



WEST TORONTO COMMUNITY HEALTH SERVICES (WTCHS)

**West Toronto Community Health Centre (WTCHC) – 209 Mavety St.
HDR Architecture Associates Inc. Project No.: 10355669
WSP Project No.: 221-11662-00**

ISSUED FOR ELECTRICAL ADDENDUM, ADD-E03

October 21st, 2024

INCLUDE IN YOUR BID AMOUNT FOR THE FOLLOWING ITEMS OF ADDITION, DELETION OR CLARIFICATION. INDICATE IN THE SPACE PROVIDED ON THE BID FORM THAT YOU HAVE RECEIVED AND INCLUDED FOR THE REQUIREMENTS OF THIS ADDENDUM.

1. ISSUED SPECIFICATIONS

1.1 SECTION 26 32 03 NATURAL GAS GENSETS

1.1.1 Updated list of acceptable manufacturers.

1.2 SECTION 26 32 05 GENSET ENCLOSURES

1.2.1 Removed item 2.1.A.7. for transformer and breaker details. Breakers to be provided as specified in Specification Section 26 32 03.

2. ISSUED DRAWINGS

Following drawings are issued with and form part of this addendum (include for additional work and/or revisions as shown/noted):

2.1 E-300 – LEVEL B1 – POWER

2.1.1 Systems furniture connections shown.

2.2 E-303 – ROOF - POWER

2.2.1 Direct connections added for heat tracing of RTU-5 domestic cold water and condensate drain piping.

2.2.2 Approximate layout of mechanical piping shown for reference with callouts. List of piping requiring heat tracing provided.

2.2.3 Drawing Note 1 revised to include reference to mechanical drawings and heat tracing piping schedule shown on drawing M-701, issued as part of ADD-M03.



2.3 E-400 – LEVEL B1 – COMMUNICATIONS

- 2.3.1 Systems furniture connections shown with boundaries for each connection for data drop quantities.
- 2.3.2 Sound masking speakers and notes added. Refer to specifications for system details and requirements.

2.4 E-801 – ENLARGED PLANS – ELECTRICAL

- 2.4.1 120V power provided for gas detection control panel.

2.5 E-1106 – SCHEDULES – ELECTRICAL

- 2.5.1 Updated panel schedule for MRP-BEA circuiting for gas detection control panel.

END OF ADD-E03

SECTION 26 32 00 NATURAL GAS GENSETS

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Submit shop drawings for products specified in this Section, including but not be limited to following:
 - 1. engine generator set (genset) with accessories;
 - 2. genset control panel and related controls;
 - 3. integration drawings identifying various integration points of other systems of building;
 - 4. certification that proposed gensets have been prototype tested as fully integrated assembly at vendors factory and is CSA approved.
- B. Include following with shop drawings:
 - 1. full design detail drawings and layouts;
 - 2. list of components and accessories;
 - 3. details of functions and functional relationship of equipment;
 - 4. information sheets with specifications for equipment; performance data, technical data, EPA rating and details of controls;
 - 5. system configuration with single-line diagrams;
 - 6. wiring schematics;
 - 7. dimensions and weight of set and associated major components;
 - 8. electrical characteristics;
 - 9. power and performance data;
 - 10. fuel consumption data;
 - 11. point by point description of control system software sequence of operation;
 - 12. nameplate data identifying electrical characteristics including kW, kVA, V and A ratings, impedances, short circuit withstand rating, etc., as applicable;
 - 13. list of manufacturer-recommended spare parts, devices and equipment to be provided to Owner and to be kept at site in order to minimize risk and to facilitate Owner's maintenance program.

1.2 STANDARDS

- A. Gensets and associated equipment to be CSA approved with certificate of compliance, and constructed to and to perform in accordance with following requirements:
 - 1. C282-15 Emergency Electrical Power Supply for Buildings including maintenance logbook;
 - 2. Standard Z32-15 Electrical Safety, and Essential Electrical Systems in Health Care Facilities;
 - 3. CSA C22.1-15 Canadian Electrical Code, Part I and Ontario Electrical Safety Code 26th Edition/ 2015;
 - 4. CSA B149,1-15 Natural Gas and Propane Installation Code;
 - 5. C22.2 No. 100-04 (R2013) Motors and Generators;
 - 6. CAN3-C235-83 (R2015) Preferred Voltage Levels for AC systems, 0 to 50,000 V.
- B. Genset manufacturer to be certified to ISO 9001 International Quality Standard and have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.3 TYPICAL DETAILS

- A. Refer to typical details found on drawings for references to products and/or execution required in this Section.

1.4 WARRANTY

- A. Warrant (full 100% parts and labour with no deductible amounts) gensets and control system equipment in writing, to be in strict accordance with Specification and free from defects for 1 year from date of turn over

to Owner. Warranty period starts after acceptance tests and subsequent written acceptance by Consultant and after full connection to building load.

- B. Include for manufacturer/supplier's authorized technician 24 hours around clock service for onsite genset and equipment.
- C. Include with warranty, following:
 - 1. first year routine maintenance service including parts and labour;
 - 2. complete oil and filter changes at manufacturer's recommended intervals to maintain warranty validity;
 - 3. manufacturer's recommended maintenance and servicing to maintain validity of warranty;
 - 4. service and maintenance requirements as per CSA C282 and Z32.

1.5 NOISE AND EMISSIONS

- A. Genset to be provided in compliance with O.Reg 524/98 necessary technical data (environmental, noise and emissions and performance), such that genset and installation on this project is exempt from requirements in obtaining required approvals and/or certifications from and/or registration with Ministry of Environment – Climate Change – Environment Activity and Sector Registry (MOECC EASR) for generator registration.

PART 2 - PRODUCTS

2.1 ENGINE GENERATOR SETS-GENERAL

- A. Engine generator sets (gensets) to be factory assembled and tested, radiator cooled, natural gas engine driven electric gensets including necessary controls and accessories as outlined herein, to comprise a continuous, standby electric generating plant for operation in conditions stipulated below. Gensets to be equipped with necessary operating accessories such as air cleaner, radiator fan, lubricating oil pump, governor, alternating current generator and other specified and required engine driven components and accessories.
- B. Genset manufacturer to be certified to ISO 9001 International Quality Standard and have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.
- C. Gensets to include prototype testing as follows:
 - 1. Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 - 2. NFPA 110, Level 1. Equipment engine, skid, cooling system, and alternator to have been subjected to actual prototype tests to validate capability of design under abnormal conditions noted in NFPA110. Calculations and testing on similar equipment which are allowed under NFPA110 are not sufficient to meet this requirement.
- D. Base design gensets: Cummins Spark-ignited C60N6 Generator Set that complies with specification requirements and drawing requirements, and which may be customized to meet herein specified requirements.
- E. Gensets and associated equipment to be constructed to and to perform in accordance with local governing authority enforced edition of CSA Standard CAN/CSA C282, "Emergency Electrical Power Supply of Buildings". Gensets to be CSA approved type tested in vendor's plant.
- F. Gensets and associated equipment to be constructed to and to perform in accordance with local governing authority enforced edition of CSA Standard Z32, "Electrical Safety, and Essential Electrical Systems in Health Care Facilities".
- G. Where requirements of preceding standards and specification are in variance, more stringent requirement is to apply unless otherwise approved by Owner and reviewed with Consultant.
- H. Genset emissions to meet required EPA exhaust New Source Performance Standards and any other required Ministry of Environment regulations, and requirements noted above.

- I. Gensets and associated equipment to comply with mechanical systems base design parameters (ie. fuel consumption, cooling operating data, air/exhaust operating data, etc.) to ensure that design minimum standards and performance criteria for units are met. Review room/enclosure (as applicable) dimension and layouts and ensure that proposed gensets and associated equipment can be accommodated and also allow for sufficient space for maintenance, repairs, and safety as per applicable code requirements. Advise Consultant of any changes due to manufacturer's changes in equipment, and/or changes in manufacturers. Be fully responsible for provision and co-ordination of a designed solution that can meet design intent, space limitations, and performance requirements with no additional costs to Contract. Co-ordinate changes with Mechanical Division, as required.
- J. Genset driven radiator fan is capable of overcoming a minimum of 0.75" water column pressure drop in an ambient temperature of 50°C (122°F). Review complete air intake and exhaust system design with regards to air restrictions and if required, provide oversized fans with blades of extra strength to overcome additional pressure drop through fresh air intake, discharge silencers, and other related factors, as applicable. Identify clearly on shop drawings that this requirement has been met.
- K. Where eventual supplied genset(s) provides performances that are different from base designed genset, and such differences exist only due to differences in product manufacturers, be responsible for providing required revisions, i.e. increasing sizing of exhaust piping, air dampers, etc. At shop drawing submission stage, submit detailed genset performance data to Mechanical Division Contractor to confirm mechanical equipment sizing and to make necessary revisions. Be responsible for costs for such revisions.
- L. Genset ratings:
 - 1. Rating of engine generator is as noted on drawings, which is at 0.8 power factor and includes 10% overload.
 - 2. Rating to be nameplate rating.
 - 3. Capable of operating at 100% of nameplate rating at rated RPM in an ambient temperature of 50°C (122°F) without overheating, or suffering any other detrimental effects, at rated generator RPM when set is equipped with all necessary operating accessories.
 - 4. Capable of handling a single full load step for nameplate kilowatt rating within voltage and frequency regulation requirements of CSA 282/CSA Z32 without stalling and without voltage dropping below 60% of nominal.
- M. Genset to meet frequency and voltage performance requirements specified in CSA 282/CSA Z32.
- N. Gensets and associated equipment to be fully integrated to comprise a standby power system which automatically functions as follows:
 - 1. start in event of a commercial power failure;
 - 2. stop when commercial power has been restored;
 - 3. be capable of operating at light loads for an extended period of time as normal power failure may occur when only part of full output of genset is required.
- O. Moving parts such as flywheels, pulleys, belts, etc., and on hot parts such as manifolds and extending up to and including flexible exhaust pipes, to be enclosed with suitable guards to protect persons from injury. Guards to be easily removable for servicing equipment and are to comply with local governing authority and code requirements.
- P. Genset supplier to obtain torsional approval of entire assembly from engine manufacturer. Align and mount genset on a common fabricated steel base of sufficient rigidity to maintain adequate alignment. Genset manufacturer to supply adjustable steel spring vibration isolators. Include also for seismic restraints to comply with local governing authority and code requirements. Provide torsional vibration analysis and critical vibration analysis of genset and submit results to Consultant.
- Q. Genset manufacturer to review engine exhaust system design and confirm in writing that back pressure will not impair operation and output of sets. Forward a copy of confirmation letter to Consultant.
- R. Genset supplier is responsible for but not limited to provide following:
 - 1. genset(s) and control panels;
 - 2. enclosure as specified in Section 26 32 05;
 - 3. system sequence of operation complete with software;

4. coordination with other trades and systems to ensure proper integration;
 5. exhaust system silencer and ancillary piping and connectors to engine;
 6. genset and full systems demonstration, testing and verification work;
 7. operating and maintenance instructions.
- S. Arrange for genset supplier to review electrical distribution system and ensure that genset grounding provisions are compatible and meet local governing electrical code requirements.

2.2 ENGINES

- A. Engines to be a multi cylinder, 4-cycle, engine capable of operating at a nominal speed of 1800 RPM when directly connected to generator and free from critical vibrations throughout its entire operation range. Engines to operate satisfactorily on natural gas fuel and produce specified rated output.
- B. Engines to be complete with inter changeable cylinder heads, exhaust valves constructed of special alloy steel, and stellite faced exhaust valve inserts. Lubricating systems to be full pressure oiling type through internally mounted, high capacity, positive displacement type gear pumps with adjustable pressure regulators, lubricating oil cooler and full flow oil filters. Full pressure lubrication to be provided to main bearings, connecting rod bearings and camshaft bearings.
- C. Provide drain canisters on air boxes for engines.
- D. Equip engines with an electronic governor with speed control and magnetic pick up assembly capable of maintaining speed and voltage regulation within limits previously specified. Electronic governor to be of type recommended by genset manufacturer to provide performance to suit specific application.
- E. Equip engines with 12/24 volt D.C. electric starting motors, with starting pinion arranged to disengage automatically when respective engine starts.
- F. Equip engines with individual safety devices to shut down engine and to sound an alarm in event of conditions specified later in this Section. Provide contacts to pre-alarm for conditions specified later in this Section. Refer to control panel requirements specified elsewhere in this Section and requirements as detailed on drawings for additional requirements. Provide sensors to connect to electronic controls to monitor and display various engine performance characteristics.
- G. Filters on air intake to engine are of dry vortex type with replaceable elements.
- H. Integral shock isolated mounted emergency lock out stop pushbutton, oil temperature gauge, oil pressure gauge and engine coolant temperature gauge are provided on engine.
- I. Engine mounted accessories are readily removable without dismantling engine alternator, or any other accessories.

2.3 ALTERNATORS

- A. Alternator features include following:
1. voltage rating as noted on drawings;
 2. drip proof, single bearing and close coupled to engine with an SAE housing;
 3. 2/3 pitch;
 4. maximum total harmonic distortion of voltage waveform is not to exceed 6.0% under any given load;
 5. excitation boost not less than three (3) times rated current for 10 seconds;
 6. direct connected brushless exciters; rotating brushless permanent magnet pilot exciter to provide power via automatic voltage regulator to main exciter, and with dynamically balanced rotor permanently aligned to engine by SAE flexible disc coupling;
 7. full amortisseur windings;
 8. windings of Class H rating;
 9. temperature rise not to exceed 130C° as measured by resistance in an ambient temperature 50°C (122°F);
 10. meet or exceed CSA 22.2 No. 100, EEMAC MG 122 and current IEEE Standards;
 11. grounding provisions to suit electrical distribution system.

- B. Extension boxes on alternators to be of sufficient size to accommodate connection cabling and a current sensor for ground fault protection as specified in control panel hereinafter. Connection boxes to be manufactured to isolate cable extending from set and prevent transmission of vibration. Cable is generally as sized on drawings, but in absence of direction, size conductors in coordination with genset supplier to suit application and local governing electrical code requirements.
- C. Voltage regulation systems are to maintain regulation within limits previously specified and include regulator and manual voltage adjustment potentiometer. Regulator to be static voltage regulator with 3 phase sensing, radio suppression module, frequency choke to prevent damage to voltage regulator in case of lower than nominal engine speed, and adjustable stability circuit. Regulator to be as recommended by genset manufacturer.
- D. Equipment is designed to minimize Radio Frequency Interference (RFI) under all operating conditions. "Balanced Telephone Influence Factor" (TIF) is not exceed fifty (50).
- E. Alternator is equipped with Resistor Temperature Detectors (RTD) type thermistors complete with required relays/contacts as required to send trouble signal to control panel. Control panel to monitor warning signal of high temperature of windings.

2.4 ENGINE FUEL SYSTEM

- A. Provide suitable fuel gas pressure regulator, strainers, air/gas control valve, gas pressure monitoring devices with auxiliary contacts, turbo charger, throttle body, gas valve train and rack. Fuel system shall be plumbed to genset skid base for ease of site connections. Exact type/rating/sizing and manufacturers of components to be as recommended by genset vendor to suit specific applications and in compliance with requirements of local governing codes and authorities.
- B. Provide flexible connectors with braided stainless steel covering, diameter to suit engine requirements. For each genset provide two (2) natural gas flexible connectors, diameter to suit engine requirements and minimum 900 mm (36") long.

2.5 JACKET COOLANT HEATERS

- A. Engine jacket coolant heaters to be complete with silicone hoses, immersion type thermostats, pressure switches and ball type-isolating valves on engine water connections. Size of heaters to be sufficient to maintain coolant in engine at genset manufacturer's rated temperature requirements with unit operating at rated loads and conditions (approximately 6 kW, per engine at 208 V, 1-phase, but confirm with genset vendor and revise to suit).
- B. Jacket heaters to be automatically disconnected when engines are running via oil pressure switches/engine run relay.
- C. Heaters to be KIM "Hotstart" or approved equal, that connect to each engine with high temperature coolant silicone hoses and clamps, specifically used for and approved by governing authorities for such applications.

2.6 COOLING SYSTEM

- A. Cooling system for engines consists of unit mounted air water radiator system with protective screen and a 50% water/50% ethylene glycol coolant solution. Radiator system is equipped with power conductors, control conductors, and ancillary devices as required.
- B. Thermostat maintains coolant temperature at manufacturer's rated temperature with genset operating at rated load. Size radiator to maintain these conditions and provide complete with high performance static pusher fan, fan motors, radiator core guard, duct adapter flange, mounting frame, expansion tank, thermostatic controls, disconnect switch, a suitable open mesh fan guard and shroud.
- C. Gate drain brass ball valves are provided for draining coolant from each engine block and radiator. Wire braided hoses, piping and fittings to be silicone and are to extend into drain containment pan under genset.

2.7 STARTING SYSTEM

- A. Supply a complete starting system for engine, including:
 - 1. cranking starter motors;

2. batteries;
 3. battery heater;
 4. battery stand with insulation board;
 5. battery cable;
 6. battery chargers;
 7. cranking motor cut-out switch (crank for three (3) attempts with intervening periods during a period of no less than 45 seconds and no more than 75 seconds).
- B. Batteries features include:
1. fully sealed, long life lead acid;
 2. Exide, Delco or Surette with sufficient capacity in an ambient room temperature of 0°C (32°F) to crank each unit at engine manufacturer's recommended cranking starting speed for a period of 60 seconds;
 3. voltage measured at starting motor terminals at end of cranking period specified above, with cranking current flowing, to not be less than 1.75 volts per cell;
 4. sized on basis of engine and battery manufacturer's published data;
 5. type and performance ratings as recommended by genset supplier and approved by Owner and reviewed with Consultant to best meet starting requirements of specified genset.
- C. Submit shop drawings and reasons to substantiate choice of batteries.
- D. Batteries to be provided on floor standing, corrosion resistant finished, steel rack, complete with following:
1. manufacturer's recommended maintenance parts and tools;
 2. jumper cables;
 3. mounting bracket for accessories;
 4. plywood base;
 5. PVC tray.
- E. Battery chargers to be Mechtron, Vulcan Electric Ltd. or equivalent as recommended by genset supplier, with features as follows:
1. remote wall mounting, totally enclosed enclosure;
 2. fully automatic operation;
 3. operating voltage of 115 volt, 60 cycle AC;
 4. AC switch and overload protection isolating voltage ratio transformer, silicon controlled rectifier assembly and DC protection, all suitable for two (2) rates of charging (trickle charge and high rate of charge for use after engine start);
 5. DC ammeter and DC voltmeter gauges, each with 2% accuracy;
 6. AC power "on" indicating light;
 7. AC power failure alarm;
 8. float voltage adjustment;
 9. equalize circuit;
 10. overload protection;
 11. DC output protection;
 12. maximum charge rate to suit application;
 13. necessary contacts for connection of common alarm signal to control system.
- F. Battery chargers to recharge a battery discharged by two cranking cycles (30 seconds each) to 80% of capacity within 4 hours and to full capacity in maximum 12 hours.

2.8 ENGINE GENERATOR MOUNTINGS

- A. Engine flywheel housing to be connected rigidly to generator housing with SAE adaptor. Unit to be mounted on common, heavy duty, stress relieved, fabricated steel baseplate. Obtain torsional approval report of entire assembly from genset manufacturer and submit copies to Consultant. Report to also outline critical speeds of assembly.
- B. Baseplates to be of sufficient rigidity to maintain alignment of engine generator shafts and frames under all conditions during shipping, installation and service and be of all welded construction without bolt on components.

- C. Engine generator feet and baseplate sole plates to be machined parallel and true. Shimming to be of steel type and only be permitted underneath generator feet.
- D. Baseplate to be supported on suitable type vibration isolators meeting specific applications. Isolation efficiency to not be less than 95%. Provide Kinetics or equivalent Korfund type to suit specific application as per genset manufacturer's recommendations. Typically, isolators to be strategically located in a manner to ensure that each isolator will carry an equal portion of weight and that pressure exerted on structure by each isolator does not exceed 345 kPa (50 psi). Review exact requirements with genset manufacturer and provide vibration isolators and seismic restraints to meet requirements of Specification.
- E. Comply with local governing authority and code requirements with regards to applicable seismic restraints. Provide necessary materials and certification by local authority and submit to Consultant.

2.9 UNIT MOUNTED CONTROL PANELS

- A. Control panels consist of a microprocessor based controller with LCD displays featuring multiple metering displays and graphics, with full options and features as specified herein, and is suitable for operating on system voltage rating noted on drawings, with short circuit capacities to suit maximum short circuit output of alternator.
- B. Control panel in enclosure is unit mounted on I-beam support base, vibration isolated from genset, and is complete with monitoring devices, meters, indicators, display, and interconnecting/interfacing devices. Digital metering and displays are mounted at eye level. Control panel enclosure is painted with enamel to match genset finish.
- C. Controls and monitoring include but are not be limited to following components:
 - 1. under frequency/over voltage control module with adjustable relay to trip main breaker on settings of $\pm 12\%$ of normal;
 - 2. ammeter $m \pm 1\%$ accuracy;
 - 3. voltmeter $\pm 1\%$ accuracy;
 - 4. power factor meter;
 - 5. frequency meter $\pm 1\%$ accuracy;
 - 6. elapsed time $\pm 1\%$ accuracy;
 - 7. engine gauges for oil temperature, oil pressure and engine coolant temperature;
 - 8. kW meter $\pm 1\%$ accuracy;
 - 9. control system to initiate genset starting and stopping sequence, and annunciate any fault condition (local or remote indication); electronic control module monitors and provides digital display of genset functions; an operator interface alpha numeric display provides for viewing of genset data and provides setup, controls and adjustments; a LED bar graph AC data display or approved equivalent is included;
 - 10. engine selector switch for "OFF AUTO MANUAL" operation; operation of engine in manual position, when selected, bypasses automatic control system and causes an alarm to occur; switch in "OFF" position causes an alarm to occur; switch in either "OFF" or manual position causes amber indicator lamp identifying "NOT IN AUTO" to illuminate when alarm occurs;
 - 11. alarm horn with silencing button, and an annunciator to flash when any audible alarm is silenced until trouble has been cleared and reset;
 - 12. miscellaneous controls as shown on drawings and as required including voltage and speed control, emergency stop, fault reset, lamp test, engine start, engine stop and indicating lights;
 - 13. engine alarm and shut down lamps with signals for conditions specified later in this Section and/or as shown on drawing and as required by local governing authorities having jurisdiction; provide engraved lamacoid identification nameplate for each lamp; provide panel with lamp test button;
 - 14. required secondary and control wiring, type "TEW" 105°C rated, extra flexible wire with thermoplastic insulation and an overall flame retarding cotton braid, neatly harnessed, suitably secured and identified with slip on identification markers; Wiring to be colour coded to suit application and standards; Note that wiring for DC supply to control panel, wiring for cranking circuits and wiring for air box damper to be minimum number 10 AWG stranded; wiring within control panel to be number 16 AWG stranded; and wiring between control panel and engine

- generator set and transfer switch to be number 14 AWG stranded; provide separate junction boxes for AC and DC wiring;
15. ground fault relay to alarm on control panel in event of ground fault on windings of generator; current sensor mounted in generator connection box, and generator leads to pass through zero sequence circuit in connection box ; no internal ground connection in generator is permitted, and annunciator light provided on control panel face to indicate operation of this device; ground fault setting to be determined by genset manufacturer to suit specific application;
 16. current transformers as required of appropriate size for local metering;
 17. current transformers as required for electronic governor;
 18. 24 volt DC control system with all fusing centrally located;
 19. required potential transformers;
 20. auxiliary contacts on devices to allow for functions required in controls system and interconnection to integrated systems such as fire alarm and building automation system;
 21. other components as shown on drawings and as required.
- D. Breakers mounted in control panel integral with genset include following features:
1. moulded case type main breaker: fixed mounted moulded case circuit breaker as required, and where frame size exceeds 225 A, to be complete with solid state adjustable trip unit; in absence of direction, size and ampacity of breaker to be to suit application based on code requirements and genset manufacturer's recommendations; breaker setting to be such that generator short circuit output will trip breaker; trip unit to include adjustable long, short, instantaneous, time delay and ground fault alarming; exact settings to be determined by genset manufacturer to meet specific applications; exact breaker type to be as recommended by breaker and genset manufacturer to meet such applications and be reviewed with Consultant prior to ordering;
 2. moulded case load bank breaker: type and frame size as main breaker, to be provided interconnected to system to allow for connection of a load bank during regular testing of genset; provide shunt trip and relays as required to interconnect in manner such that if load bank breaker is closed and loss of normal power occurs, load bank breaker will open and main genset breaker will close; exact breaker type to be as recommended by breaker and genset manufacturer to meet such applications and be reviewed with Consultant prior to ordering;
 3. refer to drawings for additional requirements.
- E. Electronic controls to monitor various engine performance characteristics including, but not limited to, following:
1. oil temperature;
 2. timing of engine;
 3. coolant pressure and level;
 4. oil and fuel pressure;
 5. running hours;
 6. air temperature;
 7. battery voltage;
 8. engine overspeed.
- F. Provide controls, contacts and annunciation of shut downs (red) and warnings (amber) alarms for following conditions, conditions as per applicable CSA Standards and conditions as detailed on drawings:
1. high oil temperature – red;
 2. high oil temperature warning – amber;
 3. high coolant temperature – red;
 4. low oil pressure warning – amber;
 5. low oil pressure – red;
 6. overcrank – red;
 7. overspeed – red;
 8. over voltage – red;
 9. low DC voltage – amber (alarm lamp complete with DC voltage sensor);
 10. cool down period – white;
 11. reverse power – red;
 12. undervoltage – red;

13. low frequency – red;
 14. high frequency – red;
 15. low coolant level – amber;
 16. low fuel pressure – amber;
 17. gas supply valves isolated – amber;
 18. battery charger failure – amber;
 19. emergency bus alive – blue;
 20. generator bus alive – amber;
 21. ECS not in auto – amber;
 22. low engine temperature – amber;
 23. alarm silence – amber;
 24. alternator winding and bearing high temperature – amber;
 25. ground fault – amber;
 26. genset main breaker open - amber;
 27. automatic transfer switch in non-auto or bypass mode – amber;
 28. combustion air intake damper does not open to 85% after 30 seconds - amber;
 29. air shutdown damper (if applicable) – amber;
 30. ventilation dampers not open – amber;
 31. remote emergency stop station (if provided) – amber;
 32. ancillary building alarms as required;
 33. two spares for future.
- G. Utilize high brilliant cluster type LED's for indicating lights that are continuously illuminated "ON".
- H. Provide required type of contacts, wiring and connections to auxiliary building systems for applications as noted in Part 3, and for connections to remote annunciators where required.
- I. Provide engraved lamacoid nameplate of each control operator, device and indicating light. Review with Consultant exact nomenclature prior to ordering.
- J. Designer/manufacture of entire control system is required to:
1. supply complete design, erection and layout drawings for system, indicating all wiring requirements, interfacing or interconnection provisions required to completely integrate controls with all remote apparatus;
 2. assemble, wire and pre-test system components prior to shipment to site; such tests to be witnessed by Consultant at Consultant's discretion; defects noted and corrected, and system retested prior to leaving plant;
 3. assist in installation and oversee work to ensure that it meets with requirements;
 4. carry out a site test of system in conjunction with other components in standby power system and demonstrate its power operation to satisfaction of Owner and reviewed with Consultant.

2.10 ADDITIONAL ENGINE GENERATOR SET REQUIREMENTS

- A. Provide type of wiring conductors, terminations and ancillary devices, and other requirements necessary to fully install and connect integrated components and accessories. Applications include for power, control, signaling and integration. Confirm exact requirements with genset vendor. Provide fire rated conductors for specific applications of life safety and other similar applications. Products and work to be in accordance with genset vendor's instructions and requirements, requirements of local governing codes and local governing authorities, and applicable CSA Standards.
- B. Nameplates/Labelling:
1. Provide identification painting, engraved lamacoid nameplates, labelling, and warning signage to Owner's requirements and reviewed with Consultant. Identify each component on panels, piping, conduits, etc.
 2. Provide ULC listed labels clearly identified for components and in locations to approval of local governing authorities and TSSA.
- C. Supply loose with engine generator set, a soldered galvanized steel drip pan to be placed beneath engine to catch any leakage from set.

- D. Supply tools and spare parts required for normal maintenance and adjustment of genset, including:
 - 1. one complete set of lubricating oil filter elements complete with gaskets;
 - 2. one complete set of air filters;
 - 3. two complete sets of spare fuses;
 - 4. two complete sets of spare lamps for all indicating and warning lights;
 - 5. one complete set of spare belts;
 - 6. other manufacturer's recommended spare parts;
- E. Submit sound pressure levels for engine generator set to Consultant, prior to units being shipped to site.
- F. After on-site successful testing, touch up paint genset(s) with manufacturer's supplied paint. Ship loose to site additional one litre of touch up paint for each genset and turn over to Owner. Paint control panel with corrosion resistant enamel paint to match genset finish. Review exact finishes with Consultant prior to ordering of paint.
- G. Genset manufacturer/supplier is responsible for factory testing and on-site testing of genset, as specified in Part 3 of this Section.
- H. Include provisions to duct/drain/filter all waste emissions/leaks, to satisfaction of Owner and reviewed with Consultant. Under no circumstances are waste emissions or waste fluids to be released into room. Provide proper ducting/piping/filtering.

2.11 REMOTE ANNUNCIATOR PANEL

- A. Remote annunciator panel provides visual and audible indication of separate alarm or status conditions, based on discrete (relay) inputs or network inputs interconnected to genset control panel.
- B. Features as follows:
 - 1. CSA approved, ULC listed and labelled;
 - 2. Visual and audible warnings of up to 20 separate alarm or status conditions in accordance with NFPA and CSA C282, and in addition provide indications for high battery voltage, low battery voltage, loss of normal power to charger; include minimum 4 spare lamp zones to allow future addition of other alarm and status functions; review exact alarm and status conditions with Consultant prior to ordering;
 - 3. Configurable LED colour (red, yellow, or green) and selectable horn operation;
 - 4. Labelling, field configurable for other alarm status and conditions;
 - 5. Alarm horn switchable for all annunciation points. Alarm horn (when switched on) to sound for first fault, and all subsequent faults, regardless of whether first fault has been cleared;
 - 6. Alarm silence and lamp test switch;
 - 7. Sealed membrane panel design provides environmental protection for internal components and is easy to clean;
 - 8. Surface mount enclosure.

2.12 TESTING, START-UP, VERIFICATION AND TRAINING

- A. Refer to Part 3 for additional requirements.
- B. Assist installing Contractor in installation of equipment and to inspect installation, test equipment, perform start-up and verify equipment. Coordinate work with Contractor.
- C. Be present to assist during third party testing and commissioning.
- D. Perform testing at times reviewed with Consultant.
- E. Provide instructions on system operating and maintenance.

2.13 ACCEPTABLE MANUFACTURERS/SUPPLIERS

- A. Selected engine-generator sets to be provided from listed approved genset suppliers and be packaged sets that are factory assembled, factory type tested and warranted together.
- B. Acceptable genset suppliers are:
 - 1. Cummins Eastern Canada LP;

2. Toromont Cat. Ltd.;
 3. WAJAX Power;
 - 3.4. Total Power Ltd.
- C. Acceptable alternator manufacturers are:
1. Newage Stamford;
 2. Caterpillar;
 3. Marathon;
- D. Acceptable engine manufacturers are:
1. Cummins;
 2. Caterpillar;
 3. MTU-DDC;
 4. Ford;
 5. General Motors;
 - 5.6. Generac.
- E. Acceptable instrument manufacturers are:
1. Crompton Instruments;
 2. Basler;
 3. Yoko-gawa.
- F. Main breakers must be of same manufacturer as accepted switchboard supplier of Section entitled Secondary Switchboards to maintain continuity of supply for standardization.
- G. Products to be provided must be CSA approved and labelled, or inspected and approved by Electrical Safety Authority.

PART 3 - EXECUTION

3.1 INSTALLATION OF GENSETS AND ENCLOSURES

- A. Provide gensets and enclosures as specified and detailed. Refer to drawing details and notes for additional requirements. Refer to Section 26 32 05 for enclosure requirements and installation requirements. Perform required installation work and coordinate work between trades.

3.2 TESTING REQUIREMENTS FOR GENSETS

- A. Perform factory test of engine generator sets prior to delivery to job site. Include for and arrange for Owner and Consultant to witness factory tests and schedule tests at time acceptable to Owner and Consultant. Include "out of town" expenses such as transportation, lodging, meals, etc., for Owner and Consultant to witness factory testing. Notify Owner and Consultant at least two weeks in advance of tests. Should additional tests be required due to failure to comply with conditions specified in this article, costs (all travel expenses, accommodation if required, plus seven hundred and fifty dollars [\$750.00] per day) for Consultant to witness these additional tests are to be borne by genset manufacturer/supplier. Genset manufacturer/supplier to be responsible for full arrangements. Tests to include period(s) of minimum 4 hours continuous operation under full load conditions as directed by Consultant. Number of periods of testing to be quantity as required until successful testing of specified requirements to satisfaction of Owner and Consultant. Ensure that proper 100% capacity resistive type artificial load banks are available for tests. Factory testing to include use of strip chart recording instruments to confirm that engine generator set complies to all specified requirements in frequency, voltage and current regulation as specified herein this Section. Submit reports for Consultant's review and obtain Owner's approval prior to shipping gensets to site.
- B. Notify Owner and Consultant minimum 2 weeks in advance of onsite testing. Under direction and in presence of Owner and Consultant, genset manufacturer's authorized technician to provide tests at site on genset and associated equipment when installation is complete, but before acceptance of same. Coordinate with independent distribution system testing company specified in article entitled, "Distribution System Testing and Coordination Study," in Section entitled Electrical Work Testing, to ensure that engine generator set performs with emergency power distribution system in accordance to requirements of all

applicable CSA Standards. Refer to and provide additional applicable testing requirements of distribution system testing and coordination study article.

- C. Coordinate and arrange for manufacturer's trained mechanic to conduct such tests and to make all required changes and adjustments found necessary by such tests. Repeat tests until all defects are corrected and equipment operates properly to Consultant's satisfaction. Perform general operational testing and other testing as per CSA Standards and requirements herein specified. Perform full load test, which is to include period(s) of minimum 4 hours continuous operation under full load conditions as reviewed with Consultant. Number of periods of testing to be as required to successfully demonstrate that genset and associated equipment complies with specified parameters to satisfaction of Owner and reviewed with Consultant. Perform initial testing with load banks. Perform testing with building loads when approved by Owner and reviewed with Consultant.
- D. On site testing to be performed at times acceptable to Owner and reviewed with Consultant. Be responsible for costs of additional testing due to failure of genset to perform to specified standards, with additional expenses in effect as specified previously for factory testing. Supply variable load banks and connecting cables, sized for 100% capacity of plant, for testing procedure indicated herein.
- E. Include for license electrician to be on site for testing, verification and commissioning Work, to make any required distribution system changes necessitated by Work. Arrange for genset supplier's controls contractor to be present for testing and commissioning.
- F. Upon completion of installation of equipment, by Contractor, equipment manufacturers to inspect installation of each complete equipment assembly and certify in writing satisfactory installation and operations of same, to Owner. Submit detailed list of deficiencies to Consultant.
- G. Equipment manufacturers to include for site visit to inspect, test, perform start-up, and verify installation to ensure that installation and Contractor is in compliance with Contract Documents.
- H. Obtain approvals from local governing authorities including Technical Standards and Safety Authority (TSSA).
- I. Upon acceptance of genset power plant, arrange for manufacturer's technician to instruct Owner's operating personnel in correct operation and maintenance of plant. Provide DVD recording of such instruction.
- J. Perform test procedures in accordance with test sheets found at end of this Section. Submit reports signed and bound to Consultant using these typical sheets.
- K. In addition to requirements specified in this Section, refer to requirements of Section entitled Electrical Work Analysis and Testing.
- L. Following are general typical guidelines for testing of gensets and controls. Review exact requirements with Consultant and Commissioning Agent prior to start of Work. Additionally, contact genset manufacturer and obtain their recommended testing procedures for specific gensets of this Project. Coordinate with genset supplier.
- M. Operational Tests:
 - 1. With engine in a "cold start" condition and emergency load at its normal operating level, simulate a power failure by means acceptable to Consultant. Do not interrupt existing services unless approved in writing by Owner and reviewed with Consultant. Test load to be load which is normally served by emergency power system. Unless instructed by or approved in writing by Owner and reviewed with Consultant, do not use building loads for testing. Provide variable load banks sized for loads as required.
 - 2. Continue operational test for 1 hour, after which time, restore normal power and demonstrate satisfactory transfer of load and shutdown of emergency generating sets.
 - 3. Observe and record following:
 - a. time delay on start;
 - b. cranking time until engine starts and runs;
 - c. time required to come up to operating speed;
 - d. time required to achieve a steady-state condition with all transfer switches transferred to emergency position;

- e. voltage, frequency, and amperes at start-up and at any observed change in load;
 - f. engine oil pressure, water temperature where applicable, and battery charge rate at 5 min intervals for first 15 minutes and at 15 minute intervals thereafter;
 - g. time delay on retransfer for each transfer switch;
 - h. time delay on engine cool down and shutdown;
 - i. check and test operation of engine starting system, and jacket coolant heaters.
4. Full Load Test:
- a. Following operational test, subject genset to a 4 hour 100% load test.
 - b. Provide variable load bank for testing, unless use of building load is permitted in writing by Owner and reviewed with Consultant.
 - c. Full load test may be initiated by any method that will start engine and, immediately upon reaching its rated speed, pick up full load in one step.
 - d. Record data for items listed above, at first load acceptance and every 15 minutes thereafter until completion of test period.
5. Cycle Crank Test:
- a. Prevent engine from running by utilizing any method recommended by manufacturer. Place control switch in "run" position to cause engine to crank.
 - b. Engage engine starting system to provide a cranking cycle consisting of:
 - 1) 30 seconds of continuous cranking; or
 - 2) three (3) 10 seconds crank attempts separated by 10 seconds rest periods;
 - 3) repeat crank cycle a second time to demonstrate that batteries have sufficient capacity for a total cranking time of 60 seconds;
 - 4) demonstrate time required to recharge batteries to meet requirements.
6. Safety Shutdown and Alarms:
- a. Test gensets as recommended by manufacturer and as described herein this Section to ensure that safety shutdowns and alarms are fully functional.
7. Ventilation:
- a. During testing of gensets, demonstrate that sufficient ventilation is provided for room/enclosure housing gensets, in accordance with requirements of CAN/CSA-C282.
8. Voltage and Frequency:
- a. Perform this test in accordance to CAN/CSA-C282/Z32.
9. Oil Analysis:
- a. Perform this test in accordance to CAN/CSA-C282/Z32.
10. Exhaust System:
- a. Coordinate with Mechanical Division as applicable, to perform required testing to show that performance of integrated engine with exhaust system and stack complies with Specification.
11. Final Testing:
- a. Upon approval of Owner, perform final load testing similar to requirements specified above but with building load connected. Notify Owner in writing, minimum 3 weeks prior to proposed testing and obtain permission. Final testing to be performed during non-regular business hours as approved by Owner.

3.3 EMISSIONS TESTING

- A. Coordinate for Owner's specialist noise and air emission's company to provide testing and required equipment and personnel to verify that complete genset assembly complies with air and noise emissions requirements of issued documents and of MOE. Include acoustical testing to verify sound levels during operation at full load. Perform required operating and maintenance of gensets during testing.
- B. Include for Owner approved specialist noise and air emission's company to provide testing and required equipment and personnel to verify that complete genset assembly complies with air and noise emissions requirements of issued documents and of MOE. Include acoustical testing to verify sound levels during operation at full load. Perform required operating and maintenance of gensets during testing.

END OF SECTION

APPENDIX: ENGINE-GENERATOR TEST REPORT

PROJECT:	_____	Project No:	_____
	_____	Date:	_____

OWNER:	_____		
ARCHITECT:	_____		
CONSULTING ENGINEERS:		WSP Canada Inc.	
LOCATION:	_____		

PRESENT:	_____		

ENGINE DATA:	_____	SERIAL NUMBER:	_____

A. UNIT – GENERAL

B. CONTROL PANEL – GENERAL

C. VIBRATION CONTROL

D. START-UP TIME
COLD UNIT: _____
HOT UNIT: _____

E. SAFETY DEVICES AND TIME DELAY OPERATION

SHUT-DOWN OPERATION	ALARM	BELL	LIGHT
LOW OIL PRESSURE			
HIGH COOLANT TEMP.			
OVERSPEED			
OVERCRANK			
OTHERS			
SHUT-DOWN TIME DELAY	4 MIN. AFTER NORMAL POWER RESTORED		

F. HOUR METER READINGS

START: _____
CONCLUSION: _____

G. RECORDING INSTRUMENTS (SPEED OF CHART)

1. VOLTAGE (REGULATOR) ALLOWABLE VARIATION: _____
ACTUAL VARIATION @ 0-1/4 LOAD = _____
ACTUAL VARIATION @ 0-1/2 LOAD = _____
ACTUAL VARIATION @ 0-3/4 LOAD = _____
ACTUAL VARIATION @ 0-1/1 LOAD = _____
2. FREQUENCY (GOVERNOR) ALLOWABLE VARIATION: _____
ACTUAL VARIATION @ 0-1/4 LOAD = _____
ACTUAL VARIATION @ 0-1/2 LOAD = _____
ACTUAL VARIATION @ 0-3/4 LOAD = _____
ACTUAL VARIATION @ 0-1/1 LOAD = _____
3. RECOVERY TIME _____

H. VOLTAGE ADJUSTMENT (SPECIFY):

I. EXHAUST PRESSURE:

J. GENERAL OBSERVATIONS:

K. INCOMPLETE ITEMS AND/OR DEFICIENCIES:

L. METHOD OF LOADING (SPECIFY):

TIME IN MINUTES:

LOADING

AMPS – PHASE 1

AMPS – PHASE 2

AMPS – PHASE 3

VOLTS – PHASE 1

VOLTS – PHASE 2

VOLTS – PHASE 3

FREQUENCY (HZ)

OIL PRESS. (PSI)

OIL TEMP. (°C)

WATER IN TEMP. (°C)

WATER OUT TEMP. (°C)

JACKET TEMP. (°C)

EXHAUST. TEMP. (°C)

ENGINE SPEED (RPM.)

CHARGER

POWER FACTOR

GENERATOR TEMP. (°C)

ROOM TEMP. (°C)

EXHAUST SMOKE

KW. RATING

VACUUM (GAS UNITS ONLY)

WSP Canada Inc.

Date: _____

Per: _____

END OF APPENDIX

SECTION 26 32 05 GENSET ENCLOSURES

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Submit shop drawings for products specified in this Section, including but not limited to following:
 - 1. genset enclosure;
 - 2. enclosure accessories and components;
- B. Shop drawings to include following:
 - 1. full design detail drawings;
 - 2. layouts and dimensions;
 - 3. equipment capacities;
 - 4. wiring schematics;
 - 5. integrated systems.

1.2 TYPICAL DETAILS

- A. Refer to typical details found on drawings for references to products and/or execution required in this Section.

1.3 WARRANTY

- A. Warrant (full parts and labour) entire genset enclosure and accessories, in writing, to be in strict accordance with Specification and free from defects for minimum one (1) year from date of site performance and acceptance test and subsequent written acceptance by Consultant.
- B. Above warranty requirements and issues to be provided by genset manufacturer or manufacturer's authorized genset supplier.

PART 2 - PRODUCTS

2.1 GENSET ENCLOSURE (SKIN-TIGHT)

- A. "Skin-tight" type genset enclosure to be provided to house genset complete with silencers, control panel, batteries and accessories. General features include but are not limited to following:
 - 1. outdoor, weatherproof, corrosion resistant;
 - 2. sound attenuated;
 - 3. non-combustible fire-rated construction designed to required local governing authority and code requirements;
 - 4. heavy duty aluminium or steel outer skin over heavy-duty steel framework construction and primed and finished with corrosion resistant paint finish;
 - 5. sound insulated panels;
 - 6. exhaust silencer;
 - ~~7. dry type distribution transformer and breaker panelboard, sized to accommodate loads of enclosure components requiring power feeds; factory prewired breaker panelboard to be 120/208 VAC with main breaker and branch breakers for feeding genset and enclosure components and accessories; include three (3) additional spare 15A 1P breakers installed in panel;~~
 - ~~8.~~7. locking access panels;
 - ~~9.~~8. flexible coolant and lubricating oil drain lines, that extend to exterior of enclosure, with internal drain valves;
 - ~~10.~~9. external radiator fill provision;
 - ~~11.~~10. radiator guard;
 - ~~12.~~11. heavy duty steel beam mounting base;
 - ~~13.~~12. insulated ventilation louvers and dampers;

- ~~14.13.~~ insulated enclosure with non-hydroscopic materials;
 - ~~15.14.~~ pitched roof, such that precipitation falling on roof does not drain over access doors;
 - ~~16.15.~~ corrosion resistant stainless-steel door hardware, hinges and locks;
 - ~~17.16.~~ locking compartments for storage of manuals, spare parts and tools;
 - ~~18.17.~~ warning signs;
 - ~~19.18.~~ vandal proof construction;
 - ~~20.19.~~ finish painted in colour as approved by Owner and reviewed with Consultant;
 - ~~21.20.~~ minimum one GFI duplex receptacle located inside enclosure on each side, and weatherproof GFI receptacle on outside of enclosure;
 - ~~22.21.~~ switches controlling AC powered LED lamps mounted in vapour tight and gasketed internal fixtures; also controlled with 60 minutes adjustable timer;
 - ~~23.22.~~ switched controlled vapour tight, gasketed DC light connected to main batteries; also controlled with 60 minutes adjustable timer;
 - ~~24.23.~~ external AC weatherproof and vandal proof LED type fixture with photocell control over panel access door;
 - ~~25.24.~~ thermostatically controlled forced air internal heater to keep interior temperature at minimum temperature as per CSA C282;
 - ~~26.25.~~ exhaust fan for internal high temperature heat removal from enclosure and include modulating thermostat control;
 - ~~27.26.~~ emergency power off (EPO) station consisting of minimum 38 mm (1-1/2") diameter mushroom head, mounted in weatherproof enclosure with break glass cover for emergency access and locking operator for authorized access; typically mount recessed or semi-recessed in exterior wall of enclosure at each walk-in door; lock operator to be keyed to Owner's requirements; provide "EMERGENCY POWER OFF" identification lettering; review exact nomenclature with Consultant prior to ordering;
 - ~~28.27.~~ storage cabinet for operating and maintenance manuals and spare parts;
 - ~~29.28.~~ seismic restraints as required by local governing building code;
 - ~~30.29.~~ in applications of use of dissimilar materials, include provisions to prevent corrosion.
- B. Enclosure to meet applicable codes and standards enforced by local governing authorities, including but not limited to:
1. CSA C282;
 2. ULC Standards;
 3. National Fire Protection Association (NFPA);
 4. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA);
 5. American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE);
 6. local applicable building codes;
 7. local applicable electrical codes;
 8. Ontario installation code for oil-burning equipment (Based on CSA B139, with Ontario amendments);
 9. Technical Standards and Safety Authority (TSSA).
- C. Overall exterior enclosure construction to be of galvanized steel or aluminum. Slope roof or provide means to direct precipitation landing on roof in direction reviewed with Consultant, such that precipitation drains in direction acceptable to Owner.
- D. Enclosure assembly to be designed such that genset components needing routine maintenance and servicing or replacement are easily accessible from access doors. Access doors to be locking, hinged type with retainers to hold doors open during service. Rooftop enclosures with fuel tanks to include access doors/panels sized to accommodate passage of fuel tanks.
- E. Intake and exhaust louvers to be located at height to minimize effects from flood waters and accumulated snow levels. No roof penetrations except for exhaust stack.
- F. Provide motorized intake louvers to minimize air flow through enclosure when generator set is not operating. Louvers to include provisions to prevent accumulation of ice or snow that might prevent operation. Louvers to be spring open, power close operation, as per governing local authority and code requirements.

- G. Enclosures to include weatherproof cable stub and openings for connection cabling through underside of base. Provide load bank cabling entry and temporary genset connections via openings with flexible boots behind a gasketed locking hinged door. Boots to prevent egress of any precipitation into enclosure when cables are run into enclosure. Exterior components and parts to be corrosion resistant and weatherproof. Coordinate location of cable access openings to suit structural base. Provide cable connection box with copper bussing.
- H. Sound-attenuated housing rated to allow generator set to operate at full rated load in an ambient temperature of up to 40°C (104°F).
- I. Acoustics:
 - 1. Maximum permissible sound emissions criteria for enclosure at engine full load rating to be net 72 dBA at 7m (23') including provisions for reverberations from neighbouring walls.
 - 2. Selection of silencer (muffler) to be coordinated with design of enclosure to meet sound level requirements.
 - 3. Submit with shop drawings, certification letter from a recognized acoustical authority certifying factory testing acoustical performance of enclosure housed genset, with genset operating at full load rating in accordance with specification requirements.
 - 4. Include for a qualified acoustical engineer to perform an acoustical field test during onsite genset testing, to certify performance and provide documented test report. Measure noise levels at 10 different locations as reviewed with Consultant.
 - 5. Obtain and submit required approvals from local governing authorities having jurisdiction.
 - 6. Materials of construction to be to general accepted trade standards unless more stringent requirements are required by any recent codes or regulations by local governing authorities. Ensure that most recent applicable standards are met.
- J. Provide complete grounding and bonding conductor system in compliance with code requirements, complete with conductors from equipment and exterior ground rods or for connection to main building grounding system. Refer to Section entitled Grounding and Bonding for additional grounding and bonding requirements.
- K. Engine exhaust system features are as follows:
 - 1. Engine exhaust system to be full factory installed within enclosure and consists of lengths of flexible stainless-steel exhaust pipe, flange, mounting brackets, and exhaust silencers with drain plug and other required accessories. Size length of flexible piping for thermal expansion and engine vibration and to suit enclosure height restriction. Silencers to be equivalent to SMS "Hospital Plus SM4P" series to provide high degree of noise reduction. Final selection to suit respective size of genset and to be coordinated with enclosure design to suit spacing and overall noise criteria. Both flexible pipe and silencer to be suitable in all respects for application and be as recommended by genset supplier. Acceptable manufacturers of silencers are SMS, Vibron Ltd., Nelson, and Maxim.
 - 2. Custom manufacturer heavy duty steel exhaust flange to extend from silencer to roof thimble. Exhaust system exhausts out of enclosure roof through an insulated roof thimble designed for application and with weatherproof sealed pre-fabricated flashed roof curb. Thimble to be of heavy duty galvanized steel corrosion resistant construction.
 - 3. Terminate exhaust pipe flange minimum 450 mm (18") above roof line and top with required temporary weatherproof cap. Exhaust stack stub assembly to be capable of supporting an on-site installation of a vertical exhaust stack up to 10' (3m) high. Provide guy wires as required for proper support. Interior exhaust piping to be insulated with minimum 50 mm (2") thick Rockwool type insulation suitable for application. Exact height of exhaust stack to suit MOE Certificate of Air and Noise Approval criteria coordinated with noise and emissions consultant and drawing requirements.
 - 4. Exhaust stack and piping to meet requirements of local governing technical standards and safety authority standards and other required governing authorities. Exterior vertical exhaust stack to be constructed of minimum schedule 40 rigid black steel, or double wall construction stainless steel chimneys as manufactured by Selkirk or Van-Packer. Diameter to suit genset sizing as noted and confirmed with genset manufacturer. Exhaust stack to extend to height reviewed with Consultant. Stack design and layout to prevent ingress of water/snow back into silencer and means reviewed with Consultant to drain any accumulation in exhaust piping away from enclosure. Stack in position to be

- designed to withstand anticipated wind forces and other forces of nature. Provide required supports and/or guy wiring as per stack manufacturers recommendations as coordinated with genset vendor.
5. Coordinate routing, dimensions, and configuration of exhaust system with enclosure dimension restrictions and equipment layout as detailed and as noted.
 6. Ensure that exhaust stack is positioned in location such that emissions do not become drawn into enclosure during operation. Weatherproof and seal openings in roof due to exhaust stack work.
 7. Where required to suit exhaust configuration of respective gensets, provide properly sized black steel pipe welded "Y" connector.
- L. Lightning Protection System Components and Requirements:
1. system components to be extension of roof/building system; and cover enclosure roofs and exhaust system stack; coordinate required component attachments with enclosure vendor such that installation of lightning system components do not penetrate roofs;
 2. 16 mm (5/8") diameter solid copper air terminals; of lengths to suit application;
 3. 25 mm (1") x no. 17 gauge copper grounding straps;
 4. minimum 4 ounce braided stranded copper "lightning conductor" down lead conductors;
 5. minimum 20 mm (3/4") diameter and minimum 3 m (10') long (sectionalized 1.2 m (5') lengths) circular cross section copper bond type ground rods;
 6. inspection pit with test coupling, earth equipotential bar, die cast brass connectors, die cast brass clamps and ground rods;
 7. no penetrations of enclosure: supplemental weatherproof and corrosion resistant structural steel supports / channels provided on enclosure to be utilized for fastening and securing components to enclosure without penetrating enclosure;
 8. ancillary devices as required.
- M. Fire Alarm System Provisions:
1. Enclosure to include provisions of empty conduits with fish cord and boxes for installation of future detectors and associated fire alarm devices provided by main building fire alarm vendor. Coordinate work with fire alarm vendor. Fire alarm device conduit runs to allow for Class A looped running of system wiring, extending from device boxes to termination box near enclosure wall easily accessible by Contractor for extension to main building. Provide separate conduit loop runs for each of initiating devices and for indicating devices. Coordinate work with respective vendors.
 2. Provide fire extinguishers of CO2 type, minimum 10 pounds (4.5 kg), and mounted within enclosure. Exact type of fire extinguisher to be as recommended by genset vendor to suit application. Provide mounting bracket and install on interior wall adjacent door. Include identification label on outside of door identifying location of extinguisher.
- N. Access and Security Signs, and Nameplates/Labeling:
1. Provide identification painting, engraved lamaroid nameplates, labelling, warning signage and access and security signage to Owner's requirements. Identify each component on panels, piping, conduits, etc.
 2. Provide ULC listed labels clearly identified for components and in locations to approval of local governing authorities and TSSA.
 3. Provide signage as follows:
 - a. corrosion resistant, weatherproof and resistant to fading from sunshine;
 - b. red lettering on white background;
 - c. be permanently affixed;
 - d. nomenclature to be reviewed with Consultant prior to manufacturer, but generally to read as follows:
 - 1) exterior: "AUTHORIZED PERSONNEL ONLY";
 - 2) above genset: "WARNING – KEEP OFF – GENSET MAY START AUTOMATICALLY AT ANY MOMENT".
- O. Testing, Start-up, Verification and Training:
1. Perform standard factory testing as integrated with factory witness testing of gensets specified in respective genset Sections. Test equipment and systems and verify proper operation. Document

- testing and results in reports signed by genset enclosure manufacturer's authorized technician. Submit copies of report to Consultant.
2. Onsite after installation inspection, testing, start-up, and verification to be integrated with genset testing, start-up, and verification work as specified in respective genset Sections. Assist installing Contractor in installation of equipment and to inspect installation, test equipment, perform start-up and verify equipment. Coordinate work with Contractor. Document testing and results in reports signed by genset enclosure manufacturer's authorized technician. Submit copies of report to Consultant.
 3. Be present to assist during onsite third-party testing and commissioning.
 4. Perform testing on dates and at times reviewed with Consultant.
 5. Provide instructions on system operating and maintenance.
- P. Acceptable enclosure manufacturers are as recommended by genset vendors/suppliers.

PART 3 - EXECUTION

3.1 INSTALLATION OF GENSET AND ENCLOSURES

- A. Provide genset and enclosure as specified and detailed. Refer to respective genset section for genset requirements.
- B. Prepare and submit with shop drawings, necessary design, erection and layout drawings, wiring, piping and control diagrams as required for proper execution and completion of Work.
- C. Coordinate controls work both at factory and on site and include for required interface work to equipment on site.
- D. Prior to start of Work, prepare schedule of Work and submit to Consultant for review. Manufacturer/supplier to upon successful factory witness testing of unit, arrange and coordinate delivery and transporting of unit to site.
- E. Perform testing, start-up and verification work as specified herein and in respective genset section.
- F. Provide transporting and hoisting of gensets and enclosures as required to locate into position. Coordinate responsibility and requirements with General Trades Contractor.
- G. Perform and coordinate installation requirements with requirements of respective genset specification Section. Provide components and installation in factory as required.
- H. For on grade installations: Coordinate structural base requirements for mounting of containerized genset with Structural Consultant and General Trades Contractor. Provide concrete pad as detailed on drawings. Unless otherwise detailed or noted on drawings, concrete pad to be typically of dimensions covering size of genset enclosure and extending 600 mm (2') beyond each side, and of depth to accommodate weight of entire unit with full loaded fuel. Include for seismic restraints as required.
- I. For roof installations: Coordinate structural mounting requirements with Structural Consultant. Coordinate roofing work with trades responsible for roofing. Provide required roof structural steel work to accommodate installation of containerized genset.
- J. Provide required vibration isolation and seismic restraints in accordance with Specification, Structural documents and as per local governing building code requirements. Secure genset on vibration isolation springs to its base by means of 13 mm (1/2") diameter "Rawstud" high tensile strength steel anchor bolts. Ensure that set is plumb and level. Check engine generator alignment when mounting is complete. If necessary, realign in accordance with manufacturer's recommendations.
- K. Install galvanized steel drip pan under each engine.
- L. Provide shore power feeders in conduit from dedicated breakers in panelboards in main building, serving container genset, and connect to integral power panel and devices as required. Connect feeders to panel and ensure that components and accessories that require external power are fed from panel breakers, as required. Identify breakers in panel. Make required connections to genset with suitable cabling and lugs. Refer to

notes on drawings. Applicable distribution equipment to be provided to general standards of electrical products specified in other Sections.

- M. Connect power wiring to building distribution system as reviewed with Consultant.
- N. Exterior feeders in conduit to be RWU90 or TWU in rigid galvanized steel conduit, or in rigid PVC underground, unless otherwise noted. Coordinate conductor and conduit runs with genset vendor to suit enclosure requirements.
- O. For initiating start-up upon loss of normal power of electrical distribution system, provide fire rated MI wiring from genset control panel to appropriate transfer switch contacts or to other designated loss of normal power signal as reviewed with Consultant, to initialize engine start-up upon loss of normal power.
- P. Fill radiator with a solution of 50% clean water and 50% permanent type ethylene glycol (exact ratio to be confirmed with genset manufacturer). Check specific gravity of engine coolant. Add glycol and/or water if required.
- Q. Check level of engine lubricating oil and add if required. Check and test operation of engine starting system, and jacket coolant heaters. Include acoustical testing to verify sound levels during operation at full load.
- R. Make conduit connections to generator set with liquid tight flexible conduits.
- S. Provide exhaust stack extension and mount to enclosure as per genset supplier's instructions. Secure as required. Provide lightning protection air terminal, down conductors and extend to grade ground rod driven into grade, as per code requirements.
- T. Connect and ground unit with proper copper ground conductors. Ground and bond equipment as per local electrical code requirements. Refer also to requirements of grounding and bonding article. Interconnect grounding to main building grounding system as may be required by local codes and electrical authority.
- U. Install lightning protection system components and wiring as detailed and as required. Connect air terminal system to main building lightning protection system or to down conductors connecting to grade ground rod. Coordinate work with genset vendor and Mechanical Division trades responsible for exhaust stack.
- V. Refer to and provide additional applicable testing requirements of distribution system testing and coordination study article.
- W. Provide and connect control panel wiring to fire alarm system, and if necessary, provide required low voltage relays, wiring and contactors from generator control panel to fire alarm system control panel for supervision and annunciation of "Main Breaker Open", "Generator Running", "Generator Failure to Start", "Low Voltage Generator Battery" and "Low Fuel Level/Pressure". Include additional points as required by local governing authorities and codes. Extend and connect these points to BAS and fire alarm system. Extend control/communications wiring in conduit to respective main building systems, as required. Engage respective system vendors to provide required connections to and software programming to interconnect systems.
- X. Coordinate fire alarm device installation work with main building fire alarm vendor. Extend fire alarm circuits from enclosure to main building and connect to local transponder/control panel designated by fire alarm vendor. Provide required low voltage relays, wiring in conduit and contactors from generator control panel to fire alarm system control panel for common supervision and annunciation of genset alarms. Coordinate with Mechanical Division BAS vendor to ensure that genset alarm points are connected to BAS as a common alarm. Extend control wiring of type suitable for specific applications and as recommended by vendor of system being connected to and terminate at panel designated by system vendor. Include for additional spare 3m (10') coiled length at end. Include for system vendor to make required connections to panel and required programming.
- Y. Coordinate and arrange for main building fire alarm system vendor and security system vendor to provide respective system devices, wiring and connections. Extend circuits from common junction box in genset enclosure to main building and connect to respective main building systems to annunciate specified separate zones/points. Provide wiring and conduit of type to suit application in accordance with local governing codes and as recommended by system manufacturer.

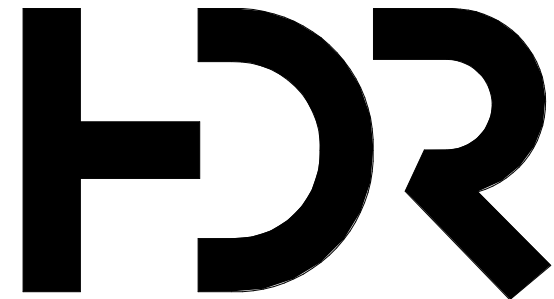
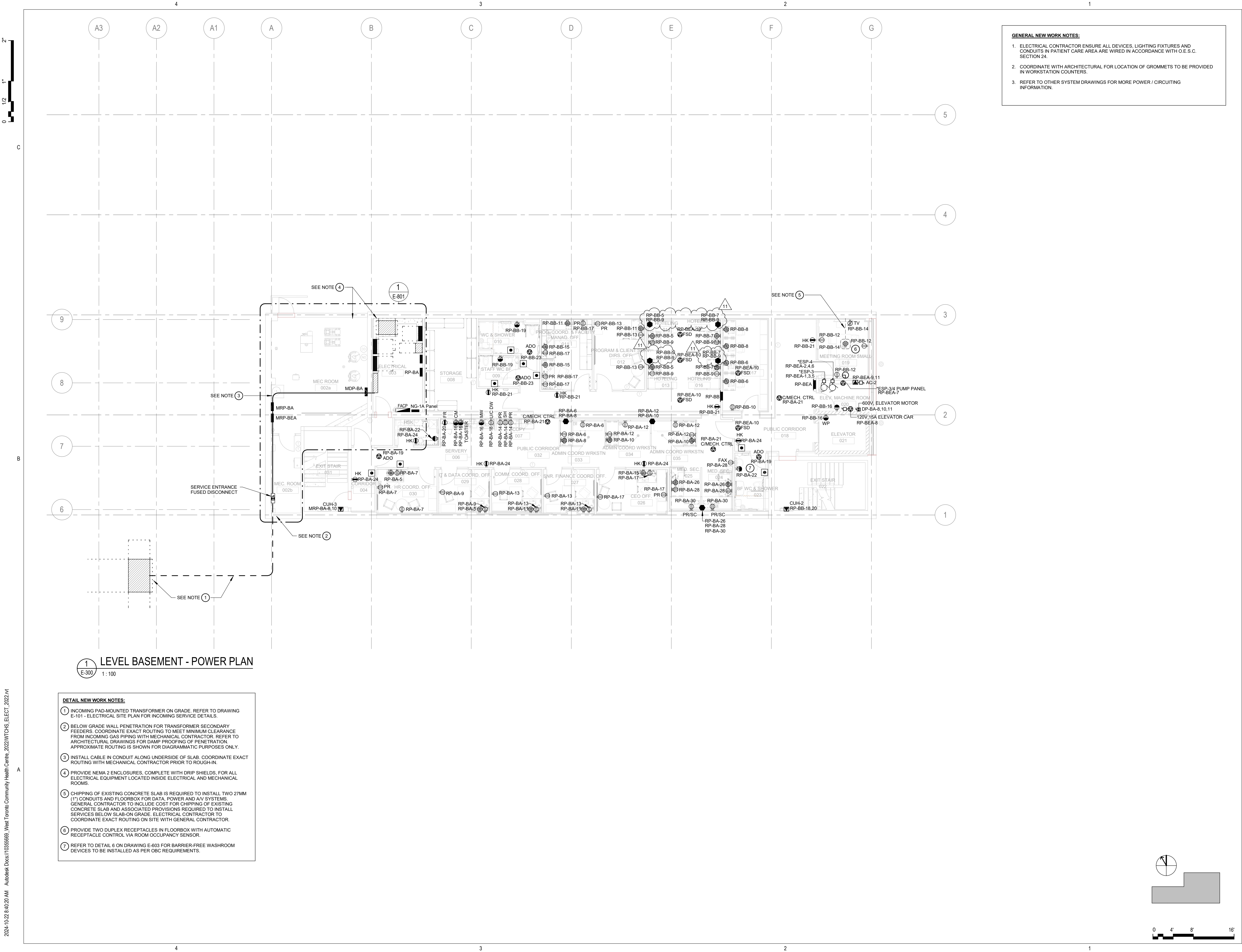
- Z. Coordinate natural gas piping connections and alarm connections with Mechanical Division Contractor and ensure proper installation is made to supply fuel to genset.
- AA. Provide connection to gas isolation valves at incoming gas supply on main building; to follow route of gas line; and indicate alarm when valves are isolated preventing gas supply.
- BB. Seal enclosure openings for cables, piping, conduits and other penetrations after installation, with water tight fire stopping and smoke seal materials.
- CC. Provide concrete bollards as required. Coordinate concrete work, excavation and backfilling work with respective general trades. Refer to Section 26 05 00 for additional related requirements.
- DD. Test and verify functions of enclosure with genset testing.
- EE. Obtain local governing technical standards and safety authority and other required local governing authority approvals and certifications.
- FF. Additionally, refer to testing, coordination and verification requirements in respective genset section and Section entitled Electrical Work Analysis and Testing and include applicable requirements.

3.2 INSTALLATION WORK FOR PLATFORMS, STAIRS AND RAILINGS

- A. Inspect areas of installation. Notify Consultant of conditions that would adversely affect the installation or subsequent utilization of areas. Do not proceed with installation until unsatisfactory conditions are corrected.
- B. Coordinate work with structural work and General Trades Contractor, as required.
- C. For on grade installations, prepare ground for structural supports and install as required to support entire assembly and anticipated loads.
- D. For roof top work coordinate work with roof structure work and General Trades Contractor, as required. Install as required to support entire assembly and anticipated loads.
- E. Install work according to manufacturer's recommendations.
- F. Position grating sections flat and square with ends on supporting structure.
- G. Maintain clearances of sections and joints as per manufacturer's instructions.
- H. Band random cut ends and diagonal or circular cut exposed edges with minimum 1/8" thick bar welded at contact points.
- I. Join abutting sections with manufacturer supplied splice plates; bolted or welded as specified.
- J. Install steps, handrail brackets, posts and rail to comply with local governing authority requirements and safety codes.
- K. Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, colour and finish as base material on which they occur. Grind or file exposed welds and steel sections smooth.
- L. Submit required approvals and certificates.
- M. Clean assemblies. Touch-up surfaces as required.

END OF SECTION

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Project Designer	JL
Project Architect	HDR
Landscape Architect	
Civil Engineer	WSP
Structural Engineer	WSP
Mechanical Engineer	WSP
Electrical Engineer	WSP
Plumbing Engineer	HDR
Interior Designer	HDR
Equipment Planner	
Wayfinding	

Sheet Reviewer	NM
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MARK	DATE	DESCRIPTION
1	2022-12-16	ISSUED FOR MOH STAGE 3.1
2	2023-05-05	ISSUED FOR STAGE 3.2 COSTING
3	2023-05-26	ISSUED FOR STAGE 3.2 COSTING-R1
4	2023-07-05	ISSUED FOR MOH STAGE 3.2
5	2023-11-24	ISSUED FOR STAGE 3.3 COSTING
6	2024-02-12	ISSUED FOR MOH STAGE 3.3
7	2024-03-22	ISSUED FOR PERMIT
8	2024-09-17	ISSUED FOR ESA
9	2024-09-13	ISSUED FOR TENDER
10	2024-10-07	ISSUED FOR ADD-E01
11	2024-10-21	ISSUED FOR ADD-E03

Project Number	10355669
Original Issue	07/08/22

Sheet Name

LEVEL B1 - POWER

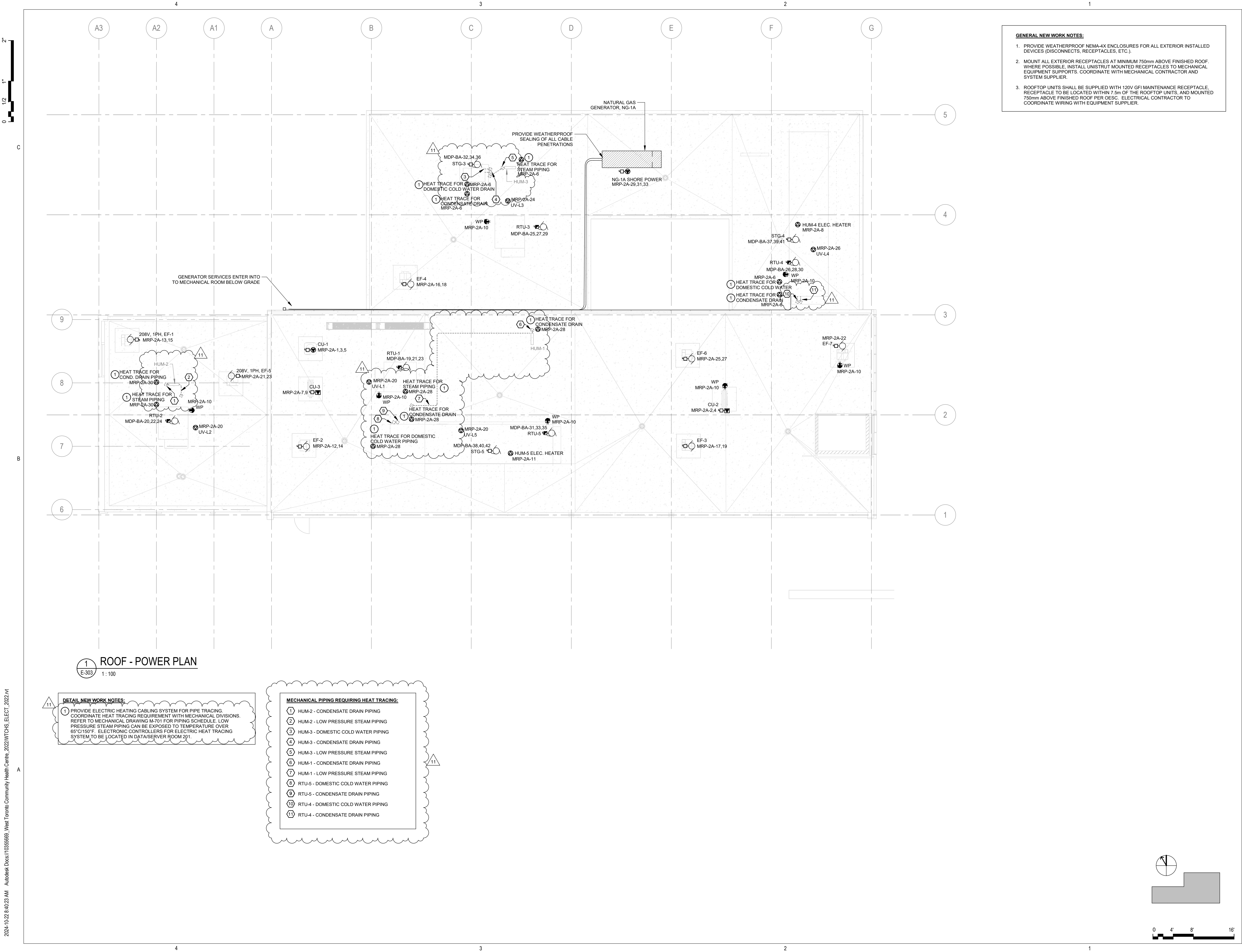
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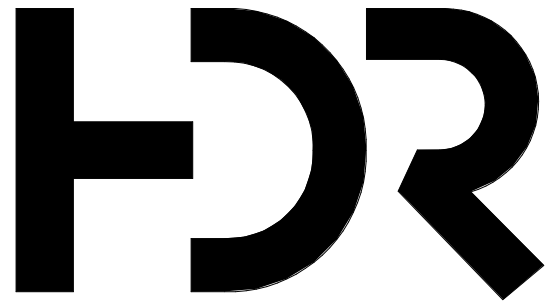
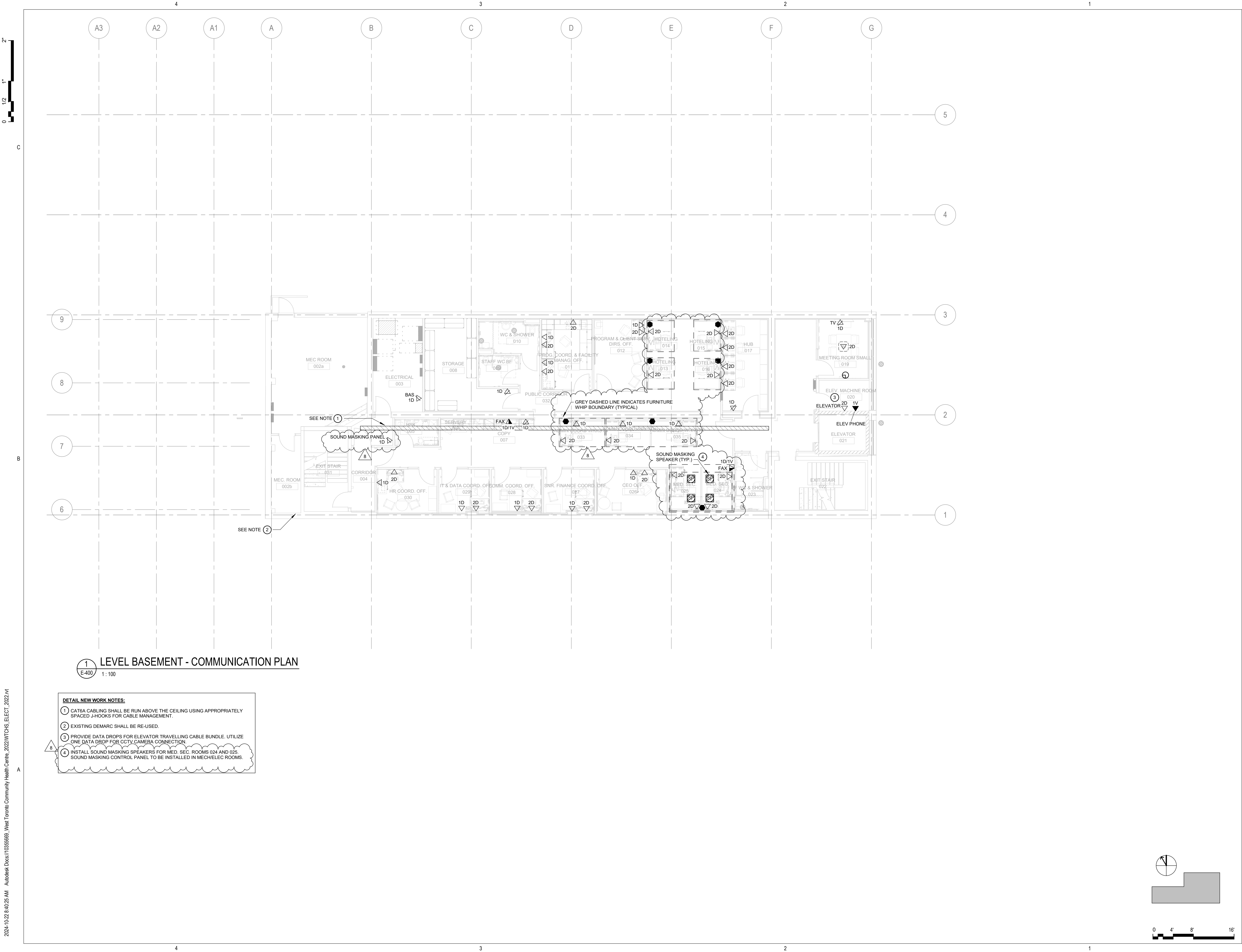
Project Status

ISSUED FOR ADD-E03

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Plumbing Engineer	WSP
Interior Designer	HDR
Equipment Planner	HDR
Wayfinding	

Sheet Reviewer	NM
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4	2024-02-12	ISSUED FOR MOH STAGE 3.3
5	2024-03-22	ISSUED FOR PERMIT
6	2024-09-17	ISSUED FOR ESA
7	2024-09-13	ISSUED FOR TENDER
8	2024-10-21	ISSUED FOR ADD-E03

Project Number	10355669
Original Issue	07/08/22

Sheet Name

LEVEL B1 -
COMMUNICATIONS

Sheet Number

E-400

Project Status

ISSUED FOR ADD-E03

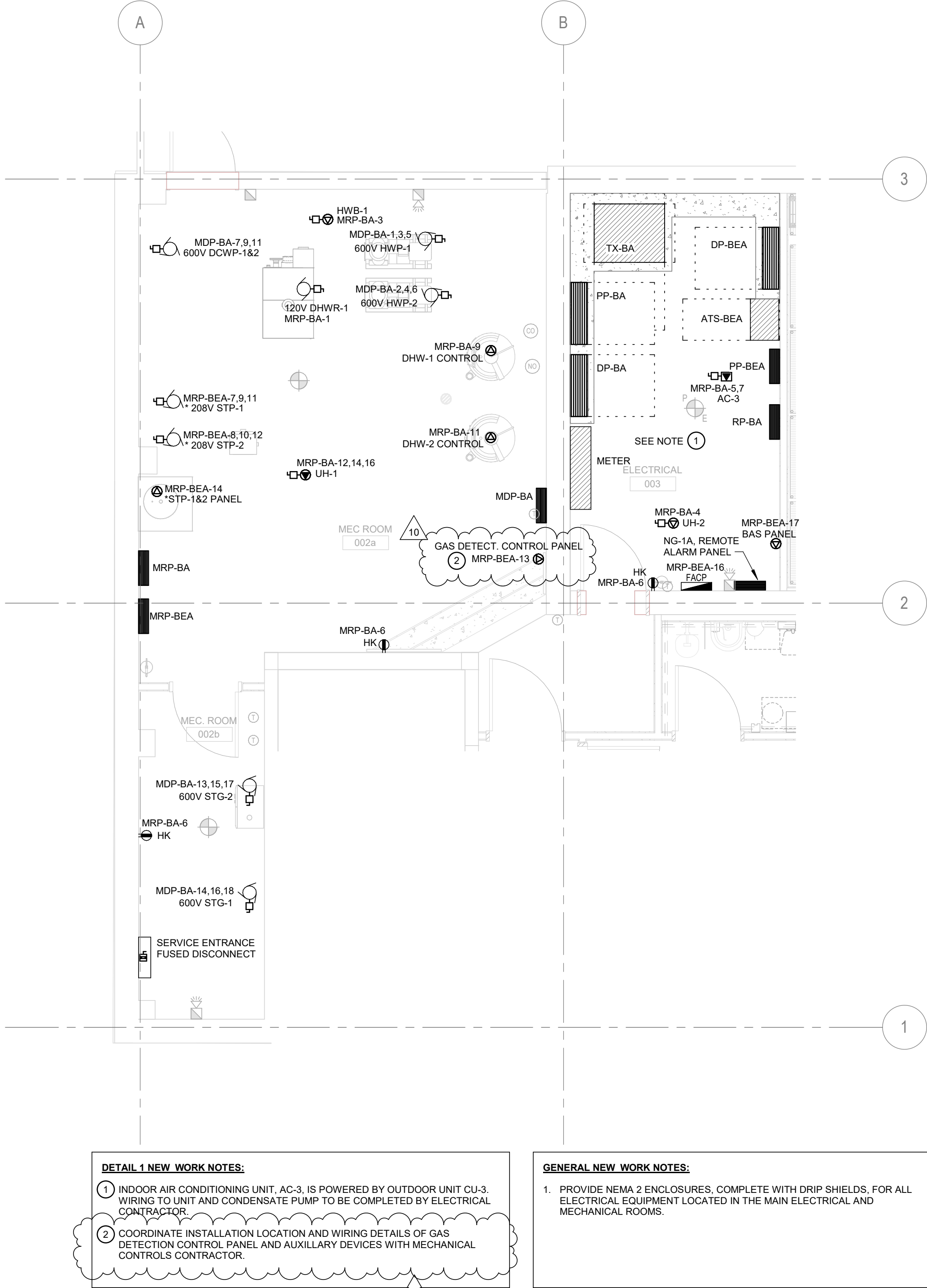
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C

B

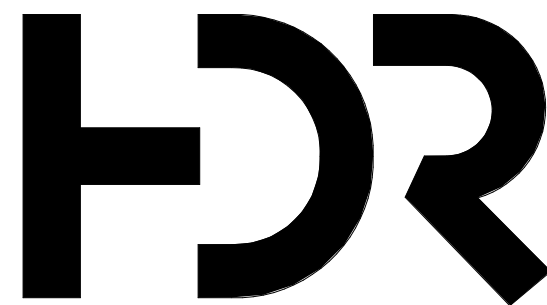
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1
E-801

BASEMENT - MAIN MECHANICAL & ELECTRICAL ROOMS

1:50



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3	2023-11-24	ISSUED FOR STAGE 3.3 COSTING
4	2024-02-12	ISSUED FOR MOH STAGE 3.3
5	2024-03-22	ISSUED FOR PERMIT
6	2024-09-04	RE-ISSUED FOR PERMIT
7	2024-09-17	ISSUED FOR ESA
8	2024-09-13	ISSUED FOR TENDER
9	2024-10-07	ISSUED FOR ADD-E01
10	2024-10-21	ISSUED FOR ADD-E03

Project Number	10355669
Original Issue	07/08/22

Sheet Name

ENLARGED PLANS - ELECTRICAL

Sheet Number

E-801

Project Status

ISSUED FOR ADD-E03



C

PANEL 'RP-BEA'															
NORMAL POWER															
LOCATION: PUBLIC CORRIDOR 018				VOLTAGE: 208V/3Ø/4W				BUS MATERIAL: COPPER				ISOLATED GROUND: <input type="checkbox"/>			
FED FROM: PP-BEA				PHASE: 3Ø				MAINS TYPE: MAIN BREAKER				100% RATED: <input type="checkbox"/>			
FEEDERS: REFER TO SLD				WIRES: 4W				MAIN BREAKER: 60 A							
MOUNTING: RECESSED				MAINS RATING: 100 A				SUB-FEED LUGS: <input type="checkbox"/>							
ENCLOSURE: NEMA 2				KAIC RATING: 22 kA				FEED-THROUGH LUGS: <input type="checkbox"/>							
CCT No.	LOAD DESCRIPTION	NOTE	POLES	RATING	LOAD (VA)										CCT No.
1															2
3	Rm. 020 - ELEVATOR SUMP PUMP, ESP-3		3	15 A	1657										4
5															6
7	Rm. 020 - ELEVATOR SUMP PUMP PANEL, ESP-3/4		1	15 A	150										8
9	Rm. 020 - ELEVATOR AC-2		2	15 A	2400										10
11															12
13															14
15															16
17															18
19															20
21															22
23															24
25															26
27															28
29															30
LOAD CLASSIFICATION				CONNECTED LOAD (VA)				DEMAND FACTOR (%)				ESTIMATED DEMAND (VA)			
MISC.				2550 VA				70.00%				1785 VA			
MOTOR				3314 VA				60.00%				1989 VA			
OTHER				300 VA				100.00%				300 VA			
MECH EQUIP.				150 VA				70.00%				105 VA			