ANNEXURE D

City of Johannesburg Red Fleet Specification:

Telescopic Aerial Ladder

6 x 4

Fire and Rescue Vehicle

Specification for 6x4 Telescopic Aerial Ladder Fire and Rescue Vehicle.

1. GENERAL

1.1 SCOPE.

1.1.1 This specification describes City of Johannesburg Red Fleet requirements for 6x4 Telescopic Aerial Ladder Fire and Rescue Vehicle.

1.2 Design Standards.

1.2.1 The vehicle shall be designed to meet the requirements and norms of National Road Traffic Act 93 of 1996 (as amended).

1.2.2 The design and construction of the vehicle shall comply fully with the standards in this specification document and the following applicable international and local standards:

A. NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition).
B. NFPA 1931: Standard for Manufacture's Design of Fire Department Ground Ladders (2020 edition).
C. EN 1777:2010, Hydraulic platforms (HPs) for firefighting and rescue services-Safety Requirements and Testing.
D. American National Standard Institute (ANSI) /SAIA A 92.2-2021 Vehicle Mounted Elevating and Rotating Aerial Devises.
E. Occupational Safety and Health Administration (OSHA) 29 CFR 1926.
F. SANS compulsory specifications and standards.

1.2.3 The vehicle design features shall comply with the requirements of Occupational Health and Safety Act. 85 of 1993 (as amended)-General Safety Regulations.

1.3 Compliance to NFPA

1.3.1 The vehicle will be tested by the manufacturer that it is in accordance with NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition), including pumps and certification to be provided.

1.3.2 Factory Acceptance Test

1.3.2.1 Before delivery of the vehicle, the following factory acceptance tests shall be conducted by nominated City of Johannesburg:

Vehicle:

A. Electrical system performance testing

B. Weld quality

C. Alternator performance test

D. Dimension Check

E. Brake Test

F. Turning diameter

G. Weight measurement, full load and empty.

H. Road Test, including acceleration, top speed test and cooling system

Firefighting:

I. Primer test

J. Pump flow test

K. Piping Hydrostatic pump test

L. Water tank to pump flow test

M. Water tank and foam tank tests

N. Power train testing

O. Superstructure integrity test

P. Complete operational test

Q. Foam system test

R. Emergency lighting system test

S. Dry vacuum test.

1.3.2.2 All products should undergo a quality assurance program and be fully inspected for compliance to specifications.

1.3.2.3 Travelling local and international for Factory Acceptance Test shall be at cost of successful bidder.

1.3.2.4 All relevant certification of the products shall be provided before the test.

1.3.2.5 All products must undergo a quality assurance program and be fully inspected for compliance to specifications.

1.3.3 Third party underwriter laboratory testing and certification

1.3.3.1 Third party inspection certificates for the vehicle components must be furnished upon delivery of the vehicle.

1.3.3.2 The following tests must be conducted and certified before delivery:

A. Magnetic particle inspection test.

B. Liquid penetrant test.

C. Ultrasonic inspection test.

D. Functional tests, load tests, stability tests

1.4 Warranty

1.4.3 The service provider will be responsible for the warranty of the complete vehicle irrespective of the components. All warranty and related calls will be logged with the service provider/s.

1.4.4 The overall warranty period on the apparatus superstructure must be at the minimum standard of five years (5) from the date of delivery.

1.4.5 The minimum five (5) years warranty for the following items must be provide:

A. Structural Integrity Warranty
B. Power Train
C. Transmission
D. Painting
E. Plumbing
F. Fire Pump

1.4.6 The chassis cab and water tank warranty must be minimum of 10 years.

1.4.7 All components and spares utilised in the manufacturing process must be approved by the Original Equipment Manufacturer (OEM).

1.4.8 All defects encountered due to poor workmanship and manufacturing deficiencies will be replaced at the cost-of-service provider/s during the warranty period.

1.5 Training and Skill Transfer

1.5.1 Training will be provided free of charge, on-site for sixty (60) personnel members, by professionals and will be based on the following:

A. Driving Techniques
B. Fire Fighter Safety
C. Operating Instructions - Warrior
D. Water & Foam Supply Systems
E. Pumping Operations & Techniques
F. Basic Vehicle Care & Preventative Maintenance
G. Basic Equipment Care & Preventative Maintenance
H. Basic Vehicle & Equipment Specifications

1.6 Registration of Vehicles.

1.6.3 The successful Bidder must include the cost of registration, licensing the vehicles and fitting number plates in their tender offer.

2 FUNCTIONAL TECHNICAL SPECIFICATION FOR TELESCOPIC AERIAL LADDER

2.1 Chassis

2.1.1 The vehicle on offer must have a 6 x 4 drive configuration

2.1.2 A custom chassis developed exclusively for the fire service must be supplied.

2.1.3 The chassis must feature an integral design.

2.1.4 The design must combine the chassis frame and aerial torque box into a single structure.

2.1.5 This must provide an optimized design that lowers vehicle centre of gravity, eliminates the need to torque aerial frame attachment bolts, and permits outriggers to maximize body compartments.

2.1.6 The chassis must be manufactured in the apparatus body builder's facility eliminating any split responsibility (body builder responsible for all design and build aspects).

2.1.7 The chassis must be designed and manufactured for heavy-duty service, with adequate strength, capacity for the intended load to be sustained, and the type of service required.

2.1.8 The chassis must be robust and be capable of withstanding loads on it when traversing rough terrain, with negligible deflection.

2.1.9 The chassis must have a ground clearance of at least 470 mm

2.1.10 Two (2) heavy-duty stainless-steel front tow eyes must be securely bolted to the frame.

2.1.11 The chassis, cab and superstructure manufacturer must also be the aerial ladder manufacturer.

2.1.12 The custom chassis frame, axles and wheels must have a wheel alignment in order to achieve maximum vehicle road performance and to promote long tyre life.

2.1.13 The alignment must conform to accepted international standards and the manufacturer's internal specifications, in respect of the following:

a FRONT AXLE: Total adjustable steering alignment. (Toe-in, toe-out, castor, camber and straight-ahead position of steering box.)

b NO STEER AXLES: Straight-ahead alignment position. (Toe and camber)

C The wheel alignment documentation must be made available at delivery.

2.1.14 The vehicle must be equipped with a one-piece bumper, made from polished stainless steel for corrosion resistance, strength, and long-lasting appearance. It must be mounted directly to the front frame extensions for maximum strength.

2.1.15 The bumper must incorporate two (2) stiffening ribs and must extend forward of the front of the cab per customer specification to provide additional protection against low-speed frontal impacts.

2.1.16 The space between the bumper and the front of the cab must be covered on the top and on each side with aluminium diamond plate.

2.1.17 Dual air horns must be provided and connected to the chassis air system and mounted behind the front bumper.

2.1.18 Two (2) rear tow eyes must be fitted

2.2 Fuel System

2.2.1 A fuel tank with a minimum capacity of 230 litres must be provided.

2.2.2 The fuel tank must be equipped with a filler neck, positioned in such a way that the neck is away from the heat of the exhaust system as required by NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) Standard for Automotive Fire Apparatus.

2.2.3 The open end of the filler neck must be equipped with a twist-off filler cap with a retaining chain.

2.2.4 A mechanical/ electronic fuel pump must be provided and sized by the engine manufacturer as part of the engine.

2.3 Front Axle/Suspension

2.3.2 The vehicle must utilize a front axle with a rated capacity of 8,482 kg.

2.3.3 The front suspension must be furnished with two (2) heavy-duty, double acting shock absorbers, one (1) each side.

2.3.4 The vehicle must be equipped with a right-hand drive integral full power steering and be rated to statically steer up to a maximum front axle load of 8,482 kg.

2.3.5 The system must be able to operate mechanically should the hydraulic system fail.

2.3.6 Rear Axle/Suspension

2.3.6.1 The vehicle must utilize an 18,144 kg capacity rear tandem axle.

2.4 Braking System

2.4.1 An ABS system must be provided to improve vehicle stability and control by reducing wheel lock-up during braking.

2.4.2 This braking system must be fitted to axles and all electrical connections must be environmentally-sealed, water-, weather-, and vibration-resistant.

2.4.3 The system must constantly monitor wheel behaviour during braking.

2.4.4 The vehicle must be equipped with air operated brake system.

2.4.5 The system must meet or exceed the design and performance requirements of current NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) Standards.

2.4.6 The air system must be provided with a rapid build-up feature, designed to meet current NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) requirements.

2.4.7 A pressure protection valve must be installed to prevent use of air horns or other air-operated devices should the air system pressure drop below maximum of 560 kPa.

2.4.8 Two (2) air pressure needle gauges, for front and rear air pressure, with warning light and buzzer must be installed at the driver's instrument panel.

2.5 Air Tank Reservoirs

2.5.1 One (1) reservoir must serve as the wet tank and a minimum of one (1) tank must be supplied for each of the front and rear axles.

2.5.2 An automatic drain valve must be installed on the wet tank. All other tanks must be equipped with manual drain valves.

2.6 Emergency/parking brake

2.6.1 Spring-actuated emergency/parking must be installed on the rear axle.

2.7 Automatic Moisture Ejectors

2.7.1 All air reservoirs must be equipped with an automatic reservoir drain valve which must automatically eject moisture and contaminants from the reservoirs.

2.7.2 The moisture ejectors must be heated.

2.8 ENGINE

2.8.1 The vehicle must utilize a Six (6) Cylinder minimum 10 litre displacement electronic diesel engine with a minimum torque of 373 kW at 1900 (r.p.m.) and a peak torque of 2,102 Nm at 1200 (r.p.m.)

2.8.2 The engine must have a minimum power rating of 354 kW at a governed engine speed of 2100 (r.p.m.)

2.9 Auxiliary Braking System:

2.9.1 The apparatus must be equipped with an auxiliary braking system.

2.9.2 A hydraulic output retarder/intarder which forms part of the gearbox must be provided.

2.9.3 The retarder must be automatically activated to 50% of retardation capacity when the accelerator pedal is released and 100% when the brake pedal is initiated.

2.9.4 The system must allow for at least 40 (forty) percent retardation.

2.10 Transmission

2.10.1 The vehicle must utilize an electronic, not less than 5-speed automatic transmission with a minimum of five (5) forward and One (1) reverse gear.

2.10.2 The gear shift module must be located within easy reach of the driver.

2.10.3 The shift position indicator must be indirectly lit for after dark operation.

2.10.4 The shift module must have a ''Do Not Shift'' light and a ''Service'' indicator light.

2.10.5 The shift module must have means to enter a diagnostic mode and display diagnostic data.

2.10.6 A transmission temperature gauge with warning light and buzzer must be installed on the cab instrument panel.

2.10.7 The transmission must be equipped with a fluid level sensor (FLS) system, providing direct feedback of transmission oil level information to the operator.

2.10.8 The transmission must contain two engine driven PTO openings located at the 1 and 8 o'clock positions.

2.10.9 The automatic transmission must be equipped with a power lock-up device to lock up the torque converter, in order to provide for a direct drive.

2.10.10 The transmission lock-up must prevent down shifting of transmission when engine speed is decreased during pump operations, thereby maintaining a constant gear ratio.

2.10.11 Transmission lock-up must be automatically activated when placing pump in gear. Transmission lock-up must be automatically deactivated when disengaging pump for normal road operation.

2.11 PTO Driven Generator

2.11.1 Each unit must be fitted with a 10 kVA, 230 V, 50 Hz, PTO driven generator

2.11.2 The control panel must be placed in an easily accessible location directly behind the cab.

2.11.3 Provision must be made for at least two (2) SABS 3-point plug sockets.

2.11.4 These sockets must be weatherproof.

2.11.5 All connections must be in accordance with the relevant SABS standards.

2.12 Driveline

2.12.1 Drivelines must have a heavy-duty metal tube and must be equipped with universal joints to allow full-transmitted torque to the axle(s).

2.12.2 Drive shafts must be axially straight, concentric with axis and dynamically balanced.

2.13 Engine Cooling System

2.13.1 The Engine cooling system must ensure adequate cooling under all operating conditions.

2.13.2 The system must be designed in a manner to meet engine manufacturer's cooling requirements for the exhaust gas recirculation.

2.14 Hydraulic System

2.14.1 A hydraulic system must be provided to power all outrigger and aerial functions with direct control stations provided for each system.

2.14.2 A system ''engaged'' indicator light must be provided on the activation switch.

2.14.3 This hydraulic system will allow for the aerial system to be activated without having to shut down the water pump or reduce engine RPM's.

2.14.4 Engagement must be allowed only with the transmission in the neutral or pump gear and the parking brake engaged.

2.15 Apparatus Cab

2.15.1 A cab with four side-hung doors must be provided.

2.15.2 The cab must be an all-welded aluminium, fully enclosed tilt cab designed exclusively for the fire service to ensure long life.

2.15.3 The cab must allow sufficient room in the occupant compartment for a driver, co-driver and three (3) personnel.

2.16 Cab Mounts and Cab Tilt System

2.16.1 The cab must be independently mounted from the body and chassis to isolate the cab structure from stresses caused by chassis twisting and body movements.

2.16.2 An electric-over-hydraulic cab tilt system must be provided to provide easy access to the engine.

2.16.3 Safety mechanisms must be provided to prevent the raised cab from suddenly dropping in case of a burst hydraulic hose or other hydraulic failure.

2.16.4 The safety mechanisms must operate when the cab is in any position, not just the fully raised position.

2.16.5 The cab tilt system must have a manual override system as a backup in the event of an electrical failure.

2.16.6 A parking brake interlock must be provided as a safety feature to prevent the cab from being tilted unless the parking brake is set.

2.16.7 The entire cab must be tilted through a 40 to 45-degree arc to allow for easy maintenance of the engine, transmission, and engine components.

2.16.8 A positive-engagement safety latch must be provided to lock the cab in the full tilt position to provide additional safety for personnel working under the raised cab.

2.16.9 In the lowered position, the cab must be locked down by cab latches at the rear of the cab.

2.16.10 A "cab ajar" indicator light must be provided on the instrument panel to warn the driver when the cab is not completely locked into the lowered position.

2.16.11 Battery jumper studs must be provided to allow jump starting of the apparatus without having to tilt the cab.

2.17 Cab Interior

2.17.1 Cab instruments and controls must be located on the cab instrument panel in the dashboard on the driver's side where they are clearly visible and easily reachable.

2.17.2 Gauges and emergency warning light switches must be installed in the driver's side of the overhead console on removable panels for ease of access and service.

2.17.3 The following gauges and controls must be provided:

- A Speedometer/Odometer
- B Tachometer with integral engine hour meter
- C Engine oil pressure gauge with warning light and buzzer
- D Engine water temperature gauge with warning light and buzzer
- E Two (2) air pressure needle gauges, for front and rear air pressure, with warning light and buzzer
- F Fuel gauge
- G Voltmeter
- H Master battery switch/ignition switch
- I Starter switch/engine stop switch
- J Heater and defroster controls with illumination

K Marker light/headlight control switch with dimmer switch

L Self-cancelling turn signal control with indicators

M Windshield wiper switch with intermittent control and washer control

N Master warning light switch in overhead control panel

O Transmission oil temperature gauge

P Pump shift control with "pump in gear" and "ok to pump" indicator lights in message centre

Q Parking brake controls with red indicator light in message centre

R Automatic transmission shift console

S Electric horn button at centre of steering wheel

T Transmission oil temperature gauge

U Air filter restriction indicator

2.17.4 Instrument controls and switches must be identified as to their function by backlit wording adjacent to each switch, or by indirect panel lighting adjacent to controls.

2.17.5 The headlight switch must control the illumination of controls and switches.

2.18 Fast Idle System

2.18.2 A fast idle system must be provided and controlled by the cab-mounted or pump panel-mounted switch.

2.18.3 The system must increase engine idle speed to a pre-set RPM for increased alternator output.

2.19 Seats colour and material (6 Seats in Total)

2.19.1 All seat cushions in the cab must be upholstered with flame-retardant, water repellent and wear resistant fabric.

2.20 Driver Seating

2.20.1 One (1) air suspension seat must be supplied for the driver's position.

2.20.2 Features must include:

A Universal styling

B High back seat

C Low profile air suspension assembly with rubber accordion cover

D Mass height and ride adjustment

E Built-in back and lumbar adjustment

F 102 mm fore and aft adjustment

2.21 Officer seating

2.21.1 Provision must be made for SCBA storage brackets on the back rest.

2.21.2 The outboard side of the seat riser must be angled, providing sufficient leg room when entering and exiting the cab.

2.21.3 Features must include:

A Universal styling

B Easy exit, flip up, and split headrest for improved exit with SCBA.

C Bench cushion must be constructed of high-density foam with a heavy-duty wear resistant material.

D All seat positions must have retractable 3-point lap and shoulder harness, providing additional safety and security for personnel.

E Extensions must be provided with the seat belts so the male end can be easily grasped and the female end easily located while sitting in a normal position.

2.22 Crew Seating

2.22.1 Seating for at least four (4) crew members must be provided in the rear.

2.22.2 The seats must be universal SCBA seat backs.

2.22.3 Features must include:

A Universal styling.

B Easy exit, flip up, and split headrest for improved exit with SCBA.

C Cushion must be constructed of high-density foam with a heavy-duty wear resistant material.

D Each seat positions must have retractable 3-point lap and shoulder harness, providing additional safety and security for personnel.

E Extensions must be provided with the seat belts so the male end can be easily grasped and the female end easily located while sitting in a normal position.

2.23 Interior Lighting

2.23.1 Interior cab lighting must include four (4) individually switched lights in the ceiling, two (2) in the front and two (2) in the rear.

2.23.2 Four (4) step lights, one (1) in each of the four (4) cab doors, must be installed to provide downward illumination of the steps and the surrounding ground.

2.23.3 The cab ceiling lights and the step lights must be wired through the "door ajar" switch to provide interior lighting when the battery power is on and any cab door is opened.

2.23.4 An engine compartment light with a switch must be installed to illuminate the engine compartment.

2.24 Alternator

2.24.1 A minimum of 265-amp NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition)-rated alternator must be provided.

2.24.2 The alternator must be installed in accordance with the engine manufacturer's recommendations.

2.25 Batteries

2.25.1 The manufacturer must supply a minimum of heavy-duty 12-volt maintenance-free batteries.

2.25.2 Each battery must be installed and positioned so as to allow easy replacement of any single battery.

2.25.3 Each battery must be equipped with carrying handles to facilitate ease of removal and replacement.

2.25.4 Batteries must be placed on non-corrosive rubber matting and secured with hold-down brackets to prevent movement, vibration, and road shock.

2.26 Dash mount Radio.

2.26.1 The apparatus must have a provision for the dash mount two-way radio.

2.27 Dash mounted GPS.

The vehicle shall have a GPS mounted on the dashboard.

2.27.1 Dimension 9.2" x 6.4" x 3" (23.3 x 16.2 x 7.6 cm)

2.27.2 The device shall have touchscreen capabilities

2.27.3 The display size shall be not less than 7.8" x 4.4"; 9.0" diagonal (19.9 x 11.2 cm; 22.9 cm diagonal)

2.27.4 Display resolution shall not less than 1280 x 720 pixels

2.27.5 Display type shall be WXGA

2.27.6 Minimum 1.6 kg

2.27.7 Water rating shall not be less than ipx7

2.27.8 Maps & memory shall accept data cards 2 micro SD cards (back of unit), have a minimum of five (5) waypoints, a minimum of 50 track points, and have a minimum of 100 track routes.

2.27.9 Sensors must have a built-in receiver with a minimum of Ten (10) hz high-sensitivity, NMEA 2000 compatibility, NMEA 0183 compatibility and supports WAAS

2.27.10 The unit shall have built-in maps-in auto guidance, bluechart (coastal), lakevu (inland)

2.27.11 The unit connections shall have one NMEA 2000 ports, NMEA 0183

2.27.12 Input ports, NMEA 0183 input (TX) ports, video input ports, BNC j1939 ports , marine network ports, 12-pin transducer ports, USB port, BNC external GPS antenna port. Bluetooth, ant+ (connectivity), Wi-Fi network (local connection)

2.27.13 The unit shall have an electrical power input between 10 to 32 VDC at typical current draw at 12 VDC 1.37, maximum power usage at 10 VDC 40.2W

2.28 Vehicle Camera System

2.28.1 It must have rear view camera.

2.28.2 The camera image/s must be displayed on the driver's full colour Mux display. The camera must be able to operate in the dark/night and over exposed lighting.

2.29 Aerial Apparatus Body

2.29.1 Performance

2.26.1.1 The apparatus body must be constructed entirely of aluminium extrusions with interlocking aluminium plates.

2.26.1.2 An extruded modular aluminium body is required due to the high strength to weight ratio of aluminium, corrosion resistant body structure, easy damage repair, and lighter overall body weight to allow for increased equipment carrying capacity.

2.26.1.3 The apparatus must incorporate a rescue style body design to maximize compartment space. The rescue style left and right-side body must combine upper and lower compartments to provide more efficient use of body storage capacity.

2.26.1.4 The body design must provide storage, conforming to the minimum NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) Chapter 6-5 requirement.

2.29.2 Body Mainframe

2.26.2.1 The body mainframe must be entirely constructed of steel/Aluminium.

2.29.3 Stabilizer Openings

2.26.3.1 The body must be designed to accommodate a four-stabilizer aerial system.

2.26.3.2 One opening must be supplied behind the rear axle as close to the wheel well opening as possible to maximize rear angle of departure and to prevent the stabilizer pads from contacting the ground during driving.

2.26.3.3 The second set must be mounted just behind the pump compartment.

2.26.3.4 The openings must be framed in aluminium extrusions.

2.26.3.5 A stabilizer cover must be supplied on the extendable stabilizer.

2.26.3.6 The cover must provide a pleasing appearance and mounting location for a red stabilizer warning light as outlined in NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 18-21.2.5.

2.26.3.7 The stabilizer openings must be supplied with clear lights to illuminate the stabilizers and the ground surrounding the openings.

2.26.3.8 The lights must illuminate when any stabilizer is moved from the stored position.

2.26.4 Rear Body Design

2.26.4.1 The rear body must be designed to provide ground ladder storage, hose deployment, and service access to aerial components.

2.26.4.2 The centre rear of the body must be open for ground ladder storage.

2.26.4.3 The area below the ground ladder storage must be for a waterway inlet, the stabilizer control panel and have access doors to hydraulic components.

2.26.4.4 The aerial master control panel that is located on the rear of the body must consist of a master switch, interlock light, and indicators that illuminate when each stabilizer is deployed.

2.26.4.5 The stabilizer controls must be divided into two boxes located one each side on the rear body so the operator may observe the stabilizers being deployed on each side of the apparatus as outlined in NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition).

2.26.5 Turn Table Access Staircase

2.26.5.1 Two staircases must be supplied on the rear body.

2.26.5.2 The staircases must be mounted inboard of the tail lights and outboard of the ground ladder storage area.

2.26.5.3 The staircases must permit continuous egress from the turntable to the ground.

2.26.5.4 The staircases must form a double beaver tail rear body design with handrails mounted to the trailing edge of the beaver tail.

2.26.5.5 The handrail stanchions must be located just below body level to prevent aerial contact with the handrails when the aerial is at low angles of operation.

2.26.5.6 Access steps must be mounted in accordance with current NFPA requirements, and must not exceed a maximum stepping height of 457 mm.

2.26.5.7 The steps must be a minimum of 102 mm deep x 381 mm wide.

2.26.5.8 The top surface of the steps must have a minimum of 225cm^2 and must have a slip-resistant surface. Access steps must be able to support minimum weight of 226 kg.

2.26.5.9 Steps must be located to provide a minimum of 203mm clearance between the leading edge of the step and any obstruction.

2.26.6 Water Tank Mounting System

2.26.6.1 The body design must be facilitated with a booster tank not less 1000 litres.

2.26.6.2 This tank must be completely removable without disturbing or dismounting the apparatus body structure

2.26.7 Foam Tank Mounting System

2.26.7.1 The body design must facilitate a 150-litre class A (1% - 6%) foam tank.

2.26.7.2 The tank must have an inspection opening.

2.26.7.3 The tank drain must be piped to drain directly to the surface beneath the unit without contacting other body or chassis components.

2.26.7.4 Adequate venting of the tank must be provided to allow foam to be drawn from the tank at a rate suitable for the foam admixing system.

2.26.7.5 The tank must be equipped with a tank level gauge, which can be seen from the pump operating panel.

2.26.8 Fire Hose Storage

2.26.8.1 The hose bed must be provided and be able to contain approximately 15 supply firefighting hoses (10 x 65mm and 5 x 100mm).

2.26.8.2 The hose bed must be constructed to prevent the accumulation of water and allow ventilation to assist in drying hose.

2.26.8.3 The hose bed compartment must be free of sharp edges and projections to prevent hose damage.

2.26.8.4 The compartment deck design must incorporate a track for the installation of adjustable hose bed dividers.

2.26.8.5 The hose bed must feed into a deployment chute located on the left and right-side body.

2.26.8.6 The dual chutes must permit a split hose bed design for the discharge of different size hose.

2.26.9 Locker Compartments

2.26.9.1 All body compartment walls and ceilings must be constructed from formed aluminium alloy plate.

2.26.9.2 Compartment floors must be constructed of aluminium diamond plate welded in place.

2.26.9.3 The compartment seams must be sealed using a permanent pliable silicone caulk.

2.26.9.4 A series of louvers must be supplied to facilitate ventilation of each compartment.

2.26.9.5 All lockers of the vehicle must be provided with the following:

A. Weather and dust proof anodized aluminium spring-loaded roller shutter doors, which must be fitted with dual type, heavy-duty, positive locking mechanisms.

B. Weather and dust proof box and pan type doors with heavy-duty positive lock-type latches.

C. An anodized aluminium drip rail must be mounted over each compartment opening to assist with water runoff.

2.26.10 Handrails

2.26.10.1 Access handrails must be provided at all step positions, including, but not limited to, the rear tailboard and installed to NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 13-8.

2.26.10.2 All body handrails must be constructed of maintenance free, corrosion resistant, extruded aluminium.

2.26.10.3 The handrails must be installed as follows:

A. Four (4) handrails, two each side, located on the aerial access stair case.

B. On the Turntable Platform.

C. All steps or ladders must sustain a minimum static load of 227 kg without deformation as outlined in NFPA1901 13-7.2.

2.26.11 Apparatus Warning Labels

2.26.11.1 A label must be supplied on the rear body to warn personnel that riding in or on the rear step is prohibited as outlined in NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 13-7.4.

2.26.11.2 A label must be applied to both sides of the apparatus and the rear to warn operators that the aerial is not insulated.

2.26.12 Rub rail

2.26.12.1 The body must have a rub rail along the length of the body on each side and at the rear.

2.26.12.2 The rub rail must be constructed of minimum 5 mm thick anodized aluminium extrusion.

2.26.12.3 The rub rail must be a minimum of 70 mm high x 32 mm deep and must extend beyond the body width to protect compartment doors and the body side.

2.26.12.4 The rub rail must be of a C-channel design to allow marker and warning lights to be recessed inside for protection.

2.26.12.5 SABS reflective tape must also be recessed in the rub rail channel.

2.26.13 Pump Compartment

2.26.13.1 The pump operator's control panel and pump compartment must be located on the left side of the body.

2.26.13.2 The compartment must be designed following NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 13.6.

2.26.13.3 The left and the right-side pump panel walls must be completely removable for easy access to the pump compartment.

2.26.13.4 Each panel must be split approximately two-thirds of the way from the bottom by an anodized extrusion, which must allow removal of the left side upper panel for easy access to gauges.

2.26.13.5 A pump compartment access door must be provided above the right-side pump panel.

2.26.13.6 The access door must be horizontally hinged and must be securely attached with a full-length stainless steel piano hinge and locking mechanism.

2.26.13.7 The access door must be as wide and high as possible.

2.26.13.8 A single bulb pump compartment light mounted in a shock resistant housing must be supplied to inspect plumbing components.

2.26.13.9 The light must switch on with the pump panel lights.

2.26.13.10 A side running board formed from aluminium diamond plate, must be provided and must extend the full length of the pump module, on each side of the apparatus.

2.26.13.11 The running board must be bolted to the pump compartment for rigidity and to provide easy removal for replacement in the case of damage.

2.26.14 Pump Operator's Panel

2.26.14.1 The pump compartment side panels must be constructed of brushed, non-glare stainless steel for lasting appearance and ease of maintenance.

2.26.14.2 Pump panel light assemblies must be provided for each side panel.

2.26.14.3 The pump panel lights must provide 1.5m -candles light intensity to the pump panel as outlined in NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 14-9.2.

2.26.14.4 Light shields must be bolted to the side pump panels.

2.26.14.5 The following instruments must be supplied as a group on the operator's panel as outlined in NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 14-12.1 and located as far as practical from hose connections.

A. Pump Master Intake
B. Pressure Control(s)
C. Pump Master Discharge
D. Engine Throttle
E. Pump Primer
F. Engine Coolant Temperature Indicator
G. Water Tank to Pump Control
H. Engine Oil Pressure
I. Water Tank Fill Valve
J. Voltmeter
K. Water Tank Level
L. Foam Tank Level

2.26.14.6 Test connections for pump gauges must be supplied on the operators panel as outlined in NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 14-12.5.

2.26.14.7 Gauges supplied on the pump operators panel must be compliant with NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 14-12.2.1.1.

2.26.14.8 Any discharge outlet 38mm or larger must have an output indicator and be labelled to identify its control function as outlined in NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 14-12.3.

2.26.14.9 The valve control levers must be located at the pump operator's panel.

2.26.14.10 The control levers must be located directly adjacent to one another and must be mounted in line so they are in the same position when shut off.

2.26.14.11 Each valve control lever must be connected directly to its respective valve by a non-corrosive rod to form a direct linkage control system.

2.26.14.12 The specified discharge gauges must be located directly above the discharge control levers when possible.

2.26.14.13 Each control must be clearly marked by metal nameplates recessed into the control lever handle.

2.26.14.14 To improve identification of discharges and intakes, colour-coded tags, in accordance with current NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) A-14-9.1 standards, must be provided.

2.26.14.15 The tags must utilize an etching process to provide easy visibility and improved field service life.

2.26.14.16 Tags must be affixed using an industrial grade adhesive backing, eliminating the need for pop rivets or screws into the stainless-steel panel or control handle.

2.27 Booster Tank

2.27.1 The booster tank must have a capacity of not less than 1000 litres.

2.27.2 The tank must have a combination vent and manual fill tower.

2.27.3 The tower must be located in the left front corner of the tank.

2.27.4 The tank overflow must be minimum of 102 mm diameter.

2.27.5 The tower must have a hinged cover and 6 mm thick polypropylene screen.

2.27.6 There must be two (2) standard tank openings; one for the tank to pump suction line with an anti-swirl plate and one for a tank fill line.

2.27.7 Baffles, both longitudinal and latitudinal must be interlocking and thermo welded to minimize water surge during travel, enhancing road handling stability.

2.27.8 Openings in the baffles must be positioned to allow water flow according to NFPA standards during filling or pumping operations.

2.27.9 The tank must be mounted so that it is insulated from the road shock and vibration.

2.27.10 The tank must be completely removable without disturbing or dismounting the apparatus body structure.

2.28 Step Surfaces

2.28.1 All body exterior step surfaces must be provided with an aggressive skid-resistant surface in accordance with current NFPA requirements.

2.28.2 Aluminium diamond plate steps must include a multi-directional, aggressive gripping surface incorporated into the diamond plate.

2.28.3 The surface must extend vertically from the diamond plate sheet.

2.28.4 Gripping surfaces must be circular in design, a minimum of 25 mm diameter and on centres not to exceed 102 mm.

2.29 Slide-out Platform

2.29.1 A slide-out platform must be mounted under the apparatus body below the pump panel to prevent electrocution of pump operator during aerial operations.

2.30 Auxiliary Ground Pads

2.30.1 Auxiliary ground pads must be provided.

2.30.2 They must have a grab handle and must be mounted in a bracket that is mounted under the apparatus next to each stabilizer.

2.31 Pump

2.31.1 The vehicle must be equipped with a mid-ship mounted single stage centrifugal pump with a capacity of at least 5 700 litres per minute.

2.31.2 Two (2) 152mm diameter suction ports with 152mm NST male threads and removable screens must be provided, one each side.

2.31.3 The ports must be mounted one (1) on each side of the mid ship pump and must extend through the side pump panels.

2.31.4 Inlets must come equipped with long handle chrome caps.

2.32 Pressure Relief Valve

2.32.1 The pump must be equipped with an automatic pressure control device.

2.32.2 A pressure setting relief valve must be provided and be of ample capacity to prevent an undue pressure rise as outlined in NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition).

2.32.3 The relief valve must be normally closed and must open against pump pressure.

2.32.4 A relief valve control with a control light to signal when open must be mounted on the pump operator's panel.

2.33 Priming System

2.33.1 A suitable priming system must be fitted with the controls located at the pump operator's position.

2.34 PTO Engage/Pump Shift

2.34.1 The pump shift control valve must be mounted in the cab, and be labelled "PUMP SHIFT".

2.34.2 The apparatus transmission shift control must be furnished with a positive lever, preventing accidental shifting of the chassis transmission.

2.34.3 A green indicator light must be located in the cab, and be labelled "PUMP ENGAGED".

2.34.4 A second green indicator light must be located in the cab and be labelled "OK TO PUMP".

2.34.5 This light must be energized when both the pump shift has been completed and the chassis automatic transmission has obtained converter to gear lockup.

2.34.6 One (1) pump panel mounted "GREEN" indicator light must be positioned by the throttle control on the pump operator's panel.

2.34.7 The light must be energized when the pump shift has been competed, chassis automatic transmission has obtained converter to gear lockup, and the chassis parking brake is set.

2.35 Pump Control System

2.35.1 One (1) master suction and one (1) master discharge gauge must be on pump panel mounted.

2.35.2 These compound gauges must be liquid filled.

2.35.3 Two (2) test plugs must be on pump panel mounted for third party testing of vacuum and pressures of the pump.

2.35.4 One (1) throttle control must be mounted on the pump operator's panel and must be used to control the engine RPM.

2.35.5 A master drain valve must be installed and operated from the pump operator's panel.

2.35.6 The master drain must provide independent ports for low point drainage of the fire pump and auxiliary devices.

2.36 Transmission Cooler

2.36.1 A vehicle transmission oil cooler must be provided to maintain safe operating temperatures during prolonged pumping operations.

2.36.2 Heat exchanger with engine cooling or cool fire pump water must be provided.

2.37 Auxiliary Engine Cooler

2.37.1 An engine cooler used to lower engine water temperature during prolonged pumping operations and controlled at the pump operator’s panel must be provided.

2.37.2 The engine cooler must be installed in the engine coolant system in such a manner as to allow cool fire pump water to circulate around engine water, thus forming a true heat exchanger action.

2.37.3 Cooler inlet and outlet must be continuous, preventing intermixing of engine coolant and pump water.

2.38 Suction Side Relief Valve

2.38.1 The pump must be equipped with a variable-pressure-setting relief valve on the pump suction side.

2.38.2 When the relief valve opens, the overflow water must be directed through a plumbed outlet to discharge below the apparatus body in an area visible to the pump operator.

2.38.3 The overflow outlet must terminate with a male 65 mm fitting to allow the overflow water to be directed away from the vehicle with a short hose under conditions where an accumulation of water around the apparatus might be hazardous.

2.39 Water and foam Tank Level Gauges

2.39.1 One (1) LED type water and One (1) LED type foam tank level gauge must be located at the pump operator's panel to provide a high-visibility display of the water tank water level.

2.39.2 The display module must be protected from vibration and contamination with the components being encased in an encapsulated plastic housing.

2.40 Pump Cooler

2.40.1 The pump must have a line installed from the pump discharge to the booster tank to allow a small amount of water to circulate through the pump casing in order to cool the pump during sustained periods of pump operation when water is not being discharged.

2.40.2 The pump cooler line must be controlled from the pump operator's panel.

2.41 Engine Gauge Package

2.41.1 A gauge package must be supplied at the pump operator's panel to monitor the vehicle's engine.

2.41.2 The weatherproof package must include the following:

A. Tachometer, to monitor engine revolutions per minute.

B. Oil pressure gauge, to monitor engine oil pressure.

C. Water temperature gauge, to monitor the engine water temperature.

D. Voltmeter, connected to the vehicle electrical system.

2.41.3 One (1) valve must be installed between the pump discharge, and the booster tank in order to fill the tank.

2.41.4 The valve control must be located at the pump operator's panel, and must visually indicate the position of the valve at all times.

2.42 Double Cross-lay Hose bed

2.42.1 Two (2) cross-lay hose beds must be provided between the crew cab and the body.

2.42.2 Each of the two cross-lay sections must have a capacity for 60m of 38mm double-jacket fire hose pre-connected to the pump discharge.

2.42.3 The cross-lay decking must be constructed entirely of maintenance-free hollow aluminium extrusions.

2.42.4 Each cross-lay section must include one (1) swivel with a hose connection to permit the use of the hose from either side of the apparatus.

2.42.5 Stainless steel rollers with nylon guides set in aluminium extrusions must be installed horizontally and vertically on each end of the cross-lay to allow easy deployment of the hose and help protect the body paint.

2.42.6 The cross-lay piping must consist of two (2) heavy-duty hoses from the pump discharge manifold to the swivels.

2.42.7 Each cross-lay discharge must include a valve. The valve control must be located at the pump operator's panel, and must visually indicate the position of the valve at all times.

2.42.8 Each cross-lay discharge must include a Class 1 liquid-filled pressure gauge mounted at the pump panel adjacent to the manual valve control.

2.42.9 The discharge must be supplied with a bleeder valve assembly to drain water from the gauge pressure line to prevent freezing of the line.

2.42.10 The bleeder valve must be controlled with a quarter-turn handle on the pump panel.

2.43 Left Side Discharges

2.43.1 Two (2) 65 mm discharge outlets with a valve must be provided at the left side pump panel.

2.43.2 The discharges must be fitted with 65 mm Male NST couplings.

2.43.3 The discharge must include a Class 1 liquid-filled pressure gauge mounted at the pump panel adjacent to the discharge control.

2.43.4 The discharge must be supplied with a bleeder valve assembly.

2.43.5 The bleeder valve must be installed to drain water from the gauge pressure line to prevent freezing of the line.

2.43.6 The drain must be controlled with a quarter-turn valve on the pump panel.

2.43.7 The valve control must be located at the pump operator panel and must visually indicate the position of the valve at all times.

2.43.8 All fabricated piping must be a minimum of Schedule 10 stainless steel for superior corrosion resistance and decreased friction loss.

2.44 Right Side Discharges

2.44.1 Two (2) 65 mm discharge outlets with a valve must be provided at the right-side pump panel.

2.44.2 The discharges must be fitted with 65 mm Male NST couplings.

2.44.3 The discharge must include a Class 1 liquid-filled pressure gauge mounted at the pump panel adjacent to the discharge control.

2.44.4 The discharge must be supplied with a bleeder valve assembly.

2.44.5 The bleeder valve must be installed to drain water from the gauge pressure line to prevent freezing of the line.

2.44.6 The drain must be controlled with a quarter-turn valve on the pump panel.

2.44.7 The valve control must be located at the pump operator panel and must visually indicate the position of the valve at all times.

2.44.8 All fabricated piping must be a minimum of Schedule 10 stainless steel for superior corrosion resistance and decreased friction loss.

2.45 Aerial Waterway Discharge

2.45.1 One (1) discharge outlet with a valve must be connected from the pump discharge to the aerial waterway.

2.45.2 The discharge must include a Class 1 liquid-filled pressure gauge mounted at the pump panel adjacent to the discharge control.

2.45.3 The discharge must be supplied with a bleeder valve assembly.

2.45.4 The bleeder valve must be installed to drain water from the gauge pressure line to prevent freezing of the line.

2.45.5 The drain must be controlled with a quarter-turn valve on the pump panel.

2.45.6 The valve control must be located at the pump operator panel and must visually indicate the position of the valve at all times.

2.45.7 All fabricated piping must be a minimum of Schedule 10 stainless steel for superior corrosion resistance and decreased friction loss.

2.46 Tank-To-Pump Suction

2.46.1 One (1) valve must be installed between the pump suction and the booster tank in order to pump water from the tank.

2.46.2 The valve control must be located at the pump operator's panel, and must visually indicate the position of the valve at all times.

2.46.3 All fabricated piping must be a minimum of Schedule 10 stainless steel for superior corrosion resistance, and decreased friction loss.

2.47 Left Side 100mm Suction

2.47.1 One (1) 100mm suction inlet with a valve must be provided on the left side of the apparatus at the pump panel.

2.47.2 The outlet of the valve must be connected to the suction side of the pump with the valve body located behind the pump panel.

2.47.3 The valve must come equipped with a brass inlet strainer, inlet swivel and must be equipped with a rocker-lug plug with a retainer chain.

2.47.4 The valve control must be located at the pump operator's panel and must visually indicate the position of the valve at all times.

2.47.5 All fabricated piping must be a minimum of Schedule 10 stainless steel for superior corrosion resistance, and decreased friction loss.

Foam proportioning system (1% - 6%)

2.47.6 A proportioning system capable of proportioning foam concentrate (s) in accordance with the foam manufacturer’s recommendations must be fitted to the vehicle.

2.47.7 The system must be capable of being manually adjusted to an ad-mixing rate of 1 % to 6%

2.48 WARNING SYSTEM

Front Upper-Level Warning Lights

2.48.1 Two (2) light bars must be mounted on the cab roof, one (1) on each side of the aerial ladder when it is in its stored (travel) position to comply with NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition).

2.49 Siren Speaker

2.49.1 One (1) speaker must be flush mounted behind the front bumper.

2.49.2 The speaker must meet NFPA requirements for sound output producing a minimum 120 dB of sound at 3m.

2.50 Electronic Siren

2.50.1 One (1) solid state electronic siren with attached noise-cancelling microphone must be installed.

2.50.2 The unit must be capable of driving high-power speakers up to 200 watts to achieve a sound output level that meets Class "A" requirements.

2.50.3 Operating modes must include hi-lo, yelp, wail, P.A., air horn, and radio broadcast.

2.50.4 It must include a Tap II feature.

2.51 Rear Upper-Level Warning Lights

2.51.1 Two (2) red rotating lights with a polycarbonate base, a single 55-watt halogen lamp, and a twist-on Lexan dome must be mounted at the upper rear of the vehicle to comply with NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition).

2.51.2 Each light must produce 80,000 candelas minimum and produce 175 flashes per minute.

2.52 Light Package

2.52.1 Eight (8) strobe-warning lights and two (2) halogen lights, all with red lenses, must be provided.

2.52.2 Lighting must be mounted as follows:

A. Zone A - Two (2) strobe lights on the front of the apparatus facing forward.

B. Zone B - Two (2) strobe lights, one at the forward most point (as is practical), one at the rearward most point (as is practical), and a surface mount mid-ship halogen light.

C. Zone C - Two (2) strobe lights on the rear of the apparatus facing rearward.

D. Zone D - Two (2) strobe lights, one at the forward most point (as is practical), one at the rearward most point (as is practical), and a surface mount mid-ship halogen light.

2.52.3 Two power supplies and one flasher must be provided in accordance with NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition)

2.52.4 A lighted rocker switch on the cab instrument panel, labelled lower-level warning, must control the lights.

2.52.5 Lower-level devices must be mounted in compliance with NFPA standards.

2.53 Deck Lights

2.53.1 Two (2) chrome-plated 12-volt, 35-watt floodlights must be installed at the rear of the apparatus.

2.53.2 Each light must be manually operated by an on/off switch at the light.

2.54 Electrical System

2.54.1 All electrical equipment installed by the apparatus manufacturer must conform to current automotive electrical system standard and the requirements of the applicable NFPA Apparatus Standard.

2.54.2 All exposed wiring must be run in a loom with a minimum 142-degree Celsius rating.

2.54.3 All wiring looms must be properly supported and attached to body members along the entire run.

2.54.4 At any point where wire or looms must pass through metal, rubber grommets must be installed to protect the wire from abrasion.

2.54.5 The main low voltage chassis to body interface point and distribution panel must be provided at the front of the body in a location providing easy service access.

2.54.6 The distribution panel must be labelled and must contain body electrical relays and wire connection bar.

2.54.7 The distribution panel must be located so as not to reduce useable compartment space.

2.54.8 An electrical harness quick disconnect must be provided to facilitate removal of the body in the future.

2.54.9 Electrical connections in exposed areas must be made using heat shrink or weather proof connections.

2.54.10 All circuits must be protected with automatic reset circuit breakers.

2.54.11 All electrical equipment switches must be mounted on a switch panel mounted in the cab convenient to the operator.

2.54.12 Light switches must be of the rocker type with integral indicator light to show when the circuit is energized.

2.54.13 All switches must be appropriately identified as to function.

2.55 Cab and Body Lighting

2.55.1 Clearance lights and reflectors must include two (2) red clearance lights, four (4) red rectangular reflectors, two (2) amber rectangular reflectors, and three (3) red marker lights centred at the rear step, recessed in the rub rail.

2.55.2 Two rectangular shaped marker lights with an amber colour lens must be installed on either side of the apparatus body, recessed in the rub rails at the front of the body and just forward of the rear axle.

2.55.3 The front body marker light must be wired to the turn indicator.

2.55.4 A rectangular shaped marker light with a red colour lens must be installed at the trailing edge on either side of the apparatus body, recessed in the rub rail.

2.55.5 One (1) red, one (1) amber and one (1) clear light must be installed on each side of the vehicle rear.

2.55.6 Light functions must include running lights, brake lights, turn signal lights and back-up lights.

2.55.7 One (1) light must be mounted in each body compartment and must be wired to a master on/off rocker switch on the cab dash.

2.55.8 The light must be in a resilient shock absorbent mount for improved bulb life.

2.55.9 The wiring connection must be made with a weather resistant plug-in style connector.

2.55.10 A single water and corrosion resistant switch with a polycarbonate actuator and sealed contacts must control each compartment light.

2.55.11 The switch must only allow the light to illuminate if the compartment door is open.

2.55.12 In addition, the switch activator a red flashing light located in the cab to alert the driver that a cab or body door is open.

2.55.13 A compartment light with a switch must be installed to illuminate the pump area for service.

2.55.14 A license plate light must be installed on the rear of the vehicle.

2.55.15 Two (2) lights must be mounted (top mount panels must have three (3) lights) under a light shield directly above each pump panel.

2.55.16 The work light switch in the cab must activate the lights when the park brake is set.

2.56 Step Lights

2.56.1 A recessed light with clear lens must be provided to illuminate the rear step area.

2.56.2 Step lights must be activated with work lights switch in cab when the park brake is set.

2.56.3 The apparatus must have sufficient lights to properly illuminate the work areas, steps, walkways and ground areas around the apparatus.

2.56.4 Areas under the driver and crew area exits must be activated automatically when the exit doors are opened.

2.56.5 Ground area lights must be switched from the cab dash with the work light switch.

2.57 Back-up Alarm

2.57.1 An electronic back-up alarm must be supplied.

2.57.2 The alarm must be wired into the chassis back-up lights to signal when the vehicle is in reverse.

2.58 Electrical System Load Manager

2.58.1 The vehicle's electrical system must be equipped with a load management device.

2.58.2 The load manager must be a one-touch device designed so that it must be protected against reverse voltage and electrostatic damage.

2.58.3 The load manager must be a user programmable device and must be able to manage up to eight items.

2.58.4 The load manager system must include the following features:

A Battery monitoring.

B Electrical load sequencing, in priority, from 1 to 8.

C The sequencer must sequence loads on at half-second intervals.

D Electrical load shedding tied through the parking brake and only shed items during stationary vehicle operations.

E Load shedding is to be the reverse order of load sequencing.

F If a load has been shed it must be reactivated once the park brake has been released.

G Automatic fast idle activation must occur before load shedding.

H The fast idle is to be activated whenever the parking brake is set and the system voltage drops below minimum of 12.8 volts for at least one minute.

I The fast idle is to remain on for a minimum of 10 minutes and until a minimum of 13.0 volts are achieved.

J Visual and audible low voltage alarm control.

K Digital display for diagnostics and status information.

L Test button to cycle all loads and the ability to verify load shedding sequences without draining the battery.

M Override switch must be provided, with label, to override operation of the management system as per NFPA requirements.

N The apparatus low voltage electrical system must be tested in compliance with current NFPA requirements.

O A third-party testing service must perform testing and certification.

2.59 Aluminium Aerial Device

2.59.1 Aerial Ladder Requirements

2.59.1.1 It must be telescopic aerial ladder of the open truss design that is compliant with NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) (Latest edition) Chapter 18 sections 18-2 through 18-6 and sections 18-17 through 18-25.

2.59.1.2 The aerial ladder must consist of four extruded aluminium telescopic ladder sections operating from -2 degrees to 82 degrees and designed to provide continuous egress for fire-fighters and civilians from an elevated position to the turntable.

2.59.1.3 The aerial ladder must have a vertical height of minimum 60m at full extension and elevation.

2.59.1.4 The measurement of height must be consistent with NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) section 18-2.2.

2.59.1.5 The measurement of horizontal reach must be consistent with NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 18-2.3.

2.59.1.6 The measurement must be from the outermost rung at full extension to the centreline of turntable rotation.

2.59.1.7 The aerial ladder must have high strength to weight ratio and an inherent corrosion resistance as described by NFPA requirements.

2.59.1.8 The aerial ladder must be completely constructed of high strength aluminium.

2.59.1.9 All material must be tested and certified by the material supplier.

2.59.1.10 All ladder sections must be semi-automatically welded by inert gas shielded arc welding methods using aluminium alloy welding wire.

2.59.1.11 Due to the unpredictable nature of fire ground operations, a minimum safety factor of 2.5 to 1 is desired.

2.59.1.12 This structural safety factor must apply to all structural aerial components including turntable and torque box stabilizer components.

2.59.1.13 Definition of the structural safety factor must be as outlined in NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) A-18-20.1:

A DL = Dead load stress. Stress produced by the weight of the aerial device and all permanently attached components.

B RL = Rated capacity stress. Stress produced by the rated capacity load of the ladder.

C WL= Water load stress. Stress produced by nozzle reaction force and the weight of water in the water delivery system.

D FY = Material yield strength. The stress at which material exhibits permanent deformation.

E 2.5 x DL + 2.5 x RL + 2 x WL equal to/less than FY

F The minimum NFPA specification is exceeded in this paragraph by requiring safety margin above 2 to 1 while flowing water.

G The stability factor or tip over safety margin must be a minimum of 1.5 to 1 as defined by NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 18-21.

2.59.1.14 An independent engineering firm must certify the aerial safety factor.

2.59.1.15 Design verification must include computer modelling and analysis, and extensive strain gauge testing performed by an independent registered professional engineer.

2.59.1.16 The welded assemblies of each production unit must be tested visually and mechanically to comply with NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 18-22.2.

2.59.1.17 Each ladder section must consist of two (2) heavy extruded aluminium side rails and a combination of aluminium rungs, tubular diagonals, verticals and two (2) full-length handrails.

2.59.1.18 The rungs on all sections, except the fly section, must be braced for maximum lateral stability.

2.59.1.19 The bracing must extend to the centre of each rung to minimize ladder side deflection.

2.59.1.20 The ladder rungs must be designed to eliminate the need to replace rubber-rung covers.

2.59.1.21 The rungs must be spaced on 356mm centres and have integral skid-resistant surface as outlined in NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 18-2.5.

2.59.1.22 An oval shaped rung must be utilized to provide a larger step surface at low angles and more comfortable grip at elevated positions.

2.59.1.23 The minimum design load must be 227 Kg distributed over an 89mm wide area per rung as outlined in NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 18-2.5.

2.59.1.24 The aerial ladder must exceed NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) sections 18-2.6 and 18-2.8 governing the minimum ladder section width and handrail height.

2.59.2 Ladder Extension Mechanism

2.59.2.1 Both power extension and retraction must be furnished and meet the requirements of NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) section 18-19, 18-20.3, and 18-5.3.

2.59.2.2 Extension must be by way of two (2) extending cylinders mounted on the underside of the base section of the ladder.

2.59.3 Extension Cylinder Size

2.59.3.1 Bore 83mm

2.59.3.2 Stroke 2,388mm

2.59.3.3 The cylinders must operate through a block and tackle cable arrangement to extend and retract the ladder.

2.59.3.4 maximum extension of the ladder is to be automatically limited by the stroke of the cylinders.

2.59.3.5 The normal operating cable safety factor must be 5:1 and the stall safety factor must be 2:1 based on the breaking strength of the cables.

2.59.3.6 The minimum ratio of the diameter of wire rope used to the diameter of the sheave used must be 1 to 12.

2.59.4 Ladder Cable Size

2.59.4.1 1st section (4-2 extend, 2 retract) minimum 11mm galvanized cable

2.59.4.2 2nd section (4-2 extend, 2 retract) minimum 8mm galvanized cable

2.59.4.3 3rd section (4-2 extend, 2 retract) minimum 8mm galvanized cable

2.59.4.4 The ladder assembly must consist of a minimum of four (4) separate welds that must extend and retract within each other.

2.59.4.5 Slide pads must be utilized between each section to minimize friction.

2.59.4.6 Slide pads must be installed at the tip of the lower three sections to accommodate the sliding loads as the ladder is extended.

2.59.5 **Aerial Extension Indicator**

2.59.5.1 Reflective tape stripes must be installed on the ladder top handrail of the base section to indicate extension in 1.5m increments.

2.59.5.2 Numeric indicators must be placed at 3m increments.

2.59.5.3 A reflective dot on the base of the 2nd section must provide a visual reference for the operator to estimate aerial elevation.

2.59.6 Aerial Finish

2.59.6.1 To reduce maintenance expense the aerial must have a natural aluminium swirled finish.

2.59.6.2 Visible inspection of all ladder weld joints must be permissible without having to remove paint or body filler to reveal the weld bead.

2.59.7 Operation Times

2.59.7.1 The aerial must complete the NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 18-2.12-time test in no more than 180 seconds.

2.59.7.2 This test involves raising the aerial from the bedded position to full elevation and extension and rotating to 90 degrees.

2.59.7.3 The following test is to begin with the stabilizers deployed:

A Time to fully extend ladder maximum 45 seconds

B Time to fully retract ladder maximum 45 seconds

C Time to fully raise ladder maximum 40 seconds

D Time to lower ladder maximum 40 seconds

E Time to fully rotate 180 degrees maximum 80 seconds

2.59.8 Aerial Ladder Rated Capacity

2.59.8.1 The aerial device must have a rated capacity of 136 kg consistent with NFPA 18-3.1.

2.59.8.2 The rated capacity must include 113 kg in personnel allowance and 23 kg for equipment mounted at the tip of the ladder.

2.59.8.3 The aerial device must be rated in multiple configurations as outlined in 18-3.4.

2.59.8.4 A sign mounted at the base of the aerial must communicate the following ratings in the unsupported fully extended configuration while maintaining a 2.5 to 1 safety margin as defined in NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition).

2.59.8.5 The loads in each configuration are in addition to 23 kg of equipment mounted at the tip.

Table A

Condition 1- Tip load only, no water flowing		
Elevation	**Capacity**	**Kilogram**
• -2 to 30 degrees	1 person	113
• 31 to 50 degrees	2 people	226
• 51 to 82 degrees	3 people	340
Condition 2- Distributed loads, no water flowing. (These include one person at the tip)		
Elevation	**Capacity**	**Kilogram**
• -2 to 20 degrees	1 person	113
• 21 to 35 degrees	2 people	226

• 36 to 50 degrees	4 people	454
• 51 to 82 degrees	8 people	908
Condition 3- Ladder tip load while flowing 3,800 l/min with pre-piped waterway		
Elevation	**Capacity**	**Kilogram**
• -2 to 25	0	0
• 26 to 45	1 person	113
• 46 to 82	2 people	226

2.59.9 Hydraulic System

2.59.9.1 The hydraulic plumbing must consist of hydraulic stainless-steel tubing wherever possible in order to:

A Eliminate hose wear.

B Eliminate the corrosion associated with galvanized steel tubing.

C Provide a stringer medium to carry the hydraulic fluid.

D An interlock device must be provided to prevent activation of the aerial ladder hydraulic pump until either the transmission is placed in neutral and the parking brake is set, or the transmission is placed in drive and the rear driveline is disengaged as outlined in NFPA 18-17.2.

2.59.9.2 The hydraulic system must be of the latest design and incorporate features to minimize heat build-up and provide smooth control of the aerial ladder.

2.59.9.3 The system must meet the performance requirement in NFPA 18-19.6, which requires adequate cooling under 2 ½ hours of operations.

2.59.9.4 All hydraulic components that are non-sealing whose failure could result in the movement of the aerial must comply with NFPA 18-19.1 and have burst strength of 4 to 1.

2.59.9.5 Dynamic sealing components whose failure could cause aerial movement must have a margin of 2 to 1 on maximum operating pressure per NFPA 18-19.1.1.

2.59.9.6 All hydraulic hoses, tubes and connections must have minimum burst strength of 3 to 1 per NFPA 18-19.2.

2.59.9.7 A Hydraulic oil pressure gauge must be supplied at the base control location per NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 18-19.4.

2.59.9.8 In addition, an aerial hour meter must be supplied at the turntable control console per NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 18-19.7.

2.59.9.9 An electronic indicator light assembly must be supplied to indicate aerial hydraulic oil level, indicating the following:

A Fluid oil is needed.

B Allowable fluid oil range.

C Full fluid oil level condition.

2.59.9.10 Hydraulic power for all operations must be supplied by a chassis mounted positive displacement pump for consistent pressure and rapid response.

2.59.9.11 The positive displacement vane pump must be able to supply minimum 53 litres per minute at a maximum pressure of 21,000 kPa

2.59.9.12 The system must operate between 7,000 and 17,500 Kpa with flow controls to protect hydraulic components and incorporate a relief valve set at 19,600 kPa to prevent over pressurization.

2.59.9.13 The hydraulic system must consist of a minimum 208 litres reservoir mounted to the torque box and plumbed to the hydraulic pump.

2.59.9.14 The tank must be supplied with a removable top to access tank strainer filter.

2.59.9.15 There must be plumbing for a supply and return line and a tank drain on the reservoir.

2.59.9.16 The reservoir cap must be marked per NFPA 18-19.5.

2.59.9.17 Gated valves under the tank must facilitate filter changes.

2.59.9.18 The Hydraulic system must use 5w-20 multi-weight SAE 32 grade oil and incorporate the following filters to provide dependable service:

A	reservoir breather	10 micron
B	magnetic reservoir strainer	125 mesh
C	pressure filter (torque box)	3 micron
D	return filter	10 micron

2.59.9.19 The aerial hydraulic system must be designed in such a manner that a hydraulic pump failure or line rupture must not allow the aerial or outriggers to lose position.

2.59.9.20 Hydraulic holding valves must be mounted directly on cylinders.

2.59.9.21 To ensure reliable performance of holding valves, no hoses must be permitted between a holding valve and cylinder.

2.59.9.22 The hydraulic system must be designed with an auxiliary power unit meeting the guidelines of NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 18-18.5.

2.59.9.23 The auxiliary power unit must be a 12-volt pump connected to the chassis electrical system.

2.59.9.24 The pump must provide operation at reduced speeds to store the aerial device and outriggers for road transportation.

2.59.9.25 Self-centring switches must be provided at the turntable and each stabilizer control station to activate the system.

2.59.9.26 The system must be designed to provide a minimum of 5 minutes of hydraulic power to operate functions.

2.59.10.1 Hydraulic power to the ladder must be transferred from the torque box by a hydraulic swivel.

2.59.10 Rescue Cage

2.59.10.2 The cage must be able to accommodate a minimum The dimension of 5 persons

2.59.10.3 The cage load maximum 500 kg

2.59.10.4 The cage must be constructed out of aluminium.

2.59.10.5 The cage must have a minimum of two (2) entry points.

2.59.10.6 The cage minimum dimensions (2300 mm L x W 1900mm x H 1400mm)

2.59.11 Aerial Torque Box

2.59.10.7 The aerial must utilize an integral torque box design.

2.59.10.8 The integral torque box design must serve to carry the chassis, body and aerial device as an integrated system.

2.59.10.9 The system design must provide a lower centre of gravity to enhance road performance, a mounting location for under slung stabilizers, and additional space for body compartments.

2.59.10.10 The strength of the torque box must be a minimum 1380 kN.m resistance to bending moment.

2.59.10.11 The stabilizers and turntable support must be welded directly to the torque box.

2.59.12 Stabilization

2.59.11.1 The unit must be equipped with two sets of extendable stabilizers.

2.59.11.2 The stabilizers must have a spread of no more than 3.36 m centreline to centreline of the stabilizer pads when fully extended.

2.59.11.3 One set of stabilizers must be mounted in the forward body area and a second set close to the rear axle to minimize impact on departure angle.

2.59.11.4 The stabilizers must have an inner and outer tube that slide on low friction pads for deployment.

2.59.11.5 The stabilizers must have a tip over safety margin of 1 1/2 times the rated load imposed by the aerial in any position the aerial device can be placed as outlined in NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 18-21.1.1.

2.59.11.6 The apparatus stabilization must be accomplished without the assistance of the chassis suspension or tires in contact with the ground.

2.59.11.7 The aerial must be able to sustain a 1 1/3 to 1 rated load on a 5-degree slope downward in the position most likely to cause overturning as outlined in NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 18-21.1.2.

2.59.11.8 The maximum ground slope the apparatus can be set up on is 12 percent.

2.59.11.9 On the 12 percent slope the apparatus can be levelled within a 6 percent operating range for the apparatus.

2.59.11.10 The cylinders must be supplied with dual pilot operated check valves on each stabilizer cylinder to hold the cylinder in the stowed or working position should a charged line be severed at any point in the hydraulic system.

2.59.11.11 The stabilizers must level side to side, corner to corner and front to rear on uneven terrain. Stabilizers must contain safety lock valves and must require no mechanical pins to assure there will be no "leak down" of stabilizer legs.

2.59.11.12 The stabilizer lift cylinders must be sized to maximize ground penetration.

2.59.11.13 Each Stabilizer that can be extended from the body must be supplied with a red warning light as outlined in NFPA 18-21.2.5.

2.59.11.14 A stabilizer extended warning light must be supplied in the cab to warn the driver of an extended stabilizer condition as outlined in NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 11-11.

2.59.11.15 A work light must be supplied in each stabilizer location to illuminate the stabilizer and ground.

2.59.11.16 The light must automatically turn on with the deployment of the stabilizer.

2.59.11.17 The stabilizer ground contact area for each foot pad must be at least 254mm x 356mm without auxiliary pads and 610mm x 610mm with auxiliary pads deployed.

2.59.11.18 The ground pressure must not exceed 525 kPa with auxiliary pads deployed when the apparatus is fully loaded and the aerial device is carrying its rated capacity in every position.

2.59.11.19 This must be accomplished with the stabilizer pads deployed, as outlined in NFPA 18-21.2.3.

2.59.13 Stabilizer Controls

2.59.12.1 The control mechanisms of the stabilizers must be located at the rear of the apparatus, so the operator may observe the stabilizers during deployment.

2.59.12.2 An audible alarm must also sound while the stabilizers are in motion as required by NFPA 18-21.2.1.

2.59.12.3 Stabilizer deployment must be completed in less than 60 seconds.

2.59.12.4 There must be an interlock that prevents the operation of the ladder until the stabilizers are down and properly set as outlined in NFPA 18-17.4.

2.59.12.5 Four (4) micro switches, one (1) on each jackleg, must sense when all four-jack feet are in firm contact with the ground.

2.59.12.6 This condition must be indicated when all four jacks down indicator lights are on and the interlock light is on.

2.59.12.7 When the apparatus has been levelled, a manual transfer switch must be used to shift hydraulic power to ladder operations.

2.59.12.8 The interlock system must have a manual override with access through a door on the rear control panel.

2.59.12.9 To simplify levelling the apparatus, two colour-coded level indicators must be supplied at the rear of the apparatus.

2.59.12.10 One indicator must be for front to rear level and the other for side-to-side level.

2.59.14 Turntable Support Assembly

2.59.13.1 The aerial ladder turntable assembly must be mounted at the rear of the apparatus.

2.59.13.2 The turntable support assembly must be constructed in such a manner that will ensure efficient transfer of aerial loads to the stabilizers and must permit storage of ground ladders in the centre rear of the apparatus.

2.59.15 Upper Turntable

2.59.14.1 The upper turntable assembly must attach to the rotation bearing and the base of the ladder.

2.59.14.2 The working platform must be covered with a non-skid material for operator safety.

2.59.14.3 Three (3) railings must be provided along the outside of the turntable disc as outlined in NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 18-18.1.

2.59.14.4 There must be a control pedestal on the left side of the turntable.

2.59.14.5 The turntable assembly must provide a mounting base for the ladder and elevating cylinders.

2.59.16 Elevation Mechanism

2.59.15.1 The aerial must utilize dual bore and stroke elevating cylinders to attach the upper turntable assembly and bottom of the base ladder section.

2.59.15.2 A pin and bearing system must connect to the turntable.

2.59.15.3 A pin and bearing system must connect to the base section of the ladder.

2.59.15.4 The elevation system must be designed following NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 18-5.1.

2.59.15.5 The elevation hydraulic cylinders must incorporate cushions on the upper limit of travel.

2.59.15.6 The hydraulic elevation cylinders must also serve as a locking device to hold the aerial in the stored position for road travel.

2.59.17 Rotation Mechanism

2.59.16.1 The aerial must be supplied with a hydraulically powered rotation system as outlined in NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 18-5.2.

2.59.16.2 The hydraulic rotation motor must provide continuous rotation under all rated conditions and be supplied with a spring-applied brake to prevent unintentional rotation.

2.59.18 Aerial Ladder Operating Position

2.59.17.1 An aerial ladder operators' position must be supplied as outlined in NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 16-4.

2.59.17.2 The operator's position must be located on the left side of the aerial turntable.

2.59.17.3 The apparatus must be supplied with labels to warn of electrocution hazard.

2.59.17.4 The control console must provide a service access door on the back and side of the console to access hydraulic and electrical connections.

2.59.17.5 The electrical panel must be contained in junction box with labelled wires.

2.59.17.6 The console must be angled, labelled and supplied with lights for night operation.

2.59.19 Console Cover

2.59.18.1 A contoured hinged cover must be supplied to protect the console from the elements.

2.59.18.2 The cover must latch in the stored position and swing away from the console so as not to interfere with sight of the aerial device.

2.59.20 Aerial Ladder Control Levers

2.59.19.1 The control levers must be arranged as outlined in NFPA 18-17.6.

2.59.19.2 The first lever from the left must be the extension control (forward for extend and back for retract).

2.59.19.3 The second lever must be for rotation (forward for clockwise and back for counter clockwise).

2.59.19.4 The third handle must control elevation (forward for down and back for up).

2.59.19.5 The aerial must employ direct hydraulic controls for precise control and dependable service with minimal electrical functions.

2.59.19.6 A ring around the control console must be provided to prevent unintentional movement as outlined in NFPA 18-17.5.1.

2.59.21 Aerial Intercom System

2.59.20.1 A two-way intercom system must be installed to provide communications between the operator's position and tip of the aerial as outlined in NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 18-4.2.

2.59.20.2 The speaker/microphone at the tip must be hands free operation.

2.59.20.3 The system must consist of a 12-volt transistorized amplifier and two (2) waterproof send and receive speakers.

2.59.22 Rung Alignment Indicator

2.59.21.1 A light on the control console must indicate when the ladder rungs are aligned for climbing.

2.59.23 Aerial Alignment Indicator

2.59.22.1 A reflective arrow mounted to the body and the turntable must indicate when the aerial is aligned for travel bed.

2.59.24 Load Indication System

2.59.23.1 A lighted elevation/safe load indicator diagram must be located on the lower left side of the base section to indicate safe load capacity at any angle of elevation.

2.59.23.2 The safe load indicator must be 381mm x 381mm in size and clearly communicate aerial capacity in any one of the following conditions: tip load, tip load with water flowing, and distributed load at full extension.

2.59.23.3 The chart must identify capacity using graphic characters to indicate each 250 increments.

2.59.23.4 The chart must be equipped with lighting and warn of electrocution hazards from power lines and lightning.

2.59.25 Aerial Waterway

2.59.24.1 A 3,800 l/min pre-piped waterway must be supplied as outlined in NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 18-6.

2.59.24.2 The waterway must telescope to the end of the third section

2.59.24.3 A waterway must run through the turntable and a swivel joint to connect to the tubular aerial waterway.

2.59.24.4 The tubular waterway must run under the aerial ladder.

2.59.24.5 A 38mm drain valve must be installed and operated from the rear of the apparatus.

2.59.24.6 The water system must be capable of flowing 3,800 l/min at 700 kPa nozzle pressure at full elevation and extension.

2.59.24.7 The friction loss between the tip and below the swivel must not exceed 700 kPa while flowing 3,800 l/min as outlined in NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 18-6.1.2.

2.59.26 Waterway Relief Valve

2.59.25.1 An automatic relief valve pre-set at 1,540 kPa must be installed in the aerial waterway to prevent over pressurization of waterway system.

2.59.25.2 The relief valve must be mounted in the lower portion of the waterway where it enters the aerial torque box frame and dump under the apparatus.

2.59.27 Electric Monitor Travel Range

2.59.26.1 The nozzle range of the electric monitor must be 135 degrees through the vertical plane and 90 degrees to either side of ladder centre line in the horizontal plane.

2.59.26.2 This water flow capability must be available at any extension, elevation or position without any restrictions while flowing 3,800 l/min.

2.59.26.3 A minimum stability factor of 1.5 to 1 must be maintained in this configuration.

2.59.28 Ladder Tip Step

2.59.27.1 Two split design folding steps must be located near the ladder tip to provide a position for a fire-fighter using the ladder pipe/monitor as outlined in NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition) 18-2.9.

2.59.27.2 The steps must have a raised surface for traction and cut outs for deployment.

2.59.27.3 Not Less than 3,800 l/min Electric Monitor

2.59.27.4 The aerial ladder must be equipped with an electrically controlled monitor.

2.59.27.5 The monitor must feature a unique lightweight construction to minimize ladder tip loads.

2.59.27.6 The monitor must be equipped with an electrically controlled automatic nozzle capable of discharging a minimum of 1,800 – 3,800 l/min at 560 – 700 kPa nozzle pressure.

2.59.27.7 This water flow capability must be available at any extension, elevation, or position without any restrictions while flowing at a minimum of 3,800 l/min.

2.59.27.8 A minimum stability factor of 1.5 to 1 must be maintained in this configuration.

2.59.27.9 The range of movement of the electric monitor and nozzle must be 135 degrees through the vertical plane (90 degrees upwards from a line perpendicular to the aerial ladder and 45 degrees downward), and 180 degrees through the horizontal plane (90 degrees to either side of the aerial ladder centre line).

2.59.27.10 The monitor must be able to move in the horizontal and vertical axis simultaneously.

2.59.27.11 The monitor relay box must include solid state components and must be coated to resist corrosion.

2.59.27.12 The monitor must have fully enclosed motors and gears with built in manual override capability and quick-attach handles.

2.59.27.13 A battery, which continuously charges from the vehicle power system must provide power for monitor movement.

2.59.27.14 Control switches for horizontal movement, vertical movement and pattern selection must be located at the control panel.

2.59.29 Monitor Tip Controls

2.59.28.1 In addition to the controls at the operator console, electric monitor directional and stream controls must be installed in close proximity to the monitor on the ladder to allow operation by a fire-fighter on the ladder.

2.59.30 Rear Aerial Waterway Inlet

2.59.29.1 One (1) 100mm inlet must be provided at the rear of the apparatus and must be connected to the vertical pedestal waterway piping to supply water to the aerial waterway from an outside source. This inlet must be fitted with a Stortz Coupling.

2.59.29.2 An optional shut off valve in the waterway would allow this to be used as a pump discharge as well.

2.59.31 Waterway Pressure Gauge

2.59.30.1 One (1) weatherproof compound vacuum pressure gauge (with liquid solution) be installed adjacent to the waterway inlet.

2.59.32 Flowminder

2.59.31.1 The aerial ladder must be equipped with one (1) Class 1 brand Flow minder for the aerial waterway to digitally display the actual volume of water being discharged in litres per minute and the total volume of water that has flowed through the waterway.

2.59.31.2 The readout must be mounted at the turntable control station.

2.59.31.3 The Flowminder must consist of:

A Weatherproof digital flow display with super-bright digits at least 12mm high.

B The display must read actual flow and must switch to total flow when the totalizer button is depressed and held.

C Flow transmitter mounted in the aerial waterway pipe above the swivel.

D The transmitter must consist of a weather-resistant black-anodized housing with brass wetted parts with a double paddle wheel.

E Connecting cables to connect the digital display to the flow transmitter and apparatus power.

F Machined mounting hardware to hold the transmitter in position in the discharge line.

G The Flow meter must be checked and calibrated prior to delivery of the apparatus.

2.59.33 Level Assist System

2.59.32.1 The outrigger jack system must be semi-automatically controlled by a microprocessor levelling system which can level the mainframe torque box within 1.7 percent (1 degree) of level on any road grade of 6 percent (3.5 degree) or less.

2.59.32.2 The level assist control system must be operable only when all four jack feet are in contact with the ground.

2.59.34 Tip Spotlight

2.59.33.1 One (1) spotlight must be supplied at the tip of the aerial ladder.

2.59.33.2 It must have a chrome-plated housing and a pivot base to allow movement of the light.

2.59.35 Ladder Base Lighting

2.59.34.1 Two (2) floodlights must be mounted at the bottom of the ladder base section, one on each side.

2.59.34.2 They must be controlled from the turntable-operating pedestal.

2.59.36 Rear Ladder Storage

2.59.35.1 A ladder storage tunnel must be provided beneath the aerial device frame work.

2.59.35.2 The ladder tunnel must have a minimum storage capacity for the 35m of ground ladders as per NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition), with access to the ladders via an opening at the rear.

2.59.35.3 The ladders will be held captive top and bottom by aluminium tracks and slide on friction reducing material.

2.59.35.4 All ladders must be removable individually without having to remove any other ladder.

2.59.35.5 A quick release, device must keep the ladders secured in the storage area.

2.59.37 Rear Pike Pole Storage

2.59.36.1 Pike poles storage must be provided at the rear of the body which is capable to cater for six (6) pike poles.

2.59.36.2 The storage area must be labelled for two (2) 1.8m poles, two (2) 2.4m poles, and two (2) 3.66m poles.

2.59.36.3 The pike poles must be secured by either "J" slotted locking tubes and/or diamond plate door(s)

2.59.38 Folding Attic Ladder

2.59.37.1 One (1) (3m) aluminium folding attic ladder must be provided.

2.59.37.2 Both ends must be equipped with moulded rubber feet and the ladder must have handles for easy carrying.

2.59.37.3 The ladder must meet or exceed the requirements of the current edition of NFPA 1931.

2.59.39 Combination Ladder

2.59.38.1 A (4.3m) combination extension/A-frame ladder must be provided.

2.59.38.2 The ladder may be used as an extension ladder or an 'A' frame ladder.

2.59.40 Roof Ladder

2.59.39.1 One (1) (4.9m) aluminium roof ladder must be provided.

2.59.39.2 A pair of folding 19mm steel roof hooks must be attached to one end of the ladder, and a pair of steel spiked feet on the other end.

2.59.39.3 The ladder must meet or exceed the requirements of the current edition of NFPA 1931.

2.59.39.4 Two-Section Extension Ladder

2.59.39.5 One (1) (7.3m) aluminium two-section extension ladder must be provided.

2.59.39.6 The ladder must meet or exceed the requirements of the current edition of NFPA 1931.

2.59.41 Three-Section Extension Ladder

2.59.40.1 One (1) (10.7m) aluminium three-section extension ladder must be provided.

2.59.40.2 The fly section must be operated by a cable and must automatically extend as the centre section is raised.

2.59.40.3 The ladder must meet or exceed the requirements of the current edition of NFPA 1931.

2.59.42 Pike Poles

2.59.41.1 Two (2) (1.83m) fibreglass pike pole, 44mm outside diameter, with painted steel pike must be provided.

2.59.41.2 Two (2) (2.43m) fibreglass pike pole, 44mm outside diameter, with painted steel pike must be provided.

2.59.41.3 Two (2) (3.66m) fibreglass pike pole, 44mm outside diameter, with painted steel pike must be provided.

2.59.43 Adapters

2.59.42.1 One aluminium 65mm male NST coupling with plug must be supplied for each 65mm discharge

2.59.42.2 An aluminium 65mm female NST coupling with cap must be supplied for the collector.

2.59.42.3 A 152mm NST x 100mm Stortz collecting head must be supplied.

2.60 Cab and Body Paintwork

2.60.1 The crew cab, body and chassis must be painted with the highest quality finish for low maintenance, long life, and attractive appearance.

2.60.2 The finish must consist of a corrosion-prevention pre-treatment to all bare metal, a sealer/primer, two coats of base colour, and two coats of clear finish.

2.60.3 The manufacturer must supply a minimum ten (10) warranty against peeling, cracking, blistering, and corrosion.

2.60.4 Any vertically or horizontally hinged smooth-plate compartment door must be painted separately to assure proper paint coverage on the body, doorjambs, and door edges.

2.60.5 Any location where aluminium is penetrated after painting for the purpose of mounting steps, handrails, doors, lights, or other specified components must be treated at the point of penetration with a corrosion inhibiting pre-treatment.

2.60.6 The pre-treatment must be applied to the aluminium sheet metal or aluminium extrusions in all locations where the aluminium has been penetrated.

2.60.7 All hardware used in mounting steps, handrails, doors, lights, or other specified components must be individually treated with the corrosion inhibiting pre-treatment.

2.60.8 The chassis frame and undercarriage components must be finished painted black.

2.60.9 The vehicle wheels must be painted to match the exterior colour of the colour of the vehicle unless otherwise specified.

2.60.10 The vehicle wheels must be trimmed in silver paint to complete the wheel finish.

2.60.11 The body must be finished painted in Phoenix Red

2.61 Chassis and Body Stripe

2.61.1 A straight white reflective stripe, 100mm minimum in width, must be applied horizontally around the cab and body.

2.61.2 Yellow reflective trim in accordance with the National Road Safety Regulation must be secured to the vehicle.

2.62 Reflective Tape on Jacks

2.62.1 The four outriggers that protrude beyond the side of the body must be striped with yellow reflective tape.

2.62.2 The tape must be visible from the front or rear of the unit.

2.63 Auxiliary Equipment

2.63.1 The following equipment will be furnished with the completed unit and will be professionally mounted. The below noted equipment list, amongst others, includes the full list of equipment as prescribed by NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition), 2009 edition, section 5.8.2 and 5.8.3:

Item no.	Item description	Equipment specification
01	1 x Hydraulic cutter	• Minimum working pressure – 720 bar • Minimum blade opening – 170 mm • Minimum cut force – 1420 KN • Weight – not exceeding 23 kg • Single quick acting coupling-core
02	1 x Hydraulic spreader	• Minimum working pressure – 720 bar • Minimum blade opening – 170 mm • Minimum spreading force – 280 KN • Weight – not exceeding - 23 kg • Minimum Pulling force – 130 KN • Single quick acting coupling-core • Minimum spreading distance – 610 mm
03	1 x Hydraulic small ram	• Minimum working pressure – 720 bar • Weight – not exceeding - 18 kg • Minimum Pulling force – 130 KN • Single quick acting coupling-core • First stage push force – not less than 229 KN • Second stage push force – not less than 83 KN

04	1 x Hydraulic large ram	• Minimum working pressure – 720 bar • Weight – not exceeding - 20 kg • Minimum Pulling force – 130 KN • Single quick acting coupling-core • First stage push force – not less than 229 KN • Second stage push force – not less than 83 KN
05	2 x hydraulic hoses	• Single quick acting couplings- core • Minimum length- 10m • Colour – two hoses with two different colours except black
06	1 x hydraulic motor	• Minimum working pressure- 720 bar • Maximum Weight - 35 kg • Minimum Motor horse power - 6.5 hp (4 stroke petrol) • Minimum displacement - 196cc • Hydraulic pump – two stage radial piston over piston • Tool operation – two tools simultaneous operation • Single quick action coupling-core
07	1 x Hydraulic hand pump	• Minimum working pressure - 720 bar • Effective oil contents: 1800 cc • 2-stage pump unit with output 1st and 2nd stage: min. 28 cc -and 2,3 cc • Maximum weight - 12 kg • Single quick action coupling-core

08	2 x Chock blocks sets	• Must be made from plastic (HDPE-high density polyethylene) • Non-absorbent, oil and chemical resistant and resistant to bloodborne pathogens • Virtually indestructible • High-visibility lanyards for easy carrying and gripping • The set must be black in colour
09	2 x Airbag steering covers	• easy to install, within seconds • suitable for all types of vehicles • must be provided with a synthetic storage box with wall-mounting bracket
10	1 x Set edge protective cover	• 6 Pillar covers at least 280mm x 240mm broad • Side window sheets at least 500mm x 700mm • 1 Windshield cover at least 1400mm x 800mm • 1 Side removal sheet 1850mm x 1200mm **Additional** • Sheets must be fitted with magnets on the edges to keep sheet in position • Pillar Covers must be fitted with tie down straps or Velcro strapping **Manufacturing Material** • Rip-stop • Woven Polyester • At least 280g per square meter • Unbrushed • Must be scotch guard treated

11	1 x Glass master	• Must cut on pull stroke • Must also be used on fiberglass, wood, plaster and underwater. • Storage of the spring-loaded center punch • Precision made of high strength aluminum alloy.
12	4 x High pressure airbags (small, medium, large, and extra-large)	**Small** • Must have a lifting force: minimum of 900kg • The inflation height must be: minimum of 80 mm • Dimensions (LxW) must be: maximum 150mm x150 mm • The Thickness including profile must be at maximum of 22 mm • The Weight must be at maximum of 0,6 kg • Must be made of rubber compound, reinforced with 3 aramide (Kevlar) inlays • Must be Equipped with light reflecting labels **Medium** • Must have a lifting force: minimum of 24 000kg • The inflation height must be: minimum of 215mm • Dimensions (LxW) must be: maximum 310mm x310 mm • The Thickness including profile must be at maximum of 25mm • The Weight must be at maximum of 9.5 kg • Must be made of rubber compound, reinforced with 3 aramide (Kevlar) inlays • Must be Equipped with light reflecting labels **Large** • Must have a lifting force: minimum of 32 000kg

		• The inflation height must be: minimum of 380mm • Dimensions (LxW) must be: maximum 658mm x 658mm • The Thickness including profile must be at maximum of 25mm • The Weight must be at maximum of 13.0kg • Must be made of rubber compound, reinforced with 3 aramide (Kevlar) inlays • Must be Equipped with light reflecting labels **Extra Large** • Must have a lifting force: minimum of 68 000kg • The inflation height must be: minimum of 520mm • Dimensions (LxW) must be: maximum 908mm x 908mm • The Thickness including profile must be at maximum of 25mm • The Weight must be at maximum of 24.0kg • Must be made of rubber compound, reinforced with 3 aramide (Kevlar) inlays • Must be Equipped with light reflecting labels
13	2 x 10m airbag hoses	• The minimum length must be 10m • Must be supplied with two hoses in different colours. • Must be equipped with push lock couplers • The hose must be made of Polyurethane
14	1 x Airbag regulator (first stage)	• Must have a Pressure reducer with PUSH LOCK couplings. • It must reduce pressure from 300 Bar to operating pressure with max 12 Bar outlet pressure • It must Indicate Cylinder Pressure and set operating pressure • It must be suitable for 300 bars

		• It must be supplied with 2m hose.
15	1 x Deadman controller (second stages)	• It must have a Dual Operations (Inflates and deflates) • It must have a Safety Pressure release automatic valve • Must have a Dead man safety system • It must have two (2) Pressure Gauges
16	10 x 65mm double jacket fire hoses (NST coupling)	• Must have National Standard Thread • Minimum 30 Meter • Must be double jacketed • Must be Canvas Hose • Must have 100% Synthetic high tensile all polyester double jacket • Must have 100% Mildew resistant • Must be single-ply synthetic polyurethane liner resists ozone • Reduced weight, • Increased flexibility • Must be tested and stenciled in accordance with NFPA Standard 1961 • Must have minimum one year warranty for manufacturing defects and delamination
17	6 x 38mm double jacket fire hoses (NST coupling)	• Must have National Standard Thread • Minimum 30 Meter • Must be double jacketed • Must be Canvas Hose • Must have 100% Synthetic high tensile all polyester double jacket • Must have 100% Mildew resistant • Must be single-ply synthetic polyurethane liner resists ozone

		• Reduced weight, • Increased flexibility • Must be tested and stenciled in accordance with NFPA Standard 1961 • Must have minimum one year warranty for manufacturing defects and delamination
18	4 x fire branches (750l/m)	• Must be manufactured of a metal alloy • Must be fitted with pistol grips • Must have a stainless steel shut-off sliding cylinder shut off valve • Must have adjustable tip - Flush, fog to straight stream • Must be integrated debris screen. • Must fit 38mm hoses with NST female couplings • Must have a selectable litre nozzle from approximately 100 l/min to 750l/min • Must be fitted with suitable steel/aluminum material spinning fog teeth • Must have variable setting of nozzle litre by means of shut/ open sliding valve • Must have minimum 5 Years Product Warranty • Must meet NFPA 1964 standards or EU Standards
19	2 x fire branches (360l/m)	• Must be manufactured of a metal alloy • Must be fitted with pistol grips • Must have a stainless steel shut-off sliding cylinder shut off valve • Must have adjustable tip - Flush, fog to straight stream • Must be integrated debris screen. • Must fit 38mm hoses with NST female couplings • Must have a selectable litre nozzle from approximately 100 l/min to 360l/min • Must be fitted with suitable steel/aluminum material spinning fog teeth • Must have variable setting of nozzle litre by means of shut/ open sliding valve

		• Must have minimum 5 Years Product Warranty • Must meet NFPA 1964 standards or EU Standards
20	2 x playpipes	• Axial Play pipe with stacked tip smooth bore nozzle with 7cm, 3,5cm & 2,5cm outlets. • Must be equipped with removable debris screen, durable metal ball and a smooth waterway. • Must have fulltime 6.35cm Swivel, • Must have 65mm female NST coupling. • Maximum weight: 3.3kg.
21	5 x SCBA backpack assembly	• The back plate shall be a one-piece, anti-static composite construction with orthopedic design so as to evenly distribute the weight of the SCBA over the user's lumbar region, hips and shoulders. • The waist pad shall swivel and pivot from side to side by approximately 20 degrees to increase comfort and stability when moving. • The shoulder and waist padding must be constructed from a high abrasion resistant, high puncture resistant, light weight, water resistant compression formed EVA. The shoulder and waist padding shall be chemical resistant and fire retardant. • The harness webbing must be constructed of a strong, hard wearing type material. • The shoulder pads must be designed with an ergonomic body contoured comfort style to maintain shape when worn, providing comfort and freedom of movement, wide for optimal support. Shoulder and waist belt harnessing must be independently adjustable.

		• Shoulder and waist adjustment friction buckles must be of Flame-Retardant polyamide construction. • Each shoulder and waist harness padding must be easily detached from the back plate by a quick release button only. This will allow for easy cleaning and disinfection of the harness if requires without the use of tools. • To enable rapid donning without obstructing other wearers in, for example, confined spaces or Fire Appliance cabs, the waist adjustment should be by means of twin 'pull forward' adjusting straps • A cam-lock mechanism shall be used to secure the cylinder strap in place to ensure simple and secure operation. • The cylinder strap shall accommodate a complete range of sizes of cylinders without the use of tools. • The pneumatic system must be easy to detach from the back plate and harness. • Hoses must be routed in hose channels inside the back plate to eliminate snag potential, including over the shoulder rescue hoses. • Hoses must be attached to the harness via hose clips. These clips must not be detached when removing hoses for cleaning. **Monitoring** • The breathing apparatus should be provided with a complete with either a pneumatic pressure gauge or an electronic monitoring unit as described below: **Pneumatic Pressure Gauge** • Pneumatic pressure gauge must be fully luminescent.

		• The low-pressure whistle warning device must be integrated into the pressure gauge hose close to the gauge. • The pneumatic gauge must be encased by a protective rubber cover. • The pneumatic gauge must be located over the left shoulder. **The Personal Alert Safety System (PASS) devise must be integrated on the pneumatic pressure gauge** • Continuous location Flashes • Manual Alarm or Tone delay • Movement detector • Pre-set alarm after 30 seconds of no movement • Pre-Alarm at minimum 75 dB • Full Alarm at minimum 90db at 2m in free air • Frequency range 2.5Khz – 3.5 KHz • LED Flashes with distress alarm • 1 flash every second • EMC tested and Approved • Small and low-profile maximum dimension metric 140 mm x 100mm x 50mm • Weight maximum 400 grams • Low battery indicator Audio/ Visual
22	9 x SCBA cylinders	• Cylinder must be a 300-bar pressure vessel • Must provide test certificate with all cylinders • Minimum 6l water capacity • The cylinder must be suitable for firefighting purpose

		• The cylinder must be manufactured from a seamless aluminum liner (Carbon Fiber), which is subsequently over wrapped with carbon and glass fibers. • The cylinder must have an excess flow valve to prevent uncontrolled flow on accidental opening. • The cylinder must have a single valve activation and ratchet to prevent inadvertent valve closure. • Must be light weight
23	1 x medical jump bag	• The item should be a Load n' Go. • It must be designed to keep equipment organized and quickly accessible using transparent pockets and elastic holsters that are arranged in a book-style configuration • It must be foam-lined construction maintains pack shape and protects contents • It must have clear, durable urethane windows, mesh pockets, and elastic holsters keep contents in place and well-organized • It must have ergonomic, padded shoulder straps and back panel for comfort during transport • It must have a quick zip access to front compartment • Zips must be robust and hold a life time warranty/Guarantee • Large side pockets must allow quick access to vital sign tools • Must be designed to carry drug module bag, Quick Roll intubation kit, LED light Attachment point. • Must have pathogen resistant material (black) • Must have transparent sleeves and windows • Must be a sturdy, high-tech construction

		• Must have an IV module • **Colour**: tactical black/ red • **Must have a minimum Capacity** of 42606 cm^3 • **Minimum Size must be:** Height = 50 cm. Width= 48 cm, Diameter =17 cm • **T**he front side of bag must be written “City of Johannesburg” and marked with the COJEMS logo using reflective material.
24	1 x Rubber Mallet	• Must be an unbreakable nylon rubber mallet • Non slip grip fiberglass handle, epoxy glued and pinned.
25	2 x Salvage sheet (3.7m x 4.3m)	• Must be treated with a fire- and water-resistant finish. • Must meet requirements for NFPA-701 (large scale), and CPAI Section 6. • Must have water resistant finish and mildew inhibitors. • Must easily be wiped clean.
26	10 x Traffic cones	• Safe, compact, highly visible • Must meet SABS Standards • Must be constructed of orange plastic material. • Must have reflective strip of minimum of 5cm wrapped around the cone • Must meet the new 2009 NFPA 1901: Standard for Automotive Fire Apparatus (2016 edition): STANDARD FOR AUTOMOTIVE FIRE APPARATUS (2016 EEDITION) apparatus standard
27	1 x Automated External Defibrillator (AED)	• Automated external defibrillator with ECG screen and manual override (unit)

		• Complete unit must include each replaceable accessory as specified within the series • Complete Operation/Maintenance Manual Book/File copies in English Language must be provided. • The unit must comply with an acceptable International Safety Standard such as IEC 60601-1 or 60601-1-2 or ISO 13485, ISO 9001 for Medical Equipment. • The service provider must maintain a system for notifying and providing Users with Updates, Modifications, and Software Releases and Recalls. • Training in the operation of the unit must be provided. • All Equipment, Materials and Workmanship provided under this contract must be guaranteed for a minimum period of 2 years. • The service provider to note that the Guarantee period must only take effect upon successful commissioning and delivery of this unit. • The unit being bid for must be a button operation BIPHASIC semi-automated external defibrillator and it must be suitable for ground mobile; ambulance use and ward use in Hospitals. • The unit being bid on must be lightweight less than 3.4kg, it must be robustly constructed, it must incorporate the latest and reliable BIPHASIC technology and the unit **must conform to IEC 601-2-4 "Particular requirements for the safety of cardiac defibrillators".** • The unit being bid on must be able to perform impedance compensation before delivering a shock to a patient. 2 • Design Standards: should meets AAMI DF-80, EN 60601-1, EN 60601-1-2 and ISO 13485, ISO 9001 • P55 dust-water ingress rating

		• Passed the 1-meter drop test • Three-lead patient monitoring • Manual override offer flexibility in monitoring, analysing, and delivering treatment. • Real-time feedback on both the rate and depth of chest compressions to enhance CPR resuscitation quality. Internal recording of up to four events • The supplier must ensure the product is in compliance with the requirements South African Heath Products Regulatory Authority (SAHPRA) – WENDY TO REMOVE INTERNATIONAL STANDARD • **SCREEN** • High-resolution LCD display. • Screen Size: not less than 76.7mm Width x 57.7 mm Height. • Sweep Speed: not more than 25 mm/sec. • Viewing Time: not more than 3 seconds. • Displayed Information on Heart rate, ECG waveform, CPR bar graph, battery gauge, elapsed time, number of shocks delivered • Defibrillator Energy: 50, 70, 85 joules (paediatric); 120, 150, 200 joules (adult) • Type: Internal non-volatile memory. • Memory Capacity: With audio recording enabled, minimum of 20 minutes of ECG, operator and device actions; • Without audio recording, minimum of 1.45 hours each for 4 patients records or a minimum of 5.8 hours for a single record of ECG and event data. • Expanded external data storage and transfer available with a slot for a USB memory stick • Event Review & Reporting: Code Review software version 3.30 or higher.

		• Communications: IrDA infrared wireless for communication with personal computer or external • Charge Time: not more than 30 minutes with a new battery.
28	4 x BIC female adaptors	• Must be made out of cast aluminum • Must be female 65mm BIC to female 65mm NST coupling • Must be male 65mm BIC to male 65mm NST coupling • must be male 65mm BIC to male 38mm NST • must be male 65mm NST to 65mm NST • Must be female 65mm NST to male 38mm NST
29	1 x PPV fan	• Must be made out of cast aluminum 7-blade air foil propeller • Blade must have low noise, high output design • Power from standard, variable speed gasoline motor • Direct drive system eliminates shaft for years of trouble-free operation • Cart style design with rear mounted wheels and pull-up full height, full width handle for easy maneuverability • Locking step brake to make setup lightning fast • The airflow test must be certified by the Third party.
30	1 x chain saw	• Must have on/off switch • It must have 68-80cc two stroke engines • Must be a low fuel consumption • Must have a reduced exhaust emission levels in accordance with environmental regulations.

		• Must have an active vibration reduction • Must have an air purge system to assist with easy start • Must have a visible fuel level indicator • Must have 400mm to 500mm guide bars • Must be fitted with chainsaw chains with the following pitch 3/8 • Must be fitted with chain guards • Must have instant manual chain breaks • Must have inertia chain break automatic chain break if an automatic kick back is experienced • Must have a tool less chain and adjuster to be easy to reach • Must be fitted with decompression valve for easy starting • Must be fitted with a cold start device (choke manual or automatic) • Must have a tool kit consisting of plug spanner, screw driver and tools required for maintenance • Must be provided with chain protector • Must be supplied with one spare chain and a sharpening kit.
31	1 x Carborundum cutter	• Must have on and off Switch • 2.5- 3.7 kw petrol motor (two stroke) • Must be fitted with a cold start device (Choke manual or automatic) • Must be air cooled • Must have active triple air filtration in cases of concrete cutting • Must fit 300mm to 400mm abrasive disks • Must have decompression switch for easy start • Must have a reversible cutting arm • Must have easy adjustable blade guard

		• Must have active vibration dampening system • Must have clearly visible Fuel indicator • The noise must be below 120db • Must have automatic Lubrication of Clutch bearing
32	1 x Low expansion foam branch	• Must be minimum 850 L/min at 7 bars • The Branch Pressure must be between 3 Bar and 8 Bar • Expansion ratio minimum 10:1 • The Flow Rate must be of minimum 300L/min • The branch must be of minimum 14-meter throw • The output must be minimum $15m^3$ /min • The Inlet side must be 65mm female NST inlet. • The couplings must be made out of Light alloy • Epoxy painting aluminum handle. • It must have a maximum weight 4 Kg
33	1 x medium expansion foam branch	• Must be a minimum of 450 L/min at 7 bars • Branch Pressure must be a minimum 2.5 Bar • Expansion ratio must be a minimum 55:1 • Flow Rate must be a minimum 270L/min • Must have a minimum of 8-meter throw • Output must be a minimum $15m^3$ /min • Must have an inlet of 65mm female NST. • Must be made of Stainless steel • Couplings must be made light alloy • Must be chrome plated brass nozzle.

		• Must be Epoxy painting aluminum handle. • Must have a Stainless-steel gauze. • The branch must be Maximum weight of 7 Kg
34	1 x 225l/m inline inductor with a pick-up tube	• Must produce a minimum of 225 L/min at 7 bars • Must have a setting between 1-6% induction of foam concentrate • It must be adjustable at a Minimum of 4.5 Bar pressure • It must have Maximum operating pressure 10 Bar • Must be a Venturi-type inductor devices, • Inlet must be a 65mm female NST • Outlet must be a 65mm Male NST
35	1 x 450l/m inline inductor with a pick-up tube	• Must produce a minimum of 450 L/min at 7 bars • Must have a setting between 1-6% induction of foam concentrate • It must be adjustable at a Minimum of 4.5 Bar pressure • It must have Maximum operating pressure of 10 Bar • Must be a Venturi-type inductor device • Inlet must be a 65mm female NST • Outlet must be a 65mm Male NST
36	1 x reciprocating saw	• It must be Rugged rubberized Constructed • It must operate at 220v • It must have a Minimum of 1200watt • It must have a minimum of 2300 strokes under no load • The Strokes length must have a minimum of 25mm • It must have an active anti vibration

		• It must have variable strokes rate settings • it must have keyless blade clamp • it must have keyless Adjustable contact shoe for depth setting • it must have Orbital action • it must have a Removable handle for stabilizing tool • it must be below 5kg in weight • it must be supplied with a rugged case. • it must be supplied with 15 packets of metal and 5 packets of wood blades. • it must have a minimum of 1m electrical cord with 3- point plug
37	1 x angle grinder	• It must fit a minimum of 230mm Cutting Disks • It must be 14mm Spindle Thread • Cutting depth must be a minimum of 60mm disk when new. • It must be able to operate at 220 Volt • It must have a smart power technology to ensure constant high cutting performance • The Cutting power must be minimum of 2300 Watt • The Blade Speed without load must be minimum of 6400 rpm • It must have quick-acting brake to stop the disc within 2.5 seconds. • It must be Double Insulated. • It must have a fully rotatable disk guard. • It must have a rugged dust removal hood and soft grips for virtually dustless operation and greater safety • It must have a vibration reducing side Handle • It must have a rotatable grip for a comfortable working position • It must have a Minimum 4m Power cord

		• It must have an Operating sound level not greater than 105 dB if measured in accordance to EN 60745 • It must have an Operator controlled Start up switch • It must have an Active Torque Control to protect operator • It must have an Active Vibration Reduction
38	1 x 30m extension cord	• Must be housed in a steel drum frame. • Must be 2 x 3 point electrical outlets fitted in the steel drum • The Electrical cable must have a minimum of 15A • It must be 30-meter length of cable • It must have 3-point plug fitted
39	1 x Pick headed axe (with a robust plastic handle)	• Must have a high-grade tool steel • The Head must be heat treated • The Handle must be rated at a minimum 500 kg • Must have a strong protruded fiberglass core with an injection molded jacket for added strength • The axe head must be bonded to the fiberglass handle with strong two-part epoxy • The axe head must be a drop forged with high carbon steel • The fiber glass handle must be a minimum of 850mm • The flat cutting blade must a minimum of 1.5 kg • It must have a minimum of 80mm pick side.
40	1 x Flat headed axe (with a robust plastic handle)	• Must have a high-grade tool steel • The head must be heat treated • The handle must be rated at a minimum of 500 kg

		• Must have a strong protruded fiberglass core with an injection molded jacket for added strength • The axe head must be bonded to the fiberglass handle with strong two-part epoxy • The axe head must be a drop forged with high carbon steel • The fiber glass handle must be a minimum of 850mm • The flat cutting blade must a minimum of 1.5 kg
41	1 x Pry axe	• It must be lightweight • It must be multi-purpose, slam, ram tool designed to pry and twist. • It must chop, cut metal, twist off locks or latches • The head and claw must be from a separate section • Must be forged from high-alloy steel • Must be heat treated for maximum strength. • Solid steel shaft must extend the axe to a minimum of 71cm • Sure, grip machine-grooved must have rubber Grips • The maximum weight must be 5kg • It must be a standard claw • Duckbill must have long, smooth incline to force windows and interiors doors. • Pike must be long, sharp, tapered and gently curved to fit a lock or latch. • Must have the following: - Pike - Recessed blade - Axe blade - Teeth - Spanner wrench - Extended shaft

		- Claw shaft - Shaft release - Standard claw with gas shutoff
42	1 x Submersible pump	• It must operate at 220 Volt • Electrical pump must have a run dry protection switch • Must have a self-primer • Outlet must be fitted with 38mm male NST coupling • Must be able to deliver a minimum of 300l/min at a 12m head • Must be made of Stainless steel/steel alloy material • It must have a minimum of 5m Electrical cord fitted
43	1 x Haligan tool	• It must be made out of Heavy-duty Steel or steel alloy • The machine grooved must have non- slip grips • The Inclined duckbill must be Long and smooth • The Pike must be long, tapered and gently curved to fit a lock or a latch • Must be Fitted with standard claw and metal cutting claw
44	1 x Spine board	• Must be a full length adult plastic spine board: minimum Length of 185cm, minimum Width of 45cm and minimum thickness of 5cm. • The load capacity must be minimum of 150kg whilst the board is supported only at the head and feet. • Must be made of strong plastic and sealed with a smooth finish. • Minimum of 12 hand-holds around the board and support runners on the under-side (inside) of the board.

		• Must be usable in any weather condition (e.g., hot and cold) and within water without any loss of innate strength and/or load capacity. • Must include a test certificate regarding the ability of the spinal board to carry a capacity of not less than 150kg loads whilst being supported only at the head and feet. • It must be suitable to be used with a spider harness. • Must be made of durable polycarbonate and polypropylene • It must be suitable for X-ray Translucent • Must have Angled edges for Log Rolling • Must have a Central Slot in lower half of the board, allowing for immobilizing each leg • Must have a Narrow Foot end
45	1 x Scoop stretcher	• It must be suitable for moving, immobilizing, lifting and carrying patient in the pre-hospital care environment. • The stretcher must allow the EMS practitioner to place a stretcher beneath the patient without moving the patient, therefore reducing the risk of further injury. • Length Opened must be maximum of 166cm • Length Folded must be maximum of 120cm • Width Open must be maximum of 43cm • Weight must be maximum of 7kg • Minimum Load Capacity of 160g whilst the board is supported only at the head and feet. • Must fold for compact storage • The unit must have telescoping tubes to allow length adjustments to fit patients of various heights.

		• The unit must have a narrow foot frame for handling in confined areas. Foot frame handles to be tapered upwards to allow ease of lifting. • It must be able to uncouple at two ends • It must have a narrow foot end • Open center design to allow for x-rays to be taken • Must be made from high quality aluminum • Each scoop must be designed with a minimum of 8holes to fit a standard spider harness.
46	2 x Portable oxygen cylinder	• Must have Pin index connection • Must be made of Aluminium body • Must Holds a D-sized tank. • Dimensions must be at minimum of: Diameter 11cm, Length 40cm. • Must have a black body with white neck • Must include the rust plastic casing.
47	2 x Pin index oxygen regulator	• Must have a Dial Click Stop Constant Flow with Pressure Gauge to Register Cylinder Pressure. • Oxygen must be delivered through Click Stop; Hand Dial marked 0-25 l/min. • Construction must be: Outer body -Aluminum, Inner Liner - Brass • Regulator must be supplied 3 x BODOC seals. • Pressure Dial must be protected by a rubber type ring. The device must be able to operate input pressure of at least 200 bars. • Must carry a minimum of 2 years Warranty • Must have a Therapy flow rate selector

		• The flow rate must be indicated in the display window to choose from ½, 1, 2, 3, 4, 6, 8,10 or 15 litres per minute
48	1 x Kendrick Extrication Devise adult	• The item should be Ideal for immobilizing and extricating the patient from Motor Vehicle Incidents and/or confined spaces. • Rigid Spinal (back) support extrication device with built-in neck support and chest flaps. • Unit must be capable of immobilization of spinal cord when correctly applied. • Weight should not exceed 3 kg. Must include 2 forehead/chin restraints that attach to a movable head immobilization system, and carry case. • Chest and extremity straps must be color- coded with sewn-in securing straps and snap-lock quick release buckles. • Carrying handles must be securely attached to the device in such a way as to withstand a patient's weight up to minimum of 40kg with no loss of integral strength. • Covering material must be heavy-duty, vinyl-coated nylon or similar, durable and washable. • Should secure a patient in the seated and/or standing position. • Must be able to be used for multiple patient sizes. • The adjustable, fold-back sides permit easy access to patient chest. • The wraparound design should provide horizontal flexibility for easy application and vertical rigidity for maximum support of the spine, neck and head during extrication. • Maximum load capacity must not be less than 60 kg • Restraint straps must be a minimum of 25mm nylon webbing with snap-lock quick release buckles. • The device must carry a minimum of a two-year guarantee.

		• X-ray, MRI (Magnetic resonance imaging) and CT (computed tomography) Scans as well as advanced life support procedures should be able to be performed with the device in place. • **Adult** - Length: between 890 mm-1370 mm - Width: not less than 230 mm - Height: between 80 mm-230 mm - Weight: not more than 3kg
	1 x Kendrick Extrication Devise child	• The item should be Ideal for immobilizing and extricating the patient from Motor Vehicle Incidents and/or confined spaces. • Rigid Spinal (back) support extrication device with built-in neck support and chest flaps. • Unit must be capable of immobilization of spinal cord when correctly applied. • Weight should not exceed 3 kg. Must include 2 forehead/chin restraints that attach to a movable head immobilization system, and carry case. • Chest and extremity straps must be color- coded with sewn-in securing straps and snap-lock quick release buckles. • Carrying handles must be securely attached to the device in such a way as to withstand a patient's weight up to minimum of 40kg with no loss of integral strength. • Covering material must be heavy-duty, vinyl-coated nylon or similar, durable and washable. • Should secure a patient in the seated and/or standing position. • Must be able to be used for multiple patient sizes. • The adjustable, fold-back sides permit easy access to patient chest.

		• The wraparound design should provide horizontal flexibility for easy application and vertical rigidity for maximum support of the spine, neck and head during extrication. • Maximum load capacity must not be less than 60 kg • Restraint straps must be a minimum of 25mm nylon webbing with snap-lock quick release buckles. • The device must carry a minimum of a two-year guarantee. • X-ray, MRI (Magnetic resonance imaging) and CT (computed tomography) Scans as well as advanced life support procedures should be able to be performed with the device in place. • **Pediatric/Child** - Length: between 790 mm -1170 mm - Width: not less than 200 mm - Height: between 50 mm-200 mm - Weight: not more than 3 kg
49	1 x Traction splint adult	• The unit must be a light weight femoral traction splint for use in the pre-hospital environment. • The unit must be capable of immobilization and traction of fractured femurs. • The unit must be easily applied. (One person application) nothing to assemble – always ready to use. • Incorporate an articulating ischial perineal cushion that is comfortable and conforms to the pelvis, simplifying pelvic procedures. • It must permit traction to decrease as the spasm releases. • The child unit must be adjustable for a range to fit an infant to a child of 6 years. • The unit must be able to be applied with minimum movement of the legs.

		Construction • It must be lightweight aluminum and stainless steel constructed. • It must be compact to allow for easy storage. • It must have a telescoping frame for adjusting length. • All points of possible contact with patient must be protected to prevent pressure injury. • It must be completed with a carry case • It must provide inline mechanical traction by means of a quick release ratchet strap • It must have an adjustable length • It must have a simple adjustable wrap around ankle hitch designed to allow for the monitoring of pedal pulses • It must have soft padded leg straps • It must have low-profile ischial pad allowing the splint to be applied with minimum movements of the injured leg • It must have a Folding Heel stand: Folding flat for storage and instantly locks in place for support
	1 x Traction splint child	
50	4 x Standpipes (key and bar)	• Must be made out of steel alloy • Must be between 1m and 1.5m long • The swivel head must be 65mm diameter Female instantaneous • Must fit the London V thread (LVT) 65 mm • London Round Thread to London V thread adaptor to standpipe. • Must be supplied with key and bar

51	2 x Hydrant wheels	• It must be constructed from Aluminum Alloy • Minimum Dimension: Diameter 150mm, Thickness 20mm • Finishing must be red powder coated • Must indicate close and open directions
52	2 x Hydrant keys (X shape)	• Must be made out of Stainless steel. • Must be wheel spanner shape
53	2 x High volume hose spanner	• Must fit 100mm Storz Couplings and 65mm NST Couplings
54	1 x 65mm collecting breeching	• Must be made out of Lightweight aluminum alloy • Must have 2 x 65mm NST female inlets • Must have a self-locking valve for positive handle positioning. • 1 x 65mm NST Male outlet
55	1 x 65mm dividing breeching	• Must have 65mm NST female inlet • 2 x 65mm NST male outlets • Must be made of hard anodized metal • It must have an Aluminum Shut off valves with high tensile control handles • It must have Self-locking valves for positive handle positioning • It must have a minimum weight of 7 Kg • Must be flow efficient at a minimum of 2400L/min through each valve.

56	1 x Set of general spanners (10, 11,12,13,14,15,17,19, battery pliers, normal pliers, long nose pliers, and shifting spanner)	• All spanners must be made of stainless steel: - Spanner sizes 10, 11, 12, 13, 14, 15, 17,19 - Battery plyers - Normal plyers - Long nose plyers - 250mm shifting spanner
57	1 x Woodland's hydrant adaptor	• Must be made out of steel alloy • Inner diameter must be 100mm • Must be fitted with 100mm Stortz coupling and blank cap.
58	2 x 65mm hose ramps	• Bridges must give you economical hose line protection for up to 65mm hose lines. • It must be not less than 30cm wide and must be interlocked to any width • Must be equipped with reflective safety strips for added visibility. • Must be made of fiber reinforced rubber. • Must accommodate two hoses.
59	2 x Dry chemical powder extinguisher	• Must be suitable for Class A, B and C fires. • The cylinder must be made out of steel • Must be 9kg
60	2 x CO2 extinguisher	• Must discharge a white cloud of "snow" which smothers a fire by eliminating its oxygen. • Must be suitable for Class A, B and C fires. • The cylinder must be made out of steel

		• Must be 9kg.
61	1 x Electrical generator	• Must have an on/off Switch • Must have minimum of 4.5Kva • Must operate at 220 volts • Must have a petrol driven motor (four stroke) • Must be fuel efficient with at least 2 hours per 5 litres of fuel • Must have 2 x three-point plug ports in a wear resistant housing fitted to steel frame. • Must have an electronic circuit breaker • Must have a Steel Framed protecting the mechanical operating parts • Must be Fitted Petrol tank with a shut off valve • Must be Fitted with a cold start device (choke manual or automatic) • Must have low oil protection with automatic shutdown • Must have a minimum of 2 years warranty
62	1 x large bolt cutter	• Must have a minimum of 750mm long • Must have heavy duty jaw bolts • Must have heavy duty straps • Must have rounded edge cutters to Brinell 400 and Rockwell C42 hardness • It must have nose Straps
63	1 x small bolt cutter	• Must have a minimum of 450mm long • Must have heavy duty jaw bolts • Must have heavy duty straps • Must have rounded edge cutters to Brinell 400 and Rockwell C42 hardness

		• It must have nose Straps
64	1 x Bow saw	• It must have a minimum of 500mm cutting length • It must have a blade tensioner
65	1 x Hack saw	• It must have a minimum of 300mm cutting length • It must have a steel wrap around handle
66	2 x Safety belt cutters	• It must cut through seat belts. • It must be made of high strength Aluminum alloy. • The Tip must be fitted with Dzus Key for opening aircraft panels. • Must cut 4500kg strength webbing with one stroke.
67	1 x Pitch fork	• Must be made out of Malleable iron head • The handle must be Fiberglass and round • Its butt must be made out of rubber
68	1 x Combination fuel/oil can	• Must be SABS Approved for combustible liquids • Must be made from a durable material • Fuel capacity must be of no less than 4 liters and not more than 6 liters • Must hold up to 2 litres of oil • Pouring spouts must be incorporated into closing lids
69	5 x 100mm double jacket high volume supply hoses	• Must be a Storz Couplings • Must be 15 Meter long

		• Must be Double Jacketed • Must be Canvas Hose • Must be 100% Synthetic high tensile all polyester double jacket • Must be single-ply synthetic polyurethane liner which resists ozone • Must be mildew resistant • It must be lightweight • It must have an increased flexibility • It must be tested and stenciled in accordance with NFPA Standard 1961
70	2 x Pike poles	• Must be made out of malleable iron head and fiberglass round handle • Must have hook and tooth • Must have a Rubber Butt
71	1 x Ground monitor	• Must be Portable and Manually operated • Must have 2x 65mm NST Female inlet fittings. • Must have high flow rate • Must be Fitted with nozzle • The nozzle must be adjustable from fog to jet • Must have adjustable height • It must rotate at a minimum of 180 degree
72	1 x Battery suction unit	• Must have a minimum battery operational time of 60 minutes (High Capacity rechargeable). • Must have a Capacity of the aspiration container at a minimum of 800ml • Must have a Protection for electrical shock • Must have integrated filter: Internal bacterial filter/fluid shut off.

		• Must have the following Electrical requirement: 100-240Volt AC, 47- 63Hertz, 0.5A max.12Volt DC, 33Watt max.
73	2 x Stabilizing head blocks sets	• Must have a large ear hole in each head support. • It must have an attachment base system that allows for the head blocks to be attached to a trauma board or scoop stretcher. • It must have reusable head and chin straps which are fully adjustable for length (Velcro or clip attachment to the head blocks). • Device must be X-ray lucent and must have minimal interference with Magnetic Resonance Imaging (MRI), or computerized tomography (CT) scanning procedures. • It must be a non-disposable item. • Must be applied with minimum movement of the cervical spine. • Complete system must consist of contoured head blocks, a base pad with adhesion to secure the blocks and the head and chin straps. • Blocks must be constructed of plastic-coated closed cell foam which must prevent bacterial growth within components. • Must not absorb blood or body fluids. • Must be easy to clean and not affected by adverse weather conditions (moisture). • The maximum weight must be 1kg. • Dual-purpose head supports must be tapered on the one side so that they can be used with a flat backboard or scoop stretcher. • The colour of the device must be orange. • The device must carry a one-year guarantee. • Must have a minimum length of 400 mm • Must have a minimum Width of 260 mm

		• Must have a minimum Height of 170 mm • Must have a maximum weight of 794g
74	1 x Bag valve mask (manual resuscitator) adult, child, and infant	**Adult manual resuscitator** • The bag must be operable with one hand. • The Bag must be capable of rapid and full re-expansion. • It must have a swivel connector present to allow for changing angle of operation. • It must have 22mm outer diameter and 15mm internal diameter fittings. • The unit must not be affected by extremes of high/ low temperatures. • It must have an oxygen inlet which is compatible with the oxygen tubing. • It must have a bag volume of minimum 1500 ml. • It must have Stroke volume of maximum 1000 ml. • Cuffed Face mask must be clear and provide a leak proof seal. • Must have Standard 22mm Internal Diameter. Mask sizes 4 and 5 to be supplied. • Must have a compatible valve fitting to standard external (positive end-expiratory pressure) PEEP fitting W/POP-OFF 60 cmH20 • It must be made of silicone, non-disposable. • It must be suitable for sterilization by autoclave or cold chemical. • Oxygen enrichment reservoir bag must be at a minimum of 2600 ml • Must be supplied in a soft carrying case made of a durable, washable material with appropriate carrying straps. • Adult bag volume must have a minimum of 1700ml **Child manual resuscitator** • The bag must be operable with one hand. • The Bag must be capable of rapid and full re-expansion.

		• It must have a swivel connector present to allow for changing angle of operation. • It must have 22mm outer diameter and 15mm internal diameter fittings. • The unit must not be affected by extremes of high/ low temperatures. • Must allow for oxygen inlet via oxygen tubing. • It must have a bag volume of minimum 500 ml. • It must have Stroke volume of maximum 350 ml. • Cuffed Face mask must be clear and provide a leak proof seal. • Must have Standard 22mm Internal Diameter. Mask sizes 1,2 and 3 to be supplied. • Must have a compatible valve fitting to standard external (positive end-expiratory pressure) PEEP fitting W/POP-OFF 60 cmH20 • It must be made of silicone, non-disposable. • It must be suitable for sterilization by autoclave or cold chemical. • Oxygen enrichment reservoir bag must be at a minimum of 900ml • Must be supplied in a soft carrying case made of a durable, washable material with appropriate carrying straps. • Child bag volume must have a minimum of 470ml **Infant manual resuscitator** • The bag must be operable with one hand. • The Bag must be capable of rapid and full re-expansion. • It must have a swivel connector present to allow for changing angle of operation. • It must have 22mm outer diameter and 15mm internal diameter fittings. • The unit must not be affected by extremes of high/ low temperatures. • Must allow for oxygen inlet via oxygen tubing. • It must have a bag volume of minimum 280 ml.

		• It must have Stroke volume of maximum 150ml. • Cuffed Face mask must be clear and provide a leak proof seal. • Must have Standard 22mm Internal Diameter. Mask sizes 00, 0 and 1 to be supplied. • Must have a compatible valve fitting to standard external (positive end-expiratory pressure) PEEP fitting W/POP-OFF 40 cmH20 • It must be made of silicone, non-disposable. • It must be suitable for sterilization by autoclave or cold chemical. • Oxygen enrichment reservoir bag must be at a minimum of 600ml • Must be supplied in a soft carrying case made of a durable, washable material with appropriate carrying straps. • Child bag volume must have a minimum of 150ml **Physical Characteristics of Adult, Pediatric and Child BVM** • Transparent Facemask allows for easy monitoring of skin color, signs of vomitus or body fluids. • Complete with Oxygen Reservoir System. • Controlled Flow rate. • Controlled Airway Pressure • Controlled Ventilation. • Reduced Risk of Gastric Insufflations. Inspiratory Resistance minimum 3.30 mm H_2O Expiratory Resistance minimum 2.20 mm H_2O Reservoir Volume minimum 2700 ml

75	2 x spider harness	• The Spider Straps must provide effective immobilization of patients on a spinal board. • The Spider Straps must attach to 10 positions on the spinal board using hook and loop straps. • The unit must secure the patient from shoulder to foot. • The spider straps must be designed for use in different types of Spinal Boards, and must be compatible with similar models. • Minimum Dimension of 145cm x 66 cm • Minimum Weight of less than 300 g • Locking design: Velcro
76	4 x Shoulder pack straps	• Must be designed for heavy-duty hose carry. • Straps must be interconnected by three stiff nylon spines giving the Hose Vice a strong, secure feel. • The shoulder straps must be adjustable, removable and be large enough that a firefighter can carry the bundle across the body for better balance. • The unit must have additional handles incorporated into the ends of the four shoulder straps. • Must have provisions to be carried by two firefighters. • Must have a large carrying capacity. • It must carry up to minimum of 30m of 38m hose. • It must have Adjustable side release buckles that can be used with the gloved hand and easy-to-operate.
77	2 x Bowring	• It must have hose advancement that fits six different size hoses • Must have an emergency bailout descender - two different options

		• Rapid intervention team (RIT) firefighter drag - hook and drag • It must have an ultimate high-rise tool-cheater bar, • It must have a stand pipe wheel, spanner wrench, • It must have a gas shut off - two different options • It must have an auto extrication – windshield removal, glass ripper • It must have oxygen (O2) cylinder wrench • It must have a door wedge • It must have a water shut off • It must have mattress hook to hook wires • It must have rocker lugs, stortz lugs • It must have sheet rock ripper - cleanly rips through while looking for hot spots