भारतीय विमानपत्तन प्राधिकरण
AIRPORTS AUTHORITY OF INDIA

No: 10-C/AAI/CHQ/Tech/2022/BIS/ Dated: 06th May, 2022

To

The Bureau of Indian Standards,
Manak Bhavan,9 Bahadur Shah Zafar Marg
New Delhi – 110 002

Subject: Request for updation in Indian Standard (IS 951:2003) for Functional requirements for Crash Fire Tender for Air Fields-reg

Sir,

Reference may please be made to Indian Standard (IS 951:2003, Reaffirmed 2008) of Functional Requirement for Airfield Crash Fire Tender.

2. The Indian Standard (IS 951:2003, Reaffirmed 2008) is required to be updated to bring it in-line with the latest developments (Technological advancement) at the international level based on the following standards: -

   i. Doc 9137- AN/898 of International Civil Aviation Organization for Rescue and Fire Fighting

   ii. NFPA 414 Standard of National Fire Protection Association for Aircraft Rescue and Fire Fighting vehicles

   iii. Advisory Circular No.: 150/5220-10E of Federal Aviation Administration Specification for Aircraft Rescue and Fire Fighting (ARFF) Vehicles.

3. Accordingly, a draft Technical Specification adopted by AAI in-line with the latest developments (Technological advancement) at the international level is enclosed herewith.

Encl:
1. Indian Standard (IS 951:2003, Reaffirmed 2008)
2. Technical Specification for ACFTs of 10,000 Litres Water Tank Capacity
3. Technical Specification for ACFTs of 6,000 Litres Water Tank Capacity

Yours truly,

(R Ashok Kumar)
General Manager (Tech.)

Technical Specifications for ACFTs of 10,000 Litres Water Tank Capacity

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Para No.	**Technical Specification**	**Parameter**
4.1	**GENERAL:**	
	The ARFFVs/ACFTs shall be supplied as a complete built-up unit and have a minimum rated water capacity, for usable 10,000 litres or more of water through monitor, side lines and ground sweep nozzles/under truck nozzles with capability as given below. The primary extinguishing agent shall be Foam Concentrate with proportioning system. In addition to primary agent, there shall be complimentary extinguishing agent of a dry powder as indicated at item 4.18.	ARFFV/ACFT will be in accordance with the applicable requirement as on date of DGCA's CAR, ICAO Doc-9137 AN/898, NFPA-414, FAA - AC No.: 150/5220-10E.
4.1.1(a)	**Fully Loaded Vehicle Performance Parameters:**	
	1. Side slope stability (degrees)	30
	2. Dynamic balance (kmph), minimum speed on a (30m) radius circle	35.5
	3. Angle of approach (degrees)	30
	4. Angle of departure (degrees)	30
	5. Interaxle clearance (degrees)	12
	6. Underbody clearance (cm)	46
	7. Under axle clearance at differential housing bowl (cm)	33
	8.Diagonal opposite wheel motion (cm)	36
	9. Wall-to-wall turning diameter	<Three times the vehicle's overall length
	10. Maximum acceleration time from 0 to 80 kmph (seconds)	35
	11. Top speed (kmph)	≥110
	12. Service brake: Stopping distance	
	i. From 32 kmph	≤12 m
	ii. From 64 kmph	≤ 49 m
	iii. Percent grade holding of fully loaded vehicle:	
	a. Ascending	≥ 50 %
	b. Descending	≥ 50 %
	iv. Emergency brake stopping distance at 64 kmph	≤ 88 m
	13. Parking brake	
	i. Percent grade holding for the parking brake	
	a. Ascending	≥ 20 %
	b. Descending	≥ 20 %
	14. Steering	Centre/Off Centre/Right Hand
	15. Drive	On all wheels
	16. Fordability (mm)	≥ 608
	17. Minimum angle of Tilt (Static)	30^0
	18.Evasive maneuver test, NATO Document	40

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Para No.	**Technical Specification**	**Parameter**
	AVTP 03-16W (kph)	
	19. "J" turn test at 46 m radius (kph)	48
4.1.1(b)	**Fully Loaded Vehicle (ARFFV/ACFT-Fire Fighting Systems) Performance Parameters**	
	1. Vehicle Water Tank Capacity Minimum Usable	10,000 litres or more
	2. Water tank: Percent of deliverable water	
	a. On level ground	100 %
	b. On 20 percent side slope	85 %
	c. 30 percent ascending/descending grade	85 %
	3. Roof Turret (Monitor) discharge- at full flow	
	a. Individual flow rate of the roof turret (L/min)	≥4,500
	b. Stream pattern/distances:	
	i. Straight/far point (m)	≥85
	ii. Dispersed/far point (m)	≥ 22
	iii. Dispersed/width (m)	≥ 11
	4. Bumper Turret	
	a. Individual flow rate of the Bumper Turret (L/min)	> 950
	b. Stream pattern/distances:	
	i. Straight/far point (m)	≥ 46
	ii. Dispersed/far point (m)	≥ 15
	iii. Dispersed/width (m)	≥ 9
	5. Ground sweep nozzle	
	a. Number of nozzles	2
	b. Flow rate (L/min) Per nozzle	Refer sub Para 6 below
	c. Dispersed pattern distances:	
	i. Far point (m)	≥ 9
	ii. Width (m)	≥ 3.5
	6. Under truck nozzle	
	a. Flow rate (L/min) per nozzle	The combined flow rate of two ground sweep nozzles and four under truck nozzles should not be more than 500 liters per minute.
	b. Number of nozzles	4
	7. Number of water/foam hand lines required per vehicle	
	Pre-Connected **water/foam hand lines** (numbers), with Hose dia. 63 mm, length ≥30 metre	4
	8. **hand line**	
	a. Nozzle flow rate (L/min)	≥ 450 at 7 bar
	b. Straight stream distance (m)	≥ 25
	c. Dispersed stream pattern	
	i. Range (m)	≥ 6
	ii. Width (m)	≥ 4.5

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	d. Hose inside diameter (mm)	63
	e. Hose length (m) with instantaneous coupling	≥ 30
	9. **Reeled water/foam hand line (first aid hose reel)**	
	a. Nozzle flow rate (L/min)	≥ 230 for dual agent lines
	b. Hose length (m)	≥ 30 for dual agent line
	c. Straight stream distance (m)	≥ 20
	d. Dispersed stream pattern	
	i. Range (m)	≥ 6
	ii. Width (m)	≥ 4.5
	10. **Complementary agent- Dry Chemical Powder**	
	a. Capacity (kg)	250
	11. **Dry chemical hand line:**	
	i. Discharge rate (kg/sec)	≥ 2.5
	ii. Range (m)	≥ 7.5
	iii. Hose length (m)	≥ 30
	12. **Foam Tank usable capacity (litres)**	1300
	13. **Pump capacity**	6,000 L/min or more
	14. **Foam proportionater**	Automatic with 3%,6%& 8% preferably with Step less System
	15. Air-Conditioned Cabin (Seating Capacity including Driver)	4+1
	16. Testing and acceptance procedure:	As per AAI Technical Specifications and subsequent amendments, if any.
4.1.2.	**Chassis**	
	The chassis should be, customized for ARFFV/ACFT application, with specially designed axles (not off-set rims), with wider track (minimum width 3 meters) ensuring specified side slope stability, at the rated capacity of each axle, meeting the performance parameters as per 4.1.1. (a) above.	
4.1.3	**General Requirements**	

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4.1.3.1(a)	The ARFFVs/ACFTs shall consist of a water tank of 10,000 litres or more of usable water capacity with necessary fittings. The primary extinguishing agent shall be foam concentrate, with 3%, 6% & 8% of foam concentrate. For this purpose, a foam concentrate tank of 1300 litres usable capacity shall have to be provided.	
(b)	A midship mounted pump, either coupled with the auxiliary engine (The emission level shall be minimum Bharat Stage IV or equivalent) ***Or*** Driven of the vehicle PTO mechanically, shall be fitted, having a minimum output of 6000 L/min at suitable delivery pressure and suction lift 3 metres.	
(c)	When discharging foam solution, the pumping system shall be capable of **discharging at a rate equal to or exceeding the total requirements** of the roof turret (monitor), Bumper Turret/ two handline nozzles, ground sweep nozzles, and under truck nozzles discharging simultaneously at designed pressures.	
4.1.3.2	The ARFFV/ACFT shall be capable of the following minimum performance with the monitor mounted on the roof of cabin and two hand lines on either side.	
	An individual output of 4,500 L/min through monitor at maximum rated pressure to give throw as per 4.1.1(b) item 3 of either water or specified quality foam concentrate.	
	A minimum output of 450 L/min of foam solution to each of the handlines on either side of the ARFFVs/ACFTs to give minimum effective throw, specified for foam concentrate, of 25 metres at nozzle pressures not exceeding 7 bar and using 30 mtrs. specified hose.	
	It shall be possible to operate the monitor and two hand lines simultaneously at pump delivery pressure suitable to the rated output and throw of monitor.	
4.1.3.3	The foam concentrate induction shall be automatic with changes in output required through a combination monitor and hand lines. The ratio of foam concentrate induction shall be within a variation ± 0.5 with an induction setting from 3%, 6% & 8% ratio preferably with Step less System. The induction ratio once fixed shall maintain this limit of variation for the entire range of inductor setting. Around the pump proportionator shall be used with clearly marked induction ratios varying from 3%, 6% & 8% preferably with Step less System.	
4.1.3.4	The system of foam production from monitor and hand lines shall be so designed as to produce satisfactory quality of foam with the following minimum properties with the use of foam concentrate.	
	a. Minimum expansion ratio - 8	
	b. 25% drainage time with foam concentrate level 'A' 5 minutes minimum.	
	c. 25% drainage time with foam concentrate level 'B' 3 minutes minimum.	
4.1.3.5	It shall be possible for the ARFFV/ACFT to use water from a separate source from open source and/or an external source of water supply for prolonged use and foam concentrate supply through a pick-up tube from drums at ground level.	

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4.1.3.6	The ARFFV/ACFT shall be equipped with Ground sweep nozzles and under truck nozzles for self-protection, particularly of the wheels. This should incorporate a pressure and flow regulator as explained in Para 4.14.16.1. The angle of the front nozzle shall be so adjusted achieve performance as per 4.1.1. 5 & 6.	
4.1.3.7	The water tank, foam concentrate tank, monitor, ground sweep nozzles and under truck nozzles shall have pneumatically controlled ball valves for operation and control from within the cabin. The hand lines should have pneumatic as well as manual control. All pneumatic control system shall be used with air supply at pressures available from the vehicle air brake system. The vehicle air brake shall be tapped so that a minimum air pressure required for the operating vehicle is available all the time and the pneumatic control fire operation actuates when the air pressure in the systems exceeds this minimum level. . In case of any leakage in the pneumatic control system the vehicle operation shall not be adversely affected. Opening and closing valves to the monitor and to the pump shall be achieved through operation of pneumatic/electro-pneumatic controls from the cabin as well as from Panel Board. Panel boards should be provided on both sides of the ARFFV/ACFT. Manual control should be provided for operation in case of failure in pneumatic control.	
4.1.3.8	The appliance shall be complete with all accessories and essential operating spares and tools. Where specific items are not required to be supplied suitable arrangement shall be made for stowage and secure location of such items to suit the ARFFV/ACFT role. All locking and securing devices shall be of sufficient strength, reliability and shall be of quick opening and closing type for removal of accessories and other items without loss of time.	
4.1.3.9	All items where standard specification does not exist, best available commercial quality as approved by the inspection authority shall be supplied.	
4.1.3.10	The unit shall be designed to be as compact as possible complete with ease of accessibility to all sub systems for maintenance and repairs. The pump or foam making equipment and controls shall be so arranged that one man can operate foam concentrate, main water line, ground sweep/under truck nozzle and monitor valves from the driver's compartment and foam concentrate, main water line and side delivery from the mid-ship mounted control panel.	
4.1.4	**MATERIAL SELECTION AND TREATMENT**	
4.1.4.1	Material used for construction of the appliances shall be new, unused and free from all defects and imperfection that might affect the serviceability of the finished product. These shall be selected with a view to combine lightness with strength and durability.	
4.1.4.2	Materials used in the assembly and components shall be of high strength to weight ratio where practicable to effect saving in dead weight and thereby increase the payload capacity. Use of dissimilar Materials in contact with each other which tends towards electrolytic corrosion shall be avoided.	
4.1.4.3	The appliance is intended for use in tropical conditions with continuous high humidity and heat and also in coastal area. This fact shall be given full consideration while selecting material and for this reason use of rubber shall be avoided as far as possible. Wherever, it is unavoidable to use rubber the parts made out of it shall be readily available.	

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4.1.4.4	The **material** used for superstructure should **be non-corrosive and guaranteed** against any sort of deterioration, deformation, ageing and corrosion for a minimum period of **twelve years**. This being one of the important criteria for evaluation, the exact material to be used, its detailed technical specification and the relevant standards to which such material conforms should be clearly stated.	
4.1.4.5	**Timber** shall not be used in body construction.	
4.1.4.6	All parts, which form waterways or come into contact with foam concentrate, shall be of non-corrosive material. All metal pipelines shall be hot dip galvanized after complete fabrication. All parts exposed to atmospheres shall be made of non-corrosive material. All ferrous fasteners shall be galvanized/chrome plated to avoid rusting over prolonged use.	
4.2	**WEIGHTS AND DIMENSIONS:**	
4.2.1	The actual gross vehicle weight (weight of fully staffed, loaded and equipped vehicle) shall not exceed maximum permissible limit weight of chassis specified by the manufacturer.	
4.2.2	The weight shall be distributed as equally as to be Demonstrated Practically over the axles and tyres of the vehicle. The difference of weight between tyres on any axle shall not exceed 5% of the average weight on tyre for that axle, and the difference in weight between axles shall not exceed 10% of the weight of the heaviest axle. Under no circumstances shall axle and tyre manufacturers rating be exceeded.	
4.2.3	The centre of gravity of the vehicle shall be kept as low as possible under all conditions of loading.	
4.2.4	**DIMENSIONS:**	
4.2.4.1	Dimensions and other performance requirements are as per table 4.1.1 (a) & (b)	
4.2.4.2	Overall height, length and width shall be kept to a minimum consistent with the best operational performance of the vehicle and the design concept needed to achieve this performance and to provide optimum maneuverability and **facilitate movement on airports.**	
4..2.4.3	The vehicle shall be constructed such that a seated driver shall be able to see the ground 6 Meter ahead of the vehicle and minimum 15 degree above the horizontal without leaving seat. The vision in the horizontal plane shall be 90 degree on each side from the straight position on a full forward control.	
4.2.4.4	Adjustable rear-view mirrors with a glass area of not less than 385 sq. cm. shall be provided on each side of vehicle. Each shall be provided with a minimum of 45 sq. cm area wide-angle convex mirrors.	
4.3	**ENGINE:**	
4.3.1	**PERFORMANCE REQUIREMENTS**	
4.3.1.1	The vehicle's engine (s) shall be HSD (High Speed Diesel) driven, and shall have minimum power output of **485 KW/650 hp**, torque and speed characteristics to meet and maintain all vehicular performances specified in this standard. The vehicle's engine (s) shall be certified by the engine manufacturer for the ARFFV/ACFT application. **In addition, Provision for open canopy for engines and incorporation of brushed or brushless alternator should be made.**	
4.3.1.2	Fully laden vehicle shall consistently be able to accelerate maximum speed, as specified, with the engine and transmission at their normal	

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	operating temperature at any ambient temperature varying from 0^0 C to 50^0 C and at elevation up to 600 meters above mean sea level.	
4.3.1.3	The vehicle shall also be capable of ascending, stopping, starting and continued ascent on a 40% grade on dry pavement at a minimum speed of 1.6 kmph with extinguishing agents being discharged at maximum rated capacity from the turret.	
4.3.1.4	The emission level shall be minimum Bharat Stage IV or equivalent. Type approval certificate or equivalent certificate relevant to emission norms of engine offered, issued by any regulatory authority with up to date amendments shall be submitted by the bidder. OEM of engine(s) shall submit a certificate conforming emission level meets minimum Bharat Stage BS IV or equivalent. ***Note:*** The Engine offered should comply the emission norms prescribed by Govt. of India with up to date amendments.	
4.3.1.5	The ARFFV/ACFT weight (kg) to engine power ratio (kW) plays an important role, in achieving **response time** of two minutes, as specified in ICAO documents. **The constructor of ARFFVs/ACFTs shall certify the achievable acceleration of 80 kmph in < 35 seconds up to minimum 12 years of use of ARFFVs/ACFTs.**	
4.3.1.6	The vehicle will be capable of operating safely on paved roads, graded gravel roads, cross country terrain, and sandy soil environments. Cross country terrain consists of open fields, broken ground, and uneven terrain. An off-road, high-mobility suspension system resulting in no more than 0.5 G_{rms} acceleration at the driver's seat of the vehicle when traversing an 8-inch (20 cm) diameter half round at 35 mph (56 kph) must be provided. The suspension design by which the manufacturer meets the suspension performance requirements is at the manufacturer's discretion.	
4.3.2	**ENGINE COOLING:**	
4.3.2.1	Engine shall be liquid cooled so that stabilized cylinder head and oil temperature remain within the engine manufacturer's prescribed limits under all operational conditions and all ambient temperatures between 0^0 (degree) Centigrade and 50^0 C.	
4.3.3	**FUEL SYSTEM:**	
4.3.3.1	Fuel system shall qualify engine manufacturer's requirements and shall include fuel pump, fuel filtration and flexible fuel lines, well protected from damage, exhaust heat and ground fires.	
4.3.3.2	Accessible filtration shall be provided for each fuel supply line and a drain shall be provided at the bottom of the fuel tank.	
4.3.3.3	Gravity feed fuel tanks are not acceptable.	
4.3.3.4	Fuel tank capacity shall be 200 litres or more to achieve a minimum of 48 km of highway travel at 90 kmph plus 2 hours of pumping at the full rated discharge.	
4.3.4	**EXHAUST SYSTEM:**	
	The size of exhaust system shall be such that undue back pressure is not generated and under no circumstances exhaust gases enter the cabin. The system shall be of high grade, rust resistant material.	
4.3.4.1	Exhaust system shall be designed so as to protect it from damage that could result from rough terrain. Tailpipe of exhaust system shall be designed to	

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	discharge upwards or to the rear of the vehicle and not towards ground nor towards panel operator.	
4.3.4.2	The exhaust system shall include a muffler to reduce engine noise.	
4.3.5	**VEHICLE ELECTRICAL SYSTEM:**	
4.3.5.1	The vehicle shall be provided with 12/24 volts electrical system and starting.	
4.3.5.2	The electrical system shall have negative ground including alternator and voltage regulator. Alternator shall be at 100% of anticipated load at 50% engine speed, and shall be, of belt driven.	
4.3.5.3	The curb idle minimum-charging rate of the alternator shall be 30 Amps.	
4.3.5.4	Batteries shall be secured and well protected from against physical injury, vibration, and water sprays and engine and exhaust heat. When an enclosed compartment is provided for batteries, it shall be well ventilated and batteries shall be easily accessible for examination, test and maintenance.	
4.3.5.5	The circuits shall be so designed that at no stage of operation overloading, overheating or short-circuiting and fluctuation of voltage is experienced.	
4.3.5.6	A built-in battery charger shall be provided on the vehicle to maintain full charge on all batteries. Grounded AC receptacle shall be provided to permit a drive away plug connection from external electric power supply to battery charger.	
4.3.5.7	An engine coolant/preheating device shall be provided as an aid to rapid starting and high initial engine performance.	
4.3.5.8	The electrical system shall be insulated, waterproofed and protected against exposure from ground fires.	
4.3.5.9	The effect of electromagnetic field of all electrical systems of Radio sets shall be suppressed so that it does not interfere with functioning of radio sets.	
4.4	**VEHICLE DRIVE:**	
4.4.1	Transmission of power from engine to wheels shall be through a torque converter and fully automatic transmission, having designed input rating parameters to maintain the operational performance during minimum period of 10 years of use, with provision of crawling as per Para 4.12.5.2, without application of brakes. The entire drive train shall be designed to have sufficient capacity to slip the wheels of the static loaded vehicle on surface having a coefficient of friction 0.8. A range of gears providing the specified top speed and a grade-ability of 50% shall be provided with sufficient intermediate gears to achieve the specified acceleration.	
4.4.2	A transmission cooling system shall be provided and designed so that the stabilized transmission oil temperature remains within the transmission conditions and at all ambient temperatures.	
4.4.3	**The transmission shall be matched to the engine properly, and shall be approved by transmission manufacturer, for the ARFFV/ACFT application.**	
4.4.4	The provision of positive drive to each wheel by means of a fully locked drive line shall be required in order to maximize traction on low friction surfaces. Positive drive may be achieved either by the use of automatic locking and torque proportioning differentials, or may be manually selectable by the seated driver, while the vehicle is in motion, by use of a single control.	

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4.4.5	All wheel drive on these vehicles shall incorporate a drive to the front and rear axles, which are engaged at all times during use. An interaxle differential shall be installed with automatic or driver selected means of differential locking.	
4.4.6	Front and rear axles shall have adequate capacity to carry the maximum imposed load under all intended operating conditions. The variations in axle track shall not exceed 20% of the tyre sectional width at rated load.	
4.5	**SUSPENSION:** The suspension system shall be designed to permit the loaded vehicle to:	
	a) Travel at the specified speeds over improved surface;	
	b) Travel at moderate speeds over unimproved surface;	
	c) Provide diagonally opposite wheel motion 360 mm above ground obstacles without raising the remaining wheels from the ground.	
	d) Provide at least 50mm of axle motion before bottoming of the suspension on level ground;	
	e) Prevent damage to the vehicle caused by wheel movement; and	
	f) Provide a good environment for the crew when traveling over all surfaces.	
4.5.1	**RIMS, TYRES AND Wheels:**	
4.5.1.1	Tyres shall be selected to maximize the acceleration speed, braking and manoeuvring capabilities of the vehicle on paved surfaces without sacrificing performance on all reasonable terrains found within/ outside the airport boundary.	
4.5.1.2	Tyres size shall be suitable to optimize floatation under soft ground conditions. The lowest tyre pressure shall be compatible with the high-speed performance requirement as specified in table 4.1.1 (a) & (b)	
4.5.1.3	All wheels on the vehicle shall be of the **single wheel type** with all rims, tyres and wheels of identical size and same tread design.	
4.5.1.4	Rims, tyres, wheels, and inflation pressures shall be approved by the respective manufacturers as having sufficient capacity to meet the specified performance, **and shall be certified for not less than 40.23 Kms (25 mi) of continuous operation at 96.5 Kmph (60 mph) at normal operating pressure.**	
4.5.1.5	Size of tyre should be such to meet all vehicular performances.	
4.6	**TOWING CONNECTIONS:**	
4.6.1	Four large tow eyes or tow hooks, capable of towing the vehicle without damage, shall be mounted, two at the front and two at the rear of the truck and attached directly to the frame structure (chassis)	
4.7	**BRAKES**	
4.7.1	The braking system shall feature service, emergency and parking brake systems. Service brakes shall have power actuation through air, hydraulic or air over hydraulic. **Calliper disc brakes shall be furnished**. A brake chamber shall be provided for each wheel and shall be mounted so that no part of the brake chamber projects below the axle. **ABS (Anti-locking Brake System)** braking system shall be provided.	

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4.7.2	Service brakes shall be of the all-wheel type with split circuits so that failure of one circuit shall not cause total service brake failure, and shall be able to hold fully loaded vehicle on a 50% grade.	
4.7.3	The service brakes shall have stopping distances as per 4.1.1. (a) on a dry hard appropriately level road way, free from loose materials, and sufficiently wide roadway without any part of vehicle leaving roadway.	
4.7.4	The service brakes shall provide one power assisted stop with the vehicle engine inoperative, for the stopping distances specified above.	
4.7.5	An emergency brake system shall be provided which is applied and released by the driver from the cab and is capable for modulation, by means of the service brake control.	
4.7.6	The parking brake shall be capable of holding the fully loaded vehicle on a 20% grade without air or hydraulic assistance.	
4.7.7	**Brakes–Air System**	
4.7.7.1	When the vehicle is supplied with air brakes, air compressor shall meet following criteria:	
	The compressor shall be engine driven;	
	The compressor shall have sufficient capacity to increase air pressure in the supply and service reservoirs from 586.1 kPa to 689.5 kPa (85 psi to 100 psi) when the engine is operating at the vehicle manufacturer's maximum recommended revolutions per minute (rpm) in a maximum of 25 seconds.	
	The compressor shall have the capacity for quick build-up from 0 kPa (0 psi) to release spring brakes, and this build-up in pressure shall be accomplished within 15 seconds.	
	The compressor shall incorporate an automatic air-drying system immediately downstream from the compressor to prevent condensation build-up in all pneumatic lines.	
4.7.7.2	Service reservoirs shall be provided. The total of the service reservoir volume shall be at least 12 times the total combined brake chamber volume at full stroke. If the reservoir volume is greater than the minimum required, proportionately longer build-up time shall be allowed using the following formula; $\frac{\text{Actual reservoir capacity X 25}}{\text{Required reservoir capacity}}$	
4.7.7.3	Reservoirs shall be equipped with air pressure regulator, drain and safety valves.	
4.7.7.4	Provision for charging of air tanks by a drive away electrical connection used to power a vehicle mounted auxiliary compressor would be provided.	
4.7.7.5	A drive away air connection for charging of air tanks from an external air source shall be provided.	
4.7.7.6	Visual and audible low air pressure warning devices shall be provided. The low-pressure warning device shall be visual and audible from the inside, and audible outside of the vehicle.	
4.7.7.7	Provision of pneumatic service outlets for inflating tyres shall be made from air compressor of ARFFV/ACFT, with a high-pressure charging tube of 30 mtrs. and nozzle. A separate provision of pneumatic service outlet for inflating pneumatic bags shall also be made from air compressor of ARFFV/ACFT.	

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4.7.7.8	Air leakage from pressure system shall not exceed 0.5 Kg. /sq. cm. per hour so that at no stage the air pressure should reduce less than brake operating pressure in 8 hours.	
4.8	**STEERING**	
4.8.1	The chassis shall be equipped with power assisted steering with direct mechanical linkage from the steering wheel to the steered axle(s) to permit the possibility of manual control in the event of power assist failure.	
4.8.2	The power steering shall have sufficient capacity to allow turning the tyres stop to stop with the vehicle stationary on a dry level, paved surface and fully loaded, with not more than 7 kg. pull on wheel.	
4.8.3	The wall-to-wall turning diameter of the fully laden vehicle shall be less than three times the vehicle length.	
4.8.4	Vehicle shall be designed for Centre/Off Centre Right/Right Hand Drive system so that driver's Left hand is free for operations controls.	
4.9	**CABIN**	
4.9.1	The cabin shall be mounted on the forward part of the vehicle and shall provide seating for 5 persons including Driver. The seating arrangement shall be; 2 adjustable seats and a long or separate seat (s) for three crewmembers with provision of stowage of fully assembled BA set suitably located to the backrest with quick release system so that it can be worn in running vehicle. In addition, there shall be instrument panel and equipment as specified without any hindrance to crew.	
4.9.2	The cab shall meet the visibility requirements of 4.2.4.3. The windshield (single piece) shall be shatterproof safety glass, and all other windows shall be constructed of approved safety glass. The cab shall be provided with wide gutters to prevent foam and water dripping on the windshield and side windows. There shall be enough space to keep and to enable the crew except driver to put on protective clothing and B.A. set while on way to a call. Two doors (01 doors each on LHS & RHS respectively) are to be provided to the cabin, with ECE R29 or equivalent test compliance which should be openable at 90 degrees for easy ingress and egress of crew. In case of specially designed cabin with two doors the design should allow easy entry and exit of the crews in the rear row(s) without disturbing the crews of front row and a Centre/Off Centre Right/Right Hand steering system shall be provided. A rear-view camera with a monitor at the panel shall be provided. The cab design shall take into consideration the provision of ample space for the crew to enter and exit the cab and carry out normal operations while wearing full protective equipment. This design will be considered only in case of engine is not housed within the cabin. In case the turret (monitor) having manual controls above the cab roof is provided, the cab shall be designed with a quick-access passage to the turret (monitor). Time required for mounting of the crews into the cabin from close-up position shall be less than or equal to 10 Seconds.	
4.9.3	The cab shall be weatherproof, and shall be fully insulated thermally and acoustically with a fire-resistant material. The cab may be of the unitized rigid body and frame structure type or it may be a separate unit flexibly mounted on the main vehicle frame. The cab shall be constructed from non-corrosive materials that provide lightest weight consistent with adequate strength to ensure a high degree of safety for the crew under all operating conditions including excess heat exposure, and in the event of a vehicle rollover accident. The material should also be guaranteed against	

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	any sort of deterioration, deformation, ageing and corrosion for a minimum period of **twelve years**.	
4.9.4	**INSTRUMENTS, WARNING LIGHTS AND CONTROLS**	
4.9.4.1	The minimum number of instruments, warning lights and controls consistent with safe and efficient operation of the vehicle, chassis, and firefighting system shall be provided. All chassis instruments and warning lights shall be grouped together on a panel in front of the driver. All firefighting system instruments, warning lights, and controls shall be grouped together by function so as to provide ready accessibility as well as high visibility for the driver as well as a crewmember sitting in the co-driver seat. Electronic controls have pneumatic and/or manual override wherever possible.	
4.9.4.2	All instruments and controls shall be illuminated, with back lighting to be used where to be demonstrated Practically.	
4.9.4.3	Groupings of both the chassis and firefighting system instruments, warning lights and controls shall be easily removable as a unit or be on a panel hinged for back access by the use of quick disconnecting fittings for all electrical, air and hydraulic circuits.	
4.9.4.4	The following instruments, or warning lights, or both shall be provided as a minimum;	
	a. Speedometer/Odometer	
	b. Engine(s) tachometer	
	c. Fuel level with audio warning	
	d. Air pressure	
	e. Engine(s) temperature	
	f. Engine(s) oil pressure	
	g. Voltmeter(s)	
	h. Oil temp. gauge light	
	i. Transmission(s) oil temp.	
	j. Pump(s)pressure,	
	k. Water tank level Gauge	
	l. Foam tank level Gauge	
	m. Low air pressure warning	
	n. Headlight beam indicator	
	o. Trafficator light	
	p. Hazard warning light	
	q. PTO engagement light.	
	r. Pump hour meter	
	s. Water control Valve	
4.9.4.5	The cab shall have all the necessary controls within easy reach of the driver for the full operation of the vehicle and the pumping system. The following cab controls shall be provided.	
	a. Accelerator	
	b. Parking brake control	
	c. Steering wheel, with directional signal control & horn	
	d. Brake pedal	
	e. Transmission range selector	
	f. Pump control or selector/P.T.O.	
	g. Foam control	
	h. Siren switch(es)	

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	i. Auxiliary agent control	
	j. Ground Sweep/ Under truck nozzle control	
	k. Roof Turret controls	
	l. Bumper Turret Controls	
	m. Light switches	
	n. Windshield wiper and washer controls	
	o. Heater-defroster controls	
	p. Master electrical switch (Isolator Switch)	
	q. Engine start/stop control	
	r. Windshield deluge system switch.	
	s. Water Tank Main valve control	
	t. Side delivery ON/OFF valve	
4.9.5	**EQUIPMENT**	
4.9.5.1	The following minimum equipment shall be provided in or on the cab.	
	a. Heater/defroster	
	b. Driver's suspension seat with vertical, fore and aft adjustment, with seat belt	
	c. Crew seats with individual retractable seat belts and grip hand rails.	
	d. Windshield washers appropriate for removing foam	
	e. Windshield wipers appropriate for removing foam	
	f. Siren	
	g. Horn	
	h. Sun visors, interior transparent	
	i. Outside rear view mirrors, as specified in 4.2.4.4	
	j. Interior lighting	
	k. P.A. System with Microphone as per 4.20.1	
	l. R.T. Set (VHF-AM) as per 4.17	
	m. Self-Contained Breathing Apparatus (SCBA) mounting bracket for crew members excluding driver.	
	n. Wind shield deluge system.	
	o. Storage space for four Nos. of Proximity suit boxes in driver's cabin.	
	p. DEVS as per 4.10	
	q. Rear view camera with a monitor at the panel.	
4.10	**DRIVER'S ENHANCED VISION SYSTEM**	
4.10.1	Provision for future installation, for a driver's enhanced vision system (DEVS), in the Cab, for ARFFV/ACFT position on a moving map display.	
4.10.2	Provision for Future Installation of Low Visibility Enhanced Vision System consisting of a FLIR Camera, Monitor and controlling devices so as to provide assistance to operator in driving under low-visibility conditions, shall be made in the ARFFVs/ACFTs.	
4.10.3	The installation should not obstruct driver view or hamper any other ARFFV/ACFT vehicle system including Monitor System. The system also be installed without any extensive vehicle modification and should include a dedicated vehicle voltage spikes & surge.	

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4.11	**BODY**	
4.11.1	The body shall be constructed of non-corrosive materials that provide the lightest weight consistent with the strength necessary for off pavement operation over rough terrain and when exposed to excess heat. The material should also be guaranteed against any sort of deterioration, deformation, ageing and corrosion for a minimum period of **twelve years.** The body may be of the unitized with chassis rigid structure type or it may be flexibly mounted on the vehicle chassis. It shall also include front and rear fenders or wheel wells; body panels shall be removable where necessary to provide access to the interior of the vehicle.	
4.11.2	Access doors shall be provided for those areas of the interior of the vehicle, which must be frequently inspected. In particular, access doors of sufficient size and number shall be provided for access to;	
	a. Engine	
	b. Pump	
	c. Fluid reservoirs	
	d. Foam proportioning system	
	e. Battery storage	
	f. Engine oil level indicator(dipstick)	
4.11.3	Suitable, lighted compartments shall be provided for storage of equipment and tools to be carried on the vehicle. Compartments shall be watertight and self-draining. The compartments shall not house any other equipment and shall be free from projections. **(List of equipment's is enclosed in Appendix – A)**	
4.11.4	The working deck of the vehicle shall be adequately reinforced to permit the crew to perform their duties in the turret area, water tank top fill area, foam liquid top fill area, and in other areas where access to auxiliary or installed equipment is necessary.	
4.11.5	Handrails or bulwarks shall be provided where necessary for the safety and convenience of the crew. Rails and stanchions shall be strongly braced and constructed of a material which is durable and resists corrosion.	
4.11.6	Steps or ladders shall be provided for access to the top fill area. The lowermost step(s) may extend below the angle of approach or departure or ground clearance limits if it (they) is/are designed to swing clear. All other steps shall be rigidly constructed. All steps shall have a non-skid surface with at least 150 mm toe room. Lowermost step(s) shall be not more than 558.8 (22 in.) mm above level ground when the vehicle is fully laden. Adequate lighting shall be provided to illuminate steps and walkways.	
4.11.7	A heavy-duty front bumper shall be mounted on the vehicle and secured to the frame structure.	
4.11.8	Paint finish shall be 'FIRE-RED' in colour and shall be resistant to damage from firefighting agents.	
4.12	**FIRE FIGHTING SYSTEMS AND AGENTS**	
4.12.1	Foam concentrate shall be used as primary extinguishing agent and dry powder (Class B and Class C Type fire) as complimentary agent.	
4.12.2	Foam system shall be proportioning type system and the separate foam concentrate tank shall be provided on the vehicle.	
4.12.3	All components of foam system including liquid tank, piping fill troughs screens, valves and delivery connections shall be made of non-corrosive material.	

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4.12.4	**Agent Pump and Drives**	
4.12.4.1	The water pump shall be made up of corrosion resistant material/suitable alloy compatible with foam concentrate with stainless steel shaft suitable for use with **Brackish Water** and shall be single or multiple stage centrifugal type, designed for dependable emergency service. The vehicles tank and the piping shall be designed to eliminate entrapment of air. The pump shall also be supported with independent automatic priming system. It shall be accessible and readily removable for repair and maintenance. Drain valves shall be provided at suitable location for draining water from the pump casing and piping.	
4.12.4.2	While discharging foam solution, the pumping system shall be capable of discharging at a rate equal to or exceeding the requirements of the roof turret (Monitor), ground sweep nozzles, hand line nozzles, and under truck nozzles, discharging simultaneously at designed pressures.	
4.12.4.3	Pump shall be single/double/multistage and closed impeller type where impeller(s) is dynamically balanced to reduce end thrust. Appropriate seal shall be provided capable of running dry for minimum **01 minute** without damage.	
4.12.4.4	The pump shall be mid ship mounted. Pump control panel shall be located on either side of appliance in addition to that positioned at the cab.	
4.12.5	**Pump Drive**	
4.12.5.1	The pump drive shall permit operation of pump and simultaneous operation of vehicle and shall not be affected by transmission ratio or clutch operation. The design of drive system shall prevent damage and minimize lurching of vehicle during simultaneous operation and shall be capable of absorbing maximum torque delivered by engine to the pump under all speeds of engine and vehicle, without causing any stalling of engine and fluctuation of pressure. **A separate modules/Fuse box to avoid any malfunctioning in pump compartment to be provided.**	
4.12.5.2	The drive shall permit discharge at rated capacity of pump during vehicular speed from 0 kmph to a maximum of 16.1 kmph in forward and 0 kmph to a maximum of 8 kmph in rearward direction. During shifting from forward to rearward drive, the pumping system shall maintain the pre-set discharge pressure.	
4.12.6	**SUCTION AND DELIVERY CONNECTION**	
4.12.6.1	The suction inlet and delivery outlets of the pump shall be fitted on the pump control panels side on both sides of the appliance.	
4.12.6.2	The suction connection shall be provided at suitable location in standard round thread of **125 mm diameter** and shall be corrosion resistant. The location of suction inlet should be at lowest possible height preferably not exceeding one meter from ground level. The inlet shall be provided with Chromium plated brass blank cap.	
4.12.6.3	Delivery outlet connection shall be provided at suitable locations, operable from panel board in standard **63 mm female** instantaneous standard couplings.	
4.12.7	**PIPING, COUPLING AND VALVES**	
4.12.7.1	All piping, couplings and valves shall be made of material, conforming to relevant international standard, to prevent corrosive and galvanic action.	
4.12.7.2	All valves shall be quarter-turn-type in manual operation and shall be easy in operation and free from leakage.	

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4.12.7.3	All piping shall be tested for leakage at 50% above the maximum pressure developed by the pump in no flow condition.	
4.12.7.4	Arrangement should be made to prevent overheating of pump at zero discharge.	
4.12.7.5	A drainage system with collector tubing from the low points on pump and piping shall be provided, operable with quarter turn valve.	
4.12.7.6	All plumbing shall be reasonably accessible for maintenance purposes. Drain cocks shall be provided where necessary and controls for these shall be readily accessible and so arranged as to prevent the cocks from being opened by vibration. The direction in which the valve/cock opens/closed shall clearly be marked near each valve/cock.	
4.13	**WATER TANK**	
4.13.1	Water tank shall have capacity as per 4.1.1(b). The tank outlets shall be arranged in such a way that Water tank percent of deliverable water is available as per 4.1.1(b)-2	
4.13.2	The tank shall be constructed to resist all forms of deterioration that could be caused by the water and the foam concentrate while affording the structural integrity necessary for off-road operation. Tank shall be made of Glass fibre Reinforced Polyester (GRP)/ Glass Reinforced Plastic/ Polypropylene conforming to relevant international standard with suitable longitudinal and traverse baffles to prevent surging, which shall permit easy access for internal inspection.	
4.13.3	The tank shall be provided with hinged lid, a top filling hole with filter of 450 mm size and a drain hole at the bottom.	
4.13.4	Over flow piping shall be arranged in such a way that it releases pressure on overfilling without wasting water during vehicles manoeuvres.	
4.13.5	The water tank shall be separate from crew compartment, chassis, engine, and easily removable, and shall be mounted on chassis in a manner that the torsional strains during movement are minimum.	
4.13.6	Two external tank fill connection shall be provided both side near operating panel, in standard 63 mm instantaneous coupling, with strainers and ball valve. The filling connection inside the tank shall discharge water just below the upper plate of the water tank.	
4.13.7	A direct filling (pump to tank using own pump) connection shall also be provided to fill the tank from open source of supply and shall be sized so as to fill the tank at 5 bar pressure.	
4.13.8	Arrangement for lifting the tank without damage should be provided for repair and maintenance etc.	
4.13.9	Main tank valve shall be operated from cabin as well as from control panel. In addition, manual override shall be provided for tank opening valve at side control panel. This valve shall have accessible control.	
4.14	**FOAM TANK**	
4.14.1	Foam concentrate tank shall have usable capacity of not less than 1300 litres or sufficient for more than two refills for water tank.	
4.14.2	Tank shall be made Glass fibre Reinforced Polyester (GRP)/ Glass Reinforced Plastic/ Polypropylene conforming to relevant international standard.	
4.14.3	The tank shall be separate and distinct from the body flexibly mounted on chassis to receive minimum torsional forces during vehicles movements and easily removable as a unit and should be suitably baffled to prevent	

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	surging. (The water and foam tank can be together with compartments or separate as per standard design of the manufacturer)	
4.14.4	The manhole of the tank size not less than 250 mm size shall be used for foam concentrate filling and shall be clearly marked '**FOAM CONCENTRATE**'. The tank shall be vented adequately to allow rapid and complete filling without the build-up of excessive pressure and to allow emptying of the tank at the maximum design flow rate without danger of collapse. The vent outlets shall be directed to the ground to prevent spillage of foam concentrate on vehicle components.	
4.14.5	The foam concentrate draw off tube shall be positioned in such a manner that foreign matter or sludge shall not pass into the compound lines. The draw off tube shall be fitted with gauge strainer of corrosion resistant material.	
4.14.6	Drain hole at the bottom of sump and a liquid induction connection shall be provided in the tank.	
4.14.7	Filling hole with a trough on top shall be connected with a pipe reaching at the bottom to avoid aeration in the liquid.	
4.14.8	**FOAM FILLING**	
4.14.8.1	The tank fill connection(s) shall be provided in a position where it can be reached easily from the ground to allow the pumping of foam-liquid compound into the storage tank. The connection(s) shall be provided with strainers of 6.4 mm mesh and shall have check valves or shall be constructed so that foam is not lost from the tank when connection or disconnection is made.	
4.14.8.2	Provision of foam concentrate filling from open source at ground level by foam concentrate filling pump shall be available with independent power drive.	
4.14.9	All pipe lines shall be made of non-corrosive material and dissimilar materials that produce galvanic corrosion shall not be selected. Where plastic piping is used, it shall be fabricated from un-plasticized resins unless the plasticizer has been provided not to adversely affect the performance characteristics of foam.	
4.14.10	All foam concentrate piping shall be adequately sized to permit flow and shall be arranged to prevent water entering the foam tank.	
4.14.11	Automatic foam concentrate proportioning arrangements shall be provided with 3%, 6% and 8% induction ratio preferably with Stepless System, for varying discharge rates and shall not require frequent calibration.	
4.14.12	**FOAM PROPORTIONING SYSTEM**	
4.14.12.1	The foam concentrate proportioning system shall provide a means of controlling the ratio of foam concentrate to the quantity of water in the foam solution being discharged from all orifices normally used for aircraft fire-fighting operations.	
4.14.12.2	The proportioning system shall be sufficiently accurate to provide for the discharge of finished foam concentrate within the range specified in Standard for Evaluating Aircraft Rescue and Fire-Fighting Foam Equipment.	
4.14.12.3	Control shall be provided at suitable location to open the foam concentrate tank from cabin as well from control panel operated pneumatically with manual override. This valve shall have accessible control.	

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4.14.13	**ROOF TURRET (MONITOR)**	
4.14.13.1	One power driven Roof Turret (Monitor) shall be provided on the rooftop of cabin so that it can be operated by a member of crew from within the cabin of ARFFV/ACFT. The system should be capable of being operated manually from within the cabin or rooftop in case of failure in power assisting mechanism. Where equipped with a turret (monitor) having manual controls above the cab roof, the cab shall be designed with a quick-access passage to the turret (monitor). The monitor should have dual flow rate i.e. 100% and 50% with a suitable selecting mechanism at the monitor control and easily operable by the operator. **The size of the manual override wheel of roof turret should be adequate for easy access.**	
4.14.13.2	Monitor shall be capable of traversing 270^0 horizontally and elevating not less than 45^0 from horizontal axis and depression of 15^0 to deliver foam at ground level not more than 12m ahead of the vehicle. The locking position shall be facing front side. The monitor should not lose control in case assistance is lost during the operation and should remain in operation at same position awaiting manual operation.	
4.14.13.3	Monitor shall be capable of discharging total rated water tank quantity in not more than two and half minute and shall have a means provided for deflective pattern of foam dispersal. The discharge rate of monitor shall not be less than 4500 L/min at maximum rated pressure with expansion ratio of minimum 1:8 by using foam concentrate.	
4.14.13.4	Range of throw shall be as per 4.1.1 (b) 3 - roof turret discharge.	
4.14.14	**HAND LINES**	
4.14.14.1	In addition, one first aid hose reel connection shall also be provided with ≥30 mtrs. rubber hose with a pistol grip type nozzle conforming to JCDD 25 (which can be used as spray and hollow jet), with discharge capacity of 230 L/min at operating pressure.	
4.14.14.2	Each side line shall have minimum discharge capacity of 450 L/min at 7 bar pressure on FB 10 EX branch with an expansion of not less than 8 and minimum throw of 25 mtrs. when either, all foam hand lines are used simultaneously (with monitor not operating) or two of them are used in combination with monitor.	
4.14.14.3	Complementary agent (Dry Powder) hand lines shall have open/close nozzle discharge rate of more than 2.5 kg/second with 7.5 mtrs range. The nozzle should be made of non-ferrous metal or stainless steel.	
4.14.14.4	An automatic Pressure & Flow regulator shall be provided for the side line to enable the monitor to operate at the optimum pressure to give rated capacity for delivery, throw and expansion etc while maintaining the pressure of 7 bar pressure at the side line delivery. A bypass valve operable by 90^0 turn of a lever shall be provided to the automatic pressure regulator to facilitate availability of higher delivery pressure and flow whenever needed.	
4.14.14.5	The monitor shall operate at the optimum rated capacity for delivery, throw and expansion etc. while operated in combination with:	
	All the ground sweep nozzles and under truck nozzles	
	Two side delivery	
4.14.14.6	ARFFV/ACFT shall have two side lines on each side, operational from cabin and panel both with manual override.	

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4.14.15	**FOAM CONCENTRATE QUALITY:** Turret (Monitor) and hand lines shall be capable of producing foam from foam concentrate solution in the specified ratio of 3%, 6% & 8% preferably with Stepless System.	
4.14.16	**GROUND SWEEP AND UNDER TRUCK NOZZELS**	
4.14.16.1	Two Ground Sweep nozzles shall be provided at the front having performance as per 4.1.1(b)- 5&6 Optimum working pressure 6 bar. Four under truck nozzles shall be provided to protect under side of vehicles, tyres and wheels. Ground sweep/ Under truck Nozzles valve shall be controlled from cabin interior within easy reach of driver and a crewmember. An automatic Pressure & Flow regulator shall be provided for the ground sweep/ Under truck Nozzles to enable the monitor to operate at the optimum pressure to give rated capacity for delivery, throw and expansion etc., while maintaining the required pressure and flow for the ground sweep/Under truck nozzles.	
4.14.17	**BUMPER TURRET**	
4.14.17.1	A power-driven bumper turret shall be provided. Flow rate shall not be less than 950 L/min. The throw range shall not be less than 46 metres. An aspiration barrel and deflector shall be provided. A foam expansion of not less than 1:8 with foam concentrate shall be achieved. The monitor shall be electronically controlled by a joystick within reach from driver and co-driver.	
4.14.17.2	An automatic oscillating mode shall be provided, horizontal and vertical range shall be programmable. When bumper monitor is in operation simultaneously with roof monitor, roof monitor flow rate shall automatically reduce to 70% of full flow rate.	
4.15	**PRIMER**	
4.15.1	A suitable primer shall be provided along with pump, which shall have both automatic and manual engagement/ disengagement provisions	
4.15.2	Primer shall be capable of priming a suction column with 7.3 mtrs lift in less than 30 second with indicator, with **125 mm suction hose diameter**.	
4.16	**LIGHTS AND ELECTRICAL SYSTEM**	
4.16.1	Following electrical gadgets shall be provided:	
	a. Siren of ≥ 95 decibel sound output at **100 feet** ahead and not less than 90 decibels at 90 degree either side at a distance of 100 feet, siren shall be mounted on cabin roof top and shall be fully protected from foam spills, rain water, dust and any damage due to monitor rotation.	
	b. A flashing red and revolving blue beacon on cab roof top	
	c. An Air horn	
	d. Headlights with selective pattern for **High beam light**	
	e. Dual tail lights and stop lights	
	f. Signal lights for turning at four corners of vehicles with visual and audible signals.	
	g. Spot light, at both ends of windshield glass, hand adjustable with 152 mm diameter.	
	h. Adequate reflector and markers to indicate overall dimensions of vehicle.	
	i. One reverse light with audible warning at the rear of vehicle.	
	j. Panel lights, top deck light, cabin lights, engine compartment lights, tools and equipment compartment lights, shall also be provided.	
	k. Two inspection lamps shall also be provided and provision of additional connection to use these lamps shall be made in various compartments.	

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	l. Two fog lamps. These shall be low mounted in front of the appliance.	
	m. Equipment storage compartment lights shall glow on opening of the door/shutter, even when the ignition switch is turned off.	
4.16.2	All appropriate lights and gadgets detailed above shall be operable from driver's cabin.	
4.16.3	Visual indication for different functions of engine, P.T.O. pump, and pneumatic circuits by means of lamps in driver's cabin shall be preferred with **provision of extra electro-magnetic switch or ever flow modules.**	
4.17	**RADIO TELEPHONE (R.T.)**	
4.17.1	One VHF Radio telephone operable on frequency range between 118 to 136 MHz- AM (Amplitude Modulation) synthesized at the airport SMC frequency and another operable on Frequency Modulation (FM) with a range between 136 to 174 MHz-FM. These will be a self-contained transmitting/receiving set, with Transmitting power of approximately 5 watts unmodulated and intrinsically safe. The equipment shall be suitable for use in all-weather condition and shall be provided at suitable location in cabin. It should be operable at 12V/ 24V power supply system of ARFFV/ACFT and should be made of waterproof construction. The RT set should also have an adjustable head set in addition to the speakers. Sockets for connecting the headset to the R T Set should be provided at the mid-ship panel. The set shall be suitably mounted to resist vehicles vibration and suppress engine noise or any other vehicular electromagnetic induction.	
4.17.2	Adequate spares for 12 years and service/repair and spares manual along with circuit diagrams should be provided. All manuals and diagrams should be in English language with standardized international symbols.	
4.17.3	The system protection fuse shall be located in an easily accessible location for quick replacement.	
4.18	**DRY CHEMICAL SYSTEM**	
4.18.1	One unit of 250 kg each dry chemical powder (foam compatible) shall be provided, using dry nitrogen as propellant gas so as to achieve performance as specified in 4.1.1 (b). The dry chemical container shall be constructed in accordance with the ASME Boiler and Pressure Vessel Code, Section 8, or equivalent, and shall be so stamped.	
4.18.2	All piping and fittings shall conform to the appropriate ASME, or equivalent, code and shall be designed to withstand the working pressure of the system. The design of the piping and valves shall provide the desired flow of gas into the system and the minimum amount of restriction from the chemical container(s) to the hose connection. Where more than one hose line is provided, piping and fittings shall be sized and designed so that there is equal flow to each line, regardless of the number of lines placed in operation.	
4.18.3	Nitrogen cylinders shall be certified from Department of Explosive (Government of India) and shall have universal filling connections. The cylinder shall be manufactured in the year of delivery and have clearance from Explosive Department, Nagpur (India) for re-filling, storing and operation.	
4.18.4	Provisions shall be made for purging all piping and hose of dry chemical after use without discharging the dry chemical remaining in the dry chemical container(s). Provisions also shall be made for the depressurization of the dry chemical container(s) without the loss of the	

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	remainder of the dry chemical. A pressure gauge shall be provided that indicates the internal pressure of the agent storage container(s) at all times.	
4.18.5	A means of pressure release in situation of over pressure shall be provided with filling opening and suitable tight-fitting cap.	
4.19	**PROVISION FOR STORAGE** of additional extinguishing media in future shall be made.	
4.20	**OTHER EQUIPMENT**	
4.20.1	**Public Address (P.A.)** equipment, battery operated, with wireless and cable connected microphone fitted in the cabin and loudspeaker fitted on the rooftop of cabin capable of being operated from cabin. PA system receiver should have a provision to connect one wireless microphone and one microphone with cable connection. The wireless microphone shall be of FM (Frequency Modulation) with a range of minimum 100 Metres. All PA system receivers shall be tuned to the frequency of wireless microphone.	
4.20.2	A spare battery charger. **There should be adequate space provision for battery compartment and polarity of line.**	
4.20.3	Instruction book, spare parts catalogue and repair manual.	
4.20.4	All tools and accessories/equipment as per **Appendix-A**	
4.20.5	**Event (Electronic) Data Recorder:** The vehicle should have a real time event (electronic) data recorder to record the performance parameters like vehicle speed, gear position, PTO on/off, engine temperature, engine RPM etc. The recorder shall be tamper proof with provision for data transfer to PC with suitable software for data interpretation. **In addition, the ARFFV / ACFT engine should have Engine Informative System (EIS) so as to obtain data about various parameters of the engine such as maintenance schedules, service alerts, performance alerts, errors etc. and history sheet of maintenance.**	
4.21	**Factory Acceptance Test – as per Annexure-V**	
4.22	**MANUFACTURE CERTIFICATE AND GUARANTEE**	
4.22.1	Manufacturer shall provide a certificate for the appliances conforming to all specifications.	
4.22.2	A guarantee shall be furnished by manufacturer for a period of 24 months for material workmanship and smooth functioning of vehicles from the date of commissioning at consignee's place.	
4.22.3	The manufacturer shall provide maintenance services as recommended by OEM for total period of Ten years including two years of guarantee period. All the charges in respect of maintenance / repair service shall be covered under para 2.12.1 of section C-1.	
4.22.4	The manufacturer shall be responsible for replacing any parts, which may become unserviceable due to the use of defective and sub-standard materials and bad workmanship during the period of guarantee free of all charges.	
4.23	**MARKINGS**	
	Following markings shall be made on the body of the vehicles:	
	a. Manufacturer's name and trade mark	
	b. "Airport Fire and Emergency Service".	
	c. Year of manufacture	

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	d. Engine and Chassis numbers	
	e. AAI Emblem	
	f. Job or Serial No.	
	g. Capacity of pump, water tank, foam tank	
	h. Pump serial number	
	i. Chassis supplier name and country of origin	
	j. Luminous strips to be provided at the rear and both sides of the vehicle	
4.24	**PRODUCT SUPPORT**	
	Manufacturer shall ensure:	
	a. Availability and supply of spares at very short notice, for at least 10 years, after expiry of guarantee.	
	b. Induction Training for selected staff at consignee place or mutually agreed place at supplier's cost.	
	c. Any other Technical helps that may be required at the time of Induction.	
	d. After sales service.	
	e. One set of workshop major repair and maintenance tools (standard tools as recommended by OEMs) required for ARFFV/ACFT shall be supplied for each consignee.	
4.25	**MANUALS:** The following literature/manuals along with soft copy shall be provided (one set with each equipment/ARFFV/ACFT). In addition, 10 sets of literature are to be provided for inspection and training purpose. All manuals should be in English language:	
	a. OPERATIONAL MANUAL: This manual should contain technical description of the equipment with lay out drawings, illustration and performance capabilities with instruction to user for commissioning the equipment for use, and use operation with limitations and precautions to be observed normal maintenance and field repairs, lubrication schedule with grades of lubricants to be used, fault finding guide, storage instructions and warning plates against possible wrong use.	
	b. PARTS MANNUAL: This manual shall contain fully exploded and illustrated details of the entire Chassis, superstructure and all carried sub-assemblies, suitably grouped for easy identification of each and separately demandable spare for replacement as required, will include details of brought out items with part numbers of source of supply.	
	c. WORKSHOP REPAIRS MANNUAL: The manual shall contain fully illustrated instructions on repair and overhaul of all items supplied against this specification including proprietary items fitted/supplied with details of fitment tolerances, special tools to be used, procedure for dismantling major assemblies.	
	d. DRAWINGS: A complete set of general arrangement drawings showing layout of equipment, piping and fluid flow controls, electrical and structural design shall be submitted along with the ARFFV/ACFT.	
	e. PRICE LIST: Price list for complete range of spares/components for Chassis and Superstructure with current price list for future requirement on FOB basis for imported spares and Ex-factory for indigenous spares as the case may be.	
4.26	**ITEMS SUPPLIED IN INDIA/WORKS OF SUPPLIER:** Items required as per **Appendix-A** under category A-Items supplied in India shall be conforming to Bureau of Indian Standards (BIS) wherever the standards exist or from works of supplier. All other equipment and	

1	2	3
Para No.	**Technical Specification**	**Parameter**
	accessories forming part of superstructure fabrication shall be provided at the place of fabrication.	
4.27	**MANUAL OVERDRIVE FOR POWER ASSISTED OPERATION:** All power assisted controls and operation should have suitable manual operation to ensure the operation in case of any failure in the power assisting mechanism. Such arrangements shall be easily accessible to the operator facilitating quick changeover. **NOTE**: Bidder must give detailed technical information in the Questionnaire (**Annexure- VI**) enclosed regarding the ARFFV/ACFT quoted by them.	

Note:

The firm should have adequate infrastructure, equipment and tools for practically demonstrating the technical Specifications as mentioned above.

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Appendix-A

Following Vehicle mounted Equipment's are to be supplied along with the ARFFV/ACFTs in properly stored Lockers with designated places and appropriate Quick-release Clippings:

Sl. No.	Equipment for Rescue Operation	Quantity	Appendix/ Standard
A.	**ITEMS TO BE SUPPLIED FROM INDIA/ WORKS OF SUPPLIER**		
1.*	Aluminium Extension Ladder, 13.5M Length (Approx).	1 No.	Appendix-I /NFPA/ Equivalent applicable standard, provided the ladder is housed within the vehicle
2.	Universal Branch Pipe (Diffuser Branch), 63 mm Male Instantaneous Inlet, Gunmetal Material.	1 No.	IS:2871/ Equivalent applicable standard
3.	Standard Branch Pipe with 19 mm Nozzle, 63 mm Male Instantaneous Inlet, Gunmetal Material.	2 Nos.	IS:903/ Equivalent applicable standard
4.	Nozzles for Standard Branch Sizes: (a) 12 mm (b) 20 mm	1 No. each	IS:903/ Equivalent applicable standard
5.	Nozzle Spanner, Material Steel.	1 No.	IS:903/ Equivalent applicable standard
6.	Foam Making Branch, FB 5X type with Pick-up Tube.	2 Nos.	IS:2097/ Equivalent applicable standard
7.	Foam Making Branch, FB 10X type with Pick-up Tube.	2 Nos.	IS:2097/ Equivalent applicable standard
8.	Portable LED Emergency Light with Accessories	1 No.	Appendix-II
9.	Safety Goggles	4 Pairs	Appendix-III
10.	Reusable Ear Plug	25 Pairs	Appendix-IV
11.	Chocks	1 Pair	Appendix-V
12. #	Suction Hose for Pump complete with Round thread Gunmetal Couplings, 2.5 Meter	4 Lengths	IS:2410/ Equivalent applicable standard
13.	Suction Strainer for Pump, Gunmetal	1 No.	IS:907/ Equivalent applicable standard
14.	Suction wrench for 125 mm suction hose coupling	2 Nos.	IS:4643/ Equivalent applicable standard
15.	Suction adopter GM 125 mm female x 63 mm male with lugs.	1 No.	IS/ Equivalent applicable standard
16.	Jack Hydraulic for 20 Ton capacity with handle	1 No.	IS /Equivalent applicable standard

17.	Branch with revolving head, GM 63 mm	1 No.	IS:906/ Equivalent applicable standard
18.	RRL Hose Type "B" 63 mm dia & 30 meters length	4 Nos.	IS:903/ Equivalent applicable standard
19.	Fireman Axe with belt & pouch.	3 Nos.	EN/Equivalent
20.	Hydraulic Spreader & Cutter with Pump & Accessories	1 No.	Appendix-VI/NFPA 1936/EN 13204/ Equivalent applicable standard
21.	Power Driven Circular Saw with Accessories.	1 No.	Appendix-VII/NFPA
22.	Pneumatic Lifting Airbag with Accessories	1 No.	Appendix-VIII/ NFPA
23.	Zero-torque Nozzle with Hand-Control, 63 mm Male Instantaneous Inlet, Discharge 750 LPM @ 7 Bar Pr.	1 No.	Appendix-IX
24.	Seat Belt/Harness Cutting Tool	3 Nos.	Reputed Make
25.	Gloves, Fire Resistant with Anti-skid Palm`	8 Nos.	EN/Equivalent
26.	Fog/Jet Nozzle with Hand-Control, 63 mm Male Instantaneous Inlet, Discharge 750 LPM @ 7 Bar Pr.	1 No.	NFPA1964/Equivalent
27.	Penetrating /Pinch ring Nozzle with 63 mm Male Instantaneous Inlet, Stainless Steel Material.	1 No.	NFPA1964/Equivalent
28.	Quick Release knife with pouch to be worn with fireman's belt.	5 Nos.	Reputed Make
29.	Hand Held Forcible Entry Tool Kit (1 no.)	1 No.	Appendix-X
30.	Hand line Nozzle with selectable flow, pistol grip and shut-off with double stops.	1 No.	NFPA1964/Equivalent

*to be stowed at the top of the vehicle with gallows. Rollers are to be provided for single man mounting / dismounting of ladder.

#to be stowed at the hose tunnels provided at the top of the vehicle.

• Test Certificates in respect of equipment's shall be submitted before prototype test of Successful bidder.

Sl. No.	Equipment for Rescue Operation	Quantity
B.	**SPARE LOCKERS HAVING DESIGNATED PLACE AND APPROPRIATE QUICK-RELEASE CLIPPING ARE TO BE PROVIDED FOR THE FOLLOWING EQUIPEMNTS:**	
1.	Adjustable Wrench	1 No.
2.	Axe, Rescue, Large, Non-wedge Type	2 Nos.
3.	Axe, Rescue, Small, Non-wedge Type	2 Nos.
4	Cutter Bolt, 61cm	1 No.
5.	Crowbar, 95cm	1 No.
6	Chisel, Cold, 2.5cm	1 No.
7.	Sledge Hammer, 1.8kg	1 No.
8.	Hook, Grab or Salving	3 Nos.
9.	Blanket, Fire Resisting	3 Nos.
10.	Short Rope Line, 15M length, 50mm Circumference, Hemp/manila	3 Nos.
11.	Long Rope Line, 30M length, 50mm Circumference, Hemp/manila	3 Nos.
12.	Piers, 17.8cm, Side-cutting	1 No.
13.	Piers, Slip joint, 25cm	1 No.
14.	Screwdrivers, Assorted (Set)	1 No.
15.	Snipers, Tin	1 No.
16.	Collecting Breeching, 63 mm Instantaneous Gunmetal	1 No.
17.	Medical First-aid Kit	1 No.
18.	Non-percolating Firefighting Delivery Hose, Synthetic Jacketed with Elastomeric Outer Covering, 63mm Instantaneous couplings, 30M Length	8 Nos.
19.	Hose Bandages	12 Nos.
20	Hose Clamps	6 Nos.
21.	Dividing Breeching, 63 mm Instantaneous Gunmetal	1 No.
22.	Insulated Pliers with Rubber Gloves Pairs Tested to 20 KV	1 No.
23.	Cropper Bolt (1 no.)	1 No.
24.	Kinetic Cutter	1 No.
25.	Hack Saw, 300mm x 12.5 mm x 0.63 mm approx. Size of Blades with 6 nos. of Spares Blade	1 No.
26.	Crow Bar, 6' Length, 25mm Diameter	1 No.
27.	Axe, Drift & Rescue	1 No.
28.	Double Female Coupling	2 Nos.
29	Double Male Coupling	2 Nos.
30	Space for Emergency Inflatable Lighting Tower with Electric Generator of 3.5 BHP (4-stroke Petrol driven) & Alternator of 1.2 KVA (Synthetic Illuminating Tube)	1 No.
31.	Adapter 63 mm male to 38 mm female GM	2 Nos.
32.	Adapter 63 mm female to 63 mm female GM	2 Nos.
33.	Crosslays for storing delivery hoses diameter 63 mm-30 mtrs. length on the ARFFV/ACFT.	4 Nos.

Technical Specifications for ACFTs of 6000 Litres Water Tank Capacity

1	2	3
Para No.	**Technical Specification**	**Parameter**
4.1	**GENERAL:**	
	The ARFFVs/ACFTs shall be supplied as a complete built-up unit and have a minimum rated water capacity, for usable 6,000 litres or more of water through monitor, side lines and ground sweep nozzles/under truck nozzles with capability as given below. The primary extinguishing agent shall be Foam Concentrate with proportioning system. In addition to primary agent, there shall be complimentary extinguishing agent of a dry powder as indicated at item 4.18.	
4.1.1(a)	**Fully Loaded Vehicle (ARFFVs/ACFTs- Chassis) Performance Parameters:**	
	1. Side slope stability (degrees)	30
	2. Dynamic balance (kmph), minimum speed on a (30m) radius circle	35.5
	3. Angle of approach (degrees)	30
	4. Angle of departure (degrees)	30
	5. Interaxle clearance (degrees)	12
	6. Underbody clearance (cm)	46
	7. Under axle clearance at differential housing bowl (cm)	33
	8.Diagonal opposite wheel motion (cm)	36
	9. Wall-to-wall turning diameter	<Three times the vehicle's overall length
	10. Maximum acceleration time from 0 to 80 kmph (seconds)	< 25
	11. Top speed (kmph)	> 115
	12. Service brake: Stopping distance	
	i. From 33 kmph	< 11 m
	ii. From 64 kmph	< 40 m
	iii. Percent grade holding of fully loaded vehicle:	
	a. Ascending	≥ 50 %
	b. Descending	≥ 50 %
	iv. Emergency brake stopping distance at 64 kmph	≤ 88 m
	13. Parking brake	
	i. Percent grade holding for the parking brake	
	a. Ascending	≥ 20 %
	b. Descending	≥ 20 %
	14. Steering	Centre/Off Centre/Right Hand
	15. Drive	On all wheels
	16. Fordability (mm)	≥ 608
	17. Minimum angle of Tilt (Static)	30^0
	18.Evasive maneuver test, NATO Document AVTP 03-16W (kph)	40
	19. "J" turn test at 46 m radius (kph)	48
4.1.1(b)	**Fully Loaded Vehicle (ARFFV/ACFT- Fire Fighting Systems) Performance Parameters:**	
	1. Vehicle Water Tank Capacity Minimum Usable	6000 litres or more
	2. Water tank: Percent of deliverable water	
	a. On level ground	100 %
	b. On 20 percent side slope	85 %

1	2	3
Para No.	**Technical Specification**	**Parameter**
	c. 30 percent ascending/descending grade	85 %
	3. Roof turret (monitor) discharge –at full flow	
	a. Individual flow rate of the roof turret (L/min)	≥3,000
	b. Stream pattern/distances:	
	i. Straight/far point (m)	≥65
	ii. Dispersed/far point (m)	≥ 20
	iii. Dispersed/width (m)	≥ 11
	4. Bumper Turret	
	a. Individual flow rate of the Bumper Turret (L/min)	> 950
	b. Stream pattern/distances:	
	i. Straight/far point (m)	≥ 46
	ii. Dispersed/far point (m)	≥ 15
	iii. Dispersed/width (m)	≥ 9
	5. Ground sweep nozzle	
	a. Number of nozzles	2
	b. Flow rate (L/min) Per nozzle	Refer sub Para 6 below
	c. Dispersed pattern distances:	
	i. Far point (m)	≥ 9
	ii. Width (m)	≥ 3.5
	6. Under truck nozzle	
	a. Flow rate (L/min) per nozzle	The combined flow rate of two ground sweep nozzles and four under truck nozzles should not be more than 500 liters per minute
	b. Number of nozzles	4
	7. Number of water/foam hand lines required per vehicle	
	Pre-Connected **water/foam hand lines** (numbers), with Hose dia. 63 mm, length ≥30 metre	4
	8. Foam hand line	
	a. Nozzle flow rate (L/min)	≥ 450 at 7 bar
	b. Straight stream distance (m)	≥ 25
	c. Dispersed stream pattern	
	i. Range (m)	≥ 6
	ii. Width (m)	≥ 4.5
	d. Hose inside diameter (mm)	63
	e. Hose length (m) with instantaneous coupling	≥ 30
	9. **Reeled water/foam hand line (first aid hose reel)**	
	a. Nozzle flow rate (L/min)	≥ 230 for dual agent lines
	b. Hose length (m)	≥ 30 for dual agent line
	c. Straight stream distance (m)	≥ 20

1	2	3
Para No.	**Technical Specification**	**Parameter**
	d. Dispersed stream pattern	
	i. Range (m)	≥ 6
	ii. Width (m)	≥ 4.5
	10. **Complementary agent- Dry Chemical Powder**	
	a. Capacity (kg)	≥ 250
	11. **Dry chemical hand line:**	
	i. Discharge rate (kg/sec)	≥ 2.5
	ii. Range (m)	≥ 7.5
	iii. Hose length (m)	≥ 30
	12. **Foam Tank usable capacity (litres)**	800
	13. **Pump capacity**	4,500 L/min or more
	14. **Foam proportionater**	Automatic with 3%, 6% & 8% preferably with Step less System
	15. Air-Conditioned Cabin (Seating Capacity including Driver)	4+1
	16. Testing and acceptance procedure:	As per AAI Technical Specifications and subsequent amendments, if any.
4.1.2.	**Chassis**	
	The chassis shall be of 6x6 configuration, customized for ARFFV/ACFT application, with specially designed axles (not off-set rims), ensuring specified side slope stability, at the rated capacity of each axle, meeting the performance parameters as per 4.1.1. (a) above.	
4.1.3	**General Requirements**	
4.1.3.1(a)	The ARFFVs/ACFTs shall consist of a water tank of 6,000 litres or more of usable water capacity with necessary fittings. The primary extinguishing agent shall be foam concentrate, with 3%, 6% & 8% ratio preferably with Step less System. For this purpose, a foam concentrate tank of 800 litres usable capacity shall have to be provided.	
(b)	A midship mounted pump, either coupled with the auxiliary engine (The emission level shall be minimum Bharat Stage IV or equivalent) ***Or*** Driven of the vehicle PTO mechanically, shall be fitted, having a minimum output of 4500 L/min at suitable delivery pressure and suction lift 3 metres.	
(c)	When discharging foam solution, the pumping system shall be capable of **discharging at a rate equal to or exceeding the total requirements** of the roof turret (monitor), Bumper Turret/ two handline nozzles, ground sweep nozzles, and under truck nozzles discharging simultaneously at designed pressures.	
4.1.3.2	The ARFFV/ACFT shall be capable of the following minimum performance with the monitor mounted on the roof of cabin and two hand lines on either side.	

1	2	3
Para No.	**Technical Specification**	**Parameter**
	a. An individual output of 3000 L/min through monitor at maximum rated pressure to give throw as per 4.1.1(b) item 3 of either water or specified quality foam concentrate.	
	b. A minimum output of 450 L/min of foam solution to each of the handlines on either side of the ARFFVs/ACFTs to give minimum effective throw, specified for foam concentrate, of 25 metres at nozzle pressures not exceeding 7 bar and using 30 mtrs. specified hose.	
	c. It shall be possible to operate the monitor and two hand lines simultaneously at pump delivery pressure suitable to the rated output and throw of monitor.	
4.1.3.3	The foam concentrate induction shall be automatic with changes in output required through a combination monitor and hand lines. The ratio of foam concentrate induction shall be within a variation ± 0.5 with an induction setting from 3%, 6% & 8% ratio preferably with Step less System. The induction ratio once fixed shall maintain this limit of variation for the entire range of inductor setting. Around the pump proportionator shall be used with clearly marked induction ratios varying from 3%, 6% & 8% preferably with Step less System.	
4.1.3.4	The system of foam production from monitor and hand lines shall be so designed as to produce satisfactory quality of foam with the following minimum properties with the use of foam concentrate.	
	a. Minimum expansion ratio - 8	
	b. 25% drainage time with foam concentrate level 'A' 5 minutes minimum.	
	c. 25% drainage time with foam concentrate level 'B' 3 minutes minimum.	
4.1.3.5	It shall be possible for the ARFFV/ACFT to use water from a separate source from open source and/or an external source of water supply for prolonged use and foam concentrate supply through a pick-up tube from drums at ground level.	
4.1.3.6	The ARFFV/ACFT shall be equipped with Ground sweep nozzles and under truck nozzles for self-protection, particularly of the wheels. This should incorporate a pressure and flow regulator as explained in Para 4.14.16.1. The angle of the front nozzle shall be so adjusted to achieve performance as per 4.1.1. 5 & 6.	
4.1.3.7	The water tank, foam concentrate tank, monitor, ground sweep nozzles and under truck nozzles shall have pneumatically controlled ball valves for operation and control from within the cabin. The hand lines should have pneumatic as well as manual control. All pneumatic control system shall be used with air supply at pressures available from the vehicle air brake system. The vehicle air brake shall be tapped so that a minimum air pressure required for the operating vehicle is available all the time and the pneumatic control fire operation actuates when the air pressure in the systems exceeds this minimum level. In case of any leakage in the pneumatic control system the vehicle operation shall not be adversely affected. Opening and closing valves to the monitor and to the pump shall be achieved through operation of pneumatic/electro-pneumatic	

1	2	3
Para No.	Technical Specification	Parameter
	controls from the cabin as well as from Panel Board. Panel boards should be provided on both sides of the ARFFV/ACFT. Manual control should be provided for operation in case of failure in pneumatic control.	
4.1.3.8	The appliance shall be complete with all accessories and essential operating spares and tools. Where specific items are not required to be supplied suitable arrangement shall be made for stowage and secure location of such items to suit the ARFFV/ACFT role. All locking and securing devices shall be of sufficient strength, reliability and shall be of quick opening and closing type for removal of accessories and other items without loss of time.	
4.1.3.9	All items where standard specification does not exist, best available commercial quality as approved by the inspection authority shall be supplied.	
4.1.3.10	The unit shall be designed to be as compact as possible complete with ease of accessibility to all sub systems for maintenance and repairs. The pump or foam making equipment and controls shall be so arranged that one man can operate foam concentrate, main water line, ground sweep/under truck nozzle and monitor valves from the driver's compartment and foam concentrate, main water line and side delivery from the mid-ship mounted control panel.	
4.1.4	**MATERIAL SELECTION AND TREATMENT:**	
4.1.4.1	Material used for construction of the appliances shall be new, unused and free from all defects and imperfection that might affect the serviceability of the finished product. These shall be selected with a view to combine lightness with strength and durability.	
4.1.4.2	Materials used in the assembly and components shall be of high strength to weight ratio where practicable to effect saving in dead weight and thereby increase the payload capacity. Use of dissimilar Materials in contact with each other which tends towards Galvanic / electrolytic corrosion shall be avoided.	
4.1.4.3	The appliance is intended for use in tropical conditions with continuous high humidity and heat and also in coastal area. This fact shall be given full consideration while selecting material and for this reason use of rubber shall be avoided as far as possible. Wherever, it is unavoidable to use rubber the parts made out of it shall be readily available.	
4.1.4.4	The **material** used for superstructure should **be non-corrosive and guaranteed** against any sort of deterioration, deformation, ageing and corrosion for a minimum period of **twelve years**. This being one of the important criteria for evaluation, the exact material to be used, its detailed technical specification and the relevant standards to which such material conforms should be clearly stated.	
4.1.4.5	**Timber** shall not be used in body construction.	
4.1.4.6	All parts, which form waterways or come into contact with foam concentrate, shall be of non-corrosive material. All metal pipelines shall be hot dip galvanized after complete fabrication. All parts exposed to atmospheres shall be made of non-corrosive material. All ferrous fasteners shall be galvanized/chrome plated to avoid rusting over prolonged use.	

1	2	3
Para No.	Technical Specification	Parameter
4.2	**WEIGHTS AND DIMENSIONS:**	
4.2.1	The actual gross vehicle weight (weight of fully staffed, loaded and equipped vehicle) shall not exceed maximum permissible limit weight of chassis specified by the manufacturer.	
4.2.2	The weight shall be distributed as equally as to be Demonstrated Practically over the axles and tyres of the vehicle. The difference of weight between tyres on any axle shall not exceed 5% of the average weight on tyre for that axle, and the difference in weight between axles shall not exceed 10% of the weight of the heaviest axle. Under no circumstances shall axle and tyre manufacturers rating be exceeded.	
4.2.3	The centre of gravity of the vehicle shall be kept as low as possible under all conditions of loading.	
4.2.4	**DIMENSIONS:**	
4.2.4.1	Dimensions and other performance requirements are as per table 4.1.1 (a) & (b)	
4.2.4.2	Overall height, length and width shall be kept to a minimum consistent with the best operational performance of the vehicle and the design concept needed to achieve this performance and to provide optimum manoeuvrability and **facilitate movement on airports.**	
4..2.4.3	The vehicle shall be constructed such that a seated driver shall be able to see the ground 6 Metre ahead of the vehicle and minimum 15 degree above the horizontal without leaving seat. The vision in the horizontal plane shall be 90 degree on each side from the straight position on a full forward control.	
4.2.4.4	Adjustable rear-view mirrors with a glass area of not less than 385 sq. cm. shall be provided on each side of vehicle. Each shall be provided with a minimum of 45 sq. cm area wide-angle convex mirrors.	
4.3	**ENGINE:**	
4.3.1	**PERFORMANCE REQUIREMENTS**	
4.3.1.1	The vehicle's engine (s) shall be HSD (High Speed Diesel) driven, and shall have minimum power output of **485 KW/650 hp**, torque and speed characteristics to meet and maintain all vehicular performances specified in this standard. The vehicle's engine (s) shall be certified by the engine manufacturer for the ARFFV/ACFT application. **In addition, Provision for open canopy for engines and incorporation of brushed or brushless alternator should be made.**	
4.3.1.2	Fully laden vehicle shall consistently be able to accelerate maximum speed, as specified, with the engine and transmission at their normal operating temperature at any ambient temperature varying from 0^0 C to 50^0 C and at elevation up to 600 metres above mean sea level.	
4.3.1.3	The vehicle shall also be capable of ascending, stopping, starting and continued ascent on a 40% grade on dry pavement at a minimum speed of 1.6 kmph with extinguishing agents being discharged at maximum rated capacity from the turret.	
4.3.1.4	The emission level shall be minimum Bharat Stage IV or equivalent. Type approval certificate or equivalent certificate relevant to emission norms of engine offered, issued by any regulatory authority with up to date amendments shall be submitted by the bidder.	

1	2	3
Para No.	**Technical Specification**	**Parameter**
	OEM of engine(s) shall submit a certificate conforming emission level meets minimum Bharat Stage BS IV or equivalent. ***Note:*** The Engine offered should comply the emission norms prescribed by Govt. of India with up to date amendments.	
4.3.1.5	The ARFFV/ACFT weight (kg) to engine power ratio (kW) plays an important role, in achieving **response time** of two minutes, as specified in ICAO documents. **The constructor of ARFFVs/ACFTs shall certify the achievable acceleration of 80 kmph in < 25 seconds during minimum 12 years of use of ARFFVs/ACFTs.**	
4.3.1.6	The vehicle will be capable of operating safely on paved roads, graded gravel roads, cross country terrain, and sandy soil environments. Cross country terrain consists of open fields, broken ground, and uneven terrain. An off-road, high-mobility suspension system resulting in no more than 0.5 G_{rms} acceleration at the driver's seat of the vehicle when traversing an 8-inch (20 cm) diameter half round at 35 mph (56 kph) must be provided. The suspension design by which the manufacturer meets the suspension performance requirements is at the manufacturer's discretion.	
4.3.2	**ENGINE COOLING:**	
4.3.2.1	Engine shall be liquid cooled so that stabilized cylinder head and oil temperature remain within the engine manufacturer's prescribed limits under all operational conditions and all ambient temperatures between 0^0 (degree) Centigrade and 50^0 C.	
4.3.3	**FUEL SYSTEM:**	
4.3.3.1	Fuel system shall qualify engine manufacturer's requirements and shall include fuel pump, fuel filtration and flexible fuel lines, well protected from damage, exhaust heat and ground fires.	
4.3.3.2	Accessible filtration shall be provided for each fuel supply line and a drain shall be provided at the bottom of the fuel tank.	
4.3.3.3	Gravity feed fuel tanks are not acceptable.	
4.3.3.4	Fuel tank capacity shall be 200 litres or more to achieve a minimum of 48 km of highway travel at 90 kmph plus 2 hours of pumping at the full rated discharge.	
4.3.4	**EXHAUST SYSTEM:**	
4.3.4.1	The size of exhaust system shall be such that undue back pressure is not generated and under no circumstances exhaust gases enter the cabin. The system shall be of high grade, rust resistant material.	
4.3.4.2	Exhaust system shall be designed so as to protect it from damage that could result from rough terrain. Tailpipe of exhaust system shall be designed to discharge upwards or to the rear of the vehicle and not towards ground nor towards panel operator.	
4.3.4.3	The exhaust system shall include a muffler to reduce engine noise.	
4.3.5	**VEHICLE ELECTRICAL SYSTEM:**	
4.3.5.1	The vehicle shall be provided with 12/24 volts electrical system and starting.	

1	2	3
Para No.	**Technical Specification**	**Parameter**
4.3.5.2	The electrical system shall have negative ground including alternator and voltage regulator. Alternator shall be at 100% of anticipated load at 50% engine speed, and shall be, of belt driven.	
4.3.5.3	The curb idle minimum-charging rate of the alternator shall be 30 Amps.	
4.3.5.4	Batteries shall be secured and well protected from against physical injury, vibration, and water sprays and engine and exhaust heat. When an enclosed compartment is provided for batteries, it shall be well ventilated and batteries shall be easily accessible for examination, test and maintenance.	
4.3.5.5	The circuits shall be so designed that at no stage of operation overloading, overheating or short-circuiting and fluctuation of voltage is experienced.	
4.3.5.6	A built-in battery charger shall be provided on the vehicle to maintain full charge on all batteries. Grounded AC receptacle shall be provided to permit a drive away plug connection from external electric power supply to battery charger.	
4.3.5.7	An engine coolant/preheating device shall be provided as an aid to rapid starting and high initial engine performance.	
4.3.5.8	The electrical system shall be insulated, waterproofed and protected against exposure from ground fires.	
4.3.5.9	The effect of electromagnetic field of all electrical systems of Radio sets shall be suppressed so that it does not interfere with functioning of radio sets.	
4.4	**VEHICLE DRIVE:**	
4.4.1	Transmission of power from engine to wheels shall be through a torque converter and fully automatic transmission, having designed input rating parameters to maintain the operational performance during minimum period of 10 years of use, with provision of crawling as per Para 4.12.5.2, without application of brakes. The entire drive train shall be designed to have sufficient capacity to slip the wheels of the static loaded vehicle on surface having a coefficient of friction 0.8. A range of gears providing the specified top speed and a grade-ability of 50% shall be provided with sufficient intermediate gears to achieve the specified acceleration.	
4.4.2	A transmission cooling system shall be provided and designed so that the stabilized transmission oil temperature remains within the transmission conditions and at all ambient temperatures.	
4.4.3	**The transmission shall be matched to the engine properly, and shall be approved by transmission manufacturer, for the ARFFV/ACFT application.**	
4.4.4	The provision of positive drive to each wheel by means of a fully locked drive line shall be required in order to maximize traction on low friction surfaces. Positive drive may be achieved either by the use of automatic locking and torque proportioning differentials, or may be manually selectable by the seated driver, while the vehicle is in motion, by use of a single control.	
4.4.5	All wheel drive on these vehicles shall incorporate a drive to the front and rear axles, which are engaged at all times during use. An interaxle	

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	differential shall be installed with automatic or driver selected means of differential locking.	
4.4.6	Front and rear axles shall have adequate capacity to carry the maximum imposed load under all intended operating conditions. The variations in axle track shall not exceed 20% of the tyre sectional width at rated load.	
4.5	**SUSPENSION:** The suspension system shall be designed to permit the loaded vehicle to:	
	a) Travel at the specified speeds over improved surface;	
	b) Travel at moderate speeds over unimproved surface;	
	c) Provide diagonally opposite wheel motion 360 mm above ground obstacles without raising the remaining wheels from the ground.	
	d) Provide at least 50mm of axle motion before bottoming of the suspension on level ground;	
	e) Prevent damage to the vehicle caused by wheel movement; and	
	f) Provide a good environment for the crew when traveling over all surfaces.	
4.5.1	**RIMS, TYRES AND Wheels:**	
4.5.1.1	Tyres shall be selected to maximize the acceleration speed, braking and manoeuvring capabilities of the vehicle on paved surfaces without sacrificing performance on all reasonable terrains found within/ outside the airport boundary.	
4.5.1.2	Tyres size shall be suitable to optimize floatation under soft ground conditions. The lowest tyre pressure shall be compatible with the high-speed performance requirement as specified in table 4.1.1 (a) & (b)	
4.5.1.3	All wheels on the vehicle shall be of the **single wheel type** with all rims, tyres and wheels of identical size and same tread design.	
4.5.1.4	Rims, tyres, wheels, and inflation pressures shall be approved by the respective manufacturers as having sufficient capacity to meet the specified performance, **and shall be certified for not less than 40.23 Kms (25 mi) of continuous operation at 96.5 Kmph (60 mph) at normal operating pressure.**	
4.5.1.5	Size of tyre should be such to meet all vehicular performances.	
4.6	**TOWING CONNECTIONS:**	
4.6.1	Four large tow eyes or tow hooks, capable of towing the vehicle without damage, shall be mounted, two at the front and two at the rear of the truck and attached directly to the frame structure (chassis)	
4.7	**BRAKES**	
4.7.1	The braking system shall feature service, emergency and parking brake systems. Service brakes shall have power actuation through air, hydraulic or air over hydraulic. **Calliper disc brakes shall be furnished.** A brake chamber shall be provided for each wheel and shall be mounted so that no part of the brake chamber projects below the axle. **ABS (Anti-locking Brake System)** braking system shall be provided.	
4.7.2	Service brakes shall be of the all-wheel type with split circuits so that failure of one circuit shall not cause total service brake failure, and shall be able to hold fully loaded vehicle on a 50% grade.	

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4.7.3	The service brakes shall have stopping distances as per 4.1.1. (a) on a dry hard appropriately level road way, free from loose materials, and sufficiently wide roadway without any part of vehicle leaving roadway.	
4.7.4	The service brakes shall provide one power assisted stop with the vehicle engine inoperative, for the stopping distances specified above.	
4.7.5	An emergency brake system shall be provided which is applied and released by the driver from the cab and is capable for modulation, by means of the service brake control.	
4.7.6	The parking brake shall be capable of holding the fully loaded vehicle on a 20% grade without air or hydraulic assistance.	
4.7.7	**Brakes–Air System**	
4.7.7.1	When the vehicle is supplied with air brakes, air compressor shall meet following criteria:	
	a. The compressor shall be engine driven;	
	b. The compressor shall have sufficient capacity to increase air pressure in the supply and service reservoirs from 586.1 kPa to 689.5 kPa (85 psi to 100 psi) when the engine is operating at the vehicle manufacturer's maximum recommended revolutions per minute (rpm) in a maximum of 25 seconds.	
	c. The compressor shall have the capacity for quick build-up from 0 kPa (0 psi) to release spring brakes, and this build-up in pressure shall be accomplished within 15 seconds.	
	d. The compressor shall incorporate an automatic air-drying system immediately downstream from the compressor to prevent condensation build-up in all pneumatic lines.	
4.7.7.2	Service reservoirs shall be provided. The total of the service reservoir volume shall be at least 12 times the total combined brake chamber volume at full stroke. If the reservoir volume is greater than the minimum required, proportionately longer build-up time shall be allowed using the following formula; $\frac{\text{Actual reservoir capacity X 25}}{\text{Required reservoir capacity}}$	
4.7.7.3	Reservoirs shall be equipped with air pressure regulator, drain and safety valves.	
4.7.7.4	Provision for charging of air tanks by a drive away electrical connection used to power a vehicle mounted auxiliary compressor would be provided.	
4.7.7.5	A drive away air connection for charging of air tanks from an external air source shall be provided.	
4.7.7.6	Visual and audible low air pressure warning devices shall be provided. The low-pressure warning device shall be visual and audible from the inside, and audible outside of the vehicle.	
4.7.7.7	Provision of pneumatic service outlets for inflating tyres shall be made from air compressor of ARFFV/ACFT, with a high-pressure charging tube of 30 mtrs. and nozzle. A separate provision of pneumatic service outlet for inflating pneumatic bags shall also be made from air compressor of ARFFV/ACFT.	

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4.7.7.8	Air leakage from pressure system shall not exceed 0.5 Kg. /sq. cm. per hour so that at no stage the air pressure should reduce less than brake operating pressure in 8 hours.	
4.8	**STEERING**	
4.8.1	The chassis shall be equipped with power assisted steering with direct mechanical linkage from the steering wheel to the steered axle(s) to permit the possibility of manual control in the event of power assist failure.	
4.8.2	The power steering shall have sufficient capacity to allow turning the tyres stop to stop with the vehicle stationary on a dry level, paved surface and fully loaded, with not more than 7 kg. pull on wheel.	
4.8.3	The wall-to-wall turning diameter of the fully laden vehicle shall be less than three times the vehicle length.	
4.8.4	Vehicle shall be designed for Centre/Off Centre Right/Right Hand Drive system so that driver's Left hand is free for operations controls.	
4.9	**CABIN**	
4.9.1	The cabin shall be mounted on the forward part of the vehicle and shall provide seating for 5 persons including Driver. The seating arrangement shall be; 2 adjustable seats and a long or separate seat (s) for three crewmembers with provision of stowage of fully assembled BA set suitably located to the backrest with quick release system so that it can be worn in running vehicle. In addition, there shall be instrument panel and equipment as specified without any hindrance to crew.	
4.9.2	The cab shall meet the visibility requirements of 4.2.4.3. The windshield (single piece) shall be shatterproof safety glass, and all other windows shall be constructed of approved safety glass. The cab shall be provided with wide gutters to prevent foam and water dripping on the windshield and side windows. There shall be enough space to keep and to enable the crew except driver to put on protective clothing and B.A. set while on way to a call. Two doors (01 doors each on LHS & RHS respectively) are to be provided to the cabin, with ECE R29 or equivalent test compliance which should be openable at 90 degrees for easy ingress and egress of crew. In case of specially designed cabin with two doors the design should allow easy entry and exit of the crews in the rear row(s) without disturbing the crews of front row and a Centre/Off Centre Right/Right Hand steering system shall be provided. A rear-view camera with a monitor at the panel shall be provided. The cab design shall take into consideration the provision of ample space for the crew to enter and exit the cab and carry out normal operations while wearing full protective equipment. This design will be considered only in case of engine is not housed within the cabin. In case the turret (monitor) having manual controls above the cab roof is provided, the cab shall be designed with a quick-access passage to the turret (monitor). Time required for mounting of the crews into the cabin from close-up position shall be less than or equal to 10 Seconds.	
4.9.3	The cab shall be weatherproof, and shall be fully insulated thermally and acoustically with a fire-resistant material. The cab may be of the unitized rigid body and frame structure type or it may be a separate unit flexibly	

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	mounted on the main vehicle frame. The cab shall be constructed from non-corrosive materials that provide lightest weight consistent with adequate strength to ensure a high degree of safety for the crew under all operating conditions including excess heat exposure, and in the event of a vehicle rollover accident. The material should also be guaranteed against any sort of deterioration, deformation, ageing and corrosion for a minimum period of **twelve years**.	
4.9.4	**INSTRUMENTS, WARNING LIGHTS AND CONTROLS**	
4.9.4.1	The minimum number of instruments, warning lights and controls consistent with safe and efficient operation of the vehicle, chassis, and firefighting system shall be provided. All chassis instruments and warning lights shall be grouped together on a panel in front of the driver. All firefighting system instruments, warning lights, and controls shall be grouped together by function so as to provide ready accessibility as well as high visibility for the driver as well as a crewmember sitting in the co-driver seat. Electronic controls have pneumatic and/or manual override wherever possible.	
4.9.4.2	All instruments and controls shall be illuminated, with back lighting to be used where practical.	
4.9.4.3	Groupings of both the chassis and firefighting system instruments, warning lights and controls shall be easily removable as a unit or be on a panel hinged for back access by the use of quick disconnecting fittings for all electrical, air and hydraulic circuits.	
4.9.4.4	The following instruments, or warning lights, or both shall be provided as a minimum;	
	a. Speedometer/Odometer	
	b. Engine(s) tachometer	
	c. Fuel level with audio warning	
	d. Air pressure	
	e. Engine(s) temperature	
	f. Engine(s) oil pressure	
	g. Voltmeter(s)	
	h. Oil temp. gauge light	
	i. Transmission(s) oil temp.	
	j. Pump(s)pressure,	
	k. Water tank level Gauge	
	l. Foam tank level Gauge	
	m. Low air pressure warning	
	n. Headlight beam indicator	
	o. Trafficator light	
	p. Hazard warning light	
	q. PTO engagement light.	
	r. Pump hour meter	
	s. Water control Valve	
4.9.4.5	The cab shall have all the necessary controls within easy reach of the driver for the full operation of the vehicle and the pumping system. The following cab controls shall be provided.	
	a. Accelerator	
	b. Parking brake control	
	c. Steering wheel, with directional signal control & horn	

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	d. Brake pedal	
	e. Transmission range selector	
	f. Pump control or selector/P.T.O.	
	g. Foam control	
	h. Siren switch(es)	
	i. Auxiliary agent control	
	j. Ground Sweep/ Under truck nozzle control	
	k. Roof Turret controls	
	l. Bumper Turret Controls	
	m. Light switches	
	n. Windshield wiper and washer controls	
	o. Heater-defroster controls	
	p. Master electrical switch (Isolator Switch)	
	q. Engine start/stop control	
	r. Windshield deluge system switch.	
	s. Water Tank Main valve control	
	t. Side delivery ON/OFF valve	
4.9.5	**EQUIPMENT**	
4.9.5.1	The following minimum equipment shall be provided in or on the cab.	
	a. Heater/defroster	
	b. Driver's suspension seat with vertical, fore and aft adjustment, with seat belt	
	c. Crew seats with individual retractable seat belts and grip hand rails.	
	d. Windshield washers appropriate for removing foam	
	e. Windshield wipers appropriate for removing foam	
	f. Siren	
	g. Horn	
	h. Sun visors, interior transparent	
	i. Outside rear view mirrors, as specified in 4.2.4.4	
	j. Interior lighting	
	k. P.A. System with Microphone as per 4.20.1	
	l. R.T. Set (VHF-AM) as per 4.17	
	m. Self-Contained Breathing Apparatus (SCBA) mounting bracket for crew members excluding driver.	
	n. Wind shield deluge system.	
	o. Storage space for four Nos. of Proximity suit boxes in driver's cabin.	
	p. DEVS as per 4.10	
	q. Rear view camera with a monitor at the panel.	
4.10	**DRIVER'S ENHANCED VISION SYSTEM**	
4.10.1	Vehicles shall be equipped with the navigation system of a driver's enhanced vision system (DEVS). The ACFT's position shall be displayed on a moving map display that shall be mounted in the cab. The vehicle's position shall be displayed with an accuracy of 2m, as well as the direction of travel. The map shall automatically pan and reorient itself to show the area around the vehicle.	

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4.10.2	**Low Visibility Enhanced Vision System**	
4.10.2.1	A low visibility enhanced vision system shall be installed in the vehicle. This system shall consist of a FLIR camera, monitor and controlling devices, and shall provide the operator with a thermal image to provide assistance in driving under low-visibility conditions.	
4.10.2.2	The FLIR shall have automatic gain and level controls and minimum horizontal (HFOV) and vertical fields of view (VFOV) of 12 degrees and 6 degrees, respectively. The FLIR shall be permitted to be a cooled or uncooled camera but shall be able to detect long waft (8 m to 12m) infrared (IR) energy and have industry standard output.	
4.10.2.3	The system should be able to detect people, debris, wreckage and equipment for the distances and conditions specified in NFPA 414 or equivalent.	
4.10.2.4	The installation should not obstruct driver view or hamper any other ARFFV/ACFT vehicle system including Monitor Operation. The system also be installed without any extensive vehicle modification and should include a dedicated vehicle voltage spikes and surges.	
4.11	**BODY**	
4.11.1	The body shall be constructed of non-corrosive materials that provide the lightest weight consistent with the strength necessary for off pavement operation over rough terrain and when exposed to excess heat. The material should also be guaranteed against any sort of deterioration, deformation, ageing and corrosion for a minimum period of **twelve years.** The body may be of the unitized with chassis rigid structure type or it may be flexibly mounted on the vehicle chassis. It shall also include front and rear fenders or wheel wells; body panels shall be removable where necessary to provide access to the interior of the vehicle.	
4.11.2	Access doors shall be provided for those areas of the interior of the vehicle, which must be frequently inspected. In particular, access doors of sufficient size and number shall be provided for access to;	
	a. Engine	
	b. Pump	
	c. Fluid reservoirs	
	d. Foam proportioning system	
	e. Battery storage	
	f. Engine oil level indicator(dipstick)	
4.11.3	Suitable, lighted compartments shall be provided for storage of equipment and tools to be carried on the vehicle. Compartments shall be watertight and self-draining. The compartments shall not house any other equipment and shall be free from projections. **(List of equipment's is enclosed in Appendix – A)**	
4.11.4	The working deck of the vehicle shall be adequately reinforced to permit the crew to perform their duties in the turret area, water tank top fill area, foam liquid top fill area, and in other areas where access to auxiliary or installed equipment is necessary.	
4.11.5	Handrails or bulwarks shall be provided where necessary for the safety and convenience of the crew. Rails and stanchions shall be strongly	

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	braced and constructed of a material which is durable and resists corrosion.	
4.11.6	Steps or ladders shall be provided for access to the top fill area. The lowermost step(s) may extend below the angle of approach or departure or ground clearance limits if it (they) is/are designed to swing clear. All other steps shall be rigidly constructed. All steps shall have a non-skid surface with at least 150 mm toe room. Lowermost step(s) shall be not more than 558.8 mm (22 in) above level ground when the vehicle is fully laden. Adequate lighting shall be provided to illuminate steps and walkways.	
4.11.7	A heavy-duty front bumper shall be mounted on the vehicle and secured to the frame structure.	
4.11.8	Paint finish shall be Yellowish Green' (As per FAA AC 150/5210-5D) in colour and shall be resistant to damage from firefighting agents.	
4.12	**FIRE FIGHTING SYSTEMS AND AGENTS**	
4.12.1	Foam concentrate shall be used as primary extinguishing agent and dry powder (Class B and Class C Type fire) as complimentary agent.	
4.12.2	Foam system shall be proportioning type system and the separate foam concentrate tank shall be provided on the vehicle.	
4.12.3	All components of foam system including liquid tank, piping fill troughs screens, valves and delivery connections shall be made of non-corrosive material.	
4.12.4	**Agent Pump and Drives**	
4.12.4.1	The water pump shall be made up of corrosion resistant material/suitable alloy compatible with foam concentrate with stainless steel shaft suitable for use with **Brackish Water** and shall be single or multiple stage centrifugal type, designed for dependable emergency service. The vehicles tank and the piping shall be designed to eliminate entrapment of air. The pump shall also be supported with independent automatic priming system. It shall be accessible and readily removable for repair and maintenance. Drain valves shall be provided at suitable location for draining water from the pump casing and piping.	
4.12.4.2	While discharging foam solution, the pumping system shall be capable of discharging at a rate equal to or exceeding the requirements of the roof turret (Monitor), ground sweep nozzles, hand line nozzles, and under truck nozzles, discharging simultaneously at designed pressures.	
4.12.4.3	Pump shall be single/double/multistage and closed impeller type where impeller(s) is dynamically balanced to reduce end thrust. Appropriate seal shall be provided capable of running dry for minimum **01 minute** without damage.	
4.12.4.4	The pump shall be mid ship mounted. Pump control panel shall be located on either side of appliance in addition to that positioned at the cab.	
4.12.5	**Pump Drive**	
4.12.5.1	The pump drive shall permit operation of pump and simultaneous operation of vehicle and shall not be affected by transmission ratio or clutch operation. The design of drive system shall prevent damage and minimize lurching of vehicle during simultaneous operation and shall be	

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	capable of absorbing maximum torque delivered by engine to the pump under all speeds of engine and vehicle, without causing any stalling of engine and fluctuation of pressure. **A separate modules/ Fuse box to be provided to avoid any malfunctioning in pump compartment.**	
4.12.5.2	The drive shall permit discharge at rated capacity of pump during vehicular speed from 0 kmph to a maximum of 16.1 kmph in forward and 0 kmph to a maximum of 8 kmph in rearward direction. During shifting from forward to rearward drive, the pumping system shall maintain the pre-set discharge pressure.	
4.12.6	**SUCTION AND DELIVERY CONNECTION**	
4.12.6.1	The suction inlet and delivery outlets of the pump shall be fitted on the pump control panels side on both sides of the appliance.	
4.12.6.2	The suction connection shall be provided at suitable location in standard round thread of **125 mm diameter** and shall be corrosion resistant. The location of suction inlet should be at lowest possible height preferably not exceeding one meter from ground level. The inlet shall be provided with Chromium plated brass blank cap.	
4.12.6.3	Delivery outlet connection shall be provided at suitable locations, operable from panel board in standard **63 mm female** instantaneous standard couplings.	
4.12.7	**PIPING, COUPLING AND VALVES**	
4.12.7.1	All piping, couplings and valves shall be made of material, conforming to relevant international standard, to prevent corrosive and galvanic action.	
4.12.7.2	All valves shall be quarter-turn-type in manual operation and shall be easy in operation and free from leakage.	
4.12.7.3	All piping shall be tested for leakage at 50% above the maximum pressure developed by the pump in no flow condition.	
4.12.7.4	Arrangement should be made to prevent overheating of pump at zero discharge.	
4.12.7.5	A drainage system with collector tubing from the low points on pump and piping shall be provided, operable with quarter turn valve.	
4.12.7.6	All plumbing shall be reasonably accessible for maintenance purposes. Drain cocks shall be provided where necessary and controls for these shall be readily accessible and so arranged as to prevent the cocks from being opened by vibration. The direction in which the valve/cock opens/closed shall clearly be marked near each valve/cock.	
4.13	**WATER TANK**	
4.13.1	Water tank shall have capacity as per 4.1.1(b). The tank outlets shall be arranged in such a way that Water tank percent of deliverable water is available as per 4.1.1(b)-2	
4.13.2	The tank shall be constructed to resist all forms of deterioration that could be caused by the water and the foam concentrate while affording the structural integrity necessary for off-road operation. Tank shall be made of Glass fibre Reinforced Polyester (GRP)/ Glass Reinforced Plastic/ Polypropylene conforming to relevant international standard with suitable longitudinal and traverse baffles to prevent surging, which shall permit easy access for internal inspection.	

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4.13.3	The tank shall be provided with hinged lid, a top filling hole with filter of 450 mm size and a drain hole at the bottom.	
4.13.4	Over flow piping shall be arranged in such a way that it releases pressure on overfilling without wasting water during vehicles manoeuvres.	
4.13.5	The water tank shall be separate from crew compartment, chassis, engine, and easily removable, and shall be mounted on chassis in a manner that the torsional strains during movement are minimum.	
4.13.6	Two external tank fill connection shall be provided both side near operating panel, in standard 63 mm instantaneous coupling, with strainers and ball valve. The filling connection inside the tank shall discharge water just below the upper plate of the water tank.	
4.13.7	A direct filling (pump to tank using own pump) connection shall also be provided to fill the tank from open source of supply and shall be sized so as to fill the tank at 5 bar pressure.	
4.13.8	Arrangement for lifting the tank without damage should be provided for repair and maintenance etc.	
4.13.9	Main tank valve shall be operated from cabin as well as from control panel. In addition, manual override shall be provided for tank opening valve at side control panel. This valve shall have accessible control.	
4.14	**FOAM TANK**	
4.14.1	Foam concentrate tank shall have usable capacity of not less than 800 litres or sufficient for more than two refills for water tank.	
4.14.2	Tank shall be made Glass fibre Reinforced Polyester (GRP)/ Glass Reinforced Plastic/ Polypropylene conforming to relevant international standard.	
4.14.3	The tank shall be separate and distinct from the body flexibly mounted on chassis to receive minimum torsional forces during vehicles movements and easily removable as a unit and should be suitably baffled to prevent surging. (The water and foam tank can be together with compartments or separate as per standard design of the manufacturer)	
4.14.4	The manhole of the tank size not less than 250 mm size shall be used for foam concentrate filling and shall be clearly marked '**FOAM CONCENTRATE**'. The tank shall be vented adequately to allow rapid and complete filling without the build-up of excessive pressure and to allow emptying of the tank at the maximum design flow rate without danger of collapse. The vent outlets shall be directed to the ground to prevent spillage of foam concentrate on vehicle components.	
4.14.5	The foam concentrate draw off tube shall be positioned in such a manner that foreign matter or sludge shall not pass into the compound lines. The draw off tube shall be fitted with gauge strainer of corrosion resistant material.	
4.14.6	Drain hole at the bottom of sump and a liquid induction connection shall be provided in the tank.	
4.14.7	Filling hole with a trough on top shall be connected with a pipe reaching at the bottom to avoid aeration in the liquid.	
4.14.8	**FOAM FILLING**	
4.14.8.1	The tank fill connection(s) shall be provided in a position where it can be reached easily from the ground to allow the pumping of foam-liquid	

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	compound into the storage tank. The connection(s) shall be provided with strainers of 6.4 mm mesh and shall have check valves or shall be constructed so that foam is not lost from the tank when connection or disconnection is made.	
4.14.8.2	Provision of foam concentrate filling from open source at ground level by foam concentrate filling pump shall be available with independent power drive.	
4.14.9	All pipe lines shall be made of non-corrosive material and dissimilar materials that produce galvanic corrosion shall not be selected. Where plastic piping is used, it shall be fabricated from un-plasticised resins unless the plasticizer has been provided not to adversely affect the performance characteristics of foam.	
4.14.10	All foam concentrate piping shall be adequately sized to permit flow and shall be arranged to prevent water entering the foam tank.	
4.14.11	Automatic foam concentrate proportioning arrangements shall be provided with 3%, 6% and 8% induction ratio preferably with Stepless System, for varying discharge rates and shall not require frequent calibration.	
4.14.12	**FOAM PROPORTIONING SYSTEM**	
4.14.12.1	The foam concentrate proportioning system shall provide a means of controlling the ratio of foam concentrate to the quantity of water in the foam solution being discharged from all orifices normally used for aircraft fire-fighting operations.	
4.14.12.2	The proportioning system shall be sufficiently accurate to provide for the discharge of finished foam concentrate within the range specified in Standard for Evaluating Aircraft Rescue and Fire-Fighting Foam Equipment.	
4.14.12.3	Control shall be provided at suitable location to open the foam concentrate tank from cabin as well from control panel operated pneumatically with manual override. This valve shall have accessible control.	
4.14.13	**ROOF TURRET (MONITOR)**	
4.14.13.1	One power driven Roof Turret (Monitor) shall be provided on the rooftop of cabin so that it can be operated by a member of crew from within the cabin of ARFFV/ACFT. The system should be capable of being operated manually from within the cabin or rooftop in case of failure in power assisting mechanism. Where equipped with a turret (monitor) having manual controls above the cab roof, the cab shall be designed with a quick-access passage to the turret (monitor). The monitor should have dual flow rate i.e. 100% and 50% with a suitable selecting mechanism at the monitor control and easily operable by the operator. **The size of the manual override wheel of roof turret should be adequate for easy access.**	
4.14.13.2	Monitor shall be capable of traversing 270^0 horizontally and elevating not less than 45^0 from horizontal axis and depression of 15^0 to deliver foam at ground level not more than 12m ahead of the vehicle. The locking position shall be facing front side. The monitor should not lose	

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	control in case assistance is lost during the operation and should remain in operation at same position awaiting manual operation.	
4.14.13.3	Monitor shall be capable of discharging total rated water tank quantity in not more than two and half minute and shall have a means provided for deflective pattern of foam dispersal. The discharge rate of monitor shall not be less than 3000 L/min at maximum rated pressure with expansion ratio of minimum 1:8 by using foam concentrate.	
4.14.13.4	Range of throw shall be as per 4.1.1 (b) 3 - roof turret discharge.	
4.14.14	**HAND LINES**	
4.14.14.1	In addition, one first aid hose reel connection shall also be provided with ≥30 mtrs rubber hose with a pistol grip type nozzle conforming to JCDD 25 (which can be used as spray and hollow jet), with discharge capacity of 230 L/min at operating pressure.	
4.14.14.2	Each side line shall have minimum discharge capacity of 450 L/min at 7 bar pressure on FB 10 EX branch with an expansion of not less than 8 and minimum throw of 25 mtrs when either, all foam hand lines are used simultaneously (with monitor not operating) or two of them are used in combination with monitor.	
4.14.14.3	Complementary agent (Dry Powder) hand lines shall have open/close nozzle discharge rate of more than 2.5 kg/second with 7.5 mtrs range. The nozzle should be made of non-ferrous metal or stainless steel.	
4.14.14.4	An automatic Pressure & Flow regulator shall be provided for the side line to enable the monitor to operate at the optimum pressure to give rated capacity for delivery, throw and expansion etc while maintaining the pressure of 7 bar pressure at the side line delivery. A bypass valve operable by 90^0 turn of a lever shall be provided to the automatic pressure regulator to facilitate availability of higher delivery pressure and flow whenever needed.	
4.14.14.5	The monitor shall operate at the optimum rated capacity for delivery, throw and expansion etc. while operated in combination with:	
	a. All the ground sweep nozzles and under truck nozzles	
	b. Two side delivery	
4.14.14.6	ARFFV/ACFT shall have two side lines on each side, operatable from cabin and panel both with manual override.	
4.14.15	**FOAM CONCENTRATE QUALITY:** Turret (Monitor) and hand lines shall be capable of producing foam from foam concentrate solution in the specified ratio of 3%, 6% & 8% preferably with Stepless System.	
4.14.16	**GROUND SWEEP AND UNDER TRUCK NOZZELS**	
4.14.16.1	Two Ground Sweep nozzles shall be provided at the front having performance as per 4.1.1(b)- 5&6 Optimum working pressure 6 bar. Four under truck nozzles shall be provided to protect under side of vehicles, tyres and wheels. Ground sweep/ Under truck Nozzles valve shall be controlled from cabin interior within easy reach of driver and a crewmember. An automatic Pressure & Flow regulator shall be provided for the ground sweep/ Under truck Nozzles to enable the monitor to operate at the optimum pressure to give rated capacity for delivery, throw and expansion etc., while maintaining the required pressure and flow for the ground sweep/Under truck nozzles.	

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4.14.17	**BUMPER TURRET**	
4.14.17.1	A power-driven bumper turret shall be provided. Flow rate shall not be less than 950 L/min. The throw range shall not be less than 46 metres. An aspiration barrel and deflector shall be provided. A foam expansion of not less than 1:8 with foam concentrate shall be achieved. The monitor shall be electronically controlled by a joystick within reach from driver and co-driver.	
4.14.17.2	An automatic oscillating mode shall be provided, horizontal and vertical range shall be programmable. When bumper monitor is in operation simultaneously with roof monitor, roof monitor flow rate shall automatically reduce to 70% of full flow rate.	
4.15	**PRIMER**	
4.15.1	A suitable primer shall be provided along with pump, which shall have both automatic and manual engagement/ disengagement provisions	
4.15.2	Primer shall be capable of priming a suction column with 7.3 mtrs lift in less than 30 second with indicator, with **125 mm suction hose diameter.**	
4.16	**LIGHTS AND ELECTRICAL SYSTEM**	
4.16.1	Following electrical gadgets shall be provided:	
	a. Siren of ≥ 95 decibel sound output at **100 feet** ahead and not less than 90 decibels at 90 degree either side at a distance of 100 feet, siren shall be mounted on cabin roof top and shall be fully protected from foam spills, rain water, dust and any damage due to monitor rotation.	
	b. A flashing red and revolving blue beacon on cab roof top	
	c. An Air horn	
	d. Headlights with selective pattern for High beam light	
	e. Dual tail lights and stop lights	
	f. Signal lights for turning at four corners of vehicles with visual and audible signals.	
	g. Spot light, at both ends of windshield glass, hand adjustable with 152 mm diameter.	
	h. Adequate reflector and markers to indicate overall dimensions of vehicle.	
	i. One reverse light with audible warning at the rear of vehicle.	
	j. Panel lights, top deck light, cabin lights, engine compartment lights, tools and equipment compartment lights, shall also be provided.	
	k. Two inspection lamps shall also be provided and provision of additional connection to use these lamps shall be made in various compartments.	
	l. Two fog lamps. These shall be low mounted in front of the appliance.	
	m. Equipment storage compartment lights shall glow on opening of the door/shutter, even when the ignition switch is turned off.	
4.16.2	All appropriate lights and gadgets detailed above shall be operable from driver's cabin.	
4.16.3	Visual indication for different functions of engine, P.T.O. pump, and pneumatic circuits by means of lamps in driver's cabin shall be preferred with **provision of extra electro-magnetic switch or ever flow modules.**	

1	2	3
Para No.	Technical Specification	Parameter
4.17	**RADIO TELEPHONE (R.T.)**	
4.17.1	One VHF Radio telephone operable on frequency range between 118 to 136 MHz- AM (Amplitude Modulation) synthesized at the airport SMC frequency and another operable on Frequency Modulation (FM) with a range between 136 to 174 MHz-FM. These will be a self-contained transmitting/receiving set, with Transmitting power of approximately 5 watts unmodulated and intrinsically safe. The equipment shall be suitable for use in all-weather condition and shall be provided at suitable location in cabin. It should be operable at 12V/ 24V power supply system of ARFFV/ACFT and should be made of waterproof construction. The RT set should also have an adjustable head set in addition to the speakers. Sockets for connecting the headset to the R T Set should be provided at the mid-ship panel. The set shall be suitably mounted to resist vehicles vibration and suppress engine noise or any other vehicular electromagnetic induction.	
4.17.2	Adequate spares for 12 years and service/repair and spares manual along with circuit diagrams should be provided. All manuals and diagrams should be in English language with standardized international symbols.	
4.17.3	The system protection fuse shall be located in an easily accessible location for quick replacement.	
4.18	**DRY CHEMICAL SYSTEM**	
4.18.1	One unit of 250 kg each dry chemical powder (foam compatible) shall be provided, using dry nitrogen as propellant gas so as to achieve performance as specified in 4.1.1 (b). The dry chemical container shall be constructed in accordance with the ASME Boiler and Pressure Vessel Code, Section 8, or equivalent, and shall be so stamped.	
4.18.2	All piping and fittings shall conform to the appropriate ASME, or equivalent, code and shall be designed to withstand the working pressure of the system. The design of the piping and valves shall provide the desired flow of gas into the system and the minimum amount of restriction from the chemical container(s) to the hose connection. Where more than one hose line is provided, piping and fittings shall be sized and designed so that there is equal flow to each line, regardless of the number of lines placed in operation.	
4.18.3	Nitrogen cylinders shall be certified from Department of Explosive (Government of India) and shall have universal filling connections. The cylinder shall be manufactured in the year of delivery and have clearance from Explosive Department, Nagpur (India) for re-filling, storing and operation.	
4.18.4	Provisions shall be made for purging all piping and hose of dry chemical after use without discharging the dry chemical remaining in the dry chemical container(s). Provisions also shall be made for the depressurization of the dry chemical container(s) without the loss of the remainder of the dry chemical. A pressure gauge shall be provided that indicates the internal pressure of the agent storage container(s) at all times.	
4.18.5	A means of pressure release in situation of over pressure shall be provided with filling opening and suitable tight-fitting cap.	

1	2	3
Para No.	**Technical Specification**	**Parameter**
4.18.6	Standby one no. of nitrogen cylinder shall be provided	
4.19	**PROVISION FOR STORAGE** of additional extinguishing media in future shall be made.	
4.20	**OTHER EQUIPMENT**	
4.20.1	**Public Address (P.A.)** equipment, battery operated, with wireless and cable connected microphone fitted in the cabin and loudspeaker fitted on the rooftop of cabin capable of being operated from cabin. PA system receiver should have a provision to connect one wireless microphone and one microphone with cable connection. The wireless microphone shall be of FM (Frequency Modulation) with a range of minimum 100 Metres. All PA system receivers shall be tuned to the frequency of wireless microphone.	
4.20.2	A spare battery charger. **There should be adequate space provision for battery compartment and polarity of line.**	
4.20.3	All tools and accessories/equipment as per **Appendix-A**	
4.20.4	**Event (Electronic) Data Recorder:** The vehicle should have a real time event (electronic) data recorder to record the performance parameters like vehicle speed, gear position, PTO on/off, engine temperature, engine RPM etc. The recorder shall be tamper proof with provision for data transfer to PC with suitable software for data interpretation. **In addition, the ARFFV / ACFT engine should have Engine Informative System (EIS) so as to obtain data about various parameters of the engine such as maintenance schedules, service alerts, performance alerts, errors etc. and history sheet of maintenance.**	
4.21	**Factory Acceptance Test – as per Annexure-V**	
4.22	**MANUFACTURE CERTIFICATE AND GUARANTEE**	
4.22.1	Manufacturer shall provide a certificate for the appliances conforming to all specifications.	
4.22.2	The manufacturer shall provide maintenance services as recommended by OEM for total period of Ten years including two years of guarantee period. All the charges in respect of maintenance / repair service shall be covered under para 2.12.1 of section C-1.	
4.22.3	The manufacturer shall be responsible for replacing any parts, which may become unserviceable due to the use of defective and sub-standard materials and bad workmanship during the period of guarantee free of all charges.	
4.23	**MARKINGS**	
	Following markings shall be made on the body of the vehicles:	
	a. Manufacturer's name and trade mark	
	b. "Airport Fire and Emergency Service".	
	c. Year of manufacture	
	d. Engine and Chassis numbers	
	e. AAI Emblem	
	f. Job or Serial No.	
	g. Capacity of pump, water tank, foam tank	

1	2	3
Para No.	**Technical Specification**	**Parameter**
	h. Pump serial number	
	i. Chassis supplier name and country of origin	
	j. Luminous strips to be provided at the rear and both sides of the vehicle	
4.24	**ITEMS SUPPLIED IN INDIA/WORKS OF SUPPLIER:** Items required as per **Appendix-A** under category A-Items supplied in India shall be conforming to Bureau of Indian Standards (BIS) wherever the standards exist or from works of supplier. All other equipment and accessories forming part of superstructure fabrication shall be provided at the place of fabrication.	
4.25	**MANUAL OVERDRIVE FOR POWER ASSISTED OPERATION:** All power assisted controls and operation should have suitable manual operation to ensure the operation in case of any failure in the power assisting mechanism. Such arrangements shall be easily accessible to the operator facilitating quick changeover. **NOTE**: Bidder must give detailed technical information in the Questionnaire (**Annexure- VI**) enclosed regarding the ARFFV/ACFT quoted by them.	

Note: The firm should have adequate infrastructure, equipment and tools for practically demonstrating the technical Specifications as mentioned above.

Appendix-A

Following Vehicle mounted Equipment's are to be supplied along with the ARFFV/ACFTs in properly stored Lockers with designated places and appropriate Quick-release Clippings:

Sl. No.	Equipment for Rescue Operation	Quantity	Appendix/ Standard
A	**ITEMS TO BE SUPPLIED FROM INDIA/ WORKS OF SUPPLIER :-**		
1*	Aluminum Extension Ladder, 10.5 M Length	1 no.	Appendix-I/NFPA/Equivalent applicable standard, provided the ladder is housed within the vehicle
2	Universal Branch Pipe (Diffuser Branch), 63 mm Male Instantar Inlet, Gunmetal Material	1 no.	IS : 2871 / Equivalent applicable standard
3	Standard Branch Pipe with 19 mm Nozzle, 63 mm Male Instantaneous Inlet, Gunmetal Material	2 nos.	IS : 903 / Equivalent applicable standard
4	Nozzles for Standard Branch Sizes: a. 12 mm b. 20 mm	1 no. each	IS : 903 / Equivalent applicable standard
5	Nozzle Spanner, Material Steel	1 no.	IS : 903 / Equivalent applicable standard
6	Foam Making Branch, FB 5X type with Pick-up Tube	2 nos.	IS : 2097 / Equivalent applicable standard
7	Foam Making Branch, FB 10X type with Pick-up Tube	2 nos.	IS : 2097 / Equivalent applicable standard
8	Portable Water Mist and Fire Extinguisher Backpack	1 no.	Appendix-II
9	Portable LED Emergency Light with Accessories	1 no.	Appendix-III
10	Oil Sorbent Kit	1 no.	Appendix-IV
11	Safety Goggles	4 pairs	Appendix-V
12	Reusable Ear Plug	25 pairs	Appendix-VI
13	Chocks	1 pair	Appendix-VII
14#	Suction Hose for Pump complete with Round thread Gunmetal Couplings, 2.5 M	4 Lengths	IS : 2410 / Equivalent applicable standard
15	Suction Strainer for Pump, Gunmetal	1 no.	IS : 907 / Equivalent applicable standard
16	Suction wrench for 125 mm suction hose coupling	2 nos.	IS : 4643 / Equivalent applicable standard
17	Suction adopter GM 125 mm female x 63 mm male with lugs	1 no.	IS / Equivalent applicable standard
18	Hydraulic Door Opening Kit	1 no.	EN / Equivalent applicable standard
19	Jack Hydraulic for 20 Ton capacity (Bottle Type) with handle	1 no.	IS / Equivalent applicable standard
20	Branch with revolving head, GM 63 mm	1 no.	IS : 906 / Equivalent applicable standard
21	Fireman Axe with belt & pouch	3 nos.	EN / Equivalent applicable standard
22	Hydraulic Spreader & Cutter with Pump & Accessories	1 no.	Appendix-VIII
23	Power Driven Circular Saw with Accessories	1 no.	Appendix-IX
24	Pneumatic Lifting Airbag with Accessories	1 no.	Appendix-X
25	Jumping Cushion	1 no.	Appendix-XI
26	Zero-torque Nozzle with Hand-Control, 63 mm Male Instantaneous Inlet, Discharge 750 LPM @ 7 Bar Pr.	1 no.	Appendix-XII

27	Seat Belt/Harness Cutting Tool	3 nos.	EN / Equivalent applicable standard
28	Gloves, Fire Resistant with Anti-skid Palm	8 nos.	EN / Equivalent applicable standard
29	Fog/Jet Nozzle with Hand-Control, 63 mm Male Instantaneous Inlet, Discharge 750 LPM @ 7 Bar Pr.	1 no.	NFPA 1964 / Equivalent applicable standard
30	Penetrating /Pinch ring Nozzle with 63 mm Male Instantaneous Inlet, Stainless Steel Material	1 no.	NFPA 1964 / Equivalent applicable standard
31	Telescopic Roof Mounted Mast	1 no.	Appendix-XIII
32	Cable Winch	1 no.	Appendix-XIV
33	Quick Release knife with pouch to be worn with fireman's belt	5 nos.	EN / Equivalent applicable standard
34	Hand Held Forcible Entry Tool Kit	1 no.	Appendix-XV
35	Hand line Nozzle with selectable flow, pistol grip and shut-off with double stops	1 no.	NFPA 1964 / Equivalent applicable standard

* to be stowed at the top of the vehicle with gallows. Rollers are to be provided for single man mounting/dismounting of ladder

to be stowed in hose tunnels provided at the top of the vehicle

- Test certificates in respect of equipment's shall be submitted before prototype test of Successful bidder as stated in clause 17.3.9 of Section-A.

Sl. No.	Equipment for Rescue Operation	Quantity
B	**SPARE LOCKERS HAVING DESIGNATED PLACE AND APPROPRIATE QUICK-RELEASE CLIPPING ARE TO BE PROVIDED FOR THE FOLLOWING EQUIPMENT'S :**	
1	Adjustable Wrench	1 no.
2	Axe, Rescue, Large, Non-wedge Type	2 nos.
3	Axe, Rescue, Small, Non-wedge Type	2 nos.
4	Cutter Bolt, 61cm	1 no.
5	Crowbar, 95cm	1 no.
6	Chisel, Cold, 2.5cm	1 no.
7	Sledge Hammer, 1.8kg	1 no.
8	Hook, Grab or Salving	3 nos.
9	Blanket, Fire Resisting	3 nos.
10	Short Rope Line, 15M length, 50mm Circumference, Hemp/ manila	3 nos.
11	Long Rope Line, 30M length, 50mm Circumference, Hemp/ manila	3 nos.
12	Piers, 17.8cm, Side-cutting	3 nos.
13	Piers, Slip joint, 25cm	1 no.
14	Screwdrivers, Assorted (Set)	1 no.
15	Snipers, Tin	1 no.
16	Collecting Breeching, 63 mm Instantaneous Gunmetal	1 no.
17	Medical First-aid Kit	1 no.
18	Non-percolating Firefighting Delivery Hose, Synthetic Jacketed with Elastomeric Outer Covering, 63mm Instantaneous couplings, 30M Length	8 nos.
19	Hose Bandages	12 nos.
20	Hose Clamps	6 nos.
21	Dividing Breeching, 63 mm Instantaneous Gunmetal	1 no.
22	Insulated Pliers with Rubber Gloves Pairs Tested to 20 KV	1 no.
23	Cropper Bolt	1 no.
24	Kinetic Cutter	1 no.

25	Hack Saw, 300mm x 12.5 mm x 0.63 mm approx. Size of Blades with 6 nos. of Spares Blade	1 no.
26	Crow Bar, 6' Length, 25mm Diameter	1 no.
27	Axe, Drift & Rescue	1 no.
28	Double Female Coupling	2 nos.
29	Double Male Coupling	2 nos.
30	Space for Emergency Inflatable Lighting Tower with Electric Generator of 3.5 BHP (4-stroke Petrol driven) & Alternator of 1.2 KVA (Synthetic Illuminating Tube)	1 no.
31	Adapter 63 mm male to 38 mm female GM	2 nos.
32	Adapter 63 mm female to 63 mm female GM	2 nos.