TECHNICAL SPECIFICATION

ELECTRICAL PRIME MOVER (TERMINAL TRACTOR)

V 2.0 – FEBRUARY 2026

SYNOPSIS

Document	:	Technical Specification for Electrical Prime Mover
Date	:	25 February 2026
Appendices	:	V2.1 – Project Phasing and Deliverables
		V2.2 – Scope of Supply
		V2.3 – Main Technical Parameters
		V2.4 – HSE Requirements and Environmental and Social (E&S) Requirements
		V2.5 – Factory and Site Acceptance Checklist

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1 PROJECT DESCRIPTION

1.1 INTRODUCTION

In this Technical Specification the scope of supply in V2.2 – Scope of Supply for a project is described, consisting of the design, manufacture, delivery and commissioning of Electric Prime Mover (EPM) for container terminal operation.

Section 1 states several general and administrative requirements. Section 2 describes the general requirements for the operational and dimensions. Section 3 provides the reader with additional requirements regarding the technical design details. Section 4 describe documentation requirement to finalisation of the project after the delivery.

This Technical Specification includes several appendices for information, clarification and additional detailed requirements of different aspects mentioned as reference in this document.

The bidder is deemed to point out any anomaly or ambiguity in this Technical Specification during Q&A stage.

1.2 TERMINOLOGY

Throughout this document a specific terminology will be followed using upper case initials. When lower case initials are used, the term is referred to in a general meaning. Below a list of all specific terminology can be found.

Customer:	the party entering into the Contract with the Contractor and retaining decisive control during all phases of the Project. The terms Customer, Company and Employer shall have the same meaning throughout this Technical Specification and its appendices.
Contract:	contractual agreement between the Customer and the Contractor, regarding the execution of the Project described in this Technical Specification.
Contractor:	party engaged by the Customer to execute the entire Project, with end responsibility for the full scope of supply as agreed in the Contract. Supplier, Vendor, Tenderer and Bidder: where used in this Technical Specification and its appendices these terms shall be understood as referring to the Contractor, as applicable to the relevant stage of the procurement procedure or Contract.
Engineer:	the Employer's Representative or another person duly authorised by the Employer to discuss, review or administer specific aspects of the Project within the scope of the authority granted under the Contract.
Project	combination of all the works described in this Technical Specification, being the design, manufacture, delivery and commissioning of the Electric Prime Movers (EPM)

1.3 PROJECT PHASING AND MILESTONES

The Project shall be clearly divided in several phases, each ended by a milestone requiring formal approval by the Customer. The different phases and the respective milestones ending them are listed in table 1 and details of project phasing and milestones are stated in V2.1 – Project Phasing and Deliverables.

Throughout the Project, the Contractor will be responsible for the delivery of different kinds of documentation as required in V2.1 – Project Phasing and Deliverables. The absence of a required document will automatically lead to the postponement of the approval or acceptance indicating the end of said phase and being an indispensable condition for the start of the subsequent phase.

Project phase		**Milestone ending the Project phase**	
P1	Tender procedure	M1	Contract award
P2	Detailed design	M2	Customer Design Approval
P3	Manufacture	M3	Factory Acceptance Test
P4	Transport and on-site commissioning	M4	Deliver to Site
P5	Site Acceptance Test	M5	Customer Provisional Acceptance
P6	Improvement Stage	M6	Customer Final Acceptance

Table 1: Project phasing and milestones

1.4 DOCUMENTATION

1.4.1 DESIGN DOCUMENTATION

The Contractor shall submit for review by the Engineer a soft copy of all design drawings, mechanical structure calculations, electrical diagrams, pneumatic diagrams, catalogue information and detail shop drawings, as described in V2.1 – Project Phasing and Deliverables.

This design review by the Engineer has the aim of verifying general conformity of the design with the specifications. The Design Approval shall not relieve the Contractor of any responsibility for the complete compliance with the requirements stipulated in this Technical Specification and in the Contract.

All documents submitted for review shall have been thoroughly checked and signed for approval by the Contractor's responsible engineer (structural, mechanical, electrical and pneumatic). Revisions to previously reviewed documents shall be indexed by the Contractor's engineer, as proof of his review and approval of the revision and shall be resubmitted. A proposal for the management of tracking revision numbers and state of documents shall be submitted by the Contractor.

All design documents shall be provided in English. All calculations are presented in the SI metric system. All calculations and computer results shall be presented in an easily understood manner. The Engineer is the only judge of the adequacy of all presented information.

1.4.2 CERTIFICATION

The Contractor shall ensure the Prime Mover is put into service in accordance with the Machinery Directive and regulations as defined in 1.5. Unless contractor provide evidence, this is not applicable in destination country of Prime Mover delivery. An EU or EC Declaration of Conformity, as applicable on the date the EPM is placed on the market or put into service, shall be provided for each EPM before Provisional Acceptance.

1.4.3 AS-BUILT DOCUMENTATION

As an indispensable condition for the Provisional Acceptance, the Contractor will supply a complete as-built file for the Electric Prime Mover. All drawings, i.e. assemblies as well as mechanical device drawings, shall be included in the as-built file. All documentation shall be provided in Polish and English, unless agreed otherwise by the Engineer. In the latter case the applied language shall be English. In any case the Engineer shall be the final judge of the completeness of the as-built documentation file.

1.4.3.1 Mechanisms, Electrical, Hydraulic and Pneumatic System

The following principles regarding as-built documentation and software apply:

- All lists of materials, referring to the correct drawing numbers in their latest revision, shall be provided as softcopy in two sets.

- All latest version program which makes EPM works, shall be provided together with requires tools to use.

1.4.3.2 Operational and maintenance documentation

One complete electronic copy and three complete hard copy sets of the operating, maintenance, inspection and component replacement documentation shall be provided for the entire Project in both English and Polish. The documentation shall include, but not be limited to:

- complete operating manual
- maintenance manuals for motor, batteries, axles, brakes, electrical and pneumatic equipment, including references to spare part numbers and descriptions of the manufacturer part numbers, catalogue data, operating and maintenance manuals including instructions for (dis)assembly
- inspection manuals for all types of inspections
- maintenance checklists for all types of manufacturer-required EPM inspections
- lubrication manual with advised intervals and with the grease and oil to be provided
- instruction manual for adjustable settings

The Contractor shall produce all documents in close cooperation with the Engineer.

1.4.4 TRAINING FOR CUSTOMER STAFF

The Contractor shall provide operational training by competent instructors to train Customer's PM operators, engineers and maintenance staff at Customer premises.

The Trainer's experience and references and qualification shall be submitted before the delivery of Prime Mover. The Trainer shall have at least three (3) years' experience on the system he is responsible to train. Customer reserved the right to request for a change of the trainer at the Contractor's cost.

All instructions and training manuals shall be in the English and Polish. The manuals for training shall reach to Customer two (2) weeks before the commencement of the training.

Customer shall provide the classroom and audio-visual facilities. The Contractor is expected to provide all necessary lecture materials, handouts, and demonstration at no additional cost to Customer.

1.4.4.1 Maintenance Staffs

Technical training course shall be conducted for at least 12 Technicians.

The course shall be conducted in three modules, after the delivery of the Prime Mover. Details shall be discussed during delivery.

The course for technicians shall cover the following:

- Safe Work Procedures including risk assessment of hazards and technical requirements in the Maintenance and inspection of battery, inverter and its power units.
- Safe Work Procedures including risk assessment of hazards and technical requirements in the Maintenance and repair of driving Motor, Axles, Brakes, Hydraulic and pneumatic components of the Prime Mover
- Safe Work Procedures including risk assessment of hazards and technical requirements in the Maintenance and repair of all electrical components of the Prime Mover
- Safe Work Procedures including risk assessment of hazards and technical requirements in the Maintenance for the removal/replacement of main components
- Downloadable and configurable version of the BMS firmware(s) as well as the related firmware loader program(s) shall be released to the Customer for the repair and maintenance of the BMS system
- Safe Work Procedures including risk assessment of hazards and technical requirements in the Troubleshooting of faults for at least following topics
  - Battery Pack
  - BMS
  - Inverter
  - Driving Motor
  - Battery cooling and heating system
  - Charging system
  - PM Cabin interior system
  - PM Cabin diagnostic system
- Daily Pre operation checks

The Contractor shall provide the hardware and software including the licenses to perform all proposed training.

Downloadable and configurable versions of the BMS firmware(s) as well as the related firmware loader program(s) shall be released to the Customer for the repair and maintenance of the BMS system during training, The training to use this software shall be provided. This includes the ability to configure hardware module addresses and/or any other battery parameters that are necessary as part of the maintenance program and/or component level replacement.

The Contractor shall provide additional training at no additional cost to Customer if coverage agreed is insufficient.

1.4.4.2 Operator Staffs

Operator training course shall be conducted for at least 18 operators.

The course for operators shall cover the following:

- Discussion and operation of instruments in the cabin
- Couple/decouple operation with Trailer
- Daily Pre operation checks
- Emergency Escape Process

The Contractor shall submit all proposed training schedule, contents for approval by Engineer.

The Contractor shall provide additional training at no additional cost to Customer if coverage agreed is insufficient.

1.5 STANDARDS AND REFERENCE SPECIFICATIONS

Applicable directives, national and international regulations, European and Local Standards are part of these specifications and shall be used by the Contractor for the design and construction of the Prime Mover. The list of directives, national and international regulations for respective parts of the Prime Mover are stated in V2.3 – Main Technical Parameters.

The following shall additionally be referenced and complied with, as applicable, and incorporated into V2.3 – Main Technical Parameters : the Machinery Directive 2006/42/EC and the Machinery Regulation (EU) 2023/1230 (which applies from 20 January 2027 and will govern conformity for machinery placed on the market from that date); the EMC Directive 2014/30/EU; EN 1175 (electrical and electronic safety of industrial trucks); IEC 62619 (safety of secondary lithium cells and batteries for industrial applications); IEC 60529 (degrees of protection, IP ratings); ISO 16750-4 and IEC 60068-2-1 (climatic and low-temperature testing); EN 13059 and ISO 2631-1 (whole-body vibration); ISO/SAE 21434 and UN Regulation No. 155 (vehicle cybersecurity); and ISO/IEC 17025 (competence of testing laboratories).

In case of conflict between a standard or reference specification and the Contract specifications, the most stringent of them shall apply. In case of inconsistencies between different standards and/or reference specifications, the most stringent requirements shall be followed unless approved otherwise by the Engineer.

2 GENERAL REQUIREMENT

2.1 GENERAL CONSIDERATION

2.1.1 OPERATIONAL

The Contractor shall be responsible for the design of the Prime Mover in accordance with this Technical Specification and with the Contract. Any item not specifically mentioned but technically necessary for the Prime Mover to achieve the functions and parameters expressly specified in this Technical Specification shall be deemed included in the scope of contractor.

The Prime Mover shall be of a robust and heavy-duty design to work continuously in different cycles, performing following tasks and also reverse processes (eg. coupling/uncoupling):

- Connect to a standard container trailer using the fifth wheel without extra staff for locking/unlocking 5th wheel on trailer and operator does not need to leave the cabin nor perform extra operations for elevated type of 5th wheel;
- Ride, position and stop under Quay or Yard cranes, under Reach Stacker or Empty Container Handler (RS and ECH), located in different parts of the terminal;
- Receive on trailer and drive with one or two ISO Containers of 20 [ft.], 40 [ft.] and 45 [ft.] on the trailer. The EPM shall be capable of operating at a GCW of up to 85 tonnes on gradients of up to 4%;
- On the back of the cabin there should be 7-pin socket according to standard ISO 1185 for electrical connection between Prime Mover and trailer. The socket of the connector should have a spring-loaded cover, to minimize penetration of dirt and moisture, and the housing should be constructed from durable corrosion-resistant die cast metal or rugged plastic. The Contractor shall ensure sufficient spare connections for future implementation of add-on systems such as telematics. If necessary, an additional 7-pin socket may be proposed for the Customer's consideration
- Nearby abovementioned 7-pin socket there shall be 2 pneumatic glad-hand connectors for connecting pneumatic brake system on trailer. Air in that connectors shall come from brake circuit from prime mover.
- The Prime Mover's maximum speed shall be electronically limited based on the Customer's specified speed limit in the terminal and speed limit shall be configurable by customer technical staff.

2.1.2 DIMENSIONS AND OVERVIEW

The Prime Mover shall have a minimum GCW capacity of 85 tonnes and shall be capable of operating at a GCW of 85 tonnes on slopes and ramps with gradients of up to 4%. Other detailed dimensions and technical parameters of the Prime Mover are specified in V2.3 – Main Technical Parameters.

Main dimensions and Technical Parameters of the Prime Mover:

- Width:	- maximum 3000 [mm]
- Length:	- maximum 6000 [mm]
- Height:	- maximum 4200 [mm]
- Cabin type:	- left hand drive
- Maximum outer turning radius with trailer:	- c.a. 15 [m]
- 5th wheel capacity:	- minimum 35 [tonnes]
- Lowest 5th wheel height from the ground level:	- 1200 [mm]
- GCW:	- minimum 85 [tonnes]

3 MAIN EQUIPMENT

3.1 STRUCTURE

The Structure of Prime Mover shall be made of welded structure of rolled steel fit for the purpose or bolted configuration of steel structure. The thickness of main steel structure shall not be less than 6mm.

The steel structure shall comply to EN 10025, type S355J0 or equivalent.

The air reservoirs and battery compartments shall have anti-collision protection and shall be fixed onto the chassis.

The design of the vehicle shall be suited up to minor collisions. Rear wheel mudguards should be easily removable to carry out maintenance works. Vehicle bumpers should provide protection against damage to the cabin. Bumper of the vehicle should be spaced from cab of at least 100 [mm] from the front of the vehicle and at least 50 [mm] on the right and left side.

Towing pin should be of a diameter 37-50 [mm] and shall be located on the front and rear side of chassis.

3.2 PLATFORM/STAIR AND LADDERS

Each walkable surface, has to be anti-slippery and surface protrusions shall be minimised (i.e. recessed, flushed with ground surface, with domed shaped fasteners).

The Prime Mover shall be designed with in-board stepladders and reachable handrails when accessing the cabin from the left-hand side and right-hand side of cabin. The access steps shall be integrated with the chassis and have anti-slip surface and bright coloured edge warning strips. No. of steps and height between steps shall be designed to ensure minimal effort is required to access the cabin.

All bolted-on platforms, stairs and ladders in the main entry system shall be “hot-dip-galvanised”. The zinc coating shall be typically in excess of 70 [µm] thick. All bindings used in these areas, up to a size no less than M8 (bolts should be Metric), are of stainless-steel Grade A2-70).

3.3 AXLES

Both front and rear axles shall be of a type proven in comparable heavy-duty service, evidenced by reference installations in equivalent duty and a documented spare-parts and service capability; any make meeting these criteria is acceptable. The axles should be designed and designated for heavy operating conditions. The product data sheet of the proposed axle shall be submitted with the offer.

3.3.1 FRONT AXLE

Heavy-duty, non-driven steering axle with semi-elliptical laminated leaf springs providing suspension in conjunction with shock absorbers mounted in maintenance-free rubber bushings.

The steering axle shall provide a minimum steering angle of 50 degrees [°] and shall not be driven or transmit torque from the traction motor. The axle shall have a minimum load capacity of 10 tonnes at a travel speed of 20 [km/h].

3.3.2 REAR AXLE

The rear axle shall meet the following requirements:

- Heavy-duty driven axle to ensure shock absorption fit for the purpose and with air suspension as stated in V2.3 – Main Technical Parameters;
- The driven axle, transferring 100 [%] of normal operation torque, equipped with the blockade of the differential mechanism activated from the driver's cab as described below;
- The axle must be able to withstand the maximum load of the 5th wheel at 30 [km/h] of no less than 35 [tonne];
- The axle must be equipped with the differential and hub reducing gears with total reduction degree not lower than 12:1.

3.4 SUSPENSION

Front – semi-elliptical leaf springs; system equipped with a hydraulic shock absorber.

Rear – pneumatic suspension with air suspension bellows and automatic height adjustment depending on actual load values. There shall be also a possibility of manually lowering and raising the chassis by specified button on operator’s dashboard.

3.5 PNEUMATIC SYSTEM

Piston compressor integrated with the motor. The rear suspension pneumatic system as well as brake system shall be fed from the main compressor.

All distribution of compressed air from compressor, where possible, should be by means of piping, attached to PM structure by ISO standardized clamps. Where flexible connection is needed, proper pneumatic hose should be used however, it shall be protected from cutting and abrasion on the structure (i.e. by PE spiral protector). There should be also 2 glad-hand connectors at the back of the cabin for supplying trailer with compressed air – those should be connected to brake circuit.

3.6 BRAKES

The brakes shall be pneumatically operated. The braking system must be of a “dual circuit” design, with independent circuits for the front and rear axle brakes and shall be equipped with an air dryer.

A fail-safe braking system shall be provided. The rear axle shall be equipped with dual-chamber spring brake actuators combining the service brake function with a spring-applied parking and emergency brake function. The spring brakes shall automatically apply in the event of insufficient pneumatic system pressure or loss of air pressure.

The parking brake should be electrically controlled and automatically engaged when the motor is switched off.

- Front axle brakes:
  - Pneumatically operated at a pressure of 8–10 [bar];
  - Type: Dry disc or drum.
- Rear axle brakes:
  - Pneumatically operated at a pressure of 8–10 [bar];
  - Equipped with dual-chamber spring brake actuators
  - Type: Dry disc or drum.

The braking system shall incorporate regenerative braking to recover the maximum practicable amount of braking energy and return it to the battery.

3.7 HYDRAULIC SYSTEM

The hydraulic pump for the steering system shall be directly driven by an electric motor and equipped with a priority valve ensuring priority oil flow to the steering system.

Hydraulic oil tank shall be fixed inside the chassis frame for additional crash protection. Tank capacity must be of minimum 32 [dm3]. Working pressure of system: 180/250 [bar]. Distribution of hydraulic oil, where possible, should be by means of piping - attached to Prime Mover structure by ISO standardized clamps. Where flexible connection is needed, proper hydraulic hose should be used however, it shall be protected from cutting and abrasion on the structure (i.e. by PE spiral protector).

3.8 STEERING SYSTEM

Fully hydrostatic steering system with heavy-duty hydrostatic steering control valve and priority valve acting on the steering system. The system should include protection of steering emergency operation mode with cutting from other hydraulic systems in situations of their failure.

The steering system shall be designed to allow to turn wheel from full turn from left to right or vs within 3 sec with max 5 full turn of steering wheels by one hand.

The steering wheel must have a knob and be adjustable in both in/out and up/down direction.

3.9 BEARING

Applied bearings shall be standardised items available from a wide range of bearing manufacturers, meeting the minimum design life stated in this document. All bearings supplied must be standardized and have equivalents within a wide range of bearings OEM. OEMs of all supplied bearings shall be clearly stated in the offer along with their product data sheets.

The certificate of origin for all bearings shall be provided.

The minimum design lifetime of bearings shall be 50 000 [hours] if it is not specified differently in this document.

3.10 5TH WHEEL

The 5th wheel shall be fixed to the Prime Mover frame by means of pivot pins. This shall allow adjustment of the 5th wheel inclination for coupling, lifting and retaining the trailer. The load-carrying capacity of the 5th wheel shall be at least 35 tonnes.

The Prime Mover frame shall be equipped with heavy-duty trailer guiding slides for easy and fast attachment to the trailer while 5th wheel is lowered at minimum height.

5th wheel shall be equipped with automatic interlocking system on the kingpin. Releasing of the interlock should be controlled from the cabin and operated pneumatically. The system must include monitoring installed inside the cabin on the operators' dashboard and demonstrating to the operator proper locking by LED light. The 5th wheel shall be prevented from accidental release during operation. The 5th wheel coupling can only be opened when the Prime Mover is stationary.

5th wheel sweep (from kingpin) clearance of minimum 1.8 [m] from cabin shall be provided to minimise the possibility of container hitting the rear of Prime Mover.

3.11 WHEELS

Wheels, fixed on axles shall not protrude nor anyhow cause disturbance of the PM track.

3.11.1 TYRES

- Pneumatic, heavy-duty, Industrial, tubeless tires- SWL 30 [km/h]
- Pneumatic, 310/80 R22.5 Size of tires is stated in V2.3 – Main Technical Parameters
- Pressure 10.0 [bar].

3.11.2 RIMS

- Heavy-duty steel rims with lifetime of minimum 50 000 working hours.
- Mounting system must prevent self-undoing of the bolts to eliminate need for periodical tightening. There is acceptable only one retightening after changing of a wheel.
- The thickness/size of the rim at the point of attachment shall not be less than 15 [mm].

3.12 CABIN

Driver's cabin shall be designed to provide maximum visibility, low level of noise, excellent comfort and ergonomics for the driver. The cabin shall be left-hand traffic type or otherwise determined by the Customer.

It shall be built to meet the following clauses:

3.12.1 DESIGN

The structure of the vehicle's cabin should be a welded cage made of high-strength reinforced steel for safety of the driver. It shall be designed and certified with FOPS (Falling Object Protective Structures) conforming to ISO3449 and ROPS (Roll-Overprotective Structures) conforming to ISO3471. The plating of the cabin shall be made of steel to increase durability to mechanical damage and allow fast and economical repairs.

An additional alternative door, away from the line of fire from falling objects shall be provided on the driver's cabin. Full access stepladder and walk-way platform shall be provided on the outside of the cabin for this door so for proper escape from the cabin during emergency. Access and escape doors must have properly positioned handrails within reach and handles for effective grip support when climbing up and coming down from the cabin.

Surface protrusions on walkways shall be minimised (i.e. recessed or flushed with surface).

Cabin door should be hinged and have steel structured with glass window. The door security lock opened, preferably, with ignition key (compatible with customer existing equipment key, with possibility for making spare keys), with possibility to leave them in open position by means of latch on chassis/ protective barriers to prevent them from closing when maintaining inside cabin.

In addition to hydraulic cylinders being used to lift and hold the cabin in place during maintenance, a mechanical safety latch is required as a failsafe.

3.12.2 DRIVER SEAT

- Seat shall be comfortable and shall be firmly anchored to the construction and equipped with pneumatic suspension. Seat should allow adjustment of the seat stiffness, depending on the weight of the driver. The seat should significantly dampen vibrations caused by riding on uneven surfaces. The seat should have height, tilt, horizontal and lumbar support adjustment. The backrest should be adjusted in a wide range and should not obstruct nor reduce view of driver when looking at any direction;
- The seat shall have foldable and adjustable armrests on left and right side of seat as well as an adjustable and removable headrest;
- The seat should have a "quick release" function, which means that it can be quickly moved downwards to the lowest position for easy exit and easy entry;
- Three-point self-tensioning and self-retractable seat belt, BR-4 type, with seat belt fastening indicator. The fastening indication is carried out by connecting to an additional LED flashing beacon on the roof. When the seat belt is fastened the flashing beacon lights up. Additionally, there shall be provided visual and audible seatbelt warning shall be activated when the seat belt is not fastened before the start of operation and shall remain active during movement until the seat belt is fastened. Seatbelt should be of enough length, even for obese operator and must offer comfortable, easy and automatic loosening during normal operation - it shall be ELR type (Emergency Locking Retractor). The seat belt offered shall meet European Commissions (EC) and Federal Motor Vehicle Safety Standards (FMVSS) requirements.
- Seat belt shall offer adjustment of shoulder part of belt – lowering and lifting and shall be brightly coloured to be visible from outside of cabin.

3.12.3 WINDOWS

- Front and rear window shall be laminated, multi-layer type and should be equipped with a solar curtain on the entire width of the window. Solar curtain cannot obscure the driver's perspective, but must absorb the sun rays (i.e. mesh type);
- The rear window shall be fitted with tinted glass absorbing sun rays;
- Windscreen washing liquid tank cannot be located inside the driver's cabin and should be of minimum capacity 5 [dm3]. The tank shall be connected with pump via delivered hose. Refill of the tank should be easy and simple;
- Electrically heated rear window that should be switched on/off by defined switch on the driver's dashboard;
- Electrically lifted and lowered left window glass with separate switch on the driver's dashboard;
- Roof of the Prime Mover should be equipped with the tinted glass with rollable, bright colour solar curtain on the entire width of the window. The cab roof window shall be located in the rear part of the cabin to provide visibility of the lowered container during trailer loading;
- Roof of driver's cabin shall be equipped with protective screen (safety guard), made of min. 4 [mm] steel flat bars, and painted RAL5005 (or otherwise determined by the Customer), all over the roof and yet allowing operator to see lowered container.

3.12.4 INSTRUCTOR'S SEAT

- There shall be additional, folding seat mounted for the instructor;
- This seat must be equipped with two-point seat belt offering comfortable, easy and automatic loosening during normal operation – ELR (BR-4) type as well.

3.12.5 EXTERIOR AND INTERIOR MIRRORS

- On both sides of the Prime Mover should be one mirror of standard type of minimum dimensions: 180 [mm] wide and 380 [mm] high and second one wide panoramic of minimum dimensions: 210 [mm] wide and 160 [mm] high. Fixed on a durable holder(s) resisting vibrations from vehicle. The mirrors should cover area: a width of 4.5 [m] just at the end of the cabin and a width of 15 [m] at 10 [m] after the cabin on both sides;
- The exterior mirrors should be electrically heated and switched on/off by defined switch on the driver's dashboard;
- Wide, panoramic reverse mirror inside of the Prime Mover cabin;
- Wide, panoramic spot mirror outside of cabin, mounted on its front, to assist driving in confined areas;
- An additional mirror should be mounted inside the cabin and placed between the dashboard and the bottom of the window glass allowing operator to observe moving loads (loading/unloading) without turning around.

3.12.6 CABIN INSULATION

- The cabin shall be mounted on anti-vibration rubber fittings which should significantly minimize vibrations;
- The driver's cabin should be sound-proofed. Noise level in the cabin shall be kept to a maximum of 85 [dB] (A) with measurement done in accordance with EN12053 or equivalent standards. High-quality fire-retardant sound insulating material to cushion motor noise, heat insulation and fittings shall be installed;
- The fire-retardant material shall be glued completely to the motor compartment firewall and to the inside of cabin side walls.

3.12.7 AUXILIARY IT DEVICES

The Prime Mover should have dedicated space, supports and power connections for IT equipment. The IT equipment will be delivered by the Customer, but installed and electrically connected by the Supplier before the handover, as described:

- Flat steel shelf 220x200 [mm] or single DIN pocket, hidden within dashboard for installing main radio unit which is 50 [mm] high;
- Shelf or mounting plate for a radio loudspeaker about 10x10 [cm], close to the DIN pocket;
- A fixing point for the CB radio microphone holder, about 5x5 [cm], close to the DIN pocket;
- Terminal TOS PC/Monitor;

3.12.8 FIRE EXTINGUISHER

One (1) unit of 6 [kg] dry chemical powder fire extinguisher shall be installed inside the cabin and easily accessible by the driver. If a 6 kg extinguisher cannot be accommodated inside the cabin, one 2 kg dry chemical powder fire extinguisher shall be installed inside the cabin and one additional 6 kg ABC powder fire extinguisher shall be installed in a hard-shell PE case with latches (without access key), nearby access to operator's cabin

All extinguisher holder/enclosures shall be designed to secure the fire extinguisher firmly in place at a suitable location. The holder shall allow for quick and easy removal of fire extinguisher.

3.12.9 VISUAL AND AUDIO INDICATORS

- A horn of a minimum 100 [dB] shall be provided to warn other users during operations. The driver shall be able to apply the horn easily when required.
- External warning buzzer switched automatically ON during reversing. Loudness should not be less than 85 [dBA]
- Vehicle shall be equipped with turn indicators on the mirror brackets or other visible places on the sides of the vehicle. Turn indicator must be visible both from the front, rear and sides of the vehicle, even with container-loaded trailer.
- The vehicle should be equipped with daytime running lights at the front for better visibility.

- A cabin roof lamp shall be provided to assist driver in coupling the trailer in low lighting conditions.

3.13 ELECTRICAL SYSTEM

The electrical system shall be designed to eliminate fire hazards, and the Prime Mover shall be protected from extensive damages during electrical short-circuit.

Fire retardant-grade cables between battery and motor.

All main circuit power supply cables originating from the batteries shall be further harness protected and be routed separately from the rest of the control cables (i.e. the power supply cable shall be distinctively separated from the rest of the control cables).

The harness shall be designed Withstand extreme cold and high heat Resistant to vibration, tension, and abrasion Harness connectors must be sealed to be resistant to water, salt spray, and chemical.

The battery isolator (main switch) shall be installed nearest to the battery compartment and be easily accessible to the user – at external surface of the Equipment (without need of opening any compartment). The supply from the batteries to the power requirement, shall pass through this isolator (main switch). The battery isolator (main switch) should be able to mount a Lock-Out/Tag-Out (LOTO) device.

3.13.1 GENERAL REQUIREMENT

- Power-Up by means of START/STOP button after turning the key 014603 type;
- 24 [V] DC negative earth;
- Wiring with code numbers according to electrical drawings;
- 24 [V] power outlet at rear of cabin, nearby pneumatic trailer outlets. It shall end with 7-pin socket according to standard ISO1185:

DIN	Signal	Colour
31	Ground (-)	WHITE
58L	TAIL LAMPS, CLEARANCE LAMPS/OUTLINE MARKER LAMPS, IDENTIFICATION LAMPS – LEFT SIDE	BLACK
L	LEFT TURN SIGNAL	YELLOW
54	STOP LAMPS	RED
R	RIGHT TURN SIGNAL	GREEN
58R	TAIL LAMS, CLEARANCE LAMPS/OUTLINE MARKER LAMPS, IDENTIFICATION LAMPS – RIGHT SIDE	BROWN
	REVERSING LIGHTS//REVERSING SIREN	BLUE

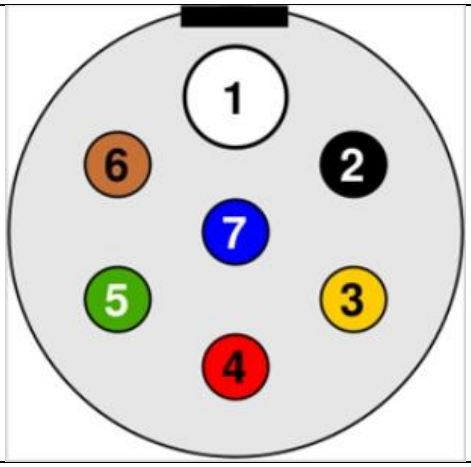


Table 2 Trailer socket wiring

3.13.2 LIGHTING

- LED headlights with dipped lights and long beam lights and LED turn indicators;
- LED rear lights, LED turn indicator and LED stoplights mounted behind the cabin;
- Reversing light of appropriate brightness and range with an external warning signal/ buzzer as described earlier;
- Rear working light LED, behind the cabin to improve visibility of the 5th wheel;
- Internal LED light inside the cabin;
- First LED beacon lamp on the roof, amber colour, starting after the main switch is ON, it shall have visibility of 360 [°] and at least 100 [m] visibility;
- Second LED beacon lamp on the roof, amber colour, demonstrating that seatbelt is fastened, i.e.: ON when the seatbelt is connected (locked). It shall have visibility of 360 [°] and at least 100 [m] visibility;
- Additional LED turn indicators installed on external mirror brackets or otherwise protruding beyond the outline of the cabin.

In general, according to ILO code of Practice OHS, all lights should be visible from 150 [m] on a clear night.

3.13.3 EQUIPMENT FOR CABIN

- Manual-type air conditioning unit shall be sized to maintain internal cab temperature of 20 [°C] maximum in all external ambient temperature conditions (as specified earlier). An adjustable thermostatic knob shall be installed within reach of the operator, enabling safe and quick adjustment of temperature;
- Windscreen wiper and washer at the front and rear window, both to be engaged separately;
- Adjustable cabin fan and heater;
- Two power cables with 12 [V], 10 [A] DC should be provided for installation place of IT equipment (as mentioned above). There should be a separate circuit from the fuse box with its own fuse;
- A standard DIN radio mounting slot within operator's reach (on dashboard or roof – facing operator for easy access).

3.13.4 OPERATOR'S DASHBOARD - ELECTRICAL EQUIPMENT

All controls in driver's cabin shall be positioned within easy reach of the driver. All indicator lights shall be of LED type.

3.13.4.1 Switches

- Power switch – START/STOP button;
- Differential mechanism lock with manual, spring-loaded pushbutton, enabled only when the pushbutton is pressed;

- Operation lights;
- Road lights;
- Locking/ unlocking of 5th wheel lock – two separate switches, placed ergonomically, nearby each other for pressing them by two fingers;
- 2-position, spring-loaded switch for lowering of rear suspension – "neutral" and "down" (i.e. with spring return to "neutral' position);
- Lifting/ lowering of left window glass.

3.13.4.2 Indicator lights or graphic symbols

- Turn indicator is activated;
- Differential mechanism is locked (if applicable);
- Parking brake is enabled;
- Check motor (if applicable);

The graphic symbols shall be intuitive and easily recognised by the driver. The digital codes are acceptable but cannot be the only information displayed on the dashboard. Each digital code must be accompanied by additional and intuitive information.

3.13.4.3 Lamps or displayed information with buzzer warning

- Low hydraulic pressure (if applicable);
- High motor temperature (if applicable);
- Low pressure in pneumatic system;
- Low traction battery energy level (if applicable);
- Low 24 [V] battery energy level (if applicable);
- Too low tire pressure, signals received from sensors, reading the tire pressure in each tire separately.
- Low battery level

3.13.4.4 Driver's dashboard

With information about motor/hydraulic/pneumatic systems. The panel should display information continuously, when ignition is ON:

- Power-On Hour Meter (Key-On Hour Meter) [h] – counts elapsed time whenever the vehicle control system is powered and the tractor is in READY/Key-On state, irrespective of motion. Does not require the traction motor to run;
- Traction Motor Run Hours (Drive Motor Operating Hours) [h] – counts elapsed time only while the vehicle is driving, i.e., when traction motor torque command is > 0 and/or vehicle speed > 0. Time at standstill does not accumulate.

- Total Odometer (Cumulative Distance) [km] – non-resettable cumulative distance travelled by the vehicle since commissioning/manufacture.
- Battery power level [kWh], [%];
- Energy consumption per travelled distance [kwh/km]
- Energy consumption per Traction run hours [kwh/hr]
- Energy consumption per Power On hours [kwh/hr]
- Regenerated energy from braking [kwh/hr]
- Speedometer;
- Gear and its direction.

3.14 DIAGNOSTIC TOOLS

The Prime Mover should be equipped with diagnostic tools and/or PC (USB) interfaces that includes software for easy access to the devices installed on the Prime Mover, as a minimum:

- Digital displays;
- Transmission /drives (if applicable);
- Communication network parts.

The software should allow to:

- Check all parameters;
- Calibrate equipment without external service;
- Maintenance of the device(s);
- Read all fault codes.

There should be diagnostic port(s) available inside the operator cabin (i.e. in fuse box), enabling full diagnostic of machine, without need for lifting cabin/opening additional compartments.

The manual and maintenance instruction must contain all access codes with their description and troubleshooting. If the software should be installed on PC laptop an installation version should be delivered on CD, DVD or memory stick with all licences. There should be at least three full set of diagnostic tools delivered.

Contractor shall also provide at least 4 user's accounts or provide access for at least 4 users into on-line spare parts catalogue and other on-line services.

3.15 ADDITIONAL FITTINGS

3.15.1 WARNING SIGNS AND NOTICES

The warning signs must be located by manufacturer according to already mentioned rules as well as all applicable legislations. The warning notices shall be in Polish.

3.15.2 CUSTOMER LOGO SIGNS

Customer logos shall be fitted in three locations on the Prime Mover cabin:

- one on the front of the cabin,
- one on the left-hand side of the cabin,
- one on the right-hand side of the cabin.

The final size, artwork and installation method (painted or adhesive) shall be subject to Customer approval

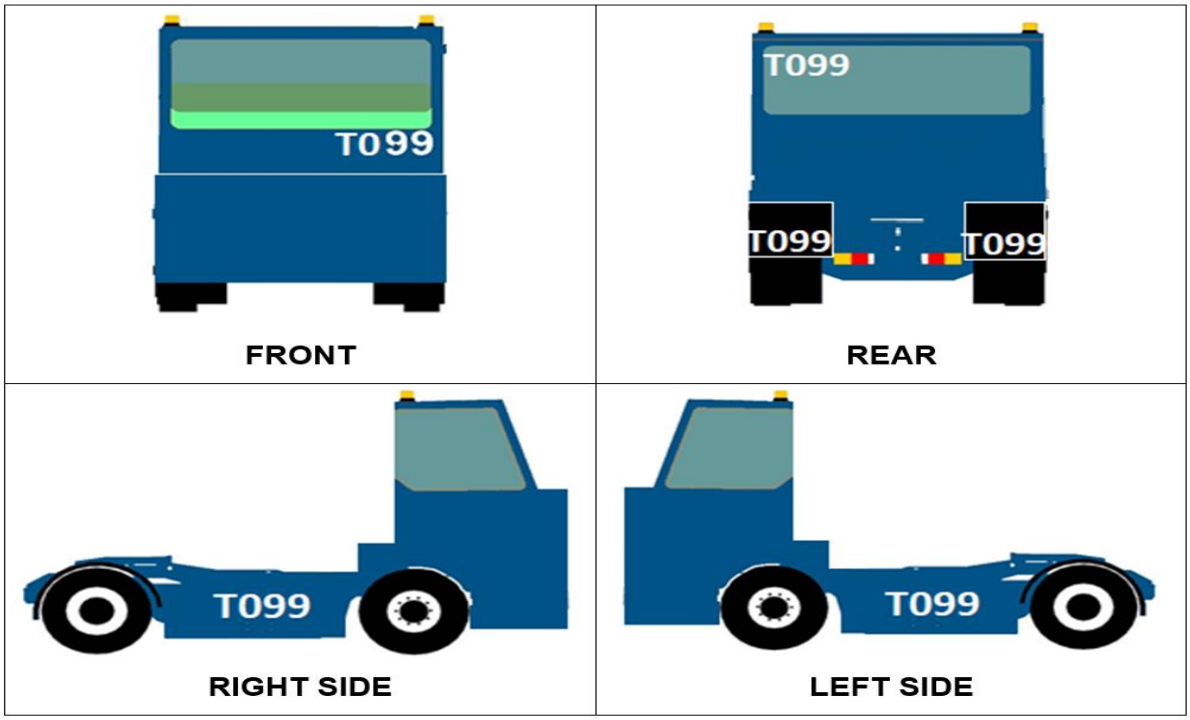
3.15.3 FLEET NUMBER/EQUIPMENT INDENTIFICATION

Each EPM shall be fitted with a fleet number / equipment identification marking.

The fleet number / equipment identification marking shall be installed in the following locations, in accordance with the attached marking arrangement drawing:

- on the front of the cabin,
- on the chassis on the left-hand side,
- on the chassis on the right-hand side,
- on both rear mudguards,
- on the rear window.

The rear window marking shall be transparent and shall be applied from the inside of the cabin.



3.15.4 OCR IDENTIFICATION

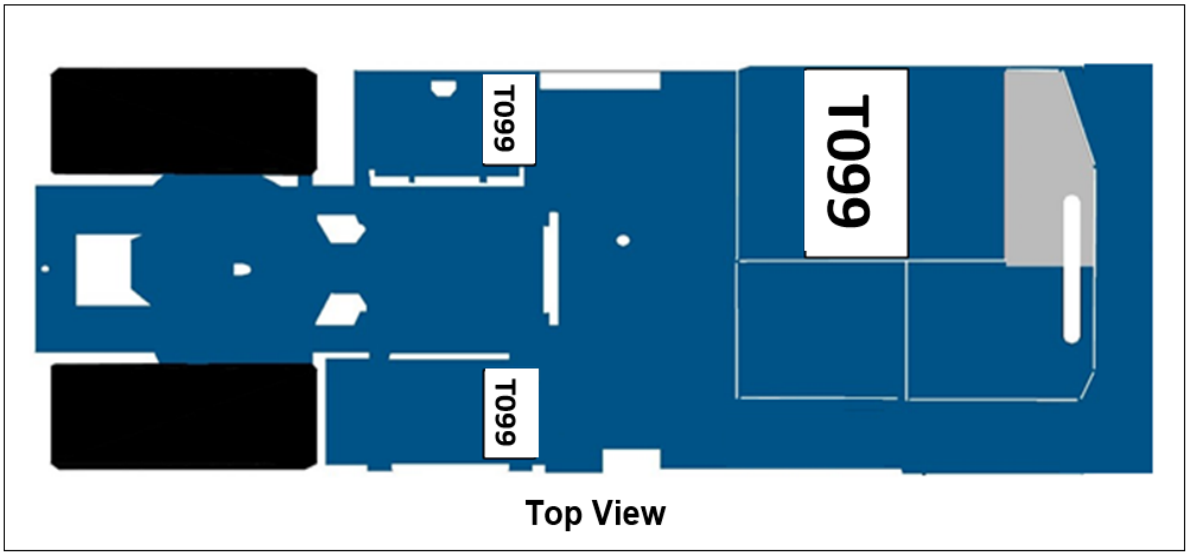
Each Prime Mover shall be fitted with additional OCR identification numbers, independent from the fleet number /equipment identification marking.

- on the roof safety guard / cab roof area,
- on the upper chassis / battery-cover surfaces on both sides of the Prime Mover.

The OCR identification numbers shall be black on a white background, for example on white plates fixed to the roof safety guard and to the upper chassis / battery-cover surfaces.

The character height of the OCR identification numbers shall be:

- 300 mm on the roof,
- 140 mm on the upper chassis / battery-cover surfaces.



Top View

The OCR identification numbers shall be installed in the following locations, in accordance with the attached top-view marking arrangement drawing:

3.16 SURFACE PREPARATION FOR PAINTING

All surfaces exposed to the atmosphere, with the exception of stainless steel, nickel and aluminium shall be blast cleaned by grit blasting and painted. Grit blasting shall be performed according to below requirements:

- All oil or grease contamination shall be removed by solvent washing or other suitable means before the start of grit blasting.
- All welded areas and appurtenances shall be given special attention for removal of welding flux in crevices before blasting.

- After welding, assembling and all further mechanical treatments, all steel surfaces shall be cleaned in accordance with ISO12944, Sa 2.5. This method of preparing the metal surface shall remove the mill scale, rust, rust scale, paint or foreign matter by use of a moderately coarse, dry abrasive propelled through a nozzle. The roughness profile RZ has to be greater than 30 [µm].
- Outdoor grit blasting shall be permitted only during daylight hours and on surfaces that are not wet after blasting or before painting. Grit blasting shall not be permitted when surface temperatures are less than 3 [°C] above dew point or the relative humidity is higher than 85 [%].
- The compressed air supply used for grit blasting shall be free of detrimental amount of water and oil. To this purpose adequate separators and traps shall be provided, kept free from water and oil.
- The Contractor shall make a proper selection of nozzle type and diameter and air pressure considering the positive influences of high air pressure and large nozzle diameters.
- The applied abrasive medium shall be iron or steel grit. The abrasive medium shall have particle size mixture selected to meet the anchor pattern requirements. Particle sizes shall not exceed 0.9 [mm]. The abrasive medium shall be regularly renewed to obtain a well, evenly blasted surface. The abrasive medium shall be dry and free of fatty particles or other impurities.
- During blasting the distance from nozzle to surface shall be approximately 250-500 [mm]. For welds the blasting direction shall be perpendicular to the surface.
- Welding spatter, slivers, laminations and underlying mill scale not removed during fabrication and exposed before and during the grit blasting operation shall be removed by the best mechanical means.
- All exposed and sharp edges of steel shall be rounded to assure proper adhesive and build-up of coatings.
- The grit blasted surface shall be rendered free of dust, oxides, salt etc. prior to the application of any prime coating. No acid washes or other cleaning solutions or solvents shall be used on metal surfaces after being grit blasted. This includes washes intended to prevent rusting.
- Grit blasting and painting operations shall be scheduled not to be in progress at the same time, and to avoid wet paint within the range of grit blasting contamination. However, for any surface the first coat of paint shall be applied within three hours after the surface preparation. Blast cleaned steel surfaces shall meet the specified requirements immediately prior to the application of the first coat of paint.

3.16.1 COATING APPLICATION

The application of coating shall be performed in accordance with below requirements:

- All coats shall be applied in accordance with the paint manufacturer’s recommendations, and only after written approval by the paint manufacturer.
- All coating materials shall be supplied in unopened, clearly identifiable containers. No mixing of different coatings is allowed without written consent by the Engineer.
- Coatings shall be thinned only as recommended by the paint manufacturer.

- Skins shall be removed completely, and paint shall be well stirred to homogeneous consistency, unless prescribed otherwise by the manufacturer.
- The following conditions shall prevent the application of coating:
  - Weather conditions such as fog, mist or rain
  - Temperature below 10 [°C] or humidity above 80 [%]
  - Wet surface
  - Any other condition stated by the paint manufacturer
- Every layer of coating shall be allowed to dry at least the specified amount of time prior to the application of the succeeding layer. Prior to the application of any coat of material, all damage to previous coats shall be thoroughly cleaned, rust shall be removed till grade 'C st. 3' according to BS EN ISO 8504-3 and BS EN ISO 8501-1and the damage shall be touched up with corresponding specific coating. Damage to finish coatings shall be indicated and refinished.
- Each coat is to be applied uniformly and completely over the entire surface. Skimps, skips, sags and drips shall be avoided.
- Painted parts shall not be transported by the Contractor until the last coat has sufficient hardness. In any case sufficient facing blocks shall be provided between different painted parts during transportation and storage.

3.16.2 PAINT SYSTEMS

The dry film thickness for the different paint systems specified below shall be strictly adhered to, on flat surfaces as well as near edges and corners. The mentioned film thickness is to be considered as the lower limit.

After application the dry film thickness shall be inspected. The costs of repair due to destructive testing shall be borne by the Contractor. The painting sequence shall be chosen in function of minimum damage to finished coating.

The the cabins shall be painted with a dry film thickness that will not cause any cracks on paints.

Steel elements not directly exposed to the atmosphere such as the inside of beams shall be painted with a minimum dry film thickness of 240 [µm].

The painting specification plan shall be drafted by the painting manufacturer and shall be agreed with the Customer complying with the minimum dry film thickness as described. The paint manufacturer shall inspect and verify that the painting has been done according to the agreed painting specification plan.

The paint type shall be Polysiloxane.

The Prime Mover shall be painted the colour stated in V2.3 – Main Technical Parameters.

3.17 POWER UNIT

Following operational condition to be taken into design consideration for Electric Prime Mover (EPM):

Average Load per Cycle	Container Move Cycle Per Hour (From Quay to Yard or Vs.)	Average Travell Distance per Cycle(km)	Average Operating hours in between charging
28 tons	4	2.5	16

Table 3 Operational conditions for the BHCT

The definition of a cycle is: the time when the PM start to move from point of receive the work order until the time work order is completed on final destination of dropping the picked up load.

- Lithium batteries capacity shall support the EPM to operate continuously for at least the specified period in column (d) in Table 3 and stopover only for fast DC battery charging. Suppliers shall recommend DC charging systems power rating for the most efficient charging time for their designed battery capacity. Each battery charging session is expected to last no longer than 1.5 hour to charge up at least 70 [%] of depth of discharge (DoD) of the battery dispense energy. Based on the operating conditions as stated in table 3, the EPM shall be designed with the battery capacity such that the EPM will require to go for charging only once per day.
- Contractors shall provide calculations to illustrate their design battery operating parameters' ability to fulfil the specified requirements in Table 3 column (b), (d) and the charging duration per battery energy expense based on the design Depth of Discharge.
- In view of the numerous short trips, the EPM(s) must achieve maximum travelling speed rapidly from stationary position in accordance with acceleration in specification. Thus, the lithium battery, drive motor and final drives shall be designed to produce high torque at low speeds.
- Beside factory tests, the Contractor shall carry out acceptance tests at customer site to confirm that the lithium battery, electric drives and drives of the Prime Mover meets Customer's speed and acceleration requirements as stated in V2.3 – Main Technical Parameters.

Climatic Condition

- Tenderers shall take the environmental conditions into consideration when designing the vehicle and its related mechanical, electrical systems and battery system. The vehicle shall be designed for associated location's climate with snowy and/or thundery showers environment as described in V2.3 – Main Technical Parameters.

Cold-weather Operation and Environmental Type Testing

- The site at Gdansk experiences sub-zero winter conditions. The EPM shall be capable of continuous operation and shall withstand storage and transport at ambient temperatures ranging from -30 degrees C to +50 degrees C.
- From a cold soak at the minimum operating temperature the EPM shall reach full drive, steering, braking, cabin heating and windscreen demisting function within a stated time. The Contractor shall state this time and any associated performance de-rating.

- The Lithium Battery System thermal management shall precondition (heat) the cells so that charging and discharging remain within the cell manufacturer safe temperature window. Charging shall not commence below 0 degrees C, or the cell manufacturer stated minimum, without preheating. The Contractor shall describe the low-temperature charging and preheating strategy and its effect on availability in cold conditions.

3.17.1 LITHIUM BATTERY SYSTEM

Total life cycle cost is an essential evaluation criterion for the proposed battery system. The Contractor shall state the expected useful lifespan with supporting justifications in their tender submissions. The information shall include for the defined end-of-life of the battery, its State of Health (SOH), the total amount of dispensable energy for the designed DoD and its discharge duty cycle. Based on the daily operation dispense energy requirement, the battery shall have a battery asset lifespan of at least 8 years.

The Contractor shall propose a Lithium Battery System certified to UN38.3 and ECE R100 (or equivalent) and supported by reference installations in comparable service. Battery OEM or supplier with local technical and maintenance support may be proposed.

The product warranty shall be equivalent to the designed useful lifespan of the battery system as per the battery defined end-of-life stated in paragraph 1 of this section 3.17. In any case the battery warranty shall be at least seven and a half (7.5) years from Provisional Acceptance. The Contractor shall state the number of years of product warranty from the battery OEM or supplier. The Customer shall manage the product warranty directly with the battery supplier beyond the standard defect liability period.

The battery system's design and component layout should consider the following:

- Battery modules shall be housed inside enclosed cabinets for long-term environmental protection;
- Battery modules and replaceable electrical components shall be front-accessible for ease of maintenance;
- Maintenance access to the cooling system;
- Even weight distribution;

The Contractor shall furnish the concept of design, general arrangement and selection of Lithium Battery System in the tender submissions.

The Contractor shall submit computations of the expected peak power output required from the battery system to justify that it is operating within the maximum C-rate allowable by the Battery System at its end-of-life.

The Contractor shall propose the desired chemistry for the Lithium battery. Long-life, support fast charging, high effective capacity (useable energy over permissible SOC range), high safety level, suitability for the stated operating environment (e.g. tropical or cold climate), minimal maintenance and low life cycle cost are key desired characteristics for the proposed battery system.

The Contractor shall furnish the detailed technical specifications of the proposed battery system covering electrical characteristics and mechanical construction. The submissions shall include, at least, the following:

- Charging and Discharging Characteristics of Battery System components such as Cell/Module/Pack/String/System
- Cycle life Characteristics Curve - Cell capacity (SOC [%]) against no. of cycles at 25 [°C] for the designed DoD [%]
- Mechanical and Internal Construction of Battery Module
- Performance Test Specifications and Reports
- Certified Safety Test Specifications and Reports e.g. UN38.3
- Material Safety Data Sheet (MSDS)

Contractor shall submit the battery design operating parameters as required in V2.3 – Main Technical Parameters.

The Lithium Battery System shall support parallel battery string operations with, preferably, three or more battery strings.

The battery system shall allow continued operations in degraded mode during the situation of localized battery string fault. The design shall be resilient such that the faulty battery string can be automatically disconnected with a corresponding reduced battery performance i.e. operate with a lower battery capacity but without resulting in total power loss.

The Battery Management System shall be capable of automatically balancing a Battery System with unbalanced battery strings during a charging process. The Contractor shall illustrate how this can be achieved in their tender submissions.

Pre-charge circuits shall be designed at every battery string layer.

The Contractor shall note that the EPM will constantly be subjected to impact shock and vibration during vehicular movements and transfer of containers on road and when interacting with port equipment. It is imperative that the electrical connectivity between battery cells/modules/strings must be resilient against such shocks and vibrations. The Contractor shall illustrate how their designs address this challenge.

An electrical isolation switch with Lock out Tag Out (LOTO) feature shall be made available on the vehicle to completely electrically isolate the Lithium Battery System from the rest of the vehicle for purpose of maintenance or troubleshooting.

3.17.2 BATTERY MANAGEMENT SYSTEM (BMS)

The BMS is an integral unit of the Battery System to ensure the safe operation of the battery system under all operating modes. It controls and monitors the health of individual battery cells, modules, strings and at pack level, and reports active faults upon detection.

The BMS shall provide the following management and protection functions for the battery system:

- Management of the battery charging and discharging operations
- Continuous monitoring on the health status of battery cells, modules, strings and system level
- Built-in intelligent cell level balancing

- Battery capacity calculation
- State-of-Charge (SOC) calculation
- State of Health (SOH)
- Cumulative battery energy counter
- Thermal management of the battery heating and cooling system
- Monitoring of HV system insulation

The BMS shall interface with the main vehicle systems when the battery system is connected to the vehicle CAN bus. This also applies to the non-battery swap option.

3.17.3 LIQUID COOLING/HEATING SYSTEM FOR LITHIUM BATTERY

The battery cooling and heating system shall be designed in accordance with min and max ambient temperature stated in V2.3 – Main Technical Parameters.

The Contractor shall provide diagnostic software and related interface tools to facilitate the troubleshooting and maintenance of the thermal heating and cooling system. The diagnostic port shall be located within the battery cabinets and be easily accessible during maintenance.

3.17.4 DIAGNOSTIC TOOLS FOR THE LITHIUM BATTERY SYSTEM

The diagnostic solutions shall satisfy the following minimum requirements:

- Management/Control of the Battery Pack;
- Comprehensive Display of Control Modes, Signals Level & Alarm Status at Battery Pack, Strings, Modules and Cells levels e.g.
    1. Each Pack, Strings, Modules and Individual Cell-Level Voltages [V];
    2. Each Module-Level Temperature Measuring Points [°C];
    3. Module/String inner CAN network communication error;
    4. Facilitate Identification on source of battery fault to string, module and cell level, etc.
- Access to historical fault logs registered at BMS level (minimum);
- Real-time datalogging of critical operating parameters of battery pack, string, module and cell levels for in-depth analysis and troubleshooting of intermittent faults;
- User Interface (UI) for log playback.

The diagnostic port(s) shall be located within the battery cabinets and be easily accessible during maintenance.

3.17.5 ELECTRICAL HV SYSTEM INSULATION MONITORING

An Insulation Monitoring Device (IMD) compliant with IEC 61557-8 (or equivalent) shall be provided to monitor the insulation resistance of the whole Electric Prime Mover with the battery system.

In case of a low insulation alarm, the equipment controller shall respond to cut off the battery supply.

The system shall be designed such that the IMD functions can be disconnected/disabled during the battery charging process as the insulation monitoring will be done at the charging station.

3.17.6 ELECTRICAL DRIVES AND MOTORS

The Contractor shall propose high efficiency, compact, thermal control and/or water-cooled electric AC drives and motors for the driving system.

The drive inverters and motors shall have a minimum protection class of IP65 and shall be capable of operating at ambient temperatures between -30 [°C] and +50 [°C]. Adequate ventilation, appropriate heating and cooling shall be provided to keep the drive components within their specified operating temperature range.

The mounting of the drive components shall take into consideration the ease of accessibility during maintenance.

The inverter drive electronics shall be well protected against short-circuits and over-voltage. The protection mechanism shall switch off the inverter output in the event of a high level of earth current being detected. The Prime Mover shall manage the pre-charge of the drives independently from the HV battery pack's pre-charge sequence.

All motors shall be provided with over-current, over-speed and over-temperature protection. It shall be suitable for intensive use and continuous operations in the local environment with minimum maintenance requirement. The Contractor shall indicate the maintenance program and service/repair requirements for the motor(s) e.g. bearing lubrication in the tender submission.

All motor(s) shall be individually tested in the motor factories, and reports of such tests, including the factory insulation resistance test, shall be submitted with the Factory Acceptance Test report.

Aluminium or aluminium alloy constructed bearing housing Motor(s) are not acceptable.

The motor shall be coupled to the axle via propeller shaft and universal coupling. Other effective methods may be proposed subject to customer approval.

Electrical power wirings must be physically and electromagnetically separated and shielded from electrical control wirings, and on long cable runs, separated by earthed shields within the trucking. All the wiring for the drive system shall be carried out in accordance with the drive manufacturer's recommendation and comply with all local regulations.

The Contractor shall submit the cable routing and layout for Customer's approval.

The Contractor shall submit detailed drawings of the drive, motors, the common earth points (CEP) position and the mounting arrangements to Customer for approval.

The design of the drive inverter system must be fail-safe. Supply power lost, sensor failures, communication failures or line faults shall not cause the motor to accelerate or be set into motion indiscriminately. These faults should be readily detected with the immediate stopping of the drive system.

The drive inverter system shall have the capability to perform self-diagnostics and to retain diagnostic information for future interrogation, inclusive of the date and time of faults logging. Data and information about the behavior of all signals during each fault condition shall be retained by the drives even if the power supply is turned off. The diagnostics shall include indications for over-current, under-voltage, over-voltage, over-temperature, component failure, communication failure, etc.

All drive inverter system faults shall be reported to the equipment and displayed on the operator console.

The Contractor shall provide the drive system diagnostics and accessories toolkit for access to the drive controller. Configuration and downloading of parameters and firmware to the drive controller and inverters shall be furnished to Customer.

The Contractor shall submit detailed information on the proposed design architecture and configuration of the drive-inverter system for the driving and hydraulic systems in the tender document. Detailed calculations and criteria used for the selection of the motors, inverters, energy storage, drive cooling system and axle assemblies shall be included in the submission.

3.17.7 DC CHARGING

The Electric Prime Mover should be designed to be compatible following charging modes for its battery system:

- *High-power DC fast charging from an offboard charging station using one or more CCS2 connectors. The charging system shall be capable of replenishing at least 70% of the usable battery energy within 1.5 hours under the specified ambient conditions. The charging cable, connector(s) and vehicle charging interface shall be suitably rated for the proposed charging power. Alternative technically equivalent solutions shall be subject to the Customer's approval*

Dedicated electric chargers (pile type) with CCS2 connectors will be made available on customer premises to carry out high power DC charging of the Electric Prime Mover Battery System.

The charging protocols and standards for charging with the DC charging station shall meet IEC 61851-1/23/24, ISO15118 and DIN70121.

A charging socket inlet with locking mechanism and rated for designed DC fast charging shall be made available on the right side of the vehicle or in front of vehicle otherwise determined by the Customer.

The charging inlet shall be protected within an easily accessible steel enclosure with a latching door for protection from weather elements and dust when not undergoing recharging. Weatherproof decals shall be used to help user locate and identify the charging inlet access door.

The exact installation location of the charging CCS2.0 socket inlet on the Electric Prime Mover shall be discussed between the Contractor and Customer after award.

During charging, the system shall cut-off the electrical supply to the battery pack when any abnormalities are detected.

3.17.8 BATTERY COMPARTMENT AND COUPLING SYSTEM

The Battery System Compartment shall contain all individual lithium battery packs, thermal heating and cooling management system, High Voltage and BMS control boxes.

The design shall cater for usage in the port under the following possible conditions:

- Operations impact from container loading or unloading on the trailer
- General driving
- Fire
- Potential impact from road accident
- Inclement weather and environmental effects
- Heat and UV exposure from sunlight
- IP rating of at least IP67

The design of the Battery System Compartment on the Prime Mover shall provide adequate shock absorption and anti-vibration measures to protect the battery system and components.

Battery compartment shall have sufficient ground clearance to prevent impact from the ground during travel. The battery housing shall be enforced as required. These enclosures shall be heavy-duty to withstand impact.

Compartment design shall cater for thermal heating and cooling system possibly via ventilation and air flow.

The Compartment design should allow ease of access for maintenance.

Warning decals (weatherproof design) for indicating high voltage shall be affixed on the exterior of the Battery System Compartment where required.

Painting and color details will be confirmed by Customer after the contract award.

3.17.9 BATTERY SAFETY

The BMS shall safely disable the battery pack output i.e. stop operating when any critical abnormalities like high temperature and low insulation are raised. Interlocks to limit functions of the equipment shall be in place to prevent operation of equipment from further aggravating the battery condition. Operator shall be alerted whenever there is an exception status from the BMS.

Fuses or circuit-breakers shall be provided in the battery circuit. They shall be suitably rated to prevent electrical overloading and thus over-heating of cables in the event of a short circuit.

When multiple battery packs are used, additional fuse links shall be provided. The type and location of these fuse links shall be carefully determined to avoid any risk of explosion.

Voltage, current and temperature sensors shall be installed in each battery module for detection of over-voltage, over-current and over temperature. Insulation monitoring device (IMD) shall be implemented at minimum battery pack level to detect leakage current or short circuit between battery pack and chassis.

A thermal management system shall be provided to maintain optimal cell operating temperatures during both charging and discharging.

Coolant level and pump pressure in the battery cooling system shall be monitored, and an alarm shall be triggered if coolant level and/or pump pressure fall below the allowable limit.

To reduce the risk of damage and injury caused by battery overheating or fire, multiple levels of protection shall be implemented, including performance derating as one of the measures.

All battery packs shall be tested and certified in accordance with UN38.3 or equivalent, to ensure that it will not cause any fire or explosion under the following conditions:

- Crush / Impact
- Nail penetration
- External short circuit
- Thermal high temperature
- Drop
- Overcharge
- Forced discharge

The battery compartment shall be equipped with an automatic fire suppression system.

Additionally, a smoke detection system shall be installed in the battery compartment and shall provide visual and audible warning signals to the operator upon detection of smoke.

3.18 SAFETY AIDS

The EPM shall be equipped with the following driver safety aids:

- Smoke detection system shall detect smoke inside driver cabin due to smoking (or) due to short circuit inside the cabin. Smoke detection system shall send alarm to Co control room through telematics system installed on Terminal Tractor.
- Operator's Fatigue Detection - installed in the cabin, providing visual (warning lights) and audible (alarm) alerts to the driver. The system should capture and identify different facial movements such as closing eyelids and yawning, smart phones usage while driving. Detection shall consist of a sensor mounted in the EPM cabin, to achieve function requested (placement shall not obstruct the Operator's view). The sensor shall record the event case on an onboard storage device with video footage for post-accident investigation purposes.

- Operator's Distraction Detection - loud buzzer (sufficient loudness – adjustable by Maintenance Team) will sound when the Operator is looking down for more than 4sec (the time adjustable by Maintenance Team). It should not sound when operators are looking left and right to check the road.
- Operator's Behaviour - system for monitoring the Operator's behaviour through data collection from components such as Vehicle Control Unit (VCU), Motor Control Unit (MCU), accelerometer, gyroscope and GPS unit. Necessary vehicle operating data and parameters shall be retrieved and analysed in real time from the ECU to determine the following events detection.
    - Speeding
    - Hard braking
    - Hard acceleration
    - Fast cornering
    - Sharp cornering
    - Safety belt not fastened
- Detection of operator presence in the cabin,
- Tailgate Warning with proximity sensor or video analytics installed at the front of the cabin to detect tailgating. The radar/VA sensor shall be able to start detection of a vehicle of up to 20 [m] ahead and the system shall provide elevating alerts when the EPM gets nearer to the vehicle/obstacle in front. Distance of detection shall be configurable.
- Side Collision Warning System with proximity/radar sensor or video analytics installed at both sides of EPM to detect side collision events. The sensors or VA shall be able to start detection of side collision of up to 0.5 [m] proximity and the system shall provide elevating alerts when the EPM gets closer to the obstacle on sides. Distance of detection shall be configurable.
- RFID for trailer recognition with the possibility of programming trailer ID number or other solution that will provide the same functionality.

The all of above-mentioned cases, event and data shall be recorded on board storage devices. These devices shall be capable of transmitting the data together with data mentioned in Clause 3.19. The Customer may request transmission via terminal Wi-Fi or cellular. Therefore, the devices shall support data transmission via cellular and/or Wi-Fi networks, subject to the Customer's request during design stage.

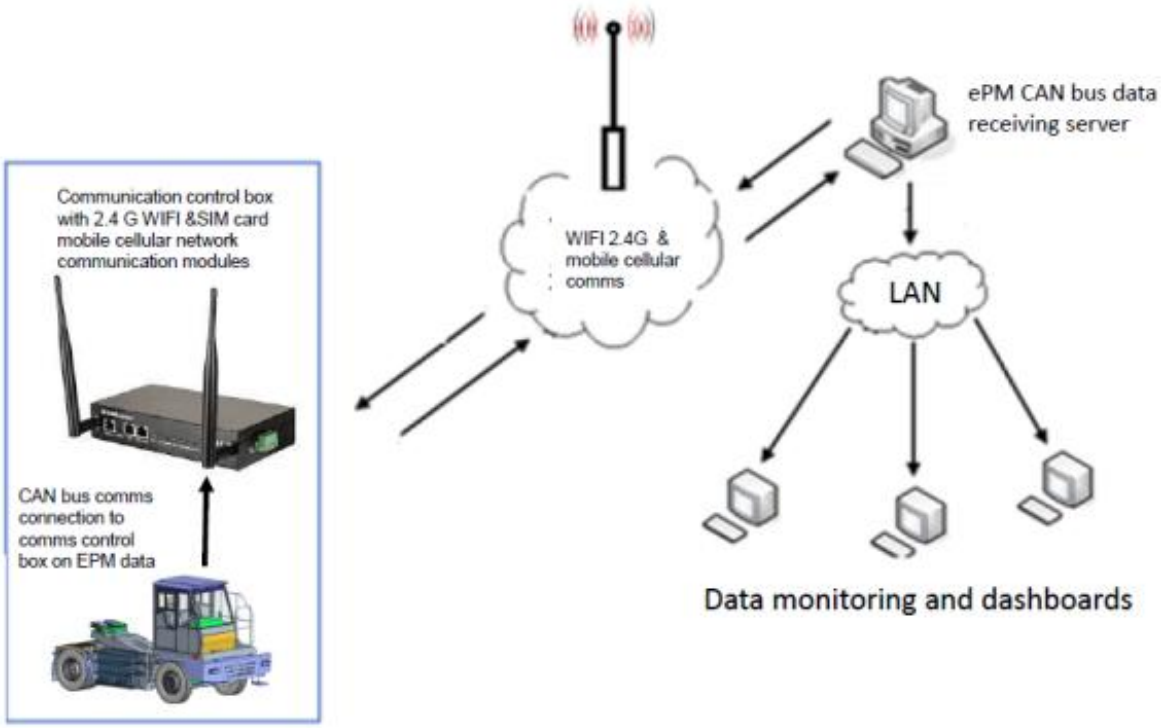
The storage device shall have sufficient capacity to retain at least 30 days of data.

The in-cabin monitoring, video recording and operator-behaviour functions in this clause shall be implemented in compliance with Regulation (EU) 2016/679 (GDPR) and the employee-monitoring provisions of the Polish Labour Code (Kodeks pracy). Lawful basis, operator information, retention period and any Data Protection Impact Assessment shall be confirmed by the Customer before deployment.

3.19 DATA ACQUISITION

The following is the set of EPM parameters that shall be collected from the EPM control systems like the BMS, vehicle controller, etc. through CAN bus to the communication control box. The communication control box should enable connection with Telematics & Position Detection System present at BHCT, as described in 3.18.

The communication control box shall have a memory buffer to cache the data for the last 30 minutes, and the data will continue to be transmitted when the communication network recovers from communication lost. Please refer to the following schematic related to the EPM data communication.



The data communication shall transmit the EPM data to the customer's data receiving servers which can be on customer's premise or otherwise designated by the customer.

Each parameter shall be sampled, recorded and transmitted to the Customer's backend server at the time interval specified in Table 4. Event-based data shall be transmitted immediately upon occurrence. Parameters for which no specific transmission interval is stated in Table 4 shall be transmitted at intervals not exceeding 5 minutes.

In the event of temporary communication loss, all sampled data shall be stored locally with the original timestamps and automatically transmitted to the Customer's backend server when communication is restored.

The contractor shall not collect the EPM data, in any form or through any mean, without customer's permission. Customer has the right to request contractor to fully erase any collected EPM data.

The communication control box shall support WIFI 2.4G wireless network, 3G/4G/5G network, multiple wireless network protocols or SIM Card and encryption methods as summarized in the following.

Parameters	Attributes	Time Interval
Ambient Air Temperature	Equipment ID	10 [s]
	Time	
	Temperature	
Battery Potential	Equipment ID	15 [min]
	Time	
	Battery Potential	
Battery State of Health (SOH)	Equipment ID	15 [min]
	Time	
	Percentage	
Battery State of Charge (SOC)	Equipment ID	10 [s]
	Time	
	Percentage	
Faults	Equipment ID	Upon Happening
	Time	
	Fault Code	
	Fault Description	
Wheel Based Vehicle Speed	Equipment ID	10 [s]
	Time	
	Speed	
Location	Equipment ID	1 [s]
	Time	
	Longitude	
	Latitude	
Cumulative Moving Hours	Equipment ID	10 [s]
	Time	
	Hours	
Cumulative Operating Hours	Equipment ID	10 [s]
	Time	
	Hours	
Distance	Equipment ID	10 [s]
	Time	
	Distance	
Fleet	Fleet ID	NIL
	Time	
	Model	
EV Charger	Session ID	Upon Start & End @ 10 [s] interval
	Start Time	
	End Time	
	Equipment ID/Battery ID	
	Stop Reason Category Code	
	Stop Reason Category Description	
	kWh Delivered	
	Charger ID	
	Charger Name/Model	
	Charge Start Battery SOC Level	
	Charge Stop Battery SOC Level	
	Energy Meter Start Value	
	Energy Meter End Value	

Table 4 CAN data acquisition

The specified time interval for the different parameters define the time resolution that the respective parameters shall be captured.

The data format for these parameters to be transmitted shall be discussed with the successful tenderer.

Tenders shall support to customer to set up of Position detection system and charging scheduling system to ensure all required data are properly collected from EPM.

3.20 AUTO GREASING SYSTEM

There shall be a system for constant greasing 5th wheel surface(s). There shall be a central tank with sufficient capacity, mounted inside chassis for protection. Greasing shall be automated in relation to 5th wheel surface condition and carried out by some greasing points directly mounted on 5th wheel plate.

There should be possibility to manually change greasing amount settings, up to the needs of actual conditions, by trained technician. There shall be a recommended grease product card delivered.

Each point connected to the central lubrication system must be capable of self-lubrication (manual lubrication) in case the central lubrication system stops working properly or fails.

3.21 DRIVE-BY-WIRE (DBW)

The Drive by Wire is an electromechanics system consist of Steer by Wire, Brake by Wire and Throttle by Wire system which control the vehicle via digital inputs from autonomous driving vehicle control unit (VCU) or the operator on board.

The following details define the minimum functional, performance, safety, and integration requirements for a drive-by-wire (DBW) platform intended to support external control systems, including readiness of future autonomous or remote operations.

The requirements are independent of any Automated Driving System (ADS) and shall be verifiable without a deployed autonomy stack.

The tenderer shall be demonstrated through a combination of vendor-provided test evidence, witnessed demonstrations, and design documentation. The tenderer shall indicate and submit for each requirement the method of compliance together with bid submission:

- test report,
- live demonstration,
- design documentation

3.21.1 CONTROL ARCHITECTURE & FUNCTIONAL SAFETY

3.21.1.1 Centralized Control

The vehicle shall implement a centralized control architecture governing all DBW functions to ensure consistent command execution and coordinated system behaviour.

3.21.1.2 Functional Safety Compliance

The DBW system shall meet an automotive functional safety integrity level appropriate for safety critical steering, braking, and propulsion functions. Reference may be made to standards such as IEC 62061 and ISO 13849-1.

Where applicable, the Tenderer shall identify safety-related functions, declare achieved safety integrity or performance levels (such as ASIL, SIL and PL), and provide supporting design and validation documentation.

Vehicle architecture shall minimize single points of failure across steering, braking, control, communication, and power subsystems. Tenderer shall provide system architecture documentation identifying redundancy design and fault handling strategy together with bid documents.

3.21.1.3 Fault Handling & Redundancy

The control system shall detect, manage, and respond safely to single point failures and degraded conditions, including loss of communication, sensor faults, and internal subsystem resets.

The Tenderer shall provide supporting safety analysis to demonstrate fail-safe behaviour under fault conditions. This may include methods such as Hazard Analysis and Risk Assessment (HARA) or Failure Modes and Effects Analysis (FMEA), or equivalent approaches. The analysis shall identify potential failure modes, their effects on vehicle behaviour, and the corresponding mitigation or safe-state response.

3.21.1.4 Control Authority and Override

The system shall define and enforce deterministic control priority between human input, external control, and safety functions. Human override inputs (throttle, steering, braking) shall take immediate effect during external control, to transit to manual driving mode safely.

3.21.1.5 Operational States

The vehicle shall support clearly defined operational states (e.g. manual, auto, external control, fault, safe stop) with deterministic state transitions, entry and exit conditions, and system behaviour in each state.

3.21.1.6 Minimal Risk Condition (MRC)

Upon loss of external command, communication, or safety critical failure, the vehicle shall transition automatically to a predefined minimal risk condition.

3.21.1.7 Hardwired Emergency Stop

A hardwired emergency stop shall be provided, independent of software and communication systems, in accordance with recognized safety standards such as ISO 13850 and ISO 13849.

3.21.2 CONTROL PERFORMANCE & STABILITY

3.21.2.1 Full External Control Capability

The DBW shall support external control of speed, braking, and steering functions via a defined interface. When external control is active, the vehicle shall be capable of responding to external control commands in a consistent and predictable manner.

3.21.2.2 Update Rate & Latency

The DBW and its control interface shall support ≥50 Hz update rate with bounded latency:

- Target: ≤100 ms
- Acceptable: ≤150 ms

Latency shall be defined and measured as command-to-actuation response time, or equivalent, with methodology clearly documented by the Vendor.

3.21.2.3 Deterministic and Repeatable Response

The DBW shall exhibit deterministic and repeatable response to identical control inputs under the same operating conditions, with consistent behaviour across repeated executions. The Tenderer shall describe the expected variability and measurement approach.

3.21.3 THROTTLE SYSTEM AND GEAR CONTROL

3.21.3.1 Speed Control

The propulsion system shall support external control of speed and torque. Speed tracking accuracy shall meet:

- Target: ±0.5 km/h
- Acceptable: ±1.0 km/h

Measurement error of vehicle speed, wheel speed, motor speed, motor torque shall be within typical industry-accepted limits (target <1%), with methodology defined by the Tenderer.

3.21.3.2 Low Speed Precision

The vehicle shall provide sufficient speed measurement resolution and control granularity to enable smooth and precise operation within the low-speed range (defined as 0 to 2 m/s) and stop within:

- Target: ±0.05 m
- Acceptable: ±0.10 m

Performance shall remain consistent under unloaded and loaded conditions.

The Tenderer shall declare the achievable speed resolution and describe the sensing and estimation method used. Target speed feedback resolution: ≤0.05 m/s within the low-speed range.

3.21.3.3 Gear Control

Gear selection shall be externally controllable with bounded response delay to support frequent directional changes.

3.21.4 STEERING SYSTEM

The DBW shall include external control of steering via an electronic or electro-hydraulic steering system. Vehicle steering system should incorporate redundant actuation capability, where applicable, to ensure continued steering control in the event of a single-point failure. The tenderer shall describe architecture including actuation, sensors, and control logic.

3.21.4.1 Steering Control

Steering performance shall be designed to achieve defined limits for response delay, steady-state error, and zero offset to support precise low-speed path control.

- Steering angle error: ≤ ±1° (target), ≤ ±2° (acceptable)
- Response delay ≤100 ms (target), ≤150–200 ms (acceptable)
- Steering steady-state error ≤ ±0.5°
- Zero offset (bias at zero command) shall be ≤ ±0.5°

3.21.5 BRAKING SYSTEM

3.21.5.1 Braking Control

Braking shall be smooth, proportional, and predictable, with bounded response delay and deceleration deviation under varying load and operating conditions. Vendor shall describe braking control logic, including response delay, modulation behaviour, and fail-safe mechanisms.

Deceleration response delay ≤100 ms (target), ≤150–200 ms (acceptable)

Braking control deviation (difference between commanded and actual deceleration) shall be ≤10% (target), ≤20% (acceptable)

The vehicle's maximum braking deceleration absolute value (under full load) > 3 m/s^2.

3.21.5.2 Anti-lock Braking System (ABS)

Vehicle braking system shall include anti-lock braking functionality and maintain stability and controllability under varying traction conditions. When controlled via external interface, braking shall not result in wheel lock, instability, or loss of directional control.

3.21.5.3 Parking Brake Control

Electronic parking brake (EPB) shall support external control with bounded response time and reliable holding behaviour.

3.21.5.4 Braking System Redundancy

The vehicle shall be equipped with a braking system designed to ensure a safe and controlled stop under fault, communication failure, or power loss scenarios.

Fail-safe braking under control or communication failure:

- The vehicle shall automatically initiate controlled braking and transition to a safe state upon detection of loss or anomaly in control or communication pathways, and braking capability shall be maintained independent of the primary control system.

Redundant braking capability:

- The vehicle shall retain the ability to achieve a safe stop through an independent or redundant braking mechanism in the event of primary braking system or network failure.

Automatic braking on power loss:

- The braking system shall automatically activate and bring the vehicle to a safe stop in the event of total loss of electrical power, without reliance on external control.

Parking brake integration:

- The parking brake shall support safe and controlled vehicle immobilization under fault conditions without introducing unsafe dynamics.

Controlled recovery:

- The vehicle shall require a defined and controlled recovery process before resuming normal operation following a fault-induced safe stop.

3.21.5.5 Environmental Robustness

Performance shall be maintained under environmental conditions representative of operational deployment.

3.21.6 COMMUNICATION, CAN & CYBERSECURITY

3.21.6.1 Documented Interfaces

The DBW communication shall be based on or compatible with SAE J1939, or an equivalent industry-standard CAN protocol. The completed and structured communication interface documentation of DBW shall be provided, including signal definitions and command acknowledgment or status feedback. External control interface shall support command acknowledgment or equivalent mechanism to confirm receipt and execution status of commands.

3.21.6.2 Deterministic Signal Timing

Control signals shall support ≥50 Hz update rate with low jitter and deterministic timing consistent with structured CAN communication principles.

3.21.6.3 Latency Under Load

CAN latency for critical control messages shall remain stable under increased traffic, with priority handling preserved.

3.21.6.4 Message Reliability

No loss of critical control messages shall occur during sustained operation under peak load, with message prioritization and arbitration.

3.21.6.5 Network Utilization Margin

CAN bus utilization shall be designed to remain within 70% under expected peak load conditions, defined as the maximum vehicle system communication load with all the installed systems active (such as throttle, steering, braking, lights and auxiliary systems), to preserve bandwidth headroom for future integration. The Tenderer shall describe assumptions, network loading conditions, and validation approach.

3.21.6.6 Cybersecurity & Access Control

External control interfaces shall implement authentication and access control measures to prevent unauthorized command injection.

The DBW and vehicle electrical/electronic architecture shall be engineered in accordance with ISO/SAE 21434 (road-vehicle cybersecurity) and shall support conformity with UN Regulation No. 155; the Contractor shall submit a Threat Analysis and Risk Assessment (TARA) and cybersecurity management system evidence.

3.21.7 FEEDBACK&DIAGNOSTICS

3.21.7.1 High Resolution Feedback

Real time feedback signals (e.g. speed, steering, braking, gear) shall provide sufficient resolution and include validity/status indication to indicate signal health and reliability.

3.21.7.2 Structured Diagnostics

System health, faults, and degraded modes shall be exposed via a structured, externally readable diagnostic interface.

3.21.8 INTEGRATION READINESS

The Tenderer shall declare any known design constraints or limitations that may affect future system integration or regulatory compliance. To the best of the Tenderer's knowledge, the delivered vehicle shall not include inherent design features that would preclude future conformity assessment of the complete integrated system.

3.21.8.1 Integration Capacity and Input/Output (I/O) Channels

The EPM shall reserve communication bandwidth, and at least four (4) configurable VCU I/O channels (digital or equivalent) with accessible interface and defined signal characteristics, for any future integration of buttons (such as momentary, latching, E-stop buttons).

3.21.8.2 In-Cabin Space for External Compute System

The Tenderer shall provide reserved space within cabin or designated equipment area for future installation of external compute systems, including minimum volume envelope, mounting provisions, ventilation and cooling considerations, and accessibility for installation and maintenance. Tenderer shall provide layout drawings indicating reserved space, and thermal management approach.

3.21.8.3 Fuse Board

The Tenderer shall provide reserved space for 12 units of spare fuse with 10AMPs capacity for each and its connection hardness on fuse board for future installation of external hardware's. The current and power capacity of main power switch of EPM shall be designed accordingly.

3.21.8.4 EPM Function Controls

EPM shall support external control of main functions including 5th Wheel up and down, lights, horn, and wiper via DBW interface. Control commands shall be accessible through defined communication interface (e.g. CAN) and provide deterministic response.

3.21.8.5 Remote Power Control

Safeguarded remote power on/off capability shall be provided to support scalable fleet operations.

3.21.8.6 Stable Power Supply

The DBW power system shall provide stable and protected electrical power under all operating conditions, including handling of inrush and transient conditions (such as engine start/stop). The power system shall be suitable for both vehicle subsystems and external systems. The tenderer shall implement appropriate protective circuitry (e.g. soft-start, surge protection, filtering, isolation). Provision for integration of external UPS or backup power system shall be supported.

4 TECHNICAL DOCUMENTATION

The EPM technical documentation shall be delivered at least 14 days prior to the delivery day of first batch of the vehicles. The following documentation shall be provided as one complete electronic copy and two complete hard copy sets for the entire Project, in both English and Polish. Vehicle-specific declarations, certificates, licences, access codes and identification documents shall be provided separately for each EPM, where applicable.

- EU/EC Declaration of Conformity; and other essential certifications under local statutory requirements for the business units of operation.
- Instruction Manual for operator;
- Maintenance Instruction Manual, including checklists for all periodical maintenance intervals;
- Circuit diagrams, wiring diagrams and schematic diagrams of all electrical equipment;
- Pneumatic, hydraulic schematics, piping diagrams;
- Spare parts catalogue list of all parts used on the Prime Mover with drawings, descriptions and numbers of parts;
- For equipment, which is not manufactured directly by manufacturer of Prime Mover, there shall be a spare parts, workshop and maintenance manual issued by the respective part manufacturers;
- Technical main data sheets and machinery cards, including tolerances, acceptable wear and other needed data;
- Assembly drawings;
- Main components drawings;
- Detailed dimension drawings of Prime Mover with front, rear, left, right and top view;
- For lithium batteries (if applicable)
  - Overall concept design, illustration of energy saving features.
  - Selection and sizing for lithium battery pack
  - Proposal for electric AC drives and motors for driving, steering, brake and air-con systems.
  - Proposal for DC Charging System
- The design calculation on the GCW, axles loading, chassis beam sizing, traction force, speed and grade-ability, stability, motor / battery / drive motor (where applicable) and turning radius with and without the trailer.

Additionally suitable parts of documentation must include:

- Technical description
- General drawing

Both documentation and vehicle shall fulfil requirements of Local rules regarding Prime Movers with regard to format, amount and quality.

Drawings, diagrams, general assembly drawings should be provided in readable/printable PDF format.

The above-mentioned documentation shall be delivered in local language and English with hard copies and two CDs or two USB memory sticks with unlimited possibility of printing.

The Contractor shall equip the supplied vehicle with all certificates and attestations required by local and/ or international law, appropriate for the type of the supplied vehicle and copies of protocols of acceptance(s) and tests at the stage of production of the equipment, in particular the protocol of inspection of welded joints of the frame structure (if applicable).

The documentation must contain complete information on operation, periodic technical inspections and a detailed specification of lubricants used by the manufacturer, including the exact name, viscosity, the standard met by them and quantity per subassembly.