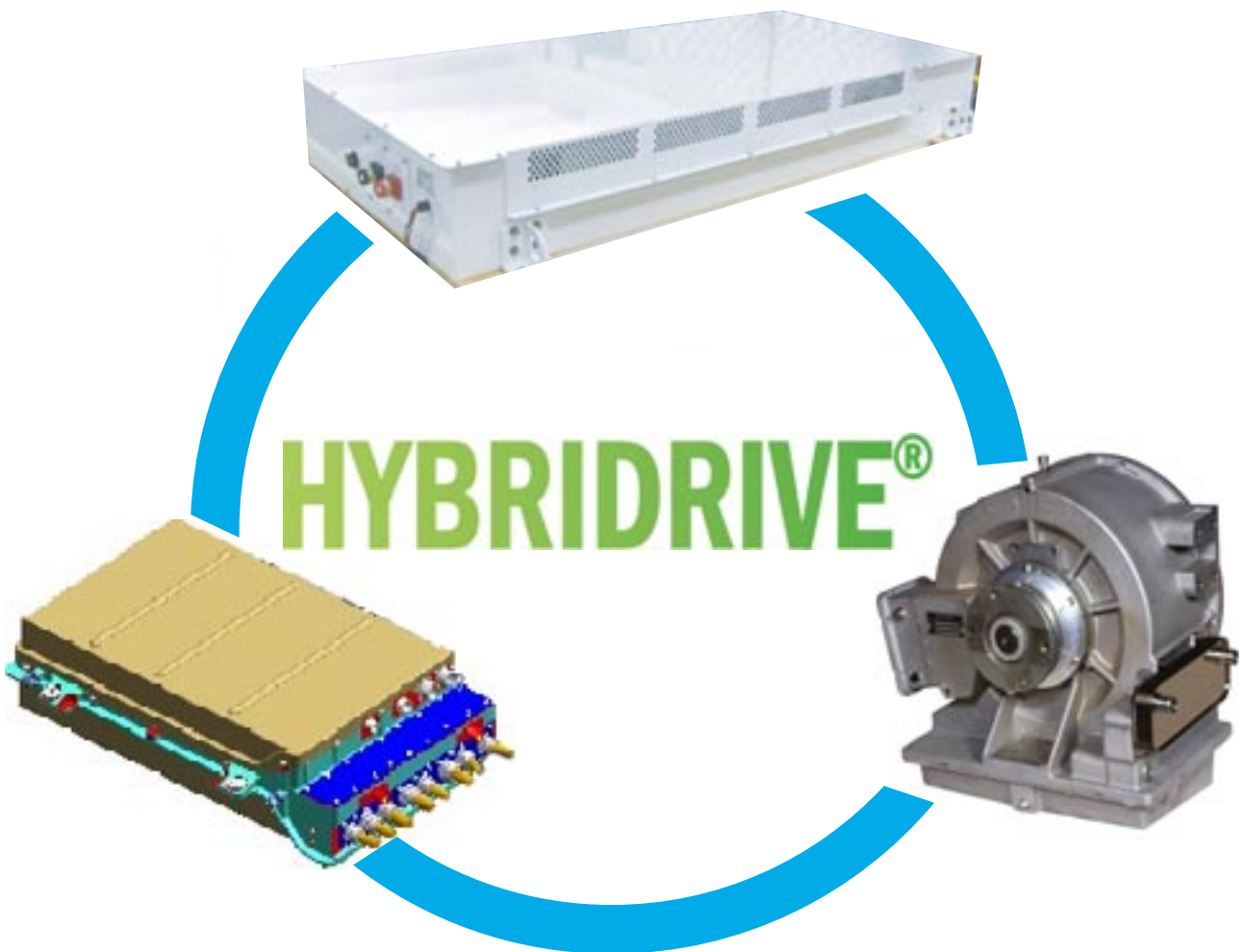


Hybridrive® Responders Information



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Hybriddrive® First Responder Information

Scope

To provide emergency and safety information associated with Hybriddrive® systems in support of implementation of First responder practices.

Hybriddrive® System Overview

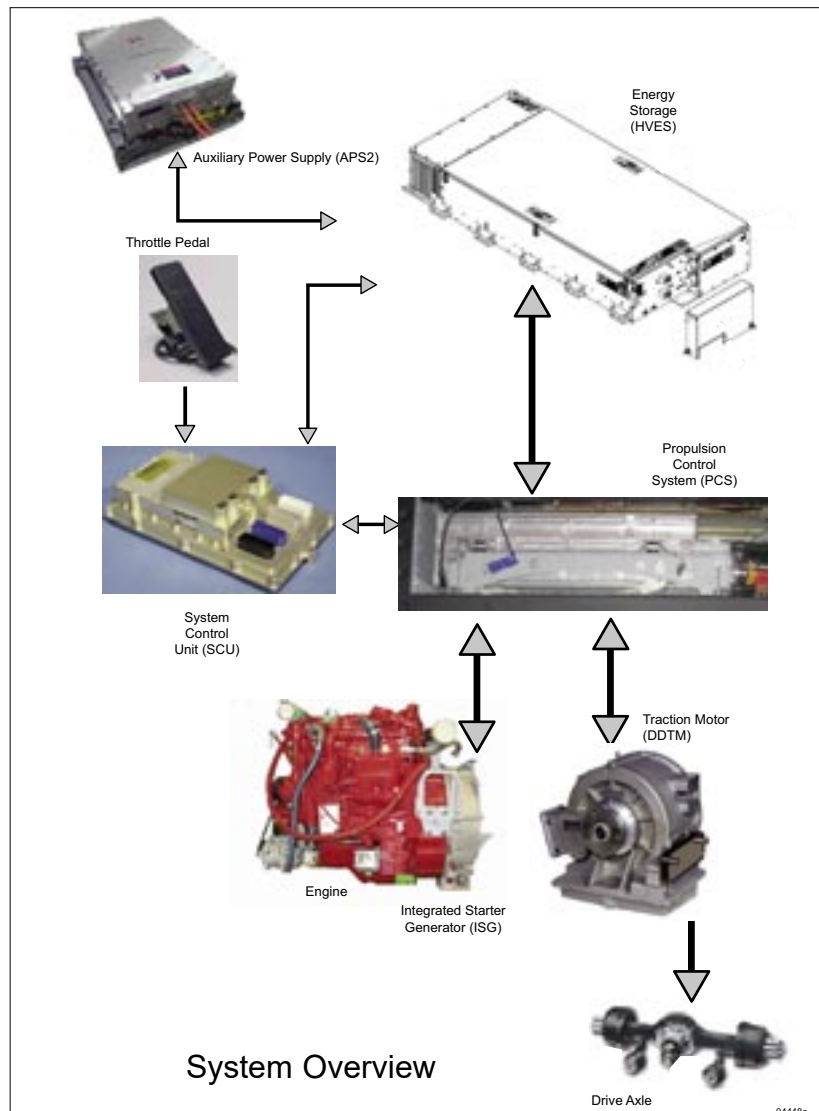
The Hybriddrive® system is a power management technology for Hybrid Electric Vehicles to improve hybrid performance, fuel economy, reliability, and to reduce cost.

A functional breakdown of the transit system will identify components within the Hybriddrive® system.

Each of the components is summarised in Section 1.

List of Abbreviations

- ACTG** AC Traction Generator
- ACTM** AC Traction Motor
- ESS** Energy Storage System
- PCS** Propulsion Control System
- SCBA** Self Contained Breathing Apparatus
- PPE** Personal Protective Equipment
- MSDS** Material Safety Data Sheet
- kW** Kilowatt



Section 1 - Component Data

Energy Storage System (ESS)

Location:

The ESS is mounted in a compartment under the rear seats on the upper deck.

Description:

Stores on average 630 volts DC in Lithium Ion battery modules.

Peak design power 200kW

Total capacity 866Wh



Energy Storage System (ESS)

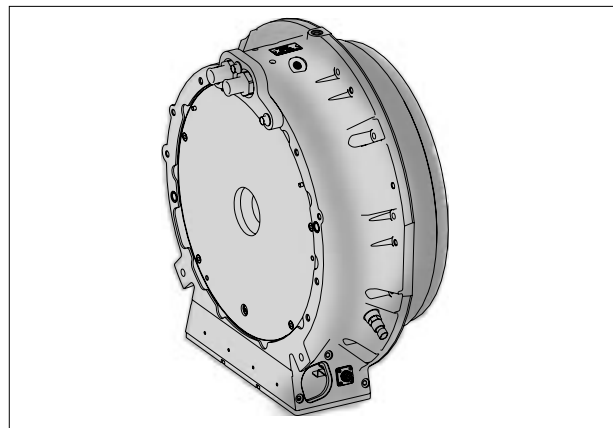
AC Integrated Starter Generator (HDS100)

Location:

Always connected to engine flywheel.

Description:

Creates 3 phase AC when engine is running.



AC Integrated Starter Generator HDS100

Traction Motor (DDTM)

Location:

Always connected to the rear axle.

Description:

Operates on and creates 3 phase AC up to 195kW peak to move the vehicle.

Peak power 195kW (260hp) @1100-3000rpm

Continuous 120kW (160hp) @1200-4100rpm



Direct Drive Traction Motor (DDTM) installed

Section 1 - Component Data

Propulsion Control System (PCS)

Location:

Location is in the PCS bay compartment at the top of the engine bay, behind a noise shield.

Description:

Propulsion system main control. Interfaces with the ESS, ACTG and ACTM using High Voltage connections.

Continuous output 2x200kW



Propulsion Control System (PCS)

Interconnecting Cables

Location/routing:

Dependent on component location.

Description:

Interconnects the ESS, ACTG and ACTM with the PCS.

All High Voltage cables are marked with an orange coloured loom.



High voltage cables in orange coloured loom

Master Disconnect Switch

Location

Right hand side in engine compartment.

Description:

Isolates the system components. Must be switched to the OFF position while any work in being carried out on the system.

It incorporates a locking facility to prevent the system being inadvertently reactivated. (Padlock required)



Engine Bay Switches

Section 2 - Component Disconnect Procedures

Disconnecting the Hybridrive® Components

Personal Protective Equipment (PPE)

Required whenever the ESS Battery is being accessed.

- Class 1 high voltage rubber gloves
- Safety Glasses
- Long sleeve heavy shirt (non-melting)
- Head protection

⚠ WARNING

Operation of the Diesel engine will always produce electrical current due to the attached generator. Therefore engine must be stopped before carrying out disconnection.

⚠ SAFETY WARNING ⚠

The mandatory 4 minute discharge period MUST be observed prior to accessing Hybridrive® System

24v Isolation Procedure

The 24 VDC supply to the Hybridrive® System **MUST** be switched OFF before performing any disconnection.

1. Switch off the Master Switch on the drivers dashboard.



Master Switch on Drivers Dashboard

2. Switch off 24 VDC by switching OFF Master Disconnect Switch, located to the right hand side of the engine compartment. Rotate the switch ANTICLOCKWISE.



Master Disconnect Switch

Master Disconnect Switch must be switched **OFF** in order to isolate the supply to the Hybridrive® System. This isolates the ESS and ensures the High Voltage circuits are made safe.

The Orange high voltage cables SHOULD NOT BE CUT AT ANY TIME.

There are safety features built into the ESS to ensure no HV output occurs after these steps have been taken

Emergency Disconnect Procedure:

If the normal 24v shut-off procedure is not possible switch off 24 VDC by disconnecting the vehicle batteries, located in a slide out tray on the driver's side of the vehicle, ahead of the front wheels



Vehicle 24V DC Battery tray extended

Section 2 - Component Disconnect Procedures

Disconnecting the Hybriddrive® Components

Accessing the ESS

The High voltage system is inert after the 24v supply is removed and the 4-minute wait period has elapsed.

If it is still necessary to access the ESS connections they can be located behind bolted panels at the rear of the bus

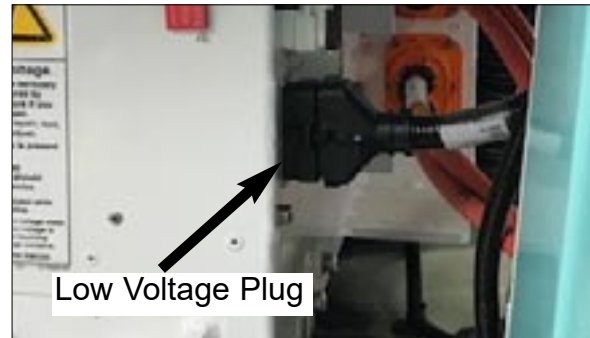


To remove the panel, first remove the reflectors to access the retaining bolts, remove these, then lift the panel away. The same applies to the louvred panel on the right hand rear side of the bus. This will allow visibility and access to the HV connectors on the ESS.



Disconnecting the ESS

Remove the low voltage plug and secure away from the ESS



Then disconnect High Voltage plugs top then bottom and tie securely away from the casing



**The Orange high voltage cables
SHOULD NOT BE CUT AT ANY TIME.**

There are safety features built into the ESS to ensure no HV output occurs after these steps have been taken

Section 3 - Recommended Safety Equipment/Techniques

Fire Fighting Equipment

Personnel:

Self contained Breathing apparatus (SCBA).

Full Fire Fighting Personal Protective Equipment (PPE).



Vehicle

BAE Hybridrive® components
ACTG, ACTM, PCS, and Cables:

Fire Extinguisher - Class C

ESS (Li-Ion Specific)

Fire Extinguisher:

Most Preferred - Class D (smothering type).

Alternate: - abundant amounts of water at a safe distance.

Note: Hydrogen gas will be produced if battery cells are ruptured and water is introduced.

Follow required HAZ MAT procedures and precautions – see MSDS Contact section.

Facility- ESS (Li-Ion Specific)

General recommendations:

Fire Extinguisher: Class D fire extinguisher (smothering type) [size to be determined by local authorities] to be within 10 feet of ESS during service.

Rescue Equipment: Non Conductive body hook.

Scaffolding work platform recommendations

Fire Extinguisher: Class D fire extinguisher (smothering type) [size to be determined by local authorities] at the platform level - one per scaffold in use.

Rescue Equipment: Non Conductive body hook - one per scaffold in use.

Fire Fighting Techniques (Li-Ion Specific)



First Aid

BAE Hybridrive® components
ACTG, ACTM, PCS, and Cables:

Standard First Aid considerations.

ESS (Li-Ion Specific):

Inhalation: If contents of an opened battery are inhaled, move victim to fresh air. Obtain medical advice.

Eye Contact: Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for at least 30 minutes while holding the eyelids open. Quickly transport victim to an emergency care facility.

Skin Contact: Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for at least 30 minutes.

Ingestion: Have victim rinse mouth thoroughly with water. DO NOT INDUCE VOMITING. Have victim rinse mouth with water again. Quickly transport victim to an emergency care facility.

Section 3 - Recommended Safety Equipment/Techniques

Environmental (Li-Ion Specific)

Personal Precautions:

Restrict access to area until completion of clean-up. Do not touch spilled material.

Environmental Precautions:

Prevent material from contaminating soil and from entering sewers and waterways.

Method for Containment:

Contain the spilled liquid with dry sand or earth.

Methods for Clean-up:

Absorb spilled material with an inert absorbent (dry sand or earth). Scoop contaminated absorbent into an acceptable waste container.

Scrub the area with detergent and water; collect all contaminated wash water for proper disposal.

Personal Protection

Skin Protection:

Wear neoprene or natural rubber gloves if handling an open or leaking battery.

Eye Protection:

Wear safety glasses.

Personal Protective Equipment:

Wear flame resistant clothing.

Arc Flash Clothing* – minimum rating of 8.75 cal/cm²

Balaclava (Ski mask) – minimum rating of 8.75 cal/cm²

Hard Hat with Face Shield – minimum rating of 8.75 cal/cm², face shield with wrap around guarding to protect the face, chin, forehead, ears, and neck area is required.

Hearing Protection – canal inserts

Eye protection - safety glasses ANZI-Z87

High Voltage Gloves – Class 0 - Leather protector gloves need not be used under limited-use conditions, when small equipment and parts manipulation necessitate unusually high finger dexterity. Extra care is required when examining prior to use.

Multi Meter – 1000v

Stray Voltage Eliminator – 1000v

High Voltage Tools – 1000v

Insulating Blanket – rated to 7.5kV

*Notes:

1. Article 130.7 (9) has been revised to specify how Arc Flash Clothing is to be worn: Shirt and coverall sleeves shall be fastened at the wrists, shirts shall be tucked into pants and shirts, coveralls, and jackets shall be closed at the neck.
2. NO synthetic materials may be worn beneath the Arc Flash Clothing.
3. Previous Arc Flash Clothing had a minimum rating of 8.0 cal/cm²

Contact Information

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Dingley Way, Farnborough

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United Kingdom

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Alexander Dennis

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Central Park, Larbert

FK5 4RU

United Kingdom

Telephone: +44 (0) 845 358 9988

email: info@alexander-dennis.com

Appendix A - MSDS

ESS Material Safety Data Sheets (MSDS) may be requested by contacting:

Manufacturer:

Energy Storage System ESS-A123

123 Systems Inc.
Arsenal on the Charles 1 Kingsbury Ave
Watertown MA 02472
Phone: (617) 778-5700
Fax: (617) 778-5749

24 Hour Emergency - **CHEMTREC**
NORTH AMERICA 800-424-9300
INTERNATIONAL 703-527-3887

**Energy Storage System
ESS-3G-32K**

BAE Systems Part Numbers:
115E808, 364A6978

Appendix A - MSDS

Energy Storage System (ESS) - ESS-3G-32K Material Safety Data Sheet (SDS)

Note: Material SDS is provided for reference only. Contact the Emergency Telephone number listed to insure you have the most current information.

MATERIAL DATA SAFETY SHEET

**Model p1.7 lithium-ion polymer battery for HEV PHEV and EV
LG Chemical Limited.**

1. Identification of the Substance/Preparation and of the Company/Undertaking

Product Name

LGCHEM P1.7 Lithium-Ion Polymer Battery

Manufacturer

LG Chemical Limited
Twin Tower
Youido-Dong, Youngdeungpo-Ku
Seoul, Korea

Emergency Telephone Number

+82-2-3773-6730

2. Hazards Identification

Primary routes of entry

Skin contact : NO
Skin absorption : NO
Eye contact : NO
Inhalation : NO
Ingestion : NO

Symptoms of exposure

Skin contact
No effect under routine handling and use.

Skin absorption
No effect under routine handling and use.

Eye contact
No effect under routine handling and use.

Inhalation
No effect under routine handling and use.

Reported as carcinogen
Not applicable

Emergency Overview

May explode in a fire, which could release hydrogen fluoride gas.
Use extinguishing media suitable for materials burning in fire.

Appendix A - MSDS

3. Composition/Information on Ingredients

Hazardous Ingredients	%	CAS Number
Aluminum Foil	2-10	7429-90-5
Metal Oxide (proprietary)	20-50	
- Manganese	5-15	
- Nickel	3-6	
- Cobalt	3-6	
Polyvinylidene Fluoride (PVDF)	<5	24937-79-9
Copper Foil	5-20	7440-50-8
Carbon (proprietary)	10-20	7440-44-0
Electrolyte (proprietary)	10-20	
Aluminum, Copper plate and inert materials	Remainder	N/A

Lithium-equivalent Content: 4.71g (58.56 Watt)

4. First Aid Measures

Inhalation

Not a health hazard.

Eye contact

Not a health hazard.

Skin contact

Not a health hazard.

Ingestion

If swallowed, obtain medical attention immediately.

IF EXPOSURE TO INTERNAL MATERIALS WITHIN CELL DUE TO DAMAGED OUTER CASING, THE FOLLOWING ACTIONS ARE RECOMMENDED ;

Inhalation

Leave area immediately and seek medical attention.

Eye contact

Rinse eyes with water for 15 minutes and seek medical attention.

Skin contact

Wash area thoroughly with soap and water and seek medical attention.

Ingestion

Drink milk/water and induce vomiting; seek medical attention.

Appendix A - MSDS

5. Fire-Fighting Measures

General Hazard

Cell is not flammable but internal organic material will burn if the cell is incinerated.

Combustion products include, but are not limited to;

hydrogen fluoride,
carbon monoxide
carbon dioxide.

Extinguishing Media

Use extinguishing media suitable for the materials that are burning.

Special Firefighting Instructions

If possible, remove cell(s) from fire fighting area. If heated above 150°C, cell(s) may explode/vent.

Firefighting Equipment

Use NIOSH/MSHA approved full-face self-contained breathing apparatus (SCBA) with full protective gear.

6. Accidental Release Measures

On Land

Place material into suitable containers and call local fire/police department.

In Water

If possible, remove from water and call local fire/police department

7. Handling and Storage

Handling

No special protective clothing required for handling individual cells.

Storage

Recommend to store the cell in an environment with under 70% RH free from corrosive gas within in a temperature range of -20 to 35°C. A temperature of 60°C or higher will accelerate the deterioration of battery performance

8. Exposure Controls/Personal Protection

Engineering controls

Keep away from heat and open flame. Store in a cool and dry place.

Personal Protection

Respirator
Not required during normal operations. SCBA required in the event of a fire.

Eye/face protection

Not required beyond safety practices of employer.

Gloves

Not required for handling of cells.

Foot protection

Steel toed shoes recommended for large container handling

9. Physical and Chemical Properties

State	Solid
Odor	N/A
PH	N/A
Vapor pressure	N/A
Vapor density	N/A
Boiling point	N/A
Solubility in water	Insoluble
Specific gravity	N/A
Density	N/A

Appendix A - MSDS

10. Stability and Reactivity

Reactivity

None

Incompatibilities

None during normal operation. Avoid exposure to heat, open flame, and corrosives.

Hazardous Decomposition Products

None during normal operating conditions. If cells are damaged, hydrogen fluoride and carbon monoxide may be released.

Conditions To Avoid

Avoid exposure to heat and open flame. Do not puncture, crush or incinerate.

11. Toxicological Information

This product does not elicit toxicological properties during routine handling and use

If the cells are opened through misuse or damage, discard immediately. Internal components of cell are irritants and sensitizers.

Sensitization:	No
Teratogenicity:	No
Reproductive toxicity:	No
Acute toxicity:	No

12. Ecological Information

Some materials within the cell are bioaccumulative. Under normal conditions, these materials are contained and pose no risk to persons or the surrounding environment.

13. Disposal Considerations

California regulated debris
RCRA Waste Code : Non regulated

Dispose of according to all federal, state, and local regulations

14. Transport Information

UN No. 3480

Proper Shipping Name: Lithium Ion Batteries
Class 9 Packing Group II Hazard Label: Miscellaneous

ICAO/IATA

Packing Instruction: 965

Maximum Gross Weight per Package on Passenger and Cargo Aircraft: 5 kg

Maximum Gross Weight per Package on Cargo Only Aircraft: 35 kg

Special Provision: A45, A88, A99

IMO

Packing Instruction: P903

Special Provision: 188, 230, 310, 957

EmS: F-A, S-I

US DOT

This product is not subject to any other requirements of dangerous goods under 49 CFR 173.185 (Lithium Batteries and Cells).

15. Regulatory Information

OSHA hazard communication standard
(29 CFR 1910.1200)

Hazardous Non-hazardous

16. Other Information

For further information, see:

For more information, consult the Technical Data Sheet (www.lgchem.com).

Sources of key data used to compile the datasheet

Information contained in this safety data sheet is based on LG Chem owned data and public sources deemed valid or acceptable. The absence of data elements indicates that no data meeting these requirements is available

Further information

This information is based on our present state of knowledge. It shall describe our products regarding safety requirements and shall not be construed as a guarantee or statement of condition and/or quality