



# Advanced Hybrid System Operation / Maintenance Manual





## **IMPORTANT SAFETY INFORMATION**

IT IS YOUR RESPONSIBILITY to be completely familiar with the warnings and cautions in this manual. These warnings and cautions advise of specific methods or actions that can result in personal injury, equipment damage, or cause the equipment to become unsafe. These warnings and cautions are not exhaustive.

Odyne Systems, LLC (Odyne) could not possibly know, evaluate, or advise the service trade of all conceivable procedures by which service might be performed or of the possible hazardous consequences of each procedure. Accordingly, **ANYONE WHO USES A SERVICE PROCEDURE OR TOOL WHICH IS NOT RECOMMENDED BY ODYNE MUST** first be thoroughly satisfied that neither personal safety nor equipment safety will be jeopardized by the service methods.

Odyne has integrated an advanced hybrid system to the Allison transmission. Vehicle manufacturers integrate Allison transmissions into vehicles used for a variety of vocations and services. The vehicle manufacturer is responsible for identifying the specific operating conditions, in which the vehicle will be subjected and to communicate the appropriate means for preventing unintended vehicle movement within those conditions, in order to ensure vehicle and operator safety.

The vehicle owner and operator should be aware of and follow the vehicle manufacturer's operating instructions and warnings related to parking and preventing unintended vehicle movement.

Proper service and repair is important to the safe and reliable operation of the equipment. The service procedures recommended by Odyne (or Allison Transmission or the vehicle manufacturer) and described in this manual are effective methods for performing service and diagnostic operations. Some procedures require using special tools. Use special tools when and in the manner recommended.

The **WARNINGS, CAUTIONS, and NOTES** in this manual apply only to the Odyne advanced hybrid system and not to other vehicle systems which may interact with the hybrid system. Be sure to review and observe any vehicle system information provided by the vehicle manufacturer and/or body builder at all times the Odyne hybrid system is being serviced.

## DEFINITION OF WARNINGS, CAUTIONS, NOTES

Three types of headings are used in this manual to attract your attention:



**WARNING:** A warning is used when an operating procedure, practice, etc., which, if not correctly followed, could result in personal injury or loss of life.



**CAUTION:** A caution is used when an operating procedure, practice, etc., which, if not strictly observed, could result in damage to or destruction of equipment.



**NOTE:** A note is used when an operating procedure, practice, etc. is essential to highlight.



## ELECTRICAL SAFETY

Odyne advanced hybrid system uses potentially hazardous electrical energy. All hybrid system components are identified with warning labels or symbols (see Section 2, safety decal installation guidelines for hybrid vehicles).

DO NOT attempt to service components containing potentially hazardous electrical energy if you are not trained to do so.

In the event of an accident, please refer to Odyne documentation and OEM documentation for first responder emergency personnel procedures to safely shut down vehicle systems.

All persons working with potentially hazardous electrical energy should familiarize themselves with safe electrical work practices. Refer to publicly available documentation that can assist a technician in developing the safe electrical work practices required to service the Odyne hybrid system electrical system. Do not attempt to service the electrical system if not trained to do so. Contact your nearest Odyne service center. To find your nearest Odyne service center call Odyne at 262-544-8405.



## HIGH VOLTAGE SAFETY FEATURES

All high voltage cables are covered in orange wire insulation and labeled.

Every high voltage device is clearly decalced with a warning or danger label.



Hybrid trucks should not be parked long term or out of service for extended long terms without charging of the batteries, which could shorten the life of the batteries.

All negative and positive high voltage cables are isolated from metal to prevent any shock by touching the metal chassis.

The high voltage DC cables contain an interlock loop that will shut down the high voltage system if they become loose or disconnected.

An inertia switch is mounted to the truck frame and will open the high voltage circuit in the event of an accident. The hybrid system will not operate unless it is inspected by Odyne personal and the inertia switch is reset.



**WARNING: DO NOT** rely on the hybrid vehicle interlock (HVIL) or control systems to de-energize the system. Always perform the electrical disconnect verification procedure to be sure the system is discharged before servicing components.

**DO NOT** attempt to bypass any high voltage interlock for any reason. Tampering with the HVIL may result in injury. Failure to follow proper safety procedures may result in serious personal injury or death.



## WARNINGS AND CAUTIONS



**WARNING:** Always turn ignition key to off position and remove key from ignition and follow Lockout Tag Out procedures to disable before servicing the hybrid system.



**WARNING:** The hybrid system may start up automatically if it is not disabled.



**WARNING:** Never service the vehicle unless the hybrid system is disabled.



**WARNING:** Before welding, the 12 volt chassis batteries must be disconnected and isolated, the battery box must be protected from excessive heat, and **CAUTION** must be observed around the high voltage (orange) cables.



**WARNING:** Do not cut into high voltage cables. **WARNING:** Do not cut into, open, or disconnect batteries. **WARNING:** Do not



cut, open, or remove the DC/DC converter. **WARNING:** Do not



cut into, open, or remove the high voltage junction box.



**WARNING:** Disable hybrid system before inspecting, servicing or replacing fuses.



**WARNING:** High voltage cables should be capped when being serviced.



**WARNING:** Use CO<sub>2</sub> or dry chemical fire extinguishers. Do not use water to extinguish a fire on this truck!



**WARNING:** Use only qualified service personal to service and repair this hybrid vehicle.

## Introduction

### Owners and Users

Thank you for choosing Odyne Systems, LLC for your Plug-in Hybrid Electric Vehicle (PHEV) system. User safety is Odyne's number one priority and is best achieved through the efforts of users and Odyne Systems.

Equipment users make a major contribution to safety by:

1. Complying with OSHA, Federal, State, ANSI, local and company regulations/standards.
2. Reading, understanding and following the instructions in this manual and other manuals supplied with this vehicle. This manual must remain with the vehicle at all times.
3. Only allow trained users, directed by informed and knowledgeable supervisors, to run the unit.

If there is anything in this manual that is not clear or may need to be added, please send comments to:

**Odyne Systems, LLC**  
**Phone:** (262) 544-8405  
**Email:** info@odyne.com  
**Web:** www.odyne.com



**This symbol means your safety is involved! Read, understand and follow all danger, warning and caution decals and instruction on your PHEV equipment and in this manual.**

This manual contains important information on the safe use of a PHEV system. Failure to read, understand and follow all safety rules, warnings, and instructions will unnecessarily expose the unit's user and others to dangerous situations. For the user's safety and the safety of those around the user, the user **MUST** operate the PHEV system as instructed in this manual.

The user is the single most important factor for safety when using any piece of equipment. Learn to operate the PHEV equipment in a safe manner.

To help the user recognize important safety information, Odyne Systems has identified warnings and instructions that directly impact safety.



**DANGER:** Indicates an imminently hazardous situation, which if not avoided, will result in death or serious injury.



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



**CAUTION:** Indicates a potentially hazardous situation, which if not avoided, may result in minor or moderate injury.



**CAUTION:** Used without the safety alert symbol indicates a situation, which if not avoided, may result in property damage.



**NOTE:** A note is used when an operating procedure, practice, etc. is essential to highlight.



**NOTE:** The best method to protect the user and others from injury or death is to use common sense. If the user is unsure of any operation, do not continue until the user is satisfied that it is safe to proceed.



**WARNING: In addition to maintenance and operating instructions in this manual, the operator must read and understand instructions in any manuals provided by other manufacturers.**

1. Study all safety messages and apply them while using the equipment.
2. Modifications to this PHEV equipment from the original design specifications without written permission from Odyne Systems, LLC are strictly forbidden. A modification may compromise the safety of the PHEV equipment, subjecting users to serious injury or death. Any such modification will void any remaining warranty.

**Consult Odyne Warranty document and/or Odyne Engineering prior to adding, modifying or servicing hybrid system components.**

3. Odyne Systems, LLC reserves the right to change, improve, modify or expand features of its equipment at any time. Specifications, model or equipment are subject to change without notice and without incurring any obligations to change, improve, modify or expand features of previous delivered equipment.
4. Comply with manufacturer's instructions and requirements of current OSHA regulations and ANSI standards, FMVSS standards, and any other standards that are applicable.

**Acronyms used in this manual:**

ANSI: American National Standards Institute

ECM: Electronic Control Module

ePTO: Electric Power Takeoff

EVSE: Electric Vehicle Supply Equipment

FMVSS: Federal Motor Vehicle Safety Standards

FSM: Final Stage Manufacturer

LED: Light Emitting Diode

MSDS: Material Safety Data Sheet

OEM: Original Equipment Manufacturer

OSHA: Occupational Health and Safety Administration

PHEV: Plug-in Hybrid Electric Vehicle

RPM: Revolutions Per Minute

SAE: Society of Automotive Engineers

SOC: State of Charge

VDC: Volts Direct Current

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# 1 Overview

This vehicle is equipped with an Odyne Plug-in Hybrid Electric Vehicle (PHEV) Propulsion System. Odyne Systems, LLC specializes in advanced hybrid systems for medium and heavy duty vehicle applications.

The vehicle is capable of zero-emission, all-electric, stationary operation (Electric Power Take Off mode), and also provides increased fuel economy in hybrid driving mode.

The information in this document is a guide to the PHEV system and equipment operation. All other information pertaining to non-Odyne equipment is available directly from the manufacturer.

This vehicle is equipped with high-voltage lithium-ion battery pack(s). When fully energized the combined system voltage is 300-400VDC. When the system is de-energized each battery pack has 300VDC internally. All high voltage cables are orange in color and/or covered in orange loom.

The hybrid system has been designed to be minimally intrusive and does not internally modify the OEM powertrain. It is a parallel hybrid system that assists while driving and provides full electric stationary operation.

Please feel free to contact Odyne Systems, LLC with any questions or concerns.

**Odyne Systems, LLC**

**Phone:** (262) 544-8405

**Email:** info@odyne.com

**Web:** www.odyne.com



**NOTE:** The figures, pictures, and locations are for reference only and may not match your vehicle.

# The Benefits of the Odyne Hybrid System

Increased Fuel Economy and Emission Reductions:

**Launch Assist** is the ability to input up to 50 additional horsepower to the diesel engine, by the electrical motor power from the energy stored in the lithium-ion battery system to accelerate the truck from a stopped position to save fuel. Launch assist is activated by a dash-mounted switch.

**Regenerative Braking** is achieved by slowing the truck down and removing the foot off the accelerator or stopping. This allows energy to be recovered by generating electricity to charge the lithium-ion batteries, thus also slows the truck down to reduce wear on brakes. (Note: when batteries are at full state of charge (SOC), regenerative braking will not activate.) Launch assist and regenerative braking is activated by the same dash-mounted switch.

**ePTO** is the operation of the truck at job sites with the engine turned off and operating off the storage batteries for smooth and quiet operation of the work attachments. The lithium-ion batteries provide approximately 6-8 hours of quiet operation before recharging is needed. When the system's lithium-ion batteries reach 5% SOC, the diesel truck engine will automatically start up and begin to recharge the batteries to 30% SOC. This reduces the engine operating time, for less wear on the engine, and increases fuel economy.

**Battery Recharge** from the plug-in utility is designed to be done at the 30% SOC to 100% SOC battery levels to take advantage of the lower cost of utility electrical energy and night rates. This further reduces the operation costs and increases fuel economy. Note: the truck's horn will sound before the engine starts up.

**Air Conditioning and Heating Systems** can be operated by battery with the engine not in operation. This reduces engine idling and maintains cab comfort to further reduce fuel consumption.

**Recharge and Maintain Truck Chassis Battery** to operate accessories and assist in cold starting conditions using the power from the hybrid batteries.

# Fuel Efficiency

Fuel efficiency during driving may vary depending upon many factors. The following guidelines below can help maximize the benefits of the Odyne Hybrid System and conserve fuel.

## **Drive Sensibly:**

Aggressive driving (speeding, rapid acceleration and braking) wastes fuel. It can lower your mileage at highway speeds and around town. Sensible driving is also safer for you and others.

## **Observe the Speed Limit:**

While each vehicle reaches its optimal fuel economy at a different speed (or range of speeds), fuel mileage usually decreases rapidly at speeds above 50 mph. Observing the speed limit is also safer.

## **Remove Excess Weight:**

Avoid keeping unnecessary items in your vehicle, especially heavy ones. Extra pounds in your vehicle could reduce your fuel mileage. Reduced fuel consumption is based on the percentage of extra weight relative to the vehicle's weight.

## **Avoid Excessive Idling:**

Idling can use up to one gallon of fuel per hour, depending on the engine size and air conditioner (AC) use. Turn off your engine when the vehicle is parked. It only takes a small amount of fuel to restart your vehicle.

## **Use Cruise Control:**

Using cruise control on the highway helps you maintain a constant speed and, in most cases, will save fuel.

## **Use Overdrive Gears:**

When you use overdrive gearing, your vehicle's engine speed goes down. This saves fuel and reduces engine wear.

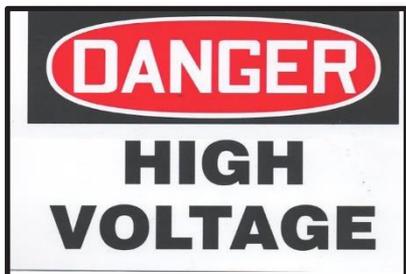
*Source of information: [www.fueleconomy.gov/feg/driveHabits.shtml](http://www.fueleconomy.gov/feg/driveHabits.shtml)*

# 2 Safety Decal Installation Guidelines for Hybrid Vehicles

The installation requirements for safety decals on PHEV systems and related components are shown in this section. Warning labels should be installed according to the following guidelines. This applies to the hybrid system and does not account for the OEM or FSM decals.

## Safety Decal Locations

1. “Danger High Voltage” decal (**P/N 60003-00**) on all high voltage Odyne components. The high voltage components are listed below.
  - Electric Motor & Inverter Bracket
  - Battery charger
  - DC-DC converter
  - Exportable power inverter
2. “Danger: Electrical Equipment, Authorized Personnel” decal (**P/N 66003**) on the following enclosures:
  - High Voltage Junction Box
  - Air conditioning controller box (as needed)
3. “Danger: Moving Machinery. Keep hands and feet clear.” decal(s) (**P/N 60007-00**) near or on the electric motor/driveshaft area.
4. One (1) “Warning: Hot Surface, Do Not Touch” decal (**P/N 60006-00**) on or near the hydronic heater and A/C compressor.
5. “Danger: This Equipment Starts Automatically. Keep Away From Driveline Area. You May Get Hurt” decals (**P/N 60010-00**) on each side of cab on the lower corner of the door.
6. Lightning Bolt Symbol decals (**P/N 60005-00**) are applied to the following components:
  - Electric motor
  - Air conditioning controller box
7. Air Conditioning warning label decal (**P/N 60015-00**) mounted near the air conditioning charge ports.



P/N 60003-00



P/N 60004-00



P/N 60005-00



P/N 60006-00



P/N 60007-00



P/N 60010-00

COMPRESSOR W/TC:	SAE 8029	CAUTION: USE ONLY PVE REFRIGERANT OIL.	Oil Type: Identical to FORD (2.8 qt (270.4cc))
CHARGE LEVEL (1.00 lbs)	22.46 (9.93 kg)	DO NOT USE PAG/POE OIL. PAG/POE OIL WILL CAUSE IMMEDIATE COMPRESSOR DAMAGE.	
REFRIGERANT:	R-134A	CAUTION: HIGH PRESSURE SYSTEM TO BE SERVICED ONLY BY QUALIFIED PERSONNEL.	ODINE Odyne, LLC Waukegan, IL, USA

P/N 60015-00

# 3

## Vehicle Controls



Figure 1. Vehicle Ignition (top) and Gear Selector (bottom)

### Vehicle Ignition

The vehicle ignition (top arrow) is used for normal startup of the vehicle's systems. In the "Off" position, all vehicle systems are turned off. In the "On" position, the hybrid system can be functional with or without the engine operating. The brand of truck may have slightly different controls as in Figure 1.



**NOTE:** The engine can be started with the ignition key or remote started by the hybrid system.

### Gear Selector

The gear selector (bottom arrow) switches between the drive, reverse and neutral settings of the transmission. The Odyne system does not affect this control.



Figure 2. Launch Assist/Regenerative Braking Switch

## Launch Assist/Regenerative Braking Switch

The hybrid propulsion system uses launch assist/regenerative braking while driving. Depressing this switch will disable the launch assist/regenerative braking system. Switch illuminates red when disabled. This feature is reset each time the ignition key is turned off.



**NOTE:** It is recommended that launch assist/regenerative braking NOT be used in dangerous road conditions (i.e. ice or snow conditions).



**NOTE:** Regenerative braking may not be available when the battery is fully charged at the beginning of a drive.



**NOTE:** Launch assist/regenerative braking will be disabled during an ABS/Traction control event.



Figure 3. Electric Power Take Off (ePTO) Switch

## Electric Power Take Off (ePTO) Switch

This switch allows the user to enter ePTO mode. The switch will illuminate green when enabled. The switch must be in ePTO mode to operate the vehicle's equipment, exportable power and the heating or air conditioning in the cab (if equipped). This feature is reset each time the ignition key is turned off.



**NOTE:** The hybrid system will automatically shutdown or restart the vehicle as needed. Keep away from driveline area. Do not crawl under vehicle while the ignition key is on and the ePTO switch is engaged.



**WARNING:** Do not leave vehicle with ePTO switch engaged and ignition in "on" position while vehicle is parked within an enclosed area. Vehicle can start automatically and run while the vehicle is parked within an enclosed area.



**NOTE:** If the switch is illuminated red (solid or flashing) the hybrid system is faulted or disabled. This will return the truck to conventional (non-hybrid) operation mode.



**Figure 4. Auxiliary Air Conditioning Switch**

## Auxiliary Air Conditioning Switch (if equipped)

This switch allows the user to enter into auxiliary air conditioning mode. When the switch is pressed the auxiliary air conditioning system will turn on. The switch will illuminate blue when enabled. This feature is only available in ePTO mode. This feature will reset each time the ignition key or ePTO is turned off.



Figure 5. Auxiliary Heating Switch

## Auxiliary Heating Switch (if equipped)

This switch allows the user to enter into auxiliary heating mode. When the switch is pressed the auxiliary heating system will turn on. The switch will illuminate red when enabled. The existing OEM controls vary the fan speed and temperature. This feature is only available in ePTO mode. This feature will reset each time the ignition key or ePTO is turned off.



**NOTE:** The vehicle's HVAC controls for heat will be active in ePTO mode. While the auxiliary heating is in use, the vehicle's dash-mounted HVAC controls for air distribution and temperature are still functional. Only the auxiliary air conditioning (if equipped) is controlled separately from the vehicle's dash-mounted HVAC controls methods.



Figure 6. Exportable Power

## Exportable Power (if equipped)

The exportable power system is used to provide electrical power for other tools and equipment. The switch will illuminate green when enabled. This feature is available in ePTO mode or while driving in ePTO mode. This feature will reset each time the ignition or ePTO is turned off.



**NOTE:** Power (120V or 240V) outlets may be located in multiple locations by FSM.



**Figure 7. Application Switch**

## Application Switch (if equipped)

The Application Switch enables any additional equipment if required and installed by the FSM. The switch will illuminate green when enabled. This feature will reset each time the ignition key or ePTO is turned off.



**NOTE:** Required for air compressor applications.

# 4 Modes of Operation

## Hybrid Operating Mode

The user enters operating mode by turning the ignition key to the start position until the engine starts. Push the switch to hybrid mode and operate as a standard truck. This mode is always on to provide the greatest fuel economy available for the vehicle while operating except when launch assist/ regenerative braking is disabled.

## Launch Assist

Once the operator presses on the accelerator, the vehicle will accelerate as normal, the Odyne System automatically engages the electric motor to provide launch assist. The additional torque added by the motor offsets fuel usage improving fuel economy while operating.

## Regenerative Braking

When the accelerator is released or when the brake pedal is pressed, the electric motor becomes a generator and provides resistance to the drivetrain to help slow the vehicle. This energy is returned to the batteries, and is called regenerative braking.



**NOTE:** There is a launch assist/regenerative braking switch on the dashboard of the vehicle. For most operating conditions the switch is left on. During dangerous road conditions, such as snow and ice, the launch assist/regenerative braking switch can be turned off.

## Operating the Vehicle

Starting the hybrid vehicle and placing it into gear is identical to the procedure for the standard vehicle. No additional steps are required.



**NOTE:** The Odyne system intelligently switches between launch assist and regenerative braking while the vehicle is being operated.



**NOTE: HIGH WATER, the vehicle cannot be driven through standing water deeper than the center of the wheel hubs.**



**NOTE:** The Odyne System does not limit OEM towing specifications.

## Electric Power Take Off (ePTO) Mode

The ePTO mode provides power for equipment, heating and/or air-conditioning of the cab (optional) and AC electrical power (optional) from the hybrid system when the vehicle is stationary. To enter this mode, the driver must depress the ePTO switch, but only after verifying the following conditions:

- Ignition switch is in the on position
- Transmission is in neutral
- Parking brake is set
- Vehicle's hood must be closed

The lamp on switch confirms proper entrance into the ePTO mode (switch illuminates green). The system may now be used regardless of whether the engine is running or not.



**NOTE:** If switch illuminates red, system has a fault or the hybrid system is disabled.



**NOTE:** If the hood is open the system can operate in ePTO but the engine will not be allowed to start.



**NOTE:** When the hybrid system reaches a low state of charge (approx. 5% SOC ), the system will initiate engine charging. The vehicle's horn will honk twice before entering this mode. If the vehicle's hood is open, the vehicle's horn will honk five times (see NOTE: below) and the engine will not start.



**NOTE:** If the engine cannot be started, due to the hood open or other conditions, system will honk the horn five times. If the condition is not corrected, the hybrid system will shut down when SOC is below 5% and the ePTO powered equipment will cease operation.

## Low State of Charge (SOC) Engine Recharging

If you enter ePTO with low SOC, the engine will keep running until batteries are charged when in ePTO mode. If the engine is off when the ePTO button is pushed, the engine starts automatically. The electric motor acts as a generator to charge the hybrid batteries. The user has full control of the vehicle's equipment at this time.

If the batteries are depleted in ePTO mode the vehicle's horn will honk twice and the engine will turn on to recharge the batteries.

## High State of Charge (SOC) Engine Recharging

If you enter ePTO with high SOC, the engine is automatically turned off. The user has full control of the vehicle's equipment at this time.



**NOTE:** The Odyne system automatically manages the engine during this time. It will continue to cycle between low and high state of charge as long as needed.

## Powering the Equipment

The equipment on this hybrid vehicle can be powered electrically, rather than with the vehicle's engine. To power the equipment, certain procedures must be followed. If the vehicle has just arrived at a location and the engine is running, do the following:

1. Place transmission in neutral.
2. Set parking brake.
3. Verify vehicle hood is closed.
4. Press the ePTO switch.
5. After a few seconds, the hybrid system will intelligently decide to either keep the engine on to charge the batteries or turn off the engine to save fuel.

If the vehicle has been parked at a location and the engine is off, do the following:

1. Turn the ignition key to the on position, but do not start the engine.
2. Verify the parking brake is on and the transmission is in neutral.
3. Verify vehicle hood is closed.
4. Press the ePTO switch; the lamp should light up (Figure 3).
5. After a few seconds the hybrid system will intelligently decide to either turn on the engine to charge the batteries or leave the engine off to save fuel.



**NOTE:** In case of a hybrid system failure, the equipment can be operated from the engine. The PTO, powered by the engine, can be utilized by depressing the ePTO switch.



**Figure 8. Plug-in Port**

## Plug-in Charging Mode

The Plug-in Charging Mode charges the hybrid batteries from grid power. To enter this mode, the vehicle's ignition switch shall be in the "Off" position, parking brake applied, and a charge cord plugged into the receptacle (Fig. 8). The operator interface screen, within the dashboard displays charging status. The vehicle is fully charged when the operator interface screen shows a fully charged status ( $SOC \geq 90\%$ ). The vehicle cannot be operated while it is plugged in. To operate the vehicle or use the ePTO mode, the user **MUST** unplug the charge cord. The vehicle will not start with the plug-in charge cord plugged in.

- NOTE:** The 12V chassis batteries will also be charged when vehicle is plugged in.
- NOTE:** The system must complete a full plug-in charge on a daily basis, when the truck is used every day.
- NOTE:** Charge station (EVSE) must be SAE J1772 compliant.
- NOTE:** Vehicle should be plugged in whenever possible. Failure to do so could void warranty.
- NOTE:** The End User is responsible for maintaining the battery system when placed in long-term storage. Failure to maintain the battery system may result in high cell imbalance or system depletion. These two conditions may have an adverse effect on the battery's ability to perform as intended, and may have an adverse effect on battery life and warranty.

# Battery Storage Environment

Whenever the battery is not in use, the battery must be stored according to the following instructions:

- For battery packs not installed on a vehicle, contact Odyne Service.
- For batteries installed on a vehicle, store in an environment that is thermally controlled between  $-40^{\circ}\text{C}$  and  $60^{\circ}\text{C}$ .
- Prior to extended storage of the system, insure the battery is charged to approximately 70% SOC ( $\sim 3.775 \text{ V} * \text{number of cells in the unit}$ ).
- The storage area must be protected and equipped with fire-fighting equipment as specified in the applicable MSDS, under the section 5, Fire Fighting Measures.

## Storage Inspections

During initial storage, periodic inspections (once per month) of the battery's condition are recommended.

- If the battery's State of Charge (SOC) has not degraded by more than 3% after one month, three month inspections are allowed.
- During extended periods of storage intervals, maintain the battery at or above 50% SOC ( $\sim 3.626 \text{ V} * \text{number of cells in the unit}$ ).
- If the delta voltage between the maximum cell and minimum cell exceeds 100 mV, the battery should be balanced.

## 5

## Vehicle Status Indicators



Figure 9. Operator Interface Screen, showing Vehicle Information

## Operator Interface Screen

The Operator Interface screen is mounted in the vehicle cab and provides information about the operation of the hybrid system. It displays the battery state of charge (SOC) as the default screen.

Push buttons toggle through different screens to display faults, warnings, battery state of charge (SOC), battery voltage, and hours of operation. The display information is useful for maintenance and troubleshooting problems with the hybrid system.

Operators are not required to look at this display during normal operation. If fault screen is displayed during operation which would limit or prohibit auxiliary functions, the fault number should be reported to Odyne Systems at (262) 544-8405.



**NOTE: Hours Displayed on Interface Screen:**

- PTO hours is the total operation time on the truck.
- Application hours is the amount of time the utility tool or device has operated.

# 6

## Maintenance

### Vehicle Chassis, Body, Equipment

Follow all normal Original Equipment Manufacturer's (OEM) recommendations.

### Odyne System

#### Hybrid System Frequent and Periodic Inspection Intervals

See Appendix, page 34.

#### Welding on Vehicle

- Ignition off, charge port disconnected
- Follow normal OEM recommendations.



**NOTE: Electronic enclosures should not be opened by anyone other than authorized Odyne personnel.**



**NOTE: If the vehicle ECM is serviced by any truck service center make sure the custom chassis logic is re-installed. Contact Odyne for software updates for ECM and RPM.**

#### Jump Starting or Charging Chassis Batteries

- Follow normal OEM recommendations.
- Charge port disconnected
- Ensure good connection to 12V positive and negative

## Air Conditioning Service Warning

The Odyne air conditioning system has been specifically designed to work with high voltage PHEV applications. Care must be used when recovering and recharging the refrigerant of the air conditioning system to maintain safe operation. Failure to follow these directions will result in permanent damage and result in operational errors of the PHEV system. The following materials must be used with the Odyne air conditioning system.

Refrigerant – R134a

Oil - Idemitsu FVC68D (Use of non-approved or contaminated oil voids the warranty.)

# 7 In Case of Emergency

If the vehicle is involved in an accident or if there are signs of a fire on board the vehicle, remain calm. Exit the vehicle and move away immediately. Be sure to set up warnings and perform any necessary measures to keep people away from the vehicle. Call 911 for emergency assistance.

In case of fire, use approved extinguishing methods.

Please see MSDS for specific handling and reactivity information.

## First Responders Information

First responders must be made aware of vehicle information and specifications. This vehicle contains:

- Diesel or gasoline engine
- Lithium-ion batteries
- High-voltage wiring in orange looms

## Towing

Unless otherwise specified by vehicle manufacturer, most chassis can be towed using standard lifting and towing practices. Although using a flatbed to transport the vehicle is always best, standard lift towing is acceptable. If the vehicle is lifted from the front and is towed under 55MPH, it is not necessary to remove the driveshaft or axles.

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Rev Level	Revision Date	Description of Changes			
01	10/26/05	Initial release			
02	01/13/09	Revised per JCS Milwaukee requirements			
03	03/24/09	Revised Document Number, Formerly MK-MOS-FR-09-44. Updated JCS Logo			
04	04/19/10	Added qualifying statement to Transport Information (Ref: Section 11).			
05	10/03/11	Removed JCS references			
06	03/23/2012	Add metal oxide exposure limit info for NMC & NCA, per OSHA 1910.1000.			
07	03/01/2013	Remove UN 3090 Classification; Add Shipping Compliance info; recommended storage temperature range; SOC Recommendation			

1. IDENTIFICATION	
<b>Product</b>	<b>Rechargeable lithium-ion single cells, modules and multi-cell battery packs</b>
<b>Synonyms / Common Name</b>	<b>Sealed Lithium Ion Battery</b>
<b>Chemical Family/Classification</b>	<b>Electric Storage Battery</b>
<b>HMS Rating</b>	<b>Sealed Lithium Ion Battery</b> <b>Health – 0 Flammability – 0 Reactivity – 0</b> <b>Organic Electrolyte</b> <b>Health – 3 Flammability – 3 Reactivity - 2</b>
<b>USDOT, IATA and IMO Description</b>	<b>UN3480 PG II classification for Lithium Batteries (all modes).</b> <b>Cells have been tested to UN Manual of Test Criteria Part III, sub-section 38.3. Consult Johnson Controls for Declaration of Conformity documentation, as needed.</b>
<b>Company Name</b>	Johnson Controls, Inc. – United States 5757 North Green Bay Avenue Milwaukee Wisconsin 53209 USA Tel. No. (414) 524-2459 Fax. No. (414) 524-2800
<b>Emergency contacts</b>	(703) 527-3887 (CHEMTREC US Service Center) Within the USA (800) 424-9300 Account 12008

**NOTE: The Johnson Controls sealed cell/battery is considered an article as defined by 29 CFR 1910.1200 (OSHA Hazard Communication Standard). The information contained in this MSDS is supplied at the customer's request for information only.**

## CAUTION

**Do not over charge, short circuit, puncture, incinerate, crush, immerse, force discharge or expose to temperatures above the declared operating temperature range of the product - possible risk of fire or rapid component disassembly. The rechargeable lithium-ion batteries described in this Material Safety Data Sheet are sealed units which are not hazardous when used according to the recommendations of the manufacturer.**

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Under normal conditions of use, the electrode materials and liquid electrolyte they contain are not exposed to the outside, provided the battery integrity is maintained and seals remain intact. Risk of exposure only in case of abuse (mechanical, thermal, electrical) which leads to the activation of safety valves and/or the rupture of the battery container. Electrolyte leakage, contamination of electrode materials, mixture with moisture/water or battery vent/fire/rapid component disassembly may follow, depending upon the circumstances.

2. HAZARDOUS INGREDIENTS				
Each cell consists of a <u>hermetically sealed</u> container enclosing a number of chemicals and materials of construction of which the following could potentially be hazardous upon release.				
Material	Content % by Weight*	CAS Number	Exposure Limits	CHIP Classification
Mixed Metal Oxide (may include nickel, iron, cobalt, phosphorus, lithium, manganese, and/or aluminum oxide compounds)	10 – 25	Mixture	<p>NMC/NCA:</p> <p><b>OSHA</b> 1910.1000 Table Z-1 - Co 0.1 mg/m<sup>3</sup> TWA (as Co dust) ; Ni – 1.0 mg/m<sup>3</sup> TWA (as Ni dust); Mn – 5.0 mg/m<sup>3</sup> TWA (as Mn dust); Al/Al oxide – 5.0 mg/m<sup>3</sup> TWA (as Al dust)</p> <p><b>ACGIH</b> - Co 0.05 mg/m<sup>3</sup> TWA (as Co dust) ; Ni – 0.05 mg/m<sup>3</sup> TWA (as Ni dust); Mn – 0.2 mg/m<sup>3</sup> TWA (as Mn dust); Al – 1.0 mg/m<sup>3</sup> TWA (as Al dust)</p>	R22, R36, R37, R43 S2, S22, S24, S26, S36, S37, S39, S45
Carbon Solids	10 – 25	1333-86-4 7782-42-5	<p><b>OSHA</b> - 3.5 mg/m<sup>3</sup> TWA (as C dust); 15 mg C/ m<sup>3</sup> TWA<sup>3</sup> (as total graphite); 5 mg C/ m<sup>3</sup> TWA (respirable as graphite)</p> <p><b>ACGIH</b> – 3.5 mg/ m<sup>3</sup> TWA (as C dust); 2 mg C/ m<sup>3</sup> TWA as graphite</p>	R36, R37 S22, S26, S37, S39
Mixed Binder	1 – 10	Mixture	None Established	NONE KNOWN
Mixed Organic Carbonate Electrolyte	10 – 60	Mixture	None Established	<p>R14, R21, R22, R41, R42, R43 S2, S8, S24, S26, S36, S37, S45</p> <div style="display: flex; justify-content: space-around;">   </div>

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Methyl Butyrate	0 – 5	623-42-7	None Established	R20, R36, R37, R38 S16, S26, S36 	
Lithium Hexafluorophosphate	2 – 25	21324-40-3	OSHA - 2.5 mg/ m <sup>3</sup> (as dust)	R14, R20, R21, R22, R34, R41, R43 S2, S8, S22, S24, S26, S27, S36, S37, S39, S45  	
Aluminum Metal	10 – 25	7429-90-5	OSHA - 15 mg Al/ m <sup>3</sup> (total); 5 mg Al/ m <sup>3</sup> (resp)	NONE KNOWN	
Copper Metal	1 – 15	7440-50-8	OSHA – 1 mg Cu/ m <sup>3</sup> ACGIH – 1.0 mg Cu/ m <sup>3</sup> (as dust); 0.2 mg Cu/ m <sup>3</sup> (as fume)	R36, R37, R38	
<i>* Amount varies depending on cell size.</i>					
<b>3. PHYSICAL DATA</b>					
Appearance and Odor	Solid metal cylinder, rectangular pouch or solid container, containing mixed metal oxides, carbon solids and organic electrolyte. Metallic odor.				
Boiling Point	Not applicable unless individual components exposed.				
Melting Point	Aluminum container – 1220 degrees F (660 degrees C) Steel pack container – 2552 to 2804 degrees F (1400 to 1540 degrees C)				
Specific Gravity (H <sub>2</sub> O = 1)	Not applicable unless individual components exposed.				
Vapor Pressure (mm Hg @ 20 deg C)	Not applicable unless individual components exposed.				
Vapor Density (Air = 1)	Not applicable unless individual components exposed.				
Solubility	Not applicable unless individual components exposed.				
Evaporation Rate (Butyl Acetate = 1)	Not applicable unless individual components exposed.				
% Volatile by Weight	Not applicable unless individual components exposed.				
<b>4. HEALTH HAZARD INFORMATION</b>					
NOTE: Under normal conditions of use, this product does not present a health hazard. The following information is provided for organic electrolyte and the mixed metal oxide exposure that may occur due to container breakage or under extreme conditions such as fire.					
Organic electrolyte – reacts with moisture/water to produce hydrofluoric acid in <u>trace</u> quantities. Hydrofluoric acid is extremely corrosive and toxic. In severe exposures it acts as a systemic poison and causes severe burns. The reaction may be delayed. Any contact with this material, even minor, requires immediate medical attention.					

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<b>ROUTES AND METHODS OF ENTRY</b>				
<b>Inhalation</b>	<p><b>EXPOSURE IS NOT EXPECTED FOR PRODUCT UNDER NORMAL CONDITIONS OF USE.</b></p> <p>In the event of overcharging or damage to the unit, exposure to organic electrolyte solution/mist is possible. Extreme exposures to the organic electrolyte can be severely corrosive to the respiratory tract and may cause sore throat, coughing, labored breathing and lung congestion/inflammation. Overcharging or seepage of electrolyte from broken batteries may present inhalation exposure in a confined area.</p>			
<b>Skin Contact</b>	<p><b>EXPOSURE IS NOT EXPECTED FOR PRODUCT UNDER NORMAL CONDITIONS OF USE.</b></p> <p>In the event of overcharging or damage to the unit, exposure to organic electrolyte solution/mist is possible. Extreme exposures to the organic electrolyte can be corrosive to the skin. Skin contact can cause serious skin burns which may not be immediately apparent or painful. Symptoms may be delayed 8 hours or longer. The fluoride ion readily penetrates the skin causing destruction of deep tissue layers and even bone.</p>			
<b>Skin Absorption</b>	<p><b>EXPOSURE IS NOT EXPECTED FOR PRODUCT UNDER NORMAL CONDITIONS OF USE.</b></p> <p>In the event of overcharging or damage to the unit, exposure to organic electrolyte solution/mist is possible. Extreme exposures to the organic electrolyte can be absorbed through the skin.</p>			
<b>Eye Contact</b>	<p><b>EXPOSURE IS NOT EXPECTED FOR PRODUCT UNDER NORMAL CONDITIONS OF USE.</b></p> <p>In the event of overcharging or damage to the unit, exposure to organic electrolyte solution/mist is possible. Extreme exposures to the organic electrolyte can be corrosive to the eyes and can cause severe irritation, burns, and cornea damage. Symptoms of redness, pain, blurred vision, and permanent eye damage may occur.</p>			
<b>Ingestion</b>	<p><b>EXPOSURE IS NOT EXPECTED FOR PRODUCT UNDER NORMAL CONDITIONS OF USE.</b></p> <p>In the event of overcharging or damage to the unit, exposure to organic electrolyte solution/mist is possible. Extreme exposures to the organic electrolyte can be corrosive and may cause sore throat, abdominal pain, diarrhea, vomiting, severe burns of the digestive tract, and kidney dysfunction. Hands contaminated by contact with internal components of a battery can also cause ingestion of mixed metal oxides and carbon solids. Hands should be washed thoroughly prior to eating, drinking, or smoking.</p>			
<b>SIGNS AND SYMPTOMS OF OVEREXPOSURE</b>				
<b>Acute Effects</b>	<p><b>EXPOSURE IS NOT EXPECTED FOR PRODUCT UNDER NORMAL CONDITIONS OF USE.</b></p> <p>In the event of overcharging or damage to the unit, exposure to organic electrolyte solution/mist is possible. Exposure and/or contact with organic electrolyte solution/mist may lead to acute irritation of the skin, corneal damage of the eyes and irritation of the mucous membranes of the eyes and upper respiratory system, including lungs.</p>			
<b>Chronic Effects</b>	<p><b>EXPOSURE IS NOT EXPECTED FOR PRODUCT UNDER NORMAL CONDITIONS</b></p>			

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	<b>OF USE.</b> In the event of overcharging or damage to the unit, exposure to organic electrolyte solution/mist is possible. Contact with the organic electrolyte may lead to skin burns/ulceration, scarring of the cornea, and chronic respirator conditions. Extreme exposures – intake of more than 6 mg of fluorine per day may result in fluorosis, bone and joint damage. Hypocalcemia and hypomagnesemia can occur from absorption of fluoride ion into blood stream.			
<b>POTENTIAL TO CAUSE CANCER</b>				
Nickel has been identified by the National Toxicology Program (NTP) as reasonably anticipated to be a carcinogen. Cobalt and cobalt compounds have been identified by the International Agency for Research on Cancer (IARC) as possible carcinogenic to humans (Group 2B). Carbon black has been identified by the International Agency for Research on Cancer (IARC) as possible carcinogenic to humans (Group 2B).				
<b>California Proposition 65:</b> This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require warning under the statute – Cobalt Oxide, Nickel Oxide, Carbon Black				
<b>MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE</b>				
Contact with or exposure to the organic electrolyte may aggravate skin diseases such as eczema and contact dermatitis, respiratory disorders such as lung injuries and asthma, and kidney function.				
<b>5. FIRST AID MEASURES</b>				
<b>Inhalation</b>	<b>EXPOSURE IS NOT EXPECTED FOR PRODUCT UNDER NORMAL CONDITIONS OF USE.</b> However, if organic electrolyte is released due to overcharging or abuse of the battery, remove exposed person to fresh air. If breathing is difficult, oxygen may be administered. In severe cases obtain medical attention immediately.			
<b>Skin contact</b>	<b>EXPOSURE IS NOT EXPECTED FOR PRODUCT UNDER NORMAL CONDITIONS OF USE.</b> However, if organic electrolyte contacts skin, wash off skin thoroughly with water. Remove contaminated clothing and wash before reuse. If irritation develops or in severe cases obtain medical attention immediately. Seek medical attention as soon as possible for all burns regardless of how minor they may appear initially.			
<b>Eye contact</b>	<b>EXPOSURE IS NOT EXPECTED FOR PRODUCT UNDER NORMAL CONDITIONS OF USE.</b> However, if organic electrolyte enters eyes, thoroughly flush eyes with water for a minimum of 15 minutes. Obtain medical attention immediately.			
<b>Ingestion</b>	<b>EXPOSURE IS NOT EXPECTED FOR PRODUCT UNDER NORMAL CONDITIONS OF USE.</b> However, if internal components are ingested, rinse out mouth thoroughly with water and give plenty of water to drink. Do not induce vomiting. Obtain medical attention immediately.			
<b>6. FIRE AND EXPLOSION DATA</b>				
<b>Flash Point</b>	Not applicable unless individual components exposed.			
<b>Autoignition Temperature</b>	No data available.			

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<b>Flammable Limits in Air, % by volume</b>	Not applicable unless individual components exposed.				
<b>Extinguishing Media</b>	Dry chemical, foam, or CO <sub>2</sub> extinguishers. CO <sub>2</sub> extinguishers, generous amounts of water spray, copious quantities of water or water-based foam can be used to cool down burning Li-ion cells and batteries.				
<b>Special Fire Fighting Procedures</b>	Use positive pressure, self-contained breathing apparatus. Wear protective clothing to prevent potential body contact with the electrolyte solution or its by-products.				
<b>Unusual Fire and Explosion Hazard</b>	The sealed battery is not considered flammable, but it will burn if involved in a fire. The organic electrolyte reacts with moisture/water to produce hydrogen fluoride (HF).				
<b>7. REACTIVITY DATA</b>					
<b>Stability</b>	The sealed battery is considered stable.				
<b>Conditions to Avoid</b>	Sparks and other sources of ignition; high temperature; over charging.				
<b>Incompatibility (materials to avoid)</b>	Organic electrolyte – reacts with water to produce hydrogen fluoride.				
<b>Hazardous Decomposition Products</b>	Carbon monoxide, carbon dioxide, phosphorous oxides. <b>Mixed metal oxide</b> – nickel, cobalt, and manganese oxides can be released. <b>Organic electrolyte</b> – reacts with water to produce hydrogen fluoride.				
<b>Hazardous Polymerization</b>	Will not occur.				
<b>8. CONTROL MEASURES</b>					
<b>Engineering Controls</b>	Store sealed batteries at ambient temperature, 20 Deg C. Never recharge batteries in an unventilated, enclosed space. Do not subject product to open flame or fire.				
<b>Work Practices</b>	Do not drop battery, puncture or attempt to open battery case. Avoid contact with the internal components of a battery. Do not subject product to direct heat or open flame or fire and avoid situations that could cause short circuit or arcing between terminals.				
<b>PERSONAL PROTECTIVE EQUIPMENT</b>					
<b>Respiratory Protection</b>  	<b>NONE REQUIRED FOR NORMAL HANDLING OF THE FINISHED PRODUCT.</b>  If necessary to handle damaged product where exposure to the organic electrolyte is a possibility, respiratory protection may be required.				

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<p style="text-align: center;"><b>Eyes and Face</b></p> 	<p><b>NONE REQUIRED FOR NORMAL HANDLING OF THE FINISHED PRODUCT.</b></p> <p>If necessary to handle damage product where exposure to the organic electrolyte is a possibility, chemical splash goggles and a faceshield are recommended.</p>			
<p style="text-align: center;"><b>Hands, Arms, and Body</b></p> 	<p><b>NONE REQUIRED FOR NORMAL HANDLING OF THE FINISHED PRODUCT.</b></p> <p>If necessary to handle damaged product where exposure to the organic electrolyte is a possibility, PVC gauntlet-type gloves with rough finish are recommended along with a chemically resistant apron.</p>			
<p><b>Other Special Clothing and Equipment</b></p>	<p>Safety footwear meeting the ANSI Z 41.1 requirements is recommended when it is necessary to handle the finished product.</p>			
<b>9. SAFE HANDLING PRECAUTIONS</b>				
<p><b>Hygiene Practices</b></p>	<p>Wash hands thoroughly before eating, drinking, or smoking after handling batteries.</p>			
<p><b>Protective Measures to be Taken During Non-Routing Tasks, Including Equipment Maintenance</b></p>	<p>Do not drop the battery, deform the container, puncture or attempt to open the battery case. Do not subject product to direct heat or open flame or fire and avoid situations that could cause short circuit or arcing between terminals.</p>			
<b>SPILL OR LEAK PROCEDURES</b>				
<p><b>Protective Measures to be Taken if Material is Released or Spilled</b></p>	<p>Remove personnel from area until fumes dissipate. Use recommended personal protective equipment. Cover battery or spilled substances with an absorbing material, place in approved sealed container and dispose in accordance with applicable local, state and federal regulations.</p>			
<p><b>Waste Disposal Method</b></p>	<p>Dispose of in accordance with applicable local, state and federal regulations.</p>			
<b>SUPPLEMENTAL INFORMATION</b>				
<p><b>Handling</b></p>	<p>Do not crush, pierce, short (+) and (-) battery terminals with conductive (i.e. metal) goods. Do not directly heat or solder. Do not throw into fire. Do not mix batteries of different types and brands. Do not mix new and used batteries. Keep batteries in non-conductive (i.e. plastic) trays.</p>			

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<b>Storage</b>	<p>Store in a cool (preferably below 30°C) and ventilated area, away from moisture, sources of heat, open flames, food and drink. Keep adequate clearance between walls and batteries. Temperature above 70°C may result in battery leakage and rupture. Since short circuit can cause burn, leakage and rupture hazard, keep batteries in original packaging until use and do not expose them to unnecessary or excessive handling.</p> <p style="color: red;">Recommended storage range: -30 to +40 Deg C. Cells may experience short temperatures from + 41 to 60 Deg C for total accumulated excursion not exceeding 7 Days. Never store cells above 60 Deg C.</p>
<b>Other</b>	<p>Follow <b>Manufacturers Recommendations</b> regarding maximum recommended currents and operating temperature range. Do not overcharge beyond the recommended upper charging voltage limit. Applying pressure or deforming the battery may lead to disassembly followed by eye, skin and throat irritation.</p>

#### 10. ECOLOGICAL INFORMATION

<b>Mammalian effects</b>	None known if used/disposed of correctly.
<b>Eco-toxicity</b>	None known if used/disposed of correctly.
<b>Bioaccumulation potential</b>	None known if used/disposed of correctly.
<b>Environmental fate</b>	None known if used/disposed of correctly.

#### 11. TRANSPORT INFORMATION

**Note: Transportation requirements do not apply once the battery pack has been installed in a vehicle as part of the vehicle's functional components.**

<b>Information &amp; Labels for conveyance</b>	<p>For the single cell batteries and multi-cell battery packs that are non-restricted to transport, use lithium-ion batteries inside label.</p> <p>For the single cell batteries and multi-cell battery packs which are restricted to transport (assigned to the Miscellaneous Class 9), use Class 9 Miscellaneous Dangerous Goods and UN Identification Number labels.</p> <p style="color: red;">Packages must be marked "Cargo Aircraft Only". Only trained, personnel certified in packing, shipping and documenting Dangerous Goods may offer this material for transport.</p> <p style="color: red;">NOTE: Cells that are non-intact, breeched, vented or physically damaged may not be shipped.</p> <p>In all cases, refer to the product transport certificate issued by the Manufacturer.</p>
<b>UN number</b>	UN 3480 PG II (all modes)
<b>Shipping name</b>	Lithium Ion Batteries
<b>Hazard classification</b>	Depending on their equivalent lithium compound content, some single cells and small multicell battery packs may be non- assigned to Class 9 (refer to Transport Certificate).
<b>Packing group</b>	II
<b>IMDG Code</b>	9033
<b>CAS</b>	Not applicable
<b>EmS No.</b>	4.1-06
<b>Marine pollutant</b>	No



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<b>ADR Class</b>	Class 9		
<b>State of Charge</b>	It is recommended that cell be shipped with a State of Charge (SOC) that does not exceed 50%. Minimum recommended shipping SOC is 20%.		
<b>12. REGULATORY INFORMATION</b>			
<b>Risk phrases</b>	Mixed Metal Oxides	R22 R36 R37 R43	Harmful if swallowed. Irritating to eyes. Irritating to respiratory system. May cause sensitization by skin contact.
	Mixed Organic Carbonate Electrolyte	R14 R21 R22 R41 R42 R43	Reacts with water. Harmful in contact with skin. Harmful if swallowed. Risk of serious damage to eye. May cause sensitization by inhalation. May cause sensitization by skin contact.
	Carbon Solids	R36 R37	Irritating to eyes. Irritating to respiratory system.
	Lithium Hexafluorophosphate	R14 R20 R21 R22 R41 R43	Reacts with water Harmful by inhalation. Risk of damage to the skin. Harmful if swallowed. Risk of serious damage to eye. May cause sensitization by skin contact.
	Methyl Butyrate	R20 R36 R37 R38	Harmful by inhalation. Irritating to eyes. Irritating to respiratory system. Irritating to skin.
	Copper Metal	R36 R37 R38	Irritating to eyes. Irritating to respiratory system. Irritating to skin.
<b>Safety Phrases</b>	Mixed Metal Oxides	S2 S22 S24 S26 S36 S37 S39 S45	Keep out of reach of children. Do not breathe dust. Avoid contact with skin. In case of contact with eyes, rinse immediately with plenty of water. Wear suitable protective clothing. Wear suitable gloves. Wear eye / face protection. In case of incident, seek medical attention.
	Mixed Organic Carbonate Electrolyte	S2 S8 S24 S26 S36 S37 S45	Keep out of reach of children. Keep away from moisture. Avoid contact with skin. In case of contact with eyes, rinse immediately with plenty of water. Wear suitable protective clothing. Wear suitable gloves. In case of incident, seek medical attention.
	Carbon Solids	S22 S26 S37 S39	Do not breathe dust. In case of contact with eyes, rinse immediately with plenty of water. Wear suitable gloves. Wear eye / face protection.

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	Lithium Hexafluorophosphate	S2 S8 S22 S24 S26  S36 S37 S39 S45	Keep out of reach of children. Keep away from moisture. Do not breathe dust. Avoid contact with skin. In case of contact with eyes, rinse immediately with plenty of water.  Wear suitable protective clothing. Wear suitable gloves. Wear eye / face protection. In case of incident, seek medical attention.
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### 13. OTHER INFORMATION

This information has been compiled from sources considered to be dependable and is, to the best of our knowledge and belief, accurate and reliable as of the date compiled. However, no representation, warranty (either expressed or implied) or guarantee is made to the accuracy, reliability or completeness of the information contained herein.

This information relates to the specific materials designated and may not be valid for such material used in combination with any other materials or in any process. It is the user's responsibility to satisfy himself as to the suitability and completeness of this information for his particular use.

JC does not accept liability for any loss or damage that may occur, whether direct, indirect, incidental or consequential, from the use of this information. JCI does not offer warranty against patent infringement.

Datum: 7. Februar 2019 Überarbeitet: Version: 1.0 Dok.Nr. 204-00007 Seite: 1 of 11	<b>Produktsicherheitsdatenblatt</b> <b>Product Safety Data sheet</b>	Date: 7 <sup>th</sup> February 2019 Revision: Version: 1.0 Doc.Nr. 204-00007 Page: 1 of 11
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**Elektrisches Energiespeichersystem**  
*Electrical energy storage system*

**Wichtige Information:** Gemäß der Europäischen Chemikalienverordnung REACH (EG) 1907/2006 in Verbindung mit (EU) 2015/830 und der Richtlinie 29 CFR 1910.1200 der amerikanischen Bundesbehörde für Arbeitssicherheit Occupational Safety and Health Administration (OSHA) sind Batterien ERZEUGNISSE bzw. ARTIKEL ohne beabsichtigte Freisetzung von chemischen Stoffen. Daher besteht keine gesetzliche Verpflichtung zur Erstellung und Aktualisierung eines Sicherheitsdatenblatts für Batterien. Dieses Produktsicherheitsdatenblatt wird unseren Kunden lediglich als Informationsmaterial zur Verfügung gestellt.

**Important note:** This battery meets the definition of an ARTICLE with no intended release of chemical substances according to the European Chemicals Regulation REACH (EG) 1907/2006 in conjunction with (EU) 2015/830 and the Hazard Communication Standard 29 CFR 1910.1200 of the Occupational Safety and Health Administration of the United States of America. Therefore the preparation and updating of a safety data sheet is not required by law. This product safety data sheet is intended as information only for our customers.

**ABSCHNITT 1: Bezeichnung des Stoffs beziehungsweise des Gemischs und des Unternehmens**  
**SECTION 1: Identification of the substance/mixture and of the company/undertaking**

**1.1 Produktidentifikator**  
**Product Identifier**

Identifizierung: <i>Identification:</i>	Produktkategorie <i>Product category</i>	Hochvolt Lithium-Ionen-Batterie <i>High-voltage lithium ion battery</i>
	Wiederaufladbar <i>Rechargeable</i>	Ja <i>Yes</i>
	Kapazität [Wh] <i>Capacity [Wh]</i>	s. Typenschild auf der Batterie <i>please check the nameplate on your battery</i>

**1.2 Relevante identifizierte Verwendungen des Stoffs oder Gemischs und Verwendungen, von denen abgeraten wird**  
**Relevant identified uses of the substance or mixture and uses advised against**

Relevante identifizierte Verwendungen: elektronische Anwendungen  
*Relevant identified uses: electronic applications*

Abgeratene Anwendungen: Nicht anwendbar  
*Uses advised against: Not applicable*

**1.3 Einzelheiten zum Lieferanten, der das Sicherheitsdatenblatt bereitstellt**  
**Details of the supplier of the safety data sheet**

Firmenname: <i>Company name:</i>	Name und Adresse <i>Name and address</i>	Torqeedo GmbH Friedrichshafener Straße 4a D-82205 Gilching +49 (0) 8153 / 9215-100 +49 (0) 8153 / 9215-319 <a href="mailto:info@torqeedo.com">info@torqeedo.com</a>
Telefon / <i>Phone</i>		
Telefax / <i>Telefax</i>		
E-mail / <i>E-mail</i>		

**1.4 Notrufnummer**  
**Emergency telephone number**

Chemtrec (International)	+1-703-527-3887
Chemtrec (US and Canada)	1-800-424-9300
Nur für Österreich	01406-43 43

**ABSCHNITT 2: Mögliche Gefahren**  
**SECTION 2: Hazards identification**

**2.1 Einstufung des Stoffs oder Gemischs**  
**Classification of the substance or mixture**

Unter normalen Bedingungen treten keine gefährlichen Stoffe aus und es kann zu keiner Berührung mit toxischen Stoffen kommen.  
*Under normal conditions of use, the chemicals and metals are contained in a sealed can and are not exposed to the outside.*

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## 2.2 Kennzeichnungselemente Label elements

Nicht anwendbar. Keine Kennzeichnung gemäß CLP-Verordnung (EG) 1272/2008 erforderlich.  
*Not applicable. A labeling as specified by the CLP regulation (EC) 1272/2008 is not required.*

## 2.3 Sonstige Gefahren Other hazards

Gefahren:

*Hazards:*

Lithium-Ionen-Batterien können bei unsachgemäßer Handhabung Feuer entwickeln, explodieren oder chemische Verätzungen verursachen. Batterien keinesfalls kurzschließen, durchstoßen, in Feuer werfen, quetschen, in Wasser tauchen, erzwungen entladen oder Temperaturen aussetzen, die außerhalb der angegebenen Betriebsspanne des Produktes liegt. Bitte lesen Sie die Bedienungsanleitung sorgfältig.

Ein Expositionsrisiko besteht nur im Falle unsachgemäßer Handhabung (mechanisch, thermisch, elektrisch). Auslaufen der Elektrolytflüssigkeit, Reaktion der Elektrodenmaterialien mit Feuchtigkeit/Wasser oder Batterientlüftung/Feuer/Explosion können, abhängig von den Begleitumständen, die Folge sein.

Durch Berührung stromführender Bauteile kann es zu einem elektrischen Schlag kommen, der thermische oder muskellähmende Auswirkungen haben kann. Letztere können zu Herzkammerflimmern, Herzstillstand oder Atemlähmung mit tödlichem Ausgang führen.

*Lithium-ion batteries may present a risk of fire or explosion or chemical burn when mistreated. Do not short circuit, puncture, incinerate, crush, immerse, force discharge or expose to temperatures above the declared operating temperature range of the product. Read instructions carefully.*

*Risk of exposure only in case of abuse (mechanical, thermal, electrical). Electrolyte leakage, electrode materials reaction with moisture/water or battery vent/fire/explosion may follow, depending on the circumstances.*

*Touching live parts may cause electrical shock which may result in thermal heating or muscle paralyzing effects. The latter may cause ventricular fibrillation, sudden cardiac arrest or respiratory paralysis with fatal ending.*

Toxizität:

*Toxicity:*

Brennt eine Batterie, so können Reizungen infolge von entstehendem Rauch oder entstehenden Dämpfen an Augen, Haut und Atemwegen auftreten.

*If a battery burns, the vapours can irritate eyes, skin and the respiratory tract.*

## ABSCHNITT 3: Zusammensetzung/ Angabe zu Bestandteilen

### SECTION 3: Composition/ information on ingredients

#### 3.1 Gemische Mixtures

Batterien sind ERZEUGNISSE bzw. ARTIKEL ohne beabsichtigte Freisetzung von chemischen Stoffen. Ein Kontakt mit den Inhaltsstoffen ist unter normalen Nutzungsbedingungen ausgeschlossen.

*Batteries meet the definition of an ARTICLE with no intended release of chemical substances. The physical form of the product precludes exposure to persons under normal conditions of use.*

Die folgenden Komponenten können in der verschlossenen Zelle enthalten sein.

*The following components may be found inside the sealed Li-ion battery can.*

Chemische Bezeichnung / Chemical name
Cobaltoxid/ Cobalt oxide
Mangandioxid/ Manganese dioxide
Nickeloxid/ Nickel oxide
Kohlenstoff/ Carbon
Elektrolyt/ Electrolyte
Aluminium/ Aluminum Foil
Kupfer / Copper Foil
Polyvinylidendifluorid / Polyvinylidene Fluoride (PVdF)
Aluminium und inerte Materialien/ Aluminium and inert materials

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**ABSCHNITT 4: Erste-Hilfe-Maßnahmen**  
**SECTION 4: First Aid measures**

Die unter Punkt 3 angegebenen Chemikalien befinden sich in einem abgedichteten Gehäuse, sodass sie bei normalem Gebrauch nicht austreten können. Die Gefahr des Austretens besteht nur durch mechanischen, thermischen oder elektrischen Missbrauch.  
*The chemicals are contained in sealed cans. Under normal conditions of use, risk of exposure occurs only if the battery is mechanically, thermally or electrically abused.*

**4.1 Beschreibung der Erste-Hilfe-Maßnahmen**  
**Description of First Aid Measures:**

Sollten Chemikalien austreten, ist Folgendes zu beachten:  
Elektrolyte sind in der Regel reizend, brennbar und potenziell ätzend. Hautkontakt und Einatmen der Dämpfe sind unbedingt zu vermeiden. In unmittelbarer Nähe sind die durch das Ausgasen entstehenden Gase reizend, brennbar, potentiell ätzend und sollten deshalb keinesfalls eingeatmet werden.

*If chemicals leak take the following actions:  
Electrolytes are usually irritating, flammable and potentially corrosive. Skin contact and inhalation of vapors must be avoided. In the immediate vicinity the venting gases are irritating, flammable and potentially corrosive. They should therefore not be inhaled.*

**Einatmen:**

**Inhalation:**

Austretende Gase können zu Atemwegsbeschwerden führen. Sofort lüften oder an die frische Luft gehen. Sofort einen Arzt rufen.  
*Contents of an opened battery can cause respiratory irritation. Remove the contamination source or bring the affected person to the fresh air. Seek medical attention!*

**Hautkontakt:**

**Skin contact:**

Verunreinigte Kleidung, Schuhe und Lederteile ausziehen. Sofort mit lauwarmen Wasser mindestens 30 Minuten lang gründlich spülen. Sofort einen Arzt rufen.  
*Remove the contaminated clothes, shoes and leather parts. Rinse immediately with lukewarm, weakly running water for at least 30 minutes. Contact the emergency medical services immediately!*

**Augenkontakt:**

**Eye contact:**

Es kann zu Reizungen an den Augen kommen. Sofort die Augen mindestens 30 Minuten lang gründlich mit Wasser spülen, dann sofort einen Arzt aufsuchen.  
*Contents of an opened battery can cause eye irritation. Immediately flush eyes thoroughly with water for at least 30 minutes. Seek medical attention immediately!*

**Verschlucken:**

**Swallowing:**

Wenn der Inhalt einer geöffneten Zelle geschluckt wurde, geben Sie nichts über den Mund, wenn die betroffene Person leicht bewusstlos wird, bewusstlos ist oder Krämpfe hat. Spülen Sie den Mund gründlich mit Wasser. KEIN ERBRECHEN HERBEIFÜHREN. Kontaktieren Sie sofort den Rettungsdienst!  
*If the contents of an opened cell have been swallowed, DO NOT supply anything over the mouth if the affected person becomes unconscious easily; is unconscious or has cramps. Rinse the mouth thoroughly with water. DONOT INDUCE VOMITING. Contact the emergency medical services immediately!*

Sollte es zu einem Stromschlag gekommen sein, ist Folgendes wichtig:

- den Verletzten nicht berühren, bevor Spannungsfreiheit der Anlage sichergestellt ist;
  - freiliegende, stromführende Kabel mit Hilfe nichtleitender Gegenstände vom Verletzten wegziehen;
  - bei bewusstlosen Patienten ist die Sicherstellung von Atmung und Herz-Kreislauffunktion vorrangig. Gegebenenfalls ist die sofortige Herz Lungen-Wiederbelebung einzuleiten;
  - bei ansprechbaren Patienten sind Brandverletzungen zu kühlen und mit einer keimarmen, nicht flusenden Wundauflage abzudecken
- If a person suffers electric shock, your actions should be based on the following:*
- do not touch the injured person until you have ensured the absence of voltage;
  - remove exposed live cables from the injured person by using non-conductive items;
  - primary objective in the treatment of unconscious patients is the maintenance of their breathing and cardiovascular system. If necessary you should give cardiopulmonary resuscitation (CPR)
  - cool burn injuries and cover them with an antiseptic non-fluffy wound dressing.

**4.2 Wichtige akute und verzögert auftretende Symptome und Wirkungen**  
**Most important symptoms and effects, both acute and delayed**

Atemwegsbeschwerden/ *respiratory disorders*

Hautirritationen/ *Skin irritation*

Augenreizungen/ *Eye Irritation*

**4.3 Hinweise auf ärztliche Soforthilfe oder Spezialbehandlung**  
**Indication of any immediate medical attention and special treatment needed**

Symptomatisch behandeln

*Treat symptomatically*

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**ABSCHNITT 5: Maßnahmen zur Brandbekämpfung**  
**SECTION 5: Firefighting measures**

Wenn ein gleichzeitiger Riss sowohl in der Batterie als auch in den darin enthaltenden Zellen auftreten sollte, wäre die enthaltene Elektrolytlösung entflammbar. Wie jeder versiegelte Behälter können Batterien bei extremen Hitzeeinflüssen reißen; das kann zur Freisetzung von brennbaren oder korrosiven Materialien führen. Bei einem Kurzschluss kann die Batterie abbrennen. Im Brandfall ist zu beachten, dass durch die Löscharbeiten eine hohe Verdünnung von ausgelaufenen Verbindungen auftritt.  
*If a simultaneous crack in the battery and the therein contained cells may occur, the contained electrolyte solution would be inflammable. Like every sealed container, batteries may tear at extreme influences of heat; leading to the discharge of inflammable or corrosive materials. Caused by a short circuit the battery may burn down. In case of a fire keep in mind that due to extinguishing there is a high dilution of leaked compounds.*

**5.1 Löschmittel**  
**Extinguishing media**

Im Brandfall:  
*In case of fire:*

Verwenden Sie bei Bränden in Verbindung mit Batterien bitte hauptsächlich Wasser oder CO<sub>2</sub>. Die Verwendung von Wasser ist unkritisch. Es wird dringend empfohlen, aufgrund der kühlenden Wirkung viel Wasser zu verwenden. Je nach Verfügbarkeit können auch andere Löschmittel (Löschschaum, Löschpulver) verwendet werden.  
*In case of fires in connection with batteries use mainly water or CO<sub>2</sub>. The usage of water is uncritical, it is highly recommended to use much water due to its cooling effect. Depending on the availability other extinguishing agents (fire extinguishing foam, extinguishing powder) may be used also.*

**5.2 Besondere vom Stoff oder Gemisch ausgehende Gefahren**  
**Special hazards arising from the substance or mixture**

Risiko bei mechanischer Einwirkung:  
Mechanische Einflüsse können unter extremen Bedingungen zu einem Reißen der Batterie führen.  
*Risk at mechanical influence:  
Mechanical influences may in extreme conditions lead to a tearing of the battery.*

Besondere Risiken durch Chemikalien:  
*Specific risks formed by chemicals:*  
Im Allgemeinen bestehen die Zersetzungsprodukte des Elektrolyts (nach dem thermischen Ereignis) aus CO<sub>2</sub>, CO, H<sub>2</sub> und HC (Kohlenwasserstoffen) als Hauptprodukte. Feuchtigkeit/ Wasser in Reaktion mit freigesetztem Elektrolyt, der Lithiumhexafluorophosphat enthält, kann zur Bildung von Fluorwasserstoff (HF) und anderen Nebenprodukten führen.  
*In general the decomposition products of electrolyte (after thermal event) consists of CO<sub>2</sub>, CO, H<sub>2</sub> and HC (hydrocarbons) as main products. Humidity/water in reaction with released electrolyte containing lithium hexafluorophosphate may lead to the formation of hydrogen fluoride (HF) and other by-products.*

**5.3 Hinweise für die Brandbekämpfung**  
**Advice for firefighters**

Wenn möglich, Batterie(n) aus dem Brandbereich entfernen. Bei Erwärmung über 125°C können Zellen explodieren oder ausgasen.  
*If possible, remove battery(s) from firefighting area. If heated above 125°C, cells may explode/vent.*

Wie üblich bei der Brandbekämpfung, ist die komplette persönliche Schutzausrüstung inkl. Atemschutz zu verwenden. Erforderliche Anpassungen müssen der Situation entsprechend vorgenommen werden.  
*As common in firefighting, the complete personal protective equipment incl. breathing protection must be used. Required adjustments must be made according to the situation.*

**ABSCHNITT 6: Maßnahmen bei unbeabsichtigter Freisetzung**  
**SECTION 6: Accidental release measures**

**6.1 Personenbezogene Vorsichtsmaßnahmen, Schutzausrüstungen und in Notfällen anzuwendende Verfahren**  
**Personal precautions, protective equipment and emergency procedures**

Bis zum Abschluss der Reinigungsarbeiten muss der Zutritt zum betroffenen Areal gesperrt werden. Materialien nicht berühren. Geeignete Schutzausrüstung entsprechend der Vorgaben in Kapitel 8 tragen.  
*Until completion of the cleaning work the access to the affected area must be closed. Do not contact trapped materials. Wear appropriate protective equipment according to the specifications in section 8.*

**6.2 Umweltschutzmaßnahmen**  
**Environmental precautions**

Bodenverunreinigung und Eindringen des Materials in Kanalisation und Gewässer vermeiden!  
*Soil contamination and penetration of material into sewage system and waterway must be avoided.*

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### 6.3 Methoden und Material für Rückhaltung und Reinigung *Methods and material for containment and cleaning up*

#### Rückhaltung:

##### Containment:

Die Stofffreisetzung muss gestoppt werden, wenn das gefahrlos möglich ist. Ausgelaufene Flüssigkeiten mit Sand, Erde oder chemischen Bindemitteln absorbieren. Betroffenes Areal sofort reinigen!

*The release of the substance must be stopped, if this is safely possible. Leaked fluids must be contained with dry sand, soil or chemicals binding agents. Clean the affected area immediately.*

#### Reinigung

##### Cleaning:

Ausgelaufenes Material und kontaminiertes Absorptionsmaterial mit Sand oder Erde abdecken und als gefährlichen Sondermüll in einem verschlossenen Container entsorgen.

*Dispose of the spilled material and the contaminated absorption material covered in sand or earth and placed in a closed container as hazardous waste.*

Betroffenes Areal mit Reinigungsmittel und Wasser schrubben; kontaminiertes Reinigungswasser sammeln und gemäß der Vorschriften entsorgen.

*Scrub the affected area with cleaning agents and water; collect contaminated cleaning water and dispose in accordance with the regulations.*

### 6.4 Verweis auf andere Abschnitte *Reference to other sections*

Entsorgung, s. Abschnitt 13

*Disposal, see section 13*

#### ABSCHNITT 7: Handhabung und Lagerung

##### SECTION 7: Handling and storage

### 7.1 Schutzmaßnahmen zur sicheren Handhabung

#### *Precautions for safe handling*

Die Batterie nicht öffnen, zerquetschen oder zerlegen oder aus großer Höhe fallen lassen oder etwas anlöten.

*Do not open the battery. Do not crush, disassemble, drop or solder.*

Die Zelle nicht öffnen, zerlegen, zerquetschen oder verbrennen.

*Do not open, dismantle, squash or burn the cell.*

Die Batterie keinen extrem hohen Temperaturen oder Feuer aussetzen.

*Do not expose battery to extreme heat or fire.*

#### Achtung:

##### Caution:

Falsche Handhabung kann zu einer Explosion führen oder einen Brand entfachen!

*Incorrect handling can cause fire or explosion.*

### 7.2 Bedingungen zur sicheren Lagerung unter Berücksichtigung von Unverträglichkeiten

#### *Conditions for safe storage, including any incompatibilities*

Lagern Sie die Batterie an einem trockenen Ort bei Raumtemperatur.

*Store the battery at a dry place at room temperature.*

Höhere Temperaturen können die Lebensdauer der Batterie beeinträchtigen.

*Increased temperatures may reduce the service life of the battery.*

Außerhalb der Reichweite von Kindern aufbewahren.

*Keep out of reach of children.*

Bitte lesen Sie die Bedienungsanleitung sorgfältig.

*Read instructions carefully.*

### 7.3 Spezifische Endanwendungen

#### *Specific end use(s)*

Nicht anwendbar

*Not applicable*

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**ABSCHNITT 8: Begrenzung und Überwachung der Exposition/ Persönliche Schutzausrüstungen**  
**SECTION 8: Exposure controls/ personal protection**

Die Hinweise unter Punkt 7 müssen eingehalten werden. Es muss somit regelmäßig geprüft werden, ob die Lagertemperatur innerhalb der vorgegebenen Grenzen liegt. Ebenso muss eine angemessene Durchlüftung gewährleistet sein, um Stauansätze zu vermeiden. Für den normalen Umgang mit den Batterien ist keine Schutzausrüstung erforderlich. Bei großem Handlingvolumen werden Sicherheitsschuhe mit Stahlkappe empfohlen.

*Advices under Point 7 must be observed. You must check continuously that storage temperature is within the specified limits. Additionally, you must ensure that there is a suitable ventilation in order to avoid moisture build up.*

*For normal use you do not need any protective equipment. Steel toed shoes recommended for large container handling.*

**8.1 Zu überwachende Parameter**  
**Control parameters**

Nicht anwendbar  
*Not applicable*

**8.2 Begrenzung und Überwachung der Exposition**  
**Exposure controls**

Nicht anwendbar unter normalen Bedingungen.  
*Not applicable under normal conditions.*

Beim Umgang mit offenen oder undichten Zellen Handschuhe aus Neopren oder Naturkautschuk tragen.  
*In case of handling of an open or leaky cell, wear gloves made of neoprene or natural rubber.*

Bei der Handhabung einer offenen oder undichten Zelle eine Schutzbrille tragen.  
*At handling of an open or leaky cell wear protective goggles.*

Im unmittelbaren Arbeitsbereich sollte eine Augenspülung zugänglich sein.  
*In the immediate working area an eye wash should be accessible.*

In den Arbeitsbereichen nicht essen, trinken oder rauchen.  
*Do not eat, drink or smoke in the work areas. Mind order and cleanliness.*

**ABSCHNITT 9: Physikalische und chemische Eigenschaften**  
**SECTION 9: Physical and chemical properties**

**9.1 Angaben zu den grundlegenden physikalischen und chemischen Eigenschaften**  
**Information on basic physical and chemical properties**

Nicht anwendbar  
*Not applicable*

**9.2 Sonstige Angaben**  
**Other information**

Nicht anwendbar  
*Not applicable*

**ABSCHNITT 10: Stabilität und Reaktivität**  
**SECTION 10: Stability and reactivity**

**10.1 Reaktivität**  
**Reactivity**

Nicht anwendbar  
*Not applicable*

**10.2 Chemische Stabilität**  
**Chemical stability**

Durch lange Lagerung wird die Kapazität der Batterie reduziert und die voraussichtliche Funktionsdauer wird verkürzt. Das Gehäuse kann durch auslaufenden Elektrolyt von innen beschädigt werden.  
*During a long storage the capacity will be reduced and the lifespan of the battery will be shorter. The plastic housing can be damaged by leaking electrolyte.*

**10.3 Möglichkeit gefährlicher Reaktionen**  
**Possibility of hazardous reactions**

Nicht anwendbar  
*Not applicable*

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**10.4 Zu vermeidende Bedingungen**  
*Conditions to avoid*

Nicht anwendbar  
*Not applicable*

**10.5 Unverträgliche Materialien**  
*Incompatible materials*

Nicht anwendbar  
*Not applicable*

**10.6 Gefährliche Zersetzungsprodukte**  
*Hazardous decomposition products*

Nicht anwendbar  
*Not applicable*

**ABSCHNITT 11: Toxikologische Angaben**  
*SECTION 11: Toxicological information*

**11.1 Angaben zu toxikologischen Wirkungen**  
*Information on toxicological effects*

Im normalen Umgang treten keine gefährlichen Stoffe aus der Batterie aus und es kann somit zu keiner Berührung mit toxischen Stoffen kommen.

*Under normal use there will be no leaking and, hence, there will be no contact with toxic contents of the battery.*

**ABSCHNITT 12: Umweltbezogene Angaben**  
*SECTION 12: Ecological information*

Bei normalem Umgang tritt keine Umweltschädigung durch die Batterie auf.

*Under normal use there will not be any environmental pollution.*

Die Batterie muss nach dem Gebrauch gesondert entsorgt werden, da sie gefährliche Chemikalien enthält, siehe Punkt 13  
*If the battery is unusable, you must recycle it. See Point 13.*

**12.1 Toxizität**  
*Toxicity*

Nicht anwendbar  
*Not applicable*

**12.2 Persistenz und Abbaubarkeit**  
*Persistence and degradability*

Nicht anwendbar  
*Not applicable*

**12.3 Bioakkumulationspotenzial**  
*Bioaccumulative potential*

Nicht anwendbar  
*Not applicable*

**12.4 Mobilität im Boden**  
*Mobility in soil*

Nicht anwendbar  
*Not applicable*

**12.5 Ergebnisse der PBT- und vPvB-Beurteilung**  
*Results of PBT and vPvB assessment*

Nicht anwendbar  
*Not applicable*

**12.6 Andere schädliche Wirkungen**  
*Other adverse effects*

Nicht anwendbar  
*Not applicable*

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**ABSCHNITT 13: Hinweise zur Entsorgung**  
**SECTION 13: Disposal considerations**

**13.1 Verfahren der Abfallbehandlung**  
**Waste treatment methods**

Bitte lesen Sie die Bedienungsanleitung sorgfältig.  
*Read instructions carefully.*

Eine Batterie ist Sondermüll.  
Die Entsorgung der Batterie darf nur über ein zugelassenes Rücknahmesystem erfolgen.  
Die Batterie darf auf keinen Fall über den Restmüll entsorgt werden.  
*The battery is classed as hazardous waste.*  
*It is not allowed to dispose of it with common waste.*  
Wenn die Batterie unbrauchbar ist, entsorgen Sie sie gemäß den geltenden Recyclingvorschriften.  
*If the battery is unusable, dispose of it according to the applicable recycling regulations.*

**ABSCHNITT 14: Angaben zum Transport**  
**SECTION 14: Transport information**

**14.1 UN-Nummer**  
**UN Number**

UN 3480 oder UN 3481  
*UN 3480 or UN 3481*

**14.2 Ordnungsgemäße UN-Versandbezeichnung**  
**UN proper shipping name**

**UN 3480:**  
ADR: LITHIUM-IONEN-BATTERIEN  
LITHIUM ION BATTERIES  
ICAO-TI/IATA-DGR: Lithium-Ionen-Batterien  
Lithium ion batteries

**UN 3481:**  
ADR: LITHIUM-IONEN-BATTERIEN IN AUSRÜSTUNGEN  
LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT  
oder / or  
LITHIUM-IONEN-BATTERIEN, MIT AUSRÜSTUNGEN VERPACKT  
LITHIUM ION BATTERIES PACKED WITH EQUIPMENT  
ICAO-TI/IATA-DGR: Lithium-Ionen-Batterien, in Ausrüstungen  
Lithium ion batteries contained in equipment  
oder / or  
Lithium-Ionen-Batterien, mit Ausrüstungen verpackt  
Lithium ion batteries packed with equipment

**14.3 Transportgefahrenklassen**  
**Transport hazard class(es)**

9 (Verschiedene gefährliche Stoffe und Gegenstände/ *Miscellaneous*)

**14.4 Verpackungsgruppe**  
**Packing group**

II (Stoffe mit mittlerer Gefahr/ *Substances presenting medium danger*)

**Verpackungsanweisung/ packing instruction**

**ADR:**  
UN 3480 P903, P908, P909, P910, LP903, LP904  
UN 3481 P903, P908, P909, P910, LP903, LP904  
**ICAO-TI/IATA-DGR:**  
UN 3480 Verpackungsanweisung 965, Teil IA  
Packing Instruction 965, Section IA  
UN 3481 Verpackungsanweisung 966, Teil I  
Packing Instruction 966, Section I  
Verpackungsanweisung 967, Teil I  
Packing Instruction 967, Section I

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**Anmerkung:**

Zellen und Batterien, Zellen und Batterien in Ausrüstungen oder Zellen und Batterien mit Ausrüstungen verpackt, die Lithium in irgendeiner Form enthalten, müssen der UN-Nummer 3090, 3091, 3480 bzw. 3481 zugeordnet werden. Sie dürfen unter diesen Eintragungen befördert

werden, wenn sie den folgenden Vorschriften entsprechen:

- a) jede Zelle oder Batterie entspricht einem Typ, für den nachgewiesen wurde, dass er die Anforderungen aller Prüfungen des Handbuchs Prüfungen und Kriterien Teil III Unterabschnitt 38.3 erfüllt;
- b) jede Zelle und Batterie ist mit einer Schutzvorrichtung gegen inneren Überdruck versehen oder so ausgelegt, dass ein Gewaltbruch unter normalen Beförderungsbedingungen verhindert wird
- c) jede Zelle und Batterie ist mit einer wirksamen Vorrichtung zur Verhinderung äußerer Kurzschlüsse ausgerüstet;
- d) jede Batterie mit mehreren Zellen oder mit Zellen in Parallelschaltung ist mit wirksamen Einrichtungen ausgerüstet, die einen gefährlichen Rückstrom verhindern;
- e) Zellen und Batterien sind gemäß einem Qualitätssicherungsprogramm hergestellt, das Folgendes beinhaltet:
- (i) eine Beschreibung der Organisationsstruktur und der Verantwortlichkeiten des Personals hinsichtlich der Auslegung und der Produktqualität;
  - (ii) die entsprechenden Anweisungen, die für die Prüfung, die Qualitätskontrolle, die Qualitätssicherung und die Arbeitsabläufe verwendet werden;
  - (iii) Prozesskontrollen, die entsprechende Aktivitäten zur Vorbeugung und Feststellung innerer Kurzschlussdefekte während der Herstellung von Zellen umfassen sollten;
  - (iv) Qualitätsaufzeichnungen, wie Prüfberichte, Prüf- und Kalibrierungsdaten und Nachweise; Prüfdaten müssen aufbewahrt und der zuständigen Behörde auf Verlangen zur Verfügung gestellt werden;
  - (v) Überprüfungen durch die Geschäftsleitung, um die erfolgreiche Wirkungsweise des Qualitätssicherungsprogramms sicherzustellen;
  - (vi) ein Verfahren für die Kontrolle der Dokumente und deren Überarbeitung;
  - (vii) ein Mittel für die Kontrolle von Zellen und Batterien, die dem in Absatz a) genannten geprüften Typ nicht entsprechen;
  - (viii) Schulungsprogramme und Qualifizierungsverfahren für das betroffene Personal und
  - (ix) Verfahren um sicherzustellen, dass am Endprodukt keine Schäden vorhanden sind.

**Note:**

*Cells and batteries, cells and batteries contained in equipment, or cells and batteries packed with equipment, containing lithium in any form shall be assigned to UN numbers 3090, 3091, 3480 or 3481 as appropriate. They may be carried under these entries if they meet the following provisions:*

- a) *each cell or battery is of the type proved to meet the requirements of each test of the Manual of Test and Criteria, Part III, sub-section 38.3; b) each cell and battery incorporates a safety venting device or is designed to preclude a violent rupture under normal conditions of carriage;*
- c) *each cell and battery is equipped with an effective means of preventing external short circuits;*
- d) *each battery containing cells or series of cells connected in parallel is equipped with effective means as necessary to prevent dangerous reverse current flow*
- e) *cells and batteries shall be manufactured under a quality management program that includes:*
- (i) *a description of the organizational structure and responsibilities of personnel with regard to design and product quality;*
  - (ii) *the relevant inspection and test, quality control, quality assurance, and process operation instruction that will be used;*
  - (iii) *process controls that should include relevant activities to prevent and detect internal short circuit failure during manufacture of cells;*
  - (iv) *quality records, such as inspection reports, test data, calibration data and certificates. Test data shall be kept and made available to the competent authority upon request;*
  - (v) *management reviews to ensure the effective operation of the quality management program;*
  - (vi) *a process for control of documents and their revision;*
  - (vii) *a means of control of cells or batteries that are not conforming to the type tested as mentioned in (a) above;*
  - (viii) *training programs and qualification procedures for relevant personnel and*
  - (ix) *procedures to ensure that there is no damage to the final product.*

**14.5 Umweltgefahren**  
*Environmental hazards*

Keine  
None

**14.6 Besondere Vorsichtsmaßnahmen für den Verwender**  
*Special precautions for user*

Nicht anwendbar  
*Not applicable*

**14.7 Massengutbeförderung gemäß Anhang II des MARPOL-Übereinkommens und gemäß IBC-Code**  
*Transport in bulk according to Annex II of Marpol and the IBC Code*

Nicht anwendbar  
*Not applicable*

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ABSCHNITT 15: Rechtsvorschriften  
SECTION 13: Regulatory information

**15.1 Vorschriften zu Sicherheit, Gesundheits- und Umweltschutz/ spezifische Rechtsvorschriften für den Stoff oder das Gemisch**  
**Safety, health and environmental regulations/ legislation specific for the substance or mixture**

Hinweise auf Vorschriften zur Beförderung gefährlicher Güter:

- Europäisches Übereinkommen über die internationale Beförderung gefährlicher Güter auf der Straße (ADR)
- Ordnung für die internationale Eisenbahnbeförderung gefährlicher Güter (RID)
- Europäisches Übereinkommen über die Beförderung gefährlicher Güter auf Binnenwasserstraßen (ADN)
- Internationaler Code für die Beförderung gefährlicher Stoffe mit Seeschiffen (IMDG-Code)
- International Civil Aviation Organization / Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO-TI)
- International Air Transport Association / Dangerous Goods Regulations (IATA-DGR)
- Gefahrgutbeförderungsgesetz (GGBefG)
- Gefahrgutverordnung Straße, Eisenbahn und Binnenschifffahrt (GGVSEB)
- Gefahrgutverordnung See (GGVSee)
- Luftverkehrsgesetz (LuftVG), Luftverkehrs-Zulassungs-Ordnung (LuftVZO)

Notes to regulations concerning the transport of hazardous goods:

- European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR)
- Convention concerning International Carriage by Rail (RID)
- European Agreement concerning the International Carriage of Dangerous Goods by Inland Navigation (ADN)
- International Maritime Dangerous Goods Code (IMDG-Code)
- International Civil Aviation Organization / Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO-TI)
- International Air Transport Association / Dangerous Goods Regulations (IATA-DGR)
- German Gefahrgutbeförderungsgesetz (GGBefG)
- German Gefahrgutverordnung Straße, Eisenbahn und Binnenschifffahrt (GGVSEB)
- German Gefahrgutverordnung See (GGVSee)
- German Luftverkehrsgesetz (LuftVG), Luftverkehrs-Zulassungs-Ordnung (LuftVZO)

EG-Einstufung für den Stoff/ Zubereitung:

EC Classification for the Substance/Preparation:

Das Produkt ist gemäß der Verordnung EG Nr. 1272/2008 als nicht gefährlich eingestuft.  
This product is not classified as hazardous according to Regulation (EC) No. 1272/2008.

USA:

USA:

Diese Batterie ist ein Artikel gem. 29 CFR1910.1200 und unterliegt nicht den Verpflichtungen des OSHA Hazard Communication Standard. Diese Sicherheitshinweise enthalten wichtige Vorgaben für die sichere Verwendung und damit den sachgerechten Umgang mit dem Produkt. Diese Sicherheitsinformationen sollten aufbewahrt werden und für Mitarbeiter und andere Benutzer des Produkts zugänglich sein.

*This battery is an article acc. to 29 CFR1910.1200 and is not subject to the obligations of the OSHA Hazard Communication Standard. These safety information contain important specifications for the secure use and thus the proper handling with the product. These security information should be retained and be accessible for employees and other users of the product.*

Kanada:

Canada:

Dieses Produkt unterliegt nicht den WHIMS-Vorschriften. Es erfüllt die Definition eines "Fabrik-Artikels" und unterliegt somit nicht den Vorschriften des Gefahrstoffgesetzes.

*This product is not governed by the WHIMS-regulations. It fulfills the definition of a "factory-made article" and is thus not subject to the regulations of the Hazardous Product Act.*

Australien:

Australia:

Die aufgeführten Stoffe entsprechen der Liste der Designated Hazardous Substances (NOHSC).  
The listed substances are according to the List of Designated Hazardous Substances (NOHSC).

**15.2 Stoffsicherheitsbeurteilung**  
**Chemical safety assessment**

Nicht anwendbar  
Not applicable

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**ABSCHNITT 16: Sonstige Angaben****SECTION 16: Other information**

Die Inhalte der Abschnitte 4 bis 8 sowie 10 bis 12 beziehen sich nicht unbedingt auf den Gebrauch und die ordnungsgemäße Verwendung des Produkts (siehe dazu Gebrauchsanweisung und Fachinformationen), sondern auf die Freisetzung größerer Mengen bei Unfällen und Unregelmäßigkeiten.

*Data of sections 4 to 8, as well as 10 to 12, do not necessarily refer to the use and the regular handling of the product (in this sense consult package leaflet and expert information), but to release of major amounts in case of accidents and irregularities.*

Diese Informationen wurden nach bestem Wissen und Gewissen sorgfältig zusammengestellt.

*This information has been compiled accurately to the best of our knowledge and belief.*

Torqueedo schließt jedoch jegliche Gewährleistung auf die Genauigkeit, Zuverlässigkeit und Vollständigkeit der aufgeführten Informationen aus!

*However, Torqueedo excludes any warranty for the accuracy, reliability or completeness of the information contained herein!*

Diese Daten stellen keine Zusicherung von Eigenschaften des beschriebenen Produktes/ der beschriebenen Produkte im Sinne der gesetzlichen Gewährleistungsvorschriften dar.

*This data does not constitute a guarantee for the characteristics of the product(s) as defined by the legal warranty regulations.*

Die Daten über die gefährlichen Inhaltsstoffe wurden dem letztgültigen Sicherheitsdatenblatt des Vorlieferanten entnommen.

*The data for the hazardous ingredients were taken respectively from the last version of the sub-contractor's safety data sheet.*

Es liegt in der Verantwortung des Anwenders, die Angemessenheit und Vollständigkeit dieser Informationen in Bezug auf seinen besonderen Verwendungszweck zu prüfen.

*It is the user's responsibility to satisfy himself as to the suitability and completeness of this information for his particular use.*

# 8

## Troubleshooting

Q: The engine doesn't start when I turn on the ignition key?

A: Make sure vehicle is not plugged into charge station.



**NOTE:** The Odyne system made no changes to the engine or the starting motor. See manufacturer's instruction for proper solution.

Q: The regenerative braking is not working. What can I do?



**NOTE:** The regenerative braking can be perceived by the driver whenever the vehicle is moving and the accelerator is released, or when the brake pedal is pressed slightly.

A: Verify that the regenerative braking switch is not off. The regenerative braking will not slow the vehicle down if the batteries are fully charged (SOC > 90% will not regenerate).



**NOTE:** The vehicle's brakes are fully functional at all times whether regenerative braking is enabled/disabled.

Q: The job site hydraulics or air do not function. What can I do?

A: Verify that the vehicle is properly entered into ePTO mode (green LED light).



**NOTE:** The PTO can be operated via the engine without the Odyne system by turning the hybrid disable switch on to disable all hybrid systems. If the hybrid system is disabled, the PTO will function as normal.

Q: The Exportable Power outlets (if equipped) don't supply electricity. What can I do?

A: The power outlets will work only upon proper entrance into ePTO mode, and exportable power switch is depressed. Verify final stage manufacturer's switch and breakers are enabled.

Q: The cabin becomes hot/cold whenever the engine shuts down.

What can I do?

A: Use the auxiliary air conditioning or heat to set the desired cabin temperature which controls the auxiliary heating and cooling systems. The vehicle must be in ePTO mode to use the auxiliary air conditioning, heater (if equipped). The original heating and cooling systems only function when the engine is on (i.e. while driving the vehicle or idling).

Q: The batteries do not charge when the charging plug is plugged in.

What can I do?

A: When the vehicle successfully enters plug-in charge mode the Odyne interface screen's amp section will show a positive reading, indicating the battery packs are charging. Also check to ensure the charge station (EVSE) is working properly.

Q: The vehicle will not enter ePTO mode. What can I do?

A: Possible reasons the vehicle will not enter ePTO mode include the following:

- The hybrid disable switch is activated.
- The vehicle ignition switch is not in the on position.
- The vehicle is not in neutral or the parking brake is not set.

Q: The vehicle exited ePTO mode. What happened?

A: Any of the following events will cause the vehicle to exit ePTO mode:

- "ePTO Mode" switch in the dash is pressed.
- Parking brake is released.
- Ignition key is moved to the off or accessory position.
- Vehicle is put into gear.
- Faulted

The lamp in the ePTO switch will extinguish once the ePTO mode is exited.



**NOTE:** If any of the troubleshooting recommendations do not solve the problem, contact Odyne Systems, LLC.

## Appendix: Hybrid System Frequent and Periodic Inspection Intervals

### Daily

1. Visually check coolant levels.
2. Inspect for leaks in cooling system.
3. Check for any illegible or missing decals or instructional markings.
4. Check that all guards and covers are in place, and not damaged.
5. Perform function test of the hybrid system.

### 30 Days (160 Hours)

1. All Daily items.
2. Visually inspect and lube PTO driveline - See PTO Sheet 37

### 90 Days (360 Hours)

1. All Daily items.
2. Visually inspect and lube PTO driveline. See PTO Sheet 37
3. Visually inspect all brackets/mounting.
4. Check electrical connections and grounds on and under chassis.
5. Visually inspect electrical wiring.

### 12 Months (1050 Hours)

1. Critical Weld and Bolt Torque Inspection of all components, and related hardware.
2. Check for any physical damage of all components.
3. Test coolant for proper freeze point/boiling point and ph levels.
4. Visually check coolant for rust, scale, or mineral deposits.
5. Annual inspection of lithium-ion battery pack(s)

### Coolant Type

The hybrid cooling system requires extended life glycol coolant mixed 50/50 with distilled water.



**NOTE:** The vehicle should be parked on level ground prior to starting any coolant level check.

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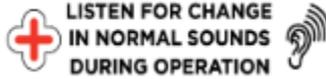
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# PTO Driveline Maintenance Schedule and checklist



## 30 Days (160 Hours) Checklist

1. Perform initial Visual and Audible inspection while PTO is operating (Make sure that nobody is under truck and operation is safe. Stay out from under the truck and away from moving parts)

Do you hear anything abnormal? Comment in maintenance chart on page 38.

**Remove key from ignition and follow your company's lock out tag out procedure from this point of inspection forward.**

2. Visually/physically check on PTO Shaft/Flange contact locations:
  - A. Can the flange move fore/aft (front to back) on the shaft while bolted?
    - Yes – Remove flange, inspect PTO shaft, and Motor shaft for damage. If the splines have no visual damage re-install and ensure 20 ft. pounds of torque is applied to the flange mounting bolt and torque cap screws to 43 ft. pounds on companion flange.
    - Does the flange/shaft still have movement?
      - Yes – Contact Odyne for further direction.
      - No – Move on to step 3.
    - NO – Move on to step three of inspection process.
3. Does the spline engagement feel secure and the torque values of the flange mounting hardware, u-joints, and system are verified?
  - Yes- Proceed to grease shaft per specification
  - No – Contact Odyne service for further direction.

4. Does the spline engagement feel secure on the lovejoy flange?  
 Yes- Verify 49 ft. Pounds of torque on Lovejoy set screws.  
 No – Contact Odyne service for further direction.

5. Lubrication spec/volume for Odyne PTO shaft vehicle applications:

-Fuchs grease or equivalent grease

-Volume (volume will vary on usage) pump grease until clean grease is visible on u-joints. Clean dirty /excessive grease from joints.

Service Performed	Date	PTO Hours	Truck Hours	Comments	Tech Initials

Service Performed	Date	PTO Hours	Truck Hours	Comments	Tech Initials

## NOTES:

For technical or service assistance please call Odyne Systems, LLC at (262) 544-8405 or visit [www.odyne.com](http://www.odyne.com)

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