METROLINX

# GO Transit Signals & Communications – Aluminum House Specification

Specification 34 42 01

Revision: 01
May 2024

**Aluminum House Specification**

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Publication Date: April 8, 2020
Revision Date: May 2024

# Amendment Record

| Revision | Date (DD/MM/YYYY) | Description of Changes |
|---|---|---|
| 00 | 08/04/2020 | Initial release |
| 01 | 24/11/2023 | General updates and formatting |

## CONTENTS

# 1. Scope

## 1.1. General

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 |
| FRP | Fiberglass Reinforced Plastic |
| GFCI | Ground Fault Circuit Interrupter |
| HVAC | Heating Ventilation and Air Conditioning |
| LED | Light Emitting Diode |
| LIGP | Low Impedance Ground Plane |
| OBC | Ontario Building Code |
| OESC | Ontario Electrical Safety Code |
| OHSA | Occupational Health and Safety Act |
| SSD | Surge Suppression Device |
| 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. Product data and specification sheets shall be submitted for all off-the-shelf products or systems used in the House.

3.1.4. The engineering drawings shall indicate the 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 the manufacturing stage.

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.

3.2.3. The requirement for a prototype (Section 3.2.1) and inspections (Section 3.2.2) may be waived on written approval by Metrolinx.

## 3.3. House Construction

3.3.1. The House shall be designed and constructed based on 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/sqft;

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

g) The roof shall be designed to withstand snow loads in accordance with the Ontario Building Code, based on the worst-case loading scenario of the current geographical limits of all MX rail corridors;

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 a 30°C 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; and

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 a 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 Combination Crossing and Signal |
| 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" 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 the House, shall be standard 3003-H14 or better, one-side bright finish sheet. The aluminum shall be a minimum of 0.100" 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 covered with Fiberglass Reinforced Plastic (FRP). Alternatively, the plywood can be painted with two coats of white or light gray fire-retardant paint on both sides if FRP is not provided. Termite-resistant 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 fibreglass 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 floor shall be designed for a uniform live load of 150 lbs/sqft (7.2 kPa), and where equipment is supported from the floor, the concentrated equipment loading shall be based on the weight of the proposed equipment distributed over the footprint of the equipment in contact with the floor. The live load and equipment dead load shall be assumed to act concurrently.

3.6.2. The underside of the floor shall be insulated with fibreglass pink insulation with a minimum R-12 value. The insulation shall be covered with a 0.05" 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" 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 subfloor.

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

## 3.7. Foundations

3.7.1. House types A, B and C shall be equipped with angle-type "drop-down piers" at each corner of the House, without compromising the space inside the House. The pier must be adjustable from the outside of the House and must be capable of extending 54" from the bottom of the House.

3.7.2. House types D, E and F shall be equipped with exterior base plates and separate AREMA Section 14.4.1 compliant galvanized steel foundations, which shall also be supplied by the Contractor. Exterior base plates complete with 1 ½" wide slotted holes shall be provided in each anchoring point of the House. They shall extend no farther than 3 ¾" beyond the exterior surface of the wall and be no longer than 12" 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.

## 3.8. Walls

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

3.8.2. If the walls adjacent to the battery trays are plywood, a 4'0" high section to the rear and side of the battery tray shall be painted with two coats of battery acid-resistant paint.

3.8.3. 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.

## 3.9. Roof

3.9.1. The interior side of the roof shall be insulated in accordance with section 3.4.8.

3.9.2. The interior side of the roof shall be covered with material in accordance with section 3.5.7.

## 3.10. Main Cable Entrance

3.10.1. The House shall be equipped with three 4" X 12" cable chutes per LIGP, with the exception of the House type A, which shall be equipped with two chutes per LIGP. The chutes shall be constructed of 1/8" 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 chutes shall have 1 3/16" formed lips designed to permit securing the chutes 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 chutes shall be 17".

3.10.2. The floor of the main cable entrance shall include three slots (4 ¼" X 12 ¼") to accommodate the cable chutes, with the exception of House type A, which shall be equipped with two slots. The slots shall be located equally along the centerline between the LIGP and the exterior wall and be blocked with removable cover(s). The chutes shall be filled with clean pea gravel once assembled and cabled on site.

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

3.10.4. All cable entrances shall be made to prevent water, dust or wildlife from entering the House.

## 3.11. Low Impedance Ground Plane (LIGP)

3.11.1. 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.

3.11.2. The structure of each LIGP frame shall support the total weight of lightning arrestors, AAR terminal strips and associated mounting hardware, as well as the internal and external signal cable connections.

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

3.11.4. The aluminum backplane shall have pre-installed threaded inserts spaced to accept 12-post AREMA terminal strips and 2-post AREMA arrestor blocks. Each 12-post terminal strip shall have four (4) inserts, and each 2-post terminal strip shall have two (2) inserts.

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

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

3.11.7. 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.

3.11.8. 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. Each LIGP shall be fully equipped with terminal strips such that all terminal locations can be used.

3.11.9. Each LIGP AAR terminal strip column shall be clearly numbered from top to bottom, starting with "1" at the top. The numbering shall be on a machine-generated sticker and be placed to the right of the terminal strip for both the front and back of each column.

3.11.10. Each LIGP AAR terminal strip column shall be clearly lettered from left to right, starting with "DA" in the left-most column and continuing to "DE" in the right-most column. The lettering shall be on a machine-generated sticker and be placed at the top of the column for both the front and back of each column.

3.11.11. Refer to drawings 4-4, 4-5 and 4-6 for further information on LIGP's.

## 3.12. Doors

3.12.1. 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 the entrance door only.

3.12.2. 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.

3.12.3. The size of doors shall be a minimum of 24" wide by 75" high.

3.12.4. 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.

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

3.12.6. 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.

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

3.12.8. 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").

3.12.9. Houses that are 12'0" and longer shall be equipped with one additional cable access door located on the opposite wall of the House.

3.12.10. 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.

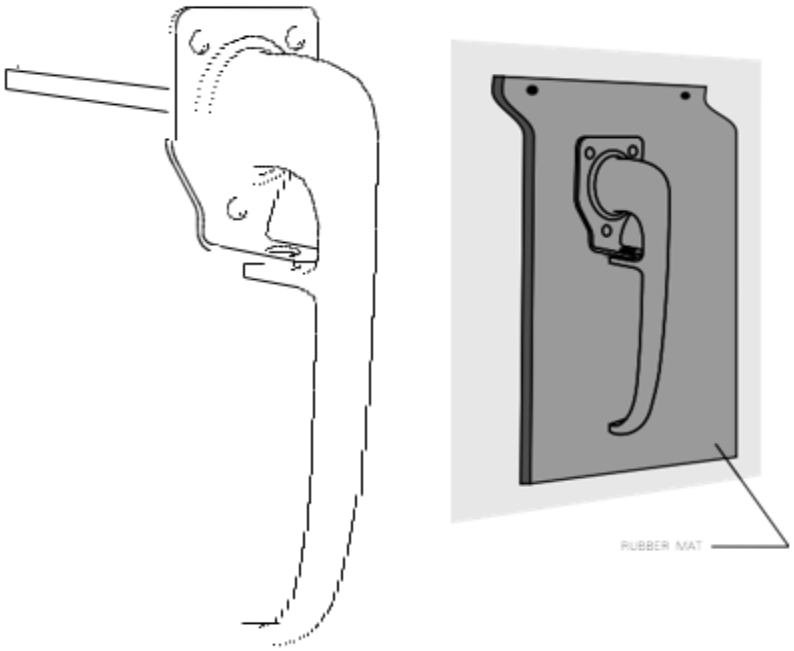
3.12.11. The entrance door(s) shall be hung on the right-hand side and swing out when facing the door from the outside.

3.12.12. 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" 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.

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

3.12.14. 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°C without cracking. The door handle shall have the equivalent strength of a steel bar not less than 1-1/4" x ¼" 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**




3.12.15. A three-point ramping type latch mechanism with a 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 ½" hole to allow for the insertion of a padlock into the handle and locking hasp. The padlock will be supplied by Metrolinx.

3.12.16. 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.

3.12.17. 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.

## 3.13. Heating, Ventilation and Air Conditioning (HVAC)

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

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

b) An upper ventilation component that shall consist of louvred vents located in the gable portions of the roof at both ends of the House. If no gables exist, the top of the louvred 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″ thick aluminum and shall resist rain ingress and damage due to impact.

3.13.2. 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°C temperature difference, assuming a wind velocity of 15 mph at a deflection factor of 0.25.

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

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

3.13.5. 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.

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

3.13.7. 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.

3.13.8. The HVAC shall provide forced air ventilation that:

a) Works in conjunction with 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

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

3.13.10. A wall-mounted thermostat shall be provided to control the HVAC to maintain the interior temperature of the House within the adjustable temperature range.

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

3.13.12. The heater unit shall be sized based on house size and standard ambient conditions with a 99% confidence interval for the greater Toronto region as per the ASHRAE handbook and structural heat loss but excluding any equipment and room lighting heat emissions.

3.13.13. Calculations shall be submitted, complete and detailed for both Air Conditioning and Heating units.

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

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

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

## 3.14. Wire Trays

3.14.1. 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.

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

3.14.3. 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″ deep by 8″ wide.

3.14.4. 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 lb at any point without any distortion of the assembly or detachment from its mounting.

3.14.5. Wire trays running between walls "B" and "D" down the centerline of the House shall be moveable and lockable to allow adjustments to their position to be made. These sliding wire trays shall be positioned directly above equipment racks by the contractor based on local conditions, allowing wires to drop directly into plastic wireways mounted to the equipment racks.

## 3.15. Battery Trays

3.15.1. Each House shall be supplied with two-tier battery trays to accommodate the intended battery bank. The battery trays shall be shipped loose and positioned by the contractor based on local conditions.

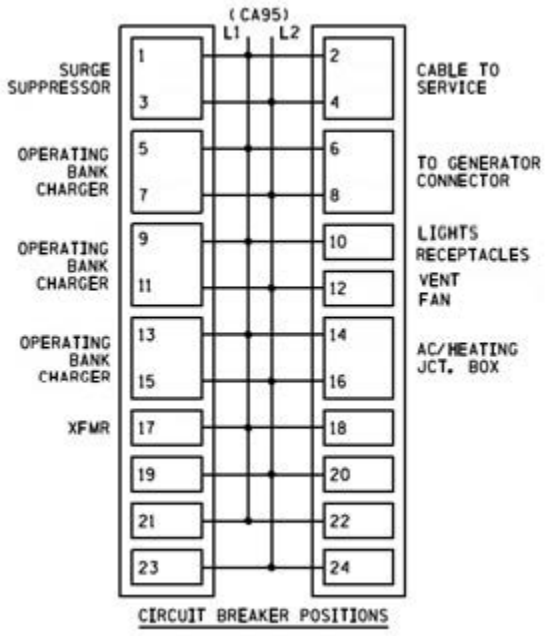
3.15.2. The frame of the battery tray shall be of formed aluminum or wood. The frame shall be supported by stainless steel or aluminum brackets. The bottom shall be covered with the House floor covering. Alternatively, polyethylene battery trays may be acceptable.

## 3.16. Electrical Requirements

3.16.1. All AC power electrical boxes, fixtures, and 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 equipped with GFCI outlets. Wiring methods and materials shall be in accordance with the National Electrical Code or CSA Electrical Codes and this Specification.

3.16.2. A suitably sized Square "D" AC load center shall be installed, wired and correctly labelled (with machine-produced stickers) by the Contractor with suitably sized breakers and positions, in accordance with Figure 3-2.

**Figure 3-2: Load Center Configuration and Layout**




a) External service breaker shall occupy AC load center positions 2 and 4;

b) The generator service breaker shall occupy AC load center positions 6 and 8;

c) House lights and receptacle chain shall occupy AC load center position 10;

d) Ventilation fan assembly shall occupy AC load center position 12;

e) HVAC unit shall occupy AC load center positions 14 and 16;

f) All other non-signal system feeds shall occupy AC load center even positions;

g) House Primary Surge Suppression Device (SSD) shall occupy AC load center positions 1 and 3; and

h) All other signal system feeds for rectifiers, low voltage transformers and POE lights shall occupy odd positions in the AC load center.

3.16.3. 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. The preferred SSD to be installed is Erico EPD120/240TDFL unless otherwise directed by Metrolinx.

3.16.4. Two Velcorp GEMS LC2-001WB-WG4 LED power-off indication lights shall be provided, one on the entrance door side (viewable to road users) and the other on the trackside (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", or in the centerline of the entrance door above the drip edge. A metal 8" x 8" x 4" enclosure complete with clear lid shall be provided to house the electrical wire connections.

3.16.5. Surface-mounted LED lighting fixtures shall be installed with guards. The lighting fixtures shall be placed so they are not directly above the House wire trays. The number of lighting fixtures shall depend on the size of the House:

a) House type A shall have two lighting fixtures;

b) House types B and C shall have four lighting fixtures; and

c) House types D, E and F shall have six lighting fixtures.

3.16.6. The House grounding connection shall consist of four (4) external solid copper ground wires welded to the outside skin on opposing corners of the House. The solid copper wire assembly shall be 48" long in order to connect directly to the corner ground rod assembly without splices.

3.16.7. 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 120/240V 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 30A 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.

3.16.8. Grade Crossing Houses (type B) shall be equipped with a test box mounted on the outside wall between the cable access and entrance doors, approximately 48" from the bottom of the House to the bottom of the test box. The test box shall be provided with a DPDT switch. A 1" diameter threaded nipple shall be provided through the wall, to the rear side of the test box, complete with plastic bushings to prevent damage to case wiring.

3.16.9. 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 center. An appropriately sized LB fitting shall be supplied to allow the external power cable entry into the House.

3.16.10. Each House shall be supplied with an equipment grounding buss bar, located adjacent to the load center, with two rows of four set screws. The grounding bar shall serve as safety grounds for wall and rack-mounted equipment and shall be welded to the frame and skin of the House.

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

## 3.17. Other Considerations

3.17.1. The House shall have a shelf suitable for storing documentation, manuals and drawings.

3.17.2. 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.

3.17.3. 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.

3.17.4. 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; and

d) Fabrication date.

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

3.17.6. The House shall be equipped with two stickers which clearly identify the House mileage and location and/or road name. The first sticker shall be placed on the main entrance door, and the second sticker shall be placed on the side of the House which faces the tracks. Metrolinx will provide the appropriate stickers for the Contractor to install. Both stickers shall be placed approximately 48" from the bottom of the House.

# 4. Typical Bungalow Drawings

**Figure 4-1: Aluminum House Wall A/Wall B View**

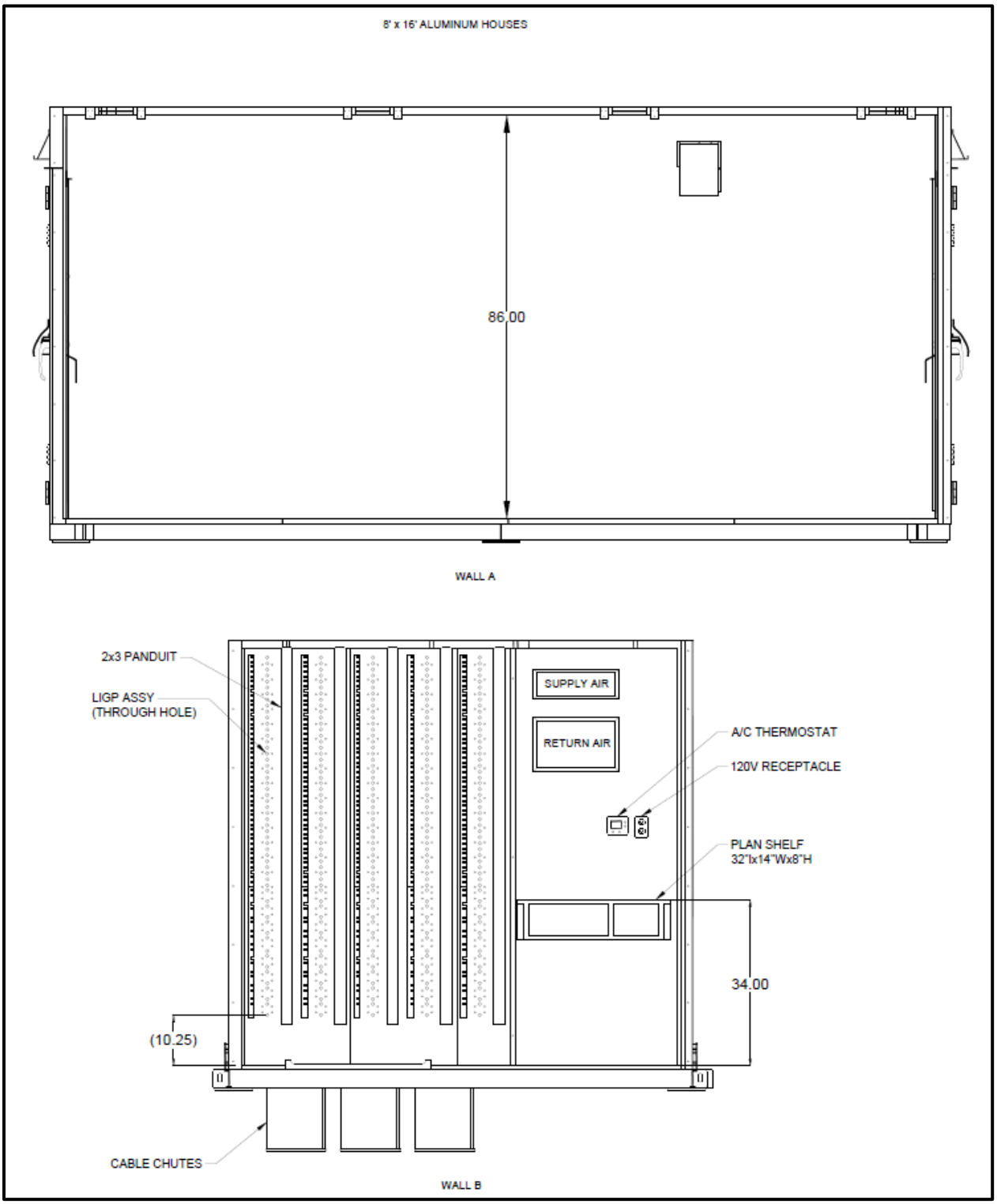


**Figure 4-2: Aluminum House Wall C/Wall D View**

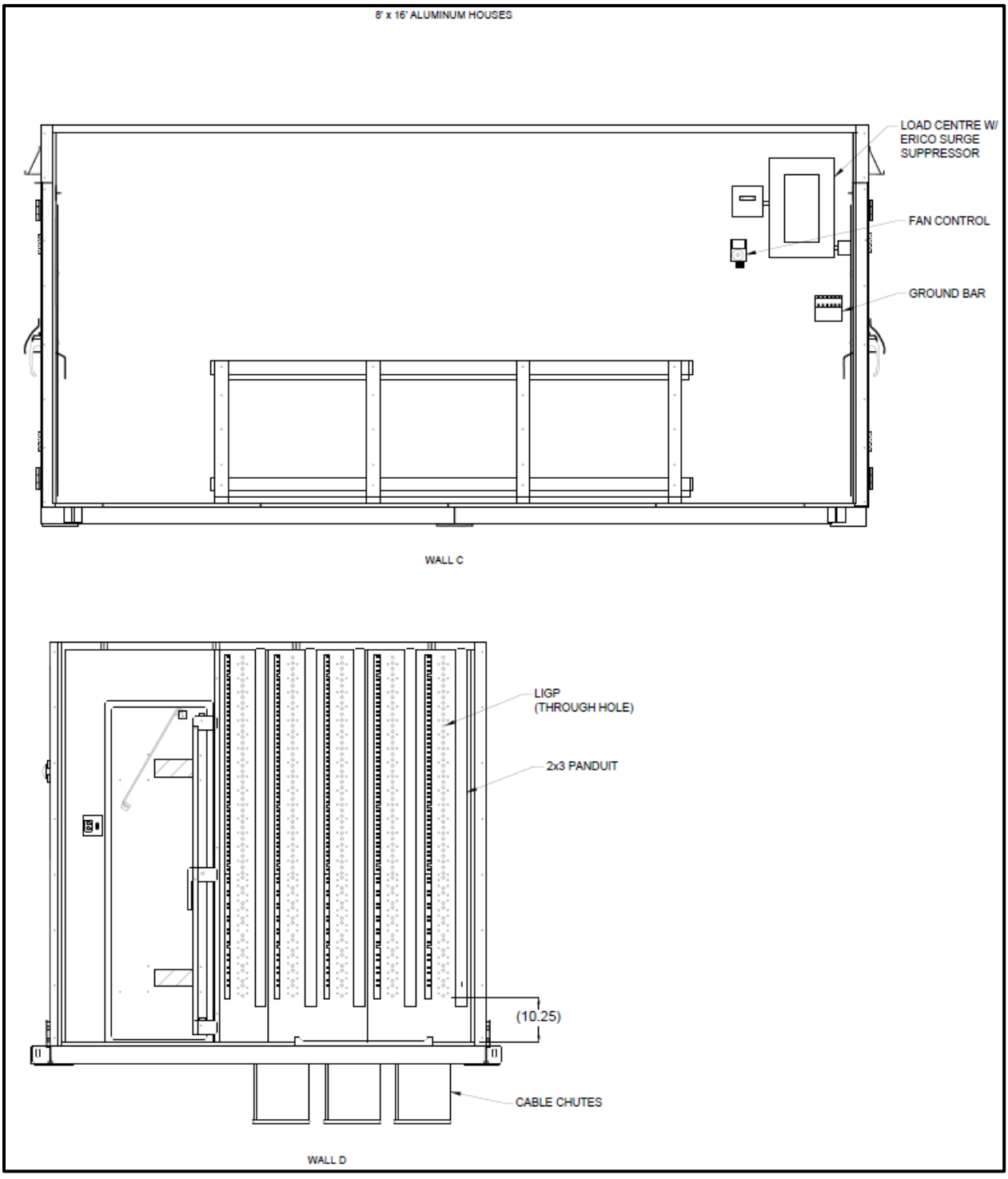


**Figure 4-3: Aluminum House Overview**

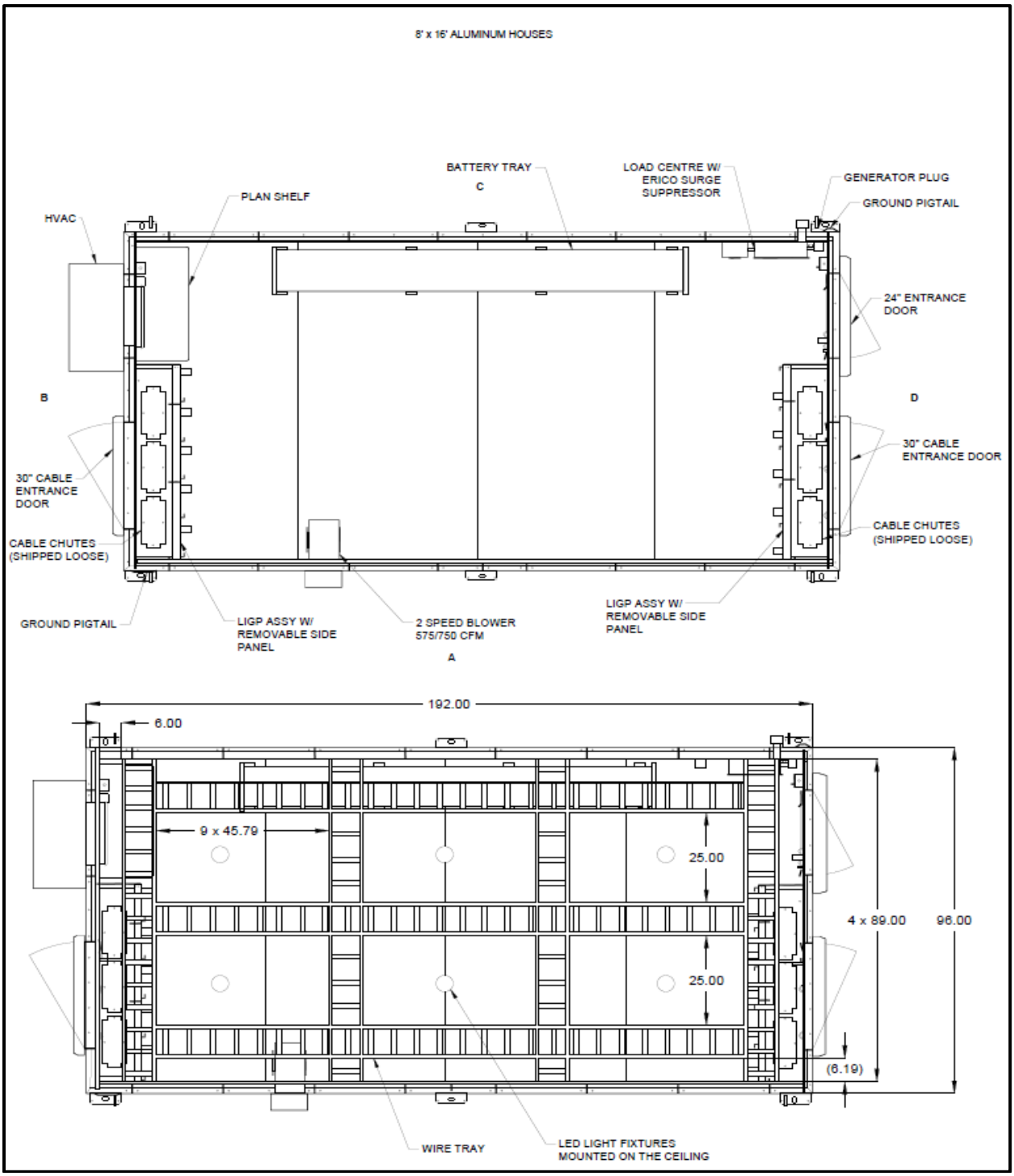


**Figure 4-4: LIGP Front View**

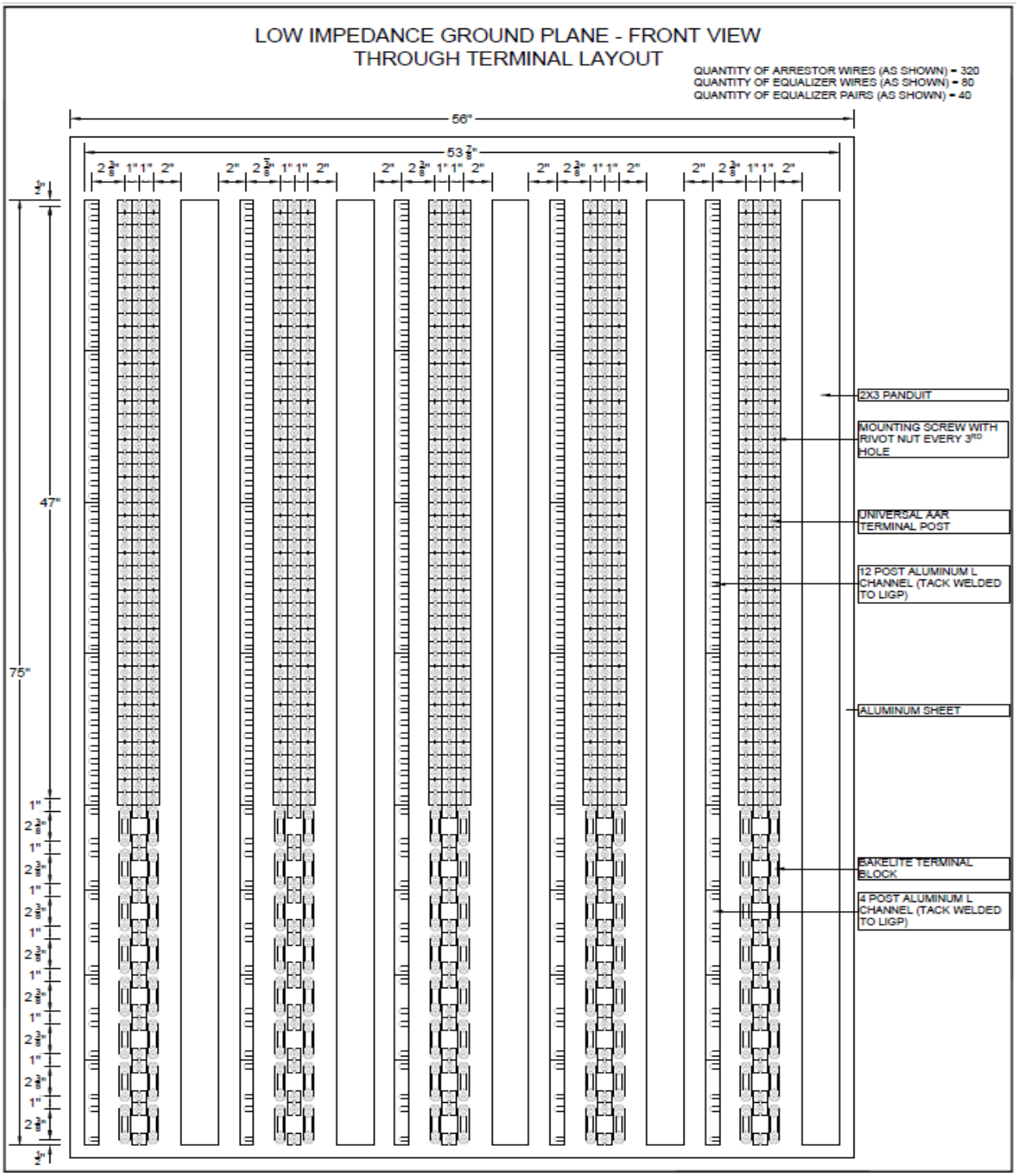


**Figure 4-5: LIGP Back View**

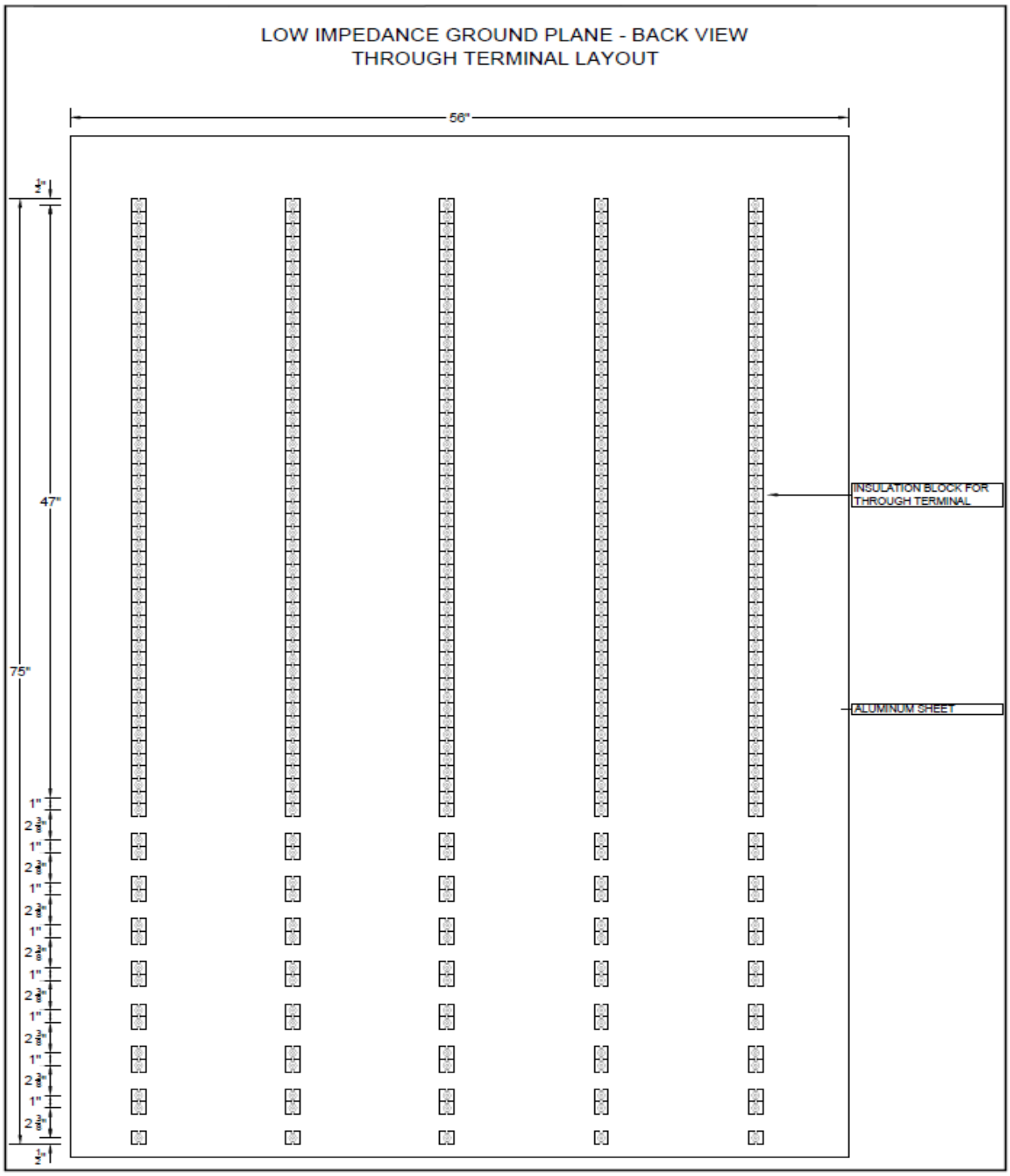
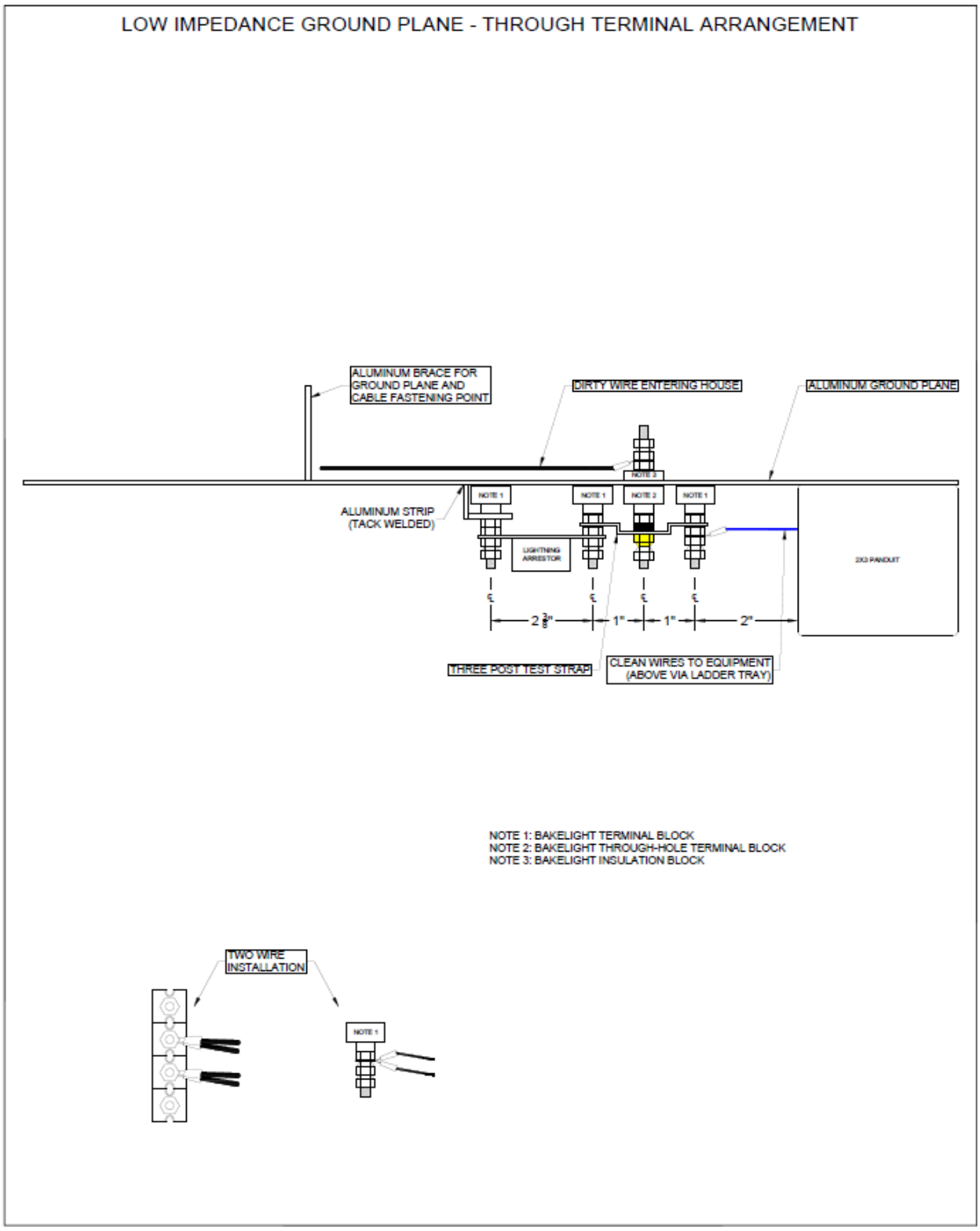


**Figure 4-6: LIGP Through Hole Terminal Arrangement**



# 5. Compliance Matrix

| **Manufacturer:** | | **Revision:** | |
|---|---|---|---|
| **Contract Number:** | | **Project Name:** | |

| Section | Criteria | Comply | Do Not Comply | N/A | Notes / Comments |
|---|---|---|---|---|---|
| 3.1 | Engineered drawings and calculations | | | | |
| 3.2.1 a) | Ontario Building Code 2012, Part 4 | | | | |
| 3.2.1 b) | CAN/CSA S157-15 | | | | |
| 3.2.1 c) | CAN/CSA S16-14 | | | | |
| 3.2.1 d) | CAN/CSA A23.3-14 | | | | |
| 3.2.1 e) | Wing loads | | | | |
| 3.2.1 f) | Gust factor | | | | |
| 3.2.1 g) | Snow loads | | | | |
| 3.2.1 h) | Roof deflection | | | | |
| 3.2.1 i) | CWB certification | | | | |
| 3.2.1 j) | Weatherproofing of House | | | | |
| 3.2.1 k) | Overall insulation requirements | | | | |
| 3.2.1 l) | Grounding | | | | |
| 3.2.1 m) | AREMA C&S Manual Part 11.5.1 | | | | |
| 3.2.1 n) | Securement of equipment racks | | | | |
| 3.2.1 o) | Faraday cage | | | | |
| 3.3 | Size of house | | | | |
| 3.4.1 | ASTM B209-14 Aluminum | | | | |
| 3.4.2 | 3003-H14 Aluminum | | | | |
| 3.4.3 | House construction | | | | |
| 3.4.4 | External hardware | | | | |
| 3.4.5 | Internal hardware | | | | |
| 3.4.6 | Exterior surface | | | | |
| 3.4.7 | Plywood requirements | | | | |
| 3.4.8 | Ceiling insulation | | | | |
| 3.4.9 | Wall insulation | | | | |
| 3.5.1 | Floor construction and loading | | | | |
| 3.5.2 | Floor insulation | | | | |
| 3.5.3 | Floor matting | | | | |
| 3.5.4 | ANSI/ASTM D-178 Rubber Matting | | | | |

| Section | Criteria | Comply | Do Not Comply | N/A | Notes / Comments |
|---|---|---|---|---|---|
| 3.6.1 | Drop down piers | | | | |
| 3.6.2 | Separate piers | | | | |
| 3.7.1 | Wall Plywood | | | | |
| 3.7.2 | Acid resistant paint | | | | |
| 3.7.3 | Wall loading | | | | |
| 3.8.1 | Ceiling insulation and plywood | | | | |
| 3.8.2 | Ceiling plywood | | | | |
| 3.9.1 | Cable chutes | | | | |
| 3.9.2 | Cable chute slots | | | | |
| 3.9.3 | Cable entrance conduits | | | | |
| 3.9.4 | Cable entrance sealing | | | | |
| 3.10.1 | LIGP construction | | | | |
| 3.10.2 | LIGP support | | | | |
| 3.10.3 | Plastic wireway | | | | |
| 3.10.4 | Aluminum backplane AAR terminals | | | | |
| 3.10.5 | LIGP bonding | | | | |
| 3.10.6 | Bakelite through-hole terminals | | | | |
| 3.10.7 | LIGP aluminum strips | | | | |
| 3.10.8 | AREMA terminal strips | | | | |
| 3.10.9 | LIGP terminal column numbering | | | | |
| 3.10.10 | LIGP terminal column lettering | | | | |
| 3.11.1 | Entrance and cable access doors | | | | |
| 3.11.2 | Door seals and gaskets | | | | |
| 3.11.3 | Size of doors | | | | |
| 3.11.4 | Operation of doors | | | | |
| 3.11.5 | Door hook | | | | |
| 3.11.6 | Door construction | | | | |
| 3.11.7 | Door rain channel | | | | |
| 3.11.8 | Door grounding | | | | |
| 3.11.9 | Extra cable access door | | | | |
| 3.11.10 | Door position monitoring switch | | | | |
| 3.11.11 | Entrance door position | | | | |
| 3.11.12 | Entrance door hinges | | | | |
| 3.11.13 | Entrance door vent | | | | |

| Section | Criteria | Comply | Do Not Comply | N/A | Notes / Comments |
|---|---|---|---|---|---|
| 3.11.14 | Entrance door latch and handles | | | | |
| 3.11.15 | Door locking system | | | | |
| 3.11.16 | Stainless steel plates | | | | |
| 3.11.17 | Cable access door locking | | | | |
| 3.12.1 | Natural ventilation system | | | | |
| 3.12.2 | Natural convection ventilation system | | | | |
| 3.12.3 | Dust filters and retainers | | | | |
| 3.12.4 | Bird screen | | | | |
| 3.12.5 | Adjustable damper | | | | |
| 3.12.6 | Vent material | | | | |
| 3.12.7 | External HVAC unit | | | | |
| 3.12.8 | External HVAC unit requirements | | | | |
| 3.12.9 | External HVAC OHSA and ASHRAE 55 | | | | |
| 3.12.10 | External HVAC unit control | | | | |
| 3.12.11 | External HVAC cooling sizing | | | | |
| 3.12.12 | External HVAC heating sizing | | | | |
| 3.12.13 | External HVAC calculations | | | | |
| 3.12.14 | External HVAC control | | | | |
| 3.12.15 | External HVAC cage | | | | |
| 3.12.16 | External HVAC monitoring system | | | | |
| 3.13.1 | Quality of wire tray | | | | |
| 3.13.2 | AREMA, CSA, OESC, ESA | | | | |
| 3.13.3 | Wire tray construction | | | | |
| 3.13.4 | Wire tray installation | | | | |
| 3.13.5 | Adjustable and lockable wire trays | | | | |
| 3.14.1 | Battery tray requirement | | | | |
| 3.14.2 | Battery tray construction | | | | |
| 3.15.1 | General AC wiring requirements | | | | |
| 3.15.2 | Load center requirements | | | | |
| 3.15.3 | SSD requirements | | | | |
| 3.15.4 | Crossing power off light requirements | | | | |
| 3.15.5 | LED lighting requirements | | | | |
| 3.15.6 | House external grounding requirements | | | | |
| 3.15.7 | Generator connection requirements | | | | |

| Section | Criteria | Comply | Do Not Comply | N/A | Notes / Comments |
|---|---|---|---|---|---|
| 3.15.8 | Crossing test box requirements | | | | |
| 3.15.9 | Load center connection | | | | |
| 3.15.10 | Grounding buss bar | | | | |
| 3.15.11 | Low voltage wiring requirements | | | | |
| 3.16.1 | Suitable documentation shelf | | | | |
| 3.16.2 | Lifting and hoisting requirements | | | | |
| 3.16.3 | Lifting and hoisting specifications | | | | |
| 3.16.4 | Data plate requirements | | | | |
| 3.16.5 | Sticker installation requirements | | | | |