GSEVAmerica

U.S. Department of Energy Advanced Vehicle Testing Activity

FMC 160e Pushback Tractor

VEHICLE SPECIFICATIONS

VEHICLE DESCRIPTION

Vehicle Model: Expediter 160e
Manufacturer: FMC
Pushback Method: Towbar-less
Rated Tow Capability: 160 M/T
Installed Features:

- Windshield Wiper
- Turn Signal
- Universal Charger (offboard)
- Hazard Lights
- IWC Charge Inlet
- Dome Light
- Dual Drive Controls
- Pickup Camera
- Information Screen

BATTERY

Manufacturer: Sonnenschein
Type: VRLA Gel
Number of Modules: 56
Pack(s) Location: Throughout chassis behind driver cabin area
Nominal Module Voltage: 6 VDC
Nominal System Voltage: 336 V
Nominal Pack Capacity[1]: 180 Ah

WEIGHTS

Delivered Curb Weight: 29,480 lbs
Front Axle Weight: 24,950 lbs
Rear Axle Weight: 4,530 lbs
Distribution F/R: 84.6/15.4 %

DIMENSIONS

Wheelbase: 118.8 in
Track F/R: 101.6/118.0 in
Length: 285.5 in
Width: 148.0 in
Height: 70.0 in

TIRES

Tire Mfg: Michelin
Tire Model: Stabi'x XZM
Tire Size: 355/65R15
Tire Pressure F/R: 145/145psi
Spare Installed: No

MOTOR

Model: 5KAF405SS2188P
Manufacturer: General Electric
Type: Hydrostatic Drive
Rated Efficiency @ Full Load: 95%
Rated Output Power: 118 HP/88.1kW

TEST NOTES:

1. Manufacturer rated capacity C/5 rate.
2. Vehicle maximum force limited to 7000 lbs of force due to software control.
3. Maximum force at speeds >4 MPH.
4. Maximum force at speeds >3 MPH.
5. Opportunity fast charger.
6. Overnight charger.

This vehicle meets all HEV America Minimum Requirements listed on back of this sheet
Values in red indicate the Performance Goal was not met. All Power and Energy Values are DC unless otherwise specified.

PERFORMANCE STATISTICS

Maximum Speed

No Load ~100% SOC: 5.3 MPH
Performance Goal: 5 MPH
No Load ~50% SOC: 5.4 MPH
Performance Goal: 5 MPH

Maximum Static Force

100% SOC:
Maximum Measured Force: 11,172 lbs
Required Battery Power: 72.1 kW
50% SOC[2]:
Maximum Measured Force[2]: 4,250 lbs
Required Battery Power: 33.6 kW

Maximum Dynamic Force

100% SOC[3]:
Maximum Measured Force: 5,000 lbs
Required Battery Power: 79.0 kW
50% SOC[4]:
Maximum Measured Force: 8,500 lbs
Required Battery Power: 89.8 kW

Charge Data

Capacity Delivered: 49 Ahr
Peak Demand: 15.5 kW
Time to Recharge[5]: 1.4 hours
Performance Goal[6]: 12 hours

This vehicle meets the following GSEVAmerica minimum requirements:

(1) The tractor shall comply with all performance requirements over the full range of environmental factors specified in SAE ARP 1247, Paragraph 3.6
(2) The manufacturer shall list and describe in detail specifically which aircraft the tractor will adequately service.
(3) The manufacturer shall specify all area of non compliance with SAE ARP 4852.
(4) The electrical system shall consist of an appropriate size and type traction battery pack powering a compatible electric motor(s) through an electronic controller(s) to produce smooth acceleration and operation.
(5) The traction battery charger shall be appropriately selected to properly charge the traction battery and meet the requirements of the particular application.
(6) The vehicle manufacturer shall specify all areas of noncompliance with SAE ARP 1817.
(7) The battery provided shall be of size and capacity to satisfy performance and accessory requirements.
(8) The vehicle manufacturer shall provide the battery manufacturer's specifications including the one-hour, three-hour and five-hour discharge rating of the traction battery (in amp-hours) and shall specify the battery discharge rate (in amperes when operating under a load.
(9) Means of restraining the traction battery in the lateral and longitudal directions shall be provided.
(10) Vehicle manufacturer shall indicate the depth of discharge below which the traction battery should not be discharged.
(11) The traction battery shall be protected by a cover which shall support at least 12 lb/sqft.
(12) The traction battery and traction battery compartment shall be designed such that electrolyte from the battery is captured in an auxilliary tray or the battery tray and not allowed to drain onto the ground. This requirement does not apply when sealed batteries are used.
(13) Battery cable connectors shall be located such that they create no danger of igniting gases expelled during battery charging.
(14) Manufacturer shall supply an MSDS for the battery an any materials used in the tractor that would not typically be found in an automotive shop.
(15) Manufacturer shall specify recommended and maximum allowable battery weight (full rated load).
(16) The electronic controller(s) and motor(s) shall be sized for the application and shall limit maximum battery discharge as specified in Section 3.2.1.5 to prevent degradation of battery life and abrupt loss of tractor operability.
(17) Such limit shall be adjustable, repeatable and accurate within 10% of battery state of charge.
(18) All wiring and components used in the high voltage propuslion system shall be of a "two wire" design using an insulated return wire rather than the vehicle chassis as ground and sized in compliance with SAE J1673.
(19) Vehicles shall not contain exposed conductors, terminals, contact blocks or devices of any type that create the potential for personnel to be exposed to 60 volts (nominal battery voltage) or greater.
(20) Access to any HIGH VOLTAGE components shall require the removal of at least one bolt, screw, cover, or latch.
(21) Devices considered to be HIGH VOLTAGE componnents shall be clearly marked as "HIGH VOLTAGE".
(22) HIGH VOLTAGE cable and wire marking shall consist of orange insulation and/or orange sleeves or spiral wrappings as required by SAE 1673, paragraph 3.5.3.
(23) All HIGH VOLTAGE cable shall comply with the requirements of SAE-J1654.
(24) All LOW VOLTAGE battery cable shall comply with the requirements of SAE-J1127 and SAE J1128.
(25) HIGH VOLTAGE connectors (except charger power supply to vehicle) shall be keyed to prevent mis-connection.
(26) A propulsion power system operating at greater than 60 volts shall be isolated from the vehicle chassis such that the leakage current does not exceed 20mA with the battery connected.
(27) Maximum regenerative braking settings shall be adjustable such that maximum current returning to the traction battery pack can be set to avoid potential damage to traction battery pack or electrical components.
(28) Accessory power system shall be used to power the following:
- Two sealed beam headlights on front of tractor (one on each side).
- Two tail lights on rear of tractor (one on each side).
- Two brake lights on rear of tractor (one on each side).
- Two back-up lights on rear of tractor.
- Emergency flashers.
- Floodlight for front and rear hitches or pickup device.

(29) The vehicle shall be equipped with a horn.
(30) If chassis ground is used for the accessory power negative it shall be isolated from the traction system by at least 500,000 ohms of resistance.
(31) The accessory power system shall be supplied from the main traction battery by an electronic DC-to-DC converter.
(32) The vehicle manufacturer shall specifyall areas of noncompliance with SAE J163, J561, and J858a.
(33) All electronic components shall be protected by an enclosure meeting the requirements of ANSI/NEMA 250/1997, Type 4 Enclosure.
(34) The electrical/electronic systems shall incorporate proper shielding and filtering, to ensure electromagnetic compatibility of the vehicle with any and all communication and navigation frequencies in and around the airport ramp areas in accordance with MIL-STD-461.
(35) The tractor shall not be susceptible to externally generated electromagnetic fields or susceptible to electromagnetic fields from on board transmitters in accordance with SAE J551-1 and SAE J551-12.
(36) It shall not be possible to drive the tractor when the tractor is connected to the charger.
(37) Charging circuits shall be isolated from the vehicle chassis such that ground current from the grounded chassis does not exceed 20mA at any tim the vehicle is connected to an off-board charger.
(38) Charge connector shall be prevented from being inadvertantly connected to the controller or motor rather than the battery.
(39) Electric systems shall comply with the requirements of SAE ARP 1247 paragraphs 3.13.1.2.5, 3.13.1.2.6, 3.13.1.2.9, 3.13.1.2.10, 3.13.1.2.12, 3.13.1.2.20 and 3.13.1.2.23.
(40) The manufacturer shall report the maximum static drawbar pull, with the battery at 100% and at 50% (+/- 10%) state of charge.
(41) The maximum tractor speed with no towed load shall be a minimum of 5 miles per hour.
(42) The maximum tractor speed shall be settable by a controlled method.
(43) The manufacturer shall report the maximum draw bar of the tractor at a speed of 4.0 miles per hour (6.0 kilometers per hour) with the traction at 100% adn at 50% (+/- 10%) state of charge.
(44) With the maximum dynamic drawbar applied the controller, motor and battery shall be capable of continuous operation at 4.0 mile per hour (6.0 kilometers per hour) for at least three minutes without overheating or damage to the propulsion system.
(45) Dash instrumentation shall include an hourmeter and an indicator light to war n the operator of a brake failure.
(46) The tractor requirements shall comply with the requirements of SAE ARP 1247, Paragraphs 3.8, 3.9, and 3.10, SAE AIR 1375 and ANSI B56.9-1992.
(47) The tractor shall be equipped with a dead man type seat switch interlock that de-activates the traction circuit whenever the operator is not on the seat.
(48) The switch and it's installation shall be designed to prevent false tripping due to driving over bumps or the operator leaning any direction on the seat.
(49) The traction system controller shall incorporate a "static return off" feature.
(50) A handbrake interlock shall be provided to prevent traction system operation unless the handbrake is disengaged.
(51) Vehicles using HIGH VOLTAGE traction systems shall be equipped with a "master" switch that shall interlock controller propulsion functions and battery contactor(s), if any, to render the propulsion system inoperative.
(52) Contactors(s) used in conjunction with the master switch shall be capable of interrupting maximum rated controller/inverter current.
(53) A manual service disconnect for vehicles using a HIGH VOLTAGE traction system shall also be required. It shall have the following characteristics:
- Manual action is required to break the connection
- The disconnection is physically verifiable
- The disconnection does not create exposed conductors capable of becoming energized when exposed
- The service disconnect is clearly marked and is accessible without the use of tools

(54) Information regarding maximum towing speed shall be properly placarded on the dash and at the tow points if potential damage exists to the traction motor during maintenance twoing at higher than recommended speeds.
(55) Requirements of SAE ARP 1247, Paragraph 3.12.5 shall be followed where applicable.

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