



Intertek
5024343

CONFORMS TO ANSI/CAN/UL/ULC STD 2200

MX PrimeGen

Power Generator

INSTALLATION OPERATION AND MAINTENANCE MANUAL

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1 COPYRIGHT, LIABILITY, AND CONTACT INFORMATION

This manual provides instructions for the installation, operation, performance, basic maintenance and troubleshooting of the MX Power Generator. In the event of unforeseen or special problems, do not take unauthorized remedial action. Contact GPT’s Customer Service department to obtain the necessary information. All agreements, assurances, and legal relationships as well as all obligations of GPT, shall be governed by the respective valid purchase contract which is not influenced by the content of this document. For any technical issues or questions:

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2 IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS – This manual contains important instructions for the MX PrimeGen Power Generator that should be followed during installation and maintenance of the generator and its batteries. Read the following safety warnings before beginning assembly, installation, or maintenance of the MX Power Generator.

1. Observe all prescribed accident prevention and safety rules. Do not perform work on the MX Power Generator alone—make sure there is somebody else working with you.
2. The installation of the MX Power Generator must conform with local codes or, in the absence of local codes, with CSA-B149.1 – Natural Gas and Propane Installation Code.
3. When installed, the MX Power Generator must be electrically grounded in accordance with local codes, or in the absence of local codes, with CSA C22.1 – Canadian Electrical Code.
4. The MX Power Generator is not intended to be used in underground mines. Do not use the MX system in underground mines.
5. Per local codes, the MX Power Generator shall be installed with a fuel shut-off valve. This is not included in the base design but is included with the regulator option added. The shut-off valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures more than 34 kPa (5 psi).
6. The MX Power Generator must be isolated from the gas supply piping system by closing its individual manual shut-off valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 34 kPa (5 psi).
7. Do not use the MX Power Generator if any part has been under water. Immediately call a qualified service technician to inspect and to replace any part of the control system, gas control and generator that has been under water.
8. The MX Power Generator is designed to combust gaseous fuels which will result in combustion products of heat, carbon dioxide and water vapour. It may contain traces of carbon monoxide, unburnt hydrocarbons, and nitrous oxides. Emissions from combustion will depend on generator set-up and operation as well as the composition of the gas feed. It is imperative that these instructions be followed, and that gas supplied meets the gas specifications outlined in this manual.
9. The MX Power Generator must be mechanically installed according to the instructions contained within this manual. It must be securely anchored to a non-combustible surface when installed.
10. Installation and repair must be performed by a qualified service person. The MX Power Generator should be inspected before use and at least annually by a qualified service person. More frequent cleaning may be required as necessary. It is imperative that control compartment, air intakes, and circulating air passageways of the system are kept clean.
11. The MX Power Generator uses an internal combustion engine. Qualified service personnel should have mechanical knowledge on how to maintain engine fuel, lubrication, ignition, and cooling systems.
12. The MX Power Generator contains electrical, and gas related safety devices as identified throughout this manual. Tampering or rendering inoperative any of these safety devices may result in personal injury or death and possible damage to the equipment and is not permitted under any circumstances.

13. The MX Power Generator has some parts constructed from sheet metal. Every effort is made to ensure that edges have been deburred when manufactured, however sharp edges may still exist. Be cautious when handling. Wear gloves for safety.
14. Any guard or other protective device removed for servicing from the MX Power Generator must be re-installed prior to operating the system.
15. The MX contains sub-systems that combust gaseous fuel and others that run high electrical loads, all of which can pose high surface temperature hazards. Avoid exterior areas, as well as internal components of the generator to avoid burns or clothing ignition when in operation or cooling down.
16. The MX Power Generator contains rotating parts, hot surface temperatures, and high voltages. It also has remote start and stop capabilities. Do not begin work on the MX Power Generator unless it is shut-off manually, switched to LOC mode, and locked out so that the system cannot be started remotely or inadvertently. Follow the shutdown procedure on Section 7.1 of this manual.
17. The MX Power Generator uses natural gas or propane as fuel. In the event of a leak, there is a possibility of a fire and explosion.
18. Lethal voltages are present in this system. The MX Power Generator has either 120/240 VAC systems or 120/208 VAC as well as 24 VDC systems. Use accepted safety procedures for working on all electrical circuits. Follow all local electrical safety regulations.
19. Study the MX Power Generator wiring diagrams and schematics before working on electrical circuits and ensure that all tools used while working on electrical circuits are insulated.
20. The MX Power Generator contains batteries. Avoid touching live battery terminals and placing tools on or near the batteries. These can provide dangerous voltages and currents, even when the system is shut-off.
21. As soon as electrical cabinet doors are opened or terminal covers are removed, there is the danger of contacting hazardous voltages. Any operations inside the cabinets or with exposed electrical terminals must only be carried out by qualified electrical personnel. If in doubt, do not touch.
22. Sparking and arcing may occur if a wire is connected or disconnected with a heavy current flow. Arcing can burn skin or eyes and damage equipment.
23. The MX Power Generator includes spark plug, which needs to be accessed during maintenance. Do not touch the conductor of a spark plug while it is energized.
24. The MX Power Generator is not intended for use as emergency power.
25. Keep the MX Power Generator's installation site clear and free from combustible materials, gasoline, and other flammable vapours and liquids. Maintain the minimum clearances specified in this manual.
26. Fuel supplied to the MX Power Generator must not contain liquids. Liquid hydrocarbons in the fuel supply pose a risk of fire and may result in serious damage and danger to the operator.
27. Do not exceed the fuel pressure stamped on the MX Power Generator's data plate without factory approval.
28. The MX Power Generator exhaust can be very hot. Do not touch any of the exhaust components or bring exposed skin near hot exhaust gases.

29. When the MX Power Generator is operating, surface temperatures of the exhaust can approach temperatures above 70°C (158°F). Avoid contact of skin and clothing with the surfaces of the exhaust to avoid burns. The MX unit must be installed so that the risk of contact by people is minimized.
30. The MX Power Generator is designed FOR OUTDOOR USE ONLY.

2.1 MANUAL ICONS AND SAFETY BANNERS



A banner with the word “WARNING!” below an icon with an exclamation point within a red triangle contain important information that, if not adhered to, can cause personal injury and/or property damage.



A banner with the word “CAUTION!” below an icon with an exclamation point within a red triangle contain important information that, if not adhered to, can cause damage to the MX Power Generator.

NOTE:

A banner with the word “NOTE:” contains supplemental information that provide additional insight on specific topics throughout this manual.

2.2 TECHNICALLY QUALIFIED PERSONNEL

This manual contains necessary information for the correct operation of the MX Power Generator and is intended for use by technically qualified service personnel. Qualified personnel are persons who are:

- ✓ Familiar with the erection, installation, commissioning, and operation of the device and of the system which is being installed or in which the device is being installed.
- ✓ Capable of performing switching operations according to safety technology standards and are authorized to switch the equipment on and off and to isolate it from voltage.
- ✓ Have mechanical knowledge on how to maintain engine fuel, lubrication, ignition, and cooling systems.
- ✓ Instructed according to the standards of safety technology in the care and use of safety equipment and trained in immediate rescue measures (first aid).
- ✓ Completed instructions with appropriate confirmation by an appropriately qualified instructor.

2.3 BATTERY SAFETY

1. Servicing of batteries are to be performed or supervised by personnel knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from batteries.
2. When replacing batteries, use the same number and the following type batteries: Type 31 AGM batteries, 12V, 100-105 Ah.



Do not dispose of battery or batteries in a fire. The battery is capable of exploding.

**CAUTION!**

Do not open or mutilate the battery or batteries. Released electrolyte has been known to be harmful to the skin and eyes and to be toxic.

**CAUTION!**

A battery presents a risk of electrical shock and high short circuit current.

3. following precautions are to be observed when working on batteries:

- Remove watches, rings, or other metal objects;
- Use tools with insulated handles;
- Wear rubber gloves and boots;
- Do not lay tools or metal parts on top of batteries;
- Disconnect charging source prior to connecting or disconnecting battery terminals; and
- Determine if the battery is inadvertently grounded. When inadvertently grounded, remove source of ground. Contact with any part of a grounded battery is capable of resulting in electrical shock. The risk of such shock is reduced when such grounds are removed during installation and maintenance (applicable to a generator not having a grounded supply circuit).

2.4 START-STOP OPERATIONS

1. The MX Power Generator is equipped with an Emergency Shutdown (ESD) button that acts as the absolute emergency shutdown of the system. Operators must shut down the device prior to doing any maintenance or repair on the system.
2. A manual shut-off valve must be installed according to local standards at the fuel inlet to allow fuel supply to be cut off in the event of any problems. Refer to Section 4.4.3 for details.

3 PRODUCT INFORMATION

The MX Power Generator is an outdoor off-grid power system that generates up to 6 kVA of electrical power using an internal combustion engine (ICE) generator system. The engine is designed for long run continuous output with standard 2,250-hour maintenance intervals and can be expanded to 9,000 continuous hours with the addition of an optional extended oil sump.

The MX Power Generator has the following features and configurations:

Voltage

- 120/208V 3 Phase 60 Hz **or**
120/240V 1 Phase 60 Hz

Fuel Types

- Natural gas **or** Propane

Fuel System

- 2.5 to 5 psig (17 to 35 kPag) inlet pressure
- Option:
External fuel pressure regulated system to 10 to 28 psig (69 to 193 kPag)

System Control

- Local or Remote operation
- Manual or Auto-Standby mode
- Emergency Shutdown (ESD)

Remote Operation

- Runtime System On/Off
- System Start/Stop
- Manual or Auto-Standby mode
- Emergency Shutdown (ESD)

LED Display

- Shows system status, alarms, runtime, etc. Refer to Section 5.2

Net Power

- 6 kVA continuous

Batteries

- Internal 24V battery system

Oil System

- Standby – 2250-Hour of runtime, with sight glass.
- Extended Run – 9,000 hours of runtime, with sight glass

Remote Monitoring

- SCADA Interface (Dry Contacts)
- Modbus, supporting RS-485 and TCP/IP
- IoT through cloud portal
(requires cellular connectivity)

Temperature Range


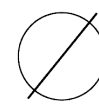


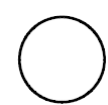
- Running range of -40°C to +40°C
- Engine starting range of -5°C to +40°C
- Engine starting range with Cold Ambient configuration (“-CA”) is -40°C to +40°C
(120V external power is recommended for engine startup below -5°C)

3.1 TERMS AND ACRONYMS


The following terms and acronyms are used throughout this manual.

GPT	Global Power Technologies
UI	User Interface
ICE	Internal Combustion Engine
COG	Center of Gravity
ESD	Emergency Shutdown
PLC	Programmable Logic Controller (also dubbed System Controller)
PCB	Printed Circuit Board
SCADA	Supervisory Control and Data Acquisition
ECU	Engine Control Unit
IoT	Internet of things

The following symbols are used in this manual and on labels on the MX PrimeGen units:


	 or Φ			
Alternating Current	Phase	Equipment Grounding Conductor	On	Off

3.2 DATA PLATE



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Intertek
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CONFORMS TO
ANSI/CAN/UL/ULC STD 2200

INLET PRESSURE
PRESSION D'ENTRÉE

kPa
(psig)^{min}

kPa
(psig)^{max}

CONSUMPTION HHV
CONSOMMATION PCS

kW
(Btu/h)^{min}

kW
(Btu/h)^{max}

FUEL TYPE
TYPE DE COMBUSTIBLE

OUTPUT RATING @40°C
PUISSANCE DE SORTIE @40°C

V φ HZ

kVA COS φ

MAX UNBALANCED LOAD
CHARGE DÉSÉQUILIBRÉE MAX

W

RPM
TR/MIN

MODEL NUMBER
NUMÉRO DE MODÈLE

SERIAL NUMBER
NUMÉRO DE SÉRIE

SEE INSTRUCTION MANUAL FOR OPERATION
RAINPROOF UNIT, FOR OUTDOOR USE ONLY
REPORTEZ-VOUS AU MANUEL D'UTILISATION
ÉQUIPEMENT RÉISTANT À LA PLUIE, POUR USAGE EXTÉRIEUR UNIQUEMENT

302785 Rev 3

Figure 3-1 – Data Plate

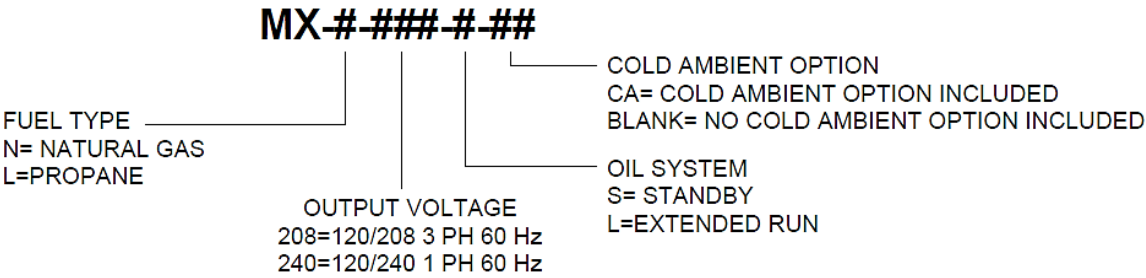


Figure 3-2 – MX Model Tree

The data plate shows important information about the MX Power Generator and can be used as a quick reference point when performing service or contacting GPT with questions. It is located on the inside of the electrical panel cabinet door. When contacting GPT, indicate both the complete Model Number and Serial Number of your MX unit.

The information listed on the data plate are as follows:

- Inlet pressure

Consumption HHV

Fuel Type

Output Rating @ 40°C

Max Unbalanced Load

Model Number

Serial Number
- Minimum and maximum levels of inlet fuel pressure permitted.

Minimum and maximum heating values permitted.

The type of fuel that the MX unit’s fuel system is designed for
L = Propane; N = Natural Gas

Nominal power output of the MX unit at 40°C (104°F)

Maximum unbalanced load

Model number of the MX unit (Refer to Model Tree in Figure 3-2)

The unique number assigned to the MX unit for traceability.

4 ASSEMBLY AND INSTALLATION



WARNING!

Before beginning any work on the MX Power Generator read this installation, operation, and maintenance manual thoroughly and pay special attention to all safety instructions. The MX Power Generator is designed **FOR OUTDOOR USE ONLY**.

4.1 SITE PREPARATION

The MX Power Generator must be anchored to a non-combustible, solid, and level surface or concrete pad using four 1/2" anchor bolts (not included). The base must be sturdy enough to accommodate the 1750-lb (794 kg) weight of the unit. The MX Power Generator is not intended for use over raised floor or cable vault.

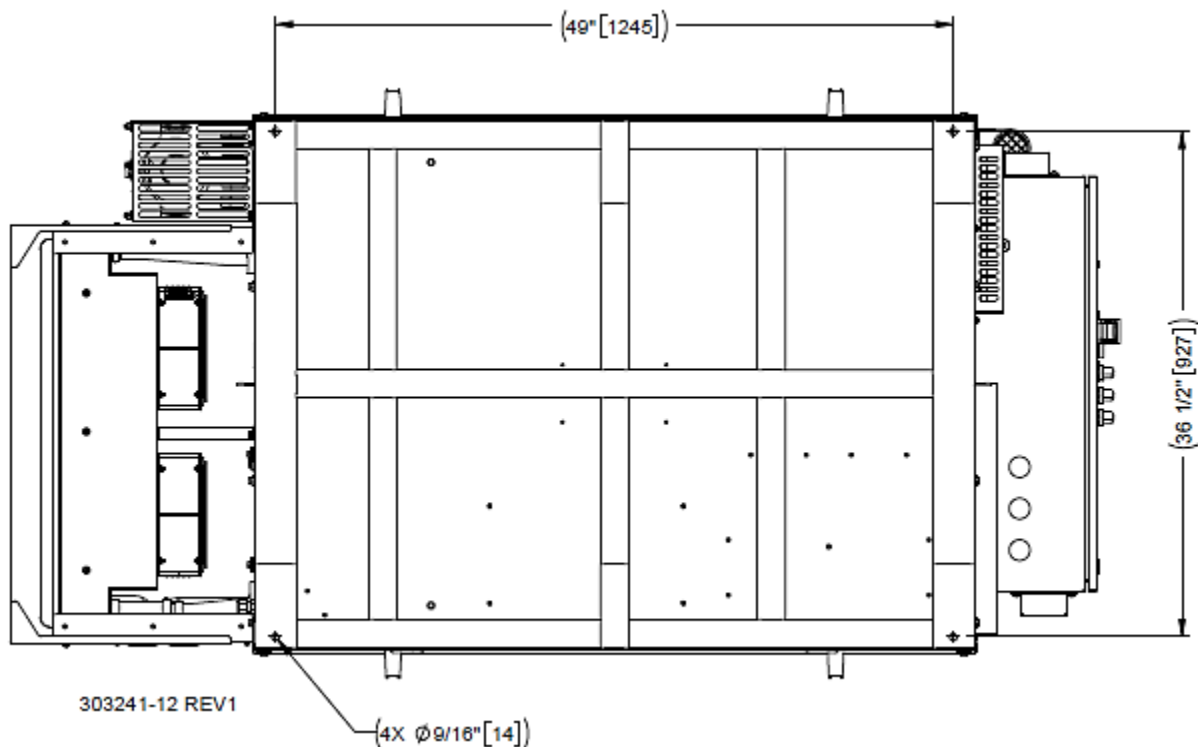


Figure 4-1– Anchor Hole Layout



WARNING!

The MX Power Generator must be installed on a non-combustible surface. It is **NOT** intended for use over raised floor or cable vault.

4.1.1 LOCATION AND ACCESS

Follow local regulations when placing the MX Power Generator near buildings and fuel tanks. Allow a minimum clearance of 40 inches (1 m) from all sides of the unit.

The MX Power Generator must be installed so that access is restricted to only qualified service personnel who have been instructed of the reasons for the restrictions applied to the location and about any precautions that must be taken when accessing the unit.

Access to the location of the MX Power Generator shall be through the use of a special tool and shall be controlled by the authority responsible for the location.

The authority responsible for the location of the MX Power Generator must provide a copy of this Installation, Operation, and Maintenance Manual to the qualified service personnel to provide guidance during installation or maintenance work on the unit.



When the MX Power Generator is operating, surface temperatures of the exhaust can approach temperatures above 70°C (158°F). The MX Power Generator must be installed so that the risk of contact by people is minimized.

4.1.2 FUEL SUPPLY



Use only the type of fuel that the specific unit is designed for and indicated on the MX unit's data plate located on the inside of the electrical panel enclosure door.

The MX Power Generator accepts either natural gas or propane fuel. Check the Data Plate located inside the cabinet door of the electrical panel to verify the type of fuel that the specific unit is compatible with.

When preparing the fuel supply, ensure that the fuel gas is:

1. Free of moisture or any other type of contamination.
2. Appropriate to the environment with accommodations or appropriate adjustments for temperature extremes.
3. Fuel supply pressure never exceeds 5 psi_g (34.5 kPa_g).

4.1.3 STANDARD SPECIFICATIONS FOR GASEOUS FUEL

Global Power Technologies' MX Power Generator can run on natural gas or propane depending on the model type.

Natural gas fuel systems:

1. Shall have a Methane number greater than 50.
2. Shall not contain any liquids.
3. Shall not contain any particulates.

Propane gas fuel systems shall be HD-5 Consumer Grade Propane or equivalent.

Standard Conditions — 1 atm and 15°C (59°F).

Table 1 shows the complete fuel specifications for the MX Power Generator.



Propane may need additional heating in cold temperatures to maintain vapour pressure. For varying gas compositions, including wellhead gas. Contact GPT for more information.

Table 1 – MX Power Generator Fuel Specifications

	NATURAL GAS	PROPANE
Inlet Connection	1/2" tube union	1/2" tube union
Inlet Pressure (Standard)	2 to 5 psig (13.8 to 34.5 kPag)	2 to 5 psig (13.8 to 34.5 kPag)
Inlet Pressure (Optional Regulator)	10 to 28 psig (68.9 to 193.1 kPag)	10 to 28 psig (68.9 to 193.1 kPag)
Lower Heating Value (LHV)	872 to 1066 BTU/scf (32.5 to 39.7 MJ/sm ³)	2237 BTU/scf 83.3/sm ³
Higher Heating Value (HHV)	966 to 1181 BTU/scf 36 to 44 MJ/sm ³	2477 BTU/scf 92.3 MJ/sm ³
Fuel Composition	80 to 99 % CH ₄	90 to 100% C ₃ H ₈
	0 to 10% [N ₂ +CO ₂]	0 to 5% C ₃ H ₆
	0 to 2 ppmv H ₂ S*	--
	0 to 50 ppmv Total Sulphur	0 to 50 ppmv Total Sulphur
Fuel Flow Rate 3 PH	678 to 2033 scf/d 19.2 to 57.6 sm ³ /d	7.6 to 21.9 gallons per day 29 to 83 litres per day
Fuel Flow Rate 1 PH	710 to 2103 scf/d 20.1 to 59.6 sm ³ /d	7.9 to 22.7 gallons per day 30 to 86 litres per day
Fuel Consumption (HHV) 3 PH	At maximum 6.0 kVA load: 88,700 BTU/hr (26.0 kW)	At maximum 6.0 kVA load: 82,200 BTU/hr (24.1 kW)
Fuel Consumption (HHV) 1 PH	At maximum 6.0 kVA load: 91,700 BTU/hr (26.9 kW)	At maximum 6.0 kVA load: 85,000 BTU/hr (24.9 kW)
*NOTE:	If H₂S is present in the gas stream, consult GPT before installation. An H₂S removal system may be required. H₂S must average 2 ppmv or less, and not exceed 4 ppmv at any time.	

4.2 UNPACKING AND LIFTING



The spreader bar used for lifting the MX Power Generator must have a minimum safe working load greater than the 1750 lb. weight of the unit. Sling angles must not exceed 15° from vertical.

Before unpacking, inspect the system for any signs of damage that may have occurred during shipping. Report any damage to GPT as soon as possible.

Use a hoist system, with spreader bar and chains, to lift the MX Power Generator into place. The hoist system design and spreader bars are not provided by GPT.

The lifting lugs on the MX Power Generator are designed for use with 3/8" shackles. Use rigging, including slings, shackles, etc., with appropriate minimum safe working load. The MX Power Generator weighs approximately 1750 lb. (794 kg). Refer to Appendix B for the MX Power Generator's detailed weight and dimensions.

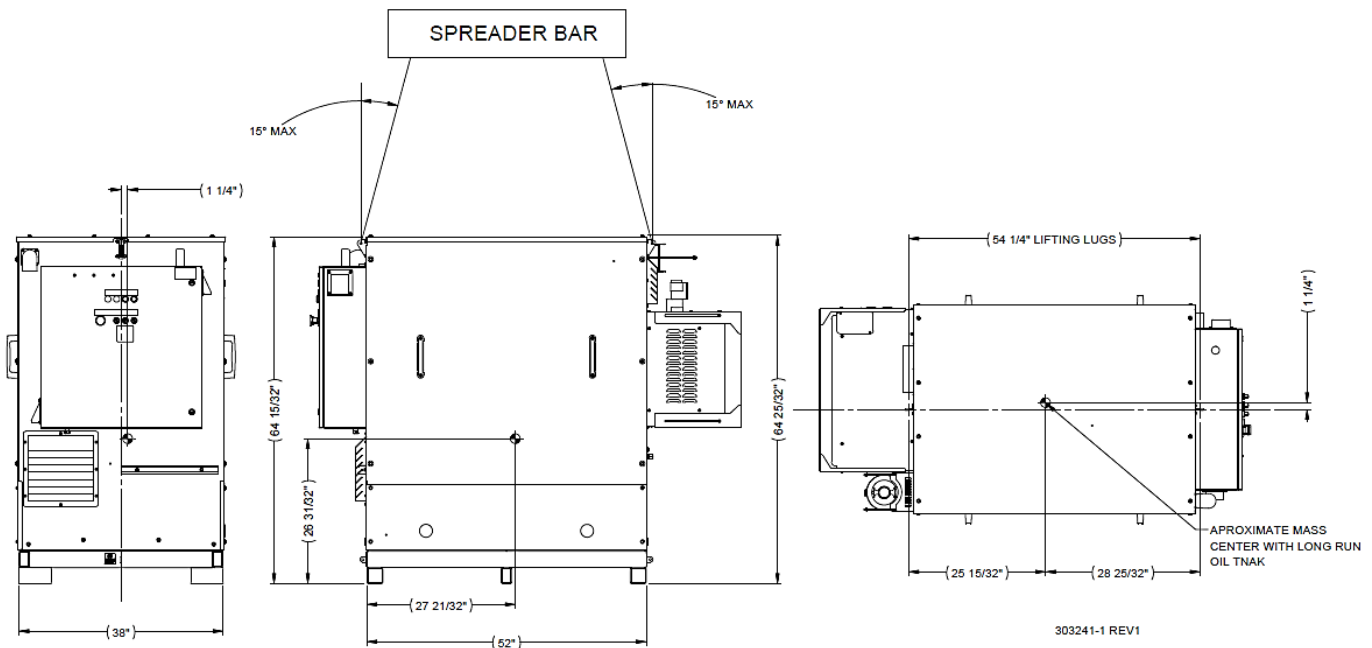


Figure 4-2 – Slinging and Lifting Diagram



WARNING!

Ensure that the center of gravity is below the spreader bar while lifting. Adjust the sling tension so that the unit remains level during lift. Mass center may vary based on MX configuration.

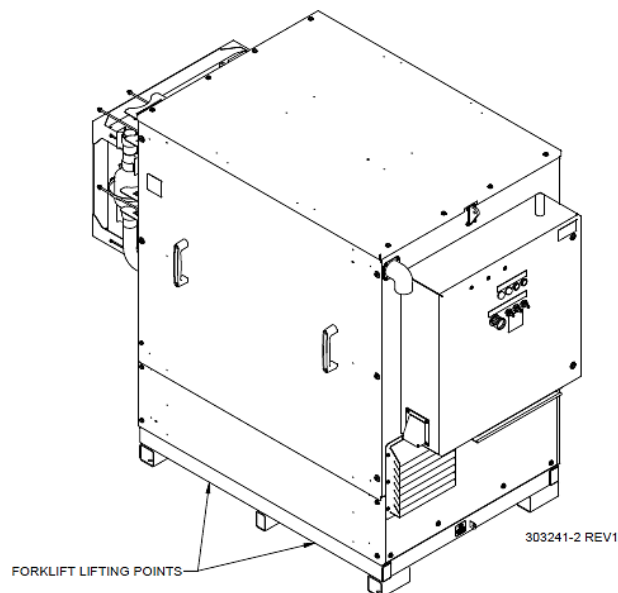


Figure 4-3 – Lifting with Forklift

The MX Power System can also be lifted using a forklift from either the front or rear side using the spaces provided in the base of the unit.

4.3 ACCESS PANELS

**CAUTION!**

Do not use power tools to remove or install the side panel fasteners. Do not force the threads into engaging if they are not going in smoothly. This will cause thread damage. Apply anti-seize compound when re-installing the fasteners.

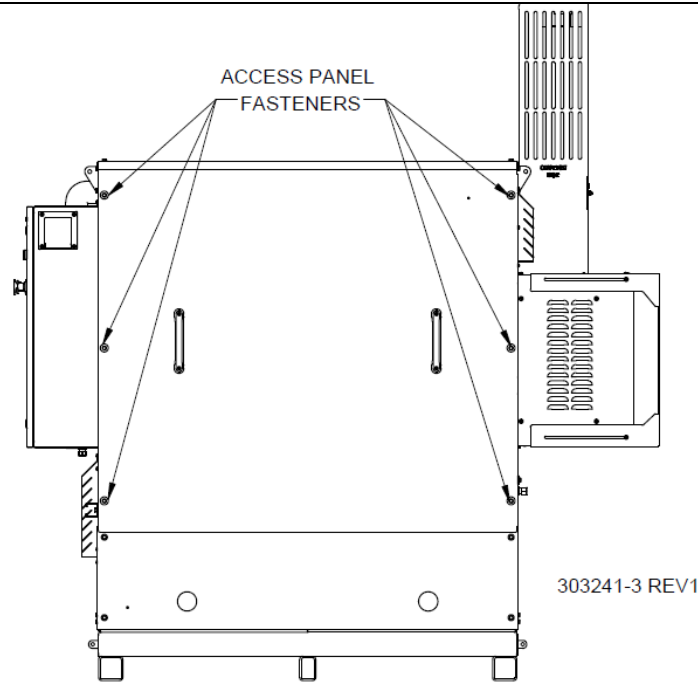


Figure 4-4 – Location of Access Panel Fasteners

The side panels will need to be removed during start-up and maintenance. Remove the panels carefully to avoid causing any damage to weather stripping. Do not use power tools to remove or install the fasteners.

The fasteners holding the MX Power Generator panels in place are shown in Figure 4-4. Do not force the threads into engaging if they are not going in smoothly. Apply anti-seize compound when re-installing the panel fasteners.

To remove the side panels:

1. Remove the six (6) panel fasteners using a 7/16" socket wrench.
2. Grip the handles firmly and lift the panel up by 1/4 to 1/2 inch.
3. Swing the bottom of the panel away from the unit.
4. Gently lower the panel down to the ground and move it out of the way.

**CAUTION!**

Be careful when removing the panels. Grip both handles firmly. The removable side panels weigh approximately 45 lb. (20.4 kg).

4.4 ASSEMBLY AND INSTALLATION

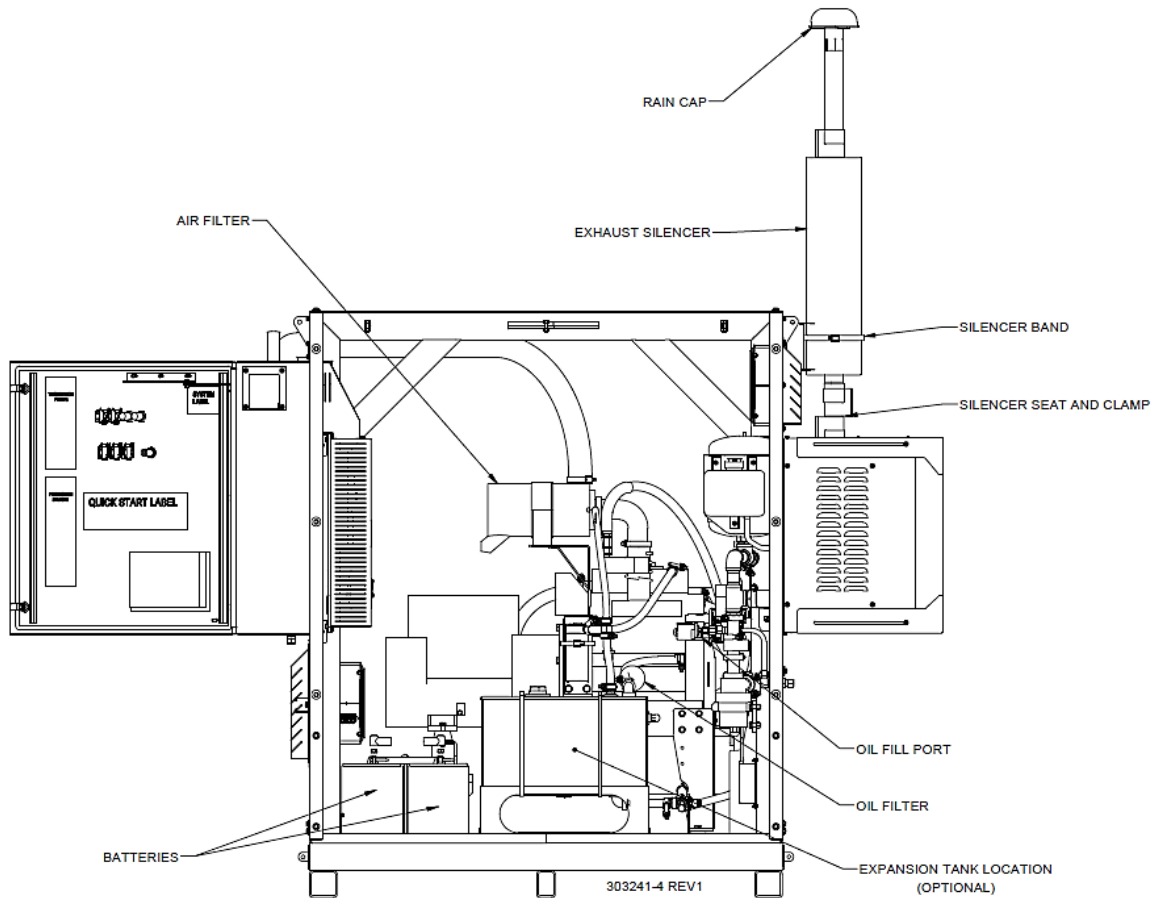


Figure 4-5 – Assembly

Parts Included for Installation

- 1 Exhaust rain cap
- 1 Exhaust silencer
- 1 Exhaust cover
- 2 Battery cables with terminal boots*
- 1 Customer assembly kit containing:
 - 4 — 1/2-20 10" threaded rods
 - 4 — 1/4-20 nuts
 - 6 — 1/4 lock washers
 - 6 — 1/4 0.625 flat washers
 - 2 — 1/2-20 x 0.625 hex screws

Tools Required

- ✓ Adjustable wrench
- ✓ Flathead screwdriver
- ✓ Phillips screwdriver
- ✓ Socket wrench set

**Battery cables may be shipped with the battery terminal boots disconnected.*

Assemble the MX Power Generator as follows:

1. Slide the exhaust silencer assembly into the silencer seat and tighten the lab joint clamp firmly to create sealed connection.
2. Tighten the band around the silencer.
3. Install the exhaust cover on the 4 threaded rods and fasten using the 4 flat washers and 4 hex nuts.
4. Additionally fasten the exhaust cover by fastening the 2 hex bolts into the side panel located at bottom of the exhaust cover.
5. Connect the batteries – see Section 4.4.1.
6. Check Radiator Glycol – see Section 4.4.2
7. Check oil levels.
8. Check the air filters.
9. Connect all required wiring connections using the connection ports provided – see Section 4.4.4.
10. Adjust wind shield gap to the optimal position for site conditions – see Section 4.4.5.

4.4.1 BATTERIES

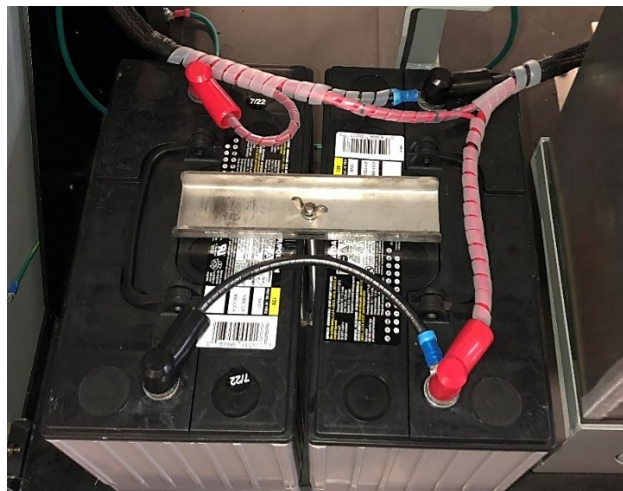


Figure 4-6 – Batteries and Connectors

The two nominal 12V batteries are connected by interconnect cables, which are shipped disconnected. Some units may also be shipped with the battery terminal covers disconnected.

Review Figure 4-7 for the batteries' wiring terminations and install the cables to the batteries as follows:

1. Terminate wires 225 and 226 on the positive terminal of the first battery.
2. Connect wire 229 from the negative terminal of the first battery to the positive terminal of the second battery.
3. Terminate wires 230 and 231 on the positive terminal of the second battery.
4. Terminate wires 221, 222 and 223 on the negative terminal of the second battery.
5. If your MX unit was shipped with the battery terminal boots disconnected, connect them by sliding the covers into the battery cables then fit the installed terminal boots over the battery stud terminal.

4.4.2 RADIATOR GLYCOL

Confirm that the glycol is full, top-up as required with ethylene glycol.

- 60/40 ethylene glycol/water mixture can be used for all MX units.
- 50/50 ethylene glycol/water can be used for MX units in warmer ambient climates that remain above -5°C (23°F).

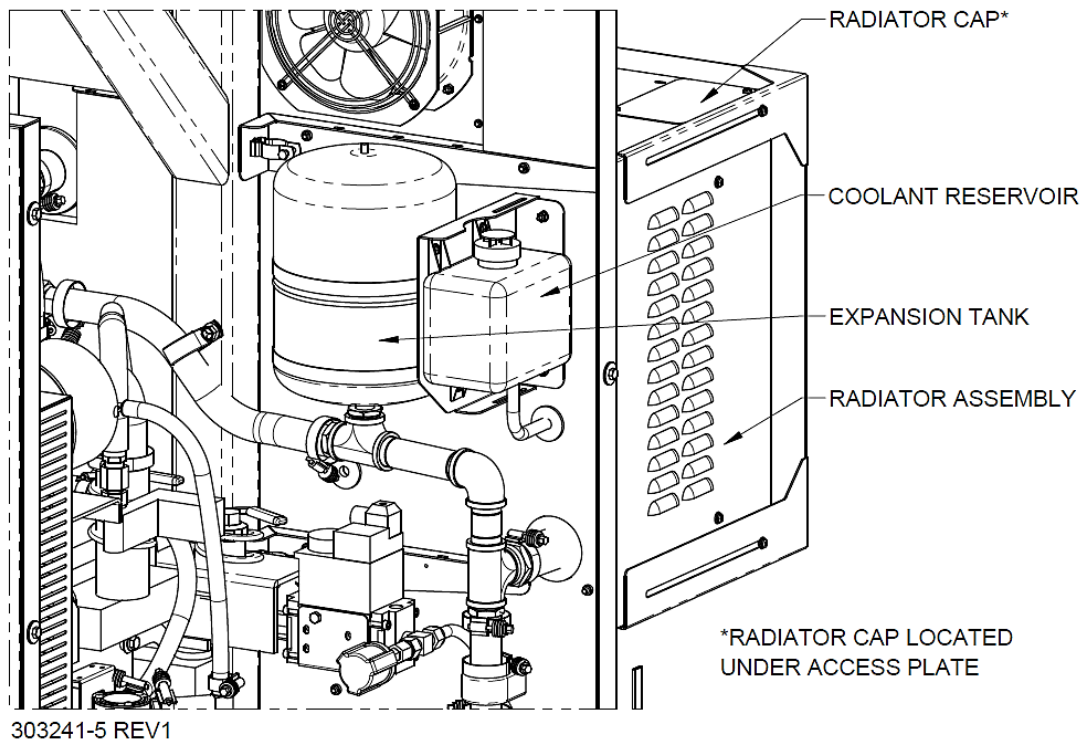


Figure 4-8 – Location of Coolant Reservoir and Expansion Tank

4.4.3 FUEL SUPPLY

Before connecting the fuel supply to the MX Power Generator, review Sections 4.1.2 and 4.1.3. Fuel is supplied to the MX Power Generator at the 1/2-inch tube union connection. Ensure that the fuel specifications and pressure are within the requirements listed in Sections 4.1.2 and 4.1.3. Connect the fuel supply as follows:

1. Install a fuel shut-off valve between the MX Power Generator and the fuel supply.
2. Inspect fuel lines and fittings to ensure that they are free of foreign materials.
3. Remove the protective cap from the MX unit's 1/2-inch tube connector.
4. Insert fuel line into the 1/2-inch tube connector following standard swage or compression fitting procedures.
5. Connect the fuel line.
6. Leak check all connections and fittings along the lines using a liquid leak detector such as Snoop®.

4.4.4 WIRING CONNECTIONS

Connect all required wiring connections using the customer connection ports—refer to the applicable wiring diagrams in this section for all potential output connections.

Table 2 and Table 3 list the locations of the Remote Start and common alarm terminal blocks.

NOTE:

Add a soft starting mechanism such as a VFD for any motor loads that are above 1kW. Power factor must be considered when calculating motor loads.

There are holes provided on the bottom of the electrical enclosure for customer connections—see Figure 4-9. Holes are sized for 1" trade size bushings or strain reliefs (1 3/8" DIA). Use copper wire rated to 60°C or 75°C only. Connect all required connections, using the wiring connection ports. Refer to the diagrams for all potential output connections.

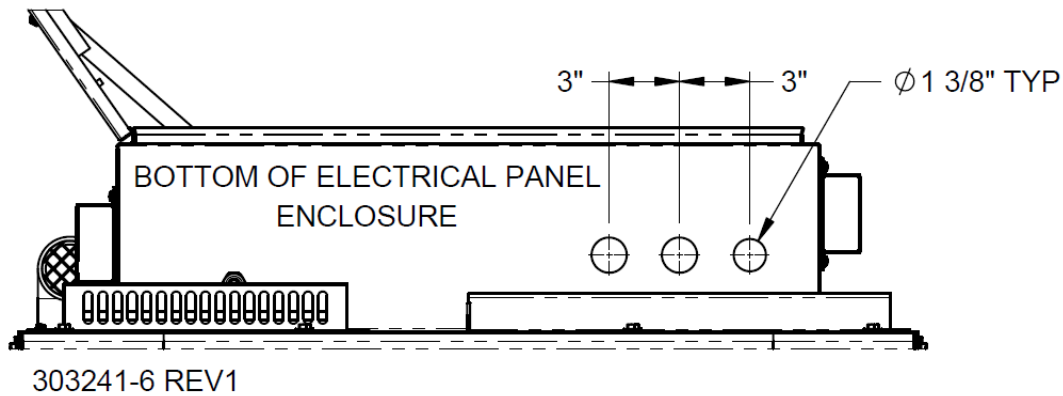


Figure 4-9 – Holes for Customer Connections



Use bushing or strain relief on customer connections to the electrical panel enclosure. Class 1 wiring methods are to be used for field wiring connections to terminals of a Class 2 circuit. Use copper wire rated to a minimum of 60°C or 75°C only.

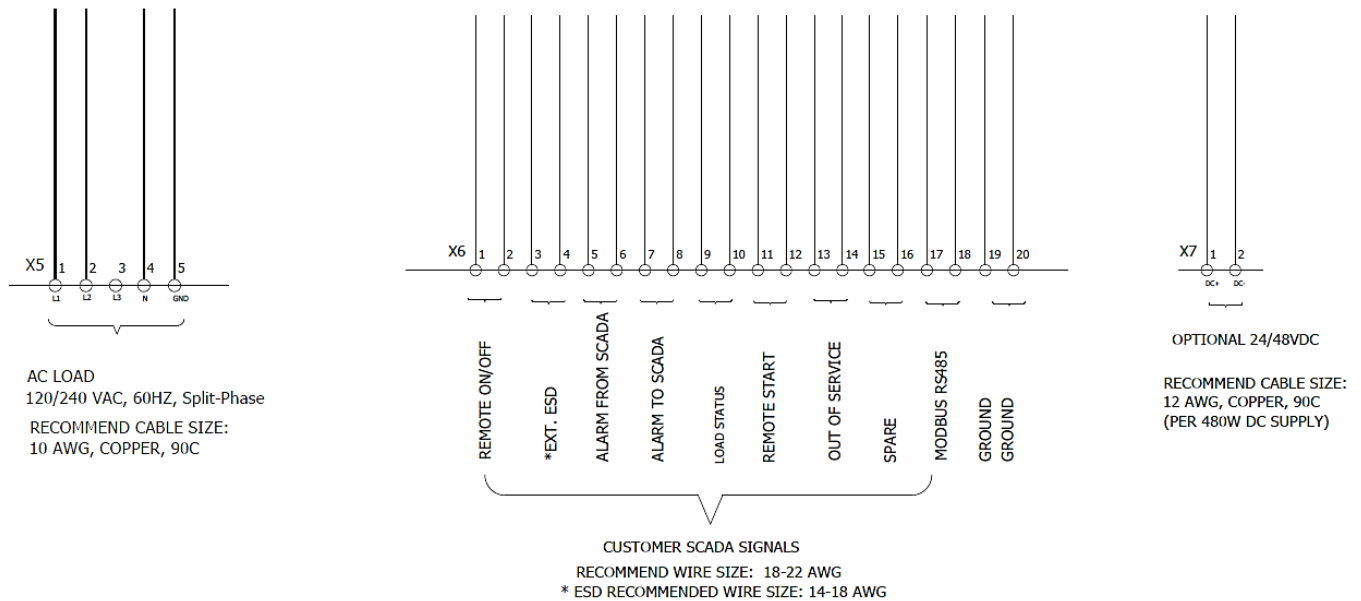


Figure 4-10 – Customer Wiring Terminations (Single Phase Systems)

Table 2 – Customer Wiring Connections (Single Phase Systems)

CONNECTION	DESCRIPTION	VOLTAGE OUTPUT
(X5)	AC Load, 60 Hz, Split Phase Recommend Cable Size: 10 AWG, Copper, 90C	120/240 V _{AC}
(X6) 1, 2	Remote On/Off	Dry Contact
(X6) 3, 4	External Emergency Shutdown (ESD)	Dry Contact
(X6) 5, 6	Alarm From SCADA	Dry Contact
(X6) 7, 8	Alarm to SCADA	Dry Contact
(X6) 9, 10	Customer Load Status	Dry Contact
(X6) 11, 12	Remote Start	Dry Contact
(X6) 13, 14	Out of Service Status	Dry Contact
(X6) 15, 16	<i>Spare, reserved for future use</i>	
(X6) 17, 18	Modbus RS-485 terminals	
(X6) 19, 20	Signal Ground Terminals	
(X7)	Optional 24/48 V _{DC} Converter terminals Recommended Cable Size: 12 AWG, Copper, 90C	Nominal 24/48 V _{DC}

Refer to Section 7.1 for operational instructions of all SCADA dry contacts on terminal block X6.

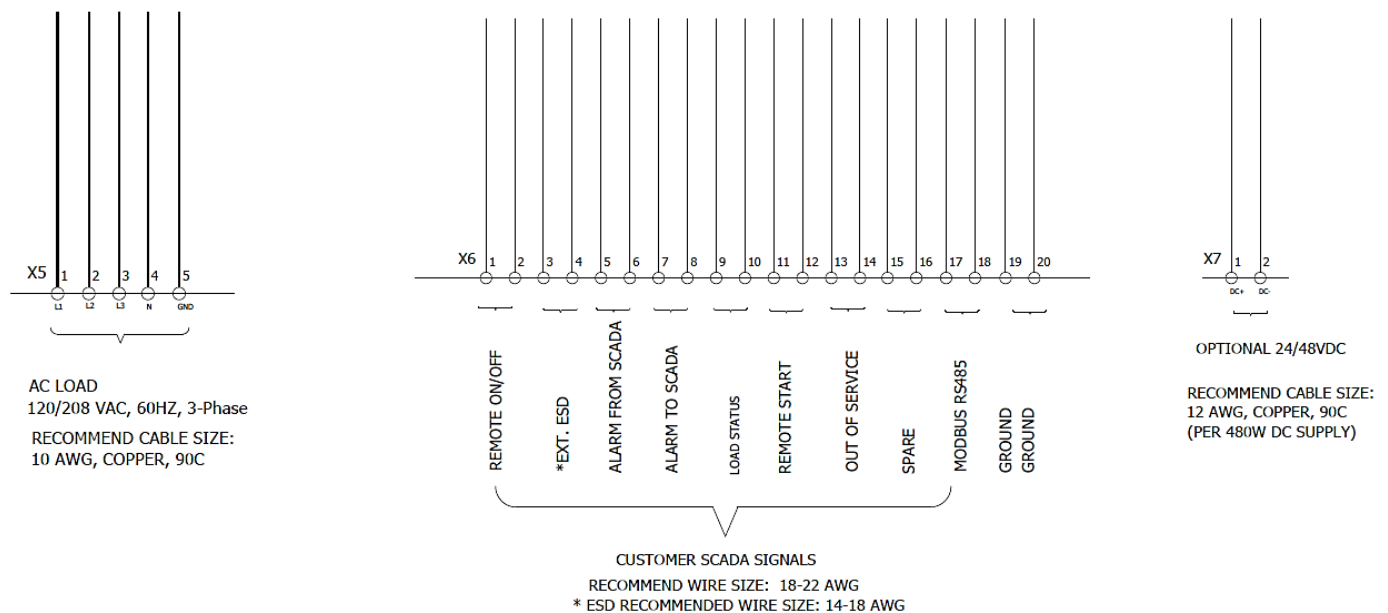


Figure 4-11 – Customer Terminations (3 Phase Systems)

**WARNING!**

Ensure that the correct polarity is followed. Incorrect polarity may cause damage to the generator or customer equipment.

Table 3 – Customer Wiring Connections (3 Phase Systems)

CONNECTION	DESCRIPTION	VOLTAGE OUTPUT
(X5)	AC Load, 60 Hz, Split Phase Recommend Cable Size: 10 AWG, Copper, 90C	120/240 V _{AC}
(X6) 1, 2	Remote On/Off	Dry Contact
(X6) 3, 4	External Emergency Shutdown (ESD)	Dry Contact
(X6) 5, 6	Alarm to MX PLC	Dry Contact
(X6) 7, 8	Alarm to SCADA	Dry Contact
(X6) 9, 10	Customer Load Status	Dry Contact
(X6) 11, 12	Remote Start	Dry Contact
(X6) 13, 14	Out of Service Status	Dry Contact
(X6) 15, 16	<i>Spare, reserved for future use</i>	
(X6) 17, 18	Modbus RS-485 terminals	
(X6) 19, 20	Signal Ground Terminals	
(X7)	Optional 24/48 V _{DC} Converter terminals Recommended Cable Size: 12 AWG, Copper, 90C	Nominal 24/48 V _{DC}

Refer to Section 7.1 for operational instructions of all SCADA dry contacts on terminal block X6.

4.4.5 WIND SHIELD ADJUSTMENT

The MX Power Generator features a wind shield attached to the radiator shroud cover. This shields the radiator from outside wind and prevents a dead zone that may limit radiator cooling.

The MX unit is shipped with the wind shield adjusted to a smaller gap. Adjust the windshield to the recommended 9-inch gap before starting up the MX until.

To adjust the windshield:

1. Loosen windshield panel fasteners using a Phillips screwdriver.
2. Slide the windshield panel to the recommended gap, then retighten.
 - To increase cooling of the radiator based on site ambient conditions, slide the windshield panel to the right.
 - In extremely windy environments, slide the windshield panel to the left one inch at a time to optimize the wind shield position for site conditions.
 - Wait 15 to 30 minutes to allow the system to stabilize between wind shield panel position adjustments.

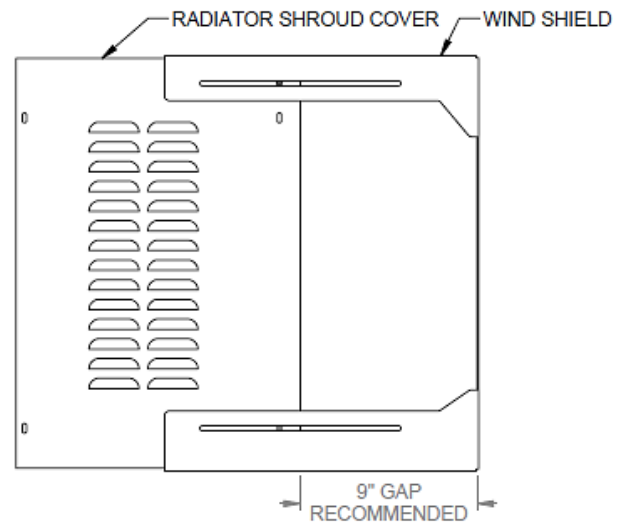


Figure 4-12 – Wind Shield Recommended Gap from Radiator Shroud Cover

NOTE: During shipping, the wind shield may be removed or adjusted to a smaller gap. Ensure that wind shield is installed with the correct gap before running the unit.

5 START-UP



WARNING!

Operation and maintenance of the MX Power Generator must only be performed by qualified personnel who are trained in the operation of the power system and qualified in servicing electrical equipment. Follow all local electrical safety regulations. Lethal voltages are present in this system! Use accepted safety procedures when working on all electrical circuits.

5.1 LOCAL START-UP

1. Initial set-up of the MX Power Generator must be done in Local and Manual operation modes.
2. Check the local switches and ensure that they are set as follows:
LOC/REM — “**LOC**”
AUTO/MAN — “**MAN**”
LOCAL ON/OFF — “**OFF**”
3. Turn on (close) the Main System Breaker (**Q1**) and Battery Charger Breaker (**Q2**) located inside engine room.
4. Turn on the Main DC Breaker (**Q3**), DC Control Breaker (**Q5**), Main AC Input Breaker (**Q6**) inside the electrical panel.
5. Turn on the fuel at the external valve and check that fuel pressure is between 2 to 5 psi (13.8 to 34.5 kPa).
6. Flip the LOCAL ON/OFF switch to the “**ON**” position. The green heartbeat LED should start blinking.
7. Wait 5 seconds, then press the green “**START**” button on the electrical cabinet door. The engine should start cranking.
8. If the engine starts successfully, it will ramp up to 1800 RPM, and start charging the batteries.
9. Allow the system to run for 2 to 10 minutes to warm-up, then turn on the customer AC load breaker (**Q7**) located inside the electrical panel enclosure.
10. Gradually increase loads from 0 to 100% over a period of 3 minutes.



Figure 5-1 – Operation Switches

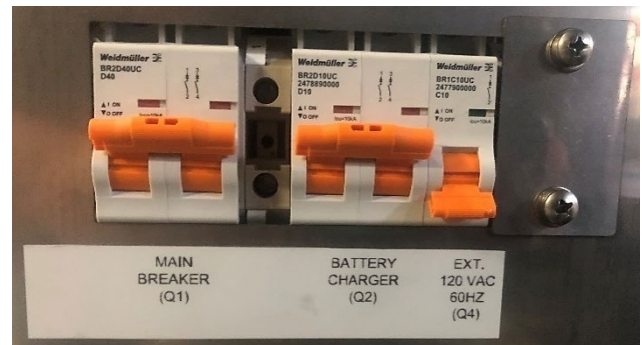


Figure 5-2 – Main System and Battery Charger Breakers (Single Phase)



CAUTION!

Ramp-up load slowly from 0 to 100% over a 3-minute period to allow the engine to adjust. This minimizes thermal load on the engine and helps maintain stability of the synchronous alternator.

11. If the receptacle plug will be used, turn on the receptacle breaker (**Q8**) located inside the electrical panel.



Figure 5-3 – Breakers Located Inside the Electrical Panel Enclosure (Single Phase)



Figure 5-4 – Breakers Located Inside the Electrical Panel Enclosure (3 Phase)

NOTE:

If the system locks out during local or manual start-up, press the “STOP” button to reset it, then press the “START” button to try starting again.

5.2 EXTERNAL BATTERY CHARGE AND COLD AMBIENT START



CAUTION!

External battery charge and cold-ambient start must be done in Local Mode. Ensure that the LOC/REM switch is turned to “LOC” before starting.

The MX Power Generator is equipped with a battery charger and optional electrical heating system (included in “-CA” or Cold Ambient configuration) to recharge the batteries and preheat critical system components when operating in cold ambient conditions.

The battery charger and heaters can be powered from a standard 120V AC plug located in the engine room.

Connect the plug to an external AC power source that can handle up to 1.5 kW load.

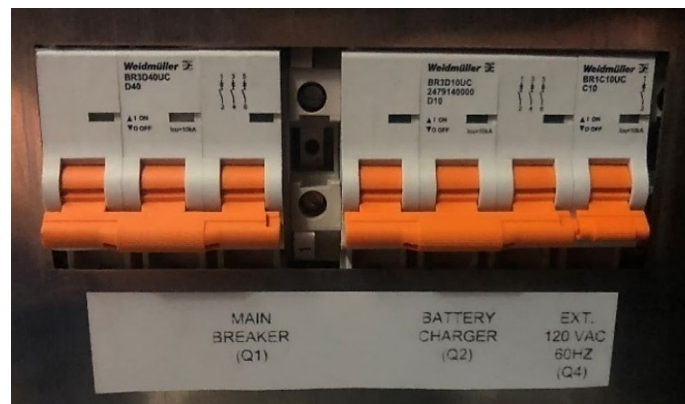


Figure 5-5 – Main System and Battery Charge Breaker (3 Phase)

If the System Controller indicates low battery voltage or low system temperatures that may prevent successful startup (see Section 12.1 for more details), perform an external battery charge or cold-ambient start as follows:

1. Ensure that the LOC/REM switch is set to “**LOC**”.
2. Turn off the Main System Breaker (Q1) located inside the engine room.
3. Plug in an external 120V AC power source. The plug is located inside the engine room and can be taken outside.
4. Check to make sure that Q2, Q3, and Q5 breakers are turned on.
5. Turn on the external 120V breaker (**Q4**) and allow the system to charge the batteries and/or heat up for 15 to 60 minutes, depending on site conditions.

NOTE: **Allow the engine coolant temperature to rise above 0°C (32°F) before attempting to start the engine.**

6. As long as engine temperature is below 0°C (32°F), run the coolant heaters in 15 minutes intervals. After every 15 minutes, press the “**PUMP**” button located near LCD screen on electrical panel to allow the coolant to circulate. Circulate coolant for 1 to 2 minutes, press the button again to turn off circulation, then reassess.

NOTE: **The pump circulation button only turns on the pump if the engine is off and selector switches are set to “LOC” and “MAN”.**

7. Once the engine coolant temperature climbs above 0°C (32°F), turn off Q4 and turn on Q1. Press the “**START**” button to turn on the engine.

A suitable inverter is also available as an option to use in locations where a 120V AC external power source is not accessible. This inverter is powered by a 12V vehicle battery to charge the MX Power Generator’s batteries and run electric heat trace when needed.

NOTE: **To order the inverter, contact GPT and quote part number 302826.**

5.3 REMOTE START-UP

The MX Power Generator can be started remotely by sending a dry contact SCADA signal to the system. To enable remote operation, the MX unit must be set as follows:

- The fuel supply must be turned on.
- Batteries must be reasonably charged.
- The Main System Breaker (**Q1**), Battery Charger (**Q2**), Main DC Breaker (**Q3**), and DC Control Breaker (**Q5**) must all be switched ON.
- The LOC/REM switch must be in the “**REM**” position (Remote Mode).

Once the conditions above are fulfilled, start the MX Power Generator remotely by doing the following:

1. Power on the MX System by sending a signal to the “**Remote On/Off**” dry contacts (**X6.1/X6.2**). These contacts must be kept shorted together to keep a Remote Mode MX powered.
2. Start the MX Engine by sending a signal to the “**Remote Start/Stop**” dry contacts (**X6.11/X6.12**). These contacts must be kept shorted together to keep the engine running.

Refer to Section 4.4.4 for SCADA wiring connections, and Section 7.1 for detailed information on each SCADA dry contact.

6 OPERATION

6.1 USER INTERFACE SETTINGS



Figure 6-1 – Operation Switches

The User Interface switches are located on the electrical enclosure door. Refer to the following subsections to understand how each button and switch functions.

6.1.1 ESD BUTTON

The ESD button activates the Emergency Shutdown System on the MX Power Generator. Pushing the ESD button on the electrical panel door of the unit will accomplish the following:

- Stop the generator.
- Cut AC/DC power to the MX unit and the customer load.
- Cut DC power to the System Controller

6.1.2 LOC/REM SWITCH – LOCAL / REMOTE MODES

This switch controls whether the MX System is in Local Mode or Remote Mode.

LOC – LOCAL MODE

The MX system will only respond to an operator who is physically at site to push the buttons on the electrical panel. When the LOC/REM switch is set to LOC:

- An operator can power on and off the MX System using the “**LOCAL ON/OFF**” switch on the electrical panel door and can start and stop the MX Engine using the push buttons.
- The MX System will shut down the system completely if the local ESD button is pressed, or a signal is sent to the External ESD dry contact.
- Remote operation is disabled; the MX System will ignore any incoming Remote Start/Stop commands. SCADA outputs will still function normally.

REM – REMOTE MODE

The MX Power Generator will respond to external signals via dry contacts. While in Remote mode:

- The MX System can be powered on and off remotely.
- The MX Engine can be started and stopped remotely.
- The MX System will shut down the system completely if the local ESD button is pressed, or a signal is sent to the External ESD dry contact.
- Local operation is disabled; the MX System will ignore any presses of the local Start and Stop buttons on the electrical enclosure door.

Refer to Section 4.4.4 for SCADA wiring connections, and Section 7.1 for detailed information on each SCADA dry contact.

6.1.3 AUTO/MAN SWITCH – AUTO-STANDBY / MANUAL MODES

This switch controls whether the MX System is in Manual Mode or Auto-Standby Mode (often shortened to simply Auto Mode). This mode is independent of the Local/Remote Modes.

MAN – MANUAL MODE

When in Manual Mode:

- The MX Engine will only start and stop with a user command; either by pushing the Start/Stops buttons in Manual Mode or by sending a Remote Start/Stop command when in Remote Mode.
- If the system is left on without the engine being started, the system will fully shut down via a shunt trip when the internal batteries discharge below 22 volts.

AUTO – AUTO-STANDBY MODE

Auto-Standby Mode will enable a set of features designed to ensure the MX Power Generator can start at any time. When enabled, an MX unit in Auto-Standby Mode will automatically power on and start the engine to maintain a minimum internal battery voltage and engine temperature.

- An MX System in Auto-Standby Mode will automatically start its engine if the battery voltage gets low. It will keep the engine running until the battery has been fully charged, at which point the engine will automatically shut off.
- An MX System in Auto-Standby Mode will automatically start its engine if the engine coolant temperature gets too low. It will keep the engine running until the coolant temperature has reached nominal operating conditions, at which point the engine will automatically shut off.
- An MX System in Auto-Standby Mode will still respond to user engine start/stop requests. In essence, Auto-Standby Mode still offers the same control available in Manual Mode, but with the automatic battery/temperature features enabled.
- An MX System in Auto-Standby mode will also restart after a loss of fuel pressure. If a fuel pressure disruption causes the engine to stop, the MX will automatically crank and start the engine when it detects fuel pressure again

NOTE:	Standard engine stops are performed more slowly in Auto-Standby Mode. Expect at least 30 seconds of engine idling before full engine shutoff occurs.
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6.1.4 LOCAL ON/OFF

This switch is utilized only in Local Mode and has no effect in Remote Mode.

When in Local Mode, turning the “**LOCAL ON/OFF**” to the ON position will power on the MX System. Returning this switch to the OFF position will power off the MX System.

6.1.5 LED STATUS LIGHTS

There are two external LEDs on the electrical enclosure door that provide quick status information to the operator.

- **ALARM** — Amber — The Alarm LED will light up if at least one system alarm is present. It will flash briefly for Level 1 warning alarms, escalating to longer blinks for Level 2 and higher alarms. Refer to Section 6.2 for guidance on viewing the system alarms on the LED Display, and Section 12.1 for detailed alarm code information.
- **STATUS** — Green — The Status LED acts as a heartbeat signal to indicate the MX System is powered on and functional. It flashes briefly as long as the System Controller is powered on, changing to longer blinks when the engine is running with the Customer Load engaged.

6.1.6 START AND STOP BUTTONS

The Start and Stop buttons are only utilized in Local Mode, and function as follows:

- **START** — Starts-up the MX Engine.
- **STOP** — Initiates the shut down and cool down sequence of the MX Engine.

6.2 LED DISPLAY

The LED Display is located inside the electrical panel enclosure. It is an alpha-numeric display that shows a variety of important operating parameters. The display is activated by pressing the button labelled “**SCREEN**”, beside or above the LCD screen, as shown in the photos below.



Figure 6-2 – Alternate Pump Button Location



Figure 6-3 – LED Display

If the display is off, pressing the “**SCREEN**” button will turn on the display. Each subsequent press of the “**SCREEN**” button will advance the display to the next screen. The display will turn off after 15 minutes of inactivity, or after all available display screens have been cycled through.

The information available on all display screens is detailed below. Note that Line 1 is the topmost line, and Line 4 is the bottommost line.

6.2.1 DISPLAY SCREENS

NOTE: The values shown below are examples only. Your MX unit’s screen may show different values based on its operating parameters.

SCREEN 1: System/Generator Timestamps and Operating Modes

S	y	s	O	N		2	0	2	1	1	2	3	1		1	3	:	2	1
G	e	n	O	N		2	0	2	1	1	2	3	1		1	4	:	3	2
L	/	R		M	o	d	e		-				L	O	C	A	L		
A	/	M		M	o	d	e		-				M	A	N	U	A	L	

- Line 1** – System power on timestamp: Date (yyyymmdd) and Time (24hr, UTC)
- Line 2** – Generator engine start timestamp: Date (yyyymmdd), and Time (24hr, UTC)
- Line 3** – Current Local/Remote Mode setting (set by LOC/REM switch)
- Line 4** – Current Auto/Manual Mode setting (set by AUTO/MAN switch)

SCREEN 2: Detailed Alarm Information

A L M 1	3 1 2	E n g	R P M	L o
A L M 2	1 1 1	F u e l	P r e s	L o
P R E V 1	1 1 5	A C	P w r F	L o
P R E V 2	0 0 0	N o	A l a r m s	

Lines 1 to 4 – This screen displays up to 4 currently active Alarm Codes, indicated by “**ALM#**”, in priority order. If less than 4 alarms are active, up to 3 of the most recently cleared alarms will be displayed on the lower lines, indicated by “**PREV#**”. In either case, each line will list the numerical Alarm Code, as well as a brief description of the Alarm Type.

NOTE: Refer to Section 12.1 for full details on Alarm Codes.

SCREEN 3: Accumulating Time/Energy Parameters

S T A R T	H R S			2 1 6 7 . 2 5
M A I N T	H R S			8 5 8 2 . 5 0
T O T A L	H R S			2 6 7 1 3 . 7 5
E N E R G Y		1 3 3 5 6 8 . 8		k W h

Line 1 – Number of engine run-hours since the engine was last started.

Line 2 – Number of engine run-hours since last routine maintenance (requires manual reset).

Line 3 – Total cumulative engine run-hours.

Line 4 – Total cumulative kilowatt-hours output from engine alternator.

SCREEN 4: Estimated Fuel Totalizers and Estimated Flow Rates

N G - T O T		5 6 1 3 7 . 3 4	S m 3
L P G - T O T		1 1 7 0 6 7 . 3 5	L
N G - F L O W		3 5 . 0 2	S L P M
L P G - F L O W		7 3 . 0 4	L / D a Y

Line 1 – Shows the estimated cumulative fuel consumption of natural gas, in Sm³

Line 2 – Shows the estimated cumulative fuel consumption of propane, in Liters

Line 3 – Shows the currently estimated flow rate of natural gas, in SLPM

Line 4 – Shows the currently estimated flow rate of propane, in L/Day

NOTE: Estimated parameters for both natural gas and propane are provided. Refer only to the parameter that matches your MX Power Generator's equipped fuel type.

SCREEN 5: Engine Cranks/Starts and Battery Voltage

E	N	G		C	R	A	N	K	S								1	3	7
E	N	G		S	T	A	R	T	S								1	0	8
B	A	T	T	E	R	Y		2	6	.	8	3		V	o	l	t	s	

Line 1 – Total cumulative number of engine crank attempts.

Line 2 – Total cumulative number of successful engine starts.

Line 3 – Blank.

Line 4 – Voltage of the MX System battery.

SCREEN 6: Electrical - Voltages, Currents, and Frequency

L	1		1	2	0	.	0	V		1	6	.	6	7	A				
L	2		1	2	0	.	2	V		1	6	.	6	5	A				
L	3		1	1	9	.	9	V		1	6	.	6	6	A				
F	R	E	Q	U	E	N	C	Y		6	0	.	0	H	z				

Line 1 – Alternator L1 Line Voltage (V) and Current (A) values.

Line 2 – Alternator L2 Line Voltage (V) and Current (A) values.

Line 3 – Alternator L3 Line Voltage (V) and Current (A) values.

Line 4 – Alternator AC Frequency (Hz).

SCREEN 7: Electrical - Real Power and Apparent Power

L	1		2	.	0	0	1	k	W		2	.	0	0	1	k	V	A	
L	2		1	.	9	9	8	k	W		2	.	0	1	8	k	V	A	
L	3		2	.	0	0	0	k	W		2	.	0	4	1	k	V	A	
T	O	T	A	L		5	.	9	9	k	W		5	.	9	9	k	V	A

Line 1 – Alternator L1 Real Power (kW) and Apparent Power (kVA)

Line 2 – Alternator L2 Real Power (kW) and Apparent Power (kVA)

Line 3 – Alternator L3 Real Power (kW) and Apparent Power (kVA)

Line 4 – Alternator Total System Real Power (kW) and Apparent Power (kVA)

SCREEN 8: Electrical - Power Factors and Line-to-Line Voltages

P	F	1		1	.	0	0		L	1	L	2		2	0	8	.	2	V
P	F	2		0	.	9	9		L	2	L	3		2	0	8	.	0	V
P	F	3		0	.	9	8		L	3	L	1		2	0	7	.	9	V
P	F			A	v	g		0	.	9	9								

Line 1 – Alternator L1 Power Factor, and L1-L2 Phase Voltage (V)

Line 2 – Alternator L2 Power Factor, and L2-L3 Phase Voltage (V)

Line 3 – Alternator L3 Power Factor, and L3-L1 Phase Voltage (V)

Line 4 – Alternator Overall System Power Factor

SCREEN 9: Electrical - Total Harmonic Distortion

T H D V 1	1 . 4 %	I 1	4 . 5 %
T H D V 2	1 . 6 %	I 2	4 . 7 %
T H D V 3	1 . 2 %	I 3	4 . 3 %
A v g V	1 . 4 %	A I	4 . 5 %

Line 1 – Alternator L1 Total Harmonic Distortion for Voltage (%) and Current (%)

Line 2 – Alternator L2 Total Harmonic Distortion for Voltage (%) and Current (%)

Line 3 – Alternator L3 Total Harmonic Distortion for Voltage (%) and Current (%)

Line 4 – Alternator Overall Total Harmonic Distortion for Voltage (%) and Current (%)

SCREEN 10: Location Temperatures

T - A M B N T	2 4 . 1 C	7 5 F
T - E R O O M	3 7 . 6 C	1 0 0 F
T - E L E C T	3 1 . 4 C	8 9 F

Line 1 – Ambient temperature, shown in degrees Celsius and Fahrenheit.

Line 2 – Engine room temperature, shown in degrees Celsius and Fahrenheit.

Line 3 – Electrical enclosure temperature, shown in degrees Celsius and Fahrenheit.

Line 4 – Blank.

SCREEN 11: Engine System Temperatures

T - E N G I N	8 2 . 8 C	1 8 1 F
T - I N L E T	7 9 . 6 C	1 7 5 F
T - O U L E T	7 6 . 7 C	1 7 0 F
T - E X H S T	3 1 8 . 1 C	6 0 5 F

Line 1 – Internal engine coolant temperature, shown in degrees Celsius and Fahrenheit.

Line 2 – Coolant inlet temperature, shown in degrees Celsius and Fahrenheit.

Line 3 – Coolant outlet temperature, shown in degrees Celsius and Fahrenheit.

Line 4 – Engine exhaust temperature, shown in degrees Celsius and Fahrenheit.

SCREEN 12: Real-Time Engine Parameters

E N G I N E - R P M	1 8 0 0			
C L P U M P - R P M	5 6 0 0			
T H R T L	1 0 %	A / F	0 . 9 9	
F U E L P R E S S U R E	-	Y E S		

Line 1 – The Engine speed is shown in RPM.

Line 2 – The radiator Coolant Pump speed is shown in RPM.

Line 3 – Engine throttle percentage is shown, and air-fuel ratio (Lambda) is also shown.

Line 4 – Fuel Pressure Switch status is shown. “YES” if fuel is available, “NO” otherwise.

SCREEN 13: Software Info and Input/Output Data

SW	VER	3	.	0	BLD	1	4	1	4
CL	PUMP	2	.	00	V	SC	0	0	8
RAD	FAN	3	.	25	V	DI	0	C	1
ENC	FAN	10	.	00	V	DO	7	C	0

- Line 1** – PLC software information is displayed, both Version and Build numbers.
- Line 2** – Coolant Pump control voltage (V) is displayed, and PLC System Controller Status (Hex).
- Line 3** – Radiator Fan control voltage (V) is displayed, and PLC Discrete Input Status (Hex).
- Line 4** – Engine Room Fan control voltage (V) is displayed, and PLC Discrete Output Status (Hex).

7 REMOTE MONITORING

The MX Power Generator offers a number of methods for Remote Monitoring of system status and key operating parameters.

The system SCADA terminals (dry contacts) provide a method of both operating the MX Generator remotely and reading out system statuses to your control system.

The MX Power Generator also provides detailed data outputs of its system statuses, alarms, and AC power. This data can be remotely monitored using the designated Modbus RS-485 terminals and/or viewed online in a web browser via IoT connectivity.

7.1 REMOTE MONITORING THROUGH DRY CONTACTS (SCADA)

The dry contact SCADA terminals on your MX Power Generator allow you to remotely control the device operation. They also provide basic status signals that can be integrated into your control systems.

Note that the LOC/REM switch of your generator must be set to REM (Remote Mode) for the system to respond to the “**Remote**” inputs described in this section. Refer to Section 4.4.4 for SCADA wiring diagrams, and Section 5.3 for full details on remotely starting your generator.

Available SCADA Dry Contacts are part of the terminal block labelled “**X6**”, and are as follows:

Remote On/Off

- With the LOC/REM switch set to REM (Remote Mode), short the **X6.1/X6.2** contacts together to power on the MX System. The MX System will remain powered on as long as these contacts remain shorted. Open these contacts to power off the MX System.
- The **X6.1/X6.2** contacts have no effect when the LOC/REM switch is set to LOC (Local Mode).

External Emergency Shutdown (ESD)

- For normal operation in either Local or Remote modes, the **X6.3/X6.4** contacts must be shorted together. A jumper wire is pre-installed across these contacts, which may be removed to integrate an external emergency shutdown signal from customer equipment.
- To send an external emergency shutdown signal to the MX, the continuity across the **X6.3/X6.4** terminals must be broken. As long as continuity is broken, the engine will shut down and the system will remain de-energized. Once continuity across these terminals is restored, the MX may be powered on and started as normal.

Alarm to PLC

- For normal operation in either Local or Remote modes, the **X6.5/X6.6** contacts must be shorted together. A jumper wire is pre-installed across these contacts, which may be removed to integrate an external alarm signal from customer equipment.
- To send an external alarm signal to the MX, the continuity across the **X6.5/X6.6** terminals must be broken. After 3 seconds of broken continuity, the PLC will acknowledge the external alarm signal with an internal Level 1 Alarm. After 10 total seconds of broken continuity, the PLC will escalate to a Level 4 Alarm and shut down the engine. If continuity across these terminals is restored, the Level 1 Alarm will automatically clear, but the Level 4 Alarm (if triggered) will stay active. Refer to Section 12.1 for more details on MX Alarms.

Alarm to SCADA

- If the MX System has any active alarms, **X6.7/X6.8** will open.
- When no internal alarms are active, the **X6.7/X6.8** contacts will remain closed.

Remote Start/Stop

- With the LOC/REM switch set to REM (Remote Mode) and the MX System powered on, short the **X6.11/X6.12** contacts together to start the MX Engine. The MX Engine will remain on as long as these contacts remain shorted. Open these contacts to turn the MX Engine off.
- The **X6.11/X6.12** contacts have no effect when the LOC/REM switch is set to LOC (Local Mode).

Out of Service Status

- Continuity between the **X6.13/X6.14** terminals indicates that the battery shunt trip is active, meaning the system is de-energized and safe for service.
- No continuity between the **X6.13/X6.14** terminals means the shunt trip is inactive, and the system should not be serviced.

Customer Load Status

- When the MX Engine is running and the customer load contactor is active, contacts **X6.9/X6.10** will be open.
- If the MX Engine is not running or the customer load contactor has not yet activated, then the **X6.9/X6.10** contacts will remain closed.

7.2 REMOTE MONITORING THROUGH MODBUS

Remote monitoring is supported via Modbus, with both RS-485 and TCP/IP protocols available. This allows the user to monitor the MX unit's system status and key operating parameters.

Table 4 – MX Modbus Configuration Settings

MODBUS VIA RS-485	MODBUS OVER TCP/IP
Baud Rate – 19,200 bps Data Bits – 8 Stop bit – 1 Parity – None Slave ID Number – 1	System Controller IP – 10.10.0.11 TCP Port – 502
<ul style="list-style-type: none"> ▪ RS-485 T/R+ will be terminal X6.18. ▪ RS-485 T/R– will be terminal X6.17. 	The spare LAN port on the MX Modem should be used for Modbus TCP/IP communications.

NOTE:

**The MX Power Generator cannot be controlled through Modbus.
Modbus support is for diagnostics and system information only.**

The MX Modbus holding registers are organized by type, as listed below.

- **MX System Parameters** – Addresses 40000 through 40059 (indexes 0 through 59)
- **MX Engine Parameters** – Addresses 40060 through 40089 (indexes 60 through 89)
- **MX Electrical Parameters** – Addresses 40090 through 40145 (indexes 90 through 145)

Table 5 – MX Generator Modbus Map

PARAMETER / DATA DESCRIPTION	TYPE	UNITS	MODBUS ADDRESS
MX System Parameters			
System Battery Voltage	float	V _{DC}	40000 - 40001
System Current Date (UTC)	sint32	yymmdd	40002 - 40003
System Current Time (UTC)	sint32	hhmmss	40004 - 40005
System Power ON, Date (UTC)	sint32	yymmdd	40006 - 40007
System Power ON, Time (UTC)	sint32	hhmmss	40008 - 40009
Generator ON, Date (UTC)	sint32	yymmdd	40010 - 40011
Generator ON, Time (UTC)	sint32	hhmmss	40012 - 40013
Current Alarm Code #1	sint32	N/A	40014 - 40015
Current Alarm Code #2	sint32	N/A	40016 - 40017
Current Alarm Code #3	sint32	N/A	40018 - 40019
Current Alarm Code #4	sint32	N/A	40020 - 40021
Previous Alarm Code #1	sint32	N/A	40022 - 40023
Previous Alarm Code #2	sint32	N/A	40024 - 40025
Previous Alarm Code #3	sint32	N/A	40026 - 40027
Combined Level 1 Alarm Word	uint32	Bitwise	40028 - 40029
Combined Level 2 Alarm Word	uint32	Bitwise	40030 - 40031
Combined Level 3 Alarm Word	uint32	Bitwise	40032 - 40033
Combined Level 4 Alarm Word	uint32	Bitwise	40034 - 40035
System Controller Combined Run Status	uint32	Bitwise	40036 - 40037
System Controller Discrete Input Status	uint32	Bitwise	40038 - 40039
System Controller Discrete Output Status	uint32	Bitwise	40040 - 40041
Actual Engine Room Temperature	float	°C	40042 - 40043
Actual Ambient Environment Air Temperature	float	°C	40044 - 40045
Actual Electrical Enclosure Temperature	float	°C	40046 - 40047
Actual Engine Coolant Outlet Temperature	float	°C	40048 - 40049
Actual Engine Coolant Inlet Temperature	float	°C	40050 - 40051
Radiator Fans Control Voltage	float	V _{DC}	40052 - 40053
Enclosure Fans Control Voltage	float	V _{DC}	40054 - 40055

PARAMETER / DATA DESCRIPTION	TYPE	UNITS	MODBUS ADDRESS
Coolant Pump Control Voltage	float	V _{DC}	40056 - 40057
Coolant Pump RPM	sint32	RPM	40058 - 40059
MX Engine Parameters			
Total Accumulated Engine Run Hours	float	Hours	40060 - 40061
Engine Run Hours Since Last Start	float	Hours	40062 - 40063
Accumulated Engine Maintenance Hours	float	Hours	40064 - 40065
Accumulated Number of Engine Cranks	sint32	N/A	40066 - 40067
Accumulated Number of Engine Starts	sint32	N/A	40068 - 40069
Actual Engine Speed	float	RPM	40070 - 40071
Actual Engine Coolant Temperature	float	°C	40072 - 40073
Actual Engine Exhaust Temperature	float	°C	40074 - 40075
Actual Engine Throttle Position	float	%	40076 - 40077
Actual Air/Fuel Ratio (Lambda)	float	N/A	40078 - 40079
Engine Control Unit Alarm Word	uint32	Bitwise	40080 - 40081
Estimated Accumulated Fuel Usage – Natural Gas	float	Sm ³	40082 - 40083
Estimated Current Fuel Flow Rate – Natural Gas	float	SLPM	40084 - 40085
Estimated Accumulated Fuel Usage – Propane	float	L	40086 - 40087
Estimated Current Fuel Flow Rate – Propane	float	L/Day	40088 - 40089
MX Electrical Parameters			
Total Accumulated Alternator Energy	float	kWh	40090 - 40091
Alternator AC Frequency	float	Hz	40092 - 40093
Alternator System Real Power	float	kW	40094 - 40095
Alternator System Apparent Power	float	kVA	40096 - 40097
Alternator AC Voltage: L1 (U)	float	V _{AC}	40098 - 40099
Alternator AC Voltage: L2 (V)	float	V _{AC}	40100 - 40101
Alternator AC Voltage: L3 (W)	float	V _{AC}	40102 - 40103
Alternator AC Current: L1 (U)	float	A _{AC}	40104 - 40105
Alternator AC Current: L2 (V)	float	A _{AC}	40106 - 40107
Alternator AC Current: L3 (W)	float	A _{AC}	40108 - 40109
Alternator L1 (U) AC Active (Real) Power	float	kW	40110 - 40111
Alternator L2 (V) AC Active (Real) Power	float	kW	40112 - 40113
Alternator L3 (W) AC Active (Real) Power	float	kW	40114 - 40115
Alternator L1 (U) AC Apparent Power	float	kVA	40116 - 40117
Alternator L2 (V) AC Apparent Power	float	kVA	40118 - 40119

PARAMETER / DATA DESCRIPTION	TYPE	UNITS	MODBUS ADDRESS
Alternator L3 (W) AC Apparent Power	float	kVA	40120 - 40121
Alternator AC Power Factor: L1 (U)	float	N/A	40122 - 40123
Alternator AC Power Factor: L2 (V)	float	N/A	40124 - 40125
Alternator AC Power Factor: L3 (W)	float	N/A	40126 - 40127
Alternator AC Voltage: L1-L2 (U-V)	float	V _{AC}	40128 - 40129
Alternator AC Voltage: L2-L3 (V-W)	float	V _{AC}	40130 - 40131
Alternator AC Voltage: L3-L1 (W-U)	float	V _{AC}	40132 - 40133
Alternator Total Harmonic Distortion (Voltage): L1	float	%	40134 - 40135
Alternator Total Harmonic Distortion (Voltage): L2	float	%	40136 - 40137
Alternator Total Harmonic Distortion (Voltage): L3	float	%	40138 - 40139
Alternator Total Harmonic Distortion (Current): L1	float	%	40140 - 40141
Alternator Total Harmonic Distortion (Current): L2	float	%	40142 - 40143
Alternator Total Harmonic Distortion (Current): L3	float	%	40144 - 40145

The MX Power Generator is also able to retrieve Modbus data from GPT's EZ-Air Instrument Air System when paired together. For full details on this feature, refer to the EZ-Air Operating Manual or contact GPT's customer service.

7.3 REMOTE MONITORING THROUGH IOT

The MX Power Generator is equipped with a cellular modem that enables remote monitoring over IoT. As long as the MX retains a cellular connection, it can be monitored from anywhere with access to the internet.

The Remote Monitoring System is a secure portal that displays data received from the MX unit. It does not allow the user to control the MX unit.

NOTE: **The MX Power Generator cannot be controlled through IoT.**

7.3.1 LOG-IN INSTRUCTIONS

MX Power Generators can be accessed remotely by logging in to GPT's Remote Monitoring System. MX Power Generator customers require a Microsoft Account in order to access the Remote Monitoring System portal.

Please contact GPT to request access to your MX Power Generator's IoT web portal. We will require your organization (company) name, as well as the user email addresses for each user who requires access. These user email addresses should be the same as used for their Microsoft Accounts.



Figure 7-1 – Cellular Modem Located in the Electrical Enclosure

Once set-up, the Remote Monitoring System can be accessed using any device with access to the internet. To log-in:

1. Open an internet browser and type the following URL: <https://gptrms.azureiotcentral.com/>
2. Sign-in using your Microsoft account credentials.

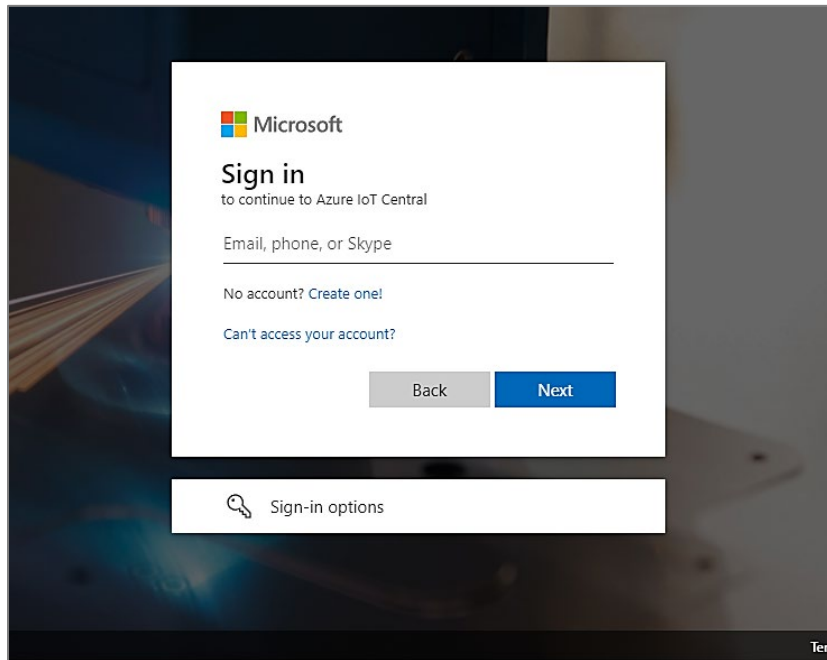


Figure 7-2 – Log-in Page for Remote Monitoring System

3. Once logged-in, the page will open to the Remote Monitoring System Dashboard which shows information about your MX unit(s). Refer to Figure 7-3.
 - If your dashboard is blank, click on “Devices” on the left side of the screen, labeled “1” in the figure below to find your MX unit(s).

The dashboard displays various information regarding your MX Power Generator. Click on the tabs below the device name, labeled “2” in the figure below, to monitor system data.

Device information is grouped as follows:

1. **System Overview** — Shows system output values, general system operating parameters, temperatures, active/previous alarms, and a description of the various alarm codes.
2. **Engine Overview** — Shows detailed engine operating parameters, engine system temperatures, estimated fuel consumption, and auxiliary system voltages.
3. **System Performance Trends** — Depicts key system and electrical parameters on various charts. Some charts show the previous 30 minutes in detail, and other charts show aggregate values across the prior 30 days.
4. **Engine Performance Trends** — Depicts key engine parameters on a chart spanning the previous 30 minutes.
5. **Raw Data** — Raw data feed from the MX Generator, with timestamps. This will show telemetry packets, as well as cellular connections/disconnections from IoT Central.
6. **Mapped Aliases** — Unused. (Blank screen)

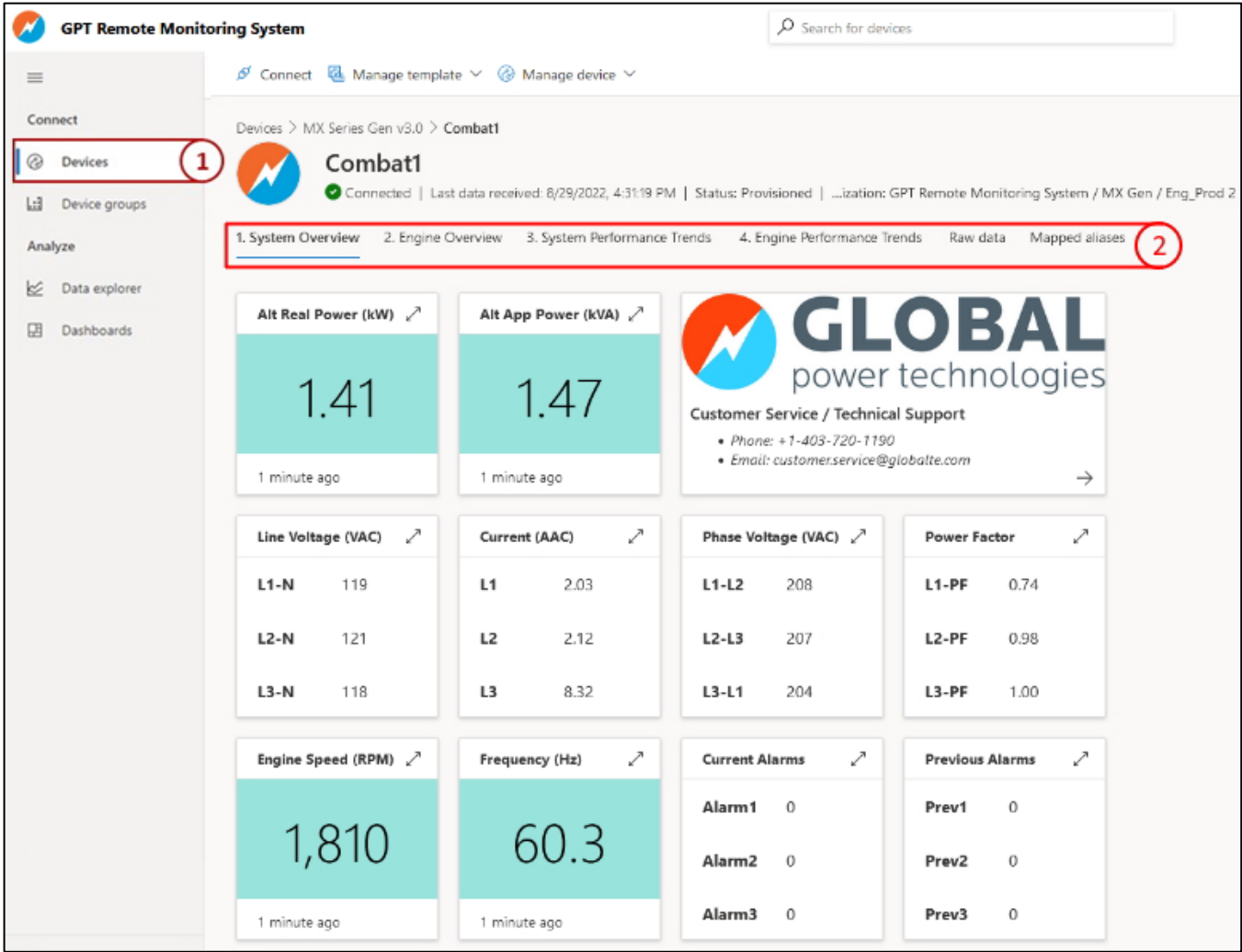


Figure 7-3 – Remote Monitoring System Dashboard

8 SHUTDOWN

**CAUTION!**

To avoid sudden disturbance to the generator, disconnect the loads gradually—100 to 0% over a period of 3 minutes. This helps extend the lifetime of the system

8.1 SHUTDOWN

Follow this procedure to safely shut down the MX Power Generator.

1. Gradually decrease loads from 100 to 0% over a period of 3 minutes. This minimizes thermal load on the engine and helps maintain stability of the synchronous alternator.
2. Disconnect the customer load by turning off the Customer Load Circuit Breaker (**Q7**).
3. Allow the system to idle for 2 minutes, then check the switch settings and proceed as follows:
 - a. If the LOC/REM switch is set to “**LOC**” and the AUTO/MAN switch is set to “**MAN**”, press the “**STOP**” button on the electrical cabinet door.
 - Or*
 - b. If the LOC/REM switch is set to “**REM**” and/or the AUTO/MAN switch is set to “**AUTO**”.
 - i. First turn off the fuel at the external main valve to stop the engine.
 - ii. Once the engine has stopped, turn the LOC/REM switch to “**LOC**” and the AUTO/MAN switch to “**MAN**”.

The engine will initiate a shutdown/cool down sequence as follows:

- Power will be disconnected,
 - Engine shutdown will begin, and
 - Generator power will be shut down.
 - The coolant pump will continue circulating for 30 seconds.
4. Wait one minute for the engine to cool down, then turn the LOCAL ON/OFF switch to “**OFF**”.
 5. If the MX unit needs to be isolated for maintenance:
 - a. Ensure that the fuel is turned off at the external main valve.
 - b. Turn off the Main DC Breaker (**Q3**) and DC Control Breaker (**Q5**) located inside the electrical enclosure to lock out the unit.
 - c. Turn off the Main System Breaker (**Q1**) and the Battery Charger Breaker (**Q2**) located in the engine room.

**CAUTION!**

Before starting maintenance activities, ensure that the system is set as follows:

1. LOC/REM switch is in LOC position
 2. AUTO/MAN switch is in MAN position
 3. LOCAL ON/OFF switch is in OFF position
-

8.2 EMERGENCY SHUTDOWN (ESD)

The MX Power Generator is equipped with an emergency shutdown system. Pushing the ESD button on the electrical panel door will accomplish the following:

1. Stops the generator.
2. Cuts power to MX unit and the customer load.
3. Cuts power to the system controller.

After the generator is stopped, it is advised to turn off the fuel supply.

After an emergency shutdown, turn off the relevant breakers (open position) as outlined in the standard shutdown sequence before resetting the ESD button.

Once the breakers have been turned off, the ESD button can be reset by twisting the button to the right. The button will pop back out to its original position.

NOTE: **Avoid using the Emergency Shutdown for routine shutdowns under normal operating conditions. It should be utilized only for emergencies.**

The ESD system is also available remotely in case there is an external site ESD that needs to also shut down the generator. A User-ESD dry contact signal can be sent to the MX unit to initiate Emergency Shutdown of the system. This ESD will function the same as the ESD button, but remotely.



The ESD dry contact is a normally-closed contact. To use external SCADA controls, remove the factory-provided jumper. Otherwise, the jumper must remain in place.

9 SERVICE AND MAINTENANCE



Operation and maintenance of the MX Power Generator must only be performed by qualified personnel who are trained in the operation of the power system and qualified in servicing electrical equipment. Follow all local electrical safety regulations. Lethal voltages are present in this system! Use accepted safety procedures when working on all electrical circuits.

9.1 RECOMMENDED MAINTENANCE AND INTERVALS

Table 6 and Table 7 show the recommended maintenance schedule for the MX Power Generator. The engine on the MX is designed for long run continuous output with standard 2,250-hour maintenance intervals and can be expanded to 9,000 continuous hours with the addition of an extended oil reservoir. A maintenance Log is available at the end of this manual. Record maintenance activities and any important notes on this log. Perform a leak check on the fuel line periodically and at each maintenance visit.

9.1.1 STANDBY OIL SYSTEMS

Perform maintenance on the MX Power Generator based on the table below if your MX unit has the standard oil system.

Table 6 – Maintenance Schedule for Standby Oil Systems

STANDBY OIL SYSTEM SERVICE RUNTIME	EVERY 2,250 HOURS	EVERY 9,000 HOURS	EVERY 18,000 HOURS	EVERY 27,000 HOURS
Change engine oil	X			
Change oil filter	X			
Check oil catch can	X	X	X	X
Change spark plugs		X	X	X
Check valve clearance		X	X	X
Change enclosure filter*	*	X	X	X
Change primary radial air filter*	*	X	X	X
Change secondary radial air filter				X
Change O2 Sensor		X	X	X
Check CCV hoses if free		X	X	X
Check compression		X	X	X
Check water pump (leaks / bearing)		X	X	X
Change coolant**	**	**	X	**
Change water pump			X	
Change spark plug wire				X
Change ignition coils				X
Clean and regrease alternator bearings				X
Check fuel line for leak	X	X	X	X
Clean electrical contacts		X	X	X
Tighten electrical connections		X	X	X
*Check enclosure and primary air filters every 2,250 hours, change at least every 9,000 hours.				
**Check coolant levels every 2,250 hours and top up as required. Replace coolant at least every 18,000 hours.				

NOTE:

All values stated above are recommended values. Oil change interval is dependent on many factors, such as number of engine starts, gas quality, average engine load, and more. We recommend that taking periodic oil samples and getting them analyzed to verify validity of the recommended service intervals for your application.

9.1.2 SYSTEMS WITH EXTENDED OIL RESERVOIR

Perform maintenance on the MX Power Generator based on the table below if your system is equipped with the extended oil reservoir option.

Table 7 – Maintenance Schedule for Systems with Extended Oil Reservoir

EXTENDED-RUN OIL SYSTEM SERVICE RUNTIME	EVERY 2,250 HOURS	EVERY 9,000 HOURS	EVERY 18,000 HOURS	EVERY 27,000 HOURS
Change engine oil**	**	X	X	X
Change oil filter		X	X	X
Check oil catch can	X	X	X	X
Change spark plugs		X	X	X
Check valve clearance		X	X	X
Change enclosure filter*	*	X	X	X
Change primary radial air filter and hose*	*	X	X	X
Change secondary radial air filter				X
Change O2 Sensor		X	X	X
Check CCV hoses if free		X	X	X
Check compression		X	X	X
Check water pump (leaks / bearing)		X	X	X
Change coolant**	**	**	X	**
Change water pump			X	
Change spark plug wire				X
Change ignition coils				X
Clean and regrease alternator bearings				X
Check fuel line for leaks	X	X	X	X
Clean electrical contacts		X	X	X
Tighten electrical connections		X	X	X
*Check enclosure and primary air filters every 2,250 hours. Replace at least every 9,000 hours **Check oil and coolant levels every 2,250 hours and top up as required. Replace coolant at least every 18,000 hours.				

NOTE:

All values stated above are recommended values. Oil change interval is dependent on many factors, such as number of engine starts, gas quality, average engine load, and more. We recommend taking periodic oil samples and getting them analyzed to verify validity of the recommended service intervals for your application.

9.2 SYSTEM CHECK

Before shutting the system down for maintenance, perform the following checks while the unit is in operation:

1. Access the electrical panel using a flat blade screwdriver.
2. Inspect the electrical panel and note anything out of the ordinary in the maintenance log. Some things to look for during this initial inspection are:
 - a. Are there any alarms on the LED Display's detailed alarm screen? (Refer to Section 6.2)
 - b. Are there any breakers that have tripped?
 - c. Are there any signs of overheating?
Use a 7/16" driver to remove the front panel of the engine compartment.
Inspect the engine compartment and note anything out of the ordinary in the maintenance log.
 - d. Are there any odd noises? Check the engine, coolant pump, radiator fans, circulation fans, etc.
 - e. Are there any noticeable spills or leaks?
3. Make note of the wind shield spacing on the maintenance log.

9.3 SYSTEM SHUTDOWN AND LOCK OUT FOR MAINTENANCE

Before beginning service or maintenance work on the MX Power Generator, ensure that the system is shut down completely. Follow the preferred shutdown procedure and allow the engine to cool for at least 15 minutes.

Check and confirm the following before beginning maintenance on the MX unit:

1. The LOC/REM switch is set to **LOC**.
2. The AUTO/MAN switch is set to **MAN**.
3. The LOCAL ON/OFF switch is set to **OFF**.
4. The Main System Breaker (**Q1**) and the Battery Charger Breaker (**Q2**) located in the engine are switched off.
5. The Main DC Control Breakers (**Q3**) and (**Q5**) located inside the electrical panel enclosure are turned off. This makes sure that the generator is locked out for maintenance.



CAUTION!

Before starting maintenance activities, ensure that the system is set as follows:

- 1) LOC/REM switch is in LOCAL position**
 - 2) AUTO/MAN switch is in MAN position**
 - 3) LOCAL ON/OFF switch is in OFF position**
-

9.4 FUEL TRAIN ASSEMBLY LEAK CHECK

The MX Power Generator's engine has an internal gas piping assembly with a zero regulator and solenoid valve. This hooks up to a gas mixer throttle for the engine intake. Outside the MX unit exists the external gas connection, featuring a 1/2-inch Swagelok connection where a manual shut-off valve must be installed for gas shut-off to the engine.

Check the fuel lines for leaks periodically and during each scheduled maintenance.

9.5 AIR SYSTEM FILTERS CHECK

There are two major air systems in the MX Power Generator: the air feeding the engine and the air circulation in the engine compartment. Both air systems are filtered to keep the system free of foreign debris. Both filters should be periodically inspected every 2,250 hours of runtime and replaced if clogged.



Figure 9-1 – Engine Air Intake

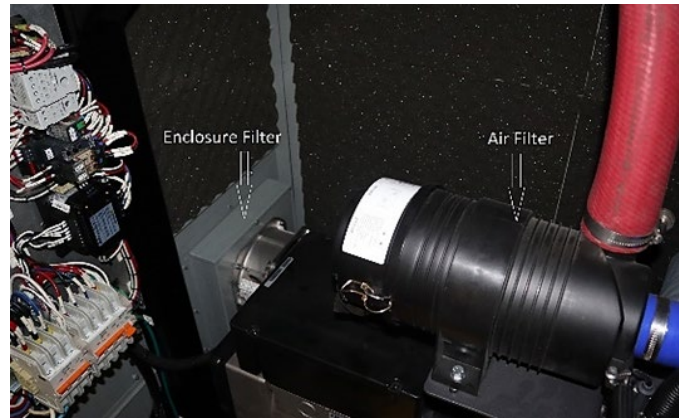


Figure 9-2 – Engine Air Circulation

During each service or maintenance visit, check the air systems as follows:

1. Inspect the engine enclosure filter and clear it of any debris. If dirty or the system's run time has exceeded 9,000 hours, replace this enclosure MERV9 air filter (GPT part number 302704).
2. Inspect the engine air intake screen located on the engine air intake elbow and clear it of any debris.
3. Remove and inspect the engine air hose for dust build up on the inner wall, clean as required.
4. Inspect the primary engine air filter. If dirt is visible, or the system's run time has exceeded 9,000 hours, replace the primary radial seal air filter (GPT part number 302756).
5. Within the primary air filter is the secondary safety radial seal air filter. If the engine run time has exceeded 27,000 hours, then this safety radial seal air filter (GPT Part number 302757) must be replaced.

For detailed service and maintenance instructions please refer to the MX Service Manual (303453).

9.6 BATTERY INSPECTION



WARNING! Keep unauthorized personnel away from batteries.

Servicing of batteries are to be performed or supervised by personnel knowledgeable of batteries and the required precautions.

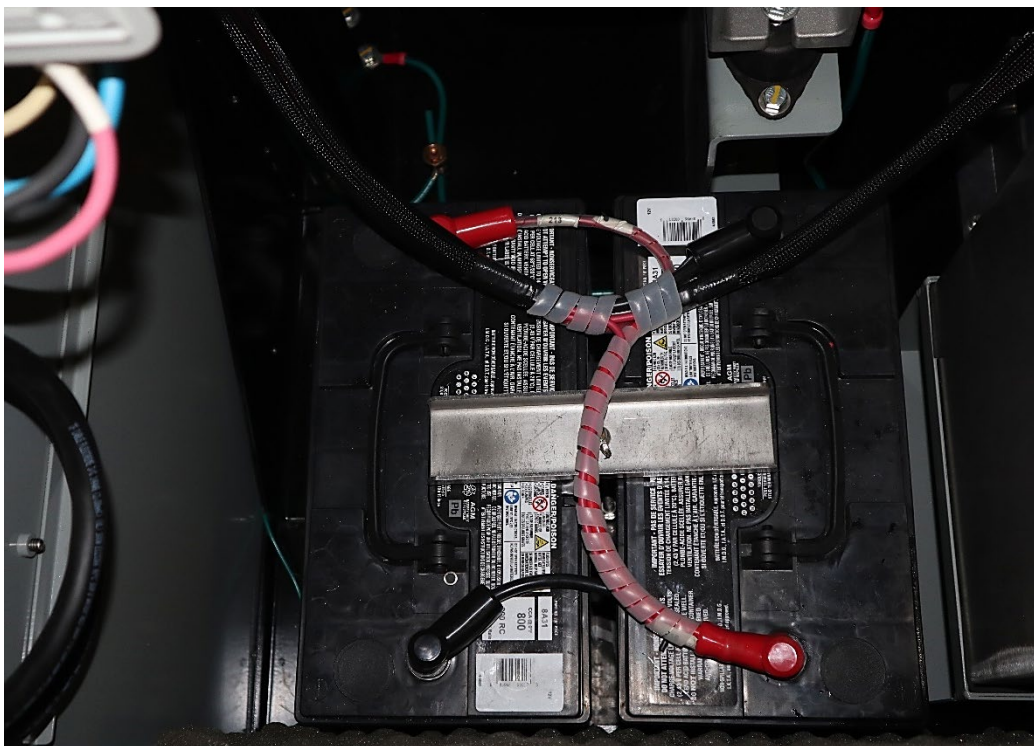


Figure 9-3 – MX Batteries

During each maintenance and service visit, inspect the battery as follows:

1. Check battery posts for corrosion. Clean any minor corrosion with wire brush or battery terminal cleaning tool. Severe corrosion may require replacement.
2. Measure the voltage of each battery to verify that voltage is between 12.6 and 14.8V.
3. Every 9,000 hours of operation, we recommend the battery positions be swapped. This ensures the batteries stay balanced, as only one position feeds the 12 VDC starting motor.
4. Ensure terminals are tight and terminal boots are in place.

For detailed service and maintenance instructions or battery replacement instructions please refer to the MX Service Manual (303453).



CAUTION!

To avoid overtightening, do not use tools when tightening the battery clamp wing nut. Keep them hand tight.

**WARNING!**

A battery presents a risk of electrical shock and high short-circuit current. The following precautions are to be observed when working on batteries:

- a. Remove watches, rings, or other metal objects;
- b. Use tools with insulated handles;
- c. Wear rubber gloves and boots;
- d. Do not lay tools or metal parts on top of batteries;
- e. Disconnect charging source prior to connecting or disconnecting battery terminals; and
- f. Determine if the battery is inadvertently grounded. When inadvertently grounded, remove source of ground. Contact with any part of a grounded battery is capable of resulting in electrical shock. The risk of such shock is reduced when such grounds are removed during installation and maintenance.

**WARNING!**

Do not dispose of battery or batteries in a fire. The battery is capable of exploding. Do not open or mutilate the batteries. Released electrolyte has been known to be harmful to the skin and eyes and to be toxic.

9.7 OIL SYSTEM CHECK

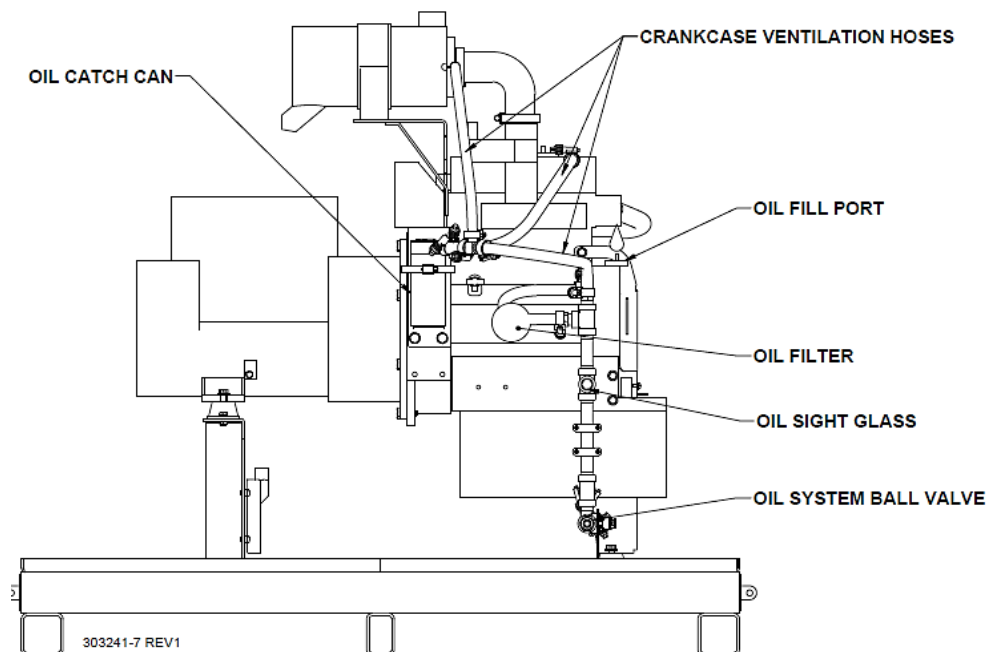


Figure 9-4 – Standby Oil Configuration

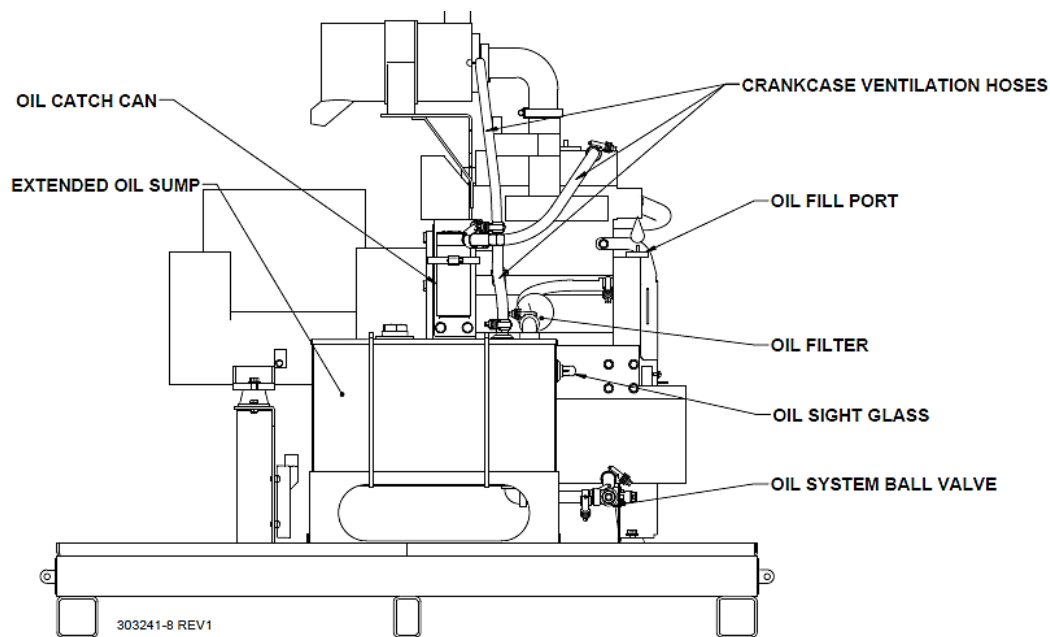


Figure 9-5 – Long Run Oil Configuration

9.7.1 CHECK OIL CATCH CAN

Every 2,250 hours the oil catch can should be opened and checked for oil & water accumulation and emptied. It can be accessed on the crank case ventilation hoses, and the can screws off the top with the hose ports.

9.7.2 CHECK OIL LEVELS

Oil levels should be checked every 2,250 hours. Oil levels can be determined by observing the MX sight glass. When the Engine is cool, the oil sight bubble should be half to fully full of oil. Oil can be added into the oil fill port, or from 1 ½ NPT plug on extend oil sump (if applicable).

9.8 OIL CHANGES

Oil changes, including the oil filter change, need to be performed on the MX Power Generator every 2250 hours of run time for systems with a standby oil system or 9000 hours for systems with extended-run oil system with the extended oil sump. There is a drain valve on the oil system that allows for the oil to be drained. Wait approximately 20 minutes for the oil to cool before changing, though if the oil gets too cold may take a long time to drain. For detailed service and maintenance instructions on performing a full oil change, please refer to the MX Service Manual (303453).

9.9 COOLANT SYSTEM CHECK

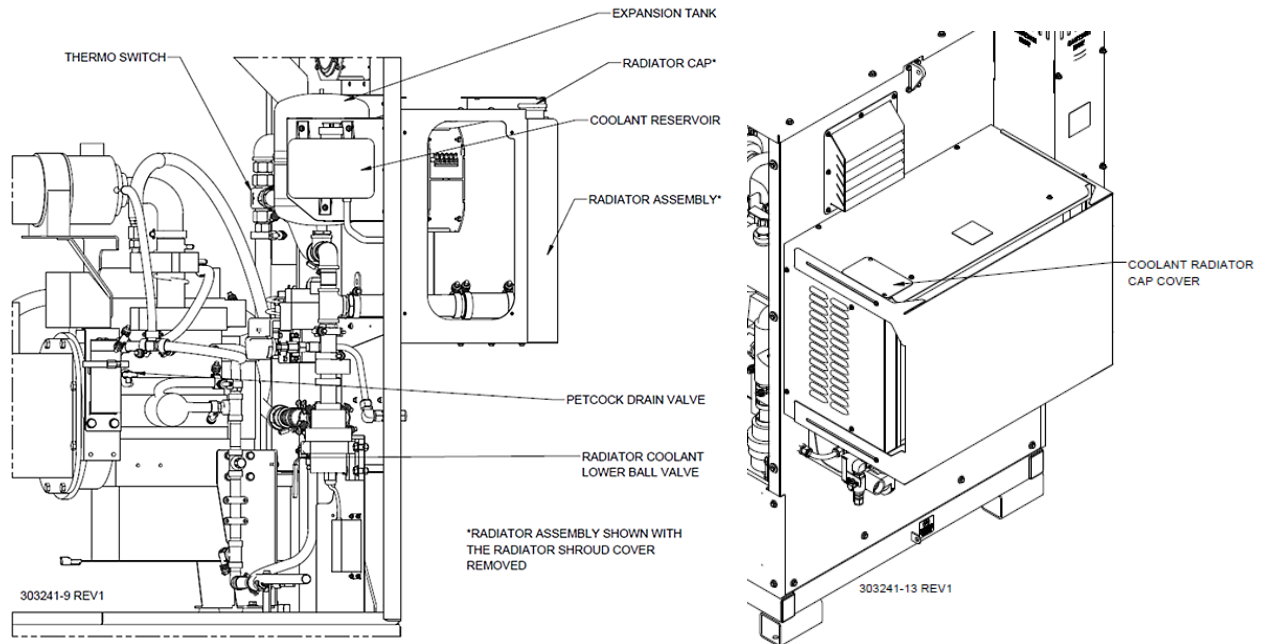


Figure 9-6 – Coolant System

If the coolant level on the reservoir is noticeably low, it can be topped up at the reservoir tank. Shut down the MX Power Generator and turn the fuel supply has off at the external valve then top up the coolant as follows:

1. Open the overflow tank.
2. Pour coolant in the tank until it hits the “Normal” line.
3. Close the tank.

If at time of inspection coolant reservoir is fully empty:

1. Remove radiator cap cover on top of radiator shroud.
2. Remove radiator cap and check coolant level inside radiator.
3. If low, fill radiator with coolant.
4. Reinstall radiator cap and radiator cap cover.
5. Open the overflow tank.
 - a. Pour coolant in the tank until it hits the “Normal” line.
 - b. Close the tank.

9.10 COOLANT CHANGES

Every 16,000 hours the coolant should be fully flushed, and the coolant pump replaced. For detailed service and maintenance instructions on coolant changes please refer to the MX Service Manual (303453).

9.11 O2 SENSOR REPLACEMENT

The O2 sensor (also known as A/F sensor) is located inside the exhaust blanket and needs to be replaced every 9,000 hours of runtime. Before replacing, ensure that the engine and exhaust elbow has cooled down and is safe to touch. For detailed instructions on how to replace refer to the MX Service Manual (303453).

9.12 ENGINE VALVE ADJUSTMENT

Every 9,000 hours the engine valves need to be adjusted. After the adjustment and maintenance takes place, a compression check should also be completed to confirm the engine is in optimal running condition. For detailed instructions and order of operations refer to the MX Service Manual (303453).

9.13 IGNITION SYSTEM REPLACEMENT

Every 27,000 hours the ignition system, including ignition coils and spark plug cords should be replaced. Please refer to the MX Service Manual (303453).

9.14 COMPRESSION CHECK

After each maintenance cycle is completed at 9,000, 18,000 and 27,000 hours, a compression check should be done to confirm the engine is in optimal running condition. For detailed instructions and order of operations, refer to the MX Service Manual (303453).

9.15 ENGINE OVERHAUL

The engine, cylinder head, and/or oil pump will need to be replaced or repaired after 27,000 to 60,000 hours. This can be determined based on history of engine loading, cylinder compression checks, and overall engine performance.

10 STORAGE

When the MX Power Generator is not in use, it should be placed in a covered storage area to prevent water from accumulating inside the crates. Keep the temperature around the unit above the dew point of water. The storage temperature should be between -18°C to 32°C (-0.4°F to 89.6°F)

If storing in humid climates (80% RH or higher), add desiccant packs inside the MX Power Generator enclosure. Replace the desiccant pack and circulate the air through the MX Power Generator every 15 to 30 days.

10.1 BATTERY STORAGE

The MX Power Generator has two (2) nominal 12V_{DC} batteries. One battery provides 12 V_{DC} to the engine starter, and both connected in series provide 24 V_{DC} for system controls and peripherals. When in storage, the batteries self-discharge over time. Self-discharge is more severe in hot climates.

If the unit will be stored for an extended period, disconnect the battery cables, and remove the battery terminal boots.

Every 3-6 months, recharge the batteries fully. If the ambient temperature is below 0°C (32°F), the batteries will need more frequent charging to maintain a voltage suitable for engine starting.

An AC plug is provided to allow external AC to power the internal MX Battery Charger.

If charging these batteries outside of an MX System, the operator should float-charge each 12V battery at a voltage of 13.8V at 25°C (77°F).

11 MAINTENANCE AND COMMISSIONING SPARES

11.1 STANDBY OIL CAPACITY SYSTEMS

Table 8 – Maintenance Materials for Standby Oil Capacity Systems

SERVICE INTERVAL - STANDBY	QTY	GPT PN	DESCRIPTION
303146 – MX Maintenance Kit: Standby Run, 2,250 Hours For every 2,250 hours outside of 9,000, 18,000, and 27,000 hours	1	302732	FILTER, OIL
	4	303046	OIL, ENGINE, SYNTHETIC, 1 GAL, 15W40
	1	302704	FILTER, AIR, 12x12x2, MERV9
	1	302756	AIR FILTER, PRIMARY RADIAL SEAL
	1	303045	COOLANT, 1 GAL, 60/40 EG, YELLOW VCS
303147 – MX Maintenance Kit: Standby Run, 9,000 Hours	1	302732	FILTER, OIL
	4	303046	OIL, ENGINE, SYNTHETIC, 1 GAL, 15W40
	3	302731	SPARK PLUG
	1	302733	SENSOR, O2, PRE-CAT EXHAUST, MX
	1	302704	FILTER, AIR, 12x12x2, MERV9
	1	302756	AIR FILTER, PRIMARY RADIAL SEAL
	1	303045	COOLANT, 1 GAL, 60/40 EG, YELLOW VCS
	1	303117	GASKET, CYLINDER HEAD COVER
	3	302745	WASHER, SEAL, VALVE COVER
303148 – MX Maintenance Kit: Standby Run, 18,000 Hours	1	302732	FILTER, OIL
	4	303046	OIL, ENGINE, SYNTHETIC, 1 GAL, 15W40
	3	302731	SPARK PLUG, 1KS-CHP
	1	302733	SENSOR, O2, PRE-CAT EXHAUST, MX
	1	302704	FILTER, AIR, 12x12x2, MERV9
	1	302756	AIR FILTER, PRIMARY RADIAL SEAL
	3	303045	COOLANT, 1 GAL, 60/40 EG, YELLOW VCS
	1	303606	PUMP, ASSY, 1" MHB, 24V, TERMINATED
	1	303117	GASKET, CYLINDER HEAD COVER
	3	302745	WASHER, SEAL, VALVE COVER
303149 – MX Maintenance Kit: Standby Run, 27,000 Hours	1	302732	FILTER, OIL
	4	303046	OIL, ENGINE, SYNTHETIC, 1 GAL, 15W40
	3	302731	SPARK PLUG
	1	302733	SENSOR, O2, PRE-CAT EXHAUST, MX
	1	302704	FILTER, AIR, 12x12x2, MERV9
	1	302756	AIR FILTER, PRIMARY RADIAL SEAL
	1	303045	COOLANT, 1 GAL, 60/40 EG, YELLOW VCS
	1	302737	COIL ASSY, IGNITION
	1	302736	CORD SET, RESISTIVE, SPARK PLUG
	1	302757	AIR FILTER, SAFETY RADIAL SEAL
	1	303117	GASKET, CYLINDER HEAD COVER
	3	302745	WASHER, SEAL, VALVE COVER

11.2 EXTENDED RUN OIL CAPACITY SYSTEMS*Table 9 – Maintenance Materials for Extended Run Oil Capacity Systems*

SERVICE INTERVAL - EXTENDED	QTY	GPT PN	DESCRIPTION
303142 – MX Maintenance Kit: Extended Run, 2,250 Hours For every 2,250 hours outside of 9,000, 18,000, and 27,000 hours	1	302704	FILTER, AIR, 12x12x2, MERV9
	1	302756	AIR FILTER, PRIMARY RADIAL SEAL
	1	3003046	OIL, ENGINE, SYNTHETIC, 1 GAL, 15W40
	1	303045	COOLANT, 1 GAL, 60/40 EG, YELLOW VCS
303143 – MX Maintenance Kit: Extended Run, 9,000 Hours	1	302732	FILTER, OIL
	10	303046	OIL, ENGINE, SYNTHETIC, 1 GAL, 15W40
	3	302731	SPARK PLUG
	1	302733	SENSOR, O2, PRE-CAT EXHAUST, MX
	1	302704	FILTER, AIR, 12x12x2, MERV9
	1	302756	AIR FILTER, PRIMARY RADIAL SEAL
	1	303045	COOLANT, 1 GAL, 60/40 EG, YELLOW VCS
	1	303117	GASKET, CYLINDER HEAD COVER
	3	302745	WASHER, SEAL, VALVE COVER
303144 – MX Maintenance Kit: Extended Run, 18,000 Hours	1	302732	FILTER, OIL
	10	303046	OIL, ENGINE, SYNTHETIC, 1 GAL, 15W40
	3	302731	SPARK PLUG
	1	302733	SENSOR, O2, PRE-CAT EXHAUST, MX
	1	302704	FILTER, AIR, 12x12x2, MERV9
	1	302756	AIR FILTER, PRIMARY RADIAL SEAL
	3	303045	COOLANT, 1 GAL, 60/40 EG, YELLOW VCS
	1	303606	PUMP, ASSY, 1" MHB, 24V, TERMINATED
	1	303117	GASKET, CYLINDER HEAD COVER
	3	302745	WASHER, SEAL, VALVE COVER
303145 – MX Maintenance Kit: Extended Run, 27,000 Hours	1	302732	FILTER, OIL
	10	303046	OIL, ENGINE, SYNTHETIC, 1 GAL, 15W40
	3	302731	SPARK PLUG
	1	302733	SENSOR, O2, PRE-CAT EXHAUST, MX
	1	302704	FILTER, AIR, 12x12x2, MERV9
	1	302756	AIR FILTER, PRIMARY RADIAL SEAL
	1	303045	COOLANT, 1 GAL, 60/40 EG, YELLOW VCS
	1	302737	COIL ASSY, IGNITION
	1	302736	CORD SET, RESISTIVE, SPARK PLUG
	1	302757	AIR FILTER, SAFETY RADIAL SEAL
	1	303117	GASKET, CYLINDER HEAD COVER
	3	302745	WASHER, SEAL, VALVE COVER

11.3 COMMISSIONING AND RECOMMENDED SPARES*Table 10 – Commissioning and Recommended Parts*

QTY	GPT PN	DESCRIPTION
2	57483	FUSE, 1A, 250V, 5x20mm GLASS
1	59998	FUSE, 2A, 250V, 5x20mm GLASS
2	25073	FUSE, 3A, 250V, 5x20mm GLASS
2	57484	FUSE, 5A, 125V, 5x20mm GLASS
1	51071	FUSE, 6A, 250V, 5x20mm GLASS
1	57485	FUSE, 15A, 125V, 5x20mm GLASS
1	303646	THERMAL CUTOFF ASSY, MX
2	302704	FILTER, AIR 12x12x2, MERV9
1	302756	AIR FILTER, PRIMARY RADIAL SEAL
1	303045	COOLANT, 60/40 EG, YELLOW VCS, 1 GAL
1	303046	OIL, ENGINE, SYNTHETIC, 15W40, 1 GAL
1	302732	OIL FILTER
3	302731	SPARK PLUG

11.4 INVERTER FOR 12 VDC TO 120VAC EXTERNAL POWER SUPPLY (OPTION)

This inverter is available as an option to use in locations where 120V AC external power source is not accessible. This inverter is powered by a 12V vehicle battery to charge the MX Power Generator's batteries and run electric heat trace, if needed.

Power and temperature ratings are as follows:

- 1.5 kVA power
- Rated to -35°C (-31°F)
- Plugs into a 12V vehicle battery

To use the inverter, connect it to a vehicle battery using the attached jumper cables ensuring that the clamps' connections are secure.

If used in extreme cold temperatures below -35°C (-31°F), warm-up the inverter inside a vehicle before operating. Contact GPT to order.

12 TROUBLESHOOTING

12.1 ALARM CODES

All MX Alarm Codes are 3 digits. The first digit corresponds to the Alarm Level, which is the severity of the alarm (higher numbers are more severe). The second and third digits correspond to the Alarm Type, as described in Table 12.

Certain alarm conditions may escalate to higher level alarms if conditions worsen. Active alarms may affect the behaviour of the MX Power Generator, depending on their Alarm Level. The various Alarm Levels and their effects are detailed in Table 11.

Table 11 – Alarm Levels (First Digit)

ALARM LEVEL 1 [1 ##]	<ul style="list-style-type: none"> These are cautionary alarms. They do not affect system operation. The system will clear these alarms automatically when the alarm condition is resolved for a sustained period.
ALARM LEVEL 2 [2 ##]	<ul style="list-style-type: none"> These warning alarms cause the customer load to disconnect from the alternator. In MANUAL MODE, the “Stop” button must be pressed to clear these alarms. In AUTOMATIC MODE, these alarms will clear automatically once the alarm condition is resolved for a sustained period.
ALARM LEVEL 3 [3 ##]	<ul style="list-style-type: none"> These warning alarms will cause the engine to shut down normally. In MANUAL MODE, the “Stop” button must be pressed to clear these alarms. In AUTOMATIC MODE, these alarms will clear automatically once the alarm condition is resolved for a sustained period.
ALARM LEVEL 4 [4 ##]	<ul style="list-style-type: none"> These warning alarms will cause the engine to quickly shut down. They cannot be cleared by the system controller. You must power-cycle the MX System to clear these alarms.

Table 12 – Alarm Code Definitions

ALARM CODES	ALARM TYPE	ALARM DETAILS
101 401	User SCADA Signal Alarm	An external alarm signal was received from the user’s SCADA system.
102 202	User AC Load Power High	The user AC load is above rated power thresholds.
103 303	Battery Voltage Low	System battery voltage is low. This can indicate system overload, battery failure, battery charger failure, or component failure.
104 404	Battery Voltage High	System battery voltage is too high. This can indicate battery failure and/or battery charger failure.
105	Engine Room Temperature Low	Engine room temperature is low, and the engine may not be able to start successfully.
106 206 306 406	Engine Room Temperature High	Engine room enclosure temperature is too high. This can indicate severe ambient conditions, engine overload, or engine room air-fan failures.

ALARM CODES	ALARM TYPE	ALARM DETAILS
107	Engine Temperature Low	Engine temperature is low, and it is unlikely to start successfully.
108 208 308 408	Engine Temperature High	Engine temperature is too high for operation. This can indicate severe ambient conditions, engine overload, or radiator cooling system failures.
409	Oil Pressure Switch Signal Loss	The oil pressure switch has lost signal. This can indicate oil circulation failure, or a failure of the oil pressure switch.
110	Coolant Pump RPM Low	The RPM signal from the coolant pump is too low. This can indicate failure of the coolant pump.
111	Fuel Pressure Switch Signal Loss	The fuel pressure switch has lost signal. This can indicate a closed fuel valve, or problems with the fuel supply.
112 312	Engine RPM Low	Engine speed is below nominal values. This may occur during load transients, or from drops in fuel supply pressure.
113	Engine RPM High	Engine speed is above nominal values. This may briefly occur during load transients. Contact GPT if this alarm is sustained for long periods of time.
114	Engine Exhaust Temperature High	Engine exhaust temperature is too high for operation. This can indicate engine overload, engine catalyst failure, or exhaust temperature sensor failure.
115	AC Power Factor Low	AC Power Factor Low; User load quality;
116	ECU CAN Bus Error	CAN Bus error message received from the Engine Control Unit. Contact GPT for assistance with this ECU alarm.
117	ECU Engine RPM Over-Speed	Engine overspeed error message received from the Engine Control Unit. Contact GPT for assistance with ECU issues.
118	ECU Engine Exhaust Over-Temperature	Engine exhaust overtemperature message received from the Engine Control Unit. This can indicate engine overload, engine catalyst failure, or exhaust temperature sensor failure.
119	ECU Engine Coolant Over-Temperature	Engine coolant overtemperature error message received from Engine Control Unit. This can indicate engine overload, or radiator cooling system failures.
320	Engine Cranking Failure	The most recent engine crank attempt failed. This can indicate a depleted or failed battery, or engine starter failure.
321	Engine Starting Failure	The most recent engine start attempt failed. This can indicate a depleted or failed battery, or engine starter failure.
122	Power Meter Communication Error	Communications to the power meter have failed. Sporadic errors will indicate high harmonics from the alternator, while prolonged errors can indicate power meter failure or wire failure
123	ECU Communication Error	Communications to the Engine Control Unit have failed. This can indicate issues with the engine wire harness, or ECU failure.

ALARM CODES	ALARM TYPE	ALARM DETAILS
125	Maintenance Hours Exceed 9000	System is overdue for maintenance. Perform routine maintenance as per Section 9. To clear the Maintenance Hour Alarm, press and hold the SCREEN button for 30 seconds while the system is powered on, but the engine is turned off.
126 326	Coolant Outlet Temperature High	Coolant temperature is too high for operation. This can indicate severe ambient conditions, engine overload, or radiator cooling system failures.
127	SD Card Fault	The PLC is unable to write logs to the Micro SD Card. This can indicate the SD Card is not inserted, write-protected, incorrectly formatted, or corrupt. Replace the SD Card if alarm persists.
129	Sensor Failure	One or more analog MX sensors are reading out-of-bounds, indicating sensor failure. When seen with other alarms, this may be the cause of the other alarm code. Contact GPT for assistance

13 PARTS LIST

The table below lists part numbers and quantity required for reference when ordering replacement parts. To order, contact GPT at 1-403-236-5556.

QTY	PART NO.	DESCRIPTION
1	302732	OIL FILTER, 1KS-CHP
4 or 10	303046	ENGINE OIL, SYNTHETIC, 1 GAL, 15W40, MOBIL PEGASUS 1
3	302731	SPARK PLUG, 1KS-CHP
1	302733	SENSOR, O2, PRE-CAT EXHAUST
1	302704	AIR FILTER, 12X12X2, MERV9
1	302756	AIR FILTER, PRIMARY RADIAL SEAL
3	303045	COOLANT, 1 GAL, 60/40 ETHYLENE-GLYCOL, YELLOW VCS
1	302737	COIL ASSEMBLY, IGNITION, 1KS-CHP
1	302736	CORD SET, RESISTIVE, SPARK PLUG, 1KS-CHP
1	302757	AIR FILTER, SAFETY RADIAL SEAL
3	302745	WASHER, SEAL, VALVE COVER, 1KS-CHP
1	302751	VALVE, THROTTLE & GAS MIXER, 1KS-CHP
1	302752	GASKET, GAS MIXER, 1KS-CHP
1	302734	SENSOR, TEMPERATURE, EXHAUST
1	302729	ECU W WIRING HARNESS, ICU-180
1	302747	INTAKE MANIFOLD, 1KS-CHP
1	302748	GASKET, INTAKE MANIFOLD-HEAD, 1KS-CHP
1	302735	SENSOR, CRANK POSITION, 1KS-CHP
1	302503	HOSE, OIL, 1/2" ID, #08 BLACK
1	302749	EXHAUST MANIFOLD, 1KS-CHP
1	302750	GASKET, EXHAUST MANIFOLD-HEAD, 1KS-CHP
1	302753	OIL PRESSURE SWITCH ASSEMBLY, 1KS-CHP
1	303110	COVER SUB-ASSEMBLY, TIMING CHAIN, 1KS-CHP
1	303111	GEAR, OIL PUMP DRIVE, 1KS-CHP
1	303112	GASKET, TIMING GEAR CASE, 1KS-CHP
1	303113	GASKET, TIMING GEAR COVER, 1KS-CHP
1	303114	SEAL, OIL, TIMING GEAR CASE, 1KS-CHP
1	303115	HEAD ASSEMBLY, SHORT (W/O STUD), 1KS-CHP
1	303116	GASKET SET, CYLINDER HEAD EXCHANGE, 1KS-CHP
1	303117	GASKET, CYLINDER HEAD COVER, 1KS-CHP
1	302557	ELBOW, EXHAUST, 2", 90°, ALUMINIZED
1	302595	STRAIGHT, EXHAUST, 36", ALUMINIZED
1	302709	RAIN CAP, EXHAUST,

QTY	PART NO.	DESCRIPTION
1	302556	LAP JOINT, EXHAUST, 2", ALUMINIZED
1	302784	CLAMP, EXHAUST, 2", ALUMINIZED
1	55088	RESERVOIR, COOLANT, .5-GAL, PLASTIC
1	61849	SWITCH, PRESSURE, 1.6 PSI, NO, PLATED STEEL
2	70862	BATTERY, 12V 105AH
2	300904	FAN, 24V, 225MM, 642CFM, 55W, IP44, -40C
1	301833	CLAMP, BATTERY PAIR
1	302023	ENGINE, 953 CC, NG/LPG, SAE 6.5 FLYWHEEL
1	302385	RADIATOR, ALUM, 2ROW, 1" CORE, 28W X 19H
2	302401	FAN, 24V, 225MM, 642CFM, 55W, IP42, -25C
1	302439	EXHAUST ELBOW W PORTS, MX
1 OR	302499	ALTERNATOR, SYNC, 120/208V 3 PH, CSA
OR 1	302500	ALTERNATOR, SYNC, 120/240V 1 PH, CSA
1	302534	EXPANSION TANK, 2.1 GAL, ½ MNPT
2	302535	HEATER, HOSE, CIR, 1" BARB, 120 V, 375 W
1	302538	VALVE, THERMO SWITCH, G1 PORTS
1	302544	AIR HOSE, 2 ID, 2 9/16 OD, EPDM
1	302549	ENCLOSURE, 30X30X8, NEMA 4
1	302555	EXPANSION JT, EXH, 2X12, 1.5 FNPT X 2TB
4	302560	MOUNT, VIB DAMPING, 210LB
1	302570	OIL TANK WELDMENT, MX
1	302581	PUMP, 1" MHB, EPDM, 24V BLDC, PWM, TACH
1	302774	ROPE, SEAL, 3/8 SQ, HIGH TEMP
1	302818	REGULATOR, ZERO GOV, 1/2 NPT, 5 PSI
1	302819	VALVE, DUAL SAFETY SHUTOFF, 24VDC
2	302820	FLANGE, DUAL SSOV, 1/2 NPT
1	302849	COVER, BLANKET, EXHAUST, MX
3 FT	302860	HEATER CABLE, SELF-REG, 10 WATT/FT, 150F
1	302861	TERMINATION KIT, 150F MAX HEATERS
1	302879	VALVE, SHUTOFF, 1/2 NPT, 24VDC, CSA 6.5
2	302913	HEATING PAD, 12X6, 360W, ADH BACK
1	302984	HOSE, ASSEMBLY, FUEL GAS, 0.5MNPT, 28"LG 316SS
1	302758	CATALYST ASSEMBLY, EXHAUST, MX
1	302974	SILENCER, EXHAUST, 6X25, 2" EI/EO, BLK
1	51071	FUSE, 6A 250V, 5X20MM, GLASS
1	57485	FUSES, 15A 125V, 5X20MM, GLASS
1	301011	BATTERY CHARGER, 24V, 10A, UNIV AC

QTY	PART NO.	DESCRIPTION
1	302874	CIRCUIT BREAKER, UL489, 30A, 3P, CURVE D—For 3 Phase Systems Only
1	302872	CIRCUIT BREAKER, UL489, 40A, 3P, CURVE D—For 3 Phase Systems Only
1	302870	CIRCUIT BREAKER, UL489, IN 3A, 1P, CURVE C
1	302867	CIRCUIT BREAKER, UL489, IN 10A, 1P, CURVE C
1	303525	CIRCUIT BREAKER, UL489, IN 30A, 1P, CURVE D
1	302873	CIRCUIT BREAKER, UL489, 10A, 3P, CURVE D—For 3 Phase Systems Only
1	302875	CIRCUIT BREAKER, UL489, 35A, 3P, CURVE D—For 3 Phase Systems Only
1	302868	CIRCUIT BREAKER, UL489, 35A, 2P, CURVE D—For 1 Phase Systems Only
1	303640	CIRCUIT BREAKER, UL489, 32A, 2P, CURVE D—For 1 Phase Systems Only
1	302863	CIRCUIT BREAKER, UL489, 40A, 2P, CURVE D—For 1 Phase Systems Only
1	303637	CIRCUIT BREAKER, UL489, 20A, 1P, CURVE C
1	301251	CONTACTOR, 40A, 3P, 480VAC, 24VDC CTL
1	302644	DC CONVERTER, 9-36V IN, 5V OUT, 60W
1	302643	DC CONVERTER, 9-36V IN, 12V OUT, 60W
2	300849	DC CONVERTER, 18-75V IN, 24V OUT, 60W
4	57483	FUSE, 1A, 250VAC, 5X20MM GLASS
1	59998	FUSE, 2A, 250VAC, 5X20MM GLASS
4	25073	FUSE, 3A, 250VAC, 5X20MM GLASS
5	57484	FUSE, 5A, 125VAC, 5X20MM GLASS
1	302852	LED INDICATOR, 24VDC, GREEN
1	302851	LED INDICATOR, 24VDC, YELLOW
1	302651	METER, POWER ACUVIM-CL-M-333-P1, 333MV
1	303555	MICRO SD CARD, 8GB
1	301945	MODEM, CELLULAR, BULLETPHUS-NA2, LTE 4G
1	302665	MODULE, 4DO, 4AO, 4TC
1	300862	MODULE, PLC, 12DI, 8DO, 6AI, VB-2100
1	300483	PUSH BUTTON, ESD, RED, 22.5MM
1	301879	PUSH BUTTON, MOMENTARY, NC, 22MM, RED
1	301880	PUSH BUTTON, MOMENTARY, NO, 22MM, GREEN
1	63269	RECEPTACLE, 15A, AC DUPLEX, DIN RAIL, LED
1	302853	RECTIFIER, 3 PH, 1.2KV, 60A, CRYDOM—For 3 Phase Systems Only
1	70487	RELAY, 12VDC, 6A SPDT
10	65548	RELAY, 24VDC, 6A SPDT
1	300841	RELAY, 24VDC, 8A DPDT
4	302657	RELAY, 24VDC, 30A SPST
1	302649	RELAY, 120VAC, 6A 4 CO
1	300843	RELAY, 120VAC, 6A SPDT

QTY	PART NO.	DESCRIPTION
1	303040	RELAY, TIMER, 0.1-10 SEC, 120VAC, 0.7A
2	302608	RELAY, 24VDC, 7A SOLID STATE, 400VDC LOAD—For 3 Phase Systems Only
1	303451	MX TEMP SENSOR BUNDLE, LMT87
1	302866	SHUNT TRIP, 24VDC, BR/SUXXXUC, WEIDMULLER
1	302142	SINGLE CONTACT BLOCK, 1 NC
1	302650	SOCKET, RXZ MIXED CONTACT, 10A, 250V
2	54595	SWITCH, PUSH BUTTON, DPDT MOMENTARY
3	301881	SWITCH, SELECTOR, MAINTAINED, 22MM, BLK
2	303646	MX THERMAL CUTOFF ASSY
1	302797	PCB MODULE, FACE PLATE, VB-2100 W/ IO EXP
1	303638	PLC ASSY, MX PLC ASSY W/ SD CARD

14 EMISSION-RELATED WARRANTY

Global Power Technologies (GPT) warrants that the MX Power Generator, including all parts of its emission control system:

1. Is designed, built, and equipped so it conforms with the requirements of EPA CFR 40 Part 1054.120 at the time of sale, and
2. Is free from defects in materials and workmanship that may keep it from meeting these requirements.

14.1 WARRANTY PERIOD

The emission-related warranty for the MX Power Generator is valid for 2,200 hours of runtime or two (2) years, whichever comes first.

14.2 COMPONENTS COVERED

This warranty covers all components whose failure would increase the MX Power Generator's emissions of any regulated pollutant, including components listed in 40 CFR Part 1068, Appendix I, and components from any other system developed by GPT to control emissions.

Components covered under this warranty are as follows:

- | | |
|---|---|
| <ol style="list-style-type: none">1. Air Intake System<ol style="list-style-type: none">a. Intake Manifoldb. Air filtersc. Intake hose2. Exhaust System<ol style="list-style-type: none">a. Exhaust Manifoldb. O2 Sensorc. Exhaust temperature sensord. Catalytic convertere. Silencerf. Exhaust pipes3. Fuel System<ol style="list-style-type: none">a. Throttle valve gas mixerb. Gas regulatorc. Shut-off valvesd. Fuel lines and fittings | <ol style="list-style-type: none">4. Engine Control System<ol style="list-style-type: none">a. ECUb. ECU Wiring Harnessc. Engine speed sensor5. Ignition Control System<ol style="list-style-type: none">a. Spark plugsb. Ignition coilsc. Cord set6. Positive Crank Case Ventilation System (No PCV Valve)<ol style="list-style-type: none">a. Oil Catch Can (Option)7. Miscellaneous Items<ol style="list-style-type: none">a. Hosesb. Clampsc. Fittingsd. Tubinge. Gasketsf. Electrical Connectors |
|---|---|

14.3 LIMITED APPLICABILITY

Global Power Technologies reserves the right to deny warranty claims for failures that have been caused by the owner's or operator's improper maintenance or use, by accidents for which Global Power Technologies have no responsibility, or by acts of God. This includes failures that have been directly caused by the operator's abuse of the MX Power Generator or the operator's use of the MX Power Generator in a manner for which it was not designed and are not attributable to Global Power Technologies in any way.

In accordance with EPA CFR 40 Part 1068.115, GPT will not deny any remission-related warranty claims based on any of the following:

1. Maintenance or other service that GPT or GPT's authorized facilities performed.
2. Engine/equipment repair work that an operator performed to correct an unsafe, emergency condition attributable to GPT as long as the operator tries to restore the engine/equipment to its proper configuration as soon as possible.
3. Any action or inaction by the operator unrelated to the warranty claim.
4. Maintenance that was performed more frequently than is specified on the Maintenance Plan outlined in Section 9 of this manual.
5. Anything that is GPT's fault or responsibility.
6. The use of any fuel that is commonly available where the MX Power Generator unit operates as long as the fuel complies with the MX unit's Fuel Standards and Specifications as outlined in Section 4.1.3 and the type of fuel marked on the MX Power Generator unit's data plate located inside the cabinet door of the electrical panel enclosure.

14.4 WARRANTY CLAIMS

To submit a warranty claim, call 1-800-848-4113 or email customer.service@globalte.com.

Replacement parts may be ordered from GPT's authorized service center:

ECI – HEAD OFFICE

PO Box 614, 2 Park Drive

Lawrence, PA 15055

Phone: 724-746-3700

Warranty repairs are limited to authorized service centers for owners located within 100 miles of an authorized service center. For owners located more than 100 miles from an authorized service center, GPT will either pay for shipping costs to and from the nearest authorized service center or send a service technician to come to the MX Power Generator's installation site to perform the warranty repair. The provisions of this paragraph apply only for the contiguous states of the United States of America, excluding the states with high-altitude areas identified in 40 CFR Part 1068, Appendix III.

APPENDIX A — PRODUCT SPECIFICATIONS

The MX Power Generator is an outdoor off-grid power system that generates up to 6 kVA of electrical power using an internal combustion engine (ICE) generator system. The engine is designed for long run continuous output with 2,250 hour maintenance intervals in the standby oil system configuration, and 9,000 hour maintenance intervals in the extended-run oil system configuration.

GPT's MX system has the following configurations:

VOLTAGE	NET POWER	FUEL	OIL SYSTEM	AMBIENT STARTUP
120/208V 3PH 60Hz 120/240V 1PH 60Hz	6 kVA	Natural Gas / Propane	Standby / Long Run	Standard / Cold Ambient

CATEGORY	SPECIFICATIONS	NOTES
Standard Nominal Electrical Power Output	120/208V 3PH 60Hz – 6.0kVA 120/240V 1PH 60Hz – 6.0kVA	Delta or wye phase configuration when the unit is limited to only one configuration
Unbalanced Load	Max 500W	Unbalanced load capability when the output has a neutral conductor
Optional Electrical Power Outputs	24 V _{DC} and/or 48V _{DC}	DC power supplies take away from the total kVA net power
Engine	3-cylinder 953 cc displacement 1800 RPM rated speed	Natural gas or Propane fuel
Ambient Temperature Range	-40°C to +40°C For temperatures outside this range, please contact GPT	Power derate between +40°C and +50°C For cold starting below -5°C, Cold Ambient configuration (-CA) will be required
Humidity Range	0-100% RH	
Electrical Area Classification	General Non-Hazardous	
Harmonic Distortion	<5%	Tested with linear load

APPENDIX B — WEIGHT AND DIMENSIONS

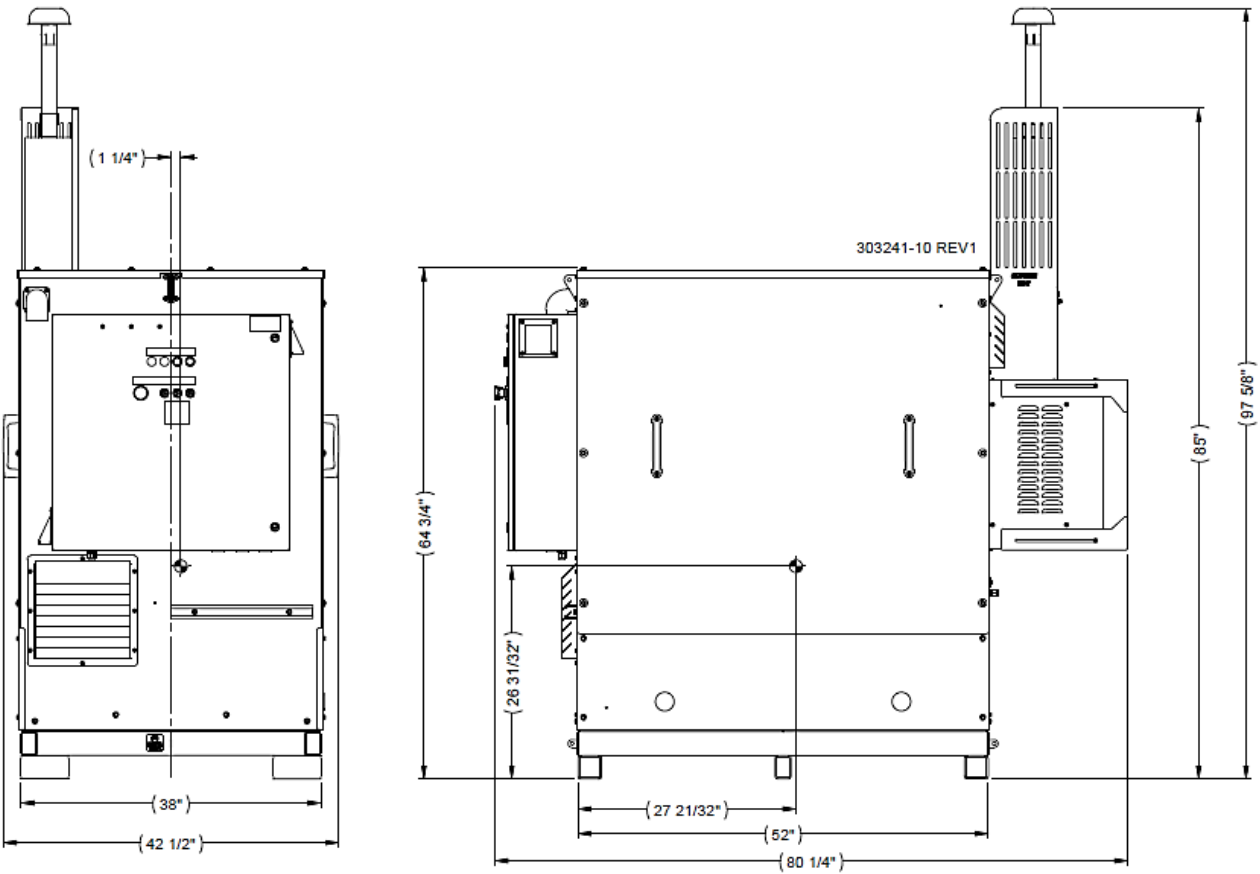


Figure B-0-1 – MX Power Generator Dimensions

OVERALL HEIGHT	85 in (97 5/8 with rain cap)	216 cm (248 cm with rain cap)
OVERALL WIDTH	80 1/4 to 90 1/4 in	204 cm to 229 cm
OVERALL DEPTH	42 1/2 in	108 cm
OVERALL APPROX. WEIGHT	1750 lb.	794 kg