

Doc Custodian: Refining Electrical Specialist	<b>Marathon Petroleum Company LP Refining</b>	Doc No.: <b>SP-60-04</b> Rev No: 0
Approved By: Refinery Maintenance Managers		<b>Temporary Generators and Distribution</b>
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## Temporary Portable Generators and Distribution

### Overview

<b>Purpose</b>	The purpose of this document is to provide the minimum requirements governing portable and vehicle mounted temporary generators and their associated temporary power distribution.
<b>Scope</b>	The scope of this document applies to all Marathon Petroleum Company LP (MPC) Refineries.
<b>Out of Scope</b>	This does not cover any permanently installed power equipment, temporary utility provided overhead distribution services, or standby generator equipment.
<b>Records Retention</b>	Printed copies of this document should not be retained more than 12 months. Any revision to this document will be retained indefinitely.

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## 1.0 References

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### 1.1 Refining References

The table below lists the Refining references used with this document.

Number	Description
<a href="#">RSP-1121-010</a>	Blinding and Energy Isolation
<a href="#">RSP-1128-000</a>	Safe Work Permit
<a href="#">RSP-1162-000</a>	Electrical Safe Work Practices

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### 1.2 Industry References

The table below lists the industry references used with this document.

Number	Description
<i>National Fire Protection Association (NFPA)</i>	
<a href="#">NFPA 70</a>	National Electrical Code
<a href="#">NFPA 70E</a>	Standard for Electrical Safety in the Workplace

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### 1.3 Regulatory References

The table below lists the regulatory references used with this document.

Number	Description
OSHA 1910	Subpart S Electrical
OSHA 1926	Subpart K Electrical

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## 2.0 Requirements

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### 2.1 General

#### 2.1.1 Approval for Temporary Installations:

- (a) Environmental Departments shall be notified of the usage of the diesel gen set.
- (b) Temporary portable generators, portable electrical distribution, and lighting installations are allowed during the construction, maintenance, or repair, of refinery equipment.
- (c) Verify if the site requires a secondary containment system to be installed.

2.1.2 Temporary electrical equipment shall comply with **Section 6.0** (*Temporary Power Requirements*) and **Appendix H** (*Assured Equipment Grounding Conductor Program*) of [RSP-1162-000](#).

#### 2.1.3 General Requirements:

- (a) Per NEC, all electrical equipment shall be listed and labeled for its intended use.
- (b) Open conductors (uninsulated) shall not be used for temporary installations.
- (c) All conductors entering enclosures shall be protected by an approved listed bushing or connector.
- (d) All unused holes in enclosures shall be plugged with an approved fitting.
- (e) All enclosure fasteners and latches shall be installed.
- (f) Clear space (working space) shall be maintained near the energized electrical equipment per NEC.
- (g) All equipment shall be rated for outdoor in use Damp/Wet locations.
- (h) Temporary installations shall be immediately disconnected and secured upon the completion of the purpose for which they were installed and removed as soon as permissible.

#### 2.1.4 Barricading:

- (a) Live parts of generators and distribution equipment operated at more than 50 volts to ground shall not be exposed to accidental contact where accessible to unqualified persons.
- (b) Hard barricades such as scaffold or lumber, shall be installed around energized temporary electrical distribution equipment to restrict access and shall have approved signage.

2.1.5 **Disconnecting Means:** Other than cord-and-plug fed connected equipment, generators shall have one or more disconnecting means.

- (a) Each disconnecting means shall simultaneously open all ungrounded conductors.
- (b) Each disconnect means shall be lockable in the open position.
- (c) Distribution equipment disconnects shall be clearly labeled indicating the loads being fed.

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## 2.0 Requirements, Continued

### 2.1 General (continued)

#### 2.1.6 Receptacles:

- (a) Receptacles of 15 and 20 amperes, 125 and 250 volts installed in a wet location shall have an enclosure that is weatherproof whether the attachment plug is inserted or not. An outlet box hood installed for this purpose shall be listed and shall be identified as “extra-duty.” Weather tight cord whips with caps are acceptable.

**Note:** Receptacles installed on portable generators and welding machines that are not rated for in use damp or wet locations shall not be used in damp or wet locations.

- (b) All receptacles installed on portable generators shall be of the grounding type and shall have the ground terminal grounded to the generator frame.

#### 2.1.7 GFCI: Ground-fault current protection shall follow the requirements of *Section 6.2 (Use of GFCI with Portable Equipment)* of [RSP-1162-000](#).

### 2.2 Temp Power Design

#### 2.2.1 Sizing: Consider the following when sizing a generator:

- (a) System voltage.  
(b) Calculate the load demand capacity requirements.  
(c) Evaluate any load starting requirements.

#### 2.2.2 Motor Loads: Motors to Generator power ratio for 480-volt 3 phase system; Across the line starting requires additional capacity for motor starting inrush currents. Staged starting of motor loads is recommended to reduce power requirements

- (a) **Single Motor:** Motor HP x 2.5 = generator kW

**Example:** 100HP motor = 250kW generator

- (b) **Multiple Motors:** Take the largest motor HP x 2.5, then add additional motors HP for generator kW.

**Example:** 100HP, 50HP, 25HP, 10HP = 250kW + 50kW + 25kW + 10kW = 335 kW

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## 2.0 Requirements, Continued

### 2.2 Temp Power Design (continued)

- 2.2.3 Other Loads:** Continuous and non-continuous loads and non-motor loads such as lighting panels, power panels, welding receptacles, utility loads, etc. Calculate the combined loads by the following methods.
- (a) Add the known wattages and calculate the kW (most accurate).
  - (b) If wattages are not known, add all the feeder breakers amperage ratings and derate by 80%.
 

**Example:** Add all circuit breaker amperage ratings, 40A + 50A + 100A + 60A = 250A. Derate by multiplying by 0.8 = 200A.
  - (c) Calculate the kW by multiplying the derated amps by the system voltage, 0.8 power factor, and the square root of three for three phase circuits.
 

**Example:** 200 (amps) X 480 (volts) X 1.73 X 0.8 (pf) / 1000= 133kW
  - (d) A quick field Rule of Thumb calculation is to divide total derated amps by 1.5.
 

**Example:** 200/1.5 =133kW
- 2.2.4 Combined Loads:** Combined motor and other loads.
- (a) Add the calculated kW for each load type.
  - (b) For motors and other loads, add the kW and match to generator sizes. Example total motor load is 285 kW add the total other load types.
 

**Example:** 285 KW + 133 kW = 418 kW total load.
- 2.2.5 Dedicated Loads:** For loads that are individually connected to one generator such as HVAC, Chillers, Heat stress, etc., evaluate the demand capacity and size the generator accordingly. Utilize the methods above for load type sizing.
- 2.2.6 Distribution Equipment:** Electrical distribution equipment shall be sized per [NFPA 70](#) requirements.
- 2.2.7 Critical Loads:** For loads that are deemed critical for life safety and or the process, evaluate utilizing a refinery power source or redundant generators for the power source.
- 2.2.8 Fuel requirement:** Generator fuel consumption, run time, and refueling capabilities shall be reviewed to ensure adequate fuel is available for the duration of service. If the generator has a Diesel Exhaust Fluid (DEF), ensure it is at the proper level.
- 2.2.9 Maintenance:** Generators diesel engines require routine maintenance activities such fuel filter replacement, oil and filter changes. For long duration run times the generator may need to be serviced.

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## 2.0 Requirements, Continued

### 2.3 Set Up

Use the following guidelines when setting up portable generators:

- (a) Placing the equipment outside of an electrically classified area is preferred.
- (b) Try to locate the equipment in low traffic areas.
- (c) Generator exhaust gasses should not be near congested areas, confined spaces, or directly under pipe racks.
- (d) Ensure that the equipment is placed on flat ground or level the generator/trailer.
- (e) Install physical guarding per barricading requirements in [Section 2.1.4](#).
- (f) Consider placement for refueling activities and notify the proper fuel delivery services.
- (g) Verify the engine fluid levels prior to placing in service.
- (h) Follow any other set up requirements of the manufacturer or rental company.

### 2.4 Wiring

#### 2.4.1 Approved Wiring Type:

- (a) All portable cable/cords shall be a minimum of 600 volt rated, listed for Hard Usage or Extra Hard Usage, and listed for wet locations if used outdoors. The outer jacket shall be complete with no damaged marks and/or 'taped-up' repairs.
- (b) The following cable types are allowed:
  - Single conductor wiring shall only be Diesel Locomotive Cable type (DLO) and rated for Extra Hard Usage.
  - Type W portable power cable rated for Extra hard usage.
  - Portable cords with types SEW, SEOW, SEOOW, SOOW, STW, STOW, STOOW.
  - Tray Cable and NEC Building wire shall be only allowed if installed in an electrical raceways per NEC.
- (c) Conductors shall be color coded to identify each current carrying conductor and EGC at the termination points, per NEC.
- (d) Flexible cords and cables shall be protected from accidental damage. Sharp corners and projections shall be avoided. Where passing through doorways or other pinch points, protection shall be provided to avoid damage.
- (e) Cable assemblies, flexible cords or cables shall be routed and supported in place at intervals that ensure that they will be protected from physical damage. Overhead supports shall be in the form of nonconductive S hooks, cable ties, straps, or similar devices so as not to cause damage to the cabling. Portable cables not installed in a raceway shall have RED DANGER tape installed throughout the cables length at intervals to ensure it is easily recognizable as a potential hazard.
- (f) Cable assemblies, flexible cords and cables installed as branch circuits or feeders shall not be installed on the ground if possible. When installed on the ground, ensure that protection is provided by either installing in a raceway or hard barricades.
- (g) Avoid coiling excessive cable as it can cause excessive heating of the conductors.

#### 2.4.2 Cable Connectors & Lugs:

- (a) All connectors and lugs shall be listed for 90C and 600 volts.
- (b) Compression, Mechanical lugs, Insulated Multi Tap, shall be rated for conductor ampacity.
- (c) Cam Locks shall be rated for the ampacity of the cable and be of the watertight design. Inspect each connection prior to mating the connectors.

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## 2.0 Requirements, Continued

### 2.5 Grounding and Bonding

**2.5.1** Portable generators used for temporary power distribution or an alternate source for refinery power systems, shall be considered a separately derived system, and the generators **NEUTRAL** shall be bonded to the generators frame and the generator frame shall be grounded to the refineries grounding system when available.

**Notes:**

- (1) When a refinery grounding system is not available and grounding is required, a grounding electrode, minimum of 8 feet, shall be installed.
- (2) A separately derived system requires that the generator frame, the ground wire(s), and the neutral wire(s) be bonded together at the generator. The neutral must be bonded at only this one place and otherwise isolated from ground.

**2.5.2** Portable generators connecting to an existing building transfer switch.

- (a) **3 Wire Switches:** In this application, the generator is considered a Non-Separately Derived System because the neutral is not switched over, and it thus remains bonded to ground upstream of the transfer switch; Connect the generator neutral to the transfer switch neutral block. Install an EGC from the generator frame to transfer switch grounding block. Verify the neutral and EGC are not bonded at the generator.
- (b) **4 Wire Switches (Switched Neutral):** In this application the generator is considered a Separately Derived System; Bond the generator neutral to the generator frame and ground the generator frame to earth (see [Section 2.5.4](#)). Connect the generator neutral to the transfer switch neutral block. Install an EGC from the generator frame to transfer switch ground block.

**2.5.3** Portable and vehicle mounted generators do **NOT** need be to grounded if the following conditions are met:

- (a) The generator supplies only equipment mounted on the generator and/or plug and cord connected equipment through receptacles mounted on the generator.
- (b) The non-current carrying metal parts of the equipment are bonded to the generator frame, and the equipment grounding conductor terminals of the generator mounted receptacle are bonded to the generator frame.

**Note:** See Sketch 3 and Sketch 5 in the [Appendix A](#).

**2.5.4** Grounded Electrode Conductor, GEC, size per NEC *Table 250.66*.

**2.5.5** Equipment Grounding Conductor, EGC, size per NEC *Table 250.122*.

**2.5.6** Neutral size per NEC *Table 250.102(C)(1)*.

**2.5.7** EGC required to be installed with all feeder and branch circuits, size per NEC.

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## 2.0 Requirements, Continued

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### 2.6 Generators in Parallel

- 2.6.1 Capacity or redundancy requirements may require that two or more generators are paralleled together (connected outputs). Paralleling will require specialized electrical switchgear and synchronization control.
  - 2.6.2 Gensets shall be placed as close to each other as possible.
  - 2.6.3 Each generator shall have its own disconnecting means.
  - 2.6.4 Generator frames shall be bonded together.
- 

### 2.7 Transfer Switches

Care shall be taken when connecting a generator to an installed manual or automatic transfer switch to identify the type of derived system (see [Section 2.5](#)).

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### 3.0 Pre-startup and Testing requirements

#### 3.1 Electrical Test

The following test shall be performed and documented on the Temporary Power Quality Control Checklist (see [Appendix A.6](#)):

- (a) Measure the winding resistance to the generator frame on each phase to verify the neutral is bonded properly.
- (b) Perform an Insulation Resistance test of all distribution equipment, cabling, and utilization equipment.
- (c) Measure the Grounded Electrode Conductor resistance, Ground resistance maximum is 25 ohms.
- (d) Test all EGCs for a low resistance path from the generator to all supplied equipment, maximum resistance is 2 ohms.

#### 3.2 QA/QC

The installation shall be inspected by a qualified electrician and the MPC Temporary Power QC documentation completed prior to energization. See [Appendix A.6](#) for the Temporary Quality Control Checklist. For critical loads, perform an IR inspection once the equipment is loaded.

#### 3.3 Labeling

All components that will require interaction shall be labeled to identify the Equipment Identification and the Load's identification.

**Example:** Generator #1 feeding I-Line #1, etc.

#### 3.4 Arc Flash

An arc flash study on the generator and temporary distribution shall be performed prior to energizing. Ensure the generator breaker settings are set per the study. Install Arc Flash Labels where operation or maintenance tasks will be performed. Only qualified persons are allowed to operate energized electrical equipment.

#### 3.5 Energy Isolation

Working on temporary portable generators and power distribution equipment requires following the site's energy isolation policy.

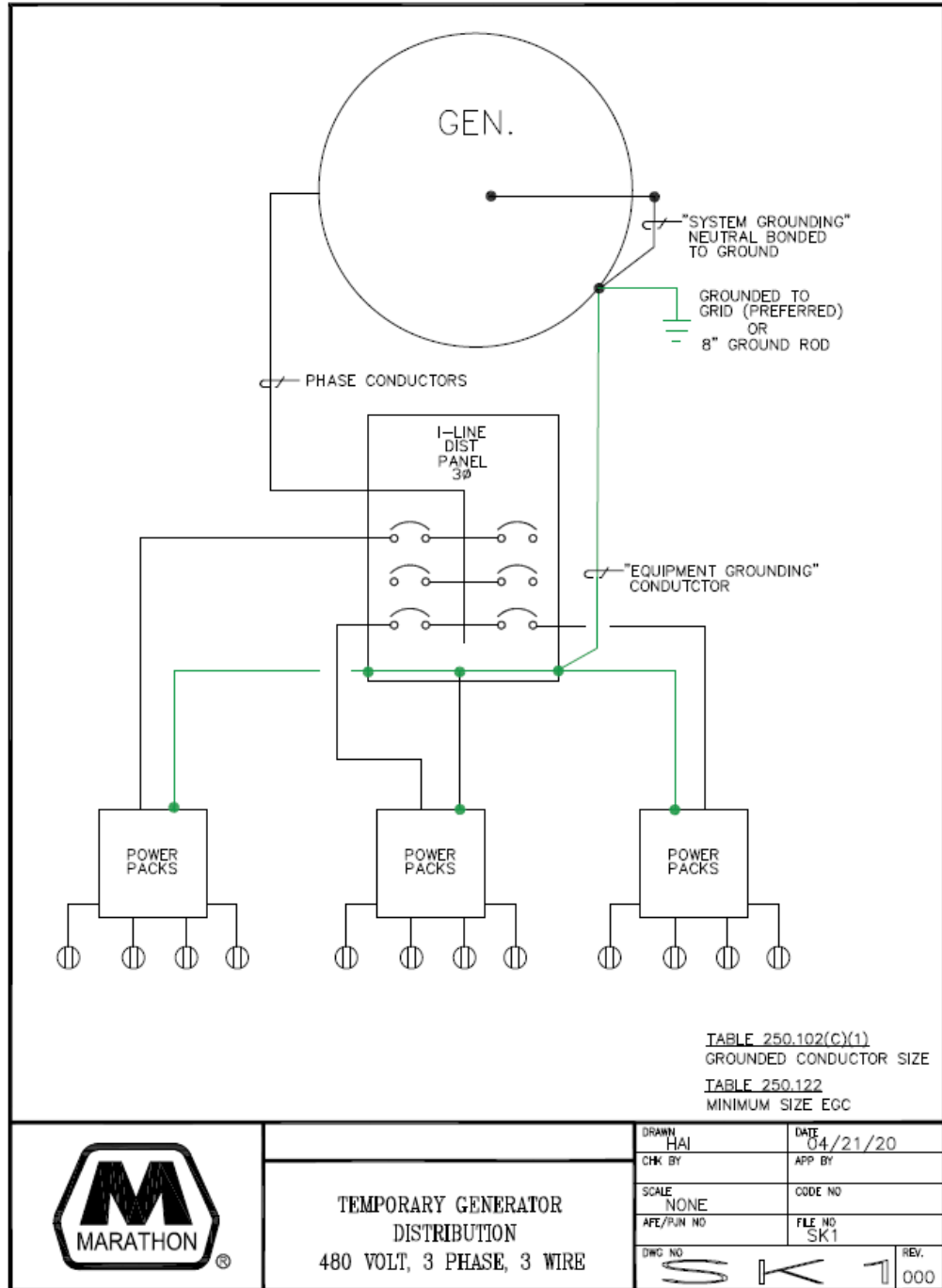
- 3.5.1 To perform work on the engine or generator, the engine starting battery shall be isolated from the starting circuit by opening the battery disconnect switches or disconnecting the main negative battery cable terminations.
- 3.5.2 Work downstream of the generator disconnecting means shall follow the site energy isolation policy.
- 3.5.3 Temporary portable generator and power distribution systems shall require energy isolation once the generator output leads are terminated to the load device.

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## Appendix A: Documentation

### A.1 Temporary Generator Distribution SKA.4 A 1

The following shows the Temporary Generator Distribution SKA.4 A 1.

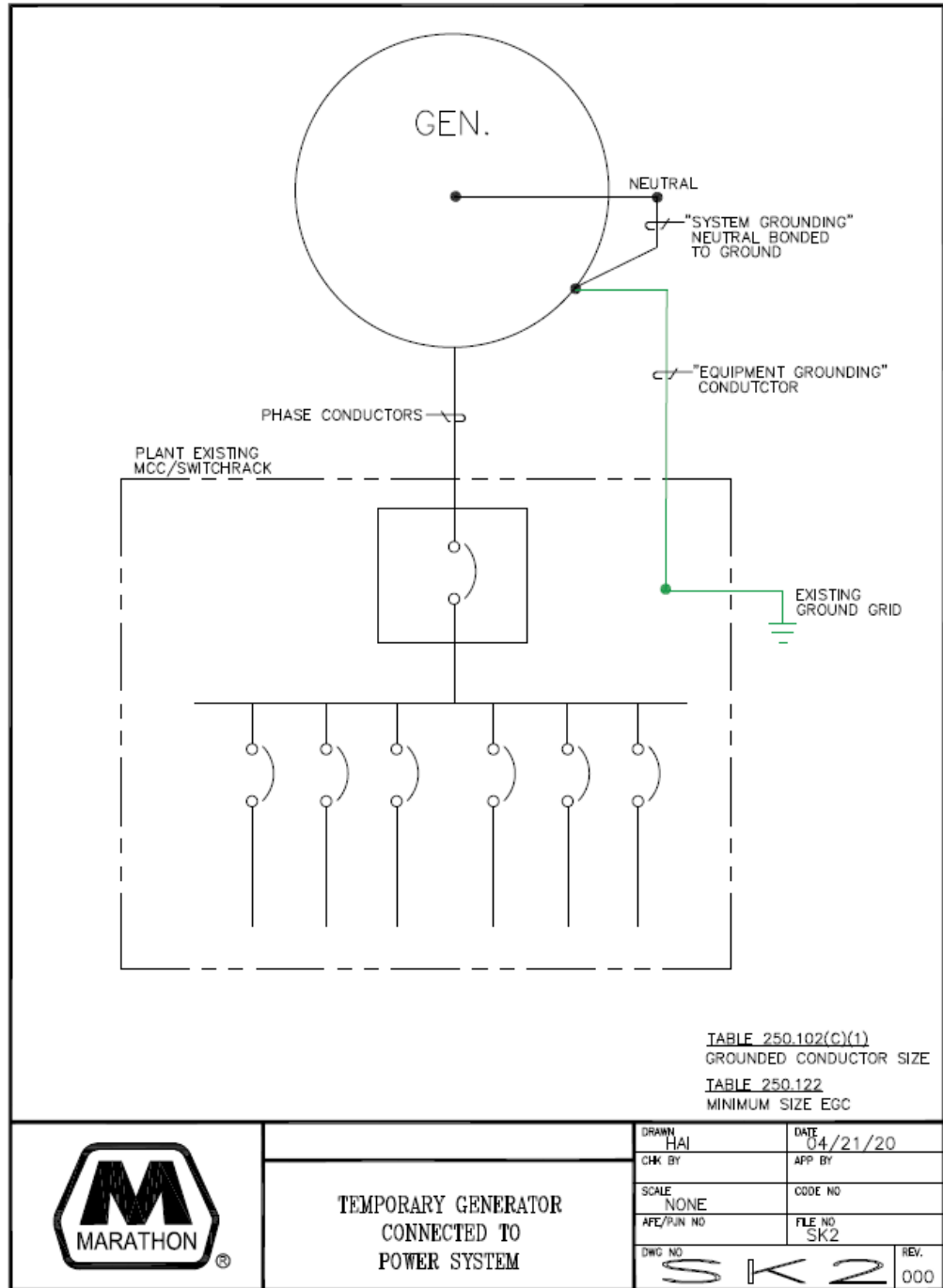


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## Appendix A: Documentation, Continued

### A.2 Temporary Generator Connected to Power System SK 2

The following shows the Temporary Generator Connected to Power System SK 2.

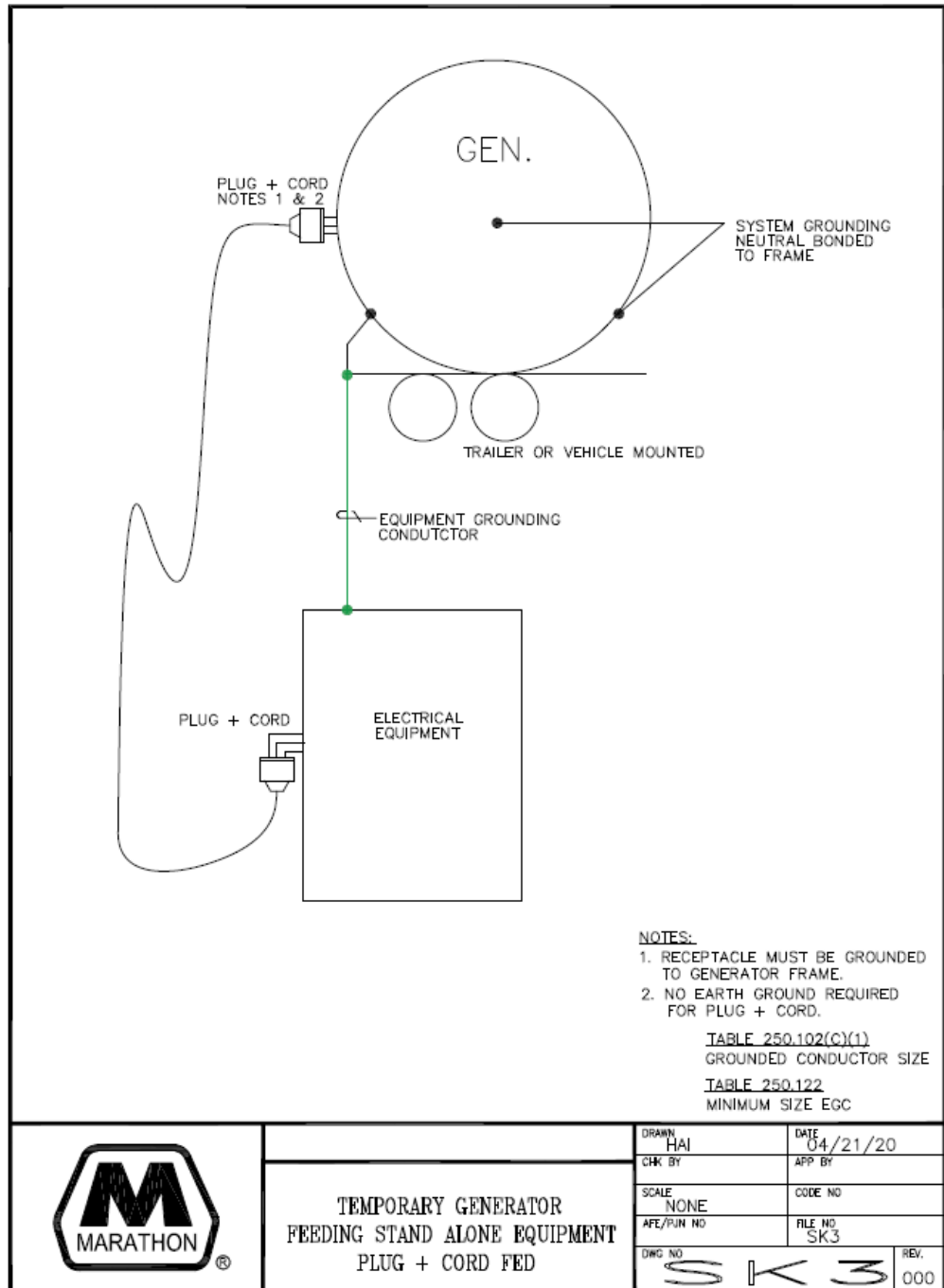


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## Appendix A: Documentation, Continued

### A.3 Temporary Generator Feeding Stand Alone Plug and Cord Fed SK3

The following shows the Temporary Generator Feeding Stand Alone Plug and Cord Fed SK3.

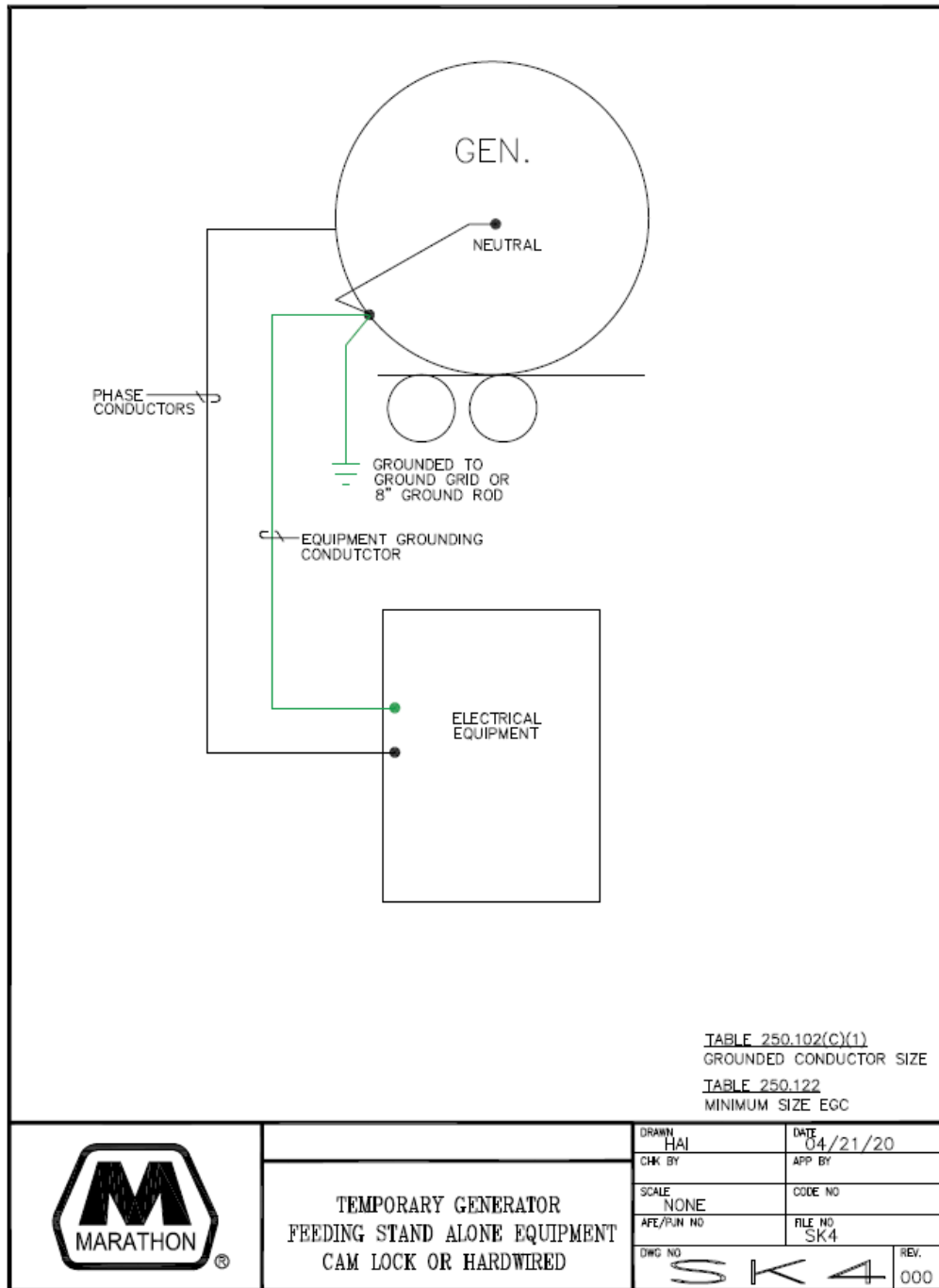


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## Appendix A: Documentation, Continued

### A.4 Temporary Generator Feeding Stand Alone Equipment Cam Lock or Hard Wired SK4

The following shows the Temporary Generator Feeding Stand Alone Equipment Cam Lock or Hard Wired SK4.

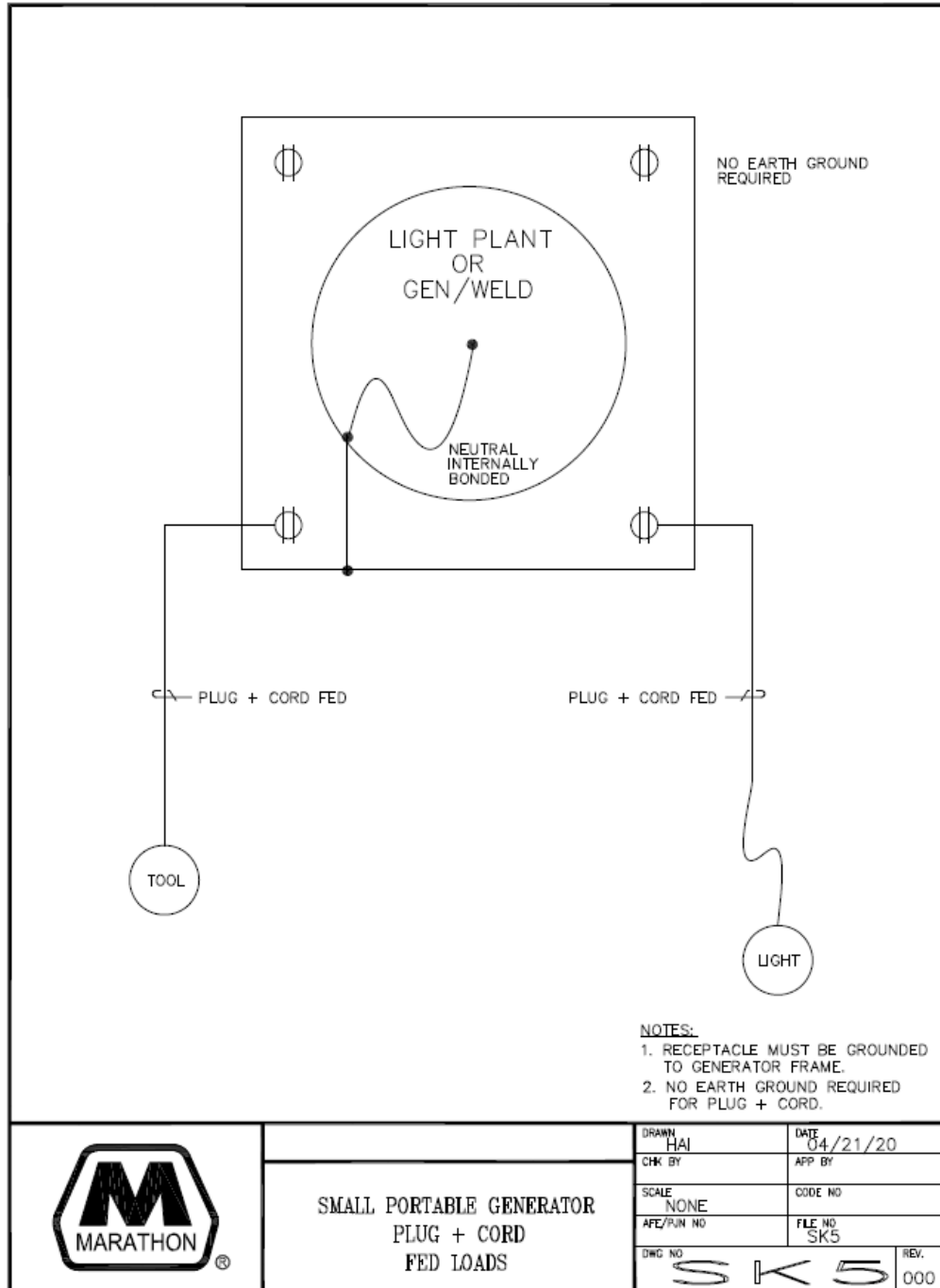


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## Appendix A: Documentation, Continued

### A.5 Small Portable Generator Plug and Cord Fed SK5

The following shows the Small Portable Generator Plug and Cord Fed SK5.



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## Appendix A: Documentation, Continued

### A.6 Temporary Power Quality Control Checklist

The following shows the Temporary Power Quality Control Checklist ([SP-60-04-FORM01](#)).

**Reference:** For the most up to date, working of this checklist, use the following link: [SP-60-04-FORM01.XLSX](#)

		<b>TEMPORARY POWER QUALITY CONTROL CHECKLIST (SP-60-04-FORM01)</b>			
DATE		RENTAL COMPANY			
EQUIPMENT LOCATION		DURATION			
PURPOSE					
<b>GENERATOR</b>					
<b>INSPECTION</b>					Contract /MPC Electrician
Is the Generator placed outside of an electrically classified area?					
Is the Generator set leveled and if trailer mounted are the wheels chocked?					
Are the generator engine fluid levels, oil, coolant, and fuel, verified to be in normal limits?					
Is the generator properly sized for the loads?					
Is the generator neutral bonded to the frame?					
Are the phase conductors properly sized for the generator and identified with phasing tape?					
Is the Equipment Grounding Conductor properly sized, connections torqued, and GREEN tape installed?					
Is the Generator frame grounded to the electrical grid or a ground rod? NOTE: if equipment is fed from the generator mounted receptacles only, the generator is not required to be grounded to the grid or earth, only the generator frame through the receptacle.					
Are ALL cables properly connected and or torqued?					
Are All guards in place near electrical connections?					
Verify the generator breaker settings match the ARC FLASH recommendations.					
Is an ARC FLASH LABEL installed where easily visible?					
Are physical barricades around energized areas?					
<b>ELECTRICAL TEST</b>					
Insulation Resistance in Meg Ohms/test at 1000 volts		Reading			
A Phase to Ground					M OHM
B Phase to Ground					M OHM
C phase to Ground					M OHM
Grounding resistance in Ohms					OHMS
Equipment Grounding Conductor resistance (<2 )					OHMS
Prior to any electrical terminations, start the generator and ensure the proper voltage and frequency are developed.					
A Ø VAC	B Ø VAC	C Ø VAC	HZ		
<b>DISTRIBUTION EQUIPMENT</b>					
<b>INSPECTION</b>					Contract /MPC Electrician
Is the Distribution Equipment placed outside of an electrically classified area?					
Is the Distribution Equipment placed out of heavy traffic areas?					
Is the Distribution Equipment in good physical condition?					
Is the Distribution Equipment Rated for DAMP/WET locations?					
Are the breaker sizes correct for the loads?					
Are all guards in place to prevent exposed energized parts?					
Is the Equipment Grounding Conductor properly sized, connections torqued, and GREEN tape installed?					
Are the breakers labeled to indicate what load device it feeds?					
Is an ARC FLASH LABEL installed where easily visible?					
<b>ELECTRICAL TEST</b>					
Insulation Resistance in Meg Ohms/test at 1000 volts		Reading			
A Phase to Ground					M OHM
B Phase to Ground					M OHM
C phase to Ground					M OHM
Equipment Grounding Conductor resistance (<2 )					OHMS

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## Appendix A: Documentation, Continued

### A.6 Temporary Power Quality Control Checklist (continued)

CABLES		
INSPECTION		Contract /MPC Electrician
Are the Cables, in good physical condition?		
Routed in a way to minimize damage, in a raceway or hung overhead?		
Are all the PRIMARY and SECONDARY connection torqued or tightly fitted CAM LOCK connections?		
Are all the cables phased with colored phasing tape at each ends?		
Is the cabling identified as energized electrical cabling with RED Danger tape?		
Equipment Grounding Conductors shall be tested to ensure a low resistance patch exist from the source to the load.		
<b>ELECTRICAL TEST</b>		
Insulation Resistance in Meg Ohms/test at 1000 volts		Reading
A Phase to Ground		M OHM
B Phase to Ground		M OHM
C phase to Ground		M OHM
A Phase to B phase		M OHM
A Phase to C phase		M OHM
B Phase to C phase		M OHM
UTILIZATION EQUIPMENT (LOADS)		
INSPECTION		Contract /MPC Electrician
Is the Utilization Equipment placed outside of an electrically classified area?		
Is the Utilization Equipment placed outside of heavy traffic areas?		
Is the Utilization Equipment in good physical condition?		
Is the utilizations rated for DAMP/WET locations while in service?		
Are all guards in place to prevent exposed energized parts?		
Is the Equipment Grounding Conductor properly sized, connections torqued, and GREEN tape installed?		
<b>ELECTRICAL TEST</b>		
Insulation Resistance in Meg Ohms/test at 1000 volts		Reading
A Phase to Ground		M OHM
B Phase to Ground		M OHM
C phase to Ground		M OHM
Equipment Grounding Conductor resistance (<2 )		OHMS
Contractor Representative		Marthon Representative
Date		Date
NAME		NAME

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## Revision History

**Document** Complete the following table for each document revision.  
**Revision History**

Rev. No.	Description of Change	Author	Approved By	Rev. Date
0	First issue of document.	T.W. Perilloux	Refinery Maintenance Managers	10/6/20

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