KUWAIT NATIONAL PETROLEUM COMPANY

LOCAL MARKETING DEPARTMENT

Technical Specification

FOR

Fuel Road Tankers / Semi Trailers
for Transportation of Petroleum Products

1. SCOPE

This Specification Covers the Minimum Technical Requirements for the design, construction, inspection and testing of the Fuel Road Tanker (covering Vehicle, Chassis and its Super Structure etc.) intended for transportation of all petroleum products including all grades of gasoline such as Gasoline (UN 1203), Gas oil (UN 1202) and Kerosene (UN 1223) & Euro IV Products across Kuwait.

2 PURPOSE

The purpose of this specifications is to ensure that the Road tankers for transportation of petroleum products entering the KNPC operating facilities are manufactured as per the specified codes and comply to the minimum requirements specified in this specification. It should also be ensured that the Road tankers are subjected to inspection procedure.

3. REFERENCE STANDARDS

Design, construction, inspection and testing of the Fuel Road Tanker with all its instrumentation and accessories shall comply with the latest issue / version of the applicable standards mentioned below. In the event of the conflict between the two standards, the most stringent shall be applicable and the KNPC decision shall be binding on the Road tanker owner.

#	STANDARD NO.	DESCRIPTION
•	BS EN 3094:2004(E)	Tanks for the transportation of dangerous goods - Metallic tanks with a working pressure not exceeding 0,5 bar. Design and construction
•	BS EN 14564:2004	Tanks for the transportation of dangerous goods - Terminology
•	BS EN 13922:2003	Tanks for the transportation of dangerous goods - Service Equipment for Tanks-Overfill Prevention Systems for Liquid Fuels
•	BS EN 13083:2001	Tanks for the transportation of dangerous goods - Service Equipment for Tanks-Adopter for Bottom Loading and Unloading
•	BS EN 13082:2001	Tanks for the transportation of dangerous goods - Service Equipment for Tanks-Vapour Transfer Valve
•	BS EN 13081:2001	Tanks for the transportation of dangerous goods - Service Equipment for Tanks-Vapour Collection Adapter and Coupler
•	BS EN 13082:2001	Tanks for the transportation of dangerous goods - Service Equipment for Tanks-Gravity Discharge Coupler
•	BS EN 13082:2001	Tanks for the transportation of dangerous goods – Testing, Inspection and markings
•	IP	Petroleum Road Tanker Design and Construction
•	NFPA-385	Standard for Tank Vehicles for Flammable and Combustible Liquids
•	API RP 1004	Bottom Loading Vapour Recovery for MC-306 Tank Motor Vehicles
•	ADR	European agreement concerning the International Carriage of Dangerous Goods by road
•	Local Government	Rules & regulations of Kuwait Government Authority – Traffic Department, Kuwait Fire Brigade & Ministry of Public Works.

4. CROSS REFERENCES

(Latest Revisions / Versions of Documents are applicable)

- **REF NO SHE-TSSA-05-2018** Appendix F: Safety Checklist For Road Fuel Tanker
- **I & C PROC NO IC – 42** Inspection of Petroleum Products Road Tankers (shell, structure, vents, drains, hoses)

Abbreviations

- ABS: Anti-lock Breaking System
- EBS: Electronically Controlled Breaking System
- GVW: Gross Vehicle Weight - the actual weight of a vehicle.
- GVWR: Gross Vehicle Weight Rating: The maximum allowed GVW for a vehicle.
- GCW: Gross Combined Weight: The total weight of everything - tow vehicle, trailer, etc.
- GCWR: The maximum allowed GCW.
- GAW (front or rear): The Gross Axle Weight - the amount of weight on that particular axle.
- GAWR (front or rear): The Gross Axle Weight Rating: The maximum allowed GAW
- LGBF: LGBF refers to the ADR tank type and is an abbreviation for the code of specified tanks (L=tank for substances in the liquid state, G=minimum calculation pressure according to 6.8.2.1.15, B=tank with bottom-filling and discharge openings with 3 closures, F=tank with a venting system fitted with a flame trap according to 6.8.2.2.6 and TE1 of 6.8.4).
- SPDT: Single Pole Double Throw type switch
- NO: Normally Open (Contacts)
- NC: Normally Closed (Contacts).
- PTO: Power Take-off (Driven pumps).
- VEC: Vendor Evaluation Committee of KNPC.

5. GENERAL REQUIREMENTS

Definition: Road Tanker: The Road tanker mentioned herein is a Truck (either single or with trailer) which is a motor vehicle designed to carry Petroleum Product loads contained in a Steel Tank mounted on the Truck / Trailer Chassis.

5.1 The fuel Road tanker, trailer or semi-trailer (referred to as tanker for brevity hence forth) is intended for transportation of fuel from Sabhan and or Ahmadi depot other KNPC facilities to various filling stations and other destinations located across Kuwait.

5.2 Both Sabhan and Ahmadi Depots are equipped with the state-of-art Terminal Automation and Vapor Recovery Systems. It is therefore, required that the Road tankers be designed with all the required instrumentation and automation system to be compatible for safe loading operation with vapor recovery.

5.3 All the Filling Stations have already been equipped with Vapor Recovery System at the underground tanks. It is, therefore, essential to equip Road tankers with all the features to facilitate these tankers to Vapor Recovery mode of operation.

5.4 The Vapor Recovery System for each Tanker / Semi-trailer shall be designed in accordance with API-RP 1004 to prevent build-up of high pressure or vacuum during the process of loading /unloading in either vapor recovery or non-vapor mode of operation as required. Required equipment, instrumentation, automation for operations must be provided with the Road tanker. Necessary hoses with couplings &

connection adapters and couplings shall be supplied with each tanker for unloading products at Stations and Customer locations with Vapor Recovery System.

5.5 The tanker chassis, the tank and its instruments shall be conforming to requirements and standards referred in this document.

5.6 All materials and equipment such as valves, manhole covers, vents, pumps, couplers, hoses, electro-pneumatic control system etc. shall comply with KNPC Specification and should be obtained from approved suppliers, according with KNPC's VEC list or approved by KNPC.

5.7 All openings such as vents, manholes and inspection openings should be protected from damage, in case of vehicle overturns, by having them enclosed within the body of the tank or dome attached to the tank or by guards.

5.8 Design, selection, construction and testing of the tanker equipment, instrumentation, engine and all accessories shall be done carefully taking note of the severe & dusty site conditions prevalent at Site. Tanker Designer shall take due precautions in designing & selection of equipment instrumentation & facilities by providing suitable enclosures wherever necessary to give additional protection from the dust, direct Sun and other sever conditions that would ensure trouble free operation under severe environmental conditions. Frequency of testing and maintenance will have to be planned accordingly to meet the frequency specified by international standards and local conditions.

The Site climatic Data are as follows :

Altitude:	:	328 feet above sea level
Vicinity to sea	:	Approx. 1500 M
Max and Min. Temp under shade	:	55^0C and (-)3^0C
Max. Metal exposed Temp	:	85^0C
Relative Humidity	:	100% to 30%
Wind Velocity	:	100 KMPH
Rain Fall	:	4" per year
Sand Storm	:	Sand storms are common and even on comparatively still days fine sand is carried in suspension by air.

All the subsystems of tankers / trailers should perform satisfactory under the above environmental conditions and to be designed for continuous operation of Road tankers e. g. round the clock operation, seven days a week throughout the year.

5.9 The Road tanker shall be designed for fast fill operation (i.e. designed for filling rates of 1550 lpm to 2400 lpm in each compartment simultaneously safely without static electricity problem safely).

5.10 The Road tankers shall meet all local Government regulations and requirements such as Ministry of Public Works & Kuwait Fire Brigade.

6 CAPACITY OF TANKERS

Different types of tankers envisaged are as follows:
Road tankers with capacity from 10 KL to 36 KL with Single / Two compartments subject to approval from KNPC for total gross weight.

The **gross capacity** of the tanks (applicable for each compartment) shall be 105% of the **rated capacity** as stated above or at least 300 liters over nominal capacity, or meet requirements of CEN/ TR 15120:2005 Annex D, **whichever is higher**.

7 DOCUMENTATION

Detailed drawings along with following documents shall be submitted to KNPC for preliminary approval before start of manufacturing. Final approval will be given only after completion of all work according to the Specification, inspection and testing followed by physical verification of performance during loading / unloading at KNPC facilities.

a. Overall plan and elevation of the tank with chassis.

b. Fabrication drawing of the tank

c. Vehicle Chassis drawing

d. Electrical wiring drawing

c. Pneumatic control diagram

d. Overall Control schematic

e. Original technical manuals of engine, chassis, all instruments and control equipment, special tank valves (general literature will not be acceptable).

All drawings shall be submitted in A1 size and shall be in metric dimensions, along with bill of material, material of construction, model number, supplier / manufacturer details. Final documentation shall be submitted in hard copy and also with soft copy on DVD-ROM.

8 TANK VEHICLE DESIGN :

8.1 General :

Design of the tank vehicle shall give engineering consideration to structural relationship between the cargo tanks, propulsion equipment and supporting members if any, with due regard to the weight & temperature of the cargo, road performance, breaking & required ruggedness. Metal thickness specified in this specification shall be the minimum thickness dictated by the structure of the tank. This thickness shall be increased where the tank shell is subjected to additional stresses. General design of the cargo tank & vehicle chassis shall be arranged to give the best combinations of structural characteristics & vehicle performance. Design of the suspension system shall incorporate features to assure prevention of lateral or tripping when turning occurs.

The tank code as per ADR shall be LGBF irrespective of the product to be carried in the Tank. Similarly, irrespective of the vapor pressure difference between three grades of Gasoline (UL-91, UL-95, UL-98), all three grades shall be considered as gasoline (UN 1203).

8.2 Vehicle Chassis :

The Road tanker vehicle design mass shall be in accordance with the maximum allowable axle load on the roads and bridges at Kuwait by the local Authorities.

8.2.1 No. of Axles:

Transporters / Road tanker Owners can select any of the options (from Figure 1 to Figure 4 for number of axles in case of trailer type Road tanker, copy attached for reference & guidelines) and submit load calculations showing design & selection of Axles, Tires & Stability requirements as per clause 9.75 & calculations in Regulation 111, Clause 5.3.1.2.

8.3 Road clearance

The clearance between any component of the Road tanker and the road shall comply with the following requirements:

a. The ground clearance for tank components and protection devices shall not be less than 250 mm within 1 m of any axle or 350 mm for any other location, when the vehicle is un-laden.

b. Tank filling and discharge connections which are rigidly attached to the tank shall not extend lower than 40 mm below the plane through the centerline of the axles.

c. The maximum height of any part on the tanker from ground level shall not exceed 3.75 meter when the tanker is empty.

For Tankers:

d. Adequate space is required to be kept below the chassis to fix two equipment boxes at the both sides.

e. Distance between front & front rear axle center (middle axle) shall not be less than 4500 mm.

f. Distance between front of the rear edge of drivers cab & original chassis end shall not be less than 7500 mm (without extension).

g. Any extension required more than the above length should be accepted and certified from the manufacturer.

h. For tankers of capacity less than 20,000 liters, the values described under clause d, e and f shall be selected in such a way that will keep the center of gravity of loaded tanker close to the center of the wheel base to the extent possible.

For semi-trailer:

i. Distance between front & front rear axle center (middle axle) shall not be less than 3200 mm.

Note: The above parameters will be superseded by the Kuwait Traffic Department's enforced parameters, if any.

8.4 SUB FRAME:

The sub-frame shall be manufactured for load distribution and reinforcement of chassis frame, mounted & manufactured according to chassis manufacturer's regulations, instructions and recommendations. The design of fasteners for the holding the tank on the chassis shall be carried out as per ADR.

8.5 VEHICLE STABILITY

The height of center of gravity of the Road tanker with maximum permissible liquid load should fall within a isosceles triangle, the base length of which at ground level is the overall width between the outside walls of the outside tires of the major load carrying axle or axles and the base angles of which are not more than 62^0 degrees at half length of the tank.

8.6 VEHICLE ROLLOVER PREVENTION AND PROTECTION

a. The Road tanker shall be equipped with rollover **prevention** system. The system shall be interlocked with the trucks Electronic braking system to ensure that the speed of the tanker is controlled while negotiation curvature. As a guideline the Road tanker should not over turn when traversing at 4 m/s^2 .

b. Further, the vehicle shall be fitted with rollover **protection** device which automatically shuts down the engine and isolates the battery. This device shall not get activated at less than 45^0 to the vertical.

8.7 REAR END PROTECTION

All Road tankers shall be fitted with a bumper which extends over the full width of the tank at front & rear of the vehicle. The bumper shall be structurally sound to give protection to the front & rear end of the tank.

Bumper to be attached only to the chassis or sub-frame of the vehicle.

It shall not be located lower than the height of the chassis in case of rigid vehicles and not lower than the height of the tank in case of trailer and semi-trailers.
It should be mounted in such a way that its inside surface shall be not less than 200 mm from the tank and its fittings.

8.8 PAINTING & REFLECTORS :

a. Painting: the tanker should be painted in red and white color combinations in accordance with KNPC specifications. Also, following warning signs should be indicated :

   NO smoking
   DANGER – HIGH INFLAMMABLE LIQUIDS
   EMERGENCY TELEPHONE NUMBERS

b. Reflectors: `the required number of reflectors should be four which are to be fixed at rear of the vehicle – two pieces , one each side (one on the top of the tank and the other below the rear bumper). KNPC may request for additional reflectors based on the inspection.

c. Label shall:
   1. be affixed / painted to the same surface of the tanker, near the mark indicating the proper shipping name.
   2. be so placed on the tanker that it is not covered or obscured by any part or attachment to the tanker or any other label or marking; and

3. be displayed next to each other when more than one label is required.
4. Labels shall satisfy the provisions below and conform, in terms of color, symbols and general format to the model shown in the ADR 5.2.2.2.2.
5. shall be fixed to indicate all instruments and inlet/outlet of the Road tanker.

Note: Where appropriate, labels in 5.2.2.2.2 are shown with a dotted outer boundary as provided for in ADR 5.2.2.2.1.1. This is not required when the label is applied on a background of contrasting color.

6. Labels shall be in the form of a square set at an angle of 45^0 (diamond-shaped) with minimum dimensions of 100mm by 100mm. They shall have a line 5mm inside the edge and running parallel with it. In the upper half of a label the line shall have the same color as the symbol and in the lower half it shall have the same color as the figure in the bottom corner. Labels shall be displayed on a background of contrasting color or shall have either a dotted or solid outer boundary line. If the size of the package so requires, the dimensions of the labels may be reduced, provided that they remain clearly visible.
7. The upper half of the label shall contain the pictorial symbol and the lower half shall contain:

   The class number (3)

   The labels may include text such as the UN number or words describing the hazard (e.g. 'flammable').
8. All labels shall be able to withstand climatic weather exposure without a substantial reduction in effectiveness.

8.9 EXTINGUISHERS:

Vehicle should be provided with two nos. stored pressure type (not cartridge type) 9 kg dry chemical powder portable fire extinguishers placed on both the sides in special holders along with one 2 Kg DCP / CO2 fire extinguisher inside driver's cabin. The location and arrangement for attachment on the Road tanker shall be discussed and approved by KNPC. The Frequency of periodical inspection for Fire Extinguisher to be mentioned and inspection tags to be provided on the fire extinguishers. In this case, rules and regulations from Kuwait Fire Brigade will govern. If not specifically mentioned then the frequency of periodical inspection for Fire Extinguisher shall be once in 3 months.

8.10 FIRST AID KIT

The first aid kit containing eye wash bottle, flame proof / intrinsically safe torch shall be provided in the driver's cabin. The products' MSDS 'Material Safety data Sheets', Written Instructions (Emergency Procedure) and Oil Spill Response Procedures shall be provided / available in the driver's cabin.

8.11 In addition to above the following equipment shall be carried on board of the transport unit for all danger label numbers:

- For each vehicle, a wheel chock of a size suited to the maximum mass of the vehicle and to the diameter of the wheel; Number of wheel chocks shall be at least 2 nos.
- Two self-standing warning signs;
- Eye rinsing liquid; and
- A shovel;

- A drain seal;
- A collecting container made of plastics.

For each member of the vehicle crew

- A warning vest (e.g. as described in the EN 471 standard);
- Portable lighting apparatus conforming to the provisions of 8.3.4;
- A pair of protective gloves;
- Eye protection (e.g. protective goggles).

8.12 OIL SPILL RESPONSE KIT

To enable to meet the oil spill control requirements, the Road tanker shall be equipped with following accessories:

- Emergency communication facility (explosion proof / intrinsically safe)
- Instruction sheet for oil spill procedure.
- Oil spill response kit consisting of – (as per Recommended manufacture's list)
    - 1 no. 20 LBS absorbent filled bags
    - 4 nos. socks (48" x 3")
    - 3 nos. pillows (18" x 18" x 2")
    - 3 nos. Pads (17" x 19")
    - 1 no. Drain cover
    - 2 nos. Safety goggles
    - 2 Pairs of Hand gloves
    - 3 nos. Disposable bags
- Traffic Cones reflective types (minimum 4 numbers).
- In addition to the other documents, driver shall be trained on how to handle the Emergency situations and carry Standard Written Instructions as given in item 8.13.

8.13 INSTRUCTIONS IN WRITING

(Emergency Procedure)

Actions in the event of an accident or emergency:

In the event of an accident or emergency that may occur during carriage, the members of the vehicle crew shall take the following actions where safe & practicable to do so:

- Apply the braking system, stop the engine & isolate the battery by activating the master-switch where available;
- Avoid sources of ignition, in particular, do not smoke or switch on any electrical equipment;
- Inform the appropriate emergency services, giving as much information about the incident or accident & substances involved as possible;
- Put on the warning vest and place the self-standing warning signs as appropriate;
- Keep the transport documents readily available for responders on arrival;
- Do not walk into or touch spilled substances & avoid inhalation of fumes, smoke, dusts & vapors by staying up-wind;
- Where appropriate & safe to do so, use the fire extinguishers to put out small /initial fires in tires, brakes & engine compartments;
- Fires in load compartments shall not be tackled by members of the vehicle crew;
- Where appropriate & safe to do so, use on-board equipment to prevent leakages into the aquatic environment or the sewage system and to contain spillages;
- Move away from the vicinity of the accident or emergency, advise other persons to move away & follow the advice of the emergency services;
- Remove any contaminated clothing and used contaminated protective equipment & dispose-off it safely.

9. TANK OVERALL DESIGN AND REQUIREMENT

9.1 TANK

a. The shape of the cross section of the cargo tank should be double D shape or circular shape that would give lowest center of gravity and more stability.

b. The material used in the construction of the cargo tanks shall be compatible with the chemical characteristics of the flammable liquid to be transported.

c. The total weight of loaded tank with all accessories & equipment should be less than max permissible pay load by at least 1000 Kgs. Also total gross weight of tanker shall be within allowed by Kuwait Government Authority such as Ministry of Public Works.

d. The average specific gravity 0.85 shall be considered for the Kerosene (UN 1223) / Gas oil (UN 1202) / Gasoline (UN 1203) to be transported by the trailers.

e. All sheet & plate material for shell, head, bulkhead and baffles cargo tanks that are required to be constructed in according to the following minimum applicable requirement.

1. Mild steel exceeding requirements given in ADR or at least ASTM A 36 killed steel. Other material Al, SS etc. are acceptable subject to approval from KNPC.
2. Cargo tank shall be manufactured of carbon steel with thickness of different parts not less than 4 mm, Heads 5 mm & Baffles 4 mm. If the cargo tank diameter is greater than 1.8 m then the requirements of the standard shall be complied.

f. Head, Baffles & stiffener rings requirements of NFPA shall be applicable. Further, baffles shall be located such that no part of the liquid, in plan view would be >0.8 m. from any metal conducting surface.

g. Head shall be dished and in one piece and un-welded.

h. Baffles should be dished, corrugated or flat with reinforcement (flat baffles without reinforcement are not permitted).

i. Each baffle should have a net area as big as 80% of the cross sectional area of the tank.

j. Baffles should be equally spaced with distance between them or between baffles & head not less than 90 cm but not more 150 cm.

k. Baffles or baffle attaching rings, where used as reinforcement members, shall be circumferentially welded to the tank shell. The welding shall be not less than 50 percent of the total circumference of the vessel and the maximum un-welded space on this joint shall not exceed 40 times the shell thickness.

l. Wherever double bulkheads are provided, they shall be separated by an air space. This air space shall be vented & equipped with drainage facilities that shall be kept operative at all times.

m. At the time of manufacture, every cargo tank shall be tested by minimum air or hydrostatic gauge pressure of 5 PSIG or equal to the design pressure (two times the static pressure created by the highest column of the water in the tanker), whichever is greater. If compartmented, each individual compartment shall be similarly tested with adjacent compartment empty & at atmospheric pressure. Air pressure, if used, shall be held for a period of at least 5 minutes during which the entire surface of all joints under pressure shall be coated with a solution of soap & water or other material suitable for the purpose, foaming or bubbling of which indicates the presence of leaks. Hydrostatic pressure, if used, shall be done by using water or other liquid having similar viscosity, the temperature of which shall be not exceed 38^0C during the test and applying the pressure as prescribed above, gauged at the top of the tank, at which time all joints under pressure shall be inspected for the issuance of liquid to indicate leaks.

n. All closures shall be in place while testing by either method. The hydrostatic test pressure shall be held for at least 15 minutes or for the time necessary for the inspector to carry out the inspection whichever is higher. During these tests, operated relief devices shall be clamped, plugged or otherwise rendered inoperative; such clamps, plugs, and similar devices shall be removed immediately after the test is finished. Certificate of hydrotest shall be submitted.

o. In addition the completed assembled tanker shall be subjected to Vapor Tightness Test as per EPA Method 27 before commissioning. The test should be demonstrated by Road tanker owner.

p. The tank shall be internally shot blasted, cleaned and painted with two coats of Epikots protective coating, white (200 microns Hempel 1540 or equivalent) to suit the products to be handled. The tank shall be externally grit blasted, and surface cleaned & protected with the following painting sequence:

- One coat 50 micron primer

- One coat 100 microns white enamel

- Finish coats 100 microns of approved Color.

q. KNPC / KNPC approved Third Party would undertake stage wise inspection during manufacturing of the Road tanker for tank shell, structure, vents, drains & hoses. Road tanker owner shall provide material certificate / catalogue / technical data & full access for the all material used in the fabrication of the tank, tanker hoses all accessories in order to inspect. The safety certificate for the Road tanker shall be issued by KNPC after Contractor submits Kuwait Fire Brigade & Ministry of Public Works's approval as these are mandatory documents and the Road tanker will be inspected & tested at KNPC Sabhan Depot.

9.2 HOOD LADDER AND BUMPER

a. Hoods with a cat walk should be fixed to tanks top side sealed & sloped to Road tankers rear side in such a way that any spillage from any opening will drain automatically to ground through external pipes at Road tanker's rear side. This hood will act as a guard to protect all fittings is case of tanker overturn as specified in NFPA 385 code. Hood shall be equipped with drain valve. Safety hand railing to be provided. Any access facility to the tank, tank top or chassis should comply with requirement given below.

b. The first step height should not exceed 550 mm from the ground. The intermediate steps should be equally spaced & shall not exceed 300 mm apart. There should be toe hold clearance of 130 mm. The access steps should preferably sloped inward the top. Hand hold should be fitted above the height of the top step/rung /platform. The ladder should rise to a height of at least 3'-6" above the landing space, i.e. top of the tank and should not be welded to the tank.

9.3 HOSES AND CONNECTIONS

a. The vehicle shall be designed for fast fill operation at the rates not less than 2400 lpm.

b. The tanker shall be equipped with necessary hoses, adapter & connection fittings for unloading of products at Stations, Customer Locations etc. The hoses shall be reinforced light weight type made of polypropylene fabric & film and provided with abrasion resistant outer cover reinforced with internal & external spiral wire of aluminum so as to ensure light weight along with high durability for all petroleum products. The hoses shall be provided with tagging & inspection system to ensure the integrity. The hoses shall be stored in the tubular containers attached alongside

the tank on the vehicle. The tubular container shall have caps for easy removal & storage of hose.

c. Generally, each tanker shall be equipped with at least one 4”Ø hose for liquid line and one 4”Ø hose for vapor line. The hose shall be equipped with Kamlok coupling for easy connection & disconnection.

d. The vapor hose couplings shall be poppeted type to open the vapor adapter on the tanker side & in the manhole at Filling Station.

e. The connection fittings will include Gravity coupler which can be connected to API Adapter on Road tanker to connect Kamlok coupling of the liquid hose & other reducer couplings and adapter as may be necessary for connecting the 3”Ø & 2”Ø adapters at the manhole.

f. Gas oil trucks shall carry 2½”Ø hose & Kerosene tanker shall carry 3”Ø hose and necessary connecting fittings.

g. The requirements mentioned above are only for guidelines & not conclusive. The Road tanker owner shall be responsible to supply all necessary hoses & fittings to achieve unloading operation safely at Stations and Customer Locations.

h. Hose sizes are subject to change as per operational requirements by KNPC & shall be complied by the Road tanker owners.

i. Each hose assembly must be hydro-tested & electrical continuity verified by TPI approved by KNPC on yearly basis as per manufacturer code and latest test date shall be /marked tagged on the hose. The record of such tests shall be all the time available in the vehicle.

9.4 VENT AND MANHOLES

a. Each compartment of the Road tanker should be provided with bolted type manhole (500 mm Ø size), in accordance with the requirement of NFPA code 385. P**ressure actuated manhole cover** set to open at 3 PSI should be fitted on each compartment as a safety device to permit exhaust of enough free air (vapor) of the tank in case of emergency in according with NFPA code 385. The same cover will be used for maintenance purpose. The manhole must pass the drop test to simulate the roll-over forces but multiplied by approximately 5 times and the drop test certificate by TPI & test certificate shall be provided.

Following anti-spill safety relief valves to be installed on the manhole cover.

b. **Normal** Venting**:** Pressure / vacuum vent valve (s) set to open at a pressure of 1 PSI and vacuum of 0.295 PSI. The valve shall be equipped with flame arrester & a safety device to prevent the content from spilling out if the tank over turns.

c. Separate **Emergency Vent** Valve (S) Set to open at less than 3 PSI & vacuum of 1 PSI. The valve shall be equipped with flame arrester & a safety device to prevent the content from spilling out if the Road tanker over turns.

d. **Vapor Vent Valve s**hould be pneumatically operated type & its outlet shall be connected to vapor recovery manifold on top of the tank which is opened automatically along with bottom valve while loading or unloading of the tanker / trailer. This valve(s) should have at least venting capacity sufficient to unload the total capacity of the tanker within 15 minutes, during either vapor recovery / non-vapor recovery mode of operation. It should be noted that the actual venting to

atmosphere during non-vapor recovery mode of operation shall take place through a small vent valve (NPT threaded) which is to be provided on the vapor manifold adjacent to the vapor return adapter in the manifold box.

e. In additional to the above, Road tanker/trailer is provided with one pneumatically operated **vapor dump vent valve** on the top of the vapor manifold which is used to vent accumulated vapors in the manifold, subsequent to loading/unloading of product to/from the Road tanker. This valve will actually play a more meaningful role when the 'rain cap' covered vent hole in vapor manifold pipe is plugged on during vapor recovery system at KNPC Depots/Filling Stations.

10. DRIVER'S CAB

Standard cabin should be without sleeping cab with proper air conditioning & ventilation system, classified for petroleum product transportation. Only material not readily flammable shall be used in construction of drivers cab according with ISO 3795/1989 burn rate not exceeding 100 mm/min. The cab should be without ash-tray and cigar lighter & equipped with anti-spark flasher, individual seat vertically & longitudinally adjustable back rest, safety belt.

Unless the driver's cab is made of materials which are not readily flammable, a shield made of metal or other suitable material of the same width as the tank shall be fitted at the rear of the cab. Any windows in the rear of the cab or in the shield shall be hermetically closed and made of fire-resistant safety glass with fire-resistant frames. Further, there shall be a clear space of not less than 15 cm between the tank and the cab or the shield.

11. ENGINE:

a. Internal combustion engine, other than those providing propulsive power, installed or carried on a tank vehicle transporting class I liquids for purpose of providing power for the operation of pumps or other devices shall meet the following requirements:

b. The engine air intake shall be equipped with an effective flame arrester or an air cleaner having effective flame arrester characteristics installed & capable of preventing emissions of flame from intake side of the engine in event of backfire. An Engine over-speed protection of an approved type for diesel engine by means of an automatic shutdown valve in the air intake system shall be provided. This protection shall shutdown the Engine in the event of intake of any flammable gas.

c. The fuel tank shall be located or constructed so as to minimize the fire hazard. Where the fuel tank is located above or immediately adjacent to the engine, suitable shielding shall be provided to prevent spillage during the filling operation or leakage from the tank or fuel system, from coming in contact with the engine or any parts of the ignition and exhaust system. All parts of fuel system shall be constructed and installed in proficient manner.

d. The fuel tanks for supplying fuel to the engine of the vehicle shall meet the following requirements:

- In the event of any leakage, the fuel shall drain to the ground without coming into contact with hot parts of the vehicle or the load;
- Fuel tanks containing petrol shall be equipped with an effective flame trap at the filler opening or with a closure enabling the opening to be kept hermetically sealed.

e. Fuel pump & other appurtenance shall be so located in relation to the engine that spillage or leakage from such parts shall be prevented from coming in contact with engine or any parts of the ignition and exhaust system or adequate shielding shall be provided to attain the same purpose.

f. The engine cooling fan shall be positioned, located or shielded so as to minimize the possibility of drawing flammable vapor toward the engine. Anti-static belts shall be used.

g. Where the engine is located in a position that spillage from the cargo tank or its appurtenances or from side racks might constitute hazard, shielding shall be provided to such spillage from contacting the engine or engine exhaust system and for draining such spillage away from the vicinity of the engine.

h. Where the engine is in an enclosed space, provision shall be made for adequate air circulation at all time to prevent accumulation of explosive vapors & to avoid overheating.

i. The exhaust system shall be constructed & installed and shall be free from tanks. The exhaust line & muffler shall have adequate clearance from combustible materials & the exhaust gases shall be discharged at a location that shall not constitute hazard.

j. The engine shall be minimum 6 – 8 cylinders four stoke, direct fuel injection type, Turbo charged (preferable) water cooled diesel engine.

k. The engine output power shall commensurate to give required acceleration to the tanker based on the capacity of the tank.

l. Engine shall be equipped with lockable speed limitation device so that Road tanker speed does not to exceed 80 Km/Hr.

m. The engine cooling system shall be heavy duty water cooling system with double thermostat centrifugal pump suitable for Kuwait climatic condition.

n. Electronic Brake System: Direct acting 2 circuits compressed air assisted with two line trailer brake connection, coupling and hoses, Drums (front and rear) with two separate circuits, manual adjustment on front and rear axle, equipped with classified ABS (Antilock Brake System) and ARS (Active Roll Stabilization) system. The parking brake compressed air operated spring loaded acting on rear wheels & trailer as applicable. The emergency brakes shall be provided by the independent of the two separate circuits. <u>The brake system shall be integrated with the roll over prevention system.</u>

o. Motor vehicles & trailers intended for use as transport units for dangerous goods shall fulfill all relevant technical requirements of ECE Regulation No. 133 or Directive 71/320/EEC4, as amended, in accordance with the dates of application specified therein.

p. FL, vehicles shall fulfill the requirements of ECE Regulation No. 133, Annex 5. except endurance braking which is not required.

q. **Exhaust** :

- Approved type spark arrestor to be provided on the engine exhaust of the vehicle unless prohibited by engine manufacturer based on type of engine. The spark arrestor shall have the quality markings such as USDA Forest Service or other documentary proof of quality. Vehicles with turbocharged engines can be exempted from the spark arrestor provided that the manufacturer's documentary proof is available **and third party ADR certificate required** to show that for such engine the spark attester is not required. Mounted in front of the axle directed to right side

with spark arrestor (not required is case of turbo charged) discharged in downward direction.

- The distance between exhaust pipe and any other part not less than 40 mm.
- The vertical exhaust behind the driver's cabin can be used in case of trailer only provided there is effective shielding and method of prevention of ingress of flammable liquid. The exhaust system should be discharged to the offside. The exhaust pipe before muffler shall be one piece pipe (Not applicable to extended extra pipe behind drivers cabinet).
- It must comply / exceed ADR requirements.

r. Spare wheel carrier with winch suspended below the chassis frame mounted at the vehicle rear with standard tool and Lifting jack 25 tons with wheel change tools in lockable space on board.

s. One piece windscreen of laminated safety glass equipped with suitable wipers.

t. weight data :

The Road tanker owner should clearly state (in Kgs.) the followings:

- Permissible load tank truck (G.V.W & G.C.W)
- Permissible pay load (+1 ton as a factor of safety)
- Chassis weight
- Super structure weight, including all equipment (unloaded)

12. LOADING AND UNLOADING MECHANISM

12.1 Loading / unloading should be through separate 4"Ø API dry disconnect adapters(one for each compartment) located in equipment cabinet and easily accessible from ground level from both sides of the tanker and compatible with loading points at KNPC facilities. Furthermore, the spacing between the two API adaptors installed in the equipment cabinet in case of double compartment tanker / trailer should be such that it is possible to couple in both the loading arms so as to ensure simultaneous loading of product in both compartments, if required. The loading valve shall by pass the PD meter & pump.

12.2 Loading / unloading should be through 4"Ø pressure balanced bottom valve Tee Elbow type pneumatically operated with shear groove (to allow body fracture from this groove keeping internal valve seat closed in case of accident) the operation of the bottom valve in conjunction with the pneumatic vapor recovery / vent valve shall be controlled by the onboard pneumatic control system depending upon the state of various input signals. The unloading shall be done through PD Meter wherever tankers are equipped with meter and pump. The Pressure Balanced Valve when tripped should withstand without passing against max pump pressure 110 psi.

12.3 A visible sight glass of sufficient thickness / strength should be installed at suitable location on the loading / unloading main pipes before it branches off to both sides of the tank. It should be capable of giving a proper indication of the products color and flow while unloading at Filling Stations (either by gravity or pump)

12.4 The 4"Ø vapor recovery adapter shall be located inside the compartment & shall be connected to vapor return system while loading & unloading wherever applicable. At

unloading locations where vapor recovery system is not available the vapor dump valve shall be kept open for free venting of the tanker.

12.5 A reinforced flexible joint should be fitted between the pipes connected or welded to the tank & those connected or welded to the chassis.

12.6 It is required to install a butterfly valve or ball valve on the loading / unloading main pipes main pipes close to the API dry adaptor at both sides of the tanker / trailer.

12.7 Each Road tanker / trailer should be (for the tankers used for unloading product at KNPC filling Station) provided with 3 hoses, 3 meters long, size 4", 3" & 2½" in steel

tubes located at two sides of the tank, along with adapter from 4"Ø X 4"Ø for Gasoline (UN 1203) & Kerosene (UN 1223), 4"Ø X 3"Ø for Gas oil (UN 1202) tankers, 4"Ø X 2½"Ø for UL98 tankers to carry out unloading at all Filling Stations, according to type of product (refer 9.3 also).

12.8 Wherever specified/required, provision for speedy unloading of product from the Road tankers & semi-trailers, Road tanker shall be equipped with PTO driven pump or by hydraulically driven pump.

12.9 **Separate engine driven pump is not acceptable.**

12.10 The Road tanker/trailer, that are equipped with transfer pump, should also have facility to carry out unloading by gravity from the two sides. Prior approval of KNPC, approval should be obtained by the manufacturer / supplier for its proposal on the configuration layout related to installation of transfer pump.

13. ELECTRICAL :

13.1 Provide 2 X 12 V, not less than 100 A.H. equipped with batteries master switch inside drivers cab. It's preferable to locate the batteries in the driver cabin but in all cases should be in an appropriate box. The box meant for keeping these batteries should be made out of nonflammable, acid proof & electrically insulated material. If the battery is/are not located under the engine bonnet, they shall be fitted & secured in a suitably ventilated box which should be located as close as possible to the rear of the driver's cabin. The box should also prevent any spillage of flammable liquid from coming into contact with the battery connections.

13.2 Provide electrical equipment & light~~n~~ing according to traffic regulations.

13.3 The electrical installation as a whole, should meet IEC standard 52a according to classification of vehicle and shall be so designed, constructed & protected such that it cannot initiate any ignition or short circuit under normal condition of use.

13.4 All parts of vehicle (tank and chassis) should be electrically bonded together (earthing loop) & connected to the control receptacle inside the equipment cabinet by using petroleum & temperature resistant flexible shielded 2 core cables.

13.5 A copper plate (80 X 60 X 6 mm) should be directly bonded to the loop and fitted on each side of the vehicle frame for external earthing connection at loading unloading locations' earthing.

13.6 All electrical wirings at any point behind the driver's cabin shall be fitted in explosion proof conduits and all connections must be of explosion proof type.

The size of conductors shall be large enough to avoid overheating. Conductors shall be adequately insulated. All circuits shall be protected by fuses or automatic circuit breakers, except for the following:

- from the battery to the cold start & stopping systems of the engine;
- from the battery to the alternator;
- from the alternator to the fuse or circuit breaker box;
- from battery to Electronic Gauging system, GPS etc.
- from the battery to the power control housing of the endurance braking system, if this system is electrical or electromagnetic;
- from the battery to the electrical lifting mechanism for lifting the bogie axle.

The above unprotected circuits shall be as short as possible.

13.7 Cables shall be securely fastened and positioned in such a way that the conductors are adequately protected against mechanical and thermal stresses.

13.8 The battery terminals shall be electrically insulated or covered by an electrically insulated battery box cover.

13.9 A safety cutoff switch should be fitted inside driver's cabin to isolate the complete electrical system from the battery. It is preferable to locate the batteries in driver's cabin in an appropriate box. If a single pole switch is used, it shall be placed in the supply lead and not in the earth lead.

Visual means should be provided on the battery master switch to indicate clearly whether the master switch is ON or OFF and a lamp should be illuminated visible from the front of the of the vehicle when the master switch is in ON position. The switch shall have a casing with protection degree IP 65 in accordance with IEC Standard 529. The cable connections on the switch shall have protection degree IP 54. However, this does not apply if these connections are contained in a housing which may be the battery box. In this case, it is sufficient to insulate the connections against short circuits, for example with a rubber cap. It shall be protected against inadvertent operation by either adding a protective cover by using a dual movement control device or by other suitable means. Additional control devices may be installed, provided they are distinctively marked & protected against inadvertent operation. If the control device(s) are electrically operated the circuits of the control device(s) are subject to the following requirements.

13.10 Explosion proof electrical bulb with fuse should be installed to provide enough lighting inside the equipment cabinet. This bulb should be energized automatically whenever the related equipment cabinet door is opened.

13.11 Permanently energized circuits:
Those parts of the electrical installation including the leads which shall remain energized when the battery master switch is open, shall be suitable for use in hazardous areas. Such equipment shall meet the general requirements of IEC 60079,

parts 0 and 141 and the additional requirements applicable from IEC 60079, Parts 1, 2, 5, 6, 7, 11, 15 or 182.

For the application of IEC 60079 part 141, following classification shall be used:

Permanently energized electrical equipment including the leads which are not subjected to 7.2 and 7.3 shall meet the requirements from Zone 1 for electrical equipment in general or meet the requirements for Zone 2 for electrical equipment situated in the driver's cabin. The requirements for explosion group IIC, temperature class T6 shall be met.

However, for permanently energized electrical equipment installed in an environment where the temperature caused by non-electrical equipment situated in that environment exceeds the T6 temperature limit, the temperature classification of the permanently energized electrical equipment shall be at least that of the T4 temperature class.

The supply leads for permanently energized equipment shall either comply with the provisions of IEC 60079, Part 7 ('Increased Safety') and be protected by a fuse or automatic circuit breaker placed as close to the source of power as practicable or, in the case of 'intrinsically safe equipment', they shall be protected by a safety barrier placed as close to the source of power as practicable.

13.12 Provisions concerning that part of the electrical installation situated to the rear of the driver's cab:

The whole installation shall be so designed, constructed & protected such that it cannot provoke any ignition or short-circuit under normal conditions of use of vehicles & that these risks can be minimized in the event of an impact or deformation. In particular:

a. Wiring

The wiring located to the rear of the driver's cab shall be protected against impact, abrasion and chafing during normal vehicle operation. However, the sensor cables of anti-lock braking devices do not need additional protection.

b. Lighting

Lamp bulbs with a screw cap shall not be used.

c. Electrical connections

Electrical connections between motor vehicles and trailers shall have a protection degree IP 54 in accordance with IEC standard 529 and be designed to prevent accidental disconnection. Examples of appropriate connections are given in ISO 12098:2004 and ISO 7638:1997.

14. TANKER INSTRUMENTATION:

a) Pneumatic Overfill Sensor

Pneumatic Overfill Sensor should be installed at the top of each tank compartment adjacent to the Optic Overfill probe and shall meet the following requirements. It should be rated for use in Class I, Div. I, Group D hazardous location and capable of operating satisfactorily under metal temperature of 85°C during extreme summer in Kuwait.

It should have adjustable sensing height. It should be based on highly reliable and full-proof mechanism for sensing of level such that no bleeding of air takes place inside the tank mixing with petroleum vapor thus reducing load on the Vapor Recovery System. It should have minimum moving parts thus achieving long life and stability of its calibration under the dynamic adverse conditions associated with such an application.

It shall be compatible with the Tanker Pneumatic Control station as well as 'Load Ready' status 'SPDT' type pressure switch.

The sensor shall be installed near the manhole cover so that it is easily accessible to test the operation of this sensor whenever required.

b) **Load ready' status 'SPDT' type Intrinsically safe pressure switch.**

It should be installed at an appropriate location in the equipment cabinet of the tanker compartment and meet the following requirements.

It should be intrinsically safe, certified and rated for use in Class-I, Div-I, Group-D hazardous location and capable of operating satisfactorily under metal temperature of 85^0C during extreme summer in Kuwait.

Shall provide 1 no. of isolated potential free (NO) electrical contact connected to optic 10 pin socket, located in the equipment cabinet installed on the tanker.

The switch is operated by the pneumatic interlock signal which is actuated by pressing the 'LOAD' button on the pneumatic control station subsequent to sequential opening of the Vapor Recovery / Vent valve and the pressure balanced bottom valve under the presence of pneumatic overfill sensor signal and brake interlock signal.

c) **Intrinsically fail safe earthing and overfill system along with retained product monitoring facility.**

It should be noted that Ahmadi & Sabhan Depot have been provided with State of the Art Gantry Control System capable of monitoring 'Infra-Red Optic based Overfill Probe' as well as 'Retained Product Probe' and 'Vehicle Static Grounding' corresponding to each compartment of the tanker and Tanker Identification Module (TIM) so as to ensure maximum possible safety during the loading process.

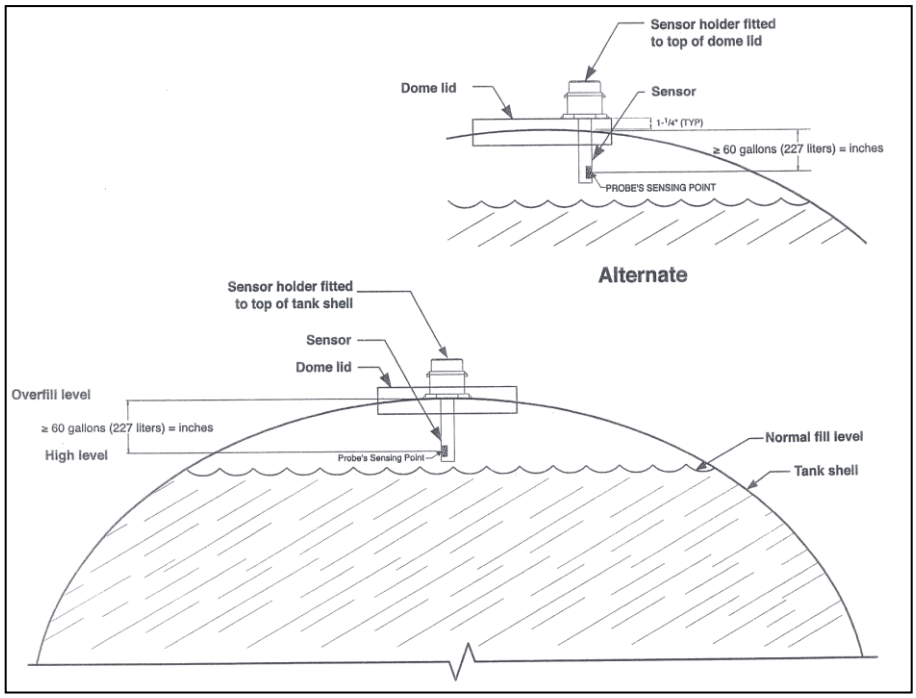
Therefore, it is required to provide the following sensors similar to products from M/s. Scully or equivalent for each of the tanker compartment in addition to the Pneumatic Overfill Sensor as stated above. It would be Road tanker owner's responsibility to ensure that all tanker equipment are compatible with Scully rack mounted instruments in the gantry.

Infra-red optic overfill flanged probe along with holder should be installed on the top of each tank compartment and shall meet the following requirements.

It should be rated for use in Class I, Div. I, Group D hazardous location and capable of operating satisfactorily under metal temperature of 85^oC during extreme summer in Kuwait. It should have:

- Adjustable sensing height.
- 2 wire probe based on infra-red optic liquid level sensing technology having no moving parts and capable of supporting self-diagnostic facility.
- Compatible with the Gantry Control System installed at Ahmadi & Sabhan Depot.

End view of trailer showing various levels and two methods of mounting sensor is given below for reference:



Retained product probe & holder should be installed at the bottom of each tank compartment and shall detect small quantities of liquid products in the compartment for full proof system to identify retained product.

It should be rated for use in Class I, Div. I, Group D hazardous location and capable of operating satisfactorily under metal temperature of 85°C during extreme summer in Kuwait.

It shall be 2 wire probe based on infra-red optic liquid level sensing technology having no moving parts and capable of supporting self-diagnostic facility.

Compatible with Gantry Control System installed at KNPC loading facilities.

Optic 10 Pin Socket with 4 J Slots Optic overfill probe, retained product probe, Electronic ground bolt and 'Load Ready' status contact, as well as compartment identification contact and Tanker Identification Module (TIM) should be electrically connected to a suitable Optic 10 pin socket with 4J slots accessible on both sides of the Road Tanker. This socket should be compatible with the corresponding 'Plug and Cable' assembly associated with Gantry Control System. Typical allocation of pins of this socket is indicated in Annexure-C.

Vehicle Static Grounding System: Specially designed electronic ground bolt should be installed on the tanker frame and electrically connected to Optic 10 pin socket with 4J slots on both sides of the Tanker / Trailer compatible with Gantry.

Control system such that static ground of vehicle's frame is accomplished in an intrinsically failsafe manner.

Typical details of onboard Pneumatic Control System configuration for each side of a tanker compartment and the list of various tanker instrumentation and control system

related items as applicable to single compartment and double compartment tanker / semi-trailer are indicated in Annexure-A & B respectively.

15. VAPOR RECOVERY SYSTEM

It should be noted that at KNPC loading facility and Filling Stations are presently equipped with the Vapor Recovery Systems.

Vapor Recovery System for each Tanker / Semi-trailer must be designed in accordance with API-RP 1004 to prevent build-up of high pressure vacuum during the process of loading /unloading in either vapor recovery or non-vapor recovery mode of operation as required. The various required features in this respect are as follows:

15.1 Vapor Recovery / Vent valve will be used as Vapor Recovery valve in the vapor recovery mode of operation when used in conjunction with Vapor Recovery System at KNPC Depot and Filling Stations and its outlet shall be connected to a vapor recovery manifold on the top of the Road tanker. During the non-vapor recovery mode of operation, this vapor recovery / vent valve will be used as Vapor vent valve to vent the vapors generated during loading and allow the air to enter the tank during unloading process by virtue of small valve in the vapor manifold adjacent to vapor adapter in the manifold. This small valve shall be removed and the opening shall be plugged once all the stations are equipped with vapor recovery system.

This vapor manifold should be fabricated out of 4”Ø pipe and should be covered by a rollover hood to ensure safety of vapor manifold in the event of an accident.

15.2 Vapor Recovery Adaptor along with Pneumatic interlock switch & dust cover shall be installed in the equipment cabinet on each side of the Tanker / semi-trailer. This will be connected to the vapor manifold through a 4”Ø diameter vapor pipe. Only one Vapor Recovery Adaptor shall be provided on each side of the tanker irrespective of the no. of compartments.

15.3 Pneumatically operated Vapor dump vent valve shall be installed on the vapor manifold which will play role only when the small vent valve in vapor manifold will be plugged for all tankers subsequent to installation of Vapor Recovery System at KNPC Depots and Filling Stations.

15.4 The main task of this valve shall be to evacuate the trapped vapors in the vapor manifold subsequent to ‘Loading’ as well as ‘Unloading’ process. Accordingly, an indicator should be provided on the equipment cabinet, to indicate status of this valve.

16. PNEUMATIC CONTROL SYSTEM

The pneumatic control system as applicable to each side of a Tanker compartment is indicated in Annexure-A that clearly indicates the source of various input signals to Pneumatic Control Station which in turn provides the pneumatic output signals to drive the final control elements in accordance with the fail-safe logic, as defined below, to ensure highest possible safety during loading / unloading of Petroleum Products to / from the Tanker / Semi-Trailer. Various essential features of the required control system configuration are as follows:-

16.1 OPERATION LOGIC PNEUMATIC CONTROL SYSTEM

Each side of a tanker compartment is provided with a pneumatic control system to carry out the process of loading / unloading which is initiated by using ‘Stop’, ‘Load’ and ‘Unload’ buttons located on the front panel of this station. The logical sequence of operation is as follows:-

a) Tanker Loading:-

The operation sequence associated with the loading process is as follows:

i) Once the driver has parked the tanker at the loading gantry of typical KNPC loading facility.

ii) The driver opens the door of equipment cabinet located on the side of the tanker which in turn actuates a 'Lever operated pneumatic switch'.

iii) This is followed by connecting the 'Plug and Cable' assembly at Gantry to the optic socket on board to verify that tanker is in the correct bay, retained product is taken care-off, tanker is grounded and compartment is identified. This is followed by the coupling of product hose which in turn provides a Brake Interlock signal on using the appropriate combination of Pneumatic logic gates driven by the associated Pneumatic signals from Interlock Pneumatic switches of API adaptor and Vapor adaptor such that Brake Interlock signal is available when either API adaptor or Vapor adaptor or both are coupled to the loading arm. Further, Vapor dump vent valve is closed when the vapor adaptor is coupled and the corresponding status of Vapor dump vent valve is indicated on a separate pneumatic indicator installed on Pneumatic control station.

iv) Once the above conditions are satisfied along with the condition of low level inside the tanker compartment, the system is ready for pressing the 'Load' button. Actuation of 'Load' button shall result in sequential operation as follows:-

- Opening of Vapor Recovery / Vent Valve.
- Actuation of 'SPDT' pressure switch to provide 'Load Ready' status contact to Gantry Interlock System.
- Actuation of Pneumatically driven 'Load' status indicator to change its state from 'Red' to 'Green'.

v) Now the tanker is ready to accept the product from loading arm after opening the associated valve and accordingly, loading of product in the tank is started by pressing the 'Start' button on electronic preset located at the gantry. The preset quantity is automatically loaded in the respective compartment and loading stops normally. The driver repeats the same sequence for the second compartment if applicable. The driver must monitor the loading operation to avoid overspill from the tanker due to mechanical integrity failure such as hose rupture, coupling detaching etc. and should always beside the loading point at all the time till end of complete loading.

vi) Once the loading is complete, the driver carries out the following action in sequence at the end of loading the preset quantity in the tanker.

- Press the 'Stop' button on pneumatic control station to clear the 'Load Ready' status indicator to 'Red'.
- Decouple the vapor loading arm from vapor adaptor and Product loading arm from API adaptor associated with the compartment and

close the associated manual valves. The loading arm, vapor arm and socket shall be placed in the parking position.

- Close the Equipment cabinet door.

vii) Now the tanker is ready to be driven away from the gantry. The driver drives up to the gate, collects the voucher and proceeds to its destination.

b) Tanker Unloading

The operation sequence associated with the unloading process is as follows:

I. Driver parks the tanker close to the relevant filling point, at a Station destination.

II. The driver opens the door of equipment cabinet located on the side of the tanker which in turn actuates a 'Lever operated Pneumatic switch'.

III. This is followed by connecting the earthing clip at the Station to the copper plate bonded to tanker frame followed by the coupling of product discharge hose and vapor hose to the filling point and vapor recovery point; which in-turn provides a brake interlock signal on using the appropriate combination of pneumatic logic gates driven by the associated pneumatic signals from interlock pneumatic switches of API adaptor such that brake interlock signal is available when either API adaptor or Vapor adaptor or both are coupled to the unloading hose and vapor hose. Further, vapor dump vent valve is closed when the vapor adaptor is coupled and the corresponding status of vapor dump vent valve is indicated on a separate pneumatic indicator installed on pneumatic control station.

In the non-vapor recovery mode, the small valve on the vapor manifold shall be kept open to vent the vapors during unloading operation.

IV. Once the above conditions are satisfied, the system is ready for pressing the 'Unload' button. Actuation of 'Unload' button shall result in sequential operation as follows:-

- Bypassing of Pneumatic Overfill sensor to take care of erratic triggering of overfill sensor as a result of slope encountered by the tanker on site.
- Opening of Vapor Recovery / Vent Valve.
- Opening of Bottom Valve.
- Actuation of Pneumatically driven 'Unload' status indicator to charge its state from 'Red' to 'Green'.

V. Now the tanker is ready to deliver the product to the Station and accordingly unloading of product takes place by opening the associated valve. The driver must monitor the unloading operation to avoid overspill from the underground tank due to mechanical integrity failure such as hose rupture, coupling detaching etc. and should always beside the unloading point at all the time till end of complete unloading. Failure to comply with this requirement would constitute violation of safety as well as contract requirements and serious action may be taken by KNPC against the erring driver and Road tanker owner.

VI. Subsequently, the driver carries out the following actions in sequence at the end of complete unloading of compartment after confirming the same in side glass.

- Press the 'Stop' button on Pneumatic Control Station of product to clear the 'Unloading ready' status indicator from 'Green' to 'Red'.
- Decouple the vapor hose and product hose from vapor adaptor and API adaptor associated with the compartment.
- Disconnect the earthing clip from the copper plate associated with the tanker.
- Close the equipment cabinet door.

VII. Now the tanker is ready to be driven out with Bill of Lading

16.2 TECHNICAL CHARACTERISTICS OF PNEUMATIC CONTROL ELEMENTS

a. The 'Stop', 'Load' and 'Unload' button on the pneumatic control station should be tamper proof and interlocked in such a way that does not permit simultaneous operation of two buttons.

b. All the Pneumatic logic gates used in the control system should be designed in such a way that the pneumatic signal on each of their port is totally isolated from another port of the same device.

c. Separate pneumatic logic 'OR' gates should be used to interface the signal from both sides of the tanker to various final control elements i.e. valves, pressure switch etc.

d. Bottom valve signal should be interfaced through Quick exhaust valve of sufficient capacity, to ensure speedy bleeding of air to facilitate its fast closure in the event of actuation of overfill sensor.

e. The control system should be designed in such a manner so as to ensure failsafe operation under any fault condition.

f. Petroleum and Temperature resistant clear Polypropylene tubing should be installed in G. I. Pipes so as to ensure reliable transmission of Pneumatic signals under all condition.

16.3 TRUCK METERING PACKAGE (OPTIONAL FOR CUSTOMERS' ROAD TANKERS)

Tankers required with pump and metering system shall be provided with PD meters with 5 digit resettable counter and ticket printer and necessary piping manifold and valves with necessary interlocks for discharging product from any of compartment from both side of the tanker meeting the following specifications:

FUEL TRANSFER PUMP:

Pumps shall be either P.T.O driven pump or Hydraulically driven
Minimum Flow rate : 1000 LPM
Max. Diff. Pressure : as per requirement
Max. Working Pressure: 12 bar

PD METER WITH TICKET PRINTER:

Flow Rate	: 1000 LPM
Accuracy	: ±0.15 %
Repeatability	:.0.02%
Temperature	: -29ºC to 65ºC

Ticket printer shall be installed in the driver Cabin

INTERLOCKS:

1 Pump shall trip to avoid dry running

Pump shall have its own recirculation and protection system.

Compartment bottom valves shall be interlocked with pneumatic isolation valves for each compartment

Pneumatic unload button shall operate the respective bottom valve and pneumatic isolation valve.

16.4 TANK LEVEL GAUGING SYSTEM

Road tankers shall be equipped with ~~a~~ dipsticks for each compartment. The mechanical dipstick shall be graduated in steps of 250 liters and graduation. The dipstick graduations shall be verified against the standard calibration data of the tanker.

ELECTRONIC DIPSTICK**:**

In addition to the above mechanical dipstick, Road tanker's each compartment shall be equipped with new electronic dipstick system for sensing the level and indicating the volumes. The system shall be approved for custody transfer application. The System should be suitable for functioning with gravity as well as with pump discharge from Tanker and the System shall be integrated and supplied with printer located in the driver's cabin.

The system shall continuously monitor the content of each compartment in terms of Volume, level, and mass. Every change in the content of individual compartment shall be registered in the System with time stamp and location data in conjunction with GPS device. The GPS System shall be installed on the Road tanker & integrated with this

Electronic Tank gauging System.

The device shall have measurement accuracy of ±0.5mm. The protection rating of the probe shall be IP 67 and enclosure shall be Ex. d II B H2 T6.

Electronic Dipstick shall be compatible to be used for sealed parcel delivery and no mix systems.

The electronic Controller/display unit shall be located in the loading/unloading cabinet of tanker and shall be suitable for the hazardous area classification.

17. **FLEET MANAGEMENT SYSTEM (OPTIONAL FOR CUSTOMERS' ROAD TANKERS)**

It is required to provide a Fleet Management System for all the Tankers. The system shall be web-based and online for real time monitoring, tracking, reporting to KNPC and accessible to KNPC authorized personnel and the Road tanker owners. It shall have a user friendly interface and compatible with Windows latest version. It should be easily accessed through KNPC intranet and also accessible by allowed user's unit anywhere anytime.

All System's equipment including GPS installed on the tankers shall be as per KNPC requirements for hazardous area. The Road tanker owner shall submit the system catalogs and details to KNPC for approval before commencing with the installation of the system on the Tankers. The Road tanker owner will bear all costs of installation, monthly fees of subscription with the provider of the software (if any), monthly fees of subscription with the mobile carrier and any other related costs for the period of the Contract.

The Fleet Management System shall have the following but not limited to features:

1) **Web Access through Internet and KNPC Intranet** – the System shall be online, web based and only authorized users can access it.
2) **GPS Monitoring and Maps** – the system shall provide the following on the monitoring screen:
   a) A map with extensive coverage of all the streets, filling stations, delivery destinations in the State of Kuwait & GCC and shall be updated in case any streets are modified or newly built.
   b) View the live status (speed, location, tank content with time stamp etc.) of each tanker on the map.
   c) Each vehicle can be set to have its own unique icon on the map.
   d) The map shall show landmarks, streets and city names for easy reference.
   e) The map shall have the option to zoom in and out to view certain details as required by the user.

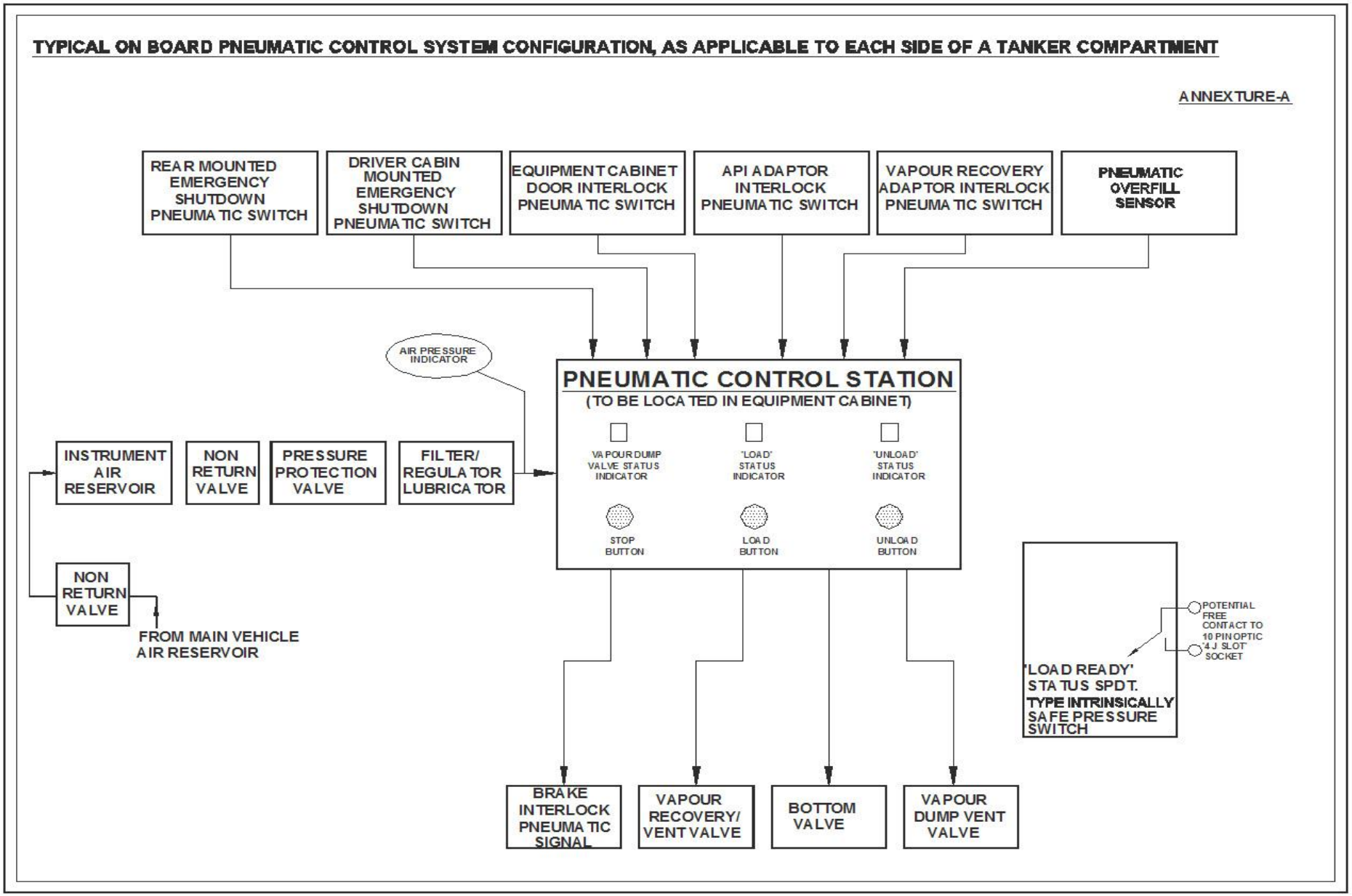
3) **Key Indications** – the System shall provide the following information on the monitoring screen:

   a) Tanker number, type (36,000 or 24,000 or other capacity as applicable) and product being transferred.
   b) Position of the tanker.
   c) Speed of the tanker.
   d) Hours of the tanker since it has been active.
   e) Intermittent deliveries if any made.
   f) Tanker content (product name) & quantity with time stamp.
   g) Seat Belt Alarm.

4) Reports – The System shall provide following reports to be viewed:
   a) Each and all tanker history such as status, route, mileage, work-hours and alarms… etc.
   b) Each and all tankers speed violations.
   c) Geo-fencing alarms for each and all tankers.
   d) Archiving the above data for a minimum period of 90 days.

The reports shall be generated at a specific time intervals set by the user (KNPC, Transporter and Customer) and can be exported and saved on user local memory / server. Also, customized report can be generated by the user (KNPC, Transporter and Customer) for any future requirements and features.

The Road tanker owner shall be responsible for the monitoring fleet movement & maintaining the system, software and the equipment installed on the tankers. He shall provide the latest versions of the system and updates that are available in the market.


TYPICAL ON BOARD PNEUMATIC CONTROL SYSTEM CONFIGURATION, AS APPLICABLE TO EACH SIDE OF A TANKER COMPARTMENT
ANNEXTURE-A
REAR MOUNTED EMERGENCY SHUTDOWN PNEUMATIC SWITCH
DRIVER CABIN MOUNTED EMERGENCY SHUTDOWN PNEUMATIC SWITCH
EQUIPMENT CABINET DOOR INTERLOCK PNEUMATIC SWITCH
API ADAPTOR INTERLOCK PNEUMATIC SWITCH
VAPOUR RECOVERY ADAPTOR INTERLOCK PNEUMATIC SWITCH
PNEUMATIC OVERFILL SENSOR
AIR PRESSURE INDICATOR
PNEUMATIC CONTROL STATION
(TO BE LOCATED IN EQUIPMENT CABINET)
VAPOUR DUMP VALVE STATUS INDICATOR
'LOAD' STATUS INDICATOR
'UNLOAD' STATUS INDICATOR
STOP BUTTON
LOAD BUTTON
UNLOAD BUTTON
INSTRUMENT AIR RESERVOIR
NON RETURN VALVE
PRESSURE PROTECTION VALVE
FILTER/ REGULATOR LUBRICATOR
NON RETURN VALVE
FROM MAIN VEHICLE AIR RESERVOIR
POTENTIAL FREE CONTACT TO 10 PIN OPTIC '4 J SLOT' SOCKET
'LOAD READY' STATUS SPDT. TYPE INTRINSICALLY SAFE PRESSURE SWITCH
BRAKE INTERLOCK PNEUMATIC SIGNAL
VAPOUR RECOVERY/ VENT VALVE
BOTTOM VALVE
VAPOUR DUMP VENT VALVE

ANNEXURE-A

TYPICAL LIST OF VARIOUS TANKER INSTRUMENTATION AND CONTROL SYSTEM RELATED ITEMS

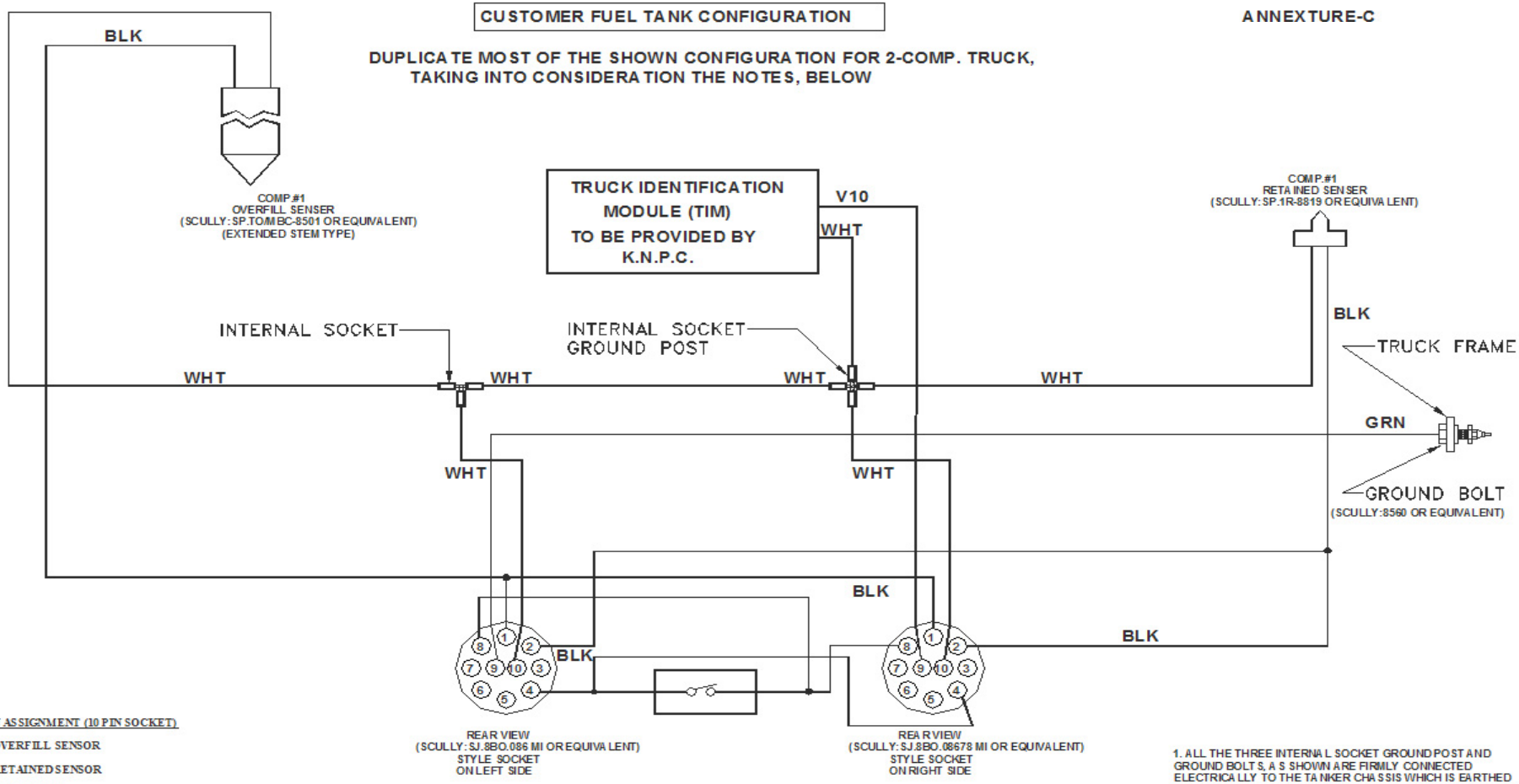
Sl. No.	Item Description	Applicable Qty (Nos.)	
		Single Compartment	Double Compartment
1.	Optic Overfill Probe	1	2
2.	Retained Product Probe	1	2
3.	Electronic Ground Bolt	1	2
4.	'Load Ready' status 'SPDT' pressure switch (Intrinsically Safe Type)	1	2
5.	Pneumatic Overfill Switch	1	2
6.	Optic 10 Pin Socket with 4J slot	1	2
7.	Equipment cabinet door interlock pneumatic switch	2	2
8.	API Adaptor interlock pneumatic switch	2	4
9.	Vapor Recovery Adaptor interlock pneumatic switch	2	2
10.	Driver cabin mounted emergency shutdown pneumatic switch	1	1
11.	Rear mounted emergency shutdown pneumatic switch	2	2
12.	Pneumatic Control Station	2	4
13.	Pressure Balanced Bottom Valve	1	2
14.	Vapor Recovery / Vent Valve	1	2
15.	Vapor Dump Vent Valve	1	1
16.	Instrument Air Reservoir	1	1
17.	Non Return Valve	2	2
18.	Pressure Protection Valve	1	1
19.	Filter / Regulator / Lubricator	1	1
20.	Pneumatic Signal Tubing (Petroleum & Temperature Resistant Polypropylene Clear Tubing)	As required	
21.	G.I. Pipe (for routing pneumatic signal tubing)	As required	
22.	Instrumentation Signal Cable (Petroleum & Temperature Resistant low capacitance shielded cable)	As required	
23.	Copper Conduit (For routing electronic signal cables)	As required	
24.	Mechanical Dip Stick	1	2
25.	Pump with Metering System	1	1
26.	Electronic Dipstick	1	2
27.	GPS	1	1
28.	Speed Control Device	1	1
29.	Anti-Rollover Device	1	1
30.	ABS Breaking System	1	1

ONE COMPARTMENT TRUCK - OVERFILL, EARTHING, RETAINED, TRUCK/COMP.I.D & LOAD/ UNLOAD READY PRESSURE SWITCH WIRING ALONG WITH SOCKETS FOR LOADING FROM EITHER SIDE

CUSTOMER FUEL TANK CONFIGURATION

ANNEXTURE-C

DUPLICATE MOST OF THE SHOWN CONFIGURATION FOR 2-COMP. TRUCK, TAKING INTO CONSIDERATION THE NOTES, BELOW



PIN ASSIGNMENT (10 PIN SOCKET)

1. OVERFILL SENSOR
2. RETAINED SENSOR
3. (SEE NOTE 4)
4. LOAD READY (SUPPLY)
5. COMPARTMENT IDENT.
6. COMPARTMENT IDENT.
7. COMPARTMENT IDENT.
8. LOAD READY (RETURN).
9. TRUCK ID/EARTH SENSING.
10. TANKER CHASSIS/SIGNAL COMMON.

1. ALL THE THREE INTERNAL SOCKET GROUND POST AND GROUND BOLTS, AS SHOWN ARE FIRMLY CONNECTED ELECTRICALLY TO THE TANKER CHASSIS WHICH IS EARTHED ON THE LOADING RACK THROUGH PIN NO. 10 OF EACH OF THE MULTI-PIN SOCKET

2. ALL ITEMS OTHER THAN* ARE TO BE PROVIDED BY TANKER CONTRACTOR.

3. PIN NO. 5 & 6 ARE SHORTED AND PIN NO.6 & 7 ARE KEPT OPEN, TO IDENTIFY COMPARTMENT 1 WHILE PIN NO.5 & 6 ARE KEPT OPEN AND PIN NO. 6 & 7 ARE SHORTED TO INDENTIFY COMPARTMENT - 2.

4. FOR DOUBLE COMPARTMENT TANKER RETAINED PRODUCT SIGNAL CORRESPONDING TO COMPARTANMENT 2 ARE ALSO CONNECTED TO PIN NO. 3 OF SOCKETS CORRESPONDING TO COMPARTMENT 1, BY USING A NADDITIONAL LINK.

ANNEXURE-C