



**STATEMENT OF WORK  
FOR  
REQUEST FOR PROPOSALS FOR INSTALLATION OF EMERGENCY  
BACK UP GENERATOR**

**at the  
Consular General's Residence  
U.S. Consulate General Montréal**

**Montréal, Quebec, Canada**

**August 19, 2020**

## 1.0 PROJECT DESCRIPTION

### 1. PROJECT SYNOPSIS

The project is described as a “Turnkey” installation and connection of an 80 KVA Cummins natural gas generator set. The work includes connecting the system with the residential (city power); install switchgear, ATS, MDB, cables, wiring, poles, construction of a sound base as per the attached specs, tools, hoisting the generator over the residence to the rear of the residence and complete civil works to ensure a proper connection and installation.

1. **Submittals.** The contractor is responsible to submit shop drawings prior to fabrication and release of any materials for the Facility Manager and COR Review and approval. The review, however, does not relieve the contractor of responsibility to engineer the work to provide a complete working system.
2. **Excavation and Utilities.** The contractor is responsible to locate all existing utility lines prior to any excavation. Prior to disconnecting any existing utility services, the contractor is responsible to provide 48-hour advance notice to the COR so an outage can be mutually scheduled.
3. **Sub-Contractors.** The contractor is responsible for all sub-contracted work needed to complete this project.
4. **Housekeeping.** The contractor is responsible to clean up daily before departing the Residence. At the completion of the work, the Contractor shall clean any impacted areas to a condition equal to original condition. Contractor tools and equipment will be secured when not in use.

### **1.1 SCOPE OF WORK:**

Installation of Generator, contractor shall provide all materials, tools and equipment, labor, transportation, sub-trades and supervision and ensure the work is completed safely and properly.

### **General Requirements**

1. Within 3 days of Notice to Proceed (NTP), the contractor shall provide the COR a project schedule showing start to completion dates including significant milestones.
2. Within 3 days of NTP, the Contractor shall provide the COR with details of the proposed installation utilizing written description or sketches or both.
3. The contractor is responsible to properly remove and dispose of all debris related to their work, including, but not limited to electrical, mechanical, sanitary accessories, soils, rock excavation, packing materials and scrap steel, uninstalled materials and/or environmental waste.
4. The contractor is responsible to properly layout and prepare for the renovation based on locations provided by the Facility Manager.
5. Contractor is responsible for all local and provincial permits for this work. This includes but not limited to street closures, utility closures, crane permits, flag men and any special signage, Etc.
6. When pursuing the work, the contractor is to take extra care not to damage existing structures. Contractor is responsible to repair any damage caused as the result of their work.
7. When pursuing the work, the contractor is to implement safety measures to protect from damage existing structures not designated as part of scope of work. The limits of construction will be clearly identified and marked to deter unauthorized personnel access.
8. Contractor will be responsible for all sub-contracted companies such but not limited to Crane, Concrete, Electrical, Plumbing and Steel work, etc.
9. Contractor is responsible to field verify measurements.

10. Contractor will be responsible for the full installation and testing of the unit.
11. At completion of work, the Contractor shall clean any impacted areas to a condition equal to original condition.
12. Contractor will warranty all construction work for a minimum of one (1) year and provide manufacturer warranties and equipment manuals for all equipment installed to the COR.
13. All construction work will be in conformance with the National and Provincial building Codes.
14. All work shall be according to attached drawings and specifications below.



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STANDARD RESIDENTIAL  
GENERATOR  
INSTALLATION DETAILS

Drawing Title

STANDARD  
GENERATOR PAD  
DETAILS - 66KVA  
TO 110KVA

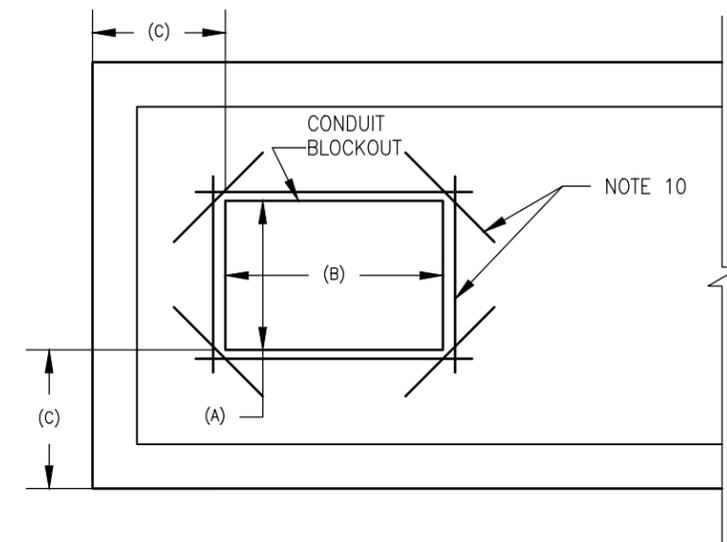
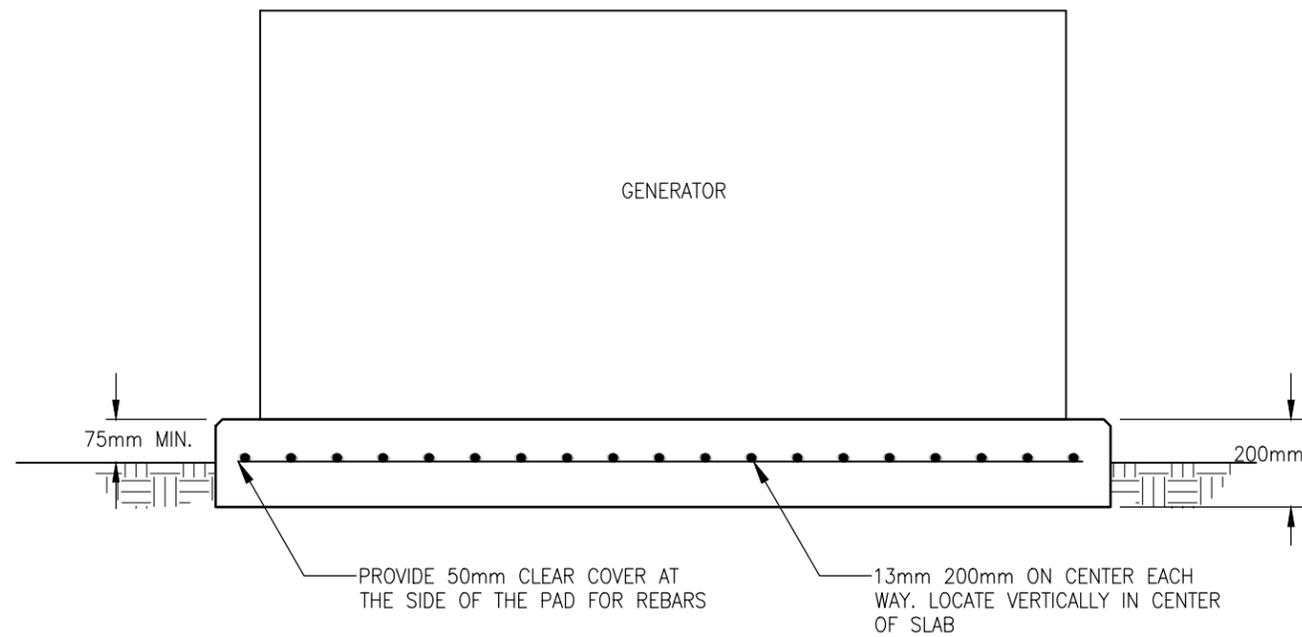
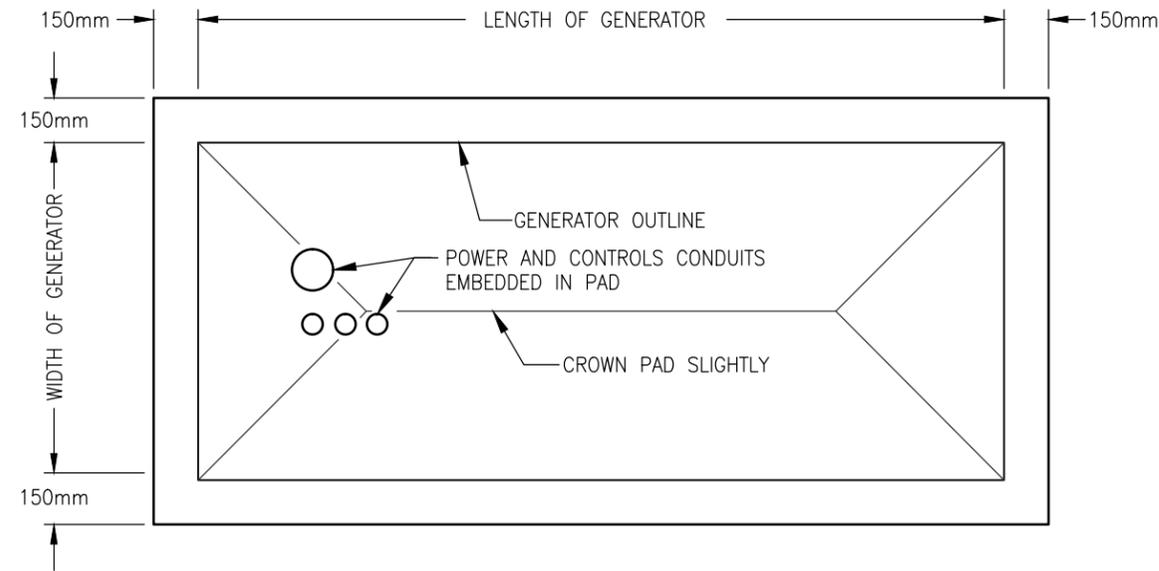
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G3

Date:  
9/17/13

NOTES

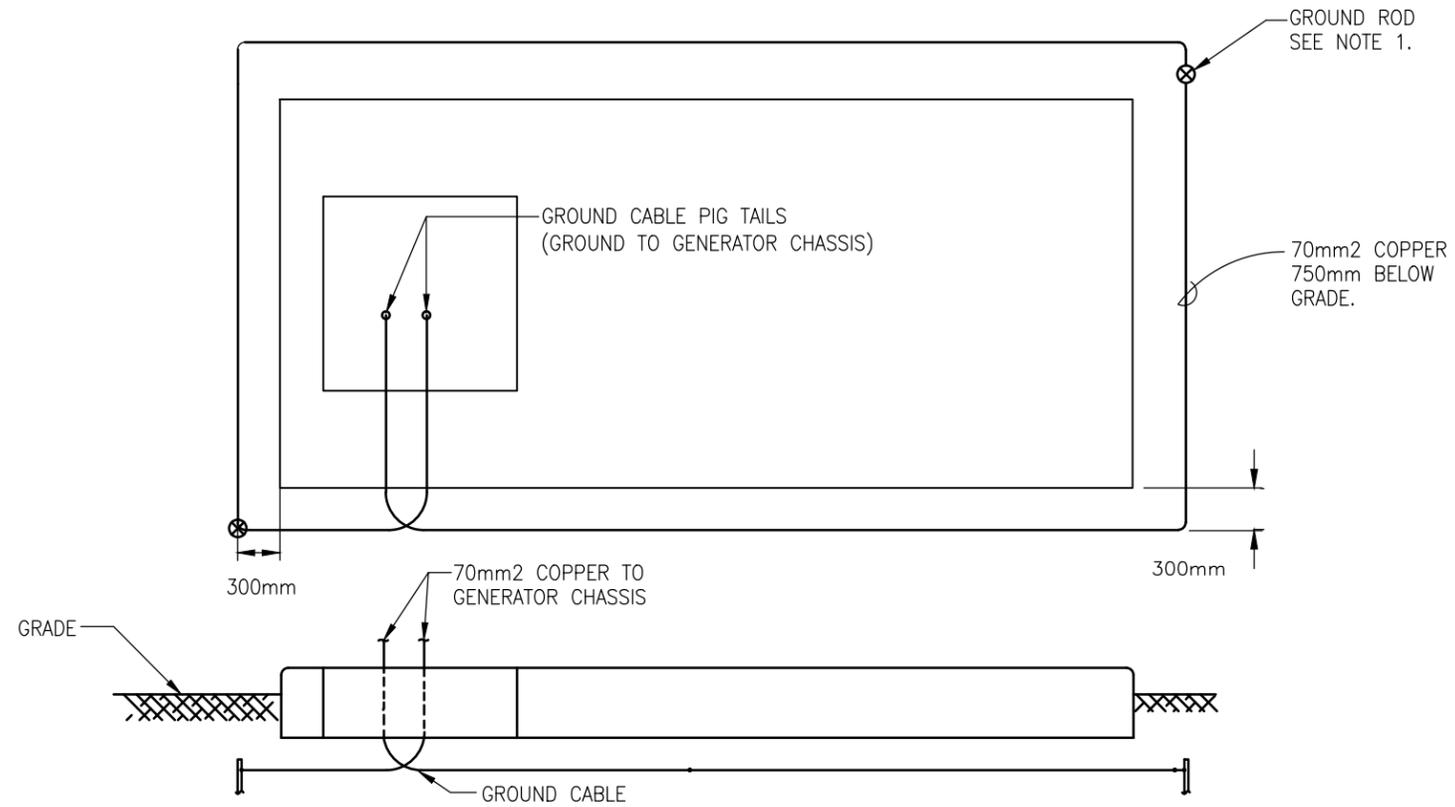
1. ALL CONCRETE SHALL BE NORMAL WEIGHT AND SHALL ATTAIN THE MINIMUM 28-DAY COMPRESSIVE STRENGTHS OF 25MPa AND 0.45 MAXIMUM W/C RATIOS AND CEMENTITIOUS MATERIALS CONTENT.
2. PROVIDE CLEAR DISTANCE TO OUTERMOST REINFORCING AS FOLLOWS:  
CONCRETE CAST AGAINST AND EXPOSED TO EARTH - 75mm  
CONCRETE EXPOSED TO EARTH OR WEATHER - 50mm
3. REINFORCING STEEL SHALL BE NEW DEFORMED BILLET STEEL CONFORMING TO A615/615M GRADE 420.
4. SOIL TO BE COMPACTED TO 95% OF ORIGINAL DENSITY. SOIL SHALL BE TREATED TO PROVIDE 100 KPa LOAD BEARING CAPACITY.
5. INSTALL GENERATOR ANCHOR BOLTS IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
6. CHAMFER ALL EXPOSED EDGES.
7. FOR GRADE CROSS-SLOPES, THICKEN THE DOWNHILL END OF THE PAD AS REQUIRED TO MAINTAIN THE EMBEDMENT BELOW GRADE SHOWN IN THE DETAIL.
8. PROVIDE FLEXIBLE CONDUIT FROM THE SLAB PENETRATION TO THE GENERATOR CONNECTION BOX. PROVIDE MINIMUM 150mm SLACK CONDUCTORS AT EACH TERMINATION TO ALLOW FOR MOVEMENT IN CASE OF SEISMIC OR OTHER EVENTS.
9. WHERE CONDUIT BLOCKOUTS ARE PROVIDED IN PAD. LOCATE OPENING PER MANUFACTURER'S RECOMMENDATIONS AND CENTER WITHIN THE WIDTH OF THE PAD. THE OPENING SHALL BE (A) NO WIDER THAN 1/3 OF THE PAD WIDTH, (B) NO LONGER THAN 1/2 THE WIDTH OF THE PAD, AND (C) THE OPENING SHALL BE NO CLOSER TO THE END OF THE PAD THAN 1/3 THE WIDTH OF THE PAD OR 300mm.
10. WHERE CONDUIT BLOCKOUTS ARE PROVIDED IN PAD PROVIDE 13mm X 600mm CORNER BARS AS SHOWN. PROVIDE ADDITIONAL 13mm BARS ON EACH SIDE OF THE OPENING AND TIE TO THE BARS CUT FOR THE OPENING. EXTEND BARS ON EACH SIDE A MINIMUM OF 250mm BEYOND THE OPENING AT EACH END. ALL BARS PROVIDED FOR OPENING SHALL BE A MINIMUM OF 50mm FROM THE EDGE OF THE OPENING.
11. PROVIDE TWO 19mm X 3050mm COPPER CLAD STEEL GROUND RODS 3050MM APART. BOND GROUND RODS TOGETHER UTILIZING MECHANICAL GROUND CONNECTORS AND 35mm<sup>2</sup> BARE COPPER GROUND CONDUCTORS. ROUTE GROUND CONDUCTOR FROM GROUND ROD THROUGH PAD TO BOND TO GROUND LUG ON GENERATOR CHASSIS.



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G3  
66KVA TO 110KVA  
GENERATOR PAD DETAIL  
SCALE: NTS



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NOTES

1. GROUND ROD - 19mm X 3050mm COPPER CLAD STEEL GROUND ROD.

1  
G8

# LARGE MULTI-RESIDENCE GENERATOR GROUNDING DETAIL

SCALE: NTS

## STANDARD RESIDENTIAL GENERATOR INSTALLATION DETAILS

Drawing Title

LARGE  
MULTI-RESIDENCE  
GENERATOR  
GROUNDING DETAIL

Sheet Number

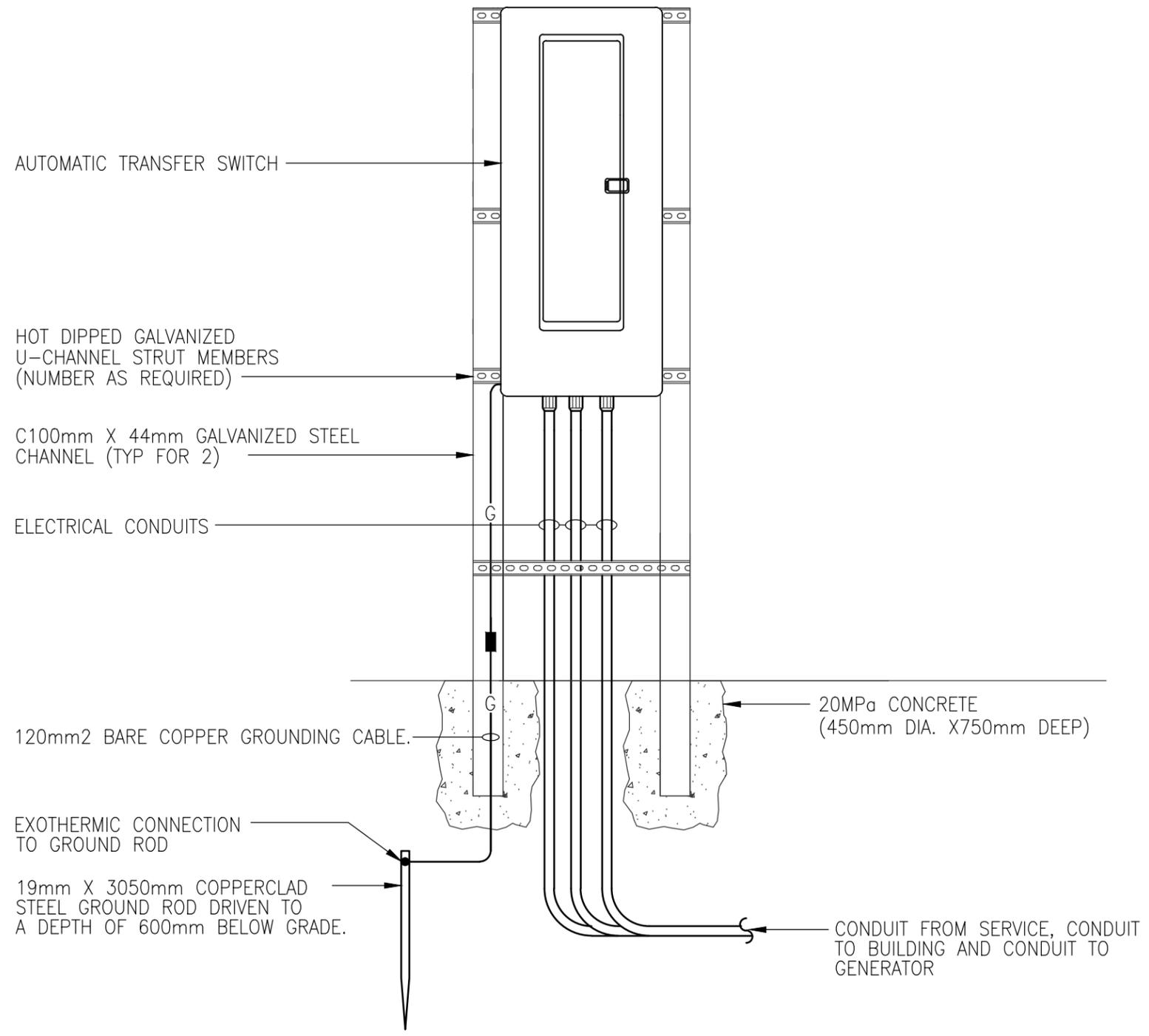
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STANDARD RESIDENTIAL  
GENERATOR  
INSTALLATION DETAILS



1  
G9  
**FREESTANDING  
ATS SUPPORT DETAIL**  
SCALE: NOT TO SCALE

Drawing Title

**FREESTANDING  
ATS SUPPORT  
DETAIL**

Sheet Number

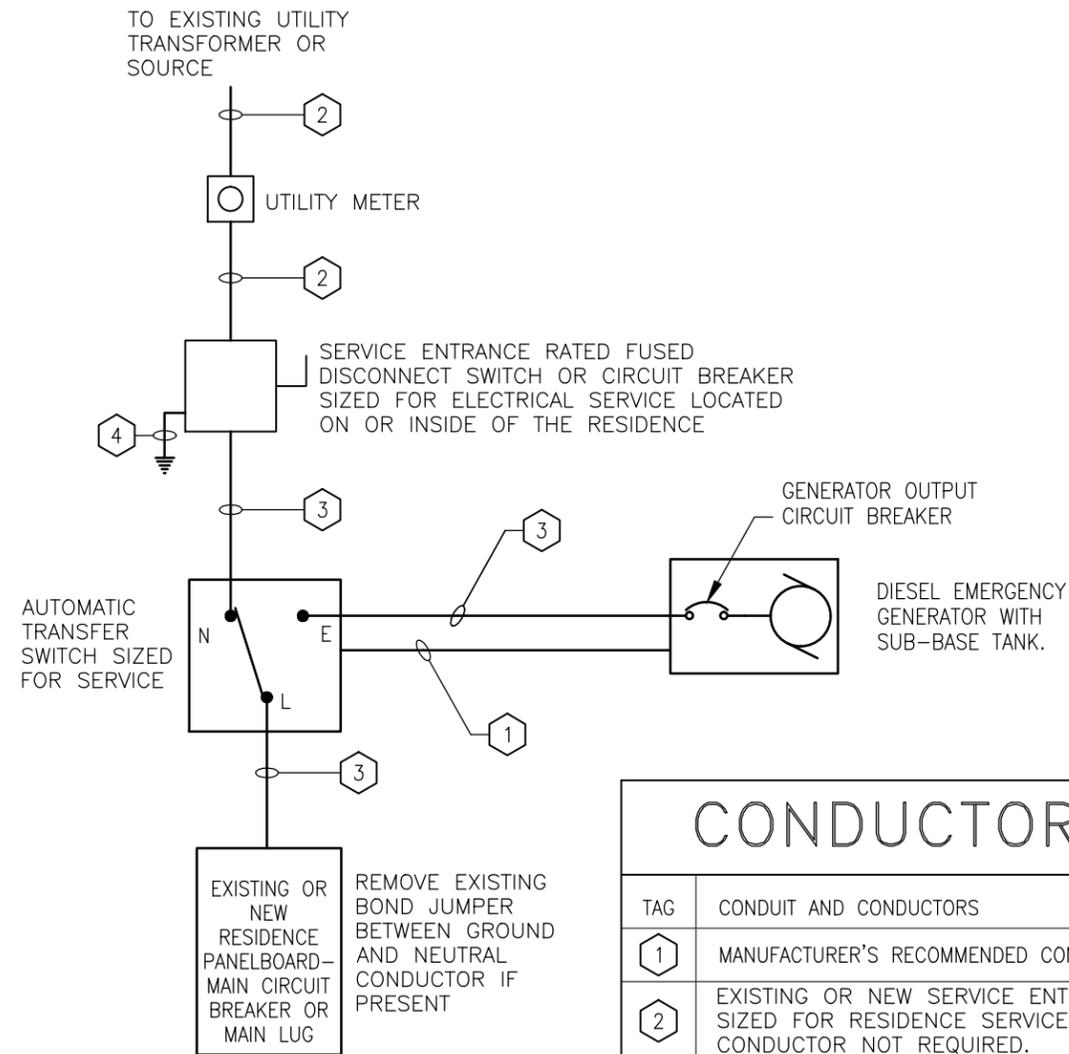
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Date:  
9/17/13



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STANDARD RESIDENTIAL  
GENERATOR  
INSTALLATION DETAILS



CONDUCTOR SCHEDULE

TAG	CONDUIT AND CONDUCTORS
1	MANUFACTURER'S RECOMMENDED CONDUIT AND CONTROL CONDUCTORS
2	EXISTING OR NEW SERVICE ENTRANCE CONDUIT AND CONDUCTORS SIZED FOR RESIDENCE SERVICE DISCONNECT AMPS. GROUND CONDUCTOR NOT REQUIRED.
3	CONDUIT AND CONDUCTORS SIZED FOR RESIDENCE SERVICE DISCONNECT AMPS. PROVIDE WITH GROUND CONDUCTOR.
4	PROVIDE GROUND CONDUCTOR AND GROUNDING ELECTRODES PER NOTES ON SHEET G12.

1  
G10 ELECTRICAL ONE-LINE DIAGRAM  
SCALE: NO SCALE

Drawing Title

TYPICAL  
ELECTRICAL  
ONE-LINE  
DIAGRAM—SINGLE  
RESIDENCE

Sheet Number

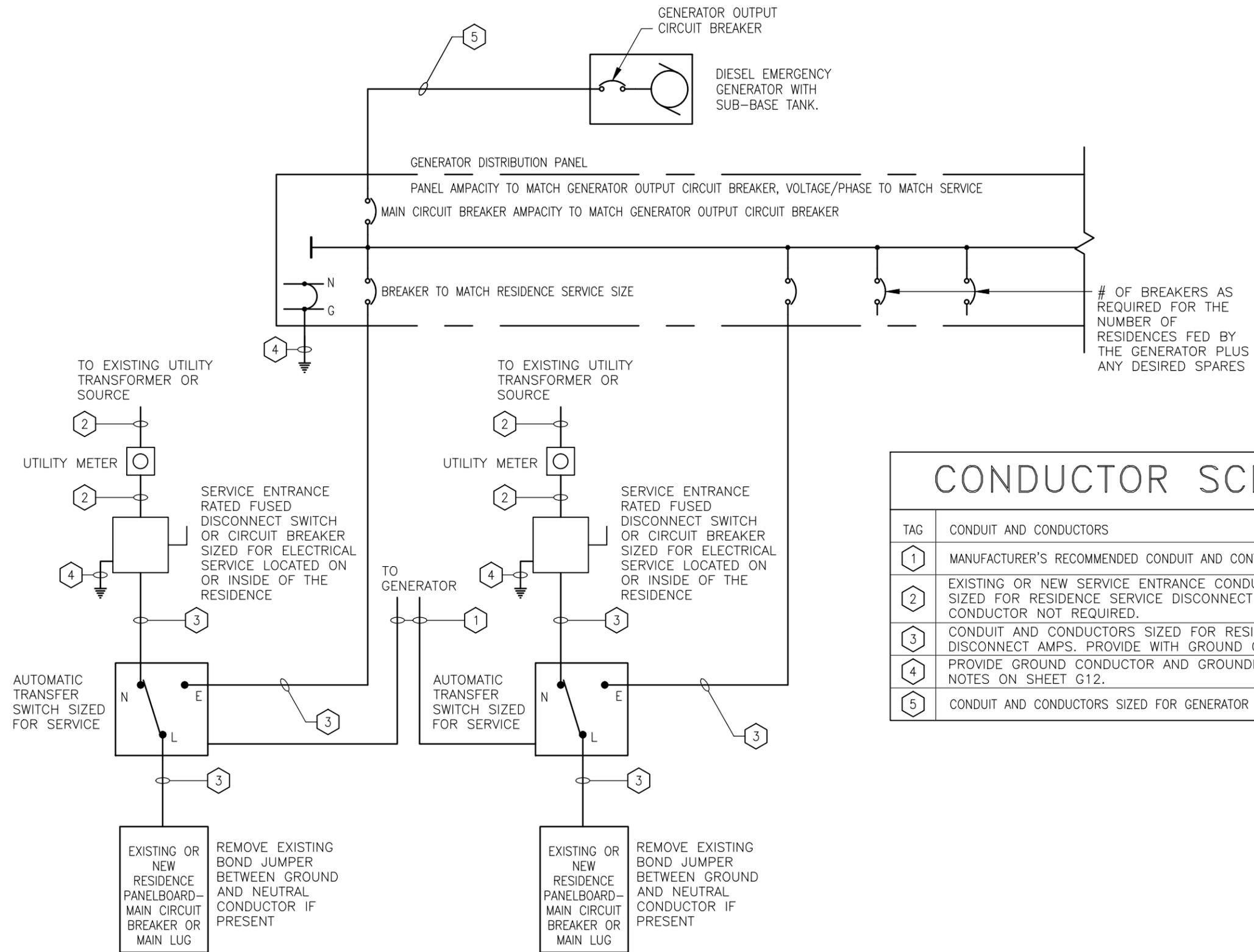
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STANDARD RESIDENTIAL  
GENERATOR  
INSTALLATION DETAILS



CONDUCTOR SCHEDULE	
TAG	CONDUIT AND CONDUCTORS
1	MANUFACTURER'S RECOMMENDED CONDUIT AND CONTROL CONDUCTORS
2	EXISTING OR NEW SERVICE ENTRANCE CONDUIT AND CONDUCTORS SIZED FOR RESIDENCE SERVICE DISCONNECT AMPS. GROUND CONDUCTOR NOT REQUIRED.
3	CONDUIT AND CONDUCTORS SIZED FOR RESIDENCE SERVICE DISCONNECT AMPS. PROVIDE WITH GROUND CONDUCTOR.
4	PROVIDE GROUND CONDUCTOR AND GROUNDING ELECTRODES PER NOTES ON SHEET G12.
5	CONDUIT AND CONDUCTORS SIZED FOR GENERATOR OUTPUT CIRCUIT BREAKER

1  
G11  
ELECTRICAL ONE-LINE DIAGRAM - MULTI-FAMILY  
SCALE: NO SCALE

Drawing Title

TYPICAL  
ELECTRICAL  
ONE-LINE  
DIAGRAM—MULTI-  
RESIDENCE

Sheet Number

G11

Date:  
9/17/13

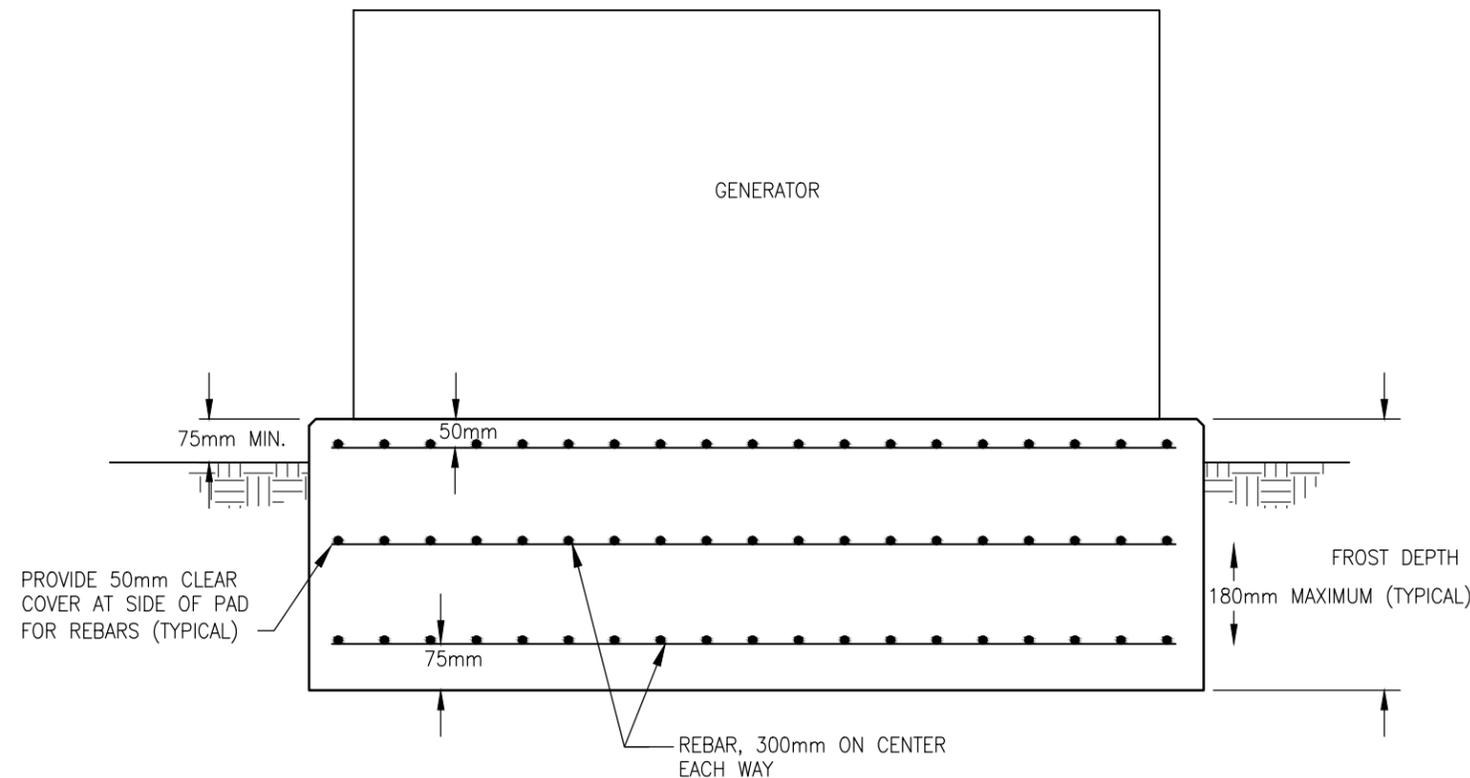
# ADDITIONAL INSTALLATION NOTES

1. EXTERIOR GENERATORS SHALL BE LOCATED NO CLOSER THAN 2-METERS TO ANY BUILDING. BUILDING OVERHANGS SHALL BE CONSIDERED THE EXTERIOR EDGE OF THE BUILDING. LOCATION OF AN EXTERIOR GENERATOR SHALL BE AS FAR AS PRACTICAL FROM ANY BUILDING SO AS TO MINIMIZE PROBLEMS WITH GENERATOR NOISE AND EXHAUST TO ANY BUILDING INTERIOR. DIRECTION OF EXHAUST SHALL BE POINTED AWAY FROM ANY BUILDING.
2. USE OF PVC CONDUIT BELOW GRADE IS ALLOWED. PROVIDE MAGNETIC LOCATOR TAPE 6" ABOVE PVC CONDUIT BELOW GRADE. CONDUIT ABOVE GRADE SHALL BE RIGID METALLIC CONDUIT OR IMC. LIQUID-TIGHT FLEXIBLE METALLIC CONDUIT MAY BE USED ABOVE GRADE WITHIN THE GENERATOR ENCLOSURE.
3. CONDUIT SHALL BE BURIED A MINIMUM OF 450mm BELOW FINISHED GRADE EXCEPT FOR UNDER DRIVEWAYS OR ROADS, WHERE CONDUIT SHALL BE BURIED A MINIMUM OF 600mm BELOW FINISHED GRADE. RIGID METAL CONDUIT, INTERMEDIATE METAL CONDUIT OR CONCRETE-ENCASED CONDUIT (MINIMUM 75mm COVER ON ALL SIDES) MAY BE BURIED 150mm BELOW FINISHED GRADE EXCEPT FOR UNDER DRIVEWAYS OR ROADS.
4. IN LOCATIONS WHERE THE FROST DEPTH IS BELOW THE BOTTOM OF THE SLAB, LOWER THE BOTTOM OF THE SLAB TO THE FROST DEPTH. PROVIDE AN ADDITIONAL REBAR MATT TO MATCH THE MATTS SHOWN ON THE SLAB DETAILS. THE NUMBER OF REBAR LAYERS SHALL BE DETERMINED BY THE OVERALL FROST DEPTH WITH THE VERTICAL SPACING OR REBAR MATTS 180mm MAXIMUM WHILE MAINTAINING THE TOP AND BOTTOM MATT LOCATIONS AS SHOWN ON THE DETAIL BELOW.
5. FOR SINGLE RESIDENCE GENERATOR INSTALLATIONS, GROUND SERVICE ENTRANCE DISCONNECT SWITCH (OR CIRCUIT BREAKER) WITH TWO 19mm X 3050mm COPPER CLAD STEEL GROUND RODS A MINIMUM OF 3050MM APART WITH TOP OF GROUND ROD 300mm BELOW FINISHED GRADE. BOND GROUND RODS TOGETHER UTILIZING MECHANICAL GROUND CONNECTORS AND 25mm<sup>2</sup> BARE COPPER GROUND CONDUCTOR BETWEEN THE RODS AND BACK TO THE DISCONNECT SWITCH (OR CIRCUIT BREAKER). BURIED PORTION OF GROUND CONDUCTOR SHALL BE 600mm BELOW FINISHED GRADE. FOR SERVICES UP TO 200-AMPS PROVIDE A 25mm<sup>2</sup> BARE COPPER GROUND CONDUCTOR AND BOND TO THE METAL COLD WATER LINE (IF AVAILABLE) AND TO BUILDING STEEL (IF AVAILABLE). UTILIZE 35mm<sup>2</sup> FOR SERVICES UP TO 300-AMPS AND 60mm<sup>2</sup> FOR SERVICES UP TO 400-AMPS.
6. FOR MULTIPLE RESIDENCE GENERATOR INSTALLATIONS, GROUND DISTRIBUTION PANEL WITH THREE 19mm X 3050mm COPPER CLAD STEEL GROUND RODS A MINIMUM OF 3050MM APART WITH TOP OF GROUND ROD 300mm BELOW FINISHED GRADE. BOND GROUND RODS TOGETHER UTILIZING MECHANICAL GROUND CONNECTORS AND 95mm<sup>2</sup> BARE COPPER GROUND CONDUCTOR BETWEEN THE RODS AND BACK TO THE DISTRIBUTION PANEL. BURIED PORTION OF GROUND CONDUCTOR SHALL BE 600mm BELOW FINISHED GRADE. IF DISTRIBUTION PANEL IS LOCATED WITHIN A BUILDING, PROVIDE A 95mm<sup>2</sup> BARE COPPER GROUND CONDUCTOR AND BOND TO THE METAL COLD WATER LINE (IF AVAILABLE) AND TO BUILDING STEEL (IF AVAILABLE).



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## STANDARD RESIDENTIAL GENERATOR INSTALLATION DETAILS



1
G12
**DEEPEMED SLAB FOR FROST LINE**  
 SCALE: NTS

Drawing Title

**ADDITIONAL  
INSTALLATION  
NOTES AND FROST  
SLAB DETAIL**

Sheet Number

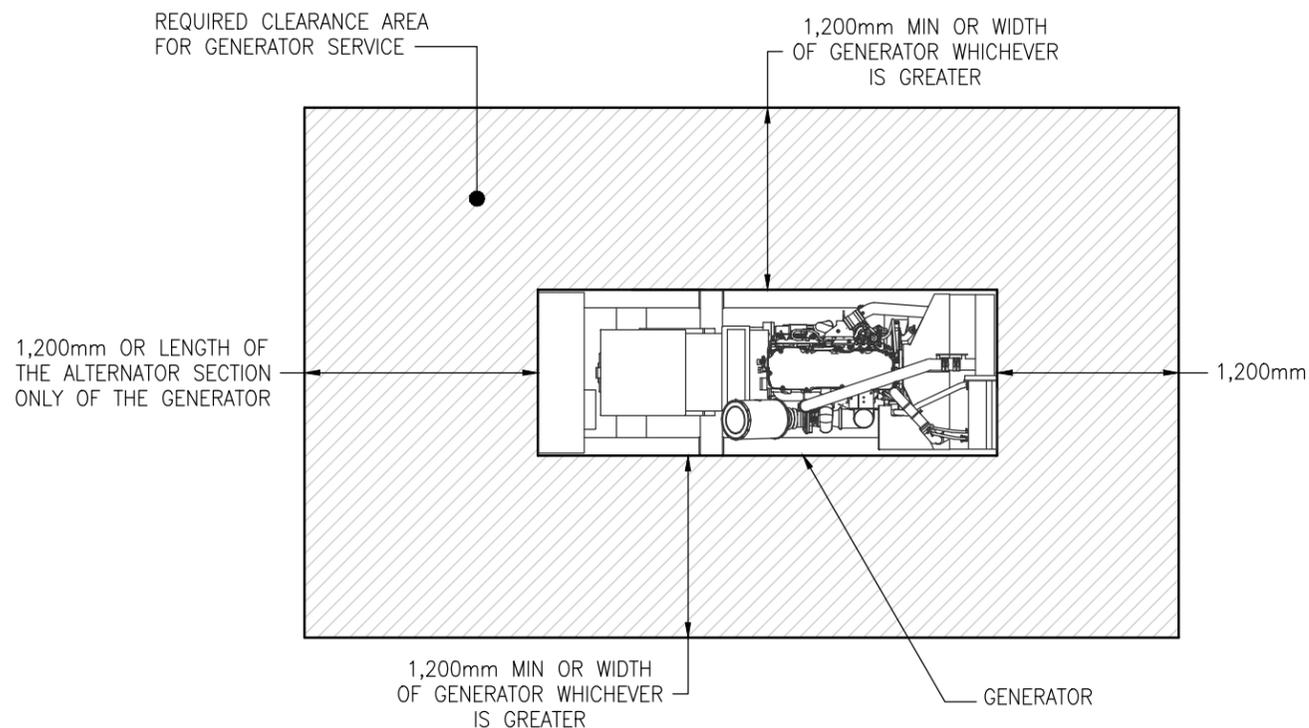
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Date:  
9/17/13



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STANDARD RESIDENTIAL  
GENERATOR  
INSTALLATION DETAILS



NOTES

1. PROVIDE GENERATOR ROOM ACCESS FOR THE LARGEST GENERATOR COMPONENT TO BE REMOVED. LARGEST COMPONENT IS TYPICALLY THE DIESEL ENGINE.
2. ACCESS SHALL BE PROVIDED THRU A PERMANENT OPENING IN THE GENERATOR ROOM.
3. PROVIDE ADDITIONAL CLEARANCE SPACE FOR OTHER GENERATOR COMPONENTS SUCH AS TRANSFER SWITCHES, BATTERIES, ETC.
4. DO NOT UTILIZE GENERATOR ROOM FOR STORAGE OF ANY TYPE.
5. CLEARANCES NOTED ON THIS SHEET ARE THE MINIMUM REQUIREMENTS FOR MAINTENANCE OF A TYPICAL GENERATOR.
6. REFER TO THE MANUFACTURERS INSTALLATION SHEET FOR THE ACTUAL GENERATOR TO BE INSTALLED FOR ADDITIONAL CLEARANCE REQUIREMENTS.
7. GENERATOR EXHAUST SHALL DISCHARGE A MINIMUM OF 10'-0" FROM ANY BUILDING OPENING.

TYPICAL MATERIAL SPECIFICATIONS FOR GENERATOR DISTRIBUTION SYSTEMS:

EXHAUST FLUE PIPING:  
STEEL PIPE, ASTM A 53, TYPE S OR E, GRADE B, SCHEDULE 40, BLACK STEEL WITH WELDED OR FLANGED JOINTS.

EXHAUST FLUE FITTINGS:  
WROUGHT CARBON STEEL FITTINGS, SCHEDULE 40, CONFORMING TO ASTM A 234/A 234M AND ASME/ANSI B16.9

EXHAUST FLUE PIPE AND SILENCER INSULATION:  
CALCIUM SILICATE, ASTM C 533, TYPE L, PREFORMED PIPE AND EQUIPMENT SECTIONS OF NONCOMBUSTIBLE, INORGANIC, HYDROUS CALCIUM SILICATE WITH A NON-ASBESTOS FIBROUS REINFORCEMENT WITH JACKET RATED FOR 650° C, 100mm THICK MINIMUM.

DUCTWORK AND FITTINGS:  
GALVANIZED SHEET METAL, ASTM A 653/A 653M AND HAVING A G90 / Z275 COATING DESIGNATION, LOCK-FORMING QUALITY. CONSTRUCTED IN ACCORDANCE WITH SMACNA HVAC DUCT CONSTRUCTION STANDARDS FOR DUCT PRESSURE CLASS OF 500 Pa, SEAL CLASS C.

FLEXIBLE CONNECTOR (AIRSIDE, INDOOR APPLICATIONS):  
GLASS FABRIC COATED WITH SILICONE RUBBER, 540 g/SQ M WITH A TENSILE STRENGTH OF 50 N/mm IN THE WARP AND 32 N/mm IN THE FILLING. RATED FOR AN OPERATING RANGE OF -55 TO 260 DEG C.

EXHAUST BELLOWS:  
MULTI-PLY, ASTM A240 STAINLESS STEEL, RATED FOR 100 kPa AT 675° C WITH FLANGED CONNECTIONS.

DIESEL FUEL PIPING:  
STEEL PIPE, ASTM A 53, TYPE S OR E, GRADE B, SCHEDULE 40, BLACK STEEL WITH WELDED OR FLANGED JOINTS FOR ABOVE GROUND PIPING GREATER THAN 50mm AND THREADED FOR PIPING 50mm AND LESS.

DIESEL FUEL FITTINGS:  
WROUGHT CARBON STEEL WEDLING FITTINGS: SCHEDULE 40, CONFORMING TO ASTM A 234/A 234M AND ASME/ANSI B16.9.  
MALLEABLE IRON THREADED FITTINGS: ASME B16.3, CLASS 150, STANDARD PATTERN

1  
G13

**TYPICAL GENERATOR CLEARANCE REQUIREMENTS**

SCALE: NONE

Drawing Title

TYPICAL  
GENERATOR  
CLEARANCE  
REQUIREMENTS  
AND MATERIAL  
SPECIFICATIONS

Sheet Number

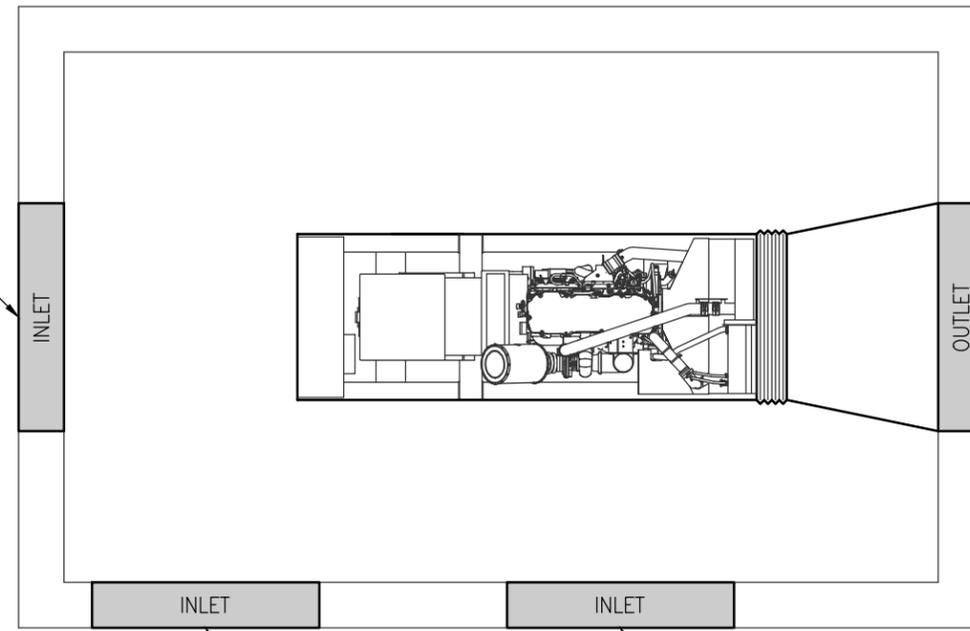
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9/17/13



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RECOMMENDED LOCATION  
FOR ROOM INTAKE FOR  
PROPER GENERATOR COOLING



ACCEPTABLE ALTERNATIVE  
LOCATION FOR ROOM INTAKE,  
TYPICAL EITHER SIDE OF  
ROOM

UNACCEPTABLE INLET  
LOCATION, TYPICAL EITHER  
SIDE OF ROOM

NOTES

1. ROOF MOUNTED INLETS ARE NOT AN ACCEPTABLE ALTERNATIVE INLET LOCATION.
2. UNACCEPTABLE ALTERNATIVE INLET LOCATIONS WILL NOT PROVIDE SUFFICIENT AIRFLOW OVER THE GENERATOR TO MEET THE RADIANT COOLING REQUIREMENTS.
3. INLETS SHALL BE SIZED FOR A MAXIMUM PRESSURE DROP OF 0.06 KPa.
4. OUTLETS SHALL BE SIZED FOR A MAXIMUM PRESSURE DROP OF 0.06 KPa.

1  
G14

**TYPICAL GENERATOR ROOM PLAN**  
SCALE: NONE

STANDARD RESIDENTIAL  
GENERATOR  
INSTALLATION DETAILS

Drawing Title

RECOMMENDED  
LOUVER  
LOCATIONS FOR  
INDOOR  
INSTALLATIONS

Sheet Number

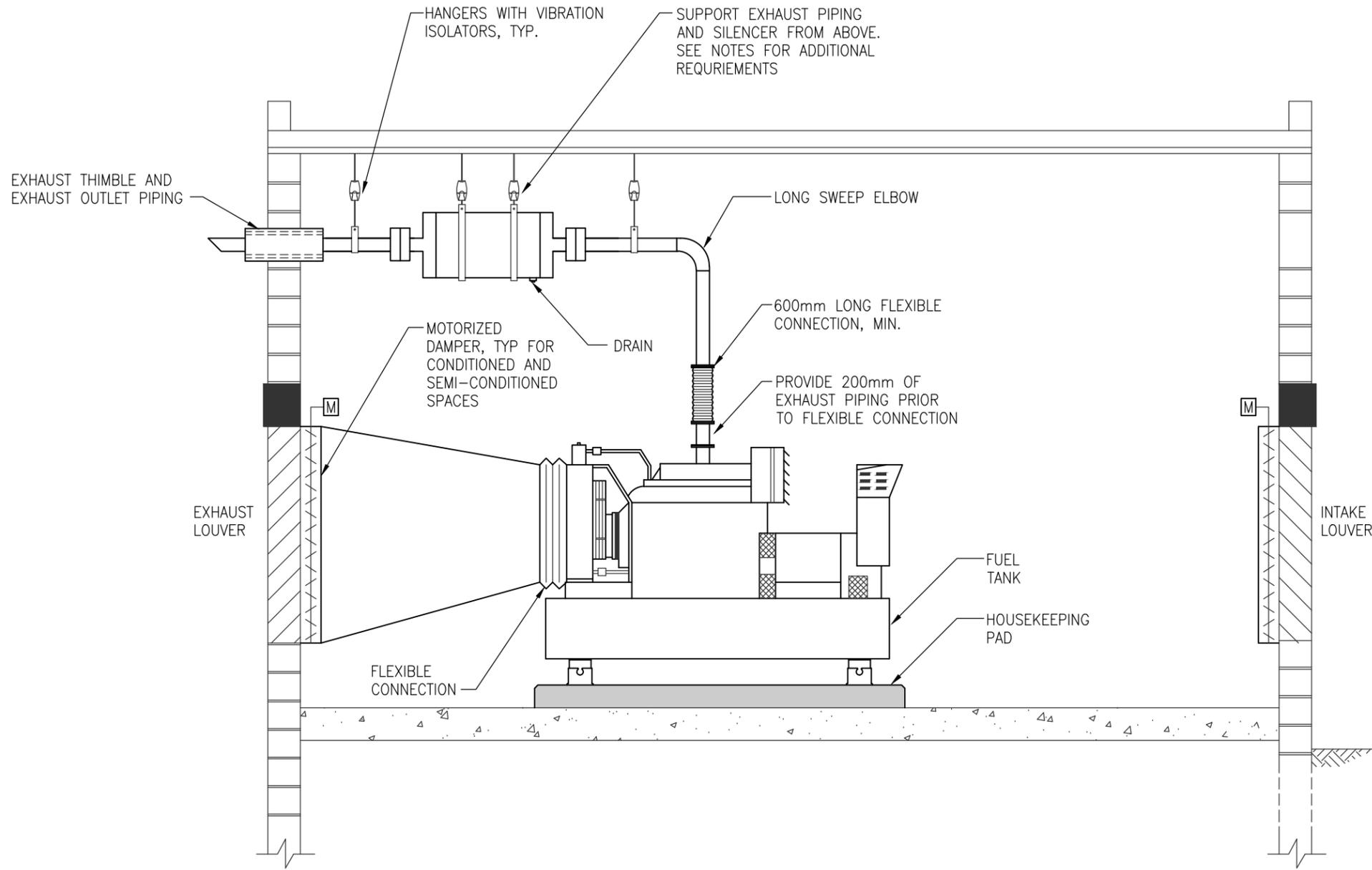
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Date:  
9/17/13



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STANDARD RESIDENTIAL  
GENERATOR  
INSTALLATION DETAILS



NOTES

1. PITCH EXHAUST PIPING A MINIMUM OF 0.5% SLOPE AWAY FROM THE GENERATOR TO MINIMIZE CONDENSATION RETURN TO THE ENGINE.
2. TRANSITIONS SHALL BE MADE WITH LONG SWEEP ELBOWS ONLY.
3. ALL FLUE PIPING SHALL HAVE A MINIMUM OF 12" CLEARANCE FROM COMBUSTIBLE MATERIALS.
4. WEIGHT OF THE EXHAUST SYSTEM SHALL NOT BEAR UPON THE GENERATOR EXHAUST CONNECTION/S OR BY ANY COMPONENT OF THE GENERATOR.
5. EXHAUST OUTLETS SHALL BE LOCATED A MINIMUM OF 10'-0" FROM OUTSIDE AIR INTAKES OR BUILDING OPENINGS AND IN ACCORDANCE WITH ALL LOCAL CODES AND REQUIREMENTS.
6. EXHAUST PIPING AND SILENCERS SHALL BE INSULATED TO PROVIDE PERSONAL PROTECTION AND MINIMIZE HEAT GAIN INTO THE GENERATOR ROOM
7. FAIL OPEN DAMPERS WILL BE UTILIZED FOR VENTILATION ISOLATION WITH SPRING RETURNS. DAMPERS SHALL BE CONNECTED TO NORMAL POWER ONLY.

1 GENERAL REQUIREMENTS ELEVATION  
G15 SCALE: NONE

Drawing Title

GENERAL INDOOR  
GENERATOR  
INSTALLATION  
REQUIREMENTS

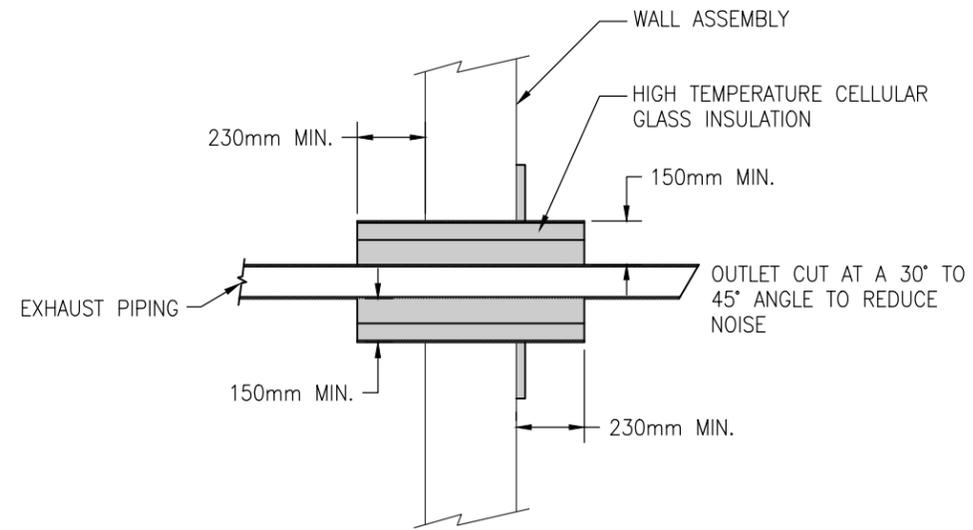
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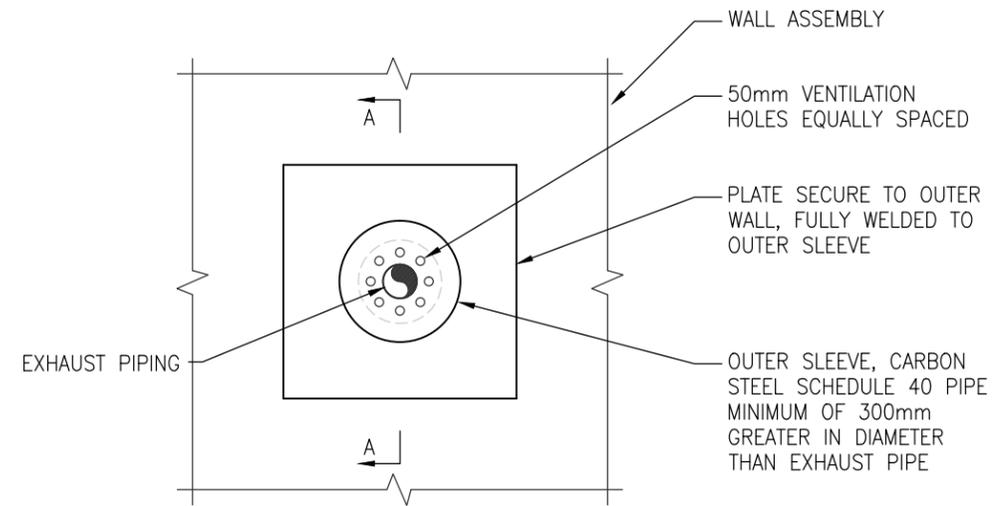
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9/17/13



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**SECTION A-A: WALL PENETRATION**



**1 THIMBLE DETAIL**  
G16 SCALE: NONE

STANDARD RESIDENTIAL  
GENERATOR  
INSTALLATION DETAILS

Drawing Title

**WALL EXHAUST  
PENETRATION  
DETAILS**

Sheet Number

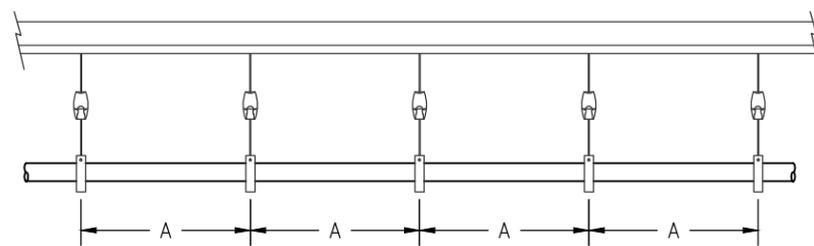
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Date:  
9/17/13



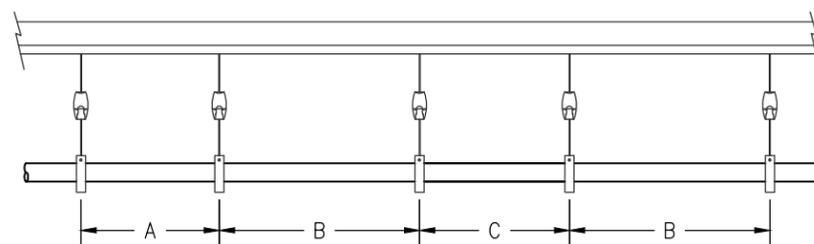
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STANDARD RESIDENTIAL  
GENERATOR  
INSTALLATION DETAILS



EQUAL SPACING BETWEEN SUPPORTS

IMPROPER SPACING



UNEQUAL SPACING BETWEEN SUPPORTS

PROPER SPACING

**GENERAL EXHAUST PIPING  
HANGER SPACING REQUIREMENTS**

1  
G17

SCALE: NONE

TABLE 1 – MAXIMUM HORIZONTAL SUPPORT SPACING	
NOMINAL PIPE DIAMETER	MAXIMUM SPACING (M)
50mm	4.0
65mm	4.3
80mm	4.6
90mm	4.9
100mm	5.2
125mm	5.8
150mm	6.4
200mm	7.3

NOTES

- HANGERS AND SUPPORTS SHALL COMPLY WITH ANSI/MSS SP-69 AND SP-58.
- SPACING SHALL NOT EXCEED THAT MAXIMUM ALLOWABLE SUPPORT REQUIREMENTS LISTED IN ANSI/MSS SP-69 AND SP-58 LISTED IN TABLE 1.
- TABLE 1 VALUES ARE BASED UPON STANDARD WEIGHT CARBON STEEL PIPING ONLY AND DOES NOT INCLUDE THE WEIGHT OF PIPING APPURTENANCES OR CHANGES IN DIRECTION THAT MAY REQUIRE ADDITIONAL SUPPORTS.
- TABLE 1 VALUES ARE BASED UPON NON-THRUST LOADS WHICH MAY REQUIRE ANCHORS AND GUIDES TO PROVIDE A FULLY RESTRAINED SYSTEM.
- UNEQUAL HANGER SPACING WILL MINIMIZE THE POTENTIAL FOR RESONANCE AND VIBRATION IN THE EXHAUST SYSTEM.
- PROVIDE TRANSVERSE AND LONGITUDINAL SEISMIC HANGERS WHERE REQUIRED BY PROJECT LOCATION. SEE SHEET G21 FOR TYPICAL SEISMIC HANGER DETAILS.

Drawing Title

**GENERAL EXHAUST  
PIPING HANGER  
REQUIREMENTS**

Sheet Number

**G17**

Date:  
9/17/13



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STANDARD RESIDENTIAL  
GENERATOR  
INSTALLATION DETAILS

**TABLE 1 – ESTIMATED EXHAUST FLOW RATE  
AT 80 Pa/M PRESSURE DROP**

	NOMINAL PIPE DIAMETER							
	50mm	65mm	80mm	90mm	100mm	125mm	150mm	200mm
MAXIMUM EXHAUST AIRFLOW (M <sup>3</sup> /MIN)	4.25	7.35	11.25	19.75	16.10	42.35	64.90	115.70

GENERAL NOTES:

1. MAXIMUM AIRFLOW IS BASED UPON A BACK PRESSURE OF 80 Pa/M THRU A SCHEDULE 40 CARBON STEEL PIPE.
2. VALUES PROVIDED IN THIS TABLE ARE ESTIMATED.

**TABLE 2 – EQUIVALENT LENGTHS FOR FITTINGS**

TYPE OF FITTING	NOMINAL PIPE DIAMETER							
	50mm	65mm	80mm	90mm	100mm	125mm	150mm	200mm
90° STANDARD ELBOW	1.6	1.9	2.3	2.9	3.0	4.0	4.6	6.4
90° MEDIUM RADIUS ELBOW	1.4	1.6	2.1	2.4	2.7	3.4	4.0	5.5
90° LONG RADIUS ELBOW	1.1	1.3	1.6	1.8	2.1	2.6	3.0	4.3
45° ELBOW	0.7	0.9	1.1	1.3	1.4	1.8	2.2	1.8
TEE,SIDE INLET OR OUTLET	3.0	3.7	4.9	5.5	6.1	7.6	9.4	13
450mm FLEXIBLE TUBE	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
600mm FLEXIBLE TUBE	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2

GENERAL NOTES:

1. VALUES REPRESENT EQUIVALENT METERS OF STRAIGHT PIPE.

EXHAUST BACK PRESSURE CALCULATIONS:

1. ANY EXTENDED EXHAUST SYSTEM SHALL BE DESIGNED BY A REGISTERED PROFESSIONAL ENGINEER.
2. EXHAUST PIPE SHALL BE SIZED TO MEET THE MINIMUM AND MAXIMUM BACK PRESSURE LIMITS FOR THE GENERATOR (7.5 KPa MEETS OR IS LESS THAN ALL GENERATORS' MAXIMUM BACK PRESSURE REQUIREMENT). REFER TO THE MANUFACTURER'S LITERATURE FOR THE EXACT BACK PRESSURE LIMITATIONS FOR THE GENERATOR TO BE INSTALLED.
3. THE FOLLOWING IS A GENERAL OUTLINE TO DETERMINE THE ANTICIPATED ENGINE BACK PRESSURE FOR ESTIMATING PURPOSES:
  - A. DETERMINE THE ENGINE EXHAUST FLOW RATE IN M<sup>3</sup>/MIN.
  - B. DETERMINE THE EXHAUST BACK PRESSURE ASSOCIATED WITH THE SILENCER. THIS INFORMATION SHOULD BE OBTAINED FROM THE SILENCER MANUFACTURER OR PROVIDER FOR THE ENGINE'S RATED EXHAUST FLOW RATE.
  - C. DETERMINE THE TOTAL LINEAR LENGTH OF EXHAUST PIPE.
  - D. DETERMINE THE TOTAL NUMBER OF FITTINGS AND TYPES.
  - E. COMPARE THE GENERATOR EXHAUST FLOW RATE TO THE FLOW RATES IN TABLE 2, ESTIMATED EXHAUST FLOW RATE AT 80 Pa/M AND SELECT THE PIPE DIAMETER WITH THE NEXT HIGHER FLOW RATE.
  - F. MULTIPLY THE NUMBER OF FITTINGS TIMES THE EQUIVALENT LENGTHS LISTED IN TABLE 2 FOR THE SELECTED EXHAUST DIAMETER.
  - G. TOTAL THE LINEAR LENGTH OF EXHAUST PIPE AND SUM OF THE EQUIVALENT PIPE LENGTH ASSOCIATED WITH THE FITTINGS.
  - H. MULTIPLY THE TOTAL EQUIVALENT PIPE LENGTH DETERMINED IN ITEM G TIMES 80 Pa/M.
  - I. ADD THE BACK PRESSURE CALCULATED IN ITEM H TO THE SILENCER BACK PRESSURE THIS IS YOUR TOTAL ESTIMATED ENGINE BACK PRESSURE AND SHOULD NOT BE GREATER THAN THE BACK PRESSURE RATING OF THE ENGINE.

Drawing Title

**ENGINE BACK  
PRESSURE  
CALCULATION  
INFORMATION**

Sheet Number

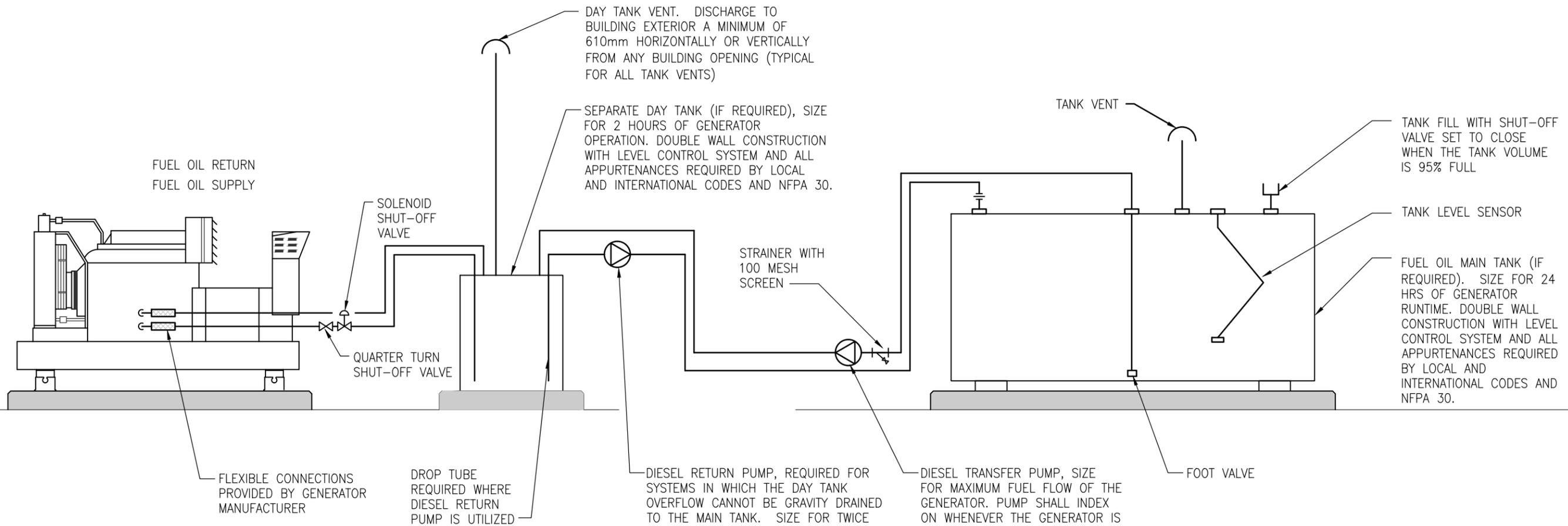
**G18**

Date:  
9/17/13



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STANDARD RESIDENTIAL  
GENERATOR  
INSTALLATION DETAILS



**SCHEMATIC NOTES**

1. THE DIESEL FLOW SCHEMATIC PROVIDES THE GENERAL REQUIREMENTS FOR A REMOTE MAIN TANK AND INTERIOR DAY TANK FOR THE DIESEL GENERATOR. ALTHOUGH THIS SCHEMATIC PROVIDES THE GENERAL ARRANGEMENT AND REQUIREMENTS, IT DOES NOT INDICATE ALL COMPONENTS REQUIRED TO COMPLY WITH LOCAL OR INTERNATIONAL CODES OR ELEVATION CHANGES BETWEEN THE COMPONENTS. RECOMMEND THAT IF A REMOTE MAIN TANK AND DAY TANK ARE REQUIRED BY THE PROJECT THAT THE FUEL OIL SYSTEM BE DESIGNED BY A PROFESSIONAL ENGINEER.
2. TYPICAL GENERATORS ARE PROVIDED WITH AN 18-24-HOUR SUB-BASE TANK THAT CAN BE UTILIZED AS THE DAY TANK SHOWN HERE.
3. THE DAY TANK SHALL BE ARRANGED SO THAT THE FUEL LEVEL DOES NOT EXCEED MAXIMUM HEIGHT ABOVE THE FUEL INJECTORS AS INDICATED BY THE GENERATOR MANUFACTURER.
4. THE DAY TANK LOW LEVEL SHALL NOT BE LOWER THAN THE LIFT HEIGHT OF THE GENERATOR'S FUEL OIL PUMP.
5. PROVIDE 20 MESH STRAINER BETWEEN THE MAIN TANK AND FUEL OIL TRANSFER PUMP.
6. FUEL SUPPLY AND RETURN PIPING SHALL BE HEAT TRACED IN COLD WEATHER ENVIRONMENTS.
7. FUEL OIL RETURN PIPING SHALL NOT INCLUDE SHUT-OFF VALVES.
8. PIPING FROM THE DAY TANK TO THE GENERATOR SHALL BE ARRANGED TO AVOID THE POTENTIAL OF AIR ENTRAINMENT.
9. SUPPORT FUEL OIL PIPING IN ACCORDANCE WITH TABLE 1

TABLE 1 - MAXIMUM HORIZONTAL SUPPORT SPACING	
NOMINAL PIPE DIAMETER	MAXIMUM SPACING (M)
32mm AND LESS	2.1
40mm	2.7
50mm	3.0
65mm	3.4
80mm	3.7
100mm	4.3
150mm	5.2
200mm	5.8

**TABLE 1 NOTES**

1. HANGERS AND SUPPORTS SHALL COMPLY WITH ANSI/MSS SP-69 AND SP-58.
2. SPACING SHALL NOT EXCEED THAT MAXIMUM ALLOWABLE SUPPORT REQUIREMENTS LISTED IN ANSI/MSS SP-69 AND SP-58 LISTED IN TABLE 1.
3. TABLE 1 VALUES ARE BASED UPON STANDARD WEIGHT CARBON STEEL PIPING ONLY AND DOES NOT INCLUDE THE WEIGHT OF PIPING APPURTENANCES OR CHANGES IN DIRECTION THAT MAY REQUIRE ADDITIONAL SUPPORTS.
4. PROVIDE TRANSVERSE AND LONGITUDINAL SEISMIC HANGERS WHERE REQUIRED BY PROJECT LOCATION. SEE SHEET G21 FOR TYPICAL SEISMIC HANGER DETAILS.

Drawing Title

**GENERAL DIESEL  
FUEL PIPING  
SCHEMATIC FOR  
INDOOR  
APPLICATIONS**

Sheet Number

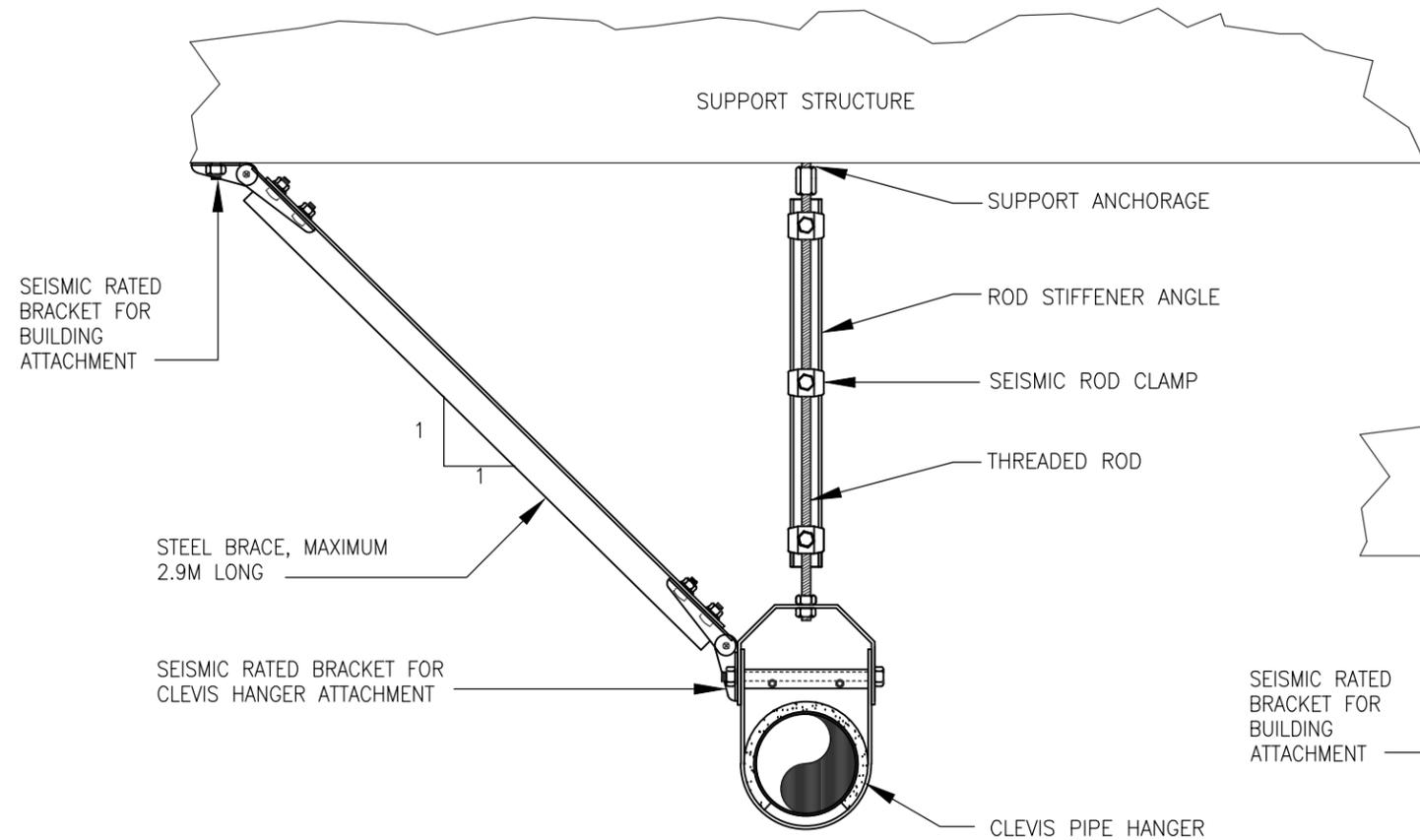
**G19**

Date:  
9/17/13

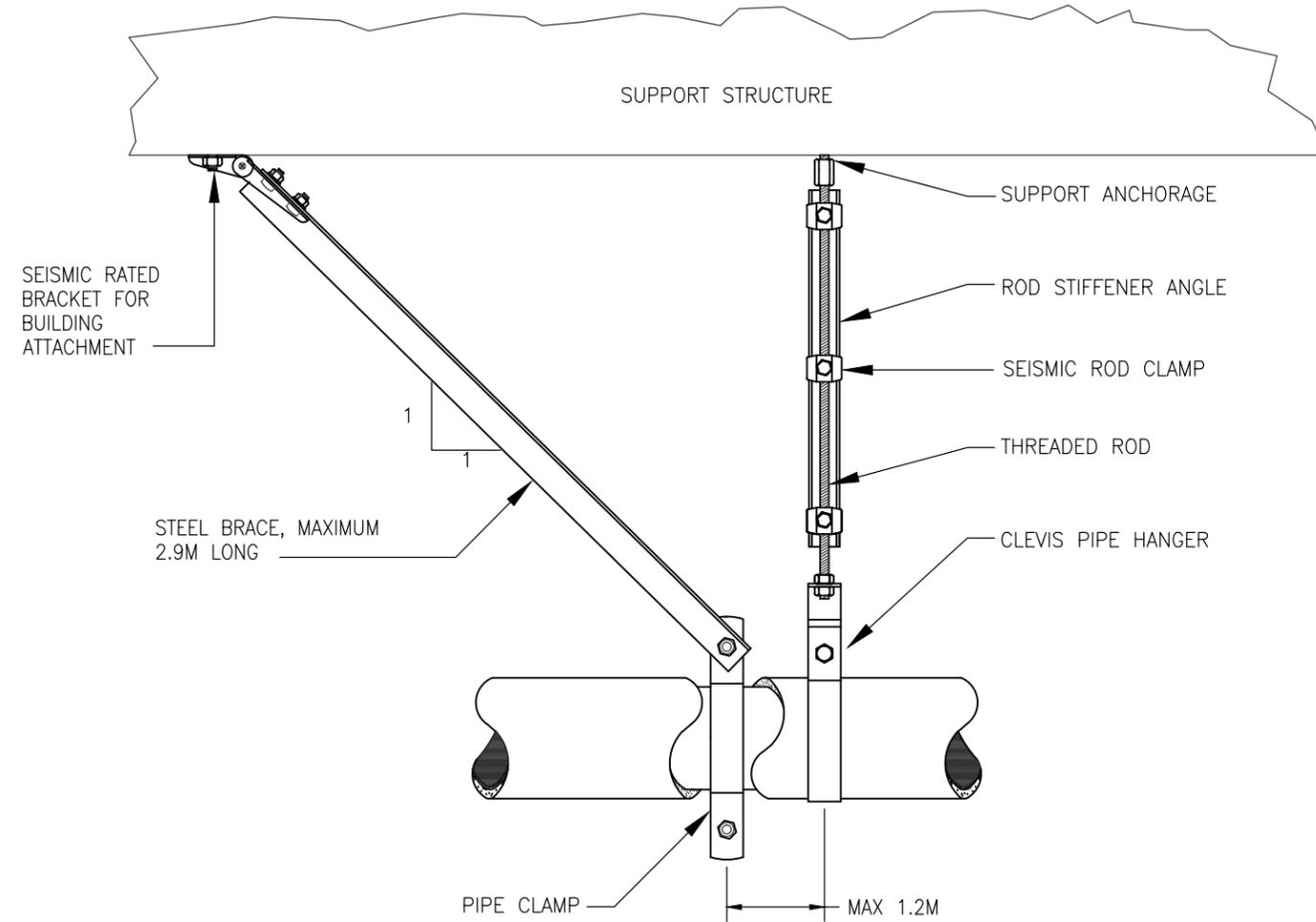


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1 TYPICAL TRANSVERSE SEISMIC HANGER  
G20 SCALE: NONE



2 TYPICAL LONGITUDINAL SEISMIC HANGER  
G20 SCALE: NONE

NOTES

1. LOCATIONS AND SIZING OF SEISMIC HANGERS AND THEIR COMPONENTS SHALL BE DETERMINED BY A REGISTERED ENGINEER BASED UPON THE SEISMIC REQUIREMENTS FOR THE PROJECT LOCATION.
2. THE IMPORTANCE FACTOR FOR THE EMERGENCY GENERATOR SYSTEM SHALL BE CONSIDERED AS AN  $I_p = 1.0$  UNLESS INDICATED OTHERWISE.

Drawing Title

TYPICAL SEISMIC  
FUEL OIL AND  
EXHAUST PIPING  
HANGER DETAILS

Sheet Number

G20

Date:  
9/17/13