Flagstaff Fire Department
Type 6 Wildland Light Engine

== Type 6 Wildland Light Engine ==

Type 6 Wildland Light Engine Configuration

The apparatus shall be a light brush apparatus on a light duty chassis. The apparatus body shall be designed to withstand the rigors of off-road use and Wildland fire fighting. Specific details of the apparatus shall be as described below.

General Craftsmanship Requirements

The installation of hardware parts such as hinges, catches, handles, or knobs shall be accomplished to avoid damaging the hardware or the mounting surface. After fabrication, all parts shall be cleaned of the following: smudges, loose, spattered, or excess welding, metal chips or filings, or any other foreign material that may detract from the intended operation, function, or appearance of the apparatus or its equipment. This shall include particles which could loosen or become dislodged during the normal expected life of the equipment. Whenever possible, this cleaning shall take place before parts are assembled.

Threaded parts or devices shall show no evidence of cross-threading, mutilation, or detrimental burrs. All screw type and rivet fasteners shall be tight to allow no relative movement between attached parts. No bolts or screws shall be tightened more than the SAE torque standard established for the grade, screw, and thread type.

Use of dissimilar metals shall be avoided whenever possible. If dissimilar metal contact is unavoidable, a nonabsorbent closed cell neoprene insulator tape shall be placed between the metals. Caulking may be used in addition to the tape to provide addition protection. Wherever dissimilar metal contact occurs, measures shall be taken to avoid moisture from collecting in the contact areas. Wherever dissimilar metal contact occurs each surface shall be properly primed and painted, even if tape and other protectants are used. Wherever dissimilar metal contact occurs, fastener quantity shall be limited, and washers, gaskets, sleeves made of compatible material shall be used. Corrosion inhibiting materials (i.e. pastes, compound) shall be applied to all screws or bolts that are inserted into dissimilar metals.

All welds shall be free of defects such as cracks, porosity, undercuts, voids, and gaps. There shall be no weld burn through. Fillets shall be uniform and smooth. There shall be no damage to adjacent parts resulting from the welding.

Wiring shall be protected from tears, abrasions, cuts, etc. from loose items within compartment spaces, and from items present in the operating environment outside of the compartments. Special care shall be taken to conceal wiring and tucked away to keep from hanging low, prevent catching on brush, rocks, and various other items present in the off-road environment.

Guards, shields, or other protection shall be provided where necessary in order to protect personnel from injury from hot, moving or rotating parts during non-maintenance operations; to protect fragile equipment from becoming damaged when operation off road, and to protect from sharp edges or corners.

Components shall be located for ease of inspection, routine maintenance, or removal. Drains, oil and fuel filters, filler plugs, grease fittings, air and water lines etc. shall be located so that they are readily accessible and do not require special tools

for servicing. Lube extensions, oil drain, fill extensions, or special tools required for minor chassis maintenance shall be provided by the contractor for each apparatus manufactured.

Securing of air, water, fuel and/or electrical lines, looms or harnesses shall not utilize stick-on/adhesive backed fasteners; insulated metal clamps or clips shall be used. Nothing shall be permitted to hang loose from apparatus.

Carrying Capacity

The chassis components and suspension shall be capable of withstanding the stresses of use in the road-less environment at full Gross Vehicle Weight Rating (GVWR) and Gross Axle Weight Rating (GAWR). The GAWR and GVWR of the chassis shall not be exceeded when loaded to its in-service weight. NFPA 1906 current edition shall apply to define in-service weight.

Minimum Capacities:

A. Vehicle shall carry five (5) personnel including the driver
B. Water tank capacity of a minimum 300 U.S. gallons
C. Foam cell capacity of a maximum 12 U.S. gallons
D. The allowance for miscellaneous equipment shall be a minimum of 2000 pounds

Noise Exposure Test

The apparatus, or each apparatus if multiple or ordered, shall be tested under the procedures defined in 49 CFR 393.94, "Vehicular interior noise levels test procedure," except that the test shall be performed with the vehicle traveling at a steady speed of 65 mph (105 km/hr.) on level, paved, smooth-surface road. The test shall be conducted from any seat location and the maximum noise level shall be 90 dBA without any warning devices in operation. Documentation shall be included in the apparatus delivery binder illustrating the results of the test to show proof of either a failure or meeting the required standard.

Training

An intensive training session, in the correct procedures, usage, and maintenance of the apparatus, shall be conducted at Flagstaff Fire Department. The training shall be conducted by BFX Fire trained personnel.

Pre-Work Conference

A pre-work conference shall be held prior to construction to review contract specification, materials requirements, delivery schedule, and payment procedures. The conference, which may be accomplished by conference call, shall include the department representative(s) and BFX Fire Apparatus representative(s), including the primary engineer working on this project. The date and time of the meeting, or conference call, will be scheduled by the department representative(s) in consultation with BFX Fire Apparatus and any/all other needed parties.

Delivery Preparations

Prior to delivery of the completed vehicle, all fluid levels shall be checked on the chassis, i.e. oil, coolant, grease levels, etc. The completed vehicle shall be weighed, and road tested, batteries fully charged, and all RAM OEM safety recalls shall be rectified. The vehicle shall be presented in a clean state.

Weather-Tight Testing

The apparatus body shall be water tested prior to the customer's inspection and only shall be deemed as "PASSING" if the compartment interiors remain dry after simulating rain for 2 minutes. The same equipment used for BFX Fire Apparatus' internal testing shall be made available to the customer to perform their own test.

Documentation

Upon delivery, a completed vehicle sticker/label shall be attached to the completed apparatus in the cab on the driver's side of the vehicle. The label shall follow the National Traffic and Motor Vehicle Safety Act, Section 114 and Federal Code of Regulations, Title 49. The apparatus shall be accompanied with a single container with the following items. The containers shall be organized and contain an inventory list of the items within the container affixed to the exterior of the container lid. Two (2) electronic files (USB DRIVE) and one (1) hard copy of each item on the list shall be supplied.

A. All applicable items listed in The National Fire Protection Association (NFPA) 1906 Standard for Wildland Fire Apparatus current edition, *General Requirements*/*Data Required of the Contractor.*
B. Record of construction details
C. Copy of warranty outlining coverage on the vehicle and apparatus
D. Certificate of Origin for chassis
E. Detailed engineering as built drawings for the following views:
    a. Driver side
    b. Passenger side
    c. Top
    d. Rear
    e. Apparatus body frame and mounting details
F. Complete wiring diagrams; understandable by the field user
G. Two (2) additional completed vehicle stickers/labels
H. Service Protocol and Warranty document
I. Certified weight slip(s) showing the completed vehicle weights with all fixed and portable equipment installed, all tanks full, and all personnel seating positions occupied with 250 pounds. The weight slip shall include tare weight, front axle weight and rear axle weights. Weight documents shall be provided from a certified scale.

Delivery

Delivery of the finished apparatus shall occur 300 days from the receipt of order.

Delivery Location

The completed apparatus shall be transported via flatbed trailer to Flagstaff, Arizona.

Warranty Policies

The warranty period for the apparatus shall commence at the time of acceptance of the apparatus.
Chassis Original Equipment Manufacturer (OEM)

Vehicle shall retain the OEM chassis warranty which shall in no way be diminished or voided by the final manufacturer. If at any time the OEM chassis warranty is voided the final manufacturer shall be responsible for repairs.

BFX Fire Apparatus shall be responsible for contacting the chassis dealer and start the chassis warranty period from the date of acceptance.

General Warranty

BFX Fire Apparatus shall warrant all services performed under this contract shall, at the time of acceptance, be free from defects in workmanship and materials and conform to the requirements of this contract for a minimum period of twelve (12) months.

Design Warranty

BFX Fire Apparatus shall warrant the design of the apparatus and all components constructed and/or designed by the contractor to be free from malfunctions due to improper design, manufacturing defects, defects in manufacturer supplied materials, or factory workmanship for a period of ten (10) years.

Corrosion Warranty

The apparatus, under normal use and with normal maintenance, shall remain free from corrosion for a period of ten (10) years from the date that the apparatus is first placed in service. A body shall be considered to have "corrosion defects" if it is found by the Government to have perforation caused by corrosion under normal use and with normal maintenance.

Other/Add On Item Warranty

All warranties provided by major component and equipment manufacturers shall be found in the apparatus manual(s). Additionally, BFX Fire Apparatus shall facilitate warranty repairs with add on equipment manufactures whenever deemed necessary.

Payment Terms

The apparatus shall be paid for in full at the time of acceptance of the apparatus. Acceptance shall be made only after specifications have been verified for compliance and any/all deficiencies have been corrected. The payment shall be made by electronic funds transfer, preferred method, or by check.

Chassis

The completed apparatus shall be mounted on a new RAM 5500 Tradesman Series 4x4 chassis with four (4) full doors.

Gross Vehicle Weight Rating

The Gross Vehicle Weight Rating (GVWR) shall be 19,500-pounds.

Dual Rear Wheels on Chassis

The chassis shall be equipped with dual rear wheels. Mud flaps shall be installed on the apparatus body aft of the rear wheels.

Wheelbase

The wheelbase shall be no greater than approximately 173.40-inches.

Cab-to-Axle

The cab-to-axle measurement shall be approximately 60.00-inches.

Motor

Power to drive the apparatus shall be supplied by a 6.7L Cummins Turbo Diesel engine. The engine shall be rated for 750 ft-lbs. of torque and 325 horsepower at 2400 RPM. The engine shall be equipped with a variable geometry turbo (VGT) with an integrated exhaust brake.

Motor Air Intake and Filtration

The chassis shall be equipped with a heavy-duty air cleaner.

Options on the Motor

The following items shall be equipped by the Original Equipment Manufacturer, aftermarket alternatives will not be accepted.

- Motor shall be equipped with dual alternators totaling 440 amps
- Motor shall be equipped with an OEM engine block heater and winter front grille cover (Cold Weather Group)

Battery

Two (2), 78 Amp, 12-volt maintenance free batteries totaling 730 cold cranking amps.

Exhaust System

The exhaust shall be mounted to OEM standards; it shall be equipped with a single, horizontally frame mounted exhaust system with impact protection and shall terminate to direct exhaust away from the apparatus aft of the rear wheels.

Exhaust/Motor Brake

The chassis motor shall be equipped with a manual push-button engine exhaust brake.

Manual DPF Regeneration

The RAM chassis cab shall have the Manual DPF Regeneration (XNR) feature which allows the end user to press and hold the Diesel Particulate Filter (DPF) button to manually clear the diesel particulate filter.

High Idle, Engine Speed Control

The chassis cab shall have an OEM feature allowing the end user to put the motor into a "high idle" setting by engaging the cruise control and using the "+" and "-" buttons to raise/lower the engine RPMs.

Transmission

The chassis shall be equipped with an AISIN heavy duty six (6) speed automatic transmission.

Transfer Case

The chassis shall be equipped with an electric-shift-on-fly transfer case.

Suspension/Axles

The chassis shall be equipped with a live front axle with a capacity (rating at the ground) of 7,250-pounds. The front springs shall be coil and have respective weight ratings based on the package(s) specified with the chassis.

The rear axle shall have a capacity (rating at the ground) of 13,500-pounds. The rear springs shall be single-stage leaf springs that are constantly rated for the main chassis weight and auxiliary applications.

Aftermarket Suspension Alteration

The chassis' rear springs shall be re-arched, or additional springs added, to level the rear of the vehicle under a simulated full capacity load.

Wheels and Tires

The chassis shall be equipped with factory **steel** 19.5-inch wheels and 225/70R19.5 Continental max traction tires. A full size matched spare tire with rim, 6-ton hydraulic jack, and **aftermarket** lug wrench shall be supplied with the completed apparatus.

Fuel Tank

The chassis shall be equipped a single fuel tank with a capacity of 52-gallons.

Cab

The cab shall be configured with a four (4) full sized door crew cab.

Interior

All interior upholstery/hardware including seating, dashboard, floor coverings, steering wheel, dash components, sun visors and all trim and door panels shall be OEM supplied vinyl and color coordinated.

- Instrument panel mounted auxiliary switches

Exterior

The following OEM supplied exterior hardware shall be included:

- Black grille
- Black wheel flares
- Halogen Quad headlamps
- Roof clearance lights
- Solar tinted glass
- Fixed rear window
- Black door handles
- Variable intermittent windshield wipers

Mirrors

The mirrors shall be the OEM manual telescoping trailer tow mirrors with power, heated glass, heated convex spotter mirrors, integrated clearance lights and turn signals.

Seating

All seating positions shall have **RED** OEM certified seat belts.

- **Front** - OEM supplied 40/20/40 **vinyl** split bench with center portion removed for console
- **Rear** - OEM supplied **vinyl** folding bench seat

Cab Door Locks and Windows

Chassis shall be equipped with OEM supplied power windows and door locks.

Window Tinting

The front-driver / passenger side windows shall be tinted. The rear and rear-driver / passenger side windows shall have a darker tint. This shall be an aftermarket window tint.

Steering Wheel

The chassis shall have a tilt steering for maximum comfort and ease of operation by multiple drivers.

Intermittent Wipers

Vehicle shall be equipped with by intermittent wipers with integrated washer.

Cruise Control

The chassis shall be equipped with cruise control.

Air Conditioning and Heating

The chassis shall be equipped with OEM air conditioning and heating.

Stereo

The chassis shall have an OEM factory installed electronic AM/FM radio with auxiliary input port but shall be replaced with an aftermarket Kenwood DNX696S navigation receiver. The Kenwood receiver shall have a DVD/CD player with a 6.80-inch touchscreen and AM/FM tuner, built-in Bluetooth for hands free calling, built-in HD radio tuner, compatible with Apple/Android audio, built-in Garmin navigation system, and shall support an optional rearview camera.

Daytime Running Lamps

The chassis shall be equipped with daytime running lights.

Back Up Camera/ Monitoring System

An Alliance Wireless Technology (AWTI) heavy duty weatherproof back-up monitoring system including camera and monitor; installation shall strictly follow manufactures recommendation and comply with all state and federal laws. All components of the system shall come with a minimum one (1) year warranty.

The Camera shall be equipped with the minimum following features:

- The camera/monitoring system components shall be designed for use in the harsh conditions regularly encountered in the Wildland environment.
- Flush mounting on the rear of the apparatus in a well-protected location to prevent it from getting damaged from off-road driving, extreme temperatures, undesirable environmental conditions (mud, dust, smoke, etc.), kicking, stepping, washing or any conditions that may be encountered in the Wildland fire arena.
- The camera shall automatically activate when the chassis transmission is placed in reverse.
- The camera shall be equipped with the ability to manually activate to act as a monitoring system regardless of the transmission condition.
- Minimum 120 Degree lens angle
- Minimum 510x492 pixels
- Minimum 15-foot night vision distance
- Aluminum alloy shell material
- Aviation cable with Weatherproof connection

The Monitor shall be equipped with the minimum following features/provisions:

- Ability to add up to three (3) additional cameras in the future.
- Ability to monitor up to (4) cameras at one time
- Minimum five-inch Color LCD monitor located inside the cab, exact mounting location shall be approved by the COR prior to installation.

Max Tow Package

Chassis shall be equipped with an OEM Max Tow Package that provides the chassis with a 4.88 axle ratio, transmission software calibration for maximum efficiency when towing, and underbody thermal protection. The chassis shall also be equipped with an OEM trailer brake controller.

Steps / Nerf Bars

Black nerf style tubular running boards shall be provided on each side of the chassis cab below the doors.

Center Console

The cab shall be equipped with an angled front, form-fitted control console located between the front driver's and officer's seats. This console shall be sized to accommodate the installation of a switch panel for the control of the emergency and general illumination lighting, siren controller, traffic advisor control head, and customer-mounted radios. The switch panel shall consist of an eight (8) switch multiplex module with lighted switches. The switch module shall have back lighted identification plates on a non-glare panel surface. The switch panel shall be illuminated whenever the master switch is in the “ON” position. Panel light brightness shall dim automatically via the multiplexing system when the chassis headlights are turned "ON". The cab console shall be fabricated from steel, and powder coated with a black finish.

The following controls and switches shall be positioned from forward to aft on the center console as follows:

- One (1) LED blue/white flexible map light
- Two (2) faceplate for customer specified radios
- Three (3) microphone clip brackets
- One (1) switch panel with eight (8) switches
- One (1) electronic siren controller
- One (1) traffic advisor control head
- One (1) FRC mini-water level indicator
- Four (4) cup holders
- Two (2) 12-volt aftermarket power outlets
- Four (4) 12-volt USB outlets
- One (1) 6.00-inch storage compartment
- One (1) 2.50-inch discharge pressure gauge with a dial face that replicates the 4.00-inch discharge pressure gauge described elsewhere in this specification

The specific console layout shall be discussed/determined during the pre-work conference and a drawing of the layout shall be provided to the end user for approval.

12-Volt Power Sources

The cab shall have four (4) additional 12-volt power sources provide on the center console for recharging cell phones, or other similar battery-operated devices. Two (2) of the power sources shall be dual 2.1A USB style ports and two (2) shall be plunger style, flush mounted in the center console and shall have rubber cabs. The power sources shall be wired so they will be "active" when the BODY MASTER switch is in the ON position.

Wiring for Radio(s) Installation

The chassis cab interior shall be wired with two (2) wiring bundles for connecting department mobile radios.

The bundles shall be separate from each other and terminate in a Deutsch brand connector. The antenna wires shall remain separate from the connector. A pigtail shall be included for each bundle for connecting the department radio into the wiring harness. Each bundle including antenna wires shall be labeled RADIO 1 or RADIO 2. In addition, the individual wires in each pigtail shall be labeled (Battery Power, Ground, PA Input, etc.). The pig tails and antenna wires shall be a minimum of 3-feet or as long as required for installation of the radios.

All connections shall be made to the battery. Blade style fuse holders, using the same size fuses as the chassis, shall be installed in the pigtails for the constant power, but no fuses shall be installed.

The location for the radio installation and radio wiring bundles shall be determined in conjunction with the NFEP, overhead shall not be acceptable.

Wiring bundle for RADIO 1 shall consist of:

Harness side connector: DT06-08SA
Pigtail side connector: DT04-08PA

- One (1) Red 10-gauge constant power to the battery. This shall split into two (2) 14-gauge wires going into the cavities 1 and 2 on the connector.
- One (1) Red with Black Stripe 12-gauge connected to the chassis ignition, supplying power when either the vehicle ignition is in the "Auxiliary" or "Run" position. This shall split into two (2) 14-gauge wires going into the cavities 3 and 4 on the connector.
- One (1) Black 10-gauge ground wired direct to the battery. This shall split into two (2) 14-gauge wires going into the cavities 7 and 8 on the connector.
- One (1) set of 18-gauge wires connected to the radio audio input for the PA system consisting of two (2) Light Blue wires going into the cavities 5 and 6 on the connector. If polarity is needed with the audio input for PA System, the positive shall be solid (cavity 5) and the negative shall have a White Stripe (cavity 6)
- One (1) antenna lead which shall be labeled coiled and secured near the RADIO 1 connector

Wiring bundle for RADIO 2 shall consist of:

Harness side connector: DTHD Series
Pigtail side connector: DTHD Series

- One (1) Red 8-gauge constant power to the battery. This shall terminate into a DTHD06-1-85 connector
- One (1) Red with White Stripe 12-gauge connected to the chassis ignition, supplying power when either the vehicle ignition is in the "Auxiliary" or "Run" position. This shall terminate into a DTHD06-1-125 connector
- One (1) Black 8-gauge ground wired direct to the battery. This shall terminate into a DTHD04-1-8P connector
- One (1) antenna lead which shall be labeled coiled and secured near the RADIO 2 connector

Radio Model(s): _____

Antenna Leads and Bases

Two (2) antenna mounts with coaxial cable shall be supplied and installed a minimum of 18.00-inches apart and centered on the chassis cab roof. The components shall consist of a brass ¾-inch New Motorola (NMO) style Antenna Mount and Double Shielded Coaxial Cable soldiered to the base. The coaxial cable shall terminate in the cab console and have a minimum of 4 feet of additional cable. The cable shall be routed from the chassis/cab headliner to the console in a concealed manner. All cables shall be labeled as to where they are installed on the roof. A protective rain cap shall be installed on each NMO antenna mount. Each cap shall be labeled as to the respective pre-wired set by placing a "RADIO 1" or "RADIO 2" on the rain cap itself.

Map Light

A Federal Signal LED flexible map light with switch shall be installed on the passenger side of the center console. The map light shall be selectable between blue and white light.

Cell Phone Signal Booster Kit

One (1) weBoost Drive 4G-M cell phone signal booster shall be installed within the interior of the chassis cab. The external antenna shall be centered on the chassis cab roof and the internal antenna shall be mounted within the driver's side front seat. The booster shall be installed within the floor mounted center console. The booster shall be installed in the chassis cab per the manufacturer's recommendation.

Ember Separator Screens

The chassis engine air intakes shall be equipped with an ember separator screen fabricated from stainless-steel screen. The screen shall be fabricated in a manner that allows it to be easily removable without the use of tools for cleaning/inspection and provide complete protection from embers from entering the filter area of the air filter box.

The chassis cab air intake shall be equipped with an ember separator fabricated from stainless-steel screen.

The auxiliary pump engine air intake shall be equipped with an ember separator fabricated from stainless-steel screen.

A warning label, stating: **"This apparatus is equipped with an air filter ember protection screen; routine inspection is required."** shall be provided and installed in the apparatus cab interior. This label shall be located so that it is visible from the driver's seating position.

Backup Alarm

One (1) Federal Signal solid state back up alarm shall be provided at the rear of the apparatus, protected from impact and debris. The back-up alarm shall be wired to the reverse circuit of the transmission and shall provide an audible alarm to the rear of the apparatus when reverse gear is selected. The alarm shall have a volume range of **87 to 107** decibels while in operation but shall continuously adjust the output to provide 5 dBa over ambient noise levels.

Skid Plates/Impact Protection

The chassis shall be equipped with impact protection/skid plates in the following locations:

- Lower radiator skid plate
- Engine/Oil pan skid plate
- Water/Fuel separator

The design shall allow for regular maintenance and checks of common items (oil drain, oil filter, differential fluids, grease fitting, fuel water separator, etc.) without major disassembly. These guards and shields shall be designed to prevent trapping common grasses and other small debris which may ignite. Reasonable component protection shall be provided as manufacturer deems necessary for operations in extreme environments and conditions for easily damaged electrical

components, drive line, cooling system, and/or suspension components. Intent of the shielding is to assist in the protection of the undercarriage components from impact during road less operations and to assist in the survivability of the apparatus. Skid plates and impact protection shall be capable of supporting the weight of the apparatus without complete failure, a degree of distortion is allowed. All exterior surfaces of the skid plates/impact protection shall be coated with a minimum 1-2 mm flat **black** powder coated finish.

Front Bumper / Brush Guard

The chassis shall be equipped with a custom heavy-duty plate style front bumper/grill guard. The front bumper/grill guard shall meet the requirements of NFPA 1906 current edition. The front bumper/grill guard shall be designed so that it does not affect the chassis manufacturer's warranty. The front bumper/grill guard shall be designed so that it does not negatively affect the chassis approach angle. The front bumper/grill guard shall be equipped with provisions for winch mounting. The front bumper/grill guard shall be equipped with two (2) integrated external tow eyes. The weight of the front bumper/grill guard shall not exceed 175 pounds. All exterior surfaces of the entire grill guard assembly shall be coated with a minimum 1-2 mm flat black powder coated finish. The front bumper shall contain a license plate mounting position with holes or a bracket for mounting.

Rear Bumper Construction

The rear bumper shall be a minimum of 3.00-inches tall by 8.00-inches deep and extend across the entire width of the apparatus body. The bumper shall be fabricated from heavy-duty steel tubing and shall be powder coated black. The top of the bumper shall be a 4F stainless-steel CNC punched and perforated non-skid resistant surface. The bumper shall be designed to protect the apparatus body.

Tow Point(s)

Two (2) front tow eyes designed for the attachment of tow straps using a clevis shall be provided to free a stuck or disabled vehicle. Each tow eye shall be mounted to the chassis frame and rated for load of 50-percent of the GVWR pulling at 0-degrees and 70-percent of the front axle GAWR for a 45-degree pull cone angle, and a combined rating of 100-percent of the GVWR and 140-percent of the front axle GAWR.

Two (2) rear tow eyes designed for the attachment of tow straps using a clevis shall be provided to free a stuck or disabled vehicle. Each tow eye shall be mounted to the chassis frame and rated for load of 50-percent of the GVWR pulling at 0-degrees and 70-percent of the rear axle GAWR for a 45-degree pull cone angle, and a combined rating of 100-percent of the GVWR and 140-percent of the rear axle GAWR.

The rear tow points shall extend through the rear panel just above the rear bumper and shall not interfere with the bumper during the normal twisting of the apparatus.

All tow eyes shall be large enough to attach a threaded clevis but shall not be large enough to pass a tow strap through.

Winch and Winch Accessories

One (1) Warn electrically operated 16,500-pound shall be installed within the heavy-duty front bumper described elsewhere in this specification. The winch shall feature 80-feet of 3/8-inch Spydura Pro synthetic rope, an 18,000-pound capacity EPIC hook, and remote control/switch. The ground (-) for the winch is routed and secured to the ground (-) on the chassis' battery. The positive (+)/power for the winch is routed and secured to the positive (+)/power side of one (1) of the 150-amp circuit breakers underneath the chassis' hood. For the winch to "power up" the end user will need to plug the winch remote into the winch otherwise, the winch is not drawing any amperage.

Winch Accessories

One (1) tow strap and two (2) threaded clevis fasteners rated at a minimum of 40,000 lbs. shall be supplied with the completed apparatus. The tow strap shall be a minimum of 30 feet in length and shall be one (1) piece.

Apparatus Frame Construction

The apparatus body and compartments shall be supported with a frame of channel or tubular aluminum members. The frame shall extend under the wheel well areas at the front and rear and shall be attached to the compartments. The cross-members in the support system shall be spaced so that there is no more than ¼-inch of vertical deflection per 256 square inches when 250 pounds is evenly distributed over 40 square inches. All tubular aluminum shall have a minimum wall thickness of 3/16-inch and any channel shall be a minimum of ¼-inch thick. The frame shall be constructed to become an integral portion of the apparatus body.

The channel or tubular aluminum deck and compartment support frames shall be strong enough to support 5000 pounds in the bed area and 1000 pounds of equipment in each side compartment (the actual load capability of the completed apparatus may be limited by the GVWR).

Flexible Mounting

A spring-loaded body mounting system shall be used to mount the body to the chassis. This system shall be designed to allow independent movement between the body frame and the chassis frame protecting the module from the stresses and twisting rendered by the flexing of the chassis frame. As such, the body frame shall not rest on the chassis frame at any point. The mounts shall be pre-engineered for their intended use.

All the mounting hardware (nuts, bolts, washers) required for complete body installation shall be Grade 8 for sizes ½-inch and smaller, and Grade 5 for sizes larger than ½-inch. All nuts shall be self-locking style. All mounting brackets shall be powder coated black.

The body front shall be mounted utilizing fluorescent powder coated pre-engineering springs. The center mount shall consist of an 18-inch-long Delrin spacer mounted mid-length allowing the body frame to rest in a neutral position under full load. The rear body mounts shall be affixed via solid mounts to the chassis frame.

Apparatus Body Construction

The installation of hardware parts such as hinges, catches, handles, or knobs shall be accomplished to avoid damaging the hardware or the mounting surface. After fabrication, all parts shall be cleaned of the following: smudges; loose, spattered, or excess welding; metal chips or fillings; or any other foreign material which might detract from the intended operation, function, or appearance of the apparatus or its equipment. This would include any particles which could loosen or become dislodged during the normal expected life of the equipment. Whenever possible, this cleaning shall take place before the parts are assembled.

Threaded parts or devices shall show no evidence of cross-threading, mutilation, or detrimental burrs. All screw type and rivet fasteners shall be tight to allow no relative movement between the attached parts. All bolts and screws shall not be tightened more than the SAE torque standard established for the grade, screw, and thread type.

The entire body shall be removable in its entirety without the disassembly of any compartments, flooring, or other structural components.

The body shall be designed to be approximately as wide as the outside wheel track on the rear axle. This will allow the apparatus to maneuver more easily in off-road environments. The body shall be approximately 98-inches-wide from side to side at the rear of the apparatus.

The top of the apparatus shall have a nonskid surface across the entire area. The non-skid shall be consistent along the tops of the body and be free of any dirt, grease, or foreign material. There surface directly under the independent body modules shall be a smooth gel coated finish to allow for a better seal between the bottom of the independent body modules and top of the body. Additionally, the top of the apparatus body shall support, without distortion, a walking person weighing up to 300 lbs.

The entire apparatus body shall be an independent structure fabricated from bonded and molded fiber reinforced composite panels and compartments. The resin shall be thermoset and shall not be subject to distortion or loss of structural integrity at temperatures at minimum of 350° Fahrenheit (176 Celsius). This shall provide a strong, lightweight, corrosion free structure that will withstand extremely high temperatures.

All fiberglass used in the construction of the body shall be grade “E” or “S,” and the resin to glass ratio shall be a 30/70 ratio average or higher. The glass reinforced polyester shall not be less than 3/16-inch thick at any point on the body. Additionally, all coring materials shall have a minimum covering of 1/8-inch thick glass and resin on either side. All coring for bulkheads, partitions, floors, compartments, and doors shall be either PVC-based, rigid, closed cell structural foam, or composite material. Wood is not acceptable. The apparatus manufacturer shall determine the proper thickness and foam density for each application.

The fiber composite body shall allow for up to 30° flex off-center without causing body fatigue or component failure.

Wheel Well Area

The inside of each wheel well shall be lined with three (3) separate pieces of minimum 18-gauge stainless steel sheet material to protect the underside of the entire body wheel well area. Each sheet shall be attached with stainless steel screws or bolted with self-locking nuts. The use of rivets shall not be acceptable.

Compartment Door Construction

All compartment doors shall be integral in design and recessed into the apparatus body sides, sized to provide easy access to all interior areas of the compartment. All doors shall be consistent in fit and finish with the apparatus body. All doors shall be weatherproof and maintain contact with all points of the weather stripping. Weather stripping shall be bulb type, attached to the opening flange of the compartment opening. The interior surface of the compartment door shall be a white gel coat surface of a quality and uniformity equal to that of the exterior surface of the apparatus body. The compartment doors shall be cored with industrial grade closed cell PVC foam, or composite material, of the correct thickness.

Door Hinges and Retainers

Door Hinges

Doors shall be equipped with stainless steel hinges and hardware. Hinge pins shall be non-removable. All side compartment doors shall open to a 90-degree angle without hindering operations of other compartment doors. Doors shall not interfere or contact the body or any other open doors. Rubber bumpers and/or stainless-steel shields shall be in place to prevent damage wherever the potential exist for doors to meet other apparatus components.

Retainers

All vertically hinged, outward-opening compartment doors shall be provided with an over center door check to hold the door in the desired position. The door check shall be attached to the top of the door and fastened to a stainless-steel plate bolted into the body and door. The passenger side front compartment shall utilize a gas shock as the door opening device. This is used due to the full-length shelf pertaining to the hard-suction hose compartment. All vertically hinged, outward opening compartment doors shall be capable of being closed with one hand, allowing a free hand to hold equipment or supplies.

Each horizontally hinged door shall be equipped with add-a-link style (removable) retainers and small rubber bumpers installed on the body fenders to allow full 180-degree opening for improved access into the compartment. A piece of black heat shrink shall be utilized over the crimp. **Any/all measures shall be taken to reinforce the mounting/fastening locations of the retainers to allow the end user to use the door as a "work bench" supporting a minimum of a 50-pound load.**

All horizontally hinged, overhead lift-up, outward opening compartment doors shall be provided with two (2) extending, gas cylinder type hold open devices, one (1) mounted vertically on each side of the compartment door opening. The pressure rating of the gas cylinders shall be carefully matched to the size and weight of the compartment door and shall hold the compartment door securely open to a greater than 90° angle without additional support. The gas cylinder hold openers shall dampen the upward movement of the compartment door while opening and shall permit the closing of the compartment door without the need to release any type of manual locking devices. All horizontally hinged, overhead lift-up compartment doors shall be capable of being closed with one hand, allowing a free hand to hold equipment or supplies.

Door Latches

Unless were noted, all compartment door latch assemblies shall be installed with threaded fasteners, shall not be welded, and shall be easily removable for servicing or replacement. All door latch assemblies shall be of a flush-mount, "D-Handle" design, with all external components fabricated from polished stainless steel. All latches shall be of a two-step slam-type design, with a single-point latching operation. Matching striker bolts shall be utilized with all latch assemblies. All striker bolts shall have slotted mounting holes and shall be attached with bolts to captive steel plates in the body structure for strength and ease of adjustment. The strikers shall be installed on a level axis and shall not be crooked. Welded striker bolts or plates shall not be acceptable.

All hardware shall be corrosion resistant and suitable for its intended use. All nuts and bolts shall be stainless steel. Stainless steel nuts shall be the self-locking type. Each **1250** lock cylinder shall be configured so that in the vertical position it is "UNLOCKED" and in the horizontal position it is "LOCKED". A minimum of ten (10) **1250** keys shall be provided with the apparatus upon delivery.

Composite Adjustable Shelf Channels

Vertically mounted composite shelving tracks shall be provided and installed in all enclosed body compartments, except passenger's side lower rear compartment, for the current or future installation of infinitely adjustable shelving, slide out trays or equipment brackets. The composite tracks shall allow for the shelves to be adjustable every 2.00-inches vertically utilizing nylon reinforced composite shelving standards with embedded stainless lock nuts.

Shelving Construction and Layout

Each shelf shall be one-piece pultruded fiberglass with nylon reinforced composite end caps and provision for dividers on 2.00-inch centers. Shelves shall be designed to maximize usable space within the compartment, prevent items from sliding off, and be adjustable. Shelves shall be capable of supporting a minimum 250 pounds unsecured load without being damaged or permanently distorted.

Street Side Front:
- Two (2) adjustable shelves

Street Side Center:
- One (1) adjustable shelf

Street Side Rear:
- One (1) adjustable shelf

Curb Side Front:
- Two (2) adjustable shelves

Curb Side Center:
- One (1) adjustable shelf

Curb Side Rear:
- Open

Shelf Dividers and Retention Clips

One (1) package of shelf dividers and retention clips shall be provided for each shelf described in this specification.

Compartment Lighting

Each compartment shall have three (3) LED light strips. The LEDs and electronics shall be enclosed in a 5/8-inch diameter Lexan tube that is sealed at both ends with rubber caps to create a waterproof environment and be suitable for mounting in a wet location. The tube shall rotate to adjust the beam direction as required. The lighting shall be secured with molded nylon

mounting clips. The lighting in all compartments shall start at the bottom of the compartment and extend up the sides and across the top to provide lighting around the perimeter of the compartment. Placement of the light strips shall be such that they are protected from being impacted by compartment contents or during removal/placement of equipment. The purpose of the LED strip lighting is to provide even lighting throughout the compartment while minimizing shadows and dark zones caused by shelving or equipment stored in the compartment.

Each side apparatus body compartment shall have a magnetic door switch installed to activate the compartment lighting and "DO NOT MOVE APPARATUS" light in the cab when any door is opened. To have the compartment lighting illuminate, the "BODY MASTER" switch shall be in the "ON" position, the "CMPT LTS" switch activated on the SPS panel, and the compartment door open.

Compartment Venting

Venting shall aid in air circulation and reduce fumes caused by fuel storage. When placed in doors, these round vents shall compliment fit and finish of the body and not impede door function.

- The driver's side center compartment shall be vented at the upper door face and at the compartment lower rear wall.
- The driver's side aft compartment shall be vented at the door face and compartment rear wall
- Integrated chainsaw compartment in the water tank

A permanent and compliant red/white placard noting fuel storage shall be in plain view and permanently affixed to the exterior surface of each door.

A permanent warning label shall be affixed to the exterior surface of the passenger side rear compartment. The label shall read "DANGER: Do Not Store Flammable Liquid or Combustible Material in this Compartment". See placard below.

Storage Compartments

Side compartments with flush doors shall be provided on both the driver and passenger sides for storage of equipment such as long handled hand tools, power tools, hoses, fittings, fuel, camping gear, and other supplies. Compartment interiors shall be completely open except for latch and shelving hardware; obstructions caused by body framework, lighting mounts, or other structural features shall not be accepted. The clear inside depth for each compartment shall be no less than 19.00-inches behind the closed-door excluding latch hardware.

Each storage compartment shall be sealed to prevent the entry of water, dust or other foreign matter during operations, there shall be no compartment venting holes except those specified for fuel storage. To prevent water entry, compartment openings shall be equipped with rubber weather stripping door seals. Hardware attachments to any portion of a storage compartment shall be completely sealed with weatherproof silicon. Compartment seams shall be completely sealed with weatherproof silicon.

Compartments shall be able to successfully pass a weatherproof test. To pass, the interior of the compartment shall remain dry after water from a typical garden hose has been applied to the exterior of each compartment top and side door area for 2 minutes.

Each compartment shall be equipped with commercially available replaceable pop-out style drain plugs for drainage in the event of moisture entering the compartment. The drain plugs shall be positioned in locations that are least prone to damage. The drain plugs shall be sealing type to prevent dirt and debris from entering the compartment; plugs shall be removable from the inside only.

The bottom of each compartment shall be equipped with 3/4-inch thick Dri-Dek black floor matting. The matting shall provide a solid surface with even support that does not allow bending or folding. The matting shall be cut to fit the exact dimension of the compartment. The matting shall be removable without the use of tools. The matting shall provide maximum drainage and traction and feature fungus, mold, and chemical resistance.

Driver's Side Compartments

The driver's side lower module of the apparatus body shall have approximate overall dimensions as specified. It shall consist of three (3) compartments, each with specified approximate clear depth behind the door when the door is shut. Each compartment shall have a “flow through” vent provided to supply air flow and minimize moisture unless designated as fuel storage.

Lower module dimension:	106.00-inches wide x 20.50-inches deep
Clear Depth:	19.50-inches

One (1) rescue style compartment shall be provided forward of the rear wheels, with approximate inside dimensions as specified. The door shall be vertically hinged and shall have approximate clear door opening as specified.

Compartment dimension:	33.00-inches wide x 39.00-inches high x 20.50-inches deep
Clear door opening:	26.50-inches wide x 32.00-inches high

One (1) compartment shall be provided center above the rear wheels, with approximate inside dimensions as specified. The door shall be a horizontally hinged, drop-down door, and have an approximate clear door opening as specified.

Compartment dimension:	44.00-inches wide x 22.00-inches high x 20.50-inches deep
Clear door opening:	42.00-inches wide x 15.00-inches high

One (1) compartment shall be provided aft of the rear wheels, with approximate inside dimensions as specified. The door shall be vertically hinged and shall have an approximate clear door opening as specified.

Compartment dimension:	28.00-inches wide x 39.00-inches high x 20.50-inches deep
Clear door opening:	20.00-inches wide x 32.00-inches high

The driver's side independent upper module of the apparatus body shall have approximate overall dimensions as specified. The module shall be constructed from 3/16-inch aluminum tread plate and the fit and trim of the upper module shall be integral with the lower compartments in both aesthetics and function. All hinges, fasteners, latches, and other hardware shall be stainless steel. The lid/cover shall be held shut by two (2) lockable stainless latches, hasp style and shall be held "open" by two (2) gas shocks. The lid/cover shall be hinged on the outboard side of the box. The lid/cover of the box shall have an approved NFPA 1906 compliant walking surface affixed to it. This module shall be designed for the storage of a minimum five (5) 1.50-inch x 50-foot rolled standard fire hose sections, two (2) 200-foot progressive hose packs with additional 24.00-inch empty space for additional equipment or hose or long handled tools (i.e. rakes, shovels, etc.). The module shall be equipped with a drain to allow moisture out but prevent moisture from entering. The module shall be wired to the "DO NOT MOVE APPARATUS" light located on the center console and a 48.00-inch LED compartment light shall be installed in a protected location. The floor of the module shall be equipped with black Dri-Dek compartment matting that shall provide a solid surface and allow drainage.

Upper module dimension:	80.50-inches wide x 15.50-inches high (inside dimension) x 20.50-inches deep

Passenger's Side Compartments

The passenger's side lower module of the apparatus body shall have approximate overall dimensions as specified. It shall consist of three (3) compartments, each with specified approximate clear depth behind the door when the door is shut. Each compartment shall have a "flow through" vent provided to supply air flow and minimize moisture unless designated as fuel storage.

Lower module dimension:	106.00-inches wide x 20.50-inches deep
Clear Depth:	19.50-inches

One (1) rescue style compartment shall be provided forward of the rear wheels, with approximate inside dimensions as specified. The door shall be vertically hinged and shall have approximate clear door opening as specified.

Compartment dimension:	33.00-inches wide x 39.00-inches high x 20.50-inches deep
Clear door opening:	26.50-inches wide x 32.00-inches high

One (1) compartment shall be provided center above the rear wheels, with approximate inside dimensions as specified. The compartment shall be accessible from two (2) sides. The passenger's side door shall be a horizontally hinged, drop-down door, and have an approximate clear door opening as specified. The rear door shall be a horizontally hinged, drop-down door, and have an approximate clear door opening as specified.

Compartment dimension:	72.00-inches wide x 22.00-inches high x 20.50-inches deep

Passenger side door opening:	67.00-inches wide x 15.00-inches high
Rear door opening:	12.00-inches wide x 9.50-inches high

One (1) compartment shall be provided aft of the rear wheels, below the upper horizontal compartment, with approximate inside dimensions as specified. The door shall be vertically hinged and shall have an approximate clear door opening as specified.

Compartment dimension:	28.00-inches wide x 16.50-inches high x 20.50-inches deep
Clear door opening:	20.00-inches wide x 11.50-inches high

The passenger's side independent upper module of the apparatus body shall have approximate overall dimensions as specified. The module shall be constructed from 3/16-inch aluminum tread plate and the fit and trim of the upper module shall be integral with the lower compartments in both aesthetics and function. All hinges, fasteners, latches, and other hardware shall be stainless steel. The lid/cover shall be held shut by two (2) lockable stainless latches, hasp style and shall be held "open" by two (2) gas shocks. The lid/cover shall be hinged on the outboard side of the box. The lid/cover of the box shall have an approved NFPA 1906 compliant walking surface affixed to it. A drop-down door shall be provided at the rear of the independent module for deployment of the pre-connected discharges. The door shall have a chrome plated lockable thumb latch and keyed to match the lower compartments. The module shall be plumbed for two (2) pre-connected discharges, described under the "DISCHARGE LOCATIONS" section, and shall be divided into three (3) sections by placing aluminum dividers on Unistrut channel to allow for adjustments. The shall be a 3.00-inch wide section, on the inboard side of the module, for storage of 1.50-inch hose to be used as the "ENGINE PROTECTION" discharge and a 6.00-inch section, aft the engine protection section, for storage of 200 feet of 1.50-inch hose to be used as a "PRE-CONNECT" discharge. Aft the pre-connect discharge shall be a 10.00-inch section for storage of 200 feet of 2.50-inch hose. The module shall be equipped with a drain to allow moisture out but prevent moisture from entering. The module shall be wired to the "DO NOT MOVE APPARATUS" light located on the center console and a 48.00-inch LED compartment light shall be installed in a protected location. The floor of the module shall be equipped with black Dri-Dek compartment matting that shall provide a solid surface and allow drainage.

Upper module dimension:	80.50-inche wide x 15.50-inches high (inside dimension) x 20.50-inches deep

Suction Hose Compartment / Access

A horizontally hinged, drop-down door shall be located at the upper rear facing portion of the passenger side pack. The door shall be positioned as high as possible and shall have a small rubber bumper placed on the outside of the door to prevent contact with the apparatus. Three (3) square aluminum tubes shall be mounted as high as possible and transect the passenger side front compartment and passenger side long horizontal compartment. The tubes shall be mounted in a manner that allows each suction hose to be easily remove or stored with the foot valve and strainer attached.

Rear Cab Protection

There shall be a permanently mounted aluminum square tube cab window guard mounted at the front of the body directly behind the cab. The purpose of the guard is to protect the rear cab area and rear window, add structural integrity of the apparatus body, and provide mounting points for the apparatus' light bar. The guard shall contain a means of concealing

and protecting the wiring required to supply power to the lights. The mounting point of the apparatus light bar shall extend approximately 2 inches above the roof height of the cab and **shall be removable**. The guard shall be constructed in a manner that allows for clear vision into and out of the cab area using an aluminum mesh window screen. The window screen shall be an integral part of the guard with the tube being slotted for installation of the screen. The window screen shall be welded to the tube to prevent vibration. This design shall protect the user from possible snagging of clothing or equipment on rough edges. There shall be drain holes in the bottom of the tubes to allow for water to exit. The cab shield assembly shall be powder coated black.

Stainless-Steel Railing Package

A stainless-steel railing system shall be installed on the top of driver and passenger side compartments. The purpose for the railing is to prevent any equipment stored on top of the vehicle from sliding off as well as providing tie-down points for equipment. The rails shall be 1.25-inch diameter tubing. The railing shall be capable of supporting up to 300 pounds without distortion and shall be secured to the side packs in such a manner that using them as grab handles/rails shall not tear the uprights out of the side packs. The rails shall start at the cab guard, travel along the outer edges of each side pack and terminate at the front of the independent modules.

Hose Reel Roller Assemblies

Two (2) polished aluminum roller assemblies shall be provided, one (1) on each side of the independent module and located approximately 2.00-inches inboard from the leading edge. The rollers shall be designed to allow hose from the center mounted hose reel to be unloaded to either side of the vehicle without snagging equipment on the apparatus. The distance between the rollers shall not exceed the width of the hose reel.

Wheel Chocks

Two (2) wheel chocks shall be provided with the completed apparatus, one (1) each side. The chocks shall be yellow in color and shall be mounted horizontally in a quick release mounting bracket on the outboard corners on the top of the side packs.

Rear License Plate Mount / Light

One (1) clear LED light shall be provided at the rear of the body on the driver's side to illuminate the license plate. Two (2) mounting bolts, washers, and nylon locking nuts shall be properly spaced to accommodate the hole pattern of a Federal Government license plate.

Apparatus Body Trim

The vertical surface at the **front** of the body shall be covered with a minimum 1/8-inch-thick polished aluminum tread plate for appearance, wear, and enhanced visibility at night. The tread plate shall be designed so that joints are minimized and shall cover the entire vertical surface area.

The vertical surface at the **rear** of the body shall be covered with a minimum 1/8-inch-thick smooth aluminum for application of the department's specified chevron graphics. The aluminum panel shall be designed so that joints are minimized and shall cover the entire vertical surface area.

Scuff guards shall be provided and installed on the bottom horizontal edges of the body, both forward and aft of the rear wheel well openings. The scuff guards shall be fabricated from 1/8-inch polished aluminum tread plate.

Steps and Grab Handles

Fold Down Steps

Two (2) NFPA-compliant fold down steps shall be provided and installed at the rear of the apparatus on the driver's side of the body. The steps shall be fabricated from heavy duty cast aluminum with spring assisted folded hinges. The top of the steps shall be an integral diamond point skid resistant surface that allows water to flow off the step without ice formation in cold weather use.

Grab Handle(s)

One (1) NFPA-compliant chrome-plated grab handle shall be provided and located at the rear of the body on the driver's side, one (1) mounted vertically on the rear-facing surface of the upper compartment, left of the control panel parallel to the outboard edge of the body, and two (2) 24.00-inch long handles mounted horizontally on top of each of the upper compartments, parallel to the outboard edges of the body.

One (1) warning plate shall be affixed to the rear of the apparatus body in a conspicuous location. The warning plate shall read "**WARNING: DO NOT RIDE ON REAR STEP WHILE VEHICLE IS IN MOTION. DEATH OR SERIOUS INJURY MAY RESULT.**"

Nozzle Cups / Hose Clamps

Two (2) Ziamatic Corporation durable neoprene rubber cups shall be shipped loose with the completed apparatus. Two (2) Performance Advantage Company Handlelok "hose clamps" shall be shipped loose with the completed apparatus. The rubber cups and hose clamps shall be accompanied by pieces of aluminum Unistrut, and mounting hardware, to allow the end user to mount the components later.

Front Bumper Hose Clamp

One (1) Ziamatic Corporation, VM-7, tool holder shall be provided with the completed apparatus and installed on the passenger side of the heavy-duty front bumper / brush guard.

Air Compressor

A Viair Corporation ultra-duty air compressor system shall be installed in the passenger front compartment forward of the rear wheels. One (1) quick disconnect air outlet shall be installed on the operator's panel and one (1) quick disconnect air

outlet shall be installed near the air compressor in the specified compartment. The compressor shall have an "ON/OFF" switch, tire inflation gun with 200 PSI gauge and 30' coiled hose.

A 2.5-gallon air storage tank shall be supplied. The tank will be located under the chassis cab and protected for off road use.

General Wiring Specification

A single Original Equipment Manufacturer (OEM) battery system shall be installed to operate both the chassis and package electrical system. A single 800-amp intermittent / 175-amp continuous Cole Hersee on/off switch shall be supplied and mounted to the driver's side of the center console in an accessible location. This switch labeled "BODY MASTER ON". When in the "OFF" position, all electrical power to the apparatus fire package shall be off. The battery shall be installed in an accessible location.

The apparatus electrical system shall remain independent of the OEM system unless there is authorization from the OEM chassis manufacturer.

The apparatus body, modules of the apparatus body (i.e. pump house) and chassis shall be individually wired as independent modules and connected as a completed unit at the final assembly via waterproof electrical connectors located in the electrical compartment. The intent of this is to be able to remove portions of the completed apparatus for major service and repair without requiring the electrical system to be cut. Seals shall be provided on each individual wire and the assembly. All GXL/SXL wiring for the apparatus body shall be within a temperature resistant harness rated at a minimum of 280-degrees. All wires in each harness shall be color and function coded. Wiring shall be run along structural rails and tied in a neat and orderly manner. Wiring passing through compartments shall be protected from tears, abrasions, and cuts caused by loose items moving in the compartment space. Wiring shall comply with OEM / component manufacturers recommendations and standards.

The completed body shall be grounded to the chassis with a minimum "0" gauge wire with crimped and soldered lugs. The lug shall be bolted to the chassis after the removal of all paints, rust, etc. Additionally, a minimum 3/4-inches braided ground strap shall be furnished between the body and chassis. The ground strap shall have soldered tabs on each end and attached to the chassis as above except that stainless steel star washers shall be used between the ground strap tab and bolt. After attachment, all ground connection points shall be sprayed (soaked) with non-hardening battery terminal sealer. A ground strap shall also be installed from the pump engine to the apparatus body.

All wire shall be protected from tears, abrasions, cuts, etc. from loose items within compartment spaces, and from items present in the operating environment outside of the compartments. Special care shall be taken to conceal wiring to prevent catching on brush, rocks, and various other items present in the off-road environment.

Electrical Components and Ratings

Electrical Components

All electrical components such as solenoids, speakers, motors, etc. shall be environmentally rated to a minimum of IP67 and shall be MIL-STD 810 compliant for temperature, humidity, vibration, altitude, shock, sand and dust, immersion, contamination by fluids, humidity and solar radiation.

Wire Grade

GXL or SXL Grade Rated from 60-260 F.

Connections Terminations

Connections shall be environmentally sealed to prevent corrosion.

Loom and Ties

All wire loom and wire ties shall be rated to a minimum of 260 F.

Indicator / Warning Light(s)

The following indicator lights are described in greater detail elsewhere in this specification:

- Battery On: There shall be a green LED indicator light visible to the driver which illuminates when the master body switch is activated. The light shall be labeled "BODY MASTER ON". The LED light shall be mounted below the OEM dash on the driver's side, in a position that will help reduce glare within the cab during night operations; this light may be programmed to dim when the headlights are "ON".
- Door Ajar "DO NOT MOVE APPARATUS": Red LED indicator light shall be provided in the cab and shall flash automatically when the ignition switch is "ON" and a lighted compartment door is "OPEN" or a chassis cab door is "OPEN".
- Pump Running: Amber LED indicator light shall be provided
- Low Voltage Alarm: Red LED indicator light shall be provided in the cab. The light shall flash when the apparatus 12-volt electrical system voltage drops below 11.9-volts. The LED light shall be mounted in a position that will help reduce glare within the cab during night operations.

"Do Not Move Apparatus" Warning

There shall be an audible alarm that sounds a tone when the door ajar light is flashing, and the parking brake is released.

Light Bar

The front and front side zones shall be covered by one (1) Whelen Justice series 56.00-inch-long LED light bar mounted on the cab guard approximately 2.00-inches above the cab roof to provide good visibility to the front and sides of the vehicle. The light bar shall have approximate dimensions of 56.00-inches-long, 2.25-inches high without mounting feet, and 12.00-inches wide. The LEDs shall be red/white/red. The white section of the light bar shall be wired so that it turns off when the parking brake is set, to meet the NFPA requirements for blocking mode. The light bar wiring shall incorporate a quick

disconnect feature to allow for the removal/replacement of the light bar in the event the OEM cab must be removed for repairs.

Lower Zone A Warning Lights

Two (2) Whelen ION-T Series red LED light head shall be mounted with the OEM chassis front grille, forward facing. Each light head shall have a clear lens and be mounted in a chrome flange. The light heads shall be controlled with the "EMR LIGHTS" switch located on the SPS panel in the chassis cab.

Forward Zone B/D Warning Lights

One (1) Whelen ION-T Series red LED light head shall be mounted on each side of the chassis within the front fender, side facing. Each light head shall have a clear lens and be mounted in a chrome flange. The light heads shall be controlled with the "EMR LIGHTS" switch located on the SPS panel in the chassis cab.

Aft Zone B/D Warning Lights

One (1) Whelen ION-T Series red LED light head shall be mounted on each side of the apparatus body within the apparatus body fender. The wiring for the light heads shall be routed in a manner that protects it from foreign debris during off-road driving conditions. Each light head shall have a clear lens and be mounted in a chrome flange. The light heads shall be controlled with the "EMR LIGHTS" switch located on the SPS panel in the chassis cab.

Lower Zone C Warning Lights

Two (2) Whelen 700 Series amber LED light heads shall be provided on the lower rear of the apparatus, rear facing, and one (1) each side. The lights shall be in the top position of a four-position bezel at the rear of the body with the DOT lights. The lights shall be programmed in a triple flash mode. The light heads shall be controlled with the "EMR LIGHTS" switch located on the SPS panel in the chassis cab.

Traffic Advisor

One (1) Whelen model TA Series directional light bar shall be provided at the rear of the apparatus body, mounted to the crossover platform frame with a weatherproof electrical quick disconnect feature. The control head shall be mounted in the cab console and shall offer control of the flash pattern for the traffic directing signal as well as two (2) light intensity settings. The control head shall indicate the current directing signal in use. The directional light bar shall have eight (8) LED lights in rectangular aluminum housing.

Electronic Siren

One (1) Whelen 100/200-watt full function siren amplifier with microphone shall be provided. The control head shall be mounted in the floor mounted console in a location readily accessible to the driver/operator.

Speaker

One (1) Federal Signal 100-watt speaker shall be mounted behind the heavy-duty front bumper/brush guard. The speaker shall be wired to the electronic siren control head and a customer specified mobile radio.

DOT / Clearance Lights

Clearance lights shall be provided and mounted on the vehicle in compliance with FMVSS. Each light shall be LED and sealed from the environment. All lights shall be easily replaceable in the event of failure or damage. Each light shall be constructed from high impact-resistant plastic to prevent damage from gravel and other debris.

Taillight Assembly

One (1) four taillight assembly shall be mounted on each side of the rear panel, two (2) assemblies total, as low as possible without affecting the functionality of the rear bumper and bumper skin. Each assembly shall consist of a Whelen 700 Series red LED stop/tail light, a Whelen 700 Series amber LED arrow turn signal light, a Whelen 700 Series emergency flasher described elsewhere in this specification, and a Whelen 700 Series back up light described elsewhere in this specification. Each light shall be approximately 7.00-inches wide by 3.00-inches tall. All four (4) lights shall be mounted together in a polished aluminum four light surface mount vertical bezel.

Taillight Assembly Layout:
Red Emergency LED Flasher
Red LED Stop/Taillight
Amber LED Arrow Turn Signal
Back Up Light

Push-Up LED Work Lights

Two (2) Whelen Pioneer Plus™ push-up shall be provided at the front of the apparatus body. The 168 watts +12v DC Pioneer light head(s) shall incorporate a Super-LED® dual flood light installed in a die-cast white powder coated aluminum housing. The PFP2 configuration shall consist of 60 white Super-LEDs with a clear optic collimator/metalized reflector assembly and a clear non-optic polycarbonate lens. Each Pioneer flood light shall have 16,000 usable lumens.

The lens/reflector assembly shall utilize a liquid injected molded silicone gasket to be resistant to water, moisture, dust, and other environmental conditions. The hard-coated lens shall provide extended life/luster protection against UV and chemical stresses. The PFP2 shall be vibration resistant. The Pioneer™ PC boards shall be conformal coated for additional protection. Two breathable membrane patches shall be installed to the bottom of the housing to maintain a consistent internal pressure. The PFP2 shall have extended LED operation with low current consumption and low operating temperature.

Each PFP2 shall be furnished with a 20’ 4/C 16GA input cable. The Pioneer shall have the ability to flash as a secondary warning light in the “Clearing Right of Way” mode when installed with an external flasher, model number PFLASH, purchased separately. The Pioneer light shall be SAE 1113-42 compliant and Class 5 testing for EMI. The PFP2 is covered by a five-year factory warranty. Mounting options are purchased separately.

- Voltage: +12v DC
- Size: H=4.125”, W=14.00”, D=2.50”
- Amp Draw: Spotlight = 13 Amps
- Lens Color: Clear

Perimeter Lights

Ten (10) 4.00-inch clear LED lights shall be provided around the vehicle's perimeter. The lights shall be activated when either the “PERIMETER LIGHTS” switch is activated on the center console, when a cab door is "OPEN", or when the vehicle is placed in “BLOCKING MODE”. The vehicle is in "BLOCKING MODE" when the vehicle transmission is in “PARK” with the parking brake set and the emergency master switch turned "ON" with the forward-facing takedown lights "OFF". The perimeter lighting “OFF” delay shall be synchronized with the chassis exterior courtesy lighting delay.

The perimeter lights shall be in the following areas and each mounted in a high-density rubber grommet:

- Two (2) 4.00-inch round lights shall be installed under the apparatus front bumper in a protected location
- Two (2) 4.00-inch round lights installed on the forward-facing panel of the apparatus body, one (1) on each side below the hose reel nozzle mounting brackets.
- Four (4) 4.00-inch round lights installed in the four (4) vertically hinged compartments of the apparatus body, one (1) in each compartment. The lights shall be house within an aluminum enclosure to provide sufficient protection from components within the compartment and leave it accessible enough to repair/replace if needed.
- Two (2) 4.00-inch round lights installed on the underside of the rear bumper and recessed to provide sufficient protection from foreign debris.

Multiplexed Electrical System

The electrical system shall be equipped with a Class 1 ES-Key multiplex solid state management system. The system shall have capabilities of performing load management functions, system monitoring and reporting, system data recording, remote diagnostics, and be fully programmable. The system shall be programmed to discontinue functions, by priority, when the apparatus 12-volt electrical system voltage drops below 11.9-volts.

Universal System Manager II

The Universal System Manager II "USM II" shall be installed within the center console. In the ES-Key network, the USM II shall be responsible for arbitrating the network variables to each module, monitoring faults and diagnostics and controlling electrical load management functions.

Remote Diagnostics Capabilities

Remote diagnostic shall be accomplished by using a supplied USB 2.0 "A" male to "A" male cable. One (1) end of the cable will connect directly to the Class 1 ES-Key Universal System Manager II and one (1) end will connect to a laptop computer. The remote diagnostic feature(s) will be done through Class 1's ES-Key Live software.

SPS Switch Panel and Programming

All accessory and emergency lighting shall be controlled by a master electrical control module mounted in a location within the cab that is easily accessible by driver and operator. The module shall consist of a multiplex smart programmable switch (SPS) module of eight (8)) lighted switches. The module shall have back lighted identification plates on a non-glare panel face illuminated when the master switch is "ON". The bundle of wires visible through the front glass shall be loomed to present a neat and professional appearance.

The function and layout of the eight (8) lighted switches are as follows:

Switch 1	Switch 2	Switch 3	Switch 4
Switch 5	Switch 6	Switch 7	Switch 8

Switch 1: EMR LIGHTS:
- Description: Activates all emergency or hazard lights
- Function: Switch is press on press off
- Indicator: Indicator light is solid when on
- Requires Body Master to be "ON": No

Switch 2: UNUSED
- Description:
- Function:
- Indicator:
- Requires Body Master to be "ON":

Switch 3: PERIMETER LIGHTS:
- Description: Activates /Deactivates the perimeter lights on the front bumper, apparatus body, and rear bumper
- Function: Switch is press on press off
- Indicator: Indicator light is solid when on
- Requires Body Master to be "ON": Yes

Switch 4: COMPARTMENT LIGHT MASTER:
- Description: Activates/Deactivates strip lighting in compartments.
- Function: Switch is press on press off
- Indicator: Indicator light is solid when on
- Requires Body Master to be "ON": Yes

Switch 5: DS FLOOD:
- Description: Activates/Deactivates the left-side LED push-up light
- Function: Switch is press on press off
- Indicator: Indicator light is solid when on
- Requires Body Master to be "ON": Yes

Switch 6: REAR FLOOD:
- Description: Activates/Deactivates the rear panel flood (backup) lights

- Function: Switch is press on press off
- Indicator: Indicator light is solid when on
- Requires Body Master to be "ON": Yes

Switch 7: PS FLOOD:

- Description: Activates/Deactivates the right-side LED push-up light
- Function: Switch is press on press off
- Indicator: Indicator light is solid when on
- Requires Body Master to be "ON": Yes

Switch 8: HOSE REEL:

- Description: Activates the hose reel rewind
- Function: Switch is momentary
- Indicator: Indicator is solid when pressed
- Requires Body Master to be "ON": Yes
- Switch shall be RED in color

NFPA 1906 Electrical Testing

Electrical system tests shall be performed in accordance with NFPA 1906 current edition. Al the time of delivery, all documentation outlined in NFPA 1906 current edition shall be provided.

Battery Charger with Sure Eject Feature

A Blue Sea System P12 25-amp battery charger shall be installed in the chassis cab and wired to the OEM battery system and Sure Eject. The battery charger shall be a four stage, three output, dry mount design, for use in harsh environments and enclosed in a rugged, finned aluminum case. The battery charger shall have the following features:

- PreFloat™ stage prevents over charging
- Power factor corrected for efficient use of AC
- Intuitive diagnostic screens
- User defined charge profiles and customizable settings
- Provides charging for up to three battery banks
- Large, bright display
- Charge Coordination with Blue Sea Systems Automatic Charging Relays (ACR) controls ACR state ensuring proper float stage for each battery
- Battery Temperature Compensation - adjusts charge voltage based on battery temperature
- AC over and under voltage shut down and automatic restart
- Over and under battery temperature protection - charger will not operate if battery temperature rises above or falls below a set value
- DC over voltage and reverse polarity protection
- Surge and short circuit protection

A Blue Sea Systems Sure Eject shall be installed forward of the rear wheels in the driver side apparatus body fender. The

automatic AC disconnect ejects power cords upon ignition to prevent damage. The motor driven design ensures consistent ejections for years of operation and the ejection piston is self-recessing with no cocking required. The keyed plug design shall allow for easy one-handed insertion in hard to reach places and an AC power indicating LED shall alert the end user if the system is charging successfully.

The EV Battery Charger display provides two (2) options to monitor the OEM battery banks. It can display a graphical representation of voltage for 1 to 3 battery banks with or without connection to a P12 battery charger. When connected to a P12 battery charger it can display the charger's summary screen, displaying voltage, current charging stage, and faults from the charger. The display shall be mounted adjacent to the Sure Eject in the driver side apparatus body fender.

Apparatus Paint and Finish

The chassis cab shall be painted by the Original Equipment Manufacturer and the apparatus body shall be a painted finish to match the OEM chassis paint color.

OEM Chassis Color: **Flame Red (PR4)**

Paint and Finish General

The finished apparatus and chassis shall be presented in as new condition; any dents, scratches, rust spots, or blemishes of any kind on the apparatus will not be accepted. All exposed ferrous metal surfaces that are not plated or stainless steel shall be cleaned and prepared and shall be painted or coated. The paint or coating, including primer, shall be applied in accordance with the paint or coating manufacturers' recommendations. The paint shall be applied by individuals who have been certified by the paint manufacturer.

Apparatus Body Exterior

All exterior body, metal, smooth surfaces are to be sanded, cleaned, etched, and primed, according to the paint manufacturer. The highest quality, state of the art, low V.O.C. acrylic urethane finishing system shall be utilized. The finish coat shall be applied in multiple coats to ensure proper paint coverage with a high gloss finish. The paint shall be warranted by the paint manufacturer.

The outer finish of a fiberglass composite body shall be painted one (1) color to match the ordered chassis paint color exactly.

Apparatus Body Interior

Surfaces shall be properly prepared and painted with Zolatone in a marble color.

Other Metal Item Finish

All aluminum and stainless steel shall remain unpainted unless specified otherwise. Metal parts that are painted shall be gloss black acrylic automotive grade enamel.

Powder Coating Standard

Items that are specified to be powder coated shall have a minimum 1-2 mm flat black powder coated finish.

Anti-Slip Surface

Horizontal walking surfaces specified to have an anti-slip coating shall meet or exceed OSHA and NFPA 1906 (current edition) requirements. Coating shall be durable and last the life of the apparatus.

Striping and Graphics

Body General

All stripes are per NFPA standards and ASTM D 4965, “Standard Specifications for Retro-reflective sheeting for Traffic Control" unless otherwise specified. Finish of the striping and emblems shall be void of air pockets, and other blemishes, and edges shall be smooth.

Sides

A reflective stripe shall be affixed to the perimeter of the apparatus. Striping on the engine sides shall cover at least 50-percent of the cab and body length, following the natural contour of the equipment.

Reflective DOT Red and White Striping for Doors

A 1.00-inch to 2.00-inch white and red reflective stripe shall be installed on the vertically hinged interior compartment door face near the edge(s). Red reflective stripe(s) shall be installed on the bottom edge of the chassis cab doors. The reflective striping shall meet and/or exceed the current edition of NFPA 1906.

Specific Department Striping

Final approval shall be obtained prior to installation based upon a drawing or rendered photograph showing exact placement, color, and configuration.

Placards and Labels

All required signs, plates and labels shall be permanent in nature and securely attached and shall meet the requirements of NFPA 1906 current edition, and UL 969, *Standard for Marking and Labeling System*.

All signs, plates and labels shall be similar in appearance, style, and design. The following signs, plates and labels shall be installed on the apparatus:

All applicable signs, plates and labels listed in NFPA 1906 current edition.

Fluids Placard

The contractor will affix a permanent placard in the driver's compartment specifying the correct type of the following fluids used in the vehicle:

- Engine Oil
- Engine Coolant
- Chassis Transmission Fluid
- Power Steering Fluid
- Front Drive Axle Lubrication Fluid
- Rear Drive Axle Lubrication Fluid
- Transfer Case Lubrication Fluid
- Pump Transmission Lubrication Fluid, if applicable
- Auxiliary Engine Oil
- Auxiliary Engine Coolant
- Foam System Lubricant
- *Any other information deemed necessary by the contractor or its subcontractors to prolong the life of the equipment*

Dimension Placard

The contractor shall affix a permanent placard in the driver's compartment specifying the empty/dry vehicle dimensions after constructions. The placard shall include the following minimum information:

- Overall Length
- Overall Height, the highest point on the vehicle excluding antennas when empty
- Overall Width
- Empty Weight

Air Intake

The chassis engine air intake (air-box) cover shall be equipped with a Warning label/placard (approved by the department prior to installation) that depicts the following information:

WARNING! Prior to removing cover:
1. Remove Ignition Key
2. Disconnect Mass Air Flow Sensor
3. Reassemble completely prior to Starting

DO NOT CLEAN FILTER WITH COMPRESSED AIR!

Pump Operation Placard

A permanent placard shall be mounted on the driver side rear panel of the apparatus body, as high as possible and within easy view from the operator's panel, that describes the necessary steps to start the pump and pump water of out the water tank to the discharge(s).

Winterization Placard

A permanent placard shall be mounted on the inboard side of the operator's panel, as high as possible and within easy view from the operator's panel, that describes the necessary steps to properly winterize the plumbing to prevent freeze damage.

Pump Test Placard

A permanent placard shall be mounted on the inboard side of the operator's panel, as high as possible and within easy view from the operator's panel, that provides the end user with the gallons per minute (GPM) at 150 pounds per square inch (PSI) and gallons per minute (GPM) at 250 pounds per square inch (PSI) of the pump.
Seating Capacity

The completed apparatus shall be designed to have a fully enclosed seat with an approved seat belt for each occupant. The term "fully enclosed" shall mean four sides, a top and a bottom, with an appropriate door for easy entrance to and exit from the seating position.

A warning label, listing the seating capacity of the completed apparatus, shall be provided in the apparatus cab interior. This label shall be located so that it is visible from all seating positions.

This apparatus shall have a seating capacity of two (2) personnel in front, and three (3) personnel in the rear for a total seating capacity of five (5).

Seating

The center portion of the 40/20/40 split bench seat shall be removed to accommodate the installation of the center console.

Seat Belt Warning

A warning label, stating: **"DANGER- Personnel Must Be Seated and Seat Belts Must Be Fastened While Vehicle Is in Motion or DEATH OR SERIOUS INJURY MAY RESULT"** shall be provided in the apparatus cab interior. This label shall be located so that it is visible from all seating positions.

Final Stage Manufacturer Vehicle Certification

A Final Stage Manufacturer vehicle certification label shall be provided and installed in the apparatus cab driver's door jamb.

Noise Hazard Warning

A warning label, stating: **"WARNING: Noise Hazards Occur During Siren Operation"**, shall be provided and installed in the apparatus cab interior. This label shall be located so that it is visible from all seating positions.

Pump Motor

The pump shall be driven by a 24.8 horsepower Kubota model D902, four-cycle, water cooled diesel engine that shall be equipped with the following provisions. The pump engine shall be fixed mounted on the water tank.

- Fuel Supply - The engine shall be piped to the chassis fuel system with provisions to prevent fuel drain-back to the tank when the engine is shutdown. The pickup tube shall be located 1.00-inch from the bottom of the tank to leave sufficient fuel in the tank for movement of the vehicle.

- Fuel Prime - A fuel pump shall be provided to assist in fuel delivery to the diesel engine from the chassis tank.

- Lubrication - Pressure feed with spin-on filter.

- Pump Controls and Starter - Controls for the pumping system shall be integrated into a single system that contains monitoring and protection features, and shall be configured with high current key switch, hour meter, voltmeter, oil pressure gauge, temperature gauge, throttle and spare openings for additional 2.00-inch diameter gauges.

- The starter and associated 12-volt, 40-amp alternator shall be hardwired to the chassis electrical system and controlled from the operator's panel. An amber LED light shall be in the cab that indicates when the pump is running.

- Exhaust - A USFS qualified spark arrestor shall be provided on the engine exhaust system. The exhaust shall be positioned to provide clear access to the air filter without the use of tools. The exhaust shall be routed away from the panel operator position and terminate behind the booster hose reel.

- Air Intake - An air cleaner is to be provided with easy access to remove the element. **An ember screen shall be provided on the inlet to the air cleaner.**

- Shielding - There shall be custom fabricated polished aluminum tread plate safety shield(s) to prevent damage or injury if the potential exists for loose clothing, hands, or foreign objects to enter the cooling fan area, belts, or any other moving parts of the auxiliary pump. A warning plate shall be permanently affixed to the top of the pump engine cover that shall read "**WARNING: NOT A STEP**".

- Maintenance - All serviceable items such as air filters, oil filters, drains, and fuel pumps shall be accessible for routine maintenance without requiring removal of any plumbing or major engine components such as complete removal of the exhaust system or air filter housing.

- Warranty - The auxiliary pump shall carry a minimum three (3) year warranty that covers labor charges from the date the pump is placed into service. The manufacturer of the diesel engine that drives the auxiliary pump shall warrant the product for a minimum of 24 months or 2000 hours.

Pump Gear Box

The Waterax BB-4 pump shall be built for maximum pressure and the gear box from the pump shall be configured as such with a gear ratio of 1.88:1.

Pump

Due to the unpredictability of water sources, the Waterax BB-4 shall have a pump body, diffusers, and impellers made of an anodized corrosive resistance aluminum. The impeller must be aluminum to match the pump body and diffusers to prevent galvanic corrosion from taking place between pump components. The pump shaft shall be stainless-steel supported by two maintenance free bearings and shall not be co-linear to the engine's drive shaft. A sealed roller bearing shall be located externally from the pump and a sintered bronze bushing shall be located within the pump cover. Both bearings must be maintenance free.

As installed on the apparatus, the pump shall be capable of delivering 50 gallons per minute minimum at 250 pounds per square inch output pressure from a 5-foot lift through 24 feet of 2.00-inch suction hose with a strainer and from the apparatus water tank or from an external draft source, i.e. fold-a-tank.

In addition, the pump manufacturer shall certify that the pump can deliver the following capacities as measured at the pump head and at net pump pressure from draft under test conditions listed:

Capacities:

- 106 gallons per minute at 150 pounds per square inch net pump pressure
- 103 gallons per minute at 250 pounds per square inch net pump pressure
- 65 gallons per minute at 350 pounds per square inch net pump pressure

The pump seal shall be a mechanical rotary seal, shall be externally pressurized and shall incorporate a blister-resistant carbon seal face, silicon carbide seat, and fully integrated drive bushing.

Testing and Certification

Upon completion, the apparatus shall undergo a complete pumping test that conforms to the requirements of NFPA Standard 1906 (latest edition) for the size and type of pump provided. The test shall consist of a continuous one-half hour test pumping at rated capacity and rated net pump pressure, a vacuum test of the primer system and plumbing, a tank discharge flow test, a pressure test of the apparatus piping and a water tank usable water volume test. The chassis engine and transmission, the pump and other components of the apparatus shall show no undue heating, leaks, or other defect. The results of the test shall be documented to establish the performance of the apparatus and to further ensure that the unit

shall perform satisfactorily when placed into service. The test results shall be certified in writing, with the certification provided to the purchaser for their records at the time of delivery of the completed apparatus.

Waterous Aquis 1.5 Foam System

The apparatus shall be equipped with an electronic, fully automatic, variable speed, direct injection, discharge side foam proportioning system. The system shall be capable of handling Class A foam concentrate. The foam proportioning operation shall be based on direct measurement of water flows and remain consistent within the specified flows and pressures. The system shall be equipped with a control module suitable for installation on the pump panel. Incorporated within the motor driver shall be a microprocessor that receives input from the system flow meter, while also monitoring foam concentrate pump output, comparing values to ensure that the operator preset proportional amount of foam concentrate is injected into the discharge side of the fire pump. A paddlewheel-type flow meter shall be installed in the discharge system specified to be "foam capable." A brass wye strainer with a removable/cleanable screen shall be installed in the foam pump supply line.

An Operator Interface Terminal (OIT) digital operation shall be available to be incorporated into the Aquis 1.5 proportioner. This OIT digital panel shall allow for push button control of Class A concentrate in infinite increments from .1% to 1%, calibration of water flow rate, adjustable units of measure, simulated water flow, optional lockout. The OIT panel shall have a warning of low foam concentration supply that flashes and displays a steady "low concentrate" warning when the concentrate tank runs low. It will also flash a "no concentrate" warning when the concentrate tank is empty and a warning of an electronic malfunction that flashes an "error" warning with associated error code. The OIT panel shall operate in manual mode as a back-up and a separate plate panel with operation instructions is furnished.

A 12-volt electric motor driven positive displacement plunger pump shall be provided. The pump capacity shall be 1.0 GPM at 200 psi with a maximum operating pressure up to 400 psi. The system will draw a maximum of 30 amps @ 12 VDC. The motor shall be controlled by the microprocessor mounted to the base of the pump. It shall receive signals from the control module and power the 1/3 hp (.25 KW) electric motor in a variable speed duty cycle to ensure that the correct proportion of concentrate is injected into the water stream. A full flow check valve shall be provided in the discharge piping to prevent foam contamination of fire pump and water tank. A 5-psi opening pressure check valve shall be provided in concentrate line.

Components of the complete foam proportioning system as described above shall include:

- Operator control module
- Paddlewheel flow meter
- Pump and electric motor/motor driver
- Wiring harnesses
- Low level tank switch
- Foam tank
- Foam injection check valve
- Main waterway check valve
- Brass Wye strainer

An installation and operation manual shall be provided for the unit, along with a one-year limited warranty by the manufacturer. The system shall be installed and calibrated. The system design shall have passed environmental testing which simulates heavy use on off-road mobile apparatus. Testing shall have been conducted in accordance with SAE standards.

All water discharges shall be supplied with foam solution except the pump to tank and freshwater discharge. No foam shall be allowed to enter the water tank.

Plumbing General

All plumbing shall be stainless-steel with high pressure flexible hose where appropriate. Sweeping elbows and tees shall be used to improve flow. Victaulic couplings shall be used where appropriate to allow easier disassembly for maintenance. The stainless welds shall be cleaned and polished. Deck mounting of plumbing components shall be maximized to the greatest extent possible to eliminate hanging fixtures and minimize component shifting, loosening, etc.

Intake Locations

All suction side plumbing shall be 2.50-inch in diameter unless otherwise noted.

One 2.50-inch tank-to-pump line, with an inline valve, shall be installed between the water tank outlet and the pump inlet. The valve shall be controlled by a T-handle and easily accessible from the rear of the apparatus.

One (1) 2.50-inch diameter rear suction shall be provided. The suction shall be directed towards the rear of the unit and shall be easily accessible from the rear of the apparatus. It shall have a fire service valve with a 2.50-inch NH flange, a polished chrome rocker lug cap, and jacketed stainless-steel aircraft cable retainer.

Discharge Locations

All main discharge plumbing shall be 2.00-inch and reduced to 1.50-inch at the valves.

One (1) 1.50-inch pump-to-tank, or tank fill, labeled "NO. 2 PUMP TO TANK, shall be supplied. The line shall have a fire service valve. The valve shall be accessible from the operator's position and controlled by a direct actuation handle. A check valve shall be positioned in the refill line beyond the valve and adjacent to the tank.

One (1) 1.50-inch discharge, labeled "NO. 3 DISCHARGE", shall be supplied. The discharge shall be directed towards the rear of the unit. The discharge shall have a fire service valve locally controlled by a direct actuation handle. The discharge shall terminate with a 1.50-inch male NH threads with a chrome rocker lug cap and jacketed stainless-steel aircraft cable retainer.

One (1) 1.50-inch discharge, labeled "NO. 19 WATER ONLY", shall be supplied. The plumbing design shall prevent the back flow of foam contaminated water into the "NO. 19 WATER ONLY" discharge. The discharge shall be directed towards the rear of the unit. The discharge shall have a fire service valve locally controlled by a direct actuation handle. The discharge shall terminate with a 1.50-inch male NH threads with a chrome rocker lug cap and jacketed stainless-steel aircraft cable retainer.

One (1) 1.50-inch discharge, labeled "NO. 5 ENGINE PROTECTION", shall be supplied. The discharge shall be plumbed to the passenger side independent module. The discharge shall have a fire service valve locally controlled by a direct actuation handle. The discharge shall terminate with a 1.50-inch male NH nipple in the independent module.

One (1) 1.50-inch discharge, labeled "PRE-CONNECT", shall be supplied. The discharge shall be plumbed to the passenger side independent module. The discharge shall have a fire service valve locally controlled by a direct actuation handle. The discharge shall terminate with a 1.50-inch male NH nipple in the independent module.

One (1) 1.00-inch central single hose reel control with valve shall be provided. The valve shall be easily accessible from the standing position at the rear of the apparatus. For additional details, see the hose reel section of this specification.

Valves

All **Elkhart Brass Unibody Series** drop-out discharge and inlet ball valves shall meet all NFPA 1906 current edition standards. All 1.00-inch and larger valves in this specification shall be brass, quarter turn, fire service valves. All valves shall be locally controlled. Valve handles shall be oriented to direction of flow, in line with plumbing when open. All knobs on all valve handles shall have Loctite in place to prevent them from coming loose during off-road operation.

All 1.00-inch and larger valves installed on the apparatus shall be supplied by the same manufacture unless specified otherwise.

All 1.00-inch and larger valves installed on the apparatus shall be warranted to be free from defects in materials and workmanship under normal use and service for a period of five years.

All valves smaller than 1.00inch shall be Apollo brass with a mechanism to hold them in the OPEN or CLOSED position.

Valve Labeling

Each valve shall be labeled as to its function immediately adjacent to the valve control. The valves shall be labeled in accordance with the US Forest Service valve numbering system in common use with off-road firefighting agencies. A placard with an identification key shall be affixed at the rear of the apparatus.

Hose Reel

The apparatus shall be equipped with one (1) center mounted Hannay polished aluminum super booster hose reel. The hose reel shall be mounted in the center between the top of the front driver's side compartment and the front passenger's side compartment, top of the tank. The hose reel shall be equipped with the following features:

- Hose reel frame and drum shall be fabricated of polished aluminum, with a sprocket being chrome plated to minimize maintenance
- The inlet connection shall be 1.00-inch
- The outlet connection shall be 1.00-inch **NH thread**

- Bottom feed, counterclockwise wind
- Open stainless-steel rollers with aluminum brackets, steel bushings, mounted high to the driver side and passenger side of the reel. The side rollers shall be approximately the width of the reel drum to allow full use of the drum to roll hose onto
- Hose capacity of a minimum of 150 feet of 1.00-inch hard line.
- A manual rewind port with removable handle, mounted vertically
- An adjustable brake
- 2/3 horsepower electric motor

The hose reel shall be controlled by a locally controlled valve at the rear of the apparatus. The connection between the valve and the reel shall be with high pressure 1.00-inch flexible hose. The reel shall have two (2) rewind switches installed, one (1) on each side of the apparatus body, in a location to allow a fire fighter to hold the booster hose while pushing the rewind button. These switches shall be marine style sealed momentary switches with a chrome button protector ring to aide in the prevention of accidental impact. A third switch shall be installed at the hose reel next to the 70-amp breaker. The switch shall be a momentary switch that is sealed from the environment. Additionally, there shall be a separate momentary switch on the master electrical control module for the driver to control the rewind of the reel while the apparatus is in pump-and-roll operations.

Booster Hose

Two (200) hundred feet of 3/4-inch Mercedes Textiles Boostlite booster hose shall be supplied an installed on the specified booster reel. Each section of hose shall be fifty (50) long and shall have 1.00-inch NH threaded aluminum pin hole couplings.

Primer

One (1) Hale Products positive displacement, oil less, rotary vane, electric motor-driven priming pump, conforming to the NFPA requirements, shall be provided and installed on the cross member, above the lower edge of the frame rails, aft of the cab body. The primer pump body shall be fabricated from heat-treated anodized aluminum for wear and corrosion resistance. The priming pump shall be capable of producing a minimum of 17.00-inches Hg of vacuum at 2000 feet above sea level.

The primer pump electric motor shall be of a 12 VDC totally enclosed design. The priming pump shall not require lubrication from an external source. The priming pump shall be operated by a single push-pull control valve mounted on the pump operator’s panel. The control valve shall be of all bronze construction and labeled "#6 Primer".

The primer shall be connected to the priming port provided on the top of the pump inlet.

Winterization / Emergency Priming Port

Operator's Panel Winterization Port

A brass 1/4-turn valve shall be provided at the operator's panel and fitted with a universal air quick coupling plug to allow for pressurization of the plumbing system for efficient winterization.

Auxiliary Priming Port

A 2.00-inch emergency priming port shall be located on the suction side of the manifold system, as close to the pump as possible, to allow the end user that ability to efficiently winterize the plumbing system or prime the plumbing system in the event of an external primer failure. The port shall have a chrome rocker lug cap and be attached to the manifold with a stainless-steel jacketed aircraft cable.

Strainer

The pump intake shall be equipped with a stainless-steel wye strainer with 3/16-inch mesh to filter out foreign material and keep debris from entering the pump. The strainer will be removable and have a screw-off cap to allow easy cleaning of the filter element in the field. The plumbing shall have two (2) Victaulic couplings between the strainer and the pump for ease of service on the pump.

Master Drain

The apparatus shall be equipped with a Trident Emergency Products master drain valve shall be plumbed to the pump, suction plumbing and discharge plumbing as required to fully drain the piping and pump to prevent damage from freezing. The drain valve and associated plumbing will be designed to withstand pressures of 600 pounds per square inch. The master drain shall be labeled "MASTER DRAIN".

Pump Cooler

A 3/8-inch pump cooling/by-pass line labeled "NO. 17 PUMP BYPASS" shall be plumbed from the discharge side of the pump to the water tank fill tower to help cool the pump when it is engaged, and water is not being discharged. This line shall be plumbed through a quarter-turn panel-mounted ball valve. The valve shall be labeled “OPEN” and “CLOSED” and a warning label shall be affixed near the valve that states “PUMP DAMAGE CAN OCCUR IF VALVE IS CLOSED”. The valve handle position shall be vertical when "OPEN" and horizontal when "CLOSED". A check valve shall be included in the line to facilitate priming.

Operator's Panel

One (1) OnScene Solutions 18.00-inch LED light strip shall be installed on the back of the pump operator's panel running vertically and serve as plumbing lights. The LEDs and electronics shall be enclosed in a 5/8-inch diameter Lexan tube that is sealed at both ends with rubber caps to create a waterproof environment and be suitable for mounting in a wet location. The LEDs shall be in a row one inch apart and have a beam angle of 120-degrees. The tube shall rotate to adjust the beam direction as required. The light shall fit in a 20.00-inch space and be secured with two (2) molded nylon mounting clips.

The operator panel lights shall be controlled by the same switch located and labeled on the operator's panel.

The operator's panel shall contain the following controls and gauges:

A. Discharge pressure gauge
B. Intake pressure gauge
C. Electronic water level indicator
D. Electronic foam level indicator
E. Panel light switch
F. Master drain handle
G. Gauge drain valve
H. Foam system controls
I. The pump primer control(s)
J. Throttle
K. Winterization air inlet
L. Low voltage indicator light and alarm
M. Horn activation switch/button, labeled "HORN"
N. LOFA panel with the following
    a. Tachometer
    b. Analog Hour meter (BFX Installed)
    c. Oil pressure gauge
    d. Water Temperature gauge
    e. Voltmeter
    f. Glow plug light
    g. Engine "ON/OFF/START" and glow plug switch/light
    h. Low water pressure override switch, labeled "PRESSURE OVERRIDE"

All gauges, controls, discharges, and suctions shall be labeled. All knobs on all valve handles shall have Loctite in place to prevent them from coming loose during off-road operation.

Discharge Pressure Gauge

One (1) 4.00-inch liquid filled pressure gauge shall be supplied for the pump discharge. It shall be marked in pounds per square inch (PSI) with an indicating range of 0 to 600 pounds per square inch (PSI). The gauge shall be located on the pump operator's panel. The gauge shall be equipped with a freeze protection diaphragm and shall be equipped with a drain cock (vent) at the gauge connection line drain.

One (1) 2.50-inch liquid filled pressure gauge shall be supplied for the pump discharge. It shall be marked in pounds per square inch (PSI) with an indicating range of 0 to 600 pounds per square inch (PSI). The gauge shall be located within the center console located inside the chassis cab. The gauge shall be equipped with a freeze protection diaphragm and shall be equipped with a drain cock (vent) at the gauge connection line drain.

Intake Pressure Gauge

One (1) McDaniel Controls 50/50 four (4) inch diameter -30-0- 300 PSI intake pressure gauge shall be provided on the operator's panel, located in a vertical pattern on the right side of the operator's panel below the discharge pressure gauge. The gauge shall be equipped with a drain cock (vent) at the gauge connection and shall be illuminated by the standard panel lighting.

Electronic Water Level Indicator(s)

One (1) Fire Research TankVision model WLA300-A00 tank indicator kit shall be installed. The kit shall include an electronic indicator module, a pressure sensor, and a 10' sensor cable. The indicator shall show the volume of water in the tank on nine (9) easy to see super bright LEDs. A wide view lens over the LEDs shall provide for a viewing angle of 180 degrees. The indicator case shall be waterproof, manufactured of aluminum, and have a distinctive blue label.

The program features shall be accessed from the front of the indicator module. The program shall support self-diagnostics capabilities, self-calibration, and a data link to connect remote indicators. Low water warnings shall include flashing LEDs at 1/4 tank, down chasing LEDs when the tank is almost empty, and an output for an audio alarm.

The indicator shall receive an input signal from an electronic pressure sensor. The sensor shall be mounted from the outside of the water tank near the bottom. No probe shall place on the interior of the tank. Wiring shall be weather resistant and have automotive type plug-in connectors.

One (1) Fire Research TankVision model WLA305-A00 miniature tank indicator shall be installed in the cab. The indicator shall show the volume of water in the tank on five (5) easy to see super bright LEDs. A wide view lens over the LEDs shall provide for a viewing angle of 180 degrees. The indicator case shall be manufactured of aluminum and have a distinctive blue label. The miniature tank indicator shall be dimmable.

The miniature indicator shall receive input information over a single wire from a Fire Research TankVision model WLA300-A00 tank primary indicator.

The indicator shall be calibrated at the time of inspection.

Electronic Foam Level indicator

One (1) Fire Research TankVision model WLA360-A00 tank indicator kit shall be installed. The kit shall include an electronic indicator module, a pressure sensor, a 10' sensor cable, and a tank vent. The indicator shall show the volume of Class A foam concentrate in the tank on nine (9) easy to see super bright LEDs. A wide view lens over the LEDs shall provide for a viewing angle of 180 degrees. The indicator case shall be waterproof, manufactured of aluminum, and have a distinctive green label.

The program features shall be accessed from the front of the indicator module. The program shall support self-diagnostics capabilities, self-calibration, and a data link to connect remote indicators. Low foam warnings shall include flashing LEDs at 1/4 tank, down chasing LEDs when the tank is almost empty, and an output for an audio alarm.

The indicator shall receive an input signal from an electronic pressure sensor. The sensor shall be mounted from the outside of the foam tank near the bottom. No probe shall place on the interior of the tank. The foam tank vent shall be installed on the

foam fill tower. Wiring shall be weather resistant and have automotive type plug-in connectors. **The location of the transducer shall be easily accessible.**

Test Gauge Connections

The plumbing system shall be provided with two (2) test ports on the pump panel exterior; one (1) plumbed to the intake side and one (1) plumbed to the discharge side of the water pump. These test ports shall be installed to provide a means for connecting certified test gauges when testing the pump's performance.

Pump Protection Shutdown System

The pumping system shall be protected from unnecessary damage using a Water Pressure switch, an Oil Pressure switch, and a High Temperature switch. The switches shall be integrated into a control panel that contains all of gauges and monitoring devices for the pumping system.

The water pressure switch shall be designed to kill the pump engine when water pressure drops below 15 pounds per square inch.

The oil pressure switch shall be designed to kill the pump engine when oil pressure drops below 10 pounds per square inch. A temporary override shall be a timed function of the control panel during start up procedures and shall not require a manual push button.

The high temperature switch shall be designed to kill the pump engine when engine temperature exceeds manufacturer's maximum operating temperature.

A toggled override switch located on the pump panel with cover shall be incorporated into the system for use during initial startup and drafting operations and shall override all shutdown systems when engaged (up position). The toggle switch shall have a red safety cover (missile switch cover) that will cover the switch and simultaneously disengage the system when in the down/armed position.

Pump Area Cover (Walk-Over) with Hinged Access

The apparatus shall be equipped with a removable plumbing area cover. All materials used in the construction and mounting of the cover shall be non-corrosive. The cover shall be fabricated of 3/16-inch aluminum CNC punched walking surface with aluminum 2.00-inch by 2.00-inch by 3/16-inch square tube support frame. The tube frame shall be fully removable for ease of pump system maintenance. The top of the cover shall be designed to provide a walkway access across the rear of the apparatus and provide shielding from the pump and plumbing manifold area. The cover shall open in the center, gull wing style, with stainless steel hinges on the outboard positions to allow easy access to the plumbing area without the use of tools. The cover shall be capable of supporting, without distortion, a walking person weighing up to 300 pounds. The walking surface shall comply with NFPA 1906. The hinged covers shall have hand railing on either side of the covers to aide in climbing and walking on top the vehicle. The cover shall be mounted and attached securely for travel in the off-road environment. There shall be a positive locking pins permanently attached, with stainless steel aircraft cable, to the structure to maintain closure.

Water Tank

The water tank shall be fabricated from ½-inch thick black protection series III copolymer polypropylene. The tank shall be designed to be completely independent of the body structure and compartments. All joints and seams shall be nitrogen-welded inside and out. All exposed edges on the tank and fill tower shall be rounded off to a ¼-inch radius.

The baffles shall be fabricated from ½-inch protection series III polypropylene and be designed for maximum airflow throughout the tank. The baffles shall be internally connected to the top, sides, end, and bottom. The tank shall have a manual fill tower with a basket strainer for both the water tank and foam tank. The lid shall be labeled "**WATER**".

The tank shall have a vent over-flow system that shall extend through the tank and exit under the vehicle, forward of the rear axle. The tank sump shall include provisions to prevent water swirl. There shall be piping inside the tank with a suction tube to the sump. The suction tube shall extend down through the anti-swirl plate and baffles. All fittings in the tank shall be heavy duty polypropylene or stainless steel. Tank inlets shall have flow detectors inside the tank.

A 1.50-inch quarter turn drain valve shall be located at the tank sump for drainage and labeled “TANK DRAIN”.

Clean Out Plug

The bottom of the tank sump shall be equipped with a 3.00-inch NPTF clean out fitting, equipped with a 3.00-inch NPTM PVC pipe plug.

Tank Capacity

The water tank shall have a usable capacity of 300 U.S. gallons.

Tank Placard

A professionally engraved placard shall be mounted in an easily viewable location that shall provide the following information:

A. Tank Manufacturer Name
B. Tank Manufacturer Phone Number
C. Tank Serial Number
D. Date Tank was Manufactured
E. Water Tank Capacity
F. Foam Tank Capacity
G. Max Fill Pressure
H. Max Fill Rate

Foam Tank

One (1) 12-gallon capacity foam concentrate storage tank shall be provided and plumbed to the on-board foam system. the tank shall be fabricated from polypropylene and shall be designed and fabricated as an integral part of the main water tank. The foam tank shall have a separate fill tower and shall be labeled "FOAM".

The foam tank shall have a translucent sight tube incorporated into the tank to indicate the foam level. The sight tube shall be labeled "FOAM LEVEL" and shall be visible from the operator's panel.

Spare Tire Storage

The tank assembly shall include an integrated lockable spare tire storage compartment with dimensions suitable to store the spare tire. The compartment shall be sweep out style to simplify cleaning and removal of gear/tools. All hardware for the compartment shall consist of stainless-steel parts. The compartment door shall utilize a stainless-steel D-Ring latch and shall be lockable using the same key number described elsewhere in this specification (1250).

Chainsaw Compartment

The tank assembly shall include an integrated lockable chainsaw compartment at the rear of the vehicle, below the operator's pump panel. The compartment shall have approximate inside dimensions of 14.00-inches high by 14.00-inches wide by 50.00-inches deep. The compartment interior shall require a means of protecting the poly construction from the teeth of the chain saw, which may cut the poly during placement, removal, and storage. There shall be a retention mechanism to secure the saw into place once the saw has been stowed. The compartment shall be vented on the driver side of the wall of the compartment. The compartment door shall utilize a stainless-steel D-Ring latch and shall be lockable using the same key number described elsewhere in this specification (1250). The door shall **seal** the compartment from all outside elements. The floor area of the compartment shall be equipped with a removable stainless-steel drip pan to house the power head of the saw. The drip pan shall be designed to help avoid damage to the bar/chain of the saw.

Integrated Top Storage

A storage compartment fabricated from 1/2-inch protection series III polypropylene shall be a component of the water tank assembly, located at the front of the apparatus. The storage compartment shall have approximate dimensions of 46.00-inches long by 16.00-inches wide by 25.00-inches deep. A drain shall be provided in the bottom of the compartment that vents through to the ground. The compartment shall have a polypropylene overlapping style lid with two (2) adjustable overlapping positive catch style lockable latches, one (1) per side. The storage compartment shall be adequately sealed to prevent water intrusion. The lid shall be equipped with two (2) extending, gas cylinder type hold open devices. The lid shall not contact the light bar when "OPEN".

Ice Chest Storage

A polypropylene ice chest storage assembly shall be provided and installed on the passenger side compartments, in front of the specified independent storage modules. The ice chest storage assembly shall have a locking mechanism to secure the ice chest when in transit and to deter theft. Minimum dimensions for the ice chest storage assembly shall be 30.50-inches long by 16.00-inches wide by 6.00-inches deep allowing for storage of a YETI Tundra 65 cooler or smaller. The space shall

be designed to allow the user to drain the ice chest without removing the chest from the storage space. The drain holes shall be provided in the lower corners of the sides of the storage assembly to allow for adequate drainage.

Hydrant Wrench Holder and Wrenches

One (1) three position captive latching type/hydrant/spanner wrench holder and hydrant wrenches shall be permanently mounted on the rear panel of the apparatus body, passenger's side, below the taillight assembly. The holder shall be mounted horizontally.

Hose Holder System

A hose holder system shall be fabricated and installed on the rear panel of the apparatus body. The system shall allow the end user to quickly attach/remove the system when desired.

Additional Equipment

The following components shall provide with the completed apparatus. These items shall be available for inspection at the final acceptance inspection. The loose equipment shall be presented in an identically organized fashion; small items shall be contained in a high durability reusable container for storage and transport.

Jack

12-ton hydraulic bottle jack

Lug Wrench

An aftermarket 4-way lug wrench / breaker bar shall be mounted in the spare tire compartment.

Keys

A minimum of two (2) complete key sets including: chassis ignition and door electronic key fobs and a minimum of four compartment keys.

Self-Adhesive Labels

The following list of self-adhesive labels shall be included in the loose equipment box:

- Two (2) “FIRST AID” labels approved
- Two (2) “FIRE EXTINGUISHER” labels
- Four (4) fuel storage compartment labels
- Two (2) additional Fluid Data labels
- Two (2) “Do not exceed MPH’ labels

All labels to be finalized during the pre-work conference.

Chassis Manuals

A minimum of one (1) printed chassis operator manual.

Component Manuals

One (1) set of operating manuals for major components such as pump, Kubota pump motor, hose reel, foam system, primer, and light bar, etc.

Vendor Training

Two (2) digital copies (USB Drives) of the manufacturer's engine training.

Calibration Magnet

A magnet and laminated directions for calibrating the foam and water level gauges.

Manual Hose Reel Crank

A manual hose reel crank to operate the hose reel equipped with the apparatus.