

व्यापक परिचालन मसौदा

हमारा संदर्भ : सीईडी 22:3/टी -32

25 01 2010

तकनीकी समिति : अग्नि शमन विषय समिति, सीईडी 22

प्राप्तकर्ता :

- 1 सिविल इंजीनियरी विभाग परिषद के सभी सदस्य
- 2 सीईडी 22 एवं सीईडी 22:3 के सभी सदस्य
- 3 रुचि रखने वाले अन्य निकाय

महोदय (यों),

निम्नलिखित मसौदा सलंगन हैं :

प्रलेख संख्या	शीर्षक
सीईडी 22 (7617)	टर्नटेबल लैडर - विशिष्टि (आई सी एस संख्या 13.220.10)

कृपया इस मसौदे का अवलोकन करें और अपनी सम्मतियाँ यह बताते हुए भेजें कि यदि यह मसौदा मानक के रूप में प्रकाशित हो तो इन पर अमल करने में आपके व्यवसाय अथवा कारोबार में क्या कठिनाइयाँ आ सकती हैं ।

सम्मतियाँ भेजने की अंतिम तिथि **31 03 2010**

सम्मति यदि कोई हो तो कृपया अधोहस्ताक्षरी को उपरलिखित पते पर सलंगन फॉर्मेट में भेजें ।

यदि कोई सम्मति प्राप्त नहीं होती है अथवा सम्मति में केवल भाषा सम्बन्धी त्रुटि हुई तो उपरोक्त प्रलेख को यथावत अंतिम रूप दे दिया जाएगा । यदि सम्मति तकनीकी प्रकृति की हुई तो विषय समिति के अध्यक्ष के परामर्श से अथवा उनकी इच्छा पर आगे की कार्यवाही के लिए विषय समिति को भेजे जाने के बाद प्रलेख को अंतिम रूप दे दिया जाएगा ।

यह प्रलेख भारतीय मानक ब्यूरो की वेबसाइट पर भी डाला जा रहा है ।

धन्यवाद ।

भवदीय

(ए .के . सैनी)

वैज्ञानिक 'एफ' एवं प्रमुख (सिविल इंजीनियरी)

ई मेल : ced@bis.org.in

सलंगन : उपरलिखित

**DRAFT IN
WIDE CIRCULATION**

DOCUMENT DESPATCH ADVICE

Reference	Date
CED 22:3/T- 32	25 01 2010

TECHNICAL COMMITTEE: FIRE FIGHTING SECTIONAL COMMITTEE, CED 22

ADDRESSED TO :

- 1 Interested Members of Civil Engineering Division Council, CEDC
2. All members of CED 22 and CED 22:3
3. All others interested

Dear Sir,

Please find enclosed the following document:

Doc No.	Title
CED 22 (7617)	Draft Indian Standard on Turntable Ladder - Specification ICS No. 13.220.10

Kindly examine the draft standard and forward your views stating any difficulties which you are likely to experience in your business or profession, if this is finally adopted as National Standard.

Last Date for comments : **31 03 2010**

Comments if any, may please be made in the format as given overleaf and mailed to the undersigned at the above address.

In case no comments are received or comments received are of editorial nature, you will kindly permit us to presume your approval for the above document as finalized. However, in case of comments of technical in nature are received then it may be finalized either in consultation with the Chairman, Sectional Committee or referred to the Sectional Committee for further necessary action if so desired by the Chairman, Sectional Committee.

The document is also hosted on BIS website www.bis.org.in.

Thanking you,

Yours faithfully,

Encl: as above

(A.K. Saini)
Sc `F' & Head (Civil Engg.)
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FORMAT FOR SENDING COMMENTS ON BIS DOCUMENTS

(Please use A4 size sheet of paper only and type within fields indicated. Comments on each clause/subclause/table/fig etc. be started on a fresh box. Information in column 3 should include reasons for the comments and suggestions for modified working of the clauses when the existing text is found not acceptable. Adherence to this format facilitates Secretariat's work)

Please e-mail your comments to ced@bis.org.in or s.chaturvedi@bis.org.in or Fax to 011 23235529

NAME OF THE COMMENTATOR/ORGANIZATION:

DOC. NUMBER AND TITLE:

Sl.No. (1)	Clause/Subclause/ Para No. (2)	Comments/suggestions (3)

For BIS Use Only

Doc: CED 22(7617)

Draft Indian Standard

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SPECIFICATION FOR TURNTABLE LADDER

**Fire Fighting
Sectional Committee, CED 22**

Last Date for Comments

FOREWORD

Formal clause shall be added later on.

Turntable ladders are provided in metropolitan cities or at other installations for fighting the fires in high rise buildings, oil installations where water or foam is intended to be used as the principal fire extinguishing medium as a water/foam tower. It may also be used for rescue purposes either as 'staircase' or by lowering a person in a sling cradle from the head of the ladder where means of escape are blocked by smoke heat and fire or otherwise.

Even the best designed electronically / hydraulically turntable ladder shall not serve the purpose for which it is intended unless it is correctly employed and operated and regularly maintained. This fact emphasizes enormous care and gives greater importance for the appliance which is meant for special use as a water tower or for rescue purpose, either as a staircase by lowering a person in a string from the head of the ladder.

Although there are several makes of turntable ladders in use in this country, those widely used are either electronically or hydraulically operated turntable ladders. Where as the principles for the selection, operation and maintenance of all such appliances are more or less based on the same principles, though details vary. The recommendations in this standard have, therefore, been framed particularly for the electronic / hydraulic turntable ladder. Keeping in view the necessity of adequate manpower requiring handling of such appliance, necessary recommendations for this has been included in this standard.

It is recommended that the manufacturer should guarantee the availability of spare parts of Turn Table Ladder and other equipments for at least ten years from the date of supply.

Doc: CED 22(7617)

Draft Indian Standard

SPECIFICATION FOR TURNTABLE LADDER

1 SCOPE

1.1 This standard covers the recommended practice and procedure for the selection, operation and maintenance of 30 meters electronic / hydraulic turntable ladder.

2 GENERAL REQUIREMENTS

- a) The turntable ladder shall be designed specifically for the purpose of fire fighting and rescue to enable fireman to go up and down. It shall comprise of ladder sections with a cage mounted at the end of top ladder section and the entire unit shall be mounted on a turntable. The entire unit shall be mounted on a suitable heavy duty diesel engine chassis. The turn table ladder shall be telescopic type.
- b) The turn table ladder shall be capable of use at any angle of elevation without any reduction in load capacity of the cage. It shall also rotate 360⁰ continuously at any angle of elevation subject to ladder remaining clear of vehicle body.
- c) The height of the ladder, when fully elevated and extended shall be not less than 30 m from the ground.
- d) The appliance shall be fast on the road and easily manoeuvrable in crowded streets and around sharp corners. The overall dimensions shall be as compact as possible.
- e) The turn table ladder shall be electronically / hydraulically controlled, permitting precise and easy operations under the most difficult conditions, with ample reserve strength and stability.
- f) Full safety interlocks shall be incorporated in the design so as to ensure the complete safety in operation and long years of reliable and trouble free service.
- g) The design of the turn table ladder shall allow a very large safety margin for all operations and in all climatic conditions. The safe working load rating shall include an allowance for the weight of the water, in the water system and reaction from the monitor jet when operating.
- h) The ladder shall have automatic plumbing system (Levelling system) to adjust at an angle up to 8.5⁰.
- j) There shall be a full back-up system for all ladder movements and outrigger movements, in case of failure of main system.
- k) If a computer control system is used, it shall be checked for interference sensitiveness and shall comply with interference sensitiveness class B for circuit linked interference.
- m) All the ladder control system shall be fully tropicalised and able to operate in the temperature up to + 60⁰ and in a dusty and humid condition without reducing maximum operating limits.

3 CHASSIS

- a) The Chassis may be 4m x 2m, right hand driven, indigenously manufactured, full forward control, diesel engine driven, having approx. 4855 mm wheel base.
- b) The engine may be compression ignition six cylinder direct injection 4 stroke water cooled engine developing minimum 150 H.P. and torque of 48 mkg. The

engine shall be naturally aspirated/ turbo charged. The fuel tank capacity shall not be less than 160 litres.

- c) The clutch may be single plate, diaphragm type, hydraulically / mechanically operated.
- d) The gear box may be synchromesh type having 5/6 forward gears and one reverse gear.
- e) The rear axle may be forged "I" section type.
- f) The rear axle may be fully floating type having capacity of 10200 Kg.
- g) The chassis frame may be "C" construction with sufficient numbers of cross members.
- h) The front and rear suspension may be semi elliptical multi leaf spring, preferably with anti roll bar.
- j) The steering system may be integral power steering.
- k) The tyre size on the front and rear axle may be 9.00 x 20 or 10.00 x 20.
- m) The braking system may be dual circuit full air brake with pneumatically operated hand brake.
- n) The electrical system may be 12/ 24 volts, negative earth.
- p) A suitable Power Take OFF (P.T.O.) (side P.T.O. or full torque P.T.O.) shall be provided depending upon the power requirements for hydraulic pump.
- q) The chassis shall have factory built, aerodynamically, full trimmed cabin.

4 OPERATING REQUIREMENTS

The appliance shall confirm the following requirements:

- a) Safe working load in the cage on hard level ground with dry monitor 270 Kg minimum.
- b) Safe working load in the cage with monitor delivering full output 180 Kg approx.
- c) Loading capacity of lifting eye 4000 Kg at an elevation of 65⁰.

The above weight requirement shall be exclusive of weight of any equipment permanently fitted in the cage or on the ladder.

5 DIMENSIONS OF APPLIANCE

The appliance shall confirm the following dimensions:

- a) In operating position:
 - i) The height from the ground — 30 m.
 - ii) Maximum out reach to the front of the cage with full jack width — 26 m approx.
 - iii) Maximum width of vehicle when outriggers (jacks) are fully extended — 4.5 m.
- b) In travelling position:
 - i) Overall length — 10 m max.
 - ii) Overall width — 2.5 m max.
 - iii) Overall height — 3.5 m max.

6 CONSTRUCTION

The appliance shall be constructed of robust material, carefully selected for lightness and durability. Use of timber shall be restricted and use of rubber be avoided as far as possible. Ferrous metal parts shall be treated for anti-corrosion by a method other than electro plating.

7 JACKING SYSTEM

- a) The jacking system shall consist of four stabilising jacks situated at each end of the main frame to enable effective levelling even on rough ground. The jacking system shall be powerful and quick acting hydraulically operated.
- b) The jack shall be of rectangular steel box section, designed to protect the operating cylinder against mechanical damage. Large swivelling end plates shall be provided.
- c) The jacking system shall be horizontal, vertical “H” type jacking system with hydraulic axle locking mechanism on rear axle. All the jack movements shall be infinitely variable within a maximum jacking width of 4.5 m.
- d) The jacking system shall allow operating each jack individually and the infinite jack projection shall be recognised on board by the controlling system and the maximum outreach shall be automatically calculated as per the jack width.
- e) The jacks shall be controlled individually or in pair with lever/ joystick and the control panel shall be situated in such a position that, the operator will have a clear look to the right and left hand side while extending the jack. The control panel shall be preferably at the rear of the vehicle.
- f) Yellow flashing warning lights shall be provided at the outer most point of the jacks to identify the position of the jacks during the night operation.
- g) Four wooden spreader plates shall be provided for the use when the appliance is required to be operated on soft ground.

8 LADDER SET

- a) The turn table ladder shall be designed to perform the following functions / operations:
 - i) Elevation
 - ii) Depression
 - iii) Extension
 - iv) Housing
 - v) Rotation of 360° continuously in either direction
- b) All the operations shall be power operated with the help of hydraulic cylinders, wire ropes and cables etc. This system shall be purpose built to provide smooth take-off, variable speed range and smooth slow down.
- c) The ladder shall consist of four sections having a height of 30 m. (Upper ladder rung or cage floor) made of high grade, corrosion resistant steel and has a minimum wind catching area. The ladder section shall be extended and retracted telescopically and simultaneously.
- d) The lower ladder section (base Ladder) shall be bolted on to a turret. The sliding sections of ladder shall be extended and retracted with the help of double acting hydraulic cylinders or via wire ropes or the combination of both. The movement of the ladder shall be simultaneous.
- e) The extension and retraction cylinders or wire rope shall be so laid, that it shall not cause any hindrance for climbing to a fireman. The ladder rungs shall be anti skid design to avoid slipping of a person while climbing up or down the ladder. The extension / retraction ropes shall have tension adjustment-mechanism.
- f) A visual indication lamp shall be provided on main control consol and cage control consol for "Rung in alignment at a convenient position".
- g) The ladder shall be possible to elevate from -15° to $+75^{\circ}$ angle. The rotation movement shall be continuous through 360° at all angles of elevation except for the cabin protection area. In driving condition the ladder set shall be placed on the ladder head rest. The ladder shall be possible to level with the ground in 8.5° in either direction when used on inclined ground.
- h) All the sliding section shall have a maintenance free nylon / steel rollers for sliding movement and means shall be provided for the lubrication of these rollers at an easily accessible position.
- j) Hook on type additional ladder shall be provided for the access to main ladder assembly from the ground. A lifting eye shall be provided at the head of the ladder section with a load capacity of 4000 Kg.

- k) An attachment system shall be provided at the top of the ladder or in rescue cage for fixing a monitor. The monitor attachment shall be quick connect type without the use of bolts and nuts. The monitor may either be permanently mounted on ladder top or may be kept at some other suitable place.
- m) All main ladder movements such as elevation, depression, extension and retractions and rotation to the left and to the right shall be possible simultaneously. Each movement shall also be possible individually. The plumbing movement shall perform automatically.
- n) All the ladder movements except rotation, just before reaching the limit position, shall be slowed down automatically until rest. In addition to this, the ladder lowering rate shall proportionally decrease with increasing ladder length in order to avoid excessive swinging on the ladder tip when ladder movement stops.
- p) The functional, ergonomically designed main operating control consol shall be provided on the left/ right hand side of the turntable preferably the operator seats back rest and arm rest should be tilt-able backward up to 30⁰ according to the angle of elevation of the ladder. The following controls shall be provided on main control:
 - i) Lever/ Joystick for rotation and elevation and depression.
 - ii) Lever/ Joystick for extension and retraction.
 - iii) Foot pedal for oil pressure On/Off (“dead man” switch)
 - iv) Button for engine start/stop (engine should be automatically set to operating speed.
 - v) Button for plumbing adjustment control on/off.
 - vi) Button for rungs in alignment during ladder movement.
 - vii) Button for one man/two man/ three man cage operation.
 - viii) Button for control consol lighting on/off.
 - ix) Button/ Knob for emergency stop.
 - x) Volume control for main control stand and top of ladder speaker.
 - xi) Microphone for intercom system.
 - xii) Button for search light for illumination at top of ladder.
 - xiii) Lever for emergency operation of jacks and ladder assembly.
 - xiv) Graduated arc with pendulum.
 - xv) Display monitor for actual ladder operation range.

9 CAGE

- a) A cage shall be made of light alloy material and it shall be foldable. There shall be sufficient working space for three persons and safe working load shall be not less than 270 Kg excluding the equipment permanently fitted in the cage. The cage levelling (Up right position) shall be controlled automatically by an electro hydraulic power unit which shall also be used for folding up and down the rescue cage. The controls for folding over and in working position shall be integrated into the control panels for the jacking system. The entrance to cage shall be provided via a drop down platform, which may also be used for closing the cage.
- b) The cage shall be quick removable type whenever needed.
- c) An emergency cage operation shall be provided in case of primary system failure by means of secondary-independent electronic / hydraulic system.
- d) An acoustic signal shall be provided if cage fails to come in operating position while the vehicle is being jacked.
- e) The cage control allows all ladder movements to be performed infinitely variable. During cage operation, the movement shall be automatically controlled by the safety system. When the ladder is operated from the cage, the speeds of movements shall be the same as it is operated from the main control consol.
- f) The location of control unit shall be on left/ right and side of the cage towards the front. The joystick / levers operation in the cage shall be identical with that of the main consol. The cage control panel is always visible and accessible, even when additional equipment is used such as water monitor.
- g) The cage control shall have operating joysticks/ levers, a display monitor of actual ladder operating range as well as press buttons/knobs for selection of various operational areas. The following control shall be provided:
 - i) Control lever/ joystick for extension and retraction.
 - ii) Control lever/ joystick for rotation and elevation/ depression
 - iii) Foot pedal for oil pressure on/off (“dead man” switch)
 - iv) Button for engine start/stop (engine shall be automatically set to operating speed.
 - v) Button for rungs in alignment during ladder movement.
 - vi) Button for control consol lighting on/off.
 - vii) Button/ Knob for emergency stop.
 - viii) Button for search light on/off.
 - ix) Display monitor for actual ladder operation range.

- h) Two wide angle flood lights shall be provided in front of the cage for illumination of area of operation during night time.
- j) The cage shall be provided with collision safety device to protect the cage against damage due to impact while in operation. All ladder movements shall stop automatically when cage collision system is activated.

10 HYDRAULIC SYSTEM

- a) A positive displacement pump shall be provided to provide the necessary hydraulic power for the jacking and all boom operations.
- b) The pump shall be driven via a power take off through universal propeller shaft.
- c) A sufficient capacity hydraulic oil tank shall be provided with an in built oil filters.
- d) All the ladder movement shall be possible simultaneously without mutual interference and any reduction in the present speed.
- e) The extension and retraction of the ladder shall be carried out by means of extension and retraction of hydraulic cylinders.
- f) Two hydraulic cylinders shall be provided to elevate and depress the ladder assembly.
- g) The rotation movement shall be achieved by means of a hydraulic motor with suitable gear mechanism and braking system.
- h) All the control valves shall be proportional control valves, permitting precise and infinitely variable speed control. The oil pressure shall be switched on/off by means of a foot pedal ("Dead man" switch).
- j) In case of electrical failure, emergency hydraulic operation shall be possible and in case of vehicle engine failure, operation may be possible by means of a separate manual hydraulic pump operated via levers mounted at the side of the body work to ensure safe operation from the ground.

11 SAFETY SYSTEMS

- a) There shall be an interlock to prevent ladder operation until the axle lock is engaged and all four jacks have sufficient ground pressure.
- b) There shall be a control light for the axle locking system, which shall be mounted on the dash board. These lights will remain ON when the power take off is switched OFF but the axle lock is not yet disengaged and/or the cage is still in operating position, preferably with warning buzzer.
- c) There shall be two independent drive elements to secure the ladder set of which each is capable of keeping the ladder in its present position, during the ladder movements that is "elevating" or "depressing" as well as "extending" or "retracting".

- d) A “Dead man” switch shall be provided at the main and cage control consol, to immediately stop all ladder movement.
- e) There shall be an interlock which only permits the ladder set to be lifted from the head rest and there after other movements are possible.
- f) There shall be a load measuring system for stability of security of the ladder parts. The ladder movements shall stop automatically due to projection and/or additional load such as rescued persons, in conjunction with the jacking widths and the actual remaining load.
- g) An operating range display shall continuously show the total working range and the present load situation. The position of the ladders and the load limit in conjunction with jacking width shall be displayed simultaneously.
- h) It is a basic requirement for stability that the speed of all the movement slows down smoothly and automatically before reaching the final position and automatically stops all movements in the defined final position.
- j) Due to tactical requirements during operation, there shall be a device provided which allows the ladder to reach operational limit beyond the free standing limit when the ladder head is supported against wall.
- k) When ladder reaches its operational limits, there shall be an automatic final stopping of all ladder movements except for retraction and rotation.
- m) There shall be a driver’s cabin protection mechanism which shall stop respective ladder movement to avoid collision of ladder with cabin.
- n) There shall be an impact cut which shall stop all ladder movements.
- p) The automatic hydraulically controlled levelling system (plumbing) shall be active at all elevation and inclination angles. It shall guarantee that the rounds are always horizontal up to angle of 8.5° . The plumbing mechanism may be switched off from main control consol.

12 EMERGENCY SYSTEM

- a) The hydraulic power of all necessary ladder movements shall be provided manually via a separate hydraulic pump. The hydraulic pump shall be provided at suitable place for safe and easy operation.
- b) In case of failure of main control system, mechanical emergency operation of all ladder movements shall be possible. All the ladder movements that is extension/ retraction/ elevation/ depression and rotation to the left and right shall be safely controlled with hydraulic system from the main control consol.
- c) An emergency system with independent pump shall also be provided for manual levelling of cage.

13 OPERATING RANGE DISPLAY

- a) An operating range display shall be provided at main control consol and cage control consol which shall provide useful information to the operator. The various signals coming from control system shall be processed and visually represented in the form of text or symbols on the display.
- b) A scaled down representation of the actual available range of operations shall be displayed showing exactly the ladder position, projection, ladder length, height and angle of elevation.
- c) A microprocessor shall monitor all ladder movements and safety systems. If the safe operating limits are reached, the ladder movements shall be blocked automatically and a corresponding message/indicator shall be shown on display screen.
- d) The display shall show test message of operational faults including its consequences.
- e) The range display shall be illuminated suitably for easy reading during night operation.

14 MONITOR

- a) The manually operated monitor may either be attached to ladder head or in the rescue cage and shall be provided with standard 2 ½" male coupling.
- b) The output of the monitor shall not be less than 1200 lpm at 1.0 MPa and throw range should be approximately 40 m.
- c) The monitor may be moved vertically upward and downward up to – 15⁰ to + 60⁰ . The horizontal movement shall be upto 30⁰ left side / right side when fitted in the cage.
- d) The monitor shall be provided with water supply via a pressure pipe of light alloy laid along the ladder assembly.

15 INTER COMMUNICATION SYSTEM

- a) An inter communication system shall be provided between the cage and the turn table controls. The system shall be talk-balk amplifier transistorised type with microphone and speaker at main control and cage control.
- b) The system shall be powered by the vehicle electrical system. It shall be rugged construction to withstand weather conditions.
- c) Any connection cables shall have an efficient and automatic take-up to prevent a stack or twisting in all the cable when the ladder sections operated.

16 BODY WORK

- a) The body work shall be designed to allow maximum accessibility to all areas to be serviced and inspected. Provision shall be made for all the major components to be removed easily. Accordingly lifting eyes shall be provided wherever feasible to ensure removal and replacements do not entail unacceptable downtime.
- b) The super structure of the deck shall be made from light weight steel sections and fasten on the vehicle frame. The structural frame shall be adequately protected from corrosion
- c) The panels shall be made of corrosion proof light alloy plates, the exterior of which are anodised for extra protection. The working deck shall be covered with light alloy chequered plate of 3 mm thickness.
- d) An access ladder, integrated on the left hand side of the superstructure gives access to the working deck. It shall be with light alloy step protection. Hand grips where necessary shall be provided.
- e) Sufficient number of lockers shall be provided for keeping hoses, branches and other accessories. The lay out of the lockers shall be made with proper load distribution. The exact location and size of the locker shall be shown in the drawings. All the lockers shall be provided with dual-skinned design dust and water proof light alloy rolling shutters. An automatic switch shall ensure immediate illumination of the respective locker. The shutters submitted along with the tenders. be lockable.
- f) Mudguard made from corrosion proof material with rubber flaps shall be provided.
- g) A crew seat shall be provided immediately behind the driver cabin over the deck suitable to accommodate four firemen. Seats shall be upholstered properly.

17 ELECTRICAL EQUIPMENT

- a) All the lockers shall be illuminated from inside. Light shall be activated automatically as soon as locker shutter is open.
- b) Two working area search lights of 70 W/ 24 Volts with protected grill shall be provided in the cage with swivel joint cable and mounting pins.
- c) A two tone horn shall be provided for traffic warning system.
- d) Two each red and blue halogen rotating beacons shall be provided and mounted on driver's cabin roof.
- e) A battery main switch shall be provided for cutting all power from the battery. The location of main switch shall be easily accessible to driver and preferably inside the driver's cabin.
- f) All the other lighting of the motor vehicle be according to Motor Vehicle Act and Rules.

- g) A 12/24 Volts, DC siren capable of producing Wail, Yelp and Hi/Lo sounds motor vehicle be provided, with a switch at officer side.

18 LUBRICATION

- a) The components of the ladder motor vehicle be lubricated and sealed for life. For the remainder, where possible an efficient means of lubrication motor vehicle be provided. Also a simple means for checking the oil level motor vehicle be provided.
- b) Means for draining the oil motor vehicle be provided by a single plug which shall be easily accessible and so positions as to drain the reservoir completely.
- c) All the greasing points shall be provided with grease nipple which shall be easily accessible.

19 PAINT FINISH

- a) All metal parts which are exposed to atmosphere and comes in contact with water shall be provided with corrosion resistant paints.
- b) The chassis and wheels shall be painted with high glossy black colour aluminium parts natural colour.
- c) The body work, cabin, turntable shall be painted with fire red colour of shade 536 of IS 5.
- d) Mudguard and the bumpers engine be painted with glossy white
- e) Lockers and roller shutters engine be anodised aluminium.
- f) The boom assembly shall be painted in glossy white.
- g) All the steps surfaces and trade plates shall be in self colour.
- h) The words "FIRE SERVICE" and the "EMBLEM" shall be painted on either side of the body of the vehicle in white paint.

20 ADDITIONAL ACCESSORIES:

- a) Following additional accessories shall be provided along with the vehicle in addition to standard accessories:
 - i) Wooden Outrigger plates — 04 Nos.
 - ii) Fog/Branch pipe suitable for cage operation — 01 No.
 - iii) Set of special tools and equipment required for repairs and maintenance of Ladder — 01 Set
 - iv) Suction hose, 3 metres length, with couplings — 04 Nos.

- v) Suction strainer, light alloy — 01 No.
- vi) Wire Mesh Basket — 01 No.
- vii) Coupling spanner — 02 Nos.
- viii) Delivery hose with coupling, 15 m x 63 mm — 10 Nos.
- ix) Select flow nozzle — 02 Nos.
- x) Collecting breeching, made of light alloy — 02 Nos.
- xi) Multipurpose saw — 01 No.
- xii) Blade for metal cutting, 300 mm diameter — 03 Nos.
- xiii) Blade for stone cutting, 300 mm diameter — 03 Nos.
- xiv) Electronic Searchlight Complete with rechargeable batteries — 02 Nos.
- xv) Mounting bracket for Searchlight, 12/24 Volt — 02 Nos.
- xvi) Manual powered combi-rescue tool for cutting and spreading — 01 No.
- xvii) Fire Blanket, 160x200 cm — 02 Nos.
- xviii) Protective gloves, five finger, made of chromed leather — 03 pairs
- xix) Protective helmet — 03 Nos.
- xx) First Aid kit, Industrial type — 01 No.

21 STABILITY

The stability of the appliance (in travelling position) when fully equipped and loaded (excluding crew members) with ladder resting in the resting stand and without extending stabilizing jacks or axle locks shall be such that it remain stable and shall not overturn, if the surface on which the appliance stands is tilted to either side at an angle of 30° from the horizontal.

22 OPERATION AND MAINTENANCE INSTRUCTIONS

Two sets of complete operation and maintenance manuals for the unit (Including all systems) with itemised illustrated spare parts list shall be supplied along with the vehicle. The entire instruction manual shall be in english language. All the electrical circuit diagrams shall be provided along with fault diagnosis notes.