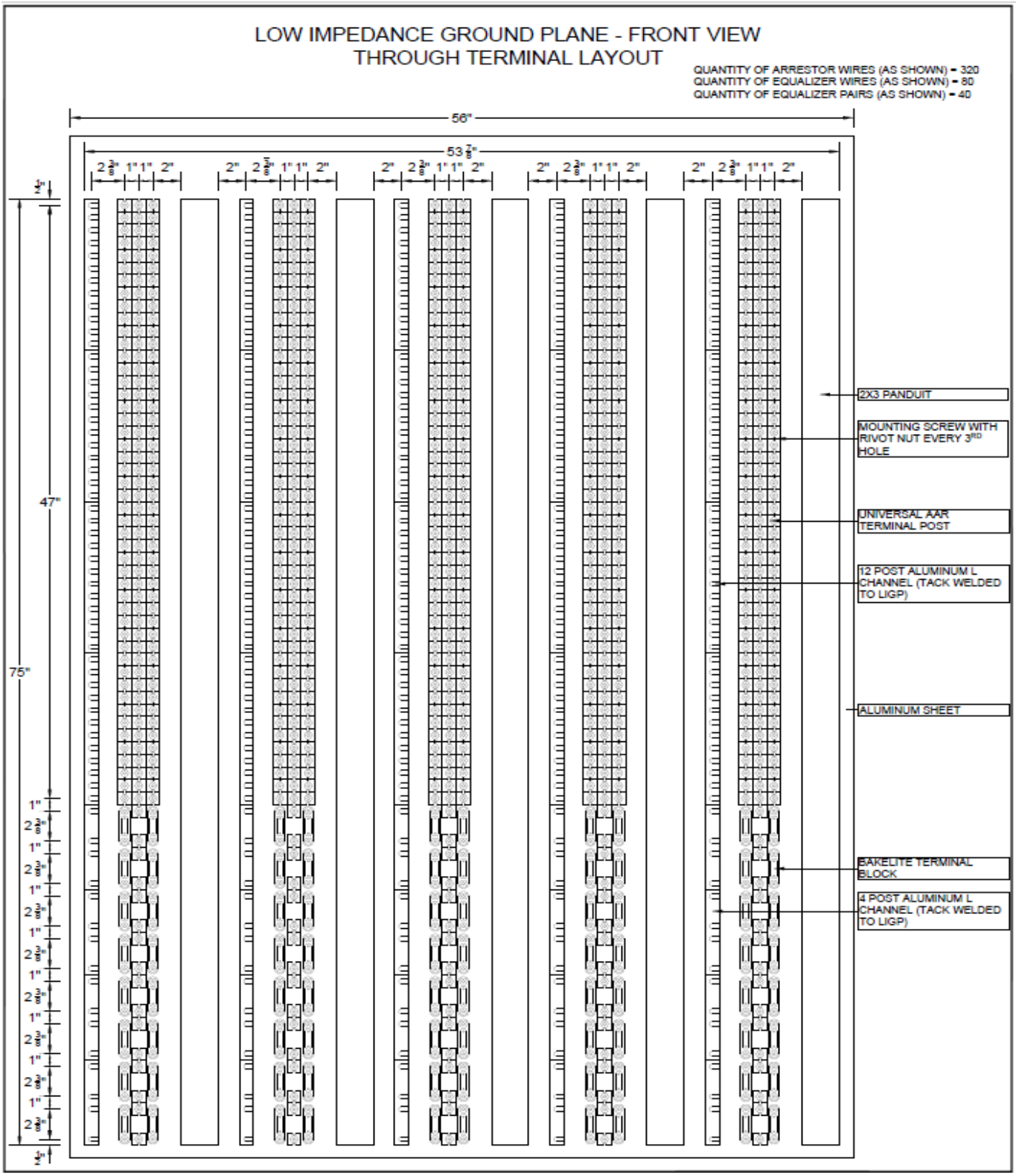
DRAWING 2 - ALUMINUM HOUSE WALL C/WALL D VIEW



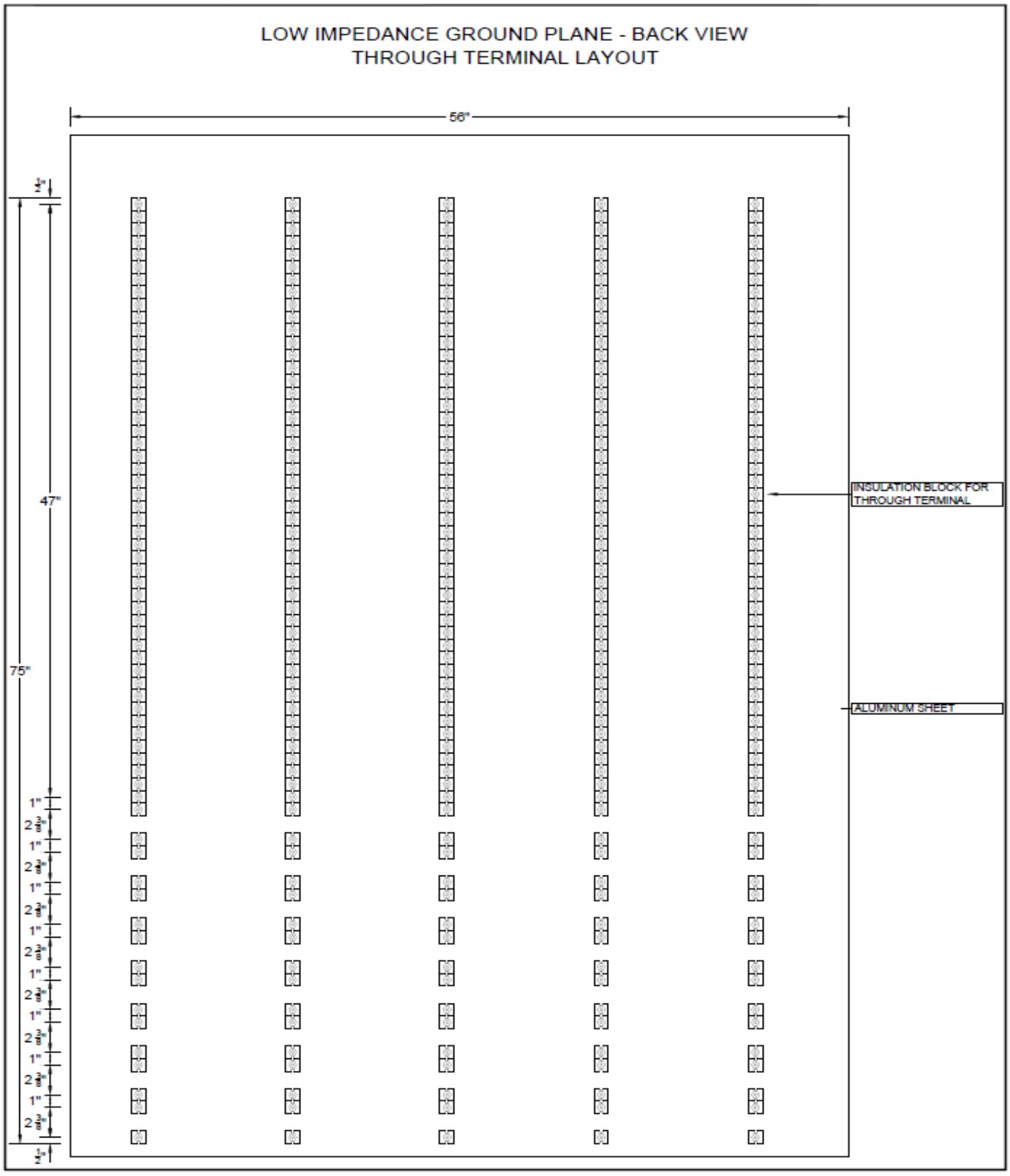
DRAWING 3 – ALUMINUM HOUSE OVERVIEW



DRAWING 4 – LIGP FRONT VIEW



DRAWING 5 – LIGP BACK VIEW



DRAWING 6 – LIGP THROUGH TERMINAL ARRANGEMENT