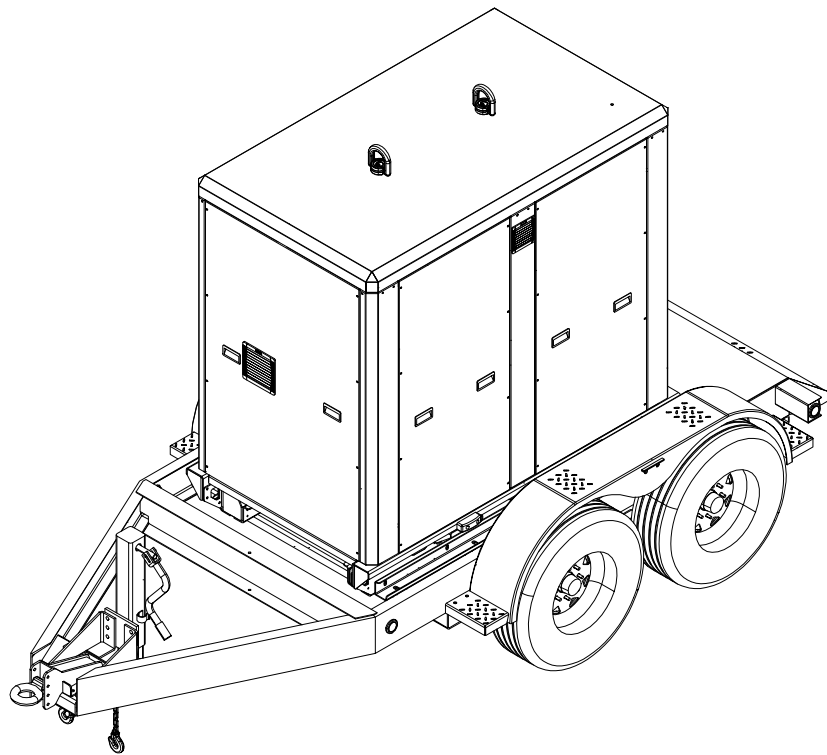


Owner's Manual

Battery Energy Storage System

MBE30/MBE40

OPzV-S Lead Acid 60 kWh • OPzV-S Lead Acid 90 kWh



For customer service contact:

www.generacmobileproducts.com

Customer Support

844-275-4672

SAVE THIS MANUAL FOR FUTURE REFERENCE

Use this page to record important information about your unit

Unit Model No.	
Unit Serial No.	
Production Date	
Date Purchased	
Volts	
Hz	
Phase	
Controller Part No.	

Record the information found on your unit data label on this page. See [Unit and Serial Number Locations](#).

When contacting a Generac Mobile Authorized Service Dealer (GMASD) about parts and service, always supply the complete model number and serial number of the unit.

Operation and Maintenance: Proper maintenance and care of the unit ensures a minimum number of problems and keeps operating expenses at a minimum. It is the operator's responsibility to perform all safety checks, to verify that all maintenance for safe operation is performed promptly, and to have the equipment checked periodically by a GMASD. Normal maintenance, service and replacement of parts are the responsibility of the owner/operator and, as such, are not considered defects in materials or workmanship within the terms of the warranty. Individual operating habits and usage may contribute to the need for additional maintenance or service.

 **CALIFORNIA WARNING**

Can expose you to lead, a carcinogen
and reproductive toxicant

www.P65Warnings.ca.gov

(000763)

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Section 1: Introduction and Safety

Introduction

Thank you for purchasing a Generac Mobile product. This unit has been designed to provide high performance, efficient operation, and years of use when maintained correctly.

The information in this manual is accurate based on products produced at the time of publication. The manufacturer reserves the right to make technical updates, corrections, and product revisions at any time without notice.

Read This Manual Thoroughly



Consult Manual. Read and understand manual completely before using product. Failure to completely understand manual and product could result in death or serious injury. (000100a)

If any section of the manual is not understood, contact your nearest Generac Mobile Authorized Service Dealer (GMASD), visit www.generacmobileproducts.com, or contact Generac Mobile Customer Service at 844-275-4672 with any questions or concerns.

This manual must be used in conjunction with all other supporting product documentation supplied with the product.

SAVE THESE INSTRUCTIONS for future reference. This manual contains important instructions that must be followed during placement, operation, and maintenance of the unit and its components. Always supply this manual to any individual that will use this unit, and instruct them on how to correctly start, operate, and stop the unit in case of emergency.

How to Obtain Service

When the unit requires servicing or repairs, contact a GMASD for assistance. Service technicians are factory-trained and are capable of handling all service needs. For assistance locating a dealer, go to <https://www.generacmobileproducts.com/parts-service/find-service>.

When contacting a GMASD about parts and service, always supply the complete model and serial number of the unit as given on the data decal located on the unit. Record the model and serial numbers in the spaces provided on the front cover of this manual.

Safety Rules

The manufacturer cannot anticipate every possible circumstance that might involve a hazard. The alerts in this manual, and on tags and decals affixed to the unit, are not all inclusive. If using a procedure, work method, or operating technique that the manufacturer does not specifically recommend, verify that it is safe for others and does not render the equipment unsafe.

Throughout this publication, and on tags and decals affixed to the unit, DANGER, WARNING, CAUTION, and NOTE blocks are used to alert personnel to special instructions about a particular operation that may be hazardous if performed incorrectly or carelessly. Observe them carefully. Alert definitions are as follows:



Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

(000001)



Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

(000002)



Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

(000003)

NOTE: Notes contain additional information important to a procedure and will be found within the regular text of this manual.

These safety alerts cannot eliminate the hazards that they indicate. Common sense and strict compliance with the special instructions while performing the action or service are essential to preventing accidents.

NOTE: The owner/operator of this equipment is responsible for strict compliance with all applicable national, state, and local laws, as well as codes or regulations pertaining to the storage and deployment of this mobile battery energy storage system. Applicable codes or standards may prohibit operating this equipment while connected to the utility grid, including for charging purposes. Use the most current version of applicable codes or standards relevant to the local

jurisdiction, equipment used, and location of storage and/or deployment. Check with the Authority Having Jurisdiction (AHJ) for any local codes or standards which may be applicable to your jurisdiction. The manufacturer makes no representations regarding this product's compliance with all applicable local codes or regulations.

General Hazards

DANGER

Automatic start-up. Disconnect utility power and render unit inoperable before working on unit. Failure to do so will result in death or serious injury.

(000191)

WARNING

Risk of injury. Do not operate or service this machine if not fully alert. Fatigue can impair the ability to operate or service this equipment and could result in death or serious injury.

(000215a)



WARNING

Loss of life. This product is not intended to be used in a critical life support application. Failure to adhere to this warning could result in death or serious injury.

(000209b)

WARNING

Equipment damage. Only qualified service personnel may install, operate, and maintain this equipment. Failure to follow proper installation requirements could result in death, serious injury, and equipment or property damage.

(000182a)

WARNING

Personal injury and equipment damage. Do not use equipment as a step. Doing so could result in fall, equipment damage, unsafe equipment operation, and could result in death or serious injury.

(000397)

WARNING

Loss of control. Do not park the unit on a steep grade or slope, even if using a parking brake. The unit could suddenly roll, move, or tip, which could cause death, serious injury, property or equipment damage.

(000498)

CAUTION

Equipment or property damage. Do not block air intake or restrict proper air flow. Doing so could result in unsafe operation or damage to unit.

(000229)

Battery Hazards

IMPORTANT NOTE: There is no user access to the batteries. Do not remove panels.



DANGER

Electrocution. Do not wear jewelry while working on this equipment. Doing so will result in death or serious injury.

(000188)



WARNING

Explosion. Do not dispose of batteries in a fire. Batteries are explosive. Electrolyte solution can cause burns and blindness. If electrolyte contacts skin or eyes, flush with water and seek immediate medical attention.

(000162)



WARNING

Explosion. Batteries emit explosive gases while charging. Keep fire and spark away. Wear protective gear when working with batteries. Failure to do so could result in death or serious injury.

(000137a)



WARNING

Electrical shock. Disconnect battery ground terminal before working on battery or battery wires. Failure to do so could result in death or serious injury.

(000164)



WARNING

Risk of burns. Batteries contain sulfuric acid and can cause severe chemical burns. Wear protective gear when working with batteries. Failure to do so could result in death or serious injury.

(000138a)



WARNING

Risk of burn. Do not open or mutilate batteries. Batteries contain electrolyte solution which can cause burns and blindness. If electrolyte contacts skin or eyes, flush with water and seek immediate medical attention.

(000163a)

⚠ WARNING

Lead exposure. This product contains lead acid batteries. Wear personal protective equipment when working with batteries to avoid ingesting or inhaling dust and fumes. Failure to do so could result in death or serious injury.

(000761)

Strictly observe the following precautions when working on batteries:

- Wear full eye protection and protective clothing.
- If electrolyte contacts the skin, wash it off immediately with water.
- If electrolyte contacts the eyes, immediately thoroughly flush with water and seek medical attention.
- Wash down spilled electrolyte with an acid neutralizing agent. A common practice is to use a solution of 454 g (1 lb) bicarbonate of soda to 3.8L (1 gal) of water. Add bicarbonate of soda solution until the evidence of reaction (foaming) has ceased. Flush the resulting liquid with water and dry the area completely.
- Do not use water on fires where molten metal is present.
- Extinguish fire with agent suitable for surrounding combustible materials.
- Cool exterior of battery if exposed to fire to prevent rupture.
- The acid mist and vapors generated by heat or fire are corrosive.
- Use NIOSH (National Institute for Occupational Safety and Health) approved self-contained breathing apparatus and full protective equipment operated in positive pressure mode.

NOTE: Dispose of used batteries responsibly, according to your local hazardous materials regulations. Never throw away used batteries in your household garbage.

Always recycle batteries in accordance with local laws and regulations. Contact your local solid waste collection site or recycling facility to obtain information on local recycling process. Contact your local solid waste management district or your local waste handler to locate a collection site nearest you.

To learn more about hazardous waste recycling, visit the websites for Battery Council International (<https://batteryCouncil.org/>) and the Environmental Protection Agency (<https://www.epa.gov/>).

Fire and Explosion Hazards**⚠ WARNING**

Fire and explosion. Installation must comply with all local, state, and national electrical building codes. Noncompliance could result in unsafe operation, equipment damage, death, or serious injury.

(000218)

Electrical Hazards**⚠ DANGER**

Electrocution. Verify electrical system is properly grounded before applying power. Failure to do so will result in death or serious injury.

(000152)

⚠ WARNING

Personal injury and equipment damage. User access prohibited. Do not open the enclosure. No user serviceable parts inside. Only qualified service personnel may install, operate, and maintain this equipment. Noncompliance could result in personal injury or equipment damage.

(000543)

⚠ WARNING

Electric shock. Only a trained and licensed electrician should perform wiring and connections to unit. Failure to follow proper installation requirements could result in death, serious injury, and equipment or property damage.

(000155a)

Lifting Hazards



⚠️ WARNING

Personal injury. Failure to properly connect lifting cables, chains, or straps could result in death, serious injury, or property damage.

(000346)

⚠️ WARNING

Personal Injury. Do not use lifting eye if there are signs of damage or corrosion. Doing so could result in death, serious injury, or property damage.

(000433)

⚠️ WARNING

Personal Injury. Do not use lifting eye other than as directed. Doing so could result in death, serious injury, or property damage.

(000434)

⚠️ WARNING

Personal Injury. Verify all fasteners are properly tightened prior to lifting unit. Failure to do so could result in death, serious injury, or property damage.

(000351)

⚠️ WARNING

Personal injury. Excessive weight. Use only appropriate lifting eyes and lifting equipment to lift unit. Improper lifting techniques could result in equipment damage, death or serious injury.

(000224)



⚠️ WARNING

Personal Injury. Never stand under a load being lifted above the ground. Doing so could result in death or serious injury.

(000762)

Trailer Hazards

⚠️ WARNING

Personal injury. Trailer must be securely coupled to the hitch with the chains correctly attached. Uncoupled or unchained towing could result in death or serious injury.

(000233a)

⚠️ WARNING

Personal injury. Do not operate unit during transport. Doing so could result in death, serious injury, or property damage.

(000231a)

⚠️ WARNING

Crushing hazard. Verify unit is properly secured and on level ground. An unsecured unit can suddenly roll or move, causing death or serious injury.

(000234a)

⚠️ WARNING

Property or Equipment Damage. Tighten wheel lug nuts after first 50 miles to factory specifications. Failure to do so could result in death, serious injury, property or equipment damage.

(000235)

Towing Safety

Towing a trailer requires care. Both the trailer and vehicle must be in good condition and securely fastened to each other to reduce the possibility of an accident. Some states require that large trailers be registered and licensed. Contact your local Department of Transportation office to check on license requirements for your particular unit.

Hitch and Coupling

- Verify the hitch and coupling on the towing vehicle are rated equal to, or greater than, the trailer's Gross Vehicle Weight Rating (GVWR).
- Verify the trailer hitch and the coupling are compatible. Verify the coupling is securely fastened to the vehicle.
- **DO NOT** tow trailer using defective parts. Inspect the hitch and coupling for wear or damage.
- Connect safety chains in a crossing pattern under the tongue.
- Before towing the unit, verify the weight of the trailer is equal across all tires. On trailers with adjustable height hitches, adjust the angle of the trailer tongue to keep the trailer as level as possible.

Safe Towing Techniques

- Practice turning, stopping and backing up in an area away from heavy traffic prior to transporting the unit.
- Maximum recommended speed for highway towing is 45 mph (72 km/h). Recommended off-road towing speed is 10 mph (16 km/h) or less, depending on terrain.
- When towing, maintain extra space between vehicles and avoid soft shoulders, curbs and sudden lane changes.

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Section 2: General Information

Specifications

General Specifications (MBE30)		MBE30-60	MBE30-90
Power output continuous	24 kW/30 kVA	*	*
Power output peak	60 kW	*	*
Frequency	60 Hz	*	*
Main output voltage	208/120 V 3-phase	*	*
120 V, 20 A, 1-phase GFCI duplex (NEMA 5-20R)	2	*	*
120 V, 20 A, 1-phase twistlock duplex (NEMA L5-30R)	1	*	*
120/240 V, 20 A, 1-phase twistlock (NEMA L14-30R)	2	*	*
Main circuit breaker	165 A	*	*
Pass-through capacity (inverter rating)	200 A	*	*
Lead acid OPzV-S batteries	60 kWh	*	—
Lead acid OPzV-S batteries	90 kWh	—	*
Operating temperature range		-4 to +122 °F (-20 to +50 °C)	
Battery type		Gel lead acid OPzV-S	
Battery design life (depth of discharge)		2,000 cycles to 80%, 3,000 cycles to 60%	
Usable stored energy		48 kWh	72 kWh
Unit weight		7,150 lbs (3,250 kg)	8,800 lbs (4,000 kg)
GVWR		11,000 lbs (4,990 kg)	
Trailer weight		1,720 lbs (780 kg)	
Axle rating (each)		6,000 lbs (2,722 kg)	
Hitch size, type		3 in, Pintle Eye	
Tire size		ST235/85R16E	

* = Standard

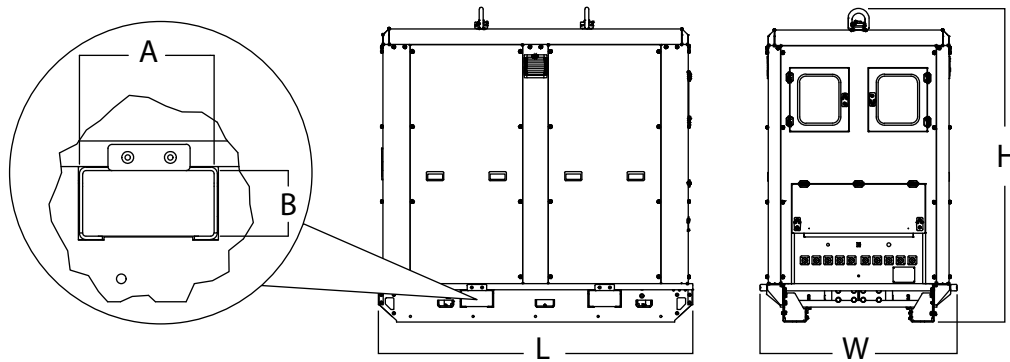
— = Not offered

General Specifications (MBE40)		MBE40-60	MBE40-90
Power output continuous	32 kW/40 kVA	*	*
Power output peak	80 kW	*	*
Frequency	60 Hz	*	*
Main output voltage	120/240 V 1-phase	*	*
120 V, 20 A, 1-phase GFCI duplex (NEMA 5-20R)	2	*	*
120 V, 20 A, 1-phase twistlock duplex (NEMA L5-30R)	1	*	*
120/240 V, 20 A, 1-phase twistlock (NEMA L14-30R)	2	*	*
Main circuit breaker	165 A	*	*
Pass-through capacity (inverter rating)	200 A	*	*
Lead acid OPzV-S batteries	60 kWh	*	—
Lead acid OPzV-S batteries	90 kWh	—	*
Operating temperature range		-4 to +122 °F (-20 to +50 °C)	
Battery type		Gel lead acid OPzV-S	
Battery design life (depth of discharge)		2,000 cycles to 80%, 3,000 cycles to 60%	
Usable stored energy		48 kWh	72 kWh
Unit weight		7,150 lbs (3,250 kg)	8,800 lbs (4,000 kg)
GVWR		11,000 lbs (4,990 kg)	
Trailer weight		1,720 lbs (780 kg)	
Axle rating (each)		6,000 lbs (2,722 kg)	
Hitch size, type		3 in, Pintle Eye	
Tire size		ST235/85R16E	

* = Standard

— = Not offered

Unit Dimensions



013923

Figure 2-1. Unit Dimensions

	L	W	H
Skid Mounted	77.2 in (1,960 mm)	47.2 in (1,200 mm)	78.7 in (2,000 mm)
Trailer Mounted	177 in (4,496 mm)	84.2 in (2,139 mm)	98 in (2,490 mm)

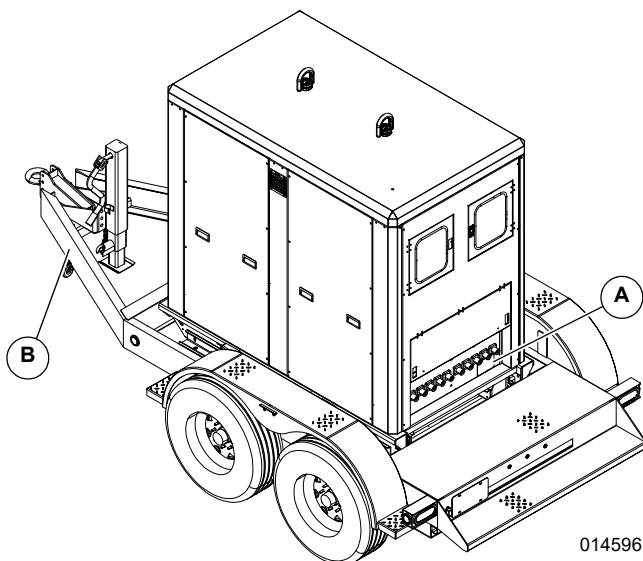
	A	B
Fork Pocket Dimensions	9 in (230 mm)	4 in (100 mm)

Unit and Serial Number Locations

See [Figure 2-2](#) to locate the unit ID tag (A) and vehicle identification number (VIN) tag (B). Important information such as the unit model number, serial number, VIN, and tire loading information are listed on these tags. Record the information from these tags in the event the tags are lost or damaged. This information may be needed when ordering parts or requesting assistance.

Altitude and Temperature Limitations

All units are subject to derating for altitude and temperature; this will reduce the available power for operating tools and accessories connected to the receptacles.



014596

Figure 2-2. Unit and Serial Number Locations

Component Locations

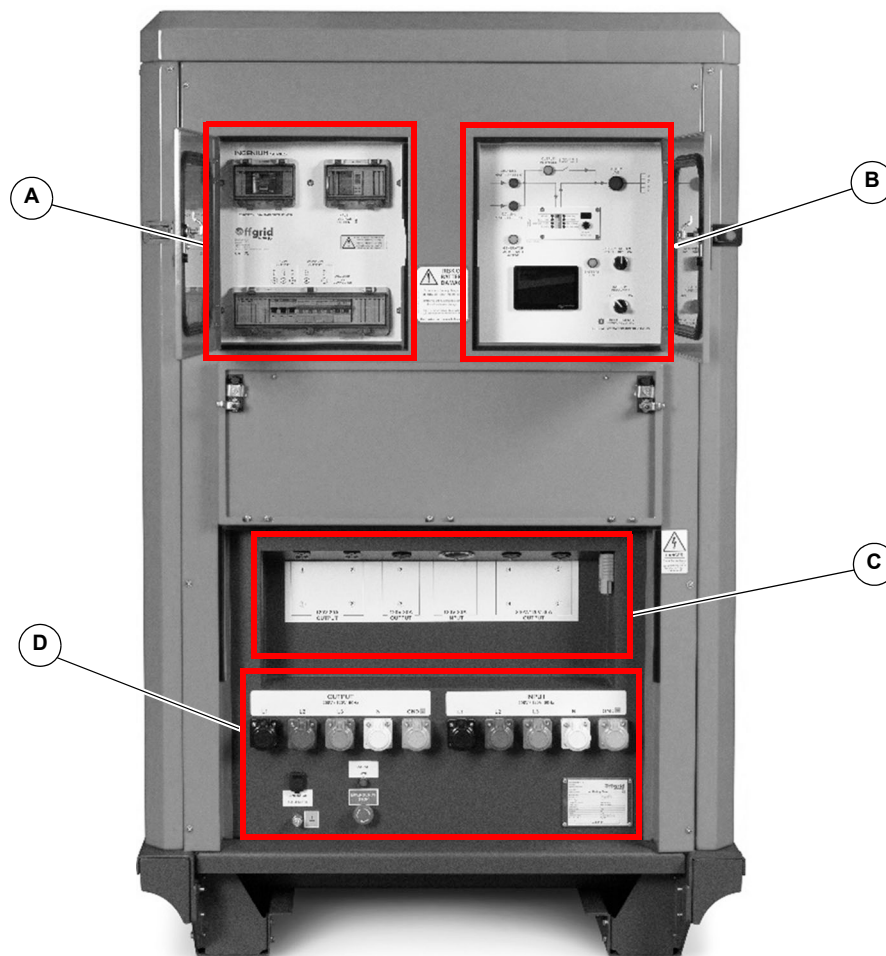
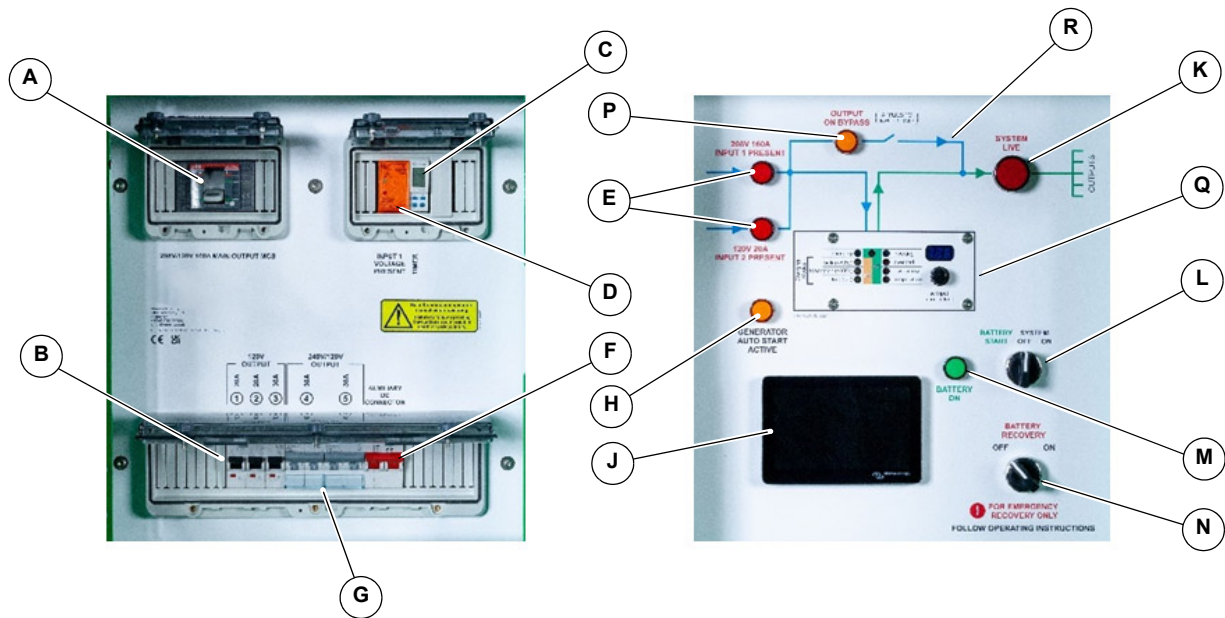


Figure 2-3. Front Panel

- A Main Line Circuit Breaker (MLCB) panel
- B Control panel
- C 120/240 V connection panel
- D 208/120 V connection panel

014597

Main Line Circuit Breaker (MLCB) and Control Panels



014598

Figure 2-4. MLCB and Control Panels

- A MLCB
- B Single-phase circuit breakers (output)
- C Generator ON/OFF digital timer
- D Input voltage indicator
- E Input supply present indicators
- F Auxiliary DC isolator switch
- G Three-phase circuit breakers (output)
- H Generator AUTO start request indicator
- J Unit control screen
- K System live indicator
- L System ON/OFF switch
- M Battery ON indicator
- N Battery recovery switch
- P System bypass indicator
- Q Inverter status panel
- R System mimic

Connection Panels

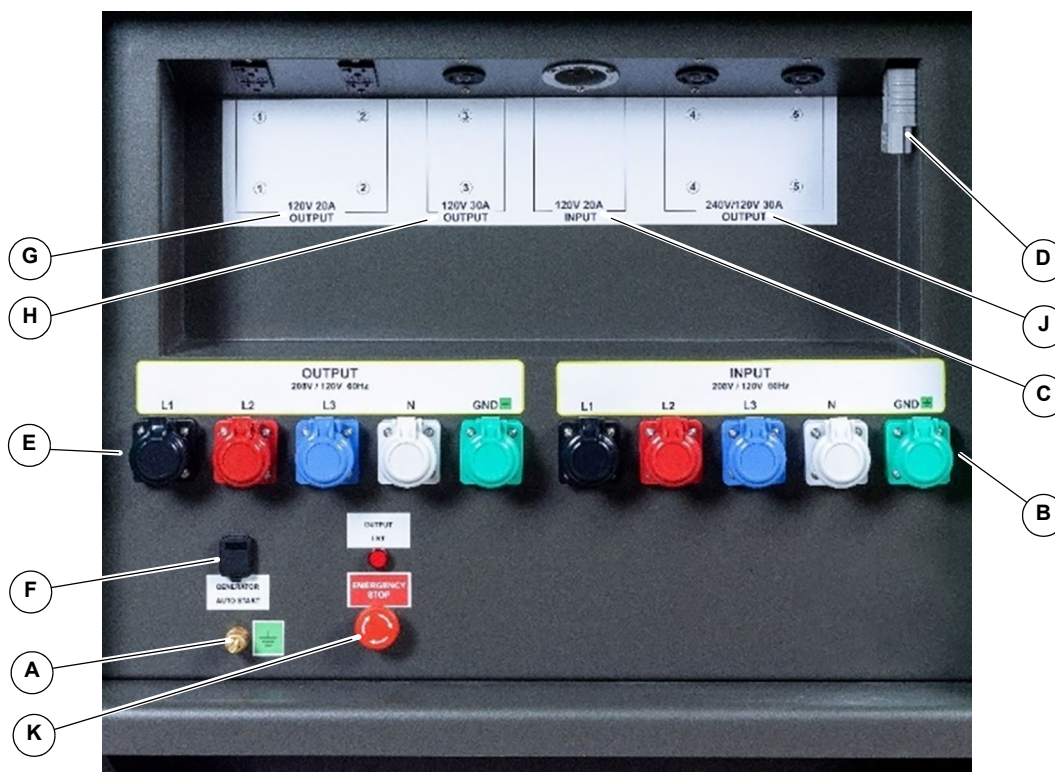


Figure 2-5. Connection Panels

- A Ground lug
- B 3-phase 208/120 V Camlock input connectors (US color code)
- C 1-phase 120 V, 20 A input connector
- D Direct auxiliary DC input
- E 3-phase 208/120 V Camlock output terminals
- F Generator AUTO start
- G 120 V, 20 A duplex GFCI receptacles (NEMA 5-20R)
- H 120 V, 30 A receptacle (NEMA L5-30R)
- J 240/120 V, 30 A receptacles (NEMA L14-30R)
- K Emergency stop button

014599

Unit Overview

The Battery Energy Storage System is capable of performing multiple functions in many different applications including:

- Use as an alternative to a diesel generating set.
- In a hybrid system in tandem with a separate power generation device.
- For use in behind the meter (BtM) applications with a limited or weak grid supply.

The unit consists of a rechargeable battery bank and a solid-state bi-directional converter combined with control and instrumentation circuitry.

When used in standalone mode, the unit works in inverter mode to provide silent, emission-free AC electricity to a load with capacity up to the rated output and with a duration relative to the limits of the energy stored within the batteries. See [Specifications](#) for the capacities of each model. The unit will continue to deliver power until the battery capacity has been depleted.

When used in tandem with a power source, the unit will use the electricity supply to recharge the battery bank while simultaneously supplying power directly to the load. When the power supply is turned OFF or disconnected, the unit automatically switches to inverter mode to supply the load. Where two separate input supplies are connected, the unit can also perform the function of an Automatic Transfer Switch (ATS) with the added benefit of a battery backup.

The unit can provide automatic START/STOP control of a generator by means of a two-wire, volt-free signal. The START and STOP commands can be based on a range of programmable parameters described in [Operation](#).

The unit may also be connected to a grid main power supply to recharge the batteries.

The system is equipped with an automatic bypass function that can be set to operate in different modes. The bypass is rated to a maximum of 200 A, (protected by an over-current protection device to 160 A) three-phase. As standard, the bypass is activated in the event of a system fault. In this instance, the generator auto-start function is activated, and the bypass switch operates to connect the input directly to the output. When the system fault is cleared/rectified, the bypass will switch back to connect the main system. There will be a brief interruption to the output supply.

As an alternative, the bypass can be set to always activate whenever an input voltage is applied. In this mode, the battery charger function is active.

NOTE: See [Figure 2-4](#). The bypass function is only available on the “primary” input (E).

Where greater power or energy is needed, the unit can be operated in cascade mode with other MBE30 units so that greater energy storage capacity is available. In this mode, it is also possible to increase the total power available through adjustment of the system settings.

Advanced Functions

The unit has an [Input Assist](#) feature available as standard (if not required, this feature can be turned off using a computer interface). This feature is designed to prevent overload of the connected source of power. The capacity of the connected power supply can be programmed into the unit to prevent the draw from exceeding the capacity. The inverters are rated to a maximum of 200 A pass-through current. The benefits of this are:

- Automatic adjustment of the power used to charge the batteries to compensate for increases in energy demand by the load.
- The unit can “top-up” the input power supply if the load demands more power than the supply can deliver.

The auto-start signal, when connected, can be used to start or stop a connected generator depending on, for example, the state of charge of the batteries or the level of power demanded by the load.

Features

The following features are standard:

- Panel-mounted color control and display screen to give the user full control of the settings in addition to the system mimic remote display.
- Remote GSM monitoring module that provides web-based access to real-time performance data and access for reprogramming the unit.

The following optional feature is available:

- Road-tow option mounted on a trailer compliant with DVSA/DOT regulations.

Protection

The unit is electronically protected against the following conditions:

- Input voltage high/low protection: 90-140 VAC (adjustable).
- Overcurrent: relative to machine output rating.
- Over-temperature.
- Low battery voltage (adjustable).
- Output over-current protection is provided by means of the MLCB.

Shut Down Protection

The safety shut down interlock causes the output of the system to be shut down if the emergency stop switch is operated or the micro-switches are activated when the cable connection access panel is opened.

Installation

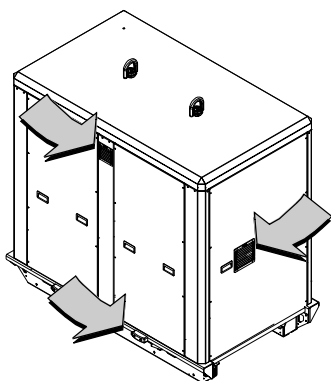
WARNING

Loss of control. Do not park the unit on a steep grade or slope, even if using a parking brake. The unit could suddenly roll, move, or tip, which could cause death, serious injury, property or equipment damage. (000498)

WARNING

Equipment and property damage. Do not alter construction of, installation, or block ventilation for unit. Doing so could result in unsafe operation or damage to the unit. (000146a)

- Install the unit on a stable and level surface that can accept the weight of the unit.
- Do not install the unit in a location where it is vulnerable to damage from the movement of structures, machinery, or other objects.
- Do not install the unit where it may be exposed to excessive water (such as run off from a roof or other surfaces). Protection from exposure to environmental extremes, when possible, will help preserve performance.
- Verify there is 20 in (500 mm) minimum clearance on all sides and above the unit to ensure adequate air flow for ventilation.



014600

Figure 2-6. Air Ventilation Locations (Exact Locations May Vary)

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Section 3: Operation

Pre-start Checklist

When the initial installation is complete, these checks must be performed before starting the unit. These checks are not required before each start, only after the initial installation.



⚠️ WARNING

Consult Manual. Read and understand manual completely before using product. Failure to completely understand manual and product could result in death or serious injury. (000100a)



⚠️ WARNING

Risk of Fire. Unit must be positioned in a manner that prevents combustible material accumulation underneath. Failure to do so could result in death or serious injury. (000147)

⚠️ WARNING

Equipment damage. Do not attempt to start or operate a unit in need of repair or scheduled maintenance. Doing so could result in serious injury, death, or equipment failure or damage. (000291)



Only qualified service personnel may install, operate, and maintain this equipment.

ISO000182a

- Verify all maintenance procedures are up to date. For more information, see [Maintenance](#).
- Verify the unit is level and positioned in a stable manner.
- Verify proper clearance on all sides and top of enclosure.
- Verify unit is a safe distance from any flammable or combustible material.
- Verify there is no water inside, on, or near the unit; dry if needed.
- For grounding requirements, follow any local, state, or National Electrical Code (NEC) guidelines.
- Verify the control power switch is OFF (O).
- Verify all circuit breakers are OFF (O).
- Inspect all electrical cords; repair or replace any that are cut, worn, or bare.
- Verify the battery has not been damaged during

transportation or use. There must be no signs of impact or damage. If the battery has been damaged, contact a GMASD for a replacement.

- Verify all covers are in place and secure.
- Verify all electrical connections at the connection lugs, if equipped, are tight and wired correctly.
- Verify the controller is in STOP mode by pressing the STOP button.
- Verify the emergency stop switch is pulled out.
- Verify all enclosure doors are closed and secure before starting the unit.

The following instructions assume that the unit has been properly set up, serviced, tested, adjusted, and otherwise prepared for use by a GMASD. Read the safety information carefully before attempting to operate this equipment.

NOTE: These precautions are extremely critical in locations such as seaboard installations and other high humidity areas. Some installations will be in environments that are much more corrosive than others.

Turn ON the Unit

Before connecting any input/output cables, verify the emergency stop button is depressed and the “SYSTEM ON/OFF” switch, main isolator, and MCBs are all in the OFF position.

1. Connect input and output cables. See [Connect Equipment](#), [Input Connections](#), and [Output Connections](#).
2. Connect generator auto-start cable (if required). See [Generator Auto-Start](#).
3. See [Figure 2-5](#). Twist the emergency stop button counterclockwise to release it.
4. Verify the green BATTERY ON indicator is illuminated. If the green BATTERY ON indicator is not illuminated, turn the SYSTEM ON/OFF switch to BATTERY START and hold for ten seconds. If this does not illuminate the BATTERY ON indicator, contact a GMASD.
5. Turn the SYSTEM ON/OFF switch to the ON position. Verify the blue LEDs illuminate on the inverter status panel and the red SYSTEM LIVE lamp illuminated on the front panel.
6. Switch the output MLCBs to the ON position.

System Reset

See [Figure 2-5](#). If necessary, the system can be reset by setting the SYSTEM ON/OFF switch to OFF, pausing until the LEDs extinguish, and then turning the ON/OFF selector switch back to ON.

Monitoring Equipment

See [Figure 2-4](#). Use the system mimic, inverter status panel, and unit control screen to monitor the unit during operation.

Inverter Status Panel

See [Figure 3-1](#). The inverter status panel displays status information on the converter circuits. Warning and alarm indicators provide feedback on fault conditions.

When the unit is connected to an input power source (a separate generator or alternative grid mains supply), the input current adjust can be used to set the maximum input current limit to prevent overloading the connected source. The figure is displayed (A) and can be adjusted by turning the dial (B). In the ON position, the minimum setting is approximately 21 A.

The charging modes (C) provide a visual reference of the charge status when the unit is operational. If the unit has a mains input then the unit will be charge with the “charging” light (D) illuminated.

- Bulk (<80%)—the unit has less than 80% of its maximum charge capacity.
- Absorption (>80%)—the unit has greater than 80% of its maximum charge.
- Float (full)—the unit has 100% charge status.

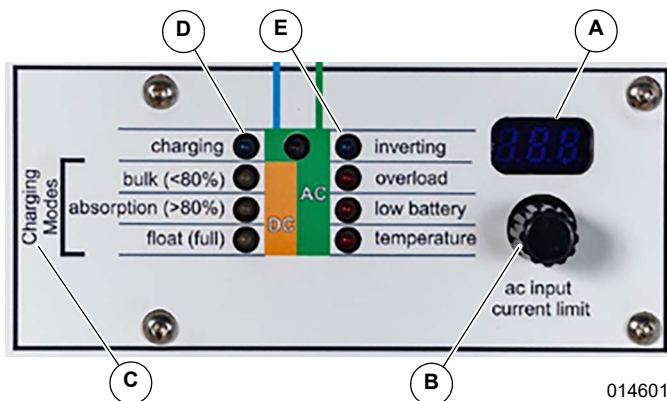


Figure 3-1. Inverter Status Panel

System Control Panel

See [Figure 2-4](#). The System Control Panel provides detailed information on the performance of all elements of the system including the inverter, battery charging functions, battery condition and performance, and any connected input source (grid and/or generator). It is also possible to adjust settings and performance parameters.

The panel provides an overview home page summarizing the overall status and performance of the system and then allows access to detailed information by selecting items from a series of menus.

The key data items are:

- Inverter status and performance.
- Battery charging status and performance.
- Battery condition, state of charge, and performance data.
- Input and output status, power levels, voltage, current, and frequency.

Alarms and error messages are also available. Historical data is stored on the panel and can be reviewed on board, downloaded to an SD card, or relayed via a GSM link to a web portal using the remote communications option.

Controls and Instruments

See [Figure 2-4](#). When illuminated, these will identify certain operations:

- System Bypass Indicator (P)—system bypass function is currently engaged and the battery system or input assist is disconnected from the input and output process.
- Input Supply Present Indicator (E)—identification of a live input supply present on the primary and secondary input connections.
- Battery On Indicator (M)—the battery system and DC circuitry is connected to the main internal system.
- System Live Indicator (K)—the unit is supplying the load and the designated output sockets are energized.
- System ON/OFF Switch (L)—this switch is used to engage the internal DC system. In normal operation, the DC system will be energized, and the green LED will be illuminated (M). If the green LED is not illuminated, then the DC system must be activated. The switch must be turned counterclockwise to the BATTERY START position and held in place for 7 to 10 seconds or until the engagement of the internal connector can be heard.
- Battery Recovery Switch (N)—this switch should not be used under normal conditions. Contact a GMASD before use.

System Bypass

The unit is equipped with a system bypass that comprises an automatic AC changeover switch that, when activated, sends a generator auto-start request and connects the input supply directly to the output.

This feature maintains output power supply, for example, in the event of a fault in the system or during maintenance.

The bypass automatically activates when the SYSTEM ON/OFF switch is set to the ON position but there is no output from the inverter units. When the switch operates, there is a momentary break in supply as the switch passes through a central OFF position.

Input Assist

For correct operation of this feature, it is necessary to correctly set the input current limit:

1. Establish the maximum desired current to be drawn from the supply.
2. See [Figure 3-1](#). Turn the input current adjust rotary control (B) until the required figure is on the digital display.

Example

The input assist feature automatically and dynamically adjusts charging current as the power demanded by the load varies. For example, if the supply to the unit is covered by a 50 A MCB, adjust the control until 50 is visible in the display. The input current will now be limited to 50 A regardless of how much current is demanded by the load. In this example, when the dial is set at 50 A and the output load requires 20 A, 30 A is available to power the battery charging function.

If the load rises to 40 A then 10 A is available to charge the batteries (and so on). When the load requires 50 A the charge function will be suspended. If the load requires 60 A the deficit of 10 A will be supplied by the battery. When the load falls back below 50 A the unit will resume charging the battery.

Generator Auto-Start

The unit is able to provide an automatic generator start signal by means of a volt-free normally open signal (closed to run). The Neutrik autostart socket is wired with all three connections: NO (Normally Open), NC (Normally Closed), and common. The standard auto-start cable is as described above.

IMPORTANT NOTE: Any software adjustment should only be performed by a GMASD.

The start signal and illumination of the GENERATOR AUTO-START ACTIVE light is given on a programmed set of conditions that can be modified. The standard settings will start the generator based on a series of AC load conditions, battery voltage/state of charge, and based on real-time functions, as can be set up in the timer.

For example, the unit will send a signal to the generator if the output load has been above a given level for a given period of time, or if the battery has discharged to a given level. Quiet hours by default are set in the device to set

different parameters (for example, SOC 50% > 90% daytime and SOC 10% > 30% overnight) or there may be a periodic signal to start and run the generator at a different specific time and for a specific period of time. Example:

- Start generator at 7am and stop generator at 8pm.
- Start generator if battery state of charge is less than 40%.
- Start generator if AC load is more than “x” kW for “x” minutes.

For a detailed explanation of the settings applicable to your unit, contact a GMASD.

Connect the Auto-Start Feature

See [Figure 3-2](#). A NAC3FCA Neutrik Plug is supplied as standard with the unit.

Make a connection between the auto-start module on the generator (see the generator manual) and the Generator Start socket ([Figure 2-5](#), item F) using the Neutrik plug supplied and any 2-core cable. Although this is a volt free connection, it is recommended to use minimum 18AWG cable.

Insert the plug and twist clockwise until the catch that locks the plug clicks into place.



014602

Figure 3-2. Auto-Start Plug

Remote Monitoring

It is possible to establish remote control and monitoring of the unit using one or more of the methods described below.

For LAN (Local Area Network) and GSM (Global System for Mobile Communications) remote control, access is achieved through a web portal providing the ability to control the unit from anywhere an Internet connection is available.

NOTE: A user account is required for the web portal. Contact a GMASD.

Local Wi-Fi® Access

When accessing the unit, the remote access portal mimics the Unit Control Display, allowing for easy navigation of the information. The remote access portal provides a great deal of information on the performance of all aspects of the system including the inverter, battery charging functions, battery condition and performance, and any connected input source (mains grid and/or generator). The remote access portal can also be used to adjust settings and performance parameters.

To allow access to the unit, the control system has a local Wi-Fi capability that allows connection of a smart device (mobile phone or tablet for example) or any Wi-Fi enabled device such as a PC. Follow these steps to connect:

1. Open the Wi-Fi settings on your device and search for the Ingenium device name.
2. Enter the password stated on the Ingenium front panel (starting venus_____).
3. Open the default browser on your device.
4. Input the IP address “172.24.24.1” or “venus.local” in the browser ribbon.
5. Follow the on-screen instructions.

The remote display provides an overview home page summarizing the overall status and performance of the system and then allows access to detailed information by accessing different aspects of the system through a menu system.

The key data items are:

- Inverter status and performance.
- Battery charging status and performance.
- Battery condition, state of charge, and performance data.
- Input and output status, power levels, voltage, current, and frequency.

Alarms and error messages are also available. Historical data is stored on the panel and can be reviewed on-screen or relayed via a GSM link to a web portal using the remote communication option.

GSM Remote Access

A GSM router is fitted that will require a local SIM to be provided by the user (not included as standard). The APN settings for the network operator that supplied the SIM will need to be programmed for the router to be enabled. This can be done in advance of delivery or as an after-sales service.

To access this, use the unit control screen to navigate to: Device List → Settings → GSM Modem → APN

Connect Equipment

DANGER

Loss of life. Property damage. Installation must always comply with applicable codes, standards, laws and regulations. Failure to do so will result in death or serious injury. (000190)



WARNING

Electrocution. Potentially lethal voltages are generated by this equipment. Render the equipment safe before attempting repairs or maintenance. Failure to do so could result in death or serious injury. (000187)

WARNING

Electric shock. Only a trained and licensed electrician should perform wiring and connections to unit. Failure to follow proper installation requirements could result in death, serious injury, and equipment or property damage. (000155a)

Verify all connections are secure and all cables are in good condition and free from snags or other mechanical hazards. Verify connections and cables are safe and secure at the point of source and delivery of power. Verify connections are suitably rated to the environment they are installed within.

IMPORTANT NOTE: Install road plates to cover cables where necessary to avoid trip hazards.

While connecting or disconnecting equipment:

- Do not allow cable connectors to lie under water.
- Do not allow connectors to drop or to be dragged across hard surfaces. Verify dust caps are fitted when not in use.
- Do not apply tension to connectors.
- Do not connect leads together when reeling them in.
- Do not make or break connections while carrying a load.

Ground Lug



DANGER

Electrocution. Verify electrical system is properly grounded before applying power. Failure to do so will result in death or serious injury. (000152)

The ground lug shown in [Figure 2-5](#) is an M10 threaded stud located on the base of the unit which can be used to connect/bond the equipment to a suitable external earth connection point. See local installation regulations for further guidance.

The unit has a ground/neutral relay internally fitted. This is closed for normal operation of the unit. However, when there is a generator input supply this relay opens and the generator central grounding point is relied upon along with any external grounding arrangements.

Input Connections

The input supply must be provided from a source that is protected by an over-current device.

Suitable input supply cables and adapters are not supplied with the unit.

The unit has two input connections:

See [Figure 2-5](#). The main input is a set of 3-phase Camlock connectors (B). This input has a maximum input rating of 200 A. The MBE30 has a 3-phase main input/output. The MBE40 has 1-phase main input/output.

There is an auxiliary 120 V, 20 A input connector (C) that can be used as a low-level charge input. Typically, this will be used for maintenance charging the unit. Both inputs can be connected simultaneously but only one of the inputs will be used. The main input has priority. When the auxiliary input is active, the unit will be unable to draw power from the output.

See [Figure 2-4](#). For the two AC input connections, there are indicators (E) that illuminate to show input voltage is present (D). For the three-phase indicator, the green LED must be illuminated to show all three phases are present. If the red LED is illuminated, check connections.

Direct DC Input

See [Figure 2-4](#). There is a direct DC input intended for connection of an auxiliary input supply (E). Typically, this could be an external battery charger or input from an independent Solar PV system. The inlet is rated for a nominal 175 A 50 V DC supply and has a 125 A input isolator switch (F). The connector is a 175 A rated 'Anderson' type connector.

Input from an external solar PV array can be connected provided a compatible solar PV regulator is used. It is recommended to use a regulator that features Maximum Power Point Tracking (MPPT). The maximum rated capacity must not exceed 125 A, 5 kWp.

Output Connections

The unit has two sets of output connections. There is a set of 3-phase Camlock connectors ([Figure 2-5](#), item E). The output has a maximum input rating of 200 A and is protected by a 1,650 MLCB ([Figure 2-4](#), item A).

There is a group of five 120/240 V single-phase output receptacles ([Figure 2-5](#), items G, H, J) each of which is protected by corresponding circuit breakers ([Figure 2-4](#), items B, G).

Cascade Operation

The unit can be cascaded to achieve an increase in storage capacity by connecting multiple units.

Automatic Generator Auto-Start Function

The auto-start function is activated using the [Digital Timer](#) settings and/or settings in the color control panel. Settings can be made in both devices and be active simultaneously. Typical settings can be based on time, load levels, or battery state of charge. See [Input Assist](#) for more details.

See [Figure 2-4](#). When the auto-start signal is active, the amber generator request indicator (H) will be illuminated.

To use the automatic generator start function, verify the generator is compatible with a two wire automatic start/stop signal. The standard configuration is open to stop, closed to run.

Before engaging the auto start function, check the status of the signal programming on the generator. It may be necessary to have the function of the switch re-programmed to suit the required parameters.

See [Connect the Auto-Start Feature](#). A NAC3FCA Neutrik Plug is supplied as standard with the unit.

See [Figure 2-5](#). Connect the auto-start lead into the generator start socket (F) and ensure the connector is twisted and locked into position. Connect the cable ends to the appropriate terminals at the generator or have a compatible connector fitted.

Digital Timer

WARNING

Electric shock. Only a trained and licensed electrician should perform wiring and connections to unit. Failure to follow proper installation requirements could result in death, serious injury, and equipment or property damage. (000155a)

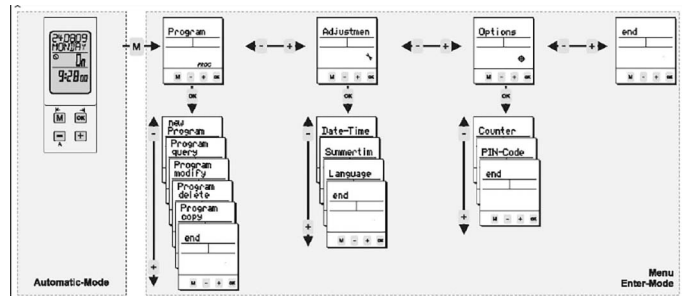
- Connect the supply voltage/frequency as stated on the product label.
- Any damage caused by attempted service by an unauthorized provider is not covered under warranty.
- The electronic circuit is protected against a wide range of external influences. Incorrect operating may occur if external influences exceed limits.

See [Figure 2-4](#). The digital timer (C) is located on the MLCB panel and can be used to control STOP/START of the generator.



Figure 3-3. Digital Timer

Menu Overview



014605

Figure 3-5. Menu Map

Connection Diagram

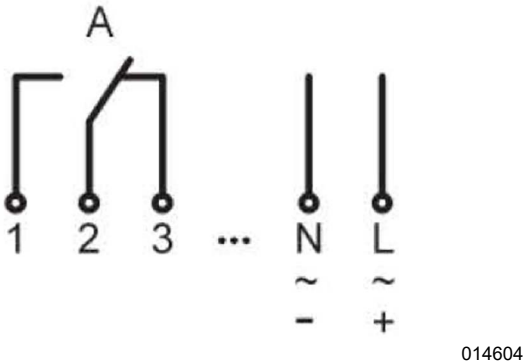


Figure 3-4. Connection Diagram

Initial Operation

The digital timer is delivered in sleep mode and the display is OFF.

1. Press the **OK** button for one second.

NOTE: The current date and time is already programmed and European daylight savings time is activated.

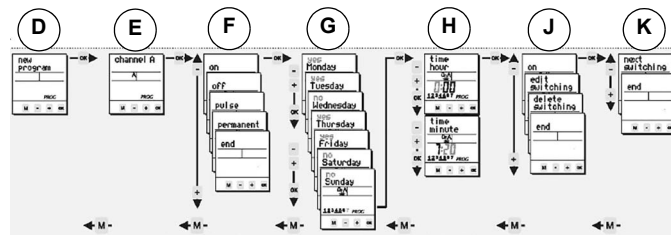
2. Select the desired language by pressing the **-/+** buttons. Press **OK** to confirm.

NOTE: Press the **M** button to move one step backwards from the current position.

3. If required, date, time, and daylight savings time can be adjusted by pressing the **-/+** buttons and then pressing **OK**.

Symbol	Description
ON	Channel is ON.
OFF	Channel is OFF.
	For the current date the "holiday program"/ "permanent by date" is activated.
	Standard programming step.
	Current state is based on a manual override. The state will be canceled with the next programming step.
P	Current state is based on a manual override. The state is permanent until terminated manually (see Channel ON/OFF and Permanent Switching Status).
1234567	Days of the week: M, T, W, T, F, S, S. An underscore indicates if the program is active for that day.
	Current state is based on a switching time with pulse function.
	The digital timer is locked. Enter the PIN to unlock the device (see Additional Adjustments).
Button	Function
M	1. Access the Enter-mode (program → adjustments → options) from the Automatic-mode. 2. Go back to the beginning of the current menu or sub-menu.
	1. Adjust selected (flashing) digit. 2. Scroll through a selection.
-/+	1. Adjust selected (flashing) digit. 2. Scroll through a selection.

A	<ol style="list-style-type: none"> 1. Automatic mode: Switch the channel ON or OFF until the next programming step occurs. 2. Automatic mode: press and hold for more than three seconds to enter Permanent Switching Status.
OK →	<ol style="list-style-type: none"> 1. Activate the digital timer when operated without power supply. 2. Confirm the selection or the entered data.



014606

Figure 3-6. New Program

Handling Advice

- The digital timer is programmable without external power supply after pressing the **OK** button.
- After completion of a (sub-) menu confirming, **end** will return the device to Automatic mode.
- With **-/+** the choice changes from **end** to **continue**. By confirming **continue**, the digital timer returns to the beginning of the current menu or sub-menu.
- When confirming **end** before completion, the digital timer returns to Automatic mode without saving the entered data.

Channel ON/OFF

Press the **A** button to manually switch channels. The resulting switch status is marked with the hand-symbol and remains until the next programming step occurs (temporary override).

Permanent Switching Status

Press the corresponding channel button **A** for more than three seconds to permanently switch the channel ON or OFF. The status remains until the next manual switch occurs by pressing and holding the **A** button for more than three seconds (permanent override).

New Program

NOTE: Steps A through C are not reflected in **Figure 3-6**. See the table below for descriptions.

A	If power supply is disconnected press OK for one second. The display appears in Automatic mode.
B	Press M , the digital timer is now in the Enter mode.
C	Press OK to confirm program.
D	Press OK to confirm new program.
E	Choose the desired channel with -/+ and press OK to confirm.
F	For regular switching times choose ON or OFF with -/+ buttons and press OK to confirm.
G	Activate the days of the week (1 through 7) on which the switching time will occur. Use -/+ to activate "yes" or deactivate "no" the corresponding date. Press OK to confirm each day.
H	Adjust the time. Use -/+ to adjust the hours and press OK . Use -/+ to adjust the minutes and press OK .
J	Verify the entered switching time. If the flashing summary is correct, verify ON or OFF by pressing OK . After verification, edit or delete the switching time (if desired) and press -/+ to confirm.
K	Press OK to proceed with next switching time. To leave the programming menu, choose end .

Pulse

Navigate to the Pulse function: Program → New Program → Channel A → pulse

The Pulse function provides the ability to set a time, date, and duration for the switching time.

After the Pulse duration expires, the digital timer turns OFF automatically (the duration of the pulse is up to 59 minutes and 59 seconds).

The programming is similar to a standard switching time (see **New Program**) with the following differences:

- Choose Pulse function (see [New Program](#), item F).
- Choose the duration of the Pulse (minute/second).
- Choose the days of the week the Pulse will occur.
- Choose the switching time (hour/minute).

Verify the blinking summary of the Pulse program.

Program Permanent

Navigate to the Program Permanent function: Program
→ New Program → Channel A → permanent

- One permanent by date programming step (holiday function) for each channel is possible. During the desired period (the function is valid for the whole day) the channel can be switched OFF (permanent OFF) or ON (permanent ON).
- The programming of this function is as described in [New Program](#).
- The choice permanent will not be offered anymore within the menu new program when already in use. The switching time can be modified and deleted within Program modify and Program delete respectively.

Additional Adjustments

Menu	Main Menu	Application
Program query	Program	Query the programming steps and remaining memory locations.
Program copy	Program	Copy from one channel to another. Memory of the channel will not be overwritten. The copied switching steps appear additionally. NOTE: Permanent by date function is not copied.
Program delete	Program	Deletion of switching time(s). The program for all channels, single channels, and single programming steps within ON channel can be deleted.
Program modify	Program	Within Program, modify each single switching time.
Date/Time	Adjustment	Adjust date and time.
Summertime	Adjustment	Adjust daylight saving time mode (ON/OFF).
Language	Adjustment	Choose languages.
Counter	Options	Displays the hour counter and pulse counter for each channel and the digital timer itself.
PIN-code	Options	The digital timer can be locked with a 4-digit PIN-code. The code can be adjusted, activated, and deactivated. If you have forgotten the code, contact a GMASD.
Reset/Function	Press and hold all front keys for two seconds to reset the digital timer. The values for date and time will be deleted and must be entered again. The switching program has not been deleted.	

Main Circuit Breaker

When the main circuit breaker is OFF (O), power is interrupted between the bus connections and the unit. Once connections have been made and the unit has been turned ON, the breaker may be switched ON (I).

The main circuit breaker will be tripped, disconnecting power, if any of the following conditions occur while the unit is running:

- Overload of the circuits. At 105% load, there will be an audible warning. At 110% load, the breaker opens and power will be disconnected.
- The customer connection box door is opened.
- The emergency stop switch is activated.

Verify any problems that cause the main circuit breaker to trip are corrected before returning the switch to ON (I).

Turn OFF the Unit

Verify the battery is fully charged before unit is disconnected.

1. See [Figure 2-4](#). Switch the MLCB outputs to the OFF position.
2. Turn the SYSTEM ON/OFF switch to the OFF position.
3. See [Figure 2-5](#). Press in the Emergency Stop button.

4. See [Figure 2-3](#). Disconnect any input and output cables from the connection panels.
5. Disconnect generator auto-start cable (if used).
6. See [Figure 2-4](#). Verify the green BATTERY ON indicator is extinguished.

Emergency Stop Switch



Equipment Damage. The emergency stop switch is not to be used to power down the unit under normal operating circumstances. Doing so could result in equipment damage.

(000246b)

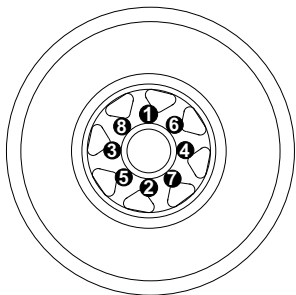
See [Figure 2-5](#). The unit is equipped with one emergency stop switch. The red button is clearly labeled EMERGENCY STOP. The switch can be accessed and activated with all doors closed and locked.

Activate the emergency stop switch by pushing the button in and turning it clockwise. The switch will remain closed until it is turned counterclockwise and released.

Towing the Trailer

NOTE: See *Towing Safety* before towing a trailer.

1. Use the jack to raise or lower the trailer onto the hitch of the towing vehicle. Lock the hitch coupling and attach the safety chains or cables to the vehicle. Raise the jack foot completely.
2. Connect any trailer wiring to the tow vehicle. Check for correct operation of the directional and brake lights.
3. Verify all doors are correctly latched.
4. Check for correct inflation of the trailer tires. For maximum tire pressures, see *Specifications*.
5. Check the wheel lugs. Tighten or replace any that are loose or missing. If a tire has been removed for axle service or replaced, tighten the lugs in the order shown to the following specifications:



014587

Figure 3-7. Lug Sequence

6. Start all lug nuts by hand.
 - First pass tighten to 20-25 ft-lbs (27-33 Nm).
 - Second pass tighten to 50-60 ft-lbs (67-81 Nm).
 - Third pass tighten to 90-120 ft-lbs (122-162 Nm).

NOTE: After first road use, repeat tightening procedure.

Lifting the Unit



⚠️ WARNING

Personal injury. Failure to properly connect lifting cables, chains, or straps could result in death, serious injury, or property damage.

(000346)

⚠️ WARNING

Personal Injury. Do not use lifting eye if there are signs of damage or corrosion. Doing so could result in death, serious injury, or property damage.

(000433)

⚠️ WARNING

Personal Injury. Do not use lifting eye other than as directed. Doing so could result in death, serious injury, or property damage.

(000434)

⚠️ WARNING

Personal Injury. Verify all fasteners are properly tightened prior to lifting unit. Failure to do so could result in death, serious injury, or property damage.

(000351)

⚠️ WARNING

Personal injury. Excessive weight. Use only appropriate lifting eyes and lifting equipment to lift unit. Improper lifting techniques could result in equipment damage, death or serious injury.

(000224)



⚠️ WARNING

Personal Injury. Never stand under a load being lifted above the ground. Doing so could result in death or serious injury.

(000762)

All lifting operations must be conducted in accordance with OSHA standard 1926 Subpart N - (later versions should be followed if issued) and any relevant local health and safety regulations. These regulations mandate the use of competent persons to manage lifting operations and to check lifting equipment.

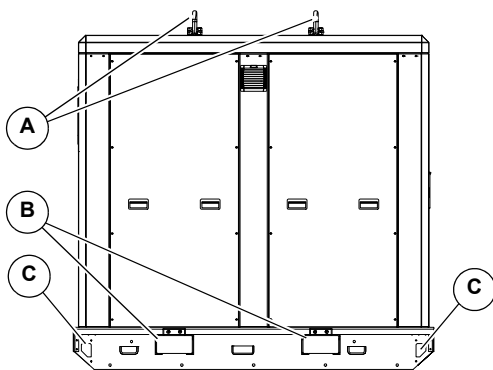
Do not attach straps or chains in such a way that use will result in distortion of the outer case of the unit. The lifting points attach to a dedicated internal brace designed to support the full weight of the unit.

Verify any lifting attachment(s) is/are firmly screwed into the threaded inserts in the top of the unit. Lifting eyes are considered as lifting equipment and subjected to thorough examination and inspection in accordance with regulations.

1. Verify the equipment being used to lift the unit is in good condition and has sufficient capacity. For approximate weights, see [Specifications](#).
2. Close and lock all doors.

IMPORTANT NOTE: Always remain aware of people and objects around the work site when moving or lifting the unit.

3. See [Figure 3-8](#) for lifting points. Lift unit in accordance with guidelines below.
 - When lifting the unit using the lifting eyes (A), use a crane hook or strapping capable of bearing the weight of the unit.
 - When lifting the unit using the fork pockets (B):
 - Verify the forklift capacity is above the total weight to be lifted.
 - Verify the length of the forks is equal to or greater than the width of the unit (measured on the fork insertion side).
 - Verify the forks of the forklift are completely inserted into the fork pockets under (supporting the unit along the entire width).



014607

Figure 3-8. Lift Points

- A Lifting eyes
- B Fork pockets
- C Tie-down locations

Transportation

When securing the unit for transportation, secure the unit with webbing straps or chains located through strapping points. Straps/chains should be fitted in opposing directions to prevent movement in a forward or backward direction while in transit.

Block the unit securely on the transport vehicle with devices suitable for the purpose to keep the unit from moving or tipping over while the vehicle moves.

See [Figure 3-8](#). Attach straps only to the locations shown (C). Do not attach straps to the unit enclosure.

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Section 4: Maintenance

Maintenance

WARNING

Equipment damage. Only qualified service personnel may install, operate, and maintain this equipment. Failure to follow proper installation requirements could result in death, serious injury, and equipment or property damage. (000182a)

WARNING

Personal injury and equipment damage. User access prohibited. Do not open the enclosure. No user serviceable parts inside. Only qualified service personnel may install, operate, and maintain this equipment. Noncompliance could result in personal injury or equipment damage. (000543)

The unit has minimal user maintenance requirements. Access to the inner parts of the unit is authorized only by suitably qualified personnel who have been trained in maintenance of the equipment. The battery is a sealed valve regulated (VRLA) type and requires no maintenance other than proper charge management.

Daily Walk Around Inspection

CAUTION

Equipment Damage. Failure to perform a daily inspection could result in damage to the unit. (000306)

Visually inspect the unit for cleanliness and damage.

Always clean the unit after each use to remove dust, grease, or mud. Use soft, clean rags to wipe the cabinet exterior and control panel. Low-pressure compressed air [less than 40 psi (276 kPa)] can also be used to remove dust and debris from the cabinet interior.

This unit contains sensitive electronic components that can be damaged by high pressure and heat.

- DO NOT wash with a high pressure hose or power washer. Water may enter the cabinet and collect in the electrical parts, causing damage.

Routine Maintenance

Check the function of the output circuits:

1. Verify the output MCBs are set to the OFF position and the BATTERY ON indicator is illuminated ([Figure 2-4](#), item M).
2. Verify the emergency stop button ([Figure 2-5](#), item K) is reset (1/4 turn counterclockwise).
3. Set the SYSTEM ON/OFF switch ([Figure 2-4](#), item L) to the ON position.

4. The display will illuminate and the blue light marked INVERTING ([Figure 3-1](#), item E) will illuminate.
5. Attach a load to any output socket/connection.
6. Set the corresponding output MCBs to the ON position.
7. Verify the connected load is being supplied with electricity.
8. Set the output MCB to the OFF position and verify the load is no longer being supplied with electricity to verify the MCBs are functioning correctly.
9. Repeat for each output circuit.
10. Verify the test button operates correctly for the 120 V GFCI duplex sockets.
11. Unplug all connectors from the output sockets.

Check the function of the input circuits:

1. Verify the output MCBs are set to the OFF position.
2. Verify the emergency stop button ([Figure 2-5](#), item K) is reset (1/4 turn counterclockwise).
3. Set the SYSTEM ON/OFF switch on the control panel ([Figure 2-4](#), item L) to the ON position.
4. The display will illuminate and the blue light marked INVERTING ([Figure 3-1](#), item E) will illuminate, and the SYSTEM ON indicator will illuminate ([Figure 2-4](#), item M).
5. Attach an input supply to the 3-phase input Cam-lock sockets ([Figure 2-5](#), item B) and switch the supply ON at source.
6. After approximately five to ten seconds the blue light marked INVERTING ([Figure 3-1](#), item E) will stop illuminating, and the MAINS ON blue light will illuminate.
7. Verify the battery charger function is active and the battery is charging, which can be done using the system control panel ([Figure 2-3](#), item B).
8. Visually inspect the unit to verify all connectors are serviceable.
9. Plug in the 20 A connector – the contactor will drop which will extinguish the SYSTEM LIVE indicator and charge will start after ten seconds. This is a 20 A (2 kW) connection.

Periodic Inspection

A periodic inspection service should be performed at least once every three months while the unit is in constant service. The inspection service should be performed by a trained and qualified person in accordance with the [Routine Maintenance](#) procedure. The unit should be briefly removed from service for these checks.

For a trailer-mounted unit that experiences frequent transportation, it is recommended that the periodic inspection service is performed more frequently.

- Check all electrical and mechanical parts for condition.
- Check all electrical terminals for tightness and for signs of stress or heating.
- Correct any faults and replace parts where necessary.
- Make a record of the service and any remedial work that was necessary, and retain for your own records.

Charging the Battery

When performing a routine service/maintenance inspection, make note of battery voltage. This can be found on the home screen of the system control panel (**Figure 2-4**). When the SYSTEM ON/OFF switch is set to OFF (not being used) and at least 30 minutes have passed since being disconnected from a charge source, the battery voltage should read no less than 50 VDC except where it is known to be in a state of significant discharge. Charge the battery in this case, turn the unit OFF, and wait at least 30 minutes before verifying battery voltage is at or above 50 VDC.

Long term battery life relies on a full charge being achieved periodically. While it is not always practical to fully charge the battery on every cycle, it is recommended to fully charge the battery at least weekly when in frequent use. Extended periods of “partial state of charge” will result in accelerated battery deterioration.

Storing the Unit

IMPORTANT NOTE: Verify the batteries are fully charged before storage. A maintenance charge must be performed monthly to counter internal consumption of the battery management system.

Short Term Storage

Before putting the unit into storage for longer than a few days, connect it to an appropriate power supply and fully charge the battery until the battery monitor shows 100% and the yellow float LED on the inverter status panel is illuminated (**Figure 3-1**, item C) and then follow the procedure in **Turn OFF the Unit**.

NOTE: The unit will experience a gradual discharge if not turned OFF, sufficient to significantly discharge the battery over a period of a few weeks.

Verify the unit is stored in a place where it is protected from mechanical damage and exposure to extreme climate.

Once a month connect the unit to a power supply and fully charge the battery.

Long Term Storage

If the unit will not be used for an extended period, it is recommended that the battery system is fully isolated by following the procedure in **Turn OFF the Unit**.

When returning the unit to service, follow the instructions in **Turn ON the Unit**.

NOTE: If possible, keep the unit connected to an input power supply while in storage. This will maintain the battery in a charged condition. In this instance, the system must be left on and powered up. Another option is to connect a battery charger to the auxiliary DC supply. The charger must be suitable for sealed lead acid batteries and have a nominal output voltage of 50 VDC.

Section 5: Troubleshooting

Fault Diagnosis



Equipment damage. Only qualified service personnel may install, operate, and maintain this equipment. Failure to follow proper installation requirements could result in death, serious injury, and equipment or property damage.






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This information is intended to be a check or verification for simple causes that can be located and fixed. It does not cover all types of problems. If these steps fail to resolve the issue, contact a GMASD.

Problem	Possible Cause	Solution
No AC output	SYSTEM ON/OFF switch is in the correct position (Figure 2-4 , item L).	Verify all switches and isolators are set to ON (Figure 2-4) and charge the battery.
	Blue light marked INVERTING (Figure 3-1 , item E) is illuminated.	
	Low battery alarm (Figure 3-1).	
Low battery alarm	Battery voltage on the system monitoring display (Figure 2-4 , item J).	Connect the unit to a power source and charge the batteries.
		Turn the SYSTEM ON/OFF switch to the ON position (Figure 2-4 , item L).
Battery does not charge	Verify the input current limit is correctly set (Figure 3-1 , item A).	Adjust the input current setting to the correct value (Figure 3-1 , item A).
	Verify the load does not exceed the set current limit.	Disconnect/turn OFF any excessive loads and check the incoming cables and supply.
Overload alarm	Check the connected load and check for a fault in the connected output.	Disconnect the output connections and observe if the unit restarts (Figure 2-5 , item E). If necessary, turn the unit OFF and ON again to reset (Figure 2-4 , item L).
Over temperature alarm	Verify there is sufficient ventilation.	Ensure adequate ventilation (see Installation for minimum clearances).
	Verify the load demand is within the rated capacity of the unit (Specifications).	Reduce any excessive connected load and connect an AC supply.

Problem	Possible Cause	Solution
Auto-start function does not work	Check the auto-start cable and verify it is correctly connected to the unit.	Connect, repair, or replace the cable (as required). Verify the generator is set to AUTO.
	Verify the start conditions have been met (or cleared) so unit is able to start.	Follow the procedure in <i>Turn ON the Unit</i> to verify correct operation of the unit.
Unit causes supply to trip	Verify the input current limit is set within the capacity of the main output isolator (<i>Figure 3-1</i> , item E).	Adjust the input current limit (<i>Figure 3-1</i> , item B).
	Check if there is a fault in the output supply.	Disconnect output circuits (<i>Figure 2-5</i> , item E).

Charge State LEDs

Bulk LED Absorption LED Float LED	Code	Meaning	Cause/Solution
	1	Device is turned OFF because one of the other phases in the system has turned OFF.	Check the failing phase.
	3	Not all, or more than, the expected devices were found in the system.	The system is not correctly configured. Reconfigure system.
	4	No other device detected.	Check the communication cables.
	5	Over-voltage on AC output.	Check the AC cables.
	10	System time synchronization problem occurred.	Equipment may be installed incorrectly. Check communication cables.

Bulk LED Absorption LED Float LED	Code	Meaning	Cause/Solution
	14	Device cannot transmit data.	Check communication cables for possible short circuit.
	16	System is turned OFF because it is an extended system and a “dongle” is not connected.	Connect dongle.
	17	One of the devices has assumed “master” status because the original “master” failed.	Check the failing unit and communication cables.
	18	Over-voltage has occurred.	Check AC cables.
	22	This device cannot function as “slave”.	This device is obsolete. Replace device.
	24	Switch-over system protection initiated.	Equipment may be installed incorrectly. Turn all equipment OFF, and then ON again. If problem persists, check installation. Possible solution: increase lower limit of AC input voltage to 210 VAC (factory setting is 180 VAC).
	25	Firmware incompatibility. The firmware of one of the connected devices is not sufficiently up to date to operate in conjunction with this device.	<ol style="list-style-type: none"> 1. Turn OFF all equipment. 2. Turn ON the device with the error. 3. Turn ON all other devices one by one until the error message occurs. 4. Update firmware in the last device that was turned ON.
	26	Internal error.	Turn all equipment OFF, and then ON again. Contact a GMASD if problem persists.

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Section 6: NHTSA Trailer Equipment Requirements

Reporting Safety Defects to the United States Government

If you believe your trailer has a defect which could cause a crash or could cause injury or death, you should immediately inform the National Highway Traffic Safety Administration (NHTSA) in addition to notifying Generac Mobile.

If NHTSA receives similar complaints, it may open an investigation; and if it finds that a safety defect exists in a group of vehicles, it may order a recall and remedy campaign. However, NHTSA cannot become involved in an individual problem between you, your GMASD, or Generac Mobile.

To contact NHTSA, you may either call the Auto Safety Hotline toll-free at 1-888-327-4236 (TTY:1-800-424-9153), go to <http://www.safercar.gov>, or write to:

Administrator
NHTSA
400 Seventh Street, SW.
Washington, DC 20590

You can also obtain other information about motor vehicle safety from <http://www.safercar.gov>.

Tire Safety Information

The following section contains tire safety information as required by 49 CFR 575.6. It will cover the following:

- Tire labeling, including a description and explanation of each marking on tires provided with the vehicle, and information about the location of the Tire Identification Number (TIN);
- Recommended tire inflation pressure, including a description and explanation of:
 - Recommended cold tire inflation pressure,
 - The vehicle placard and tire inflation pressure label and their location in the vehicle
 - Adverse safety consequences of underinflations (including tire failure), and
 - Measuring and adjusting air pressure to achieve proper inflation;
- Glossary of tire terminology, including “cold tire pressure”, “maximum inflation pressure,” and “recommended inflation pressure,” and other non-technical terms;
- Tire care, including maintenance and safety practices;
- Vehicle load limits, including a description and explanation of:
 - Locating and understanding load limit information, total load capacity, seating capacity, towing capacity, and cargo capacity,

- Calculating total and cargo load capacities with varying seating configurations including quantitative examples showing/illustrating how the vehicle’s cargo and luggage capacity decreases as the combined number and size of occupants increases,
- Determining compatibility of tire and vehicle load capabilities,
- Adverse safety consequences of overloading on handling and stopping and on tires.

Steps for Determining Correct Load Limit – Trailer

Determining the load limits of a trailer includes more than understanding the load limits of the tires alone. On all trailers there is a Federal certification / VIN label that is located on the forward half of the left (road) side of the unit. This certification / VIN label will indicate the trailer’s Gross Vehicle Weight Rating (GVWR). This is the most weight the fully loaded trailer can weigh. It will also provide the Gross Axle Weight Rating (GAWR). This is the most a particular axle can weigh. If there are multiple axles, the GAWR of each axle will be provided.

If your trailer has a GVWR of 10,000 pounds or less, there is a vehicle placard located in the same location as the certification label described above. This placard provides tire and loading information. In addition, this placard will show a statement regarding maximum cargo capacity. Cargo can be added to the trailer, up to the maximum weight specified on the placard. The combined weight of the cargo is provided as a single number. In any case, remember: the total weight of a fully loaded trailer cannot exceed the stated GVWR.

For trailers with living quarters installed, the weight of water and propane also need to be considered. The weight of fully filled propane containers is considered part of the weight of the trailer before it is loaded with cargo, and is not considered part of the disposable cargo load. Water, however, is a disposable cargo weight and is treated as such. If there is a fresh water storage tank of 100 gallons, this tank when filled would weigh about 800 pounds. If more cargo is being transported, water can be off-loaded to keep the total amount of cargo added to the vehicle within the limits of the GVWR so as not to overload the vehicle. Understanding this flexibility will allow you, the owner, to make choices that fit your travel needs.

When loading your cargo, be sure it is distributed evenly to prevent overloading front to back and side to side. Heavy items should be placed low and as close to the axle positions as reasonable. Too many items on one side may overload a tire. The best way to know the actual

weight of the vehicle is to weigh it at a public scale. Talk to your dealer to discuss the weighing methods needed to capture the various weights related to the trailer. This would include the weight empty or unloaded, weights per axle, wheel, hitch or king-pin, and total weight.

Excessive loads and/or underinflation cause tire overloading and, as a result, abnormal tire flexing occurs. This situation can generate an excessive amount of heat within the tire. Excessive heat may lead to tire failure. It is the air pressure that enables a tire to support the load, so proper inflation is critical. The proper air pressure may be found on the certification / VIN label and/or on the Tire Placard. This value should never exceed the maximum cold inflation pressure stamped on the tire.

Trailers 10,000 lbs (4,536 kg) GVWR or Less

1. Locate the statement “The weight of cargo should never exceed XXX kg or XXX lbs.” on your vehicle’s placard.
2. This figure equals the available amount of cargo and luggage load capacity.
3. Determine the combined weight of luggage and cargo being loaded on the vehicle. That weight may not safely exceed the available cargo and luggage load capacity.

Trailers over 10,000 lbs (4,536 kg) GVWR

NOTE: These trailers are not required to have a tire information placard on the vehicle.

4. Determine the empty weight of your trailer by weighing the trailer using a public scale or other means. This step does not have to be repeated.
5. Locate the GVWR of the trailer on your trailer’s VIN (Certification) label.
6. Subtract the empty weight of your trailer from the GVWR stated on the VIN label. That weight is the maximum available cargo capacity of the trailer and may not be safety exceeded.

Steps for Determining Correct Load Limit – Tow Vehicle

1. Locate the statement “The combined weight of occupants and cargo should never exceed XXX kg or XXX lbs.” on your vehicle’s placard.
2. Determine the combined weight of the driver and passengers that will be riding in your vehicle.
3. Subtract the combined weight of the driver and passengers from XXX kg or XXX lbs.
4. The resulting figure equals the available amount of cargo and luggage load capacity. For example, if the “XXX” amount equals 1400 lbs. and there will be five 150 lb passengers in your vehicle, the amount of available cargo and luggage load capacity is 650 lbs. (1400-750 (5x150) = 650 lbs.)

5. Determine the combined weight of luggage and cargo being loaded on the vehicle. That weight may not safely exceed the available cargo and luggage load capacity calculated in Step 4.
6. If your vehicle will be towing a trailer, load from your trailer will be transferred to your vehicle. Consult the tow vehicle’s manual to determine how this reduces the available cargo and luggage load capacity of your vehicle.

Glossary of Tire Terminology

Accessory weight means the combined weight (in excess of those standard items which may be replaced) of automatic transmission, power steering, power brakes, power windows, power seats, radio, and heater, to the extent that these items are available as factory-installed equipment (whether installed or not).

Bead means the part of the tire that is made of steel wires, wrapped or reinforced by ply cords and that is shaped to fit the rim.

Bead separation means a breakdown of the bond between components in the bead.

Bias ply tire means a pneumatic tire in which the ply cords that extend to the beads are laid at alternate angles substantially less than 90 degrees to the centerline of the tread.

Carcass means the tire structure, except tread and sidewall rubber which, when inflated, bears the load.

Chunking means the breaking away of pieces of the tread or sidewall.

Cord means the strands forming the plies in the tire.

Cord separation means the parting of cords from adjacent rubber compounds.

Cracking means any parting within the tread, sidewall, or inner liner of the tire extending to cord material.

Curb weight means the weight of a motor vehicle with standard equipment including the maximum capacity of fuel, oil, and coolant, and, if so equipped, air conditioning and additional weight optional engine.

Cold inflation pressure means the tire pressure when the vehicle hasn’t been driven for at least three hours.

Extra load tire means a tire designed to operate at higher loads and higher inflation pressure than the corresponding standard tire.

Groove means the space between two adjacent tread ribs.

Gross Axle Weight Rating or GAWR means the value specified by the vehicle manufacturer as the load-carrying capacity of a single axle system, as measure at the tire-ground interfaces.

Gross Vehicle Weight Rating or GVWR means the value specified by the manufacturer as the loaded weight of a single vehicle.

Hitch weight means the downward force exerted on the hitch ball by the trailer coupler.

Innerliner means the layer(s) forming the inside surface of a tubeless tire that contains the inflating medium within the tire.

Innerliner separation means the parting of the innerliner cord material in the carcass.

Light truck (LT) tire means a tire designated by its manufacturer as primarily intended for use on lightweight trucks or multipurpose passenger vehicles.

Load rating means the maximum load that a tire is rated to carry for a given inflation pressure.

Maximum load rating means the load rating for a tire at the maximum permissible inflation pressure for that tire.

Maximum permissible inflation pressure means the maximum cold inflation pressure to which a tire may be inflated.

Maximum loaded vehicle weight means the sum of - (a) Curb weight; (b) Accessory weight; (c) Vehicle capacity weight; and (d) Production options weight.

Measuring rim means the rim on which a tire is fitted for physical dimension requirements.

Non-pneumatic rim means a mechanical device which, when a non-pneumatic tire assembly incorporates a wheel, supports the tire, and attaches, either integrally or separably, to the wheel center member and upon which the tire is attached.

Non-pneumatic spare tire assembly means a non-pneumatic tire assembly intended for temporary use in place of one of the pneumatic tires and rims that are fitted to a passenger car in compliance with the requirements of this standard.

Non-pneumatic tire means a mechanical device which transmits, either directly or through a wheel or wheel center member, the vertical load and tractive forces from the roadway to the vehicle, generates the tractive forces that provide the directional control of the vehicle and does not rely on the containment of any gas or fluid for providing those functions.

Non-pneumatic tire assembly means a non-pneumatic tire, alone or in combination with a wheel or wheel center member, which can be mounted on a vehicle.

Normal occupant weight means 68 kilograms (150 lbs.) times the number of occupants specified in the second column of Table I of 49 CFR 571.110.

Occupant distribution means distribution of occupants in a vehicle as specified in the third column of Table I of 49 CFR 571.110.

Open splice means any parting at any junction of tread, sidewall, or innerliner that extends to cord material.

Outer diameter means the overall diameter of an inflated new tire.

Overall width means the linear distance between the exteriors of the sidewalls of an inflated tire, including elevations due to labeling, decorations, or protective bands or ribs.

Passenger car tire means a tire intended for use on passenger cars, multipurpose passenger vehicles, and trucks, that have a gross vehicle weight rating (GVWR) of 10,000 pounds or less.

Pin weight means the downward force applied to the 5th wheel or gooseneck ball, by the trailer kingpin or gooseneck coupler.

Ply means a layer of rubber-coated parallel cords.

Ply separation means a parting of rubber compound between adjacent plies.

Pneumatic tire means a mechanical device made of rubber, chemicals, fabric and steel or other materials, that, when mounted on an automotive wheel, provides the traction and contains the gas or fluid that sustains the load.

Production options weight means the combined weight of those installed regular production options weighing over 2.3 kilograms in excess of those standard items which they replace, not previously considered in curb weight or accessory weight, including heavy duty brakes, ride levelers, roof rack, heavy duty battery, and special trim.

Radial ply tire means a pneumatic tire in which the ply cords that extend to the beads are laid at substantially 90 degrees to the centerline of the tread.

Recommended inflation pressure means the proper Cold Inflation Pressure as shown on the Tire Information label.

Reinforced tire means a tire designed to operate at higher loads and at higher inflation pressures than the corresponding standard tire.

Rim means a metal support for a tire or a tire and tube assembly upon which the tire beads are seated.

Rim diameter means nominal diameter of the bead seat.

Rim size designation means rim diameter and width.

Rim type designation means the industry or manufacturer's designation for a rim by style or code.

Rim width means nominal distance between rim flanges.

Section width means the linear distance between the exteriors of the sidewalls of an inflated tire, excluding elevations due to labeling, decoration, or protective bands.

Sidewall means that portion of a tire between the tread and bead.

Sidewall separation means the parting of the rubber compound from the cord material in the sidewall.

ST tire means a tire designed for use only on trailers drawn on a road.

Test rim means the rim on which a tire is fitted for testing, and may be any rim listed as appropriate for use with that tire.

Tread means that portion of a tire that comes into contact with the road.

Tread rib means a tread section running circumferentially around a tire.

Tread separation means pulling away of the tread from the tire carcass.

Treadwear indicators (TWI) means the projections within the principal grooves designed to give a visual indication of the degrees of wear on the tread.

Vehicle capacity weight means the rated cargo and luggage load plus 68 kilograms times the vehicle's designated seating capacity.

Vehicle maximum load on the tire means that load on an individual tire that is determined by distributing to each axle its share of the maximum loaded vehicle weight and dividing by two.

Vehicle normal load on the tire means that load on an individual tire that is determined by distributing to each axle its share of the curb weight, accessory weight, and normal occupant weight (distributed in accordance with Table I of 49 CFR 571.110) and dividing by two.

Wheel center member means, in the case of a nonpneumatic tire assembly incorporating a wheel, a mechanical device which attaches, either integrally or separably, to the nonpneumatic rim and provides the connection between the nonpneumatic rim and the vehicle; or in the case of a nonpneumatic tire assembly not incorporating a wheel, a mechanical device which attaches, either integrally or separably, to the nonpneumatic tire and provides the connection between the tire and the vehicle.

Wheel-holding fixture means the fixture used to hold the wheel and tire assembly securely during testing.

Tire Safety

The National Traffic Safety Administration (NHTSA) has published a brochure (DOT HS 809 361) that discusses all aspects of Tire Safety, as required by 49 CFR 575.6. This brochure is reproduced in part below. It can be obtained and downloaded from NHTSA, free of charge, from the following website:

http://www.nhtsa.dot.gov/cars/rules/TireSafety/ridesonit/tires_index.html

Studies of tire safety show that maintaining proper tire pressure, observing tire and vehicle load limits (not carrying more weight in your vehicle than your tires or vehicle can safely handle), avoiding road hazards, and inspecting tires for cuts, slashes, and other irregularities are the most important things you can do to avoid tire failure, such as tread separation or blowout and flat tires. These actions, along with other care and maintenance activities, can also:

- Improve vehicle handling

- Help protect you and others from avoidable breakdowns and accidents
- Improve fuel economy
- Increase the life of your tires

This booklet presents a comprehensive overview of tire safety, including information on the following topics:

- Basic tire maintenance
- Uniform Tire Quality Grading System
- Fundamental characteristics of tires
- Tire safety tips

Use this information to make tire safety a regular part of your vehicle maintenance routine. Recognize that the time you spend is minimal compared with the inconvenience and safety consequences of a flat tire or other tire failure.

Basic Tire Maintenance

Properly maintained tires improve the steering, stopping, traction, and load-carrying capability of your vehicle. Underinflated tires and overloaded vehicles are a major cause of tire failure. Therefore, as mentioned above, to avoid flat tires and other types of tire failure, you should maintain proper tire pressure, observe tire and vehicle load limits, avoid road hazards, and regularly inspect your tires.

Finding Your Vehicle's Recommended Tire Pressure And Load Limits

Tire information placards and vehicle certification labels contain information on tires and load limits. These labels indicate the vehicle manufacturer's information including:

- Recommended tire size
- Recommended tire inflation pressure
- Vehicle capacity weight (VCW – the maximum occupant and cargo weight a vehicle is designed to carry)
- Front and rear gross axle weight ratings (GAWR – the maximum weight the axle systems are designed to carry)

Both placards and certification labels are permanently attached to the trailer near the left front.

Understanding Tire Pressure And Load Limits

Tire inflation pressure is the level of air in the tire that provides it with load-carrying capacity and affects the overall performance of the vehicle. The tire inflation pressure is a number that indicates the amount of air pressure – measured in pounds per square inch (psi) – a tire requires to be properly inflated. (You will also find this number on the vehicle information placard expressed in kilopascals (kpa), which is the metric measure used internationally.)

Manufacturers of passenger vehicles and light trucks determine this number based on the vehicle's design load limit, that is, the greatest amount of weight a vehicle can safely carry and the vehicle's tire size. The proper tire pressure for your vehicle is referred to as the "recommended cold inflation pressure." (As you will read below, it is difficult to obtain the recommended tire pressure if your tires are not cold.)

Because tires are designed to be used on more than one type of vehicle, tire manufacturers list the "maximum permissible inflation pressure" on the tire sidewall. This number is the greatest amount of air pressure that should ever be put in the tire under normal driving conditions.

Checking Tire Pressure

It is important to check your vehicle's tire pressure at least once a month for the following reasons:

- Most tires may naturally lose air over time.
- Tires can lose air suddenly if you drive over a pothole or other object or if you strike the curb when parking.
- With radial tires, it is usually not possible to determine underinflation by visual inspection.

For convenience, purchase a tire pressure gauge to keep in your vehicle. Gauges can be purchased at tire dealerships, auto supply stores, and other retail outlets.

The recommended tire inflation pressure that vehicle manufacturers provide reflects the proper psi when a tire is cold. The term cold does not relate to the outside temperature. Rather, a cold tire is one that has not been driven on for at least three hours.

When you drive, your tires get warmer, causing the air pressure within them to increase. Therefore, to get an accurate tire pressure reading, you must measure tire pressure when the tires are cold or compensate for the extra pressure in warm tires.

Steps For Maintaining Proper Tire Pressure

1. Locate the recommended tire pressure on the vehicle's tire information placard, certification label, or in the owner's manual.
2. Record the tire pressure of all tires.
3. If the tire pressure is too high in any of the tires, slowly release air by gently pressing on the tire valve stem with the edge of your tire gauge until you get to the correct pressure.
4. If the tire pressure is too low, note the difference between the measured tire pressure and the correct tire pressure. These "missing" pounds of pressure are what you will need to add.
5. At a service station, add the missing pounds of air pressure to each tire that is underinflated.
6. Check all the tires to make sure they have the same air pressure (except in cases in which the

front and rear tires are supposed to have different amounts of pressure).

If you have been driving your vehicle and think that a tire is underinflated, fill it to the recommended cold inflation pressure indicated on your vehicle's tire information placard or certification label. While your tire may still be slightly underinflated due to the extra pounds of pressure in the warm tire, it is after to drive with air pressure that is slightly lower than the vehicle manufacturer's recommended cold inflation pressure than to drive with a significantly underinflated tire. Since this is a temporary fix, don't forget to recheck and adjust the tire's pressure when you can obtain a cold reading.

Tire Size

To maintain tire safety, purchase new tires that are the same size as the vehicle's original tires or another size recommended by the manufacturer. Look at the tire information placard, the owner's manual, or the sidewall of the tire you are replacing to find this information. If you have any doubt about the correct size to choose, consult with the tire dealer.

Tire Tread

The tire tread provides the gripping action and traction that prevent your vehicle from slipping or sliding, especially when the road is wet or icy. In general, tires are not safe and should be replaced when the tread is worn down to 1/16 of an inch. Tires have built-in treadwear indicators that let you know when it is time to replace your tires. These indicators are raised sections spaced intermittently in the bottom of the tread grooves. When they appear "even" with the outside of the tread, it is time to replace your tires. Another method for checking tread depth is to place a penny in the tread with Lincoln's head upside down and facing you. If you can see the top of Lincoln's head, you are ready for new tires.

Tire Balance And Wheel Alignment

To avoid vibration or shaking of the vehicle when a tire rotates, the tire must be properly balanced. This balance is achieved by positioning weights on the wheel to counterbalance heavy spots on the wheel-and-tire assembly. A wheel alignment adjusts the angles of the wheels so that they are positioned correctly relative to the vehicle's frame. These adjustments require special equipment and should be performed by a qualified technician.

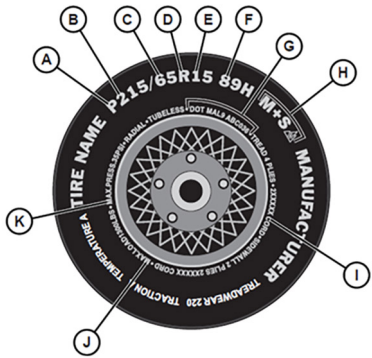
Tire Repair

The proper repair of a punctured tire requires a plug for the hole and a patch for the area inside the tire that surrounds the puncture hole. Punctures through the tread can be repaired if they are not too large, but punctures to the sidewall should not be repaired. Tires must be removed from the rim to be properly inspected before being plugged and patched.

Tire Fundamentals

Federal law requires tire manufacturers to place standardized information on the sidewall of all tires. This information identifies and describes the fundamental characteristics of the tire and also provides a tire identification number for safety standard certification and in case of a recall.

Information on Passenger Vehicle Tires



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Figure 6-1. Passenger Vehicle Tires

- A "P" indicates the tire is for passenger vehicles. This three-digit number gives the width in millimeters of the tire from sidewall edge to sidewall edge.
- B In general, the larger the number, the wider the tire. This two-digit number, known as the aspect ratio, gives the tire's ratio of height to width. Numbers of 70 or lower indicate a short sidewall for improved steering response and better overall handling on dry pavement.
- C "R" stands for radial. Radial ply construction of tires has been the industry standard for the past 20 years.
- D This two-digit number is the wheel or rim diameter in inches. If you change your wheel size, you will have to purchase new tires to match the new wheel diameter.

(Number) This two- or three-digit number is the tire's load index. It is a measurement of how much weight each tire can support. You may find this information in your owner's manual. If not, contact a local tire dealer.

NOTE: You may not find this information on all tires because it is not required by law.

- F (Letter) The speed rating denotes the speed at which a tire is designed to be driven for extended periods of time. The ratings range from 99 miles per hour (mph) TO 186 MPH. These ratings are listed below.

NOTE: You may not find this information on all tires because it is not required by law.

NOTE: See [Table 6-1](#) for complete list of letter and speed ratings.

U.S. DOT Tire Identification Number. This begins with the letters "DOT" and indicates that the tire meets all federal standards. The next two numbers or letters are the plant code where it was manufactured, and the last four numbers represent the week and year the tire was built. For example, the numbers 3197 means the 31st week of 1997. The other numbers are marketing codes used at the manufacturer's discretion. This information is used to contact consumers if a tire defect requires a recall.

- G The "M+S" or "M/S" indicates that the tire has some mud and snow capability. Most radial tires have these markings; hence, they have some mud and snow capability.
- H Tire Ply Composition and Materials Used. The number of plies indicates the number of layers of rubber-coated fabric in the tire. In general, the greater the number of plies, the more weight a tire can support. Tire manufacturers also must indicate the materials in the tire, which include steel, nylon, polyester, and others.
- I Maximum Load Rating. This number indicates the maximum load in kilograms and pounds that can be carried by the tire.
- J Maximum Permissible Inflation Pressure. This number is the greatest amount of air pressure that should ever be put in the tire under normal driving conditions.

Table 6-1. Tire Letter and Speed Rating

Letter Rating	Speed Rating
Q	99 MPH
R	106 MPH
S	112 MPH
T	118 MPH
U	124 MPH
H	130 MPH
V	168 MPH
Y	186 MPH

NOTE: For tires with a maximum speed capability over 149 mph, tire manufacturers sometimes use the letters ZR. For those with a maximum speed capability over 186 mph, tire manufacturers always use the letters ZR.

Uniform Tire Quality Grading (UTQGS)

Quality grades can be found where applicable on the tire sidewall between tread shoulder and maximum section width. For example: TREADWEAR 200 TRACTION AA

Temperature A

All passenger car tires must conform to federal safety requirements in addition to these grades.

Treadwear

The treadwear grade is a comparative rating based on the wear rate of the tire when tested under controlled conditions on a specified government test course. For example, a tire graded 150 would wear one and one-half (1.5) times as well on the government course as a tire graded 100. The relative performance of tires depends upon the actual conditions of their use, however, and may depart significantly from the norm due to variations in driving habits, service practices and differences in road characteristics and climate.

Traction

The traction grades, from highest to lowest, are AA, A, B, and C. Those grades represent the tire’s ability to stop on wet pavement as measured under controlled conditions on specified government test surfaces of asphalt and concrete. A tire marked C may have poor traction performance.

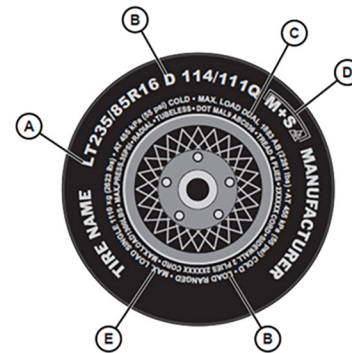
NOTE: The traction grade assigned to this tire is based on straight-ahead braking traction tests, and does not include acceleration, cornering, hydroplaning, or peak traction characteristics.

Temperature

The temperature grades are A (the highest), B, and C, representing the tire’s resistance to the generation of heat and its ability to dissipate heat when tested under controlled conditions on a specified indoor laboratory test wheel. Sustained high temperature can cause the material of the tire to degenerate and reduce tire life, and excessive temperature can lead to sudden tire failure. The grade C corresponds to a level of performance which all passenger car tires must meet under the Federal Motor Safety Standard No. 109. Grades B and A represent wheel than the minimum required by law.

NOTE: The temperature grade for this tire is established for a tire that is properly inflated and not overloaded. Excessive speed, underinflation, or excessive loading, either separately or in combination, can cause heat buildup and possible tire failure.

Additional Information on Light Truck Tires



014609

Figure 6-2. Light Truck Tires

- A The “LT” indicates the tire is for light trucks. An “ST” is an indication the tire is for trailer use only.
- B Load Range. This information identifies the tire’s load-carrying capabilities and its inflation limits. Maximum Load Dual. This information indicates the maximum load and tire pressure when the tire is used as a dual, that is, when four tires are put on each rear axle (a total of six or more tires on the vehicle).*
- C The “M+S” or “M/S” indicates that the tire has some mud and snow capability. Most radial tires have these markings; hence, they have some mud and snow capability.
- D This information indicates the maximum load and tire pressure when the tire is used as a single.*

* Maximum load is presented in kilograms and pounds (kg/lbs). Maximum tire pressure is presented in kilopascals and pounds per square inch (kPa/psi) for when the tire is cold.

Preventing Tire Damage

- Slow down if you have to go over a pothole or other object in the road.
- Do not run over curbs of foreign objects in the roadway, and try not to strike the curb when parking.

Tire Safety Checklist

- Check tire pressure regularly (at least once a month), including the spare.
- Inspect tires for cracks, foreign objects, uneven wear patterns on the tread, or other signs of wear or trauma.
- Remove bits of glass and foreign objects wedged in the tread.
- Verify your tire valves have valve caps.
- Check tire pressure before going on a long trip.
- Do not overload your vehicle. Check the tire information placard or owner's manual for the maximum recommended load for the vehicle.

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