

DEP SPECIFICATION

FIRE-FIGHTING VEHICLES AND FIRE STATIONS

DEP 80.47.10.33-Gen.

February 2012

(Amendment A01 has been incorporated – February 2013)

ECCN EAR99

DESIGN AND ENGINEERING PRACTICE



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for fire-fighting vehicles and fire stations.

Excluded from the scope of this DEP are fire-fighting vehicles with hydraulic booms.

NOTE: Experience indicates that the large capital expenditure required for a fire-fighting vehicle with a hydraulic boom is not justifiable. The pre-incident plans, on which such a justification should be based, often indicate that fixed fire-fighting systems are the more cost effective solution. The resulting remaining risk can almost always be covered by other means, e.g., stationary monitors.

This is a revision of the DEP of the same number dated September 2010; see (1.5) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorised access to DEPs does not for that reason constitute an authorisation to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in oil refineries, chemical plants, gas plants, and exploration and production facilities. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process shall be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

NOTE: Except where modified (e.g., 'chassis Manufacturer', 'superstructure Manufacturer', etc.) the term Manufacturer is intended to mean the party receiving the order from the Contractor and who retains responsibility for the performance of the completed fire fighting vehicle.

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.3.2 Specific definitions

Term	Definition
GOST	Gosudarstvennyy standart, GOST (Russian: <i>ГОСТ</i>) refers to a set of technical standards maintained by the Euro-Asian Council for Standardization, Metrology and Certification (EASC), a regional standards organization operating under the auspices of the Commonwealth of Independent States (CIS).
RAL	RAL is a colour matching system used in Europe. In colloquial speech, RAL refers to the RAL CLASSIC system, mainly used for varnish and powder coating.

1.3.3 Abbreviations

Term	Definition
UKCAA	United Kingdom Civil Aviation Authority
DCS	Differential Scanning Calorimetry
DEP	Design and Engineering Practice
DTA	Differential Thermal Analysis
GRE	Glass Reinforced Epoxy
GRUP	Glass Reinforced Unsaturated Polyester
ICAO	International Civil Aviation Organization
MOC	Management of Change
NFPA	National Fire Protection Association
NST	National Standard Thread
PTO	Power Take-Off
SCBA	Self Contained Breathing Apparatus
Shell GSI	Shell Global Solutions International
SWW	Shell Wide Web

1.4 CROSS REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets (). Other documents referenced in this DEP are listed in (12).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated September 2010.

Throughout this DEP, the informative wording has been deleted and moved to the companion Informative document of the same number. Therefore, there is a reduction in the text and sub sections as compared to the original DEP.

Amendment A01

Section	Change
1.6	Updated DEP feedback process.
3.3.1	Reference to pressure vessel DEPs have been updated to the new pressure vessel DEP 31.22.00.31-Gen.
3.3.3	Reference to pressure vessel DEPs have been updated to the new pressure vessel DEP 31.22.00.31

5.1.3	Reference to pressure vessel DEPs have been updated to the new pressure vessel DEP 31.22.00.31
12.	Reference to pressure vessel DEPs have been updated to the new pressure vessel DEP 31.22.00.31
12.	Added DEP feedback form - DEP 00.00.05.80-Gen.

1.6 COMMENTS ON THIS DEP

Amendment A01

Comments on this DEP may be submitted to the Administrator using one of the following options:

Shell DEPs Online (Users with access to Shell DEPs Online)	Enter the Shell DEPs Online system at https://www.shelldeps.com Select a DEP and then go to the details screen for that DEP. Click on the "Give feedback" link, fill in the online form and submit.
DEP Feedback System (Users with access to Shell Wide Web)	Enter comments directly in the DEP Feedback System which is accessible from the Technical Standards Portal http://www.shell.com/standards . Select "Submit DEP Feedback", fill in the online form and submit.
DEP Standard Form (Other users)	Use DEP Standard Form 00.00.05.80-Gen. to record feedback and email the form to the Administrator at standards@shell.com .

Feedback that has been registered in the DEP Feedback System by using one of the above options will be reviewed by the DEP Custodian for potential improvements to the DEP.

1.7 DUAL UNITS

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

2. FIRE-FIGHTING VEHICLES

2.1 FIRE VEHICLE SIZING

The determination of required volumes of fire-extinguishing agent such as foam concentrate, dry chemical powder, water and CO₂, or other agents, shall be based on the credible fire scenarios for the facility. See DEP 80.47.10.30-Gen.

Credible fire scenarios, as well as manpower availability, shall determine the number of vehicles required for a facility.

Where multiple vehicles are required, the specified volumes for each vehicle shall be indicated in the requisition. It is the Manufacturer/Supplier's responsibility to engineer a vehicle covering at least these specified volumes while at the same time meeting all other requirements of this DEP.

This DEP provides guidance as to what may be typically carried on fire-fighting vehicles, other than airfield crash rescue vehicles, which have a mandatory load requirement.

Special fire-fighting vehicles may be specified to address specific fire hazards. For example, these may be large-capacity foam-proportioning vehicles, hose-laying vehicles, hose-retrieving vehicles, etc. This DEP provides general guidance for the vehicle itself in that situation.

Hydraulic-boom vehicles, hydraulic-platform vehicles, and areal-ladder vehicles are normally not required for a petrochemical complex and/or gas plants. In situations where these vehicles are requested, a dedicated risk assessment shall be conducted which includes all the operational risks of heavy vehicles having ladder, boom or hydraulic-platform capabilities.

2.2 THE VEHICLE

The fire-fighting vehicle shall consist of a commercially available chassis with a superstructure. It shall be designed for oil and gas industrial response purposes with an expected lifetime of 20 years. This shall be done in accordance with local authority road traffic and transport regulations.

An assessment of site roads should be made in order to establish maximum specifications for:

1. Vehicle width
2. Length (turning circle)
3. Vehicle height
4. Gross weight (pipe bridges, culverts, etc.) restrictions.

The maximum vehicle width shall be 2.5 m (8 ft – 3 in). For safety purposes, the vehicle's sides shall be equipped with obstacle reflectors.

The vehicle water supply shall be primarily from a fire water system (i.e., hydrants) with an inlet pressure of 6 barg (90 psig) to 16 barg (230 psig); see DEP 80.47.10.31-Gen. Where open water is identified as a viable alternative water supply, vehicles shall also be provided with facilities and equipment for suction from open water.

The vehicle shall be designed ergonomically for the size of the people who will operate it.

The vehicle should be able to carry all of the equipment specified in the requisition and be capable of towing a trailer with a mass of at least 5 t (11,000 lbm) at the same time.

The Principal shall specify whether local traffic regulations govern overall weight, axle weight, power/weight ratio, lighting, etc.

Static calculations for axle/wheel-load, centre of gravity, and tilting stability shall be made and shown to comply with the Chassis Manufacturer's requirements.

The vehicle should be of open construction to assist visual inspection, maintenance and repair. The equipment used for water/foam systems shall be located so that it will be readily accessible. Fire-fighting systems shall be simple and easy to operate, to facilitate training and use in an emergency. However, sub-zero climate construction shall consider enclosures and access panel locations.

For paved road or level road conditions, the angle of approach and departure shall be at least 15°; see NFPA 1901. If the vehicle is to be used in rough off-road terrain, angles between 20° and 30° should be specified according to the response area ground conditions. Assuming the lowest point of the vehicle is the underside of the differential housing bowl, the clearance from the road surface shall be at least 300 mm (12 in).

Mechanical, electrical, pneumatic and hydraulic components shall be installed so that the:

- Chassis structure, or any other component, and the electrical wiring do not obstruct dismounting or repair;
- Pneumatic tubing is not damaged while operating the vehicle.

The electrical system shall be dust proof and waterproof. See (2.8).

The Manufacturer/Supplier shall provide Installation drawings (Process Engineering Flow Schemes, General Arrangements, tank details, etc.) of the water, foam and dry chemical powder systems that indicate the location of flanges, connections, valves, drains, etc. Storage compartment layouts shall be included. The Principal shall approve and comment on the Installation drawings.

Monitoring inspection during construction should be carried out by the Principal or an expert appointed by the Principal. Road tests and performance testing of all fire-fighting systems shall form part of the final inspection for acceptance prior to delivery; see (5).

The Manufacturer's proposals shall indicate any deviations from the requirements given in this DEP. For the Manufacturer's guidance, the quotation requirements are listed in (9).

2.3 CHASSIS, STEERING AND BRAKES

The chassis shall be of a standard commercial type, commonly available and serviceable in the country of destination, with spare parts locally available. The chassis shall consist of a steel structure.

The chassis shall be provided with towing connections at the rear and at the front; the additional forces when these connections are used shall be considered in the design.

In order to negotiate street corners on site, the chassis should have a wheelbase of no longer than approximately 4 m (13 ft).

A single rear axle should be fitted, unless local regulation limits on axle loading make a double rear axle necessary. In the latter case, a non-retractable dual rear axle should be fitted.

The choice of suspension shall reflect the vehicle's condition of being continuously fully loaded.

The transmission should drive a rear single axle only, unless the Principal specifies that both front and all rear axles are to be driven. It should be possible to lock all differentials to assist driving in difficult terrain conditions.

Steering shall be hydraulically power-assisted and shall be left- or right-hand drive depending on the country of use.

The brake system shall be of the positive air type and should be equipped with an Anti-locking Brake System (ABS). The air pressure shall release the brakes no more than 30 s after the engine has started, even if a trailer is connected. The braking system shall comply with United Nations agreement E/ECE/324-E/ECE/TRANS/505 - Addendum 12, Regulation 13.

The compressed air system shall be of sufficient capacity to supply air for all fixed-installed systems on the vehicle. To keep the brake system pressurised a DN 8 (NPS ¼) connection for an external air supply shall be provided at the rear of the vehicle. The connection shall be of the quick connect type with a drive-away/pull-out facility; the body material shall be of aluminium brass or stainless steel.

The chassis shall be equipped with:

1. Wheels, fitted with radial tyres suitable for wet roads or, if specified, suitable for off-the-road conditions, and mud flaps (front and rear);
2. Fuel tank, 200 litres (50 gal) minimum capacity, able to be refilled during operation;
3. Air pressure vessel, fitted on the inside of the chassis if necessary to provide space for lockers or other superstructure details;

NOTE: This may not always be possible as some Manufacturers will not issue a chassis warranty if modifications are made after chassis delivery.

4. Stabilisers on front and rear axles;
5. Spare wheel, tools and jack (to be supplied as standard equipment but not carried on the vehicle unless specified in the requisition);
6. 12 V or 24 V battery system - two 12 V/110 A h (minimum) batteries in series for the 24 V system;
7. Main battery switch, double pole type, operated from the inside and the outside of the cabin;
8. Pneumatic braking connections in accordance with ISO 1728;
9. A socket for trailer lighting in accordance with ISO 1185.

2.4 ENGINE

The vehicle shall be driven by a diesel engine that is also capable of providing power to the installed water/foam system when stationary. The diesel engine should be a 6 cylinder type and shall be provided with:

1. An adequate cooling system of sufficient capacity to prevent overheating. For example, a system while in stationary use in tropical areas and in prolonged fire fighting use under full operational conditions of both water and foam pumps. The Principal shall specify the maximum ambient temperature. The cooling fluid shall be a high-efficiency cooling medium with an anti-corrosion additive.
2. If specified, an electric heating element, with a thermostat in the cooling system, to facilitate immediate optimum performance upon starting the engine in extremely cold conditions.
3. A synchromesh gearbox or, if specified, an automatic gearbox with an oil cooler. The gearbox shall be fitted with a switch to operate the reversing lights and an on-off buzzer when reverse gear is engaged. If an oil cooler is to be supplied, a connection for a temperature indicator shall be provided.
4. A Power Take-Off (PTO) transmission for the water booster pump (if any).
5. A PTO transmission for the foam pump, unless the pump is driven from a different source.

PTOs shall be electrically or pneumatically engaged from the driver's cabin and, if specified, from the operating panel. Manual engagement of the PTO may be specified if required.

The PTOs shall be selected to transmit the torque and power required by the booster and foam pumps when rotating at the required engine speed with all discharge branches completely open. A duplex PTO may be used to drive the water booster and foam concentrate pump.

NOTE: Particularly in conjunction with an automatic gearbox, a "fool-proof" logic control device shall be installed to ensure:

- Parking brake is applied before engaging PTO;
- Engine speed is at correct level before engaging any of the PTOs;
- Proper engaging sequence to engage and to disengage PTOs.

6. A (RQV) regulator (automatic revolution regulator).
7. An exhaust pipe, with spark arrestor(s) of an approved type, which should be located in front of the front wheels or directed vertically upwards behind the cab and in such a way that it complies with local regulations.
8. An automatic over speed protection of an approved type for the diesel engine, by means of an automatic shutdown valve in the air intake system. This protection shall shut down the engine in the event of intake of flammable gas.
9. Dust filters for the engine's air intake shall be specified in the requisition (for desert or unusually dusty areas).
10. NFPA 1901 shall be used as guidance for minimum acceleration and top speed performance requirements.

2.5 CABIN

2.5.1 General

The framework of the driver's cab shall be of metal construction, covered tightly on the outside with metal plate. If specified, a ventilation hatch in the roof shall be provided.

The framework shall be mounted on shock absorbers and be of such construction that harmful stresses will not occur during normal use.

To ensure that the crew will be offered maximum protection in case of an accident, the cab should comply with the United Nations Agreement E/ECE/324-E/ECE/TRANS/505):

1. Protection of the Occupants of the Cab of a Commercial Vehicle (including roof and rear wall strength: Addendum 28, Regulation 29;
2. Strength of Seats, their Anchorage and Head Restraints: Addendum 16, Regulation 17 (vehicle type M1 to be read as vehicle type N3);
3. Safety Belt Anchorage: Addendum 13, Regulation 14;
4. Safety Belts: Addendum 15, Regulation 16.

Adequate measures shall be taken to strengthen the doors and doorframes in case of a side-on collision.

Consideration shall be given to protection of the cabin during a roll-over.

The maximum noise level in the cab (under full load conditions) shall be maximum 85 dB(A) as measured in accordance with ISO 5128.

2.5.2 Floor

The floor of the cab shall be treated with an anti-resonance material. The floor of the driver's compartment shall be covered with a fixed rubber-type material, the topcoat of which shall be non-sliding, wear resistant and water repellent.

2.5.3 Doors

The cab shall be provided with two doors, constructed and suspended in such a way that they provide easy access into and out of the vehicle for the crew in 'turn out' clothing.

The doors shall be treated internally with an anti-resonance material and be protected with an anti-corrosive coating.

The windows shall be weatherproofed with rubber strips.

There shall be drain holes in the bottom of the doors. The door handles shall be made of non-corrosive material and they shall not protrude or have openings facing forward.

2.5.4 Windscreen

The windscreen shall be of laminated safety glass with the upper 20% to 30% tinted, either by integration or by means of a self-adhesive strip. The driver shall be given as wide a view as possible from the cab to all sides. The windscreen shall be fitted with at least two wide arc wipers having two speeds, intermittent wipe and an electrically operated screen washing system with at least two nozzles.

2.5.5 Sunscreen and sunshades

The driver's cab shall be fitted with a sunscreen fitted along the top of the windscreen on the outside. Two adjustable sunshades shall be provided on the inside.

2.5.6 Mirrors

The cab shall be equipped with driving mirrors on the right and left sides of the vehicle plus a parking mirror on each side. The mirrors shall be adjustable, free from vibration and fastened in such a way that they do not move out of position under normal driving conditions.

2.5.7 Steps

The steps of the cab shall not protrude outside the vehicle width. They shall be made of non-corroding material and have a non-slip surface (not rubber).

2.5.8 Front seats

The driving cab shall have seats for 3 persons unless otherwise specified by the Principal, covered with heavy-duty leatherette or other washable material. The seats shall be fitted with inertia reel safety belts, fixed at 3 points for the outer seats and fixed at 2 points for the middle seat.

2.5.9 Lighting and siren

All lighting shall conform to applicable local standards, to suit right-hand or left-hand drive as required and be installed as follows:

1. An internal light (minimum 15 W) with on-off switch fitted in the roof of the cab; it shall also operate when the doors are opened;
2. A map reading-light fitted to the dashboard next to the driving seat;
3. One long-range search light at the front of the vehicle;
4. Twin reversing lights at the rear of the vehicle, operating automatically on selection of reverse gear;
5. Floodlights;
6. Revolving beacons with halogen bulbs, the colour of the beacon to be specified by the Principal;
7. Searchlight;
8. Fog lamps with protectors against flying stones, fitted at the front of the vehicle if required.

A two-tone siren shall be provided unless otherwise specified by the Principal.

2.5.10 Ventilation

Air vents shall be distributed across the width of the dashboard in order to demist the windscreen and windows of the front doors. The vents shall have adjustable outflow openings on the left-hand and right-hand side of the dashboard. The vehicle shall be fitted with a blower having at least two speeds. For tropical climates, a high-capacity ventilation system shall be provided.

2.5.11 Heating

The cab shall be equipped with an adjustable heating system capable of achieving and maintaining a temperature of $15^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ($59^{\circ}\text{F} \pm 4^{\circ}\text{F}$) inside the cab within 20 minutes, even when the outside temperature is -15°C (5°F).

For extremely cold (e.g., arctic) climates, a heating system shall be provided which is independent of the engine.

2.5.12 Cooling

If prolonged driving is required under tropical/desert conditions, the installation of a standard air conditioning unit should be considered; if installed the air conditioning unit shall use a cooling medium with minimum or no ozone depletion potential. If an air conditioning unit is installed, a battery and alternator with increased capacity are likewise required. The air conditioning should be an integral part of the engine design rather than a stand-alone unit mounted on the roof of the cab that may obstruct the stream discharged from an overhead monitor.

2.5.13 Dashboard

Notwithstanding the switches supplied by the chassis Manufacturer, the dashboard shall contain switches for the following:

1. Revolving beacons and siren;
2. Fog lamps, if required;
3. Floodlights;
4. Compartment/cabinets lighting (as a master switch);
5. Map reading-light;
6. Switch for heating element in the cooling system, if applicable;
7. Electrical main switch (inside the cab with a second switch outside for emergency use);
8. Engaging PTOs.

The function of each switch shall be indicated in white text and symbols engraved on black plates in the language or in symbols as specified by the Principal. Reference ISO/DIS 10085.

The dashboard shall also contain indicators for the following:

1. Engine cooling water temperature;
2. Lubricating oil pressure;
3. Fuel tank level;
4. Charging current;
5. Brake air pressure;
6. Engaged signal for each PTO.

2.5.14 Portable search light

Two portable searchlights (500 W) shall be installed in the cab. The lights shall be suitable to operate in a Hazardous Area classified as Zone 1; refer to IP 15. The automatic charging device shall be connected to the vehicle's electrical system.

2.5.15 Mudguards

A mudguard and a mud flap shall be fitted to each wheel. The underside of the superstructure shall not be used as a mudguard.

2.5.16 Mobile radio

Sufficient space shall be provided to install a rack containing a mobile radio. The Principal shall specify the make and type of radio and its required voltage (refer to DEP 32.71.00.10-Gen.) and the required dimensions of the rack.

A cable shall be installed to provide electrical power from the vehicle battery to the radio. In addition, a cable shall be installed to connect the radio to the remote handset and speaker located at the rear water/foam operating panel if installed. See (3.2.8).

The aerial shall be installed on the cabin roof for optimum performance.

A dedicated loudspeaker shall be installed in the cabin.

The hand-held microphone shall be equipped with a push-to-talk button.

The radio set and microphone shall be within reach of the driver.

2.6 EXTENDED (CREW) CAB

2.6.1 General

Some Chassis Manufacturers can supply crew cab extensions which can be converted to sleeping compartments. This may mean a single tilting cab (to allow engine and transmission access) of some length and the mechanisms and so the weight of these should be carefully assessed. Preferably, the extended crew cab should be made in two separate sections, comprising a tilting standard driver's cab and a crew compartment fixed to the chassis.

If the crew compartment is constructed immediately behind the driver's compartment, an elastic seal shall be fitted between the rear wall of the tilting driver's compartment and the front wall of the fixed crew compartment. This seal shall be draught proof and waterproof under any driving condition, and the permissible sound level within the cab shall not be exceeded.

In modern designs, crew compartments are often integrated in the superstructure. See (2.7).

It should not normally be necessary to locate a water/foam monitor on the roof of a cabin, as the preference is to have any roof mounted monitor at the rear of the vehicle, above the pump itself. This minimises movement on the roof and thereby reduces risk to personnel through working at heights.

Where a monitor on a crew roof is an absolute requirement, the roof of the crew compartment should be covered with aluminium ribbed sheet and be strong enough to carry at least one person in case a top-mounted monitor is provided. The compartment shall be fitted with doors and a two-way communication system with the driver.

2.6.2 Seats

The Principal shall specify the required option, depending on the number of crew.

Examples of options are:

- Single bench (4 seats);
- One bench and two separate (folding) seats (6 seats);
- Two benches (8 seats).

All seats should be of the padded jump seat design with headrests and shall be equipped with seat belts; see (2.5.1). Where there is an identified need, jump seats should have integral Self Contained Breathing Apparatus (SCBA) fittings to allow donning en-route to an incident.

Space should be provided under the seats to hold spare SCBA cylinders. These should be provided with holders to prevent movement in transit.

2.6.3 Mounting brackets for breathing air apparatus

Where crew cab jump seat SCBA fittings are not required, SCBA sets may be kept in an equipment compartment. The construction and attachment of brackets for breathing air apparatus shall be robust and be fitted in such a way that brackets and apparatus do not break loose during maximum braking retardation.

The Principal shall specify the location and number of the mounting brackets and type of equipment.

2.6.4 Floor

The floor of the crew compartment shall be covered with chequered aluminium plates or other equivalent non-slip material.

2.7 SUPERSTRUCTURE

The equipment compartments, foam tank, pump, and powder units shall be attached to the chassis beams by a method that ensures flexibility of the bodywork superstructure and good road grip for the wheels.

NOTE: Modular design concept superstructures are available on the market.

The interface of the superstructure/body mounting frame and chassis shall conform to the specification of the Chassis Manufacturer.

Cabinets of minimum depth of 550 mm (22 in) shall be fitted for the storage of portable fire-fighting equipment. Their number and size shall depend on the amount of equipment to be carried, as determined by scenario assessments. If specified, all cabinets shall be closed by roller shutters which are self-locking in any position or, if specified, vertical hinged doors with flush mounted handles. Manufacturers should be requested to provide drawings of the proposed compartment layouts and sizes for bid review.

Separate compartments with shelves shall be provided for the storage of individual fire hoses; suction hoses shall be located in racks on top of the compartments. Taking into account local ergonomic requirements, fixed or hinged steps and/or ladders shall be provided for access to hoses and equipment. All cabinets and racks shall be self-draining with the cabinet floors made of corrosion resistant material.

Generally all horizontal top surfaces (e.g., operating platforms and tank roofs) require regular access. Therefore, a railing (minimum height 300 mm [12 in]) shall be provided around surfaces such as top of cabinets, hose compartments and tanks.

2.8 ELECTRICAL SYSTEMS

The vehicle shall be equipped with the following electrical systems, in accordance with statutory regulations, and shall be dust and waterproof to at least IP 55 in accordance with IEC 60529 and, if required, suitable for tropical conditions:

1. Plug and socket, 4-pole, for a battery charger. The plug and socket shall be manufactured from an approved non-metallic material and be of the pull-out-and-drive-away type, i.e., socket cover to be sawn off.

A wall-mounted, constant-voltage type of battery charger shall be specified. It shall be fitted with overload protection and an automatic cut-out device for controlling the charging of the batteries. In addition, as close as possible to both batteries' positive terminals, a fuse shall be installed in each charging conductor. The socket shall be located at the rear of the vehicle so that the plug is automatically pulled out of the socket and falls to the ground if the vehicle drives away.

NOTE: The battery charger supplied shall be wall-mounted in the fire station. The electric supply shall be 110 V or 220/240 V, 50-60 Hz as specified by the Principal.

2. Lighting installed over the water booster pump and positioned elsewhere so that all gauges, operating handles, operating panels and their surroundings are properly illuminated. This lighting shall be switched on and off by a control switch in the

driver's cabin and also from the control panel for operations at the rear of the vehicle. The lighting in the storage cabinets shall operate automatically when doors and shutters are opened. Light fittings in compartments shall also be in accordance with IP 55 to IEC 60529. All light fittings shall be protected against mechanical damage.

3. Detachable floodlight (70 W/24 V) at each side of the driver's cabin, with plugs and sockets. The sockets shall be 2-pole, screwed connections, in accordance with DIN 14690-1. Material shall be aluminium.
4. A red, or other colour if specified, emergency warning revolving beacon or strobe light with halogen lamp at left and right-hand side.
5. An adjustable (from passenger position) searchlight.
6. If the vehicle may use public roads to respond to Company facilities emergencies, additionally a red, or other colour if specified, emergency warning revolving beacon or strobe light with halogen lamp at left and right-hand side of the rear top of the vehicle.

NOTE: Countries may have restrictions on industrial emergency vehicle warning beacon lights and therefore colour may vary from red to blue or orange. This shall be checked against local regulations with emergency services.

7. A double-tone siren with a minimum noise level of 100 dB(A) at 5 m (16 ft).
8. Amber, or other colour if specified, revolving beacon at the rear of the vehicle, normally positioned on the left for left-hand drive vehicles. This shall be over and above any emergency warning lights.
9. Two adjustable floodlights, at the rear.

NOTE: Working lights (floodlights and search lights) shall be adjustable both horizontally and vertically.

10. A connection for trailer lighting, 24 V DC in accordance with ISO 1185.
11. A connection with a 24-core, or as otherwise specified, screened cable for operating the cab-mounted mobile radio from the operating panel.
12. All additional electric cables and wiring installed on the chassis shall be run in conduit.
13. The colour or identification code used for electric wiring shall be the Manufacturer's standard unless otherwise specified by the Principal.
14. Audible reversing signal with appropriate octave band. Refer to (3.2.9) and ISO 7731.