



Terex Utilities

PRODUCT ADVISORY

PA-1024-14

DATE: 7/21/14

REVISED:

TO: Owners, Users, Dealers, and Installers

Models Affected: Units with a 408V HyPower™ System Installed

SUBJECT: 408V HyPower™ Systems

Issue:

The batteries used on the HyPower™ system can provide a longer, more satisfactory service life if they are charged in a specific manner. This is necessary so that each battery in the series is brought to the optimal charged state. To help optimize battery performance, the following changes have been incorporated into the 408V HyPower™ manual. Failure to charge the batteries according to the instructions in this Product Advisory and in the updated manual can effect battery performance.

Action:

By using the different charging systems/methods listed below, you can improve battery performance and charge balance between the batteries. It's important to note that using only one method described below to continually charge the battery system does not always guarantee that the balance between the batteries is being achieved. It takes a combination of the charging methods below to achieve this.

Plug-in Charging: The system should be plugged in when not in use and needs a minimum 8 hour charge to recover from a day's use. The plug-in charge provides 2.5 amps of charging current to the hybrid batteries. This charging time also has a conditioning element that brings the batteries to the proper chemical state.

Automatic Charging: The system has a second method of charging which involves using the chassis engine and PTO to drive the generator. This charge provides 40 to 90 amps of charging current depending on the condition of the batteries. This charging occurs automatically when the battery voltage drops below a predetermined battery charge state.

Equalizing Charge: The third method of charging also uses the chassis engine and PTO to drive the generator. This method of charging is initiated by the operator by starting the engine while the system is in the normal hybrid mode. The equalizing charge will last for 30 minutes, or until the batteries reach a predetermined charge state, whichever comes first.

Effective immediately, we are implementing a 30 day maintenance program to perform this equalizing charge, followed by a full plug-in charge at night or over the weekend to condition and improve the balance of the batteries. Upon receipt of this product advisory, we encourage performing this equalizing "forced charge" each day for a week (5 working days). As with the plug-in charge, the system must be operated in hybrid mode during the day to deplete the batteries, achieving a complete discharge/charge cycle. After one week of daily equalizing charges, these can be performed once a month. This will not only improve the performance of the system, but it will also extend the life of the batteries.

Follow this procedure when performing the maintenance charge:

1. Run the unit until the automatic charge has been initiated.
2. When the engine turns off then activate the equalizing charge.
3. Perform an equalizing charge before parking for the night.
4. Plug in overnight for at least 8 hours to reach a full state of charge and complete the conditioning phase.

Owners, Users, Dealers, and Installers: No parts are required to perform this maintenance procedure. A supplement to the manual is included with this bulletin.



APPENDIX

HyPower™ OPERATOR'S MANUAL

Terex South Dakota, Inc.
500 Oakwood Road
Watertown, SD 57201

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INTRODUCTION

The Terex HyPower™ system is a plug-in hybrid system used to power a truck-mounted aerial device hydraulic system. The Terex HyPower™ system allows the hydraulic pump to be powered from either the truck engine or from an electric motor/generator.

The truck engine and transmission system operate normally, and are not affected for travel, so over the road power and capabilities are not affected. The hydraulic pump is mounted on a motor generator which is installed on the transmission mounted power take off (PTO). The truck engine can provide power through the transmission and PTO to run the hydraulic pump alone or also rapidly re-charge the HyPower™ batteries while at the same time providing normal hydraulic pump power for the aerial device. When operated in Hybrid mode the PTO mounted Motor/Generator powers the hydraulic pump and the truck engine is not running. If the run time should discharge the batteries the engine will automatically start to recharge the batteries.

Power for the electric motor comes from two separate high-voltage battery packs independent from the truck starting batteries. The high voltage battery packs are attached to the truck's left and right frame rails underneath the body. The battery packs provide nominal voltage of 408V. The batteries will be charged with an onboard charger when plugged into a 120V AC 15 Amp outlet. The truck's engine can provide charging when a wall outlet is not available.

The aerial device will operate in the normal manner as shown in the Operators Manual either in PTO mode or Hybrid mode. The auxiliary controls such as Two Speed Throttle, Stop/Start, and Letdown power will operate in the normal mode when using truck engine power but as shown in this manual when in Hybrid mode.

The system also can provide up to 3800 watts of 110V AC power from an inverter by the optional exportable power feature. Optional thermostatically controlled electronic chassis cabin heating and cooling can be provided for cab comfort powered by the hybrid battery.



The Terex HyPower™ batteries supply 408V and can be lethal. Do not perform any repairs, maintenance, or testing when batteries are connected. Do not cut or probe orange colored cables.





GENERAL SAFETY GUIDELINES

HYBRID VOLTAGE

The Terex HyPower™ system uses voltages above 408V to provide power. Do not perform any repairs, maintenance, or testing unless qualified. Do not cut or probe any orange cables or orange covered cable. The orange color indicates potentially lethal voltages.

HYBRID WARNING LIGHT

A flashing HyPower™ warning light may indicate critical system error. If the warning strobe remains active after three attempts to select hybrid mode, discontinue use of HyPower™ system and perform Hybrid System Lock-out Procedure. Perform visual inspection of hybrid components including condition of orange high voltage cables - See High Voltage Cable Warning. If there is no visible damage to high voltage cables, visibly loose connectors, or oil leaks from the hybrid system enclosure the hydraulic system operation can occur using PTO Mode.

HIGH VOLTAGE CABLE WARNING

All high voltage cables are indicated with the color orange. Daily visual inspection of high voltage cables is required during pre-operation checks. Any high voltage cable that is found to be loose, cut or damaged in any way is considered to be a safety hazard until lock-out procedures are implemented. If lock-out procedures are not implemented serious injury or death can occur.

If high voltage cables are loose from connectors, cut or damaged in any way, stop use of HyPower™ system immediately. Do not use in PTO mode - see Motor/Generator Warning. Use of the auxiliary let down is allowed to lower/stow boom. If upon visual inspection, securing a high voltage cable is required for travel, perform the following procedure:

1. Perform Standard Truck Maintenance Lock-Out Procedure
2. Using approved personal protection equipment, secure orange high voltage cables using non conductive materials.
3. Remove engine start lock out. Do not remove HyPower™ lock-out or operate in PTO Mode until service by qualified service personnel is performed.

EMERGENCY STOP FUNCTION

Emergency Stop disables HyPower™ system and isolates high voltage in battery box. It does not disable the PTO clutch. The Motor/Generator rotates when the PTO clutch is engaged producing deadly high voltage - See Motor/Generator Warning.

MOTOR/GENERATOR WARNING - ROTATING PERMANENT MAGNET

Motor/Generator is constructed with a high energy permanent magnet which, when rotated at high speeds, develops a dangerous voltage at the terminals and/or orange high voltage cables. The motor/generator is directly coupled to the PTO and rotates when the PTO clutch is engage. Do not operate in PTO mode if orange motor/generator high voltage cable is loose, cut or damaged or motor/generator is damaged.

HYBRID SYSTEM ENCLOSURE HIGH VOLTAGE WARNING

The hybrid system enclosure contains dangerous high voltage levels. Removing side access panels exposes high voltage which can cause death or serious injury. The access panels are locked and should only be opened by trained service personnel.

HYBRID SYSTEM ENCLOSURE HYDRAULIC LEAK WARNING

The hybrid system enclosure utilizes hydraulic oil for cooling some components. If there is evidence of hydraulic oil leaking from the drain in the bottom center of the enclosure, do not operate in either hybrid or PTO mode. Maintenance from qualified service personnel is required.



STANDARD TRUCK MAINTENANCE LOCK-OUT PROCEDURE

When performing any truck service or visual inspection implement the Hybrid Lock-Out Procedure. If hydraulic operation is required, inspect all orange high voltage cables for exposed wire and/or loose connections before engaging PTO mode. See High Voltage Cable Warning. Maintenance action or removal of any HyPower™ system components including cables requires trained service personnel. Any attempt to service or remove Hybrid System equipment or cables can cause serious injury or death.

HYBRID LOCK-OUT PROCEDURE

One of the emergency stop switches (typically driver side) accommodates a padlock. Depress it and use your companies lockout/tagout procedures to prevent unauthorized use.

Render the truck's starting means inoperative by removing the key and/or disconnect the PTO clutch solenoid power. See Motor/Generator Warning.

AUTO CHARGE WARNING

When in hybrid mode, the HyPower™ system automatically turns the engine on without warning when the battery pack charge is low. Turn the hybrid system off when not in use. See Standard Truck Maintenance when servicing truck.

BATTERY BOXES EXPOSED TO STANDING WATER

The HyPower™ battery boxes are designed to withstand travel through standing water up to designated water line (bottom of the chassis frame rails). It is not to be parked in water.



If travel occurs through water above the water line or there is exposure to standing water, maintenance from qualified service personnel is required.

APPENDIX

OPERATOR CONTROLS AND DESCRIPTION

All controls operate as shown in the Operator’s manual when in “PTO” mode. The following information is when in Hybrid mode running off battery power.

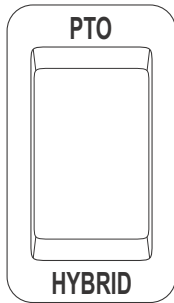
BELOW ROTATION CONTROLS

Each outrigger and the tool selector has an electric switch that automatically activates the electric motor in low speed (tool) or high speed (outriggers).

CAB CONTROLS


Refer to Operator’s Manual for other controls and operation.

The operator can turn the system off or can select to operate in a conventional PTO mode or Hybrid mode via 3-position switch mounted on the dash.

CONTROL		DESCRIPTION
PTO master power		Push switch up to “PTO”. In PTO mode hydraulic power comes from truck engine. All controls operate as shown in Operator’s manual. <ul style="list-style-type: none"> • PTO indicator light is steady on: Indicates PTO is engaged and operational. • PTO indicator light is flashing: Indicates PTO has been selected but has not yet engaged.
Off		Return to center position to turn off PTO and Hybrid mode for road travel.
Hybrid		Push switch down to “HYBRID” mode. In hybrid hydraulic mode power is supplied by the hybrid batteries with the truck engine off. <ul style="list-style-type: none"> • Hybrid indicator light is steady on: Indicates Hybrid system is ON and Operational. <p>NOTE: Requires the parking brake to be engaged and the transmission in neutral for PTO on Hybrid mode to operate.</p>
Ignition Key Switch		Starting the engine with the ignition key while in Hybrid mode will charge the batteries until a full state of charge is reached. The engine will shutdown automatically.

EMERGENCY STOP

There is an Emergency Stop button located on each side of the front of the body. The driver’s side Emergency Stop button can accommodate a padlock.

CONTROL	DESCRIPTION
	Push to shutdown the hybrid system and isolate the voltage to within the battery packs. Turn stop button clockwise to reset.







UPPER CONTROLS

HYBRID MODE

NOTE: Refer to Operator’s Manual for controls and operation when in PTO mode.

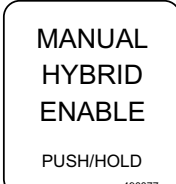
The enable lever on the single stick control turns on the electric motor to power the hydraulic pump.

CONTROL	DESCRIPTION
<p>Two-speed throttle (if required)</p>  <p>Auxiliary let down power (optional)</p> 	<p>Pressing and holding the two-speed button for more than five (5) seconds will activate the auxiliary let down if the warning strobe and hybrid fault dash light are flashing.</p> <p>If the engine is ON, the two-speed signal will toggle the engine’s speed between high idle and low idle speeds. If the engine is not running, the two-speed signal serves only to activate the auxiliary let down.</p> <p>The auxiliary let down power is turned ON and OFF by pressing and holding or releasing the two-speed throttle push button.</p> <p>The auxiliary let down will only activate if there is a Hybrid Fault signal (Hybrid dash light flashing, Warning Strobe on).</p>
<p>Engine stop/start control (optional)</p> 	<p>While in Hybrid mode the engine may start automatically to recharge the batteries. Pressing the start/stop control will stop the engine and the electric motor. Pressing the start/stop control again will reset the hybrid system allowing it to resume normal operation.</p> <p> If the system was shutdown during automatic recharge mode (i.e. engine running), the system may start the engine to resume the charging process. All controls must be off or neutral for the start signal to reset the hybrid mode.</p> <p>Start signal will not function if the auxiliary let down has been activated. Ground personnel can reset the system by toggling the 3-position switch in the cab to OFF and then back to Hybrid mode.</p>

LOWER CONTROLS

HYBRID MODE

NOTE: Refer to Operator’s Manual for controls and operation when in PTO mode.

CONTROL	DESCRIPTION
<p>Enable</p> 	<p>Press and hold the Hybrid Enable switch to operate the lower control.</p> <p>NOTE: Return control levers to neutral before releasing the Hybrid Enable switch.</p>

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PRE-OPERATION

DAILY PRE-OPERATION CHECKS

The following should be added to the Daily Pre-Operation Checks:

1. Visually check cables at the battery boxes and auxiliary power box for damage.
2. Visually check motor/generator for damage and hydraulic fluid leaks.
3. Check emergency stop following proper procedure.
 - a. Depress one emergency stop switch prior to selecting hybrid mode.
 - b. Select hybrid mode and verify Hybrid dash light and Warning Strobe is flashing and that none of the enable functions are operational.
 - c. Reset the emergency stop switch and repeat for each emergency stop switch.
4. Check if hydraulic oil is leaking from the bottom center drain of the hybrid system enclosure. If there is evidence of hydraulic oil leaking from the drain, do not operate in either hybrid or PTO mode. Maintenance from qualified service personnel is required.

OPERATING TEMPERATURE RANGE

The Hybrid System is limited to battery pack temperatures between 0–120 degrees F, and ambient air temperatures of -40 degrees F to 120 degrees F.

If the battery temperatures drop below 0 degrees F the system will automatically start the engine and engage the PTO. The warning strobe will be flashing and the Hybrid light on the dashboard will flash slowly, normal unit operation may continue fusing engine PTO power.

If the Battery temperatures rise above 120 degrees F, the hybrid system will deactivate. The warning strobe will be flashing and the Hybrid light on the dashboard will flash fast, normal unit operation may continue using engine PTO power.

OPERATION

Once the mode of operation (PTO or Hybrid is selected) the aerial device will operate as shown in the Operator’s manual.

OPERATION IN PTO MODE

In PTO mode hydraulic power is from truck engine.

1. Follow instructions in the Operators manual to locate and park the truck.
2. Push switch up to “PTO”.
 - PTO Indicator light is steady on: Indicates PTO is engaged and operational.
 - PTO Indicator light is flashing: Indicates PTO has been selected but has not yet engaged.
3. Return to center “OFF” position to turn off PTO and stop hydraulic flow.



If the PTO cannot be selected, there is a ground fault in the high voltage cable to the electric motor/generator. Spinning the PTO in this condition could energize the chassis.

Ground personnel should toggle the 3-position switch to PTO mode and start the engine. If the Warning Strobe and Hybrid Fault light are still flashing, the auxiliary let down should be used to stow the booms.



OPERATION IN HYBRID MODE

In Hybrid mode power is supplied by the Hybrid batteries.

1. Follow instructions in the Operators manual to locate and park the truck.
2. Turn truck ignition switch "OFF" to stop engine.
3. Turn ignition switch to "ON" but do not start engine.
4. Push switch down to "HYBRID".
 - Hybrid Indicator light is steady on: Indicates Hybrid system is ON and Operational (this may take 10–15 sec.).
 - Hybrid Indicator light is slow flashing: Indicates a Hybrid system fault. System will deactivate/shutdown, continue operating without Auxiliary and HVAC power, or start the engine and continue operating as if in conventional PTO mode.
 - Hybrid Indicator light is fast flashing: Indicates an Emergency Stop button has been depressed or there is a potentially hazardous Hybrid system fault. The hybrid system will be deactivated. To continue using the aerial device, the engine can be started and conventional PTO mode selected with one exception. If there is a ground fault in the motor/generator wire harness neither conventional PTO mode nor Hybrid mode can be used safely. Use the auxiliary let down system to fold the aerial device if necessary.
5. Return to center position to turn off Hybrid mode.

NOTE: Requires the parking brake to be engaged and the transmission in neutral.

Starting the engine with the ignition key while in Hybrid mode will charge the batteries for 30 minutes or until a full state of charge is reached, whichever comes first. The engine will then shut down automatically and continue to operate in hybrid mode.

HYDRAULIC TOOLS

1. Selecting tools will initially start the electric motor in high-speed until the pressure switch in the tool hydraulic circuit is activated, then the electric motor will reduce to low-speed.
If the hybrid system is in an engine charging state, it will remain at low-speed for 30 seconds after the pressure switch deactivates before setting the engine up to high speed for optimal charging.
2. Using the tool again will force the engine back to low-speed.

NOTE: Leave tools ON only when operating tool to conserve battery power.

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BATTERY CHARGING

The batteries can be charged using three methods.

PLUG-IN METHOD (MAINTENANCE CHARGE - 2.5 AMPS)

The primary method is to plug into a 120V/15A wall circuit. Plug-in charging increases the state of charge of the batteries and conditions the batteries to extend their life. It also simultaneously charges the chassis batteries to keep them at peak performance. It is IMPORTANT to plug in after each day of use only if the batteries have been used to a state of required recharging (identified by the initiation of the automatic engine charge). If this state of discharge has not been reached, it is recommended to wait until the system charges automatically on a subsequent day before performing a plug-in charge. No other devices should be powered by the same wall circuit while charging. Depending on the state of charge when plug-in charging is initiated, it will require between eight (8) and sixteen (16) hours to complete the plug-in charge cycle. No damage can be done to the battery during extensive intervals of plug-in charging.

The parking brake must be set, the wheels chocked and the ignition Key must be OFF before charging. The engine is interlocked from starting while charging. First, plug the locking connector of the included extension cord into the hybrid system plug, then plug the standard 3-prong connector into a 120V/15A wall outlet. Once system checks are completed, charging will commence and the charging indicator light will illuminate. The Emergency Stop buttons must be pulled out to successfully perform a plug-in charge or to operate the hybrid normally. If an Emergency Stop button is depressed, the system will go into a fault mode with the hybrid warning strobe and hybrid dash light flashing to indicate the fault. In this fault state, the hybrid will be unable to charge.

ENGINE CHARGE

AUTOMATIC

When in hybrid mode, and engine not running, if the charge from plugging in overnight doesn't last the work day, the engine will automatically start and charge the batteries for a preset time of five (5) minutes to provide approximately 15 minutes of boom use. Hydraulic functions and optional auxiliary power remain operational during the engine charge. Optional HVAC will automatically shut down during engine charging. The use of tools during engine charging will force the engine to low speed, reducing the amount of charge the batteries will receive.

FULL ENGINE METHOD (EQUALIZING CHARGE - 40 TO 90 AMPS)



If the engine is started with the ignition key while in hybrid mode, the batteries will be charged until a full state of charge is reached or for 30 minutes whichever comes first. The engine will automatically shutdown. Hydraulic functions and optional auxiliary power remain operational during the engine charge. Optional HVAC will automatically shut down during engine charging. This method should NOT be used in lieu of the Primary Plug-in Method. Battery life could be drastically reduced. However, this method can be used in combination with plug-in charging to reduce the total amount of time required to fully charge/condition the batteries. A minimum of six (6) to eight (8) hours plugged into 120V/15A wall outlet is then required to condition the batteries after charging with the engine.



The Terex HyPower™ batteries supply 408V and can be lethal. Do not perform any repairs, maintenance, or testing when batteries are connected.



OPTIONS

CONTROL	DESCRIPTION
<p>Outlets (optional)</p> 	<p>The Auxiliary Outlet box will usually be mounted in the front curbside body cabinet. It provides 110V power and contains two 20 Amp duplex receptacles, one 20 Amp locking receptacle, and one 30 Amp locking receptacle. It is rated for 3300 Watts / 3800 Watts peak. All circuits are GFI protected.</p> <p>NOTE: Auxiliary Power can only function while the hybrid system is operational.</p>
<p>Cab comfort (optional)</p> 	<p>To maintain cab comfort without the engine running an optional electric HVAC system is available. The electric HVAC system can only function while the hybrid system is operational. The optional HVAC system will automatically be shut down during engine charging, during this time the chassis HVAC system is available.</p>

HVAC OPERATION

QT QUICK START

Use the COOL, HEAT or AUTO button to start desired function. To adjust setpoint, push plus (+) or minus (-) button to increase or decrease temperature in single increments or press and hold either button to scroll temperature until desired setpoint is reached. The plus button allows the setpoint to increase and the minus button decreases the setpoint. The fan speed automatically adjusts to the temperature difference between the setpoint and inside temperature, or it can be set manually by pushing the fan button.

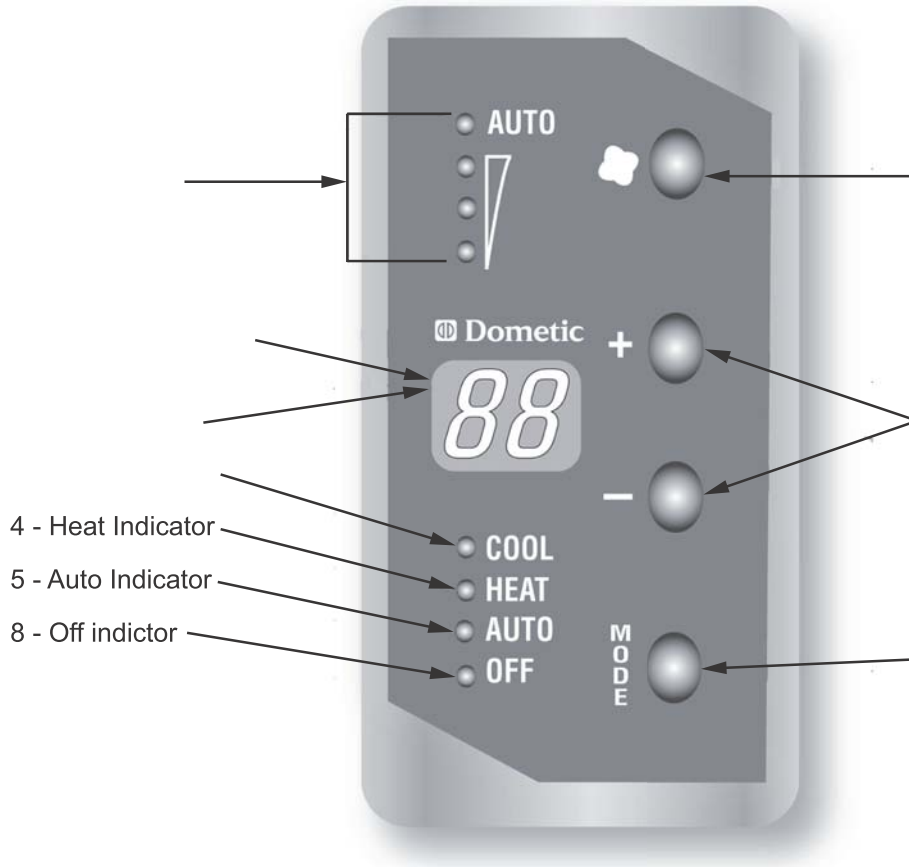
The Qt Control/Display is arranged for logical operation. See next page for Control/Display diagram.

1. Data Display - Large LED readout that provides indication of current setpoint, temperatures, programmed values and fault/error messages.
2. Mode Key - Enables user to cycle through the different modes (refer to indicators). The mode sequence begins OFF, COOL, HEAT, AUTO, OFF.
3. Cool Mode Indicator - Lights when COOL mode is manually selected or when compressor is on during AUTO mode.
4. Heat Mode Indicator - Lights when HEAT mode is manually selected or when heating element is on during AUTO mode.
5. Auto Indicator - Lights when system is in automatic changeover mode. It will switch from cooling to heating as needed. Fan speed is automatically selected.
6. Plus (+) and Minus (-) Keys - Raises or lowers the setpoint. In programming mode, these keys change function numbers and corresponding values. Press and hold keys for large changes.
7. Fan Key - Selects manual fan control. In the OFF mode, pressing this key will start the fan in manual mode.
8. Off Indicator - Lights when the system is de-energized (by pressing the MODE key). Data display remain on. Setpoint adjustments, temperature displays and manual fan controls remain active when the system is in the OFF mode.

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9. Fan Speed Indicators - Row of four small LEDs beside the fan key. The top light indicates the fan is in AUTO mode, the bottom light indicates low fan speed, and the other two lights indicate medium and high speed. When AUTO fan LED is not lit, the fan is in manual mode and fan speed can be adjusted by pressing the fan key.
10. Cooling or Heating Indicator - When COOL or HEAT mode is manually selected, the dot in the upper-left corner in the data display will illuminate when the compressor is running in COOL mode or the heater element is running in HEAT mode.

NOTE: This indicator does not function during AUTO mode. The compressor and heating element "power up" is indicated by the HEAT and COOL mode indicator lights. See sections 3 and 4 above.



THE QT CONTROL/DISPLAY

QT BASIC OPERATION

POWER ON

When AC power is applied to the system at the circuit breaker, the Qt Control/Display microprocessor performs a self-check and retrieves, from permanent memory, the last operating configuration. This process takes about four seconds, after which the system will begin operating just as it had been when power was last turned off.

NOTE: These systems have a two-minute compressor restart delay to allow the system refrigerant pressures to equalize before starting. This delay begins when the compressor shuts down for any reason. This delay is increased by the Compressor Time Delay function so that vehicles with multiple units can be set to prevent all units from turning on at the same time if power is lost and restored.



SYSTEM OFF

Press the OFF key to turn the system off. Note that the data display remains energized even when the system is off. The fan can be turned on manually when the system is in the OFF mode.

NOTE: The Qt has built-in protection against sudden power interruptions. The system automatically stores the current operating configuration in permanent memory every time you make changes. (The new operation mode must be in affect for 30 seconds before it is saved into permanent memory.) When AC power is lost, the Qt system retains these settings, and when AC power is restored it resumes operation using the same settings as before.

SELECTING SETPOINT

Press either plus (+) or minus (-) key once and the setpoint will be displayed. Press either key once more to change the setpoint. Pressing and holding either key will scroll the setpoint temperature. While in setpoint mode, a dot will appear in the top-middle of the display. After three seconds of no key presses, the new setpoint is applied, the dot disappears in the display and the current internal temperature is shown.

DISPLAYING TEMPERATURE

When the unit is in any mode such as OFF, HEAT, COOL or AUTO, the display will show the internal temperature. In order to see the internal temperature when the unit is in program mode, press the fan key twice to save existing data and exit program mode.

COOL MODE

Press the MODE key until the COOL LED lights. Note that the internal temperature must be above the setpoint by approximately three degrees before the compressor is energized and cooling begins. At this point a dot will be illuminated in the upper-left corner of the display indicating the compressor is on. When the internal temperature equals the setpoint the compressor is de-energized and the dot will go off. When the compressor cycles off in any mode, a two-minute compressor delay is initiated. When the compressor is called to run again, it will be delayed for the remaining time left in the two-minute delay and shown on the display.

HEAT MODE

Press the MODE key until the HEAT LED lights. Note that the internal temperature must be below the setpoint by approximately three degrees before the heat element is energized and heating begins. At this point a dot will be illuminated in the upper-left corner of the display indicating the heating element is on. When the internal temperature equals the setpoint the heating element is de-energized and the dot will go off.

NOTE: When the system is in AUTO mode, the HEAT LED will illuminate when the heat element is energized. When the heat element is de-energized, the heat LED will go off.

AUTO MODE

Press the MODE key until the AUTO LED is lit. Note that the COOL or HEAT LED will be lit along with the AUTO LED when the compressor or heating element is energized. If the internal temperature equals the setpoint, only the AUTO LED will be on.

AUTOMATIC FAN SPEED (INTERNAL AIR FLOW)

The internal fan runs continuously in any mode unless the system is turned off (except in Power Saver mode, see heading "POWER SAVER MODE").

Fan operation in continuous AUTO mode is automatic (top LED will be lit) and is based on a temperature differential of internal temperature and setpoint.

In COOL mode or AUTO COOL, the fan speed increases one speed for every degree of change of internal temperature above the setpoint. After 3 degrees F above setpoint is obtained, high fan speed is reached. As internal temperature decreases or approaches setpoint, the fan speed will decrease to medium speed at 2 degrees F above setpoint and low speed at 1 degrees F above setpoint. Upon a further drop in internal temperature, the compressor cycles off and the fan will continue to operate at low speed.

In HEAT mode or AUTO HEAT, the fan increases one speed until 3 degrees F below the setpoint is obtained. At that point the fan will operate at medium speed. As the internal temperature increases or approaches the setpoint, the fan speed will decrease to low speed and stay at that speed. This cycle is continuous using the AUTO function depending on the mode the system is in.

APPENDIX

MANUAL SPEED CONTROL

OFF mode: Pressing the fan button will start the blower in speed 1 (low speed, one LED lit, no AUTO fan LED). Subsequent presses of the fan key will move the fan speed up one speed at a time until speed 3 is reached (high speed) and then it will move down one speed at a time until speed 1 is reached. At this time one more press will turn the fan off and no indicators will illuminate. At high speed, three LEDs will be lit, medium speed, two LEDs will be lit and low speed, only the bottom LED will be lit.

NOTE: The user cannot return the fan speed to AUTO mode while the control is in of mode.

COOL, HEAT or AUTO mode: The default is AUTO fan mode (see automatic fan speed section). When fan button is pressed, the fan will go to manual operation at speed 1 (low speed). Subsequent presses of the fan key will move the fan speed up one speed at a time until speed 3 is reached (high speed) and then it will move down one speed at a time until speed 1 is reached. At this time one more press will return fan back to AUTO mode. During HEAT mode operation, if in AUTO fan mode, maximum speed is medium speed. However, if manual fan mode is initiated, then all three speeds are used.

ADJUSTING DISPLAY BRIGHTNESS

Press the MODE and plus (+) keys simultaneously. Subsequent presses will adjust the LED from a high, medium and low brightness.

PROGRAMMING THE QT DIGITAL/CONTROL SYSTEM

Qt Display/Control systems are programmed at the factory for optimum values. The following programming changes are to be made by a trained technician or with the aid of a factory technician.

All programming is done in the OFF mode. While in the OFF mode, enter program mode by pressing the MODE and minus (-) keys simultaneously for three seconds. The display will flash "PO" during those three seconds. After the three-second flash, a flashing 1 will appear in the display. This 1 is function #1. See the table below. While in program mode, the OFF LED will flash indicating program mode.

Scroll through the different function numbers by pressing the plus (+) or minus (-) key. When the correct function number is displayed, press the MODE key to display the current value. Adjust this value by using the plus (+) or minus (-) key.

NOTE: Some functions denote values or test operations that cannot be adjusted.

Press the fan key to save information. This action will return the user to the current function number. Continue to change and/or observe values by scrolling as described above or press the fan key again to exit program mode and return to OFF mode. When program mode is exited, the OFF LED stops blinking and remains lit.

FACTORY MEMORY RESET

This feature can only be used in the OFF mode.

To restore programmed functions to factory settings: Press the plus (+) and minus (-) keys simultaneously for three seconds. During the three seconds, the display will flash "00" and then a 1 will alternate across the screen until the reset is complete.

FAHRENHEIT/CELSIUS DISPLAY

Factory Default: Fahrenheit

While in OFF mode, enter program mode by pressing MODE and minus (-) keys for three seconds. The display will flash "PO" during the three seconds. After the three-second flash, a flashing 1 will appear on the display, which is function #1. While in program mode, the OFF LED will flash, which indicates program mode. Scroll through the function numbers by pressing the plus (+) or minus (-) key until #2 is displayed. Press the MODE key and the current value is displayed Degrees F or Degrees C. Use the plus (+) or minus (-) key to change the value and then, press fan key twice to save information and exit program mode.

LOW FAN SPEED ADJUSTMENT

Factory Default: 38

The lowest fan speed can be adjusted to suit individual preferences. For instance, the user may wish to decrease the low fan speed setting in the sleeper compartment to minimize fan noise.



LEAVING THE JOB SITE

1. Ensure the 3-position PTO/Hybrid switch is in the OFF (centered) position.
2. Be sure the PTO is disengaged and the Hybrid system is NOT operational before travel.
3. Follow all other instructions in the Operator's Manual for leaving the job site and traveling.

FREQUENT AND PERIODIC INSPECTION INTERVALS

In addition to the frequent and periodic inspection intervals shown in the unit manuals, the following must be performed for the HyPower system.

DAILY

1. Visually check cables at the battery boxes and auxiliary power box for damage.
2. Visually check motor/generator for damage and hydraulic fluid leaks.
3. Check emergency stop following proper procedure:
 - a. Depress one emergency stop switch prior to selecting hybrid mode.
 - b. Select hybrid mode and verify Hybrid dash light and Warning Strobe is flashing and that none of the enable functions are operational.
 - c. Reset the emergency stop switch and repeat for each emergency stop switch.
4. Check if hydraulic oil is leaking from the bottom center drain of the hybrid system enclosure. If there is evidence of hydraulic oil leaking from the drain, do not operate in either hybrid or PTO mode. Maintenance from qualified service personnel is required.
5. The plug in method of charging **SHOULD** be used whenever the truck is not in use. No damage can be done to the battery during extensive intervals of plug in charging.

30 DAYS (120 HOURS)

Perform an equalizing charge by starting the engine while in hybrid mode. The engine will throttle up and run for 30 minutes or until the batteries are fully charged. If the engine stops due to the 30 minute time limit, allow the system to cool for 60 minutes before performing a second equalizing charge. Follow this by a full 8 hour plug-in maintenance charge.

Failure to perform this equalizing sequence will cause the batteries to become unbalanced and require tear down to charge batteries individually.

Follow this procedure when performing the equalizing charge:

1. Run the unit until the automatic charge has been initiated.
2. When the engine turns off then activate the equalizing charge.
3. Perform an equalizing charge before parking for the night.
4. Plug in overnight for at least 8 hours to reach a full state of charge and complete the conditioning phase.

180 DAYS (720 HOURS)

1. Check tightness of auxiliary outlet box bolts, motor/generator attachment bolts, system enclosure bolts, and battery pack bolts for proper torque.
2. Remove the drain plugs at the bottom of the battery boxes to check for water.
3. Check oleophobic gas vents for obstructions and blockages.

360 DAYS (1440 HOURS)

1. Clean and/or replace the air filter installed inside the longbox vent.

APPENDIX

MAINTENANCE GUIDELINES

Additional precautions prior to any maintenance or inspection:

1. To prevent unauthorized use during inactivity remove the ignition key.
2. One of the emergency stop switches (typically driver side) accommodates a padlock. Depress it and use your company's lockout/tagout procedures.
3. Starting means rendered inoperative and/or PTO clutch solenoid power disconnected. (If the PTO is engaged and spinning, the motor/generator is spinning and producing up to 500V within its wire harness.)

OPERATIONAL TESTS

Perform all operational tests in both conventional PTO mode and Hybrid mode.

STORAGE PROCEDURE

To protect the life of the batteries, the vehicle should be stored where the Hybrid system can be plugged into a 120V/15A wall circuit when not in use. Unit must be stored in an area where temperatures remain within the system operating temperature range (0 to 120°F) to allow charging. When plugging the unit in, verify that the hybrid charge indicator light comes ON approximately 30 seconds after plugging the unit in. If the light does not come on, verify that the electrical outlet and charging cord are functional. While in storage, a plug-in charge must be performed every 6 months (180 days).



