



Inter-Depot LPG Road Tanker

Specifications

Nr TS-LPG-REEA-TRP-004

Version 01

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1. Purpose

Those technical specifications provide detail regarding the minimum standard for LPG Large bulk vehicles (horse and LPG tanker semi-trailer) purchased or permanently contracted by REA (RUBIS EASTERN AFRICA).

The bidders must pay specific attention to the countries where vehicles will operate reported in the tender documentation.

The vehicle object of those specifications will be used for inter-depot transport (terminal / refinery to LPG filling plant) with full drops delivery operated by LPG compressor or suction pump on site.

Vehicles used for delivery to customers using onboard pump and meter are defined in a different REA specification.

2. Definitions and acronyms

REA refers to RUBIS Eastern Africa

Eastern Africa Community in this document refers to Kenya, Uganda, Rwanda and Burundi.

ADR refers to the European Agreement concerning the International Carriage of Dangerous Goods by Road

3. Vehicle operational environment

Country of operation: Kenya
Uganda
Rwanda
Burundi
Zambia

Those specs do not cover LPG vehicles specifications for other countries where does operate KENOLKOBIL. Enquiry KK LPG Technical Manager for vehicles aiming to operate in other countries.

Design product:

Country	Local specifications	Mixture to consider as per ADR classification
Kenya	LPG mixture - 20% Propane max	Mixture A,A01, A02,A0, B1 and B2.
Uganda	LPG mixture - 60% Propane max	
Rwanda	LPG mixture - 60% Propane max	
Burundi	LPG mixture - 60% Propane max	

Zambia	LPG mixture - 80% Propane max	
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Climate temperature range: 5°C to 50°C

Humidity range: 40% to 95%

Road conditions: paved

Type of delivery: Bulk drop (pressure discharge with site compressor or on site pump)

4. Regulation

4.1. Law and standards

The regulation beside the ADR is extended with:

- For Eastern Africa Community:
 - KS EAS 902 Bulk LPG road tankers Assembling requirements
 - KS EAS 903 Welded steel tanks for Liquefied Petroleum Gas (LPG) — Design and manufacture
 - East Africa Community Vehicle Load Act, 2013
- For Zambia:
 - SANS 10087-4: The handling, storage, distribution and maintenance of liquefied petroleum gas in domestic, commercial and industrial installations Part 4: The transportation of LP gas including the design, construction, inspection, fittings, filling, maintenance and repair of LP gas bulk vehicles and rail tank cars
 - SANS1518: Transport of dangerous goods - Design, construction, testing, approval and maintenance of road vehicles and portable tanks
 - Zambia Roads and road traffic act

4.2. Speed limitation

Vehicle are required to be fitted with speed limiters set at 80 km/h.

4.3. Road side driving

Countries are left hand drive country with exception of Rwanda and Burundi.

4.4. Axle load, Gross weight & dimensions limitations

Are only reported below requirements for East Africa Community. Requirements for Zambia to be

4.4.1. Axle load limitation

Country	Axle	Nr of Tyre	Max load (tons)
East Africa Community	Single	2	8
		4	10
	Tandem	4	18
		8	16
	Tridem	6	22.5
		12	24
	Liftable unit	2	8.5
		4	10

Note: no axle within a tandem or tridem axle unit shall exceed the permissible maximum single axle load limit.

Tyres must be:

- 12R22.5 or 315/80R22 for single axle (steering axle or power axle) or tandem / tridem dual tyres
- For tandem / tridem single tyre:
 - 385/65R22.5 for vehicles manufactured before 2020
 - 455/55.R22.5 for vehicles manufactured in 2020 and after

Country	Axle	Nr of Tyre	Max load (tons)
Zambia	Single	2	4.5
		4	4.5
	Tandem	4	9
		8	9
	Tridem	6	13.5
		12	13.5
	Liftable unit	2	9
		4	9

An exemption must be obtained in terms of regulation 58 to be able to drive vehicle with higher load per axle in Zambia. The contractor or REA should apply upfront before to source the vehicle to get authorization of max mass per axle and gross weight at East African Community level or South Africa Level.

4.4.2. Gross Vehicle weight limitation

Country	Vehicle	Prime axle	Trailer axle	Max GVW (tons)
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East Africa Community	Rigid	4x2	NA	18	
		6x4	NA	26	
	Semi-trailer	4x2	Tandem	36	
			Tridem	42	
		6x4	Tandem	44	
			Tridem	50	
Zambia	Rigid	4x2	NA	DND	
		6x4	NA		
	Semi-trailer	4x2	Tandem		
			Tridem		
		6x4	Tandem		
			Tridem		

4.4.3. Dimensions

Country	Dimensions	Max
East Africa Community	Overall width	2.65 m
	Overall height	4.3 m
	Overall length	
	- Rigid vehicle	12.5 m
	- Articulated vehicle	17.4 m
	- Combination vehicle	22.0 m
Zambia	Overall width	2.60 m
	Overall height	4.80
	Overall length	
	- Rigid vehicle	12.5 m
	- Articulated vehicle	15.5 m
	- Combination vehicle	22.0 m

5. Horse design

Horse (cab) must be compliant with KS EAS 902 last version or alternatively fully compliant with the ADR.

Certificate of compliances with the relevant standard must be provided by the horse manufacturer.

6. Road tanker design standard

6.1. Vessel design criteria

6.1.2. For East Africa Community

Vessel must be compliant to both standards below:

- DEAS 903

- ADR Mixture A,A01, A02,A0, B1 and B2.

In application of DEAS 903 Annexure A & B, the manufacturer should get an authorization in writing to apply design temperature -20 to +50 degC. If this authorization cannot be obtained, the design temperature is -20 +65 degC

6.1.2. For Zambia

- EN12493
- ADR Mixture A,A01, A02,A0, B1 and B2.

6.1.3. Max Filling ratio

As part of derogation mentioned in 6.1.2. the following derogation to design vessel as per filling ratio prescribed in the ADR should be applied (more stringent than DEAS 903 Annexure B requirements)

6.2. **Product approvals and plates**

Pressure vessel must be designed and manufacture as per ADR requirements.

The information reported on the plate must comply with local regulation **and** ADR requirements and include all of the products to be carried in the vessel ie Mixture A,A01, A02,A0, B1 and B2.

6.3. **Registration / approval certification of Vessel and Pipe work**

The Supplier is responsible for the delivery of the vessel and piping approved by a legally recognised organisation (Notified body), e.g. SGS, DNV, Veritas or other applicable equivalent Notified body.

The Supplier is responsible for the delivery of all necessary documentation for local registration of the vessel and pipe-work.

6.4. **Applicable LPG equipment and piping standards**

LPG equipment (valves, etc) must comply with the European Standard EN12252 Equipping of Liquefied Petroleum Gas Road Tankers, or an equivalent standard.

The following material quality standards apply:

- Carbon steel seamless pipe, API 5L grade B, DIN 1.0356 (TtSt35N), ASTM A334 grade 1, or equivalent.
- General fittings must be suitable for use with LPG, the service required and be of a recognized international standard, e.g. UL listed, ASME, API, EN, ISO, etc.

6.5. Loading and discharge options

Loading with external pump through fill line with spray bar and vapour balance line.

Discharge either:

- without pump and with use of external compressor.
- with on site pump

Loading and discharge from the rear of the vehicle.

6.6. Operational safety features

The following defines the safety features must be fitted on the vehicle:

- An emergency shutdown (ESD) system must be provided on the vehicle that closes the internal shut off valves
- ESD system linked to that of the depot where the product is loaded, by control of the compressed air supply to the road tanker system from the site safeguarding system.
- ESD system activated by opening the valve cabinet door.
- ESD function triggered by handbrake release.
- Drive away protection system activated by opening the valve cabinet and putting the parking brake (articulated chassis) on, that ensures that hoses are disconnected and made secure before the vehicle can be driven. A fail safe interlock override system must be fitted in case of accidental cabinet/bar opening when the vehicle is in motion.
- Left hand drive option: 3 ESD pneumatic stop buttons located at the front left and rear right of the truck/trailer and inside the valve cabinet, and connected to the pneumatic control system of the internal valves.

6.7. Vessel volume indication

The vessel must be fitted with:

- Rochester Magnetel Rough Rider M6339 (4"/100 mm) or M6342 (8"/200 mm).
- Volume indicator fitted in the manhole at the rear.
- Maximum fill level gauge in the manhole at the rear, with pressure indicator.
- Additional maximum fill level gauges x % y % z % in cabinet (x, y and z to be advised upon filling ratio calculation) with x:
 - x Normal filling level for Kenyan market mixture
 - y Normal filling ratio for Mixture B2
 - z Normal filling ratio for Kenyan market mixture +5%
- The maximum orifice size at the connection of the fixed ullage gauges to the vessel must not exceed 1.5 mm diameter and the operational bleed screw must remain captive.
- Maximum fixed level gauges must be set taking into account the lowest operating temperature likely to be encountered during normal operations for each grade of LPG that will be loaded.
- Fixed level gauges must be labelled for the product they have been set.

- Refer ADR Part 4 Chapter 4.1.4.1 (packing instruction P200) for safe maximum fill level calculation details.
- Manhole (vessel inspection entrance)
- The design must be of flush type to accept a semi-ellipsoidal dished inwards cover welded to the cover flange. A handling bar must be welded across the manhole cover.
- Manhole located at rear dished end of vessel, minimum \varnothing 460 mm, and prepared for volume indicator.
- Manhole including a $\frac{3}{4}$ " or 1 1/4" emergency suction installation, minimum \varnothing 460 mm.
- A Rego 7590u or 7591u, or equivalent check-lock valve must be used and sealed with a blind flange at the back of the manhole. The manhole must be closed with a removable outer steel cover and there must be an internal pipe that will point to the lowest part of the vessel in a roll over situation. When the manhole is prepared for volume indicator, the emergency suction nozzle must be located directly on the vessel shell.

6.8. Pressure and temperature gauges

The vessel must be fitted with:

- Temperature indicator so that it records the liquid temperature and fitted in a sealed pocket (thermowell) in the form of a blind tube constructed to the vessel design code.
- Vessel pressure indicator, when not fitted on the maximum fill level gauge, in valve cabinet.

6.9. Baffle/surge plates

Surge plates to be installed as per DEAS 903 requirement.

6.10. External corrosion protection

All new and rebuilt vessels must be protected against corrosion to the following standards before fitting to the chassis.

- SA 2½ grit blast external surface preparation as per ISO 8501.
- Hot metal spray zinc coating on the whole of the vessel to 70 microns thickness..
- 40 microns epoxy primer coat.
- 110 microns 2 pass epoxy topcoat, colour white.

6.11. Vessel connections

- The number of vessel connections, particularly those into the liquid phase, must be minimised.
- All connections to the vessel that serve as a passageway for the product into and out of the vessel with more than 1.5 mm diameter, other than those for pressure relief valves, meter pressure balance connection and permanently plugged or blanked nozzles, must be protected by an internal shut-off valve.
- When the manhole is prepared for volume indicator, the emergency suction nozzle must be located directly on the vessel shell. The design of the check-lock valve connection must ensure that the valve is protected in the event of collision or rollover of the vehicle.

- Vessel nozzles with fittings/equipment which have controlling orifices not exceeding 1.5 mm diameter, e.g. the proprietary equipment like rotogauges, fixed ullage gauges, ..., do not require protection by an internal shut-off valve.

6.12. Vessel internal shut-off valves

Each new or rebuilt vessel must be equipped with pneumatically controlled internal valves, of the collision protected type (i.e. the closing part of the valve is inside the tank being opened via a lever in order to prevent uncontrolled loss of product after incidents).

The following Fisher and Rego models are recommended although other approved suppliers may deliver comparable valves. The preferred valve material is stainless steel. Aluminium valves or equipment must, as a minimum, be UN listed.

- The closing rate of the internal valves must not be greater than the rate of flow, which would result from failure of the piping or hose immediately downstream of the valves or 120% of the nominal operating flow rate. Common closing rates are 90 m³/h for loading valve and 135 m³/h for discharge valve.
- The internal valve actuator system must include fusible links set to ensure positive closure the valves in case of fire at or adjacent to the vehicle. Fusible links must have melting points not in excess of 120°C (this is commonly achieved by the use of scub tubing).

Approved models are:

Fisher

- Internal valve discharge, C403/4 series.
- Internal valve for loading of the vessel, C 403 series with filter removed.
- Internal valve vapour, C407.
- Pneumatic control (C403) Fisher P326-5.
- Pneumatic control (C404) Fisher P312.
- Pneumatic control (C407) Fisher P389.

Rego

- Internal valve discharge, 3" A3217 or 4" A3219,
- Internal valve for loading of the vessel, 3" A3217 with filter removed.
- Internal valve vapour, 1¼" A3209.
- Pneumatic control A3217FPA.
- Pneumatic control A3219 FPA.
- Pneumatic control vapour return A 3209PA.

6.13. Vessel Pressure Relief valve

The vessel must be fitted with at least 2 PRVs connected directly to the vapour space. They must be of the internal spring-loaded type, i.e. the operating mechanism must be with the vessel and specifically designed for transport vessels. Weather caps must be provided to prevent water and solid particles from collecting in the outlet of the PRV. The design of the PRV connections must ensure that the valve is protected in the event of collision or rollover of the vehicle. PRV must be designed in accordance with API 520.

Approved PRV models are

- **Fischer:** Pressure relief valve H721 / 731. The number of these valves required per vessel will depend on the vessel size and climatic conditions and will be calculated by the supplier.
- **REGO:** Pressure relief valve A 84 -34 / 36. The number of these valves required per vessel will depend on the vessel size and climatic conditions and will be calculated by the supplier.

6.14. LPG pipe work

- All valves and fittings on the vehicle must be suitable for liquid phase LPG at the anticipated operating pressures and temperatures. These must be installed or fitted in accordance with the manufacturer's instructions and recommendations.
- Carbon steel seamless pipe to API 5L grade B or an equivalent must be used, with Schedule 80 for diameters up to 40 mm and Schedule 40 for diameters greater than 40 mm.
- Section of piping or hose in which LPG may be trapped must have a thermal expansion relief valve fitted to prevent excessive pressures from developing. They must be positioned so that a release would not impinge on the vessel, fittings or operator.
- All piping, valves and vessel connections must be protected by their location from possible collision or roll-over damage, or alternatively by mechanical means in which case the protection, e.g. under-run bumper, must have sufficient impact resistance to withstand typical collision or roll-over forces.
- Mechanical barriers must not be attached to pipe work or valves which they are intended to protect.
- Valves which are fitted in the piping system for operational and maintenance purposes must be fire-safe and meet API 6FA or equivalent.
- Threaded connections, if unavoidable, must be kept to a minimum and must not be used on piping greater than 35 mm nominal bore. Larger sizes of pipe should be welded or have welded flanges (butt-welded type).
- Threaded fittings when used should be made from forged carbon steel to BS 3799 or ANSI/ASME 16.11 and may require the use of heavy wall pipe. The thread on both the fitting and pipe should be tapered and of the NPT form.
- Jointing materials, thread sealants and gaskets must be suitable for use with LPG and maintain satisfactory performance over the range of service conditions.

Each line is described starting at the outer connection of the internal shut-off valve.

6.14.1. Liquid Discharge line

From inside the vessel to the coupling

- Internal Pneumatic valve 3”.
- 3” Steel piping with a minimum of bends fitted with TERV.
- 3” Manifold (share with loading line) with bleed valve and TERV
- Inside the cabinet (common equipment for liquid loading):

- 3" ball valve quarter turn fire safe either ASA300 flange or BW (butt welded ended)
- 10 cm pipe fitted with TERV and bleed valve
- Welded concentric reduction 3" x 2"
- 2" LPG Dry coupling (Todo or Manntek) ASA300 flange connection with cap(to share with loading line)

6.14.2. Loading line (following product direction)

- Inside the cabinet (common equipment with discharge line)
 - 2" LPG Dry coupling (Todo or Manntek) ASA300 flange connection with cap (to share with discharge line)
 - 2" ball valve flange ASA300
 - Welded concentric reduction 2" x 3"
 - 10 cm pipe fitted with TERV and bleed valve
 - 3" ball valve quarter turn fire safe either ASA300 flange or BW (butt welded ended)
- 3" Manifold (share with loading line) with bleed valve and TERV
- 3" steel pipe with a minimum of bends connected to a bottom 3" ASA 300 nozzle fitted with TERV
- Internal 3" pneumatic valve
- Internal check valve (non return valve)
- Internal 3" piping
- Internal spray bar 3" reduced at 2" at 1/3rd of the tanker length

6.14.3. Vapour line (from tanker coupling to inside pipe outlet)

- Inside the cabinet
 - 2" LPG Dry coupling (Todo or Manntek) ASA300 flange connection with cap
 - 15 cm x 2" steel piping fitted with bleed valve
 - 2" ball valve flange ASA300 or BW ended
- 2" pipe connected to 2" ASA300 flange below the vessel
- Internal pneumatic valve 2"
- Internal 2" pipe with outlet above the vessel 90% level.

6.14.4. Coupling positions

The dry coupling must be inside the cabinet at the rear of the vehicle. Coupling axis must be in vehicle axis.

When watching the rear of the vehicle, the liquid coupling must be on the left and vapour coupling on the right.

The distance between each coupling must be enough to allow easy connection of both couplings with relevant Female couplings.

Coupling axis must be between 0.8 and 1.3 m above ground level.

Approved dry coupling models

Manufacturer	2"
MANNTEK	#L258B4471 2" Dry disconnect Male adaptor SS / PS 25Bar with 2"ANSI Cl.300 Flange + Dust Cap composite with cable
TODO	2" (DN50) TODO-Gas Dry-Break Adaptor (male), stainless-steel / Viton, 2" ASA 300LBS Flange Connection + Dust Cap composite with cable

6.15. Pneumatic pipe work

All pneumatic system piping is to be of fusible *plastic*. It shall be secured with a combination of cable ties and mounting brackets and, where possible, sleeved using flexible plastic sheathing. Where the pipe work penetrates metal or other sharp edges or holes, the penetration shall be protected with suitable grommets or protective edging. To prevent mechanical damage, pipe work is to be routed inside chassis members and internal to the chassis rail or cabinet spaces where possible.

6.16. Pneumatic logics

6.16.1. Site / Tanker ESD connection

The pneumatic network will be modify to comply with the following sketch in order that the air operated valves and Internal pneumatic valve be shut off in case of :

- Handbreak off
- Emergency push button of the truck activated (at least 2 ESD buttons)
- Dead man function activated
- Plastic pipe melted
- Shut down from the site side

For this last case, a 3/2 distributor is used on site to:

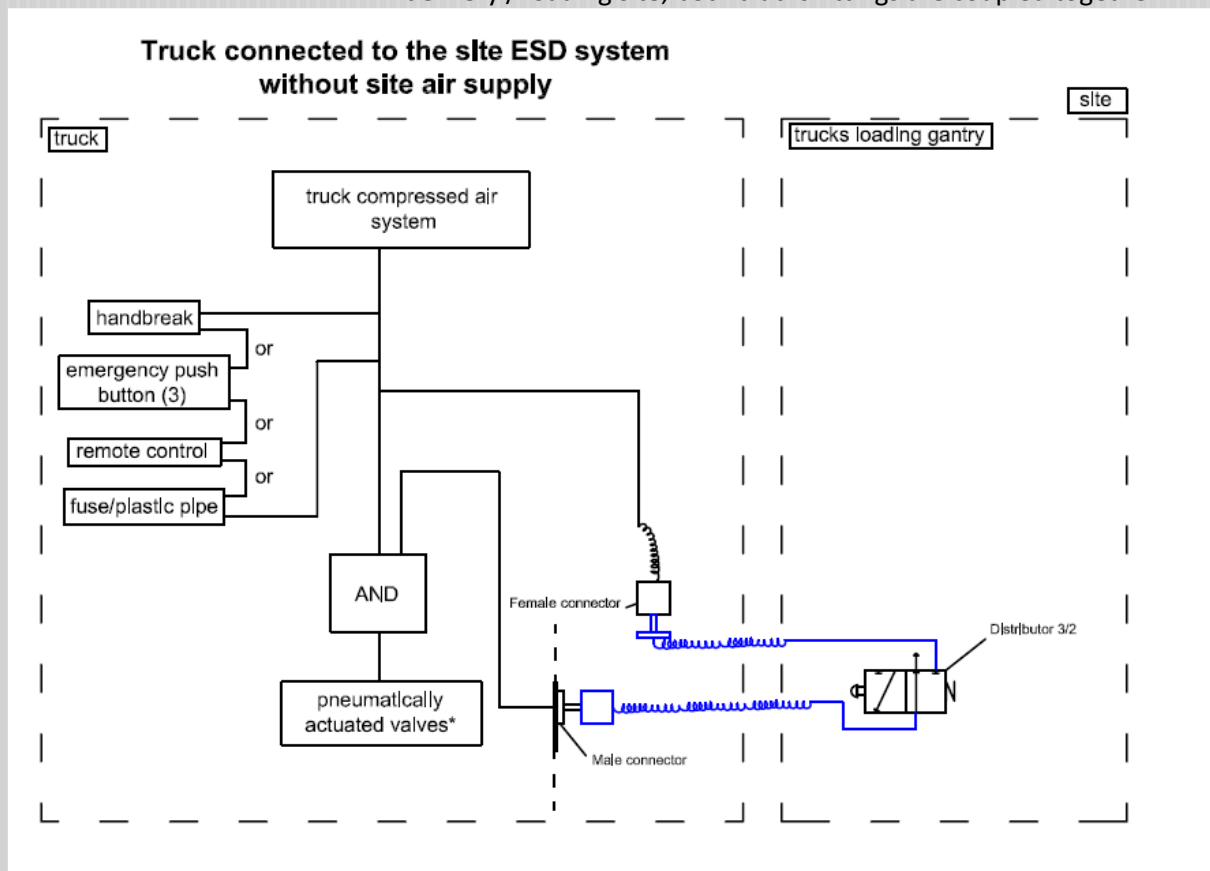
- Let the air goes to the actuators on normal operation
- Block the air arrival and drain the air in the actuators in case of shut down activated from the site

The contractor has to supply all the element on the trucks including the air fittings

The air connection will be

- Gromelle fitting MALE: GD1866315
- Gromelle fitting FEMALE : GD1852614
- Those fittings can be supplied by EASIGAS (for free)

On route or when we do not use this interface truck / site on delivery / loading site, both trucks fittings are coupled together.



6.16.2. Internal valve operations

A set of 2 pneumatic button / lever must be installed withing the cabinet:

- 1 lever to operate the liquid internal valve
- 1 lever to operate the vapour internal valve

6.17. **Articulated vessel chassis mounting**

Articulated vehicles are normally of self-supporting design eliminating the need for a full-length chassis. Mountings must be attached to the vessel shell via backing plates welded directly to the shell to minimize high stress concentrations in the shell. All such welds must be continuous. Mountings will be required for:

- semi-trailer running gear,

- landing legs to enable the trailer to stand unattached to the towing vehicle,
- “fifth wheel” rubbing plate, normally fitted with a bolted in position kingpin,
- cabinet for delivery equipment (couplings).

The mounting design shall take into account the driving conditions and vibration/fatigue related aspects of the operating environment.

The axles need to be suitable for single tyre fitting to reduce weight and fuel consumption due to lower rolling resistance (some countries restrict the usage of single rim axles - in this situation, the lightest combination of rims and tyres needs to be selected).

The mounting must fully meet EAS 902 5.2. requirements.

6.18. Cabinet

All connections for off/loading facilities are to be located in the same cabinet to reduce weight and construction cost. To reduce torque and vibration, the cabinet must be attached to the vessel rather than the chassis whenever possible. The cabinet must be lockable and designed to ensure adequate ventilation through openings at the front and back of the cabinet.

The cabinet with the couplings must be placed at the rear of the vehicle.

The cabinet must present 2 locks points:

- 1 for a lock
- 1 for sealing

The manufacturer must pay attention to the fact that in no circumstances we can open the cabinet to access to the coupling without removing both the lock and the seal.

6.19. Ancillary equipment

- A process and instrumentation diagram (P&ID), detailing the complete loading and unloading schematic, with all valves shown and numbered on the diagram and in a table of functionality descriptions. A weatherproof copy of this diagram must be installed in the cabinet. A paper copy must be included in the tanker manual with one copy for the truck and one copy for the office.
- The manual must be written in English.
- Hazard chemical signage (front, sides and rear):
 - panels Numeric
 - Eastern Africa Community, ADR reference (23 – 1075)
 - Zambia Hazchem reference 2YE - 1075

Transporter must be able to change the signage plate according to local country regulation.

- Hazard chemical panels visuals (Hazchem warning 2A “flammable gas” flame diamond signage)
- Bonding reel length 15 m and with a manual rewind feature and heavy duty crocodile clip must be placed in the cabinet and bounded to the vessel.
- Two 9 kg, or equivalent size, dry powder fire extinguishers placed at both side of the chassis, in protected cover(s) made of plastic, fibreglass or

stainless steel, and mounted vertically or at an angle (horizontal mounting must be avoided)..

7. Other requirements

7.1. Electricals

All electrical parts and elements must be compliant with EAS 902 last version for both horse and trailer.

Certified electrician to issue certificate of compliance for all vehicle's elements.

7.2. Brakes

All combination vehicle (Horse and trailer) must be fitted with ABS braking system

7.3. Suspensions

Trailer must be fitted with pneumatic suspensions system.

An axle can be a lifted axle type.

8. Branding

Vehicles (horse and trailer) will be branded as per REA requirements to be issue to the contractor.

Annexure A: Typical tanker PI*D

