

**ADDENDUM NO. 1**  
**March 28, 2025**

**2025 SRE Acquisition - High Speed Rotary Plow**  
**City of Duluth No. 25-4402**  
**Duluth International Airport**  
**Duluth, Minnesota**

**SEH No. DULAI 183286**

From: Short Elliott Hendrickson Inc.  
3535 Vadnais Center Drive  
St. Paul, MN 55110-3507  
651.490.2000

To: Document Holders

DOCUMENT HOLDERS on the above-named project are hereby notified that this document shall be appended to, take precedence over and become part of the original bidding documents dated March 7, 2025, for this work. Bids submitted for the construction of this work shall conform to this document.

This addendum consists of 1 page and attached Document TS-1 Technical Specification (24 pages).

**Changes to Specifications:**

1. Document TS-1 Technical Specification, DELETE in its entirety and REPLACE with attached new Document TS-1.

Changes made:

- a. Section 4.8 – added inclusion of remote drains for all fluids if available.
- b. Section 4.8.9.1 Auto Greaser – added new section for an auto greaser, if available.
- c. Section 4.13 – spare caster wheel required.
- d. Section 4.17.2 – added basis of design radios for emergency two-way transceiver radios.

**NOTE:** Receipt of this Addendum No. 1, dated March 28, 2025 shall be acknowledged on [Bid Express](#). Failure to do so will not allow Bidder to submit Bid.

**END OF ADDENDUM**

## **TS-1 TECHNICAL SPECIFICATION**

### **ROTARY PLOW (SRE) WITH CARRIER VEHICLE**

#### **PART 1 - GENERAL**

This specification is the basis for procurement of a rotary plow with carrier vehicle. The unit is intended to cast heavy concentrations of snow away from airport runways, taxiways and aprons.

##### **1.1 RELATED INFORMATION.**

- A.** FAA Advisory Circular 150/5220-20A Airport Snow and Ice Control Equipment.
- B.** FAA Advisory Circular 150/5210-5D Painting, Marking, and Lighting of Vehicles Used on an Airport
- C.** SAE International ARP5539 Rotary Plow with Carrier Vehicle.

##### **1.2 INTENTION OF TERMS.**

Whenever in these specification or on the plans, the words "directed," "required," "permitted," "ordered," "designated," "prescribed," or words or the like import are used, it shall be understood that the direction, requirement, permission, order, designation, or prescription of the Airport is intended; and similarly, the words "approved," "acceptable," "satisfactory," or words of the like import, shall mean approved by, or acceptable to, or satisfactory to the Airport, subject in each case to the final determination of the owner.

Any referent to a specific requirement of a numbered paragraph of the contract specifications or a cited standard shall be interpreted to include all general requirements of the entire section, specification item, or cited standard that may be pertinent to such specific reference.

##### **1.3 PATENTED MATERIAL, EQUIPMENT AND PROCESS**

If the successful Bidder utilizes any design, device, equipment, material or process that is covered by a patent, trademark or copyright, the Bidder shall indemnify and hold harmless the Owner and Owner's representative from any and all claims for infringement by reason of the use of any patented design, device, equipment, material or process or the use of any trademark or copyright.

##### **1.4 DECALS**

The Contractor shall not affix advertising decals, stickers or other signs to the specified equipment. Vehicle mud flaps, when specified, shall be installed with the blank side facing outward.

##### **1.5 BRAND NAMES**

Whenever in the specification proprietary names, manufacturers, trade names or catalog numbers are specified, such reference is made for the purpose of defining the minimum performance, quality and other salient characteristics of the desired item. Where "brand names" are specified, the term "or equal" is deemed to follow. Such reference is not intended to be restrictive in nature. The Contractor may offer any material, item or process deemed equal with respect to the required minimum characteristics of the specified "brand name". The Owner reserves the right to make the final determination of equivalency.

## **1.6 MANUALS AND DOCUMENTS**

As a minimum, copies of the following documents must be submitted with final delivery of the equipment/vehicle. Supplier shall provide both paper and electronic copies. Paper copies shall be assembled in a three-ring binder with tabs for each section below, as applicable. Submittal of this information is in addition to any other submittal required specified within the Specifications.

1. Applicable Title documents. Required to transfer ownership and license/tag in the State of Minnesota.
2. An owner's/Operator's manual that includes all standard manufacturer/vendor literature.
3. Internet Access. Provide internet access to parts manual if available.
4. Manufacturer's standard warranties and guaranties
5. Maintenance instructions
6. Vendor Certifications
7. Manufacturer's/Vendor's Contact Information
8. Additional documents per Document 01 78 23

## **1.7 REQUIREMENTS.**

The truck (carrier vehicle) and rotary plow shall meet the requirements of Federal Aviation Administration Advisory Circular (AC) 150/5220-20A Airport Snow and Ice Control Equipment as amended by SAE International ARP5539 Rotary Plow with Carrier Vehicle and as modified by this specification.

## **1.8 SYSTEM DESCRIPTION.**

Snow removal equipment shall consist of a diesel powered, 4 X 4 truck (carrier vehicle). The truck engine shall have a minimum of 495 rated horsepower. The truck shall be equipped with a rotary snowplow at least 102 inches wide. The rotary snowplow shall be a two-stage unit including distinct input and discharge stages. The first stage input auger shall cut and force the snow into the second stage discharge impeller. The rotary snowplow unit shall be designed and built to withstand hard and continuous use in cold climates. The rotary snowplow unit shall have the capacity to displace a minimum of 5,000 tons of snow per hour with a casting distance of 100 feet minimum operating at a forward speed of up to 40 miles per hour. The minimum casting distance of 100 feet shall be under a no-wind condition. The minimum casting distance shall be as measured from the longitudinal centerline of the snow removal unit to the center of mass within the perimeter of the cast pattern. The performance requirement is based on snow with a unit weight of 25 pounds per cubic foot.

All parts and components of this equipment shall be designed and manufactured to be of the size, material, and strength necessary to sustain the specified performance operating in all snow removal conditions with minimum wear and failure.

## **1.9 BID SUBMITTALS.**

Refer to Document 00 21 13 – Instructions to Bidders

## **1.10 BID SUBMITTAL - SPECIFICATION COMPLIANCE CERTIFICATION.**

By submitting a bid, the bidder intends to comply with the performance, design and construction requirements of this specification. The Goods are all of the tangible personal property required to be furnished under the Contract Documents and Specifications.

The Bidder shall provide a detailed description of the item(s) in which the proposed Goods fail to comply with the procurement specification. Failure to submit this information shall be grounds to consider the bid non-responsive.

### **1.11 OPERATIONAL STANDARDS AND TESTING.**

Each Bidder shall certify that the equipment offered complies with the performance requirements of FAA Advisory Circular 150/5220-20 Airport Snow and Ice Control Equipment, SAE ARP5539 and this specification. Equipment testing shall be conducted on standard production models.

### **1.12 SCHEDULE.**

The Goods are to be delivered to the point of delivery designated by the Owner, commissioned and ready for Owner's acceptance on or before **500 calendar days** after the effective date of the Contract. The Bidder shall indicate if earlier delivery can be provided.

### **1.13 SHOP DRAWINGS AND PRODUCTION SCHEDULE.**

Within sixty calendar days of the effective date of the Contract, the Contractor shall provide to the Owner complete shop drawings of all system components and operating systems comprising the Goods to be provided.

Within sixty calendar days of the effective date of the Contract, the Contractor shall provide to the Owner a production schedule indicating the dates of substantial completion of each major component and operating system. The schedule shall also indicate the dates of final completion, testing, shipment and delivery of the Goods.

### **1.14 PRE-DELIVERY INSPECTION.**

The Owner will perform a pre-delivery inspection of the equipment at the Contractor's facility. The trip shall be for two (2) Airport representatives made to the facility at the end of equipment acquisition. Travel, meals, and lodging **expenses shall be paid for by the Contractor**. The purpose of the inspection is to verify compliance with critical requirements of the specification. The inspection shall not serve as the final acceptance inspection.

### **1.15 MATERIAL SAFETY DATA SHEETS**

The Contractor shall submit applicable Material Safety Data Sheets (MSDS) for all chemical products supplied with the acquired equipment/vehicle to the Owner under a separate cover and within the calendar day limit of the Contract.

### **1.16 ACCEPTANCE**

Delivery of equipment by the Contractor does not constitute acceptance by the Owner. Acceptance of the furnished equipment will be based on combination of submitted manufacturer certifications and acceptance tests conducted by the Contractor at the time of delivery. The Contractor shall maintain ownership, secure storage responsibilities, and insure the vehicle/equipment for loss and/or damage throughout the entire delivery and acceptance process. The Contractor shall provide manufacturer certification for components and systems identified within the Technical Specification. The Contractor shall prepare and furnish the Owner a signed written certification that the components constituting the whole of the equipment being provided comply with the applicable performance, vehicle requirements of the Technical Specifications.

## 1.17 DELIVERY.

### A. Preparation for Delivery:

1. The completed unit, truck with rotary plow, must be fully assembled and tested prior to delivery.
2. The vendor is responsible for the safe and timely delivery of the unit and its accessories, spare parts, and tools to the place of delivery.
3. Shipment. The equipment shall be packed in such a manner as to ensure acceptance and safe delivery to the designated point.
4. Marking for shipment shall be in accordance with the instructions issued by the Purchaser.
5. Shipment shall be Free on Board (FOB) to the address noted herein below. Cash on Delivery (COD) deliveries will not be accepted. All vehicles/equipment shall be off loaded at the designated location at Contractor's expense. A minimum of three (3) business days' notice shall be given prior to delivery. Delivery must be made between the hours of 8:00 am and 4:00 pm weekdays.

**Duluth International Airport  
4875 Malstrom Street  
Duluth, MN 55811  
Attn: Ryan Welch, Airside Operations Manager**

6. Marking: Carrier vehicles must be marked for shipment in accordance with instructions agreed to by the purchaser. Duluth Airport Logo and vehicle number will be applied to vehicle and included in the contractor's pricing.

**B. Field Testing, Startup, and Operations and Maintenance Training.** At no additional expense to the Owner, the Contractor shall, upon delivery of the equipment, have an authorized representative conduct an operational test of the furnished equipment in the presence of the Owner. The Contractor shall demonstrate that all features and components are in proper working order and operate as intended by the Specifications. This demonstration is an addition to any other stated acceptance tests within the Specifications and as required by the Owner.

The Owner shall be instructed as to the proper use of the equipment including, but not limited to, connection/hook-up, plow operation, bucket operation, and other requested features. The demonstration shall be made by a factory trained specialist from the Contractor who shall be responsible for complete instruction as to operation and maintenance of the equipment.

A demonstration specialist shall remain at the Airport for a sufficient amount of time to provide thorough instruction to personnel, or as instructed by the Owner. All meals, motel and travel costs shall be the responsibility of the successful bidder.

**C. Completeness.** All equipment delivered by the Contractor shall be complete and ready for Owner use; complete and fully operational. All parts necessary for operation or which are normally furnished as standard equipment shall be furnished by the Contractor whether specified or not. Substitutions or cancellations are not permitted without written approval from the Owner.

**D. Main Component List.** The manufacturer shall provide a dedicated component list for each unit delivered. The component list shall be itemized and list each main system component. The list shall include but not be limited to items such as engine(s), transmission, main hydraulic system components, drive gear boxes, axles, brakes, etc. The list shall provide the description, manufacturer, part number, and quantity required. The serial number of the engine, transmission, drive gear boxes and axles installed on the subject machine shall be provided. The list shall be provided prior to shipping the equipment. The complete unit and all components shall be newly manufactured and unused. The Owner shall reject any component found to be used, or not of current production. The Contractor (Bidder) will replace the component in question with an appropriate and acceptable new replacement component at his own expense.

## **1.18 WARRANTY.**

The carrier vehicle, rotary plow, and plow attachments shall be warranted against defective materials, workmanship and performance deficiencies for a period of one year. The successful Bidder shall be responsible for warranty work on all equipment and components, including attachments and non-factory parts. Provide point of contact name and telephone number for warranty service and parts that is available 24 hours per day, 7 days per week, 365 days per year. Bidder shall submit complete warranty information with the bid.

Components such as engine, emissions parts, transmission, or other items that are warrantied separately from the vehicle manufacturer's warranty shall be clearly identified in the service manuals.

The warranty period for remedying all defects in the Goods will begin on the date on which testing, start-up and training has been completed to the Owner's satisfaction, all of the Goods are functioning as intended and the Owner has accepted all of the goods to be in accordance with the Procurement Documents.

## **1.19 QUALITY ASSURANCE.**

**A. Quality Assurance Provisions.** The Contractor shall be responsible for the performance inspection requirements specified. The Contractor shall utilize his own or any other inspection facilities or services. The Contractor shall maintain records of inspections and tests. Copies of these records shall be provided to the Owner.

**B. Substitutions.** The Contract, if awarded, will be on the basis of material and equipment described or specified in these technical specifications. After the Contract has been awarded, the procedure for submittal of substitute or equal item of material or equipment by Contractor, and consideration by Owner, is set forth in the General Conditions. When the Contractor elects to use a material exceeding the specifications for its convenience or availability, it does so at its own expense.

## **1.20 MATERIALS.**

Materials shall conform to the specifications listed in this document, Advisory Circular 150/5220-20, SAE ARP5943, and SAE ARP5539. Materials shall be of the best quality available for their intended commercial use. Component parts shall be new and free of all defects and imperfections that could affect the serviceability of the finished product. Contractor shall promptly repair any defects and related defects discovered within the standard 12-month warranty period, or selected warranty period. Unless otherwise approved by the Owner, Contractor shall commence to correct the defect and related defect within 15 calendar days from receipt of notification from the Owner. All materials supplied shall be of current serial numbers representing that the materials are current and readily available upon need due to failure and normal replacement. No obsolete, but unused parts shall be utilized in the manufacturing of this equipment.

## **1.21 DESIGN.**

Equipment shall be developed in accordance with the best engineering practices available. Vehicle design shall include current state-of-the-art procedures that consider improved cab visibility, interior lighting and the mitigation of noise and vibration. Design and installation of equipment shall permit easy accessibility for maintenance and service.

## **1.22 CONSTRUCTION.**

Equipment shall be constructed to provide maximum protection against structural member failures. Equipment shall withstand the cold, moisture, strains, jars, vibration, and other conditions that are likely to be encountered during operation. All components and assemblies shall be free of hazardous protrusions, sharp edges, cracks, or other elements that might cause injury to personnel or damage to equipment. All oil, hydraulic, air lines, and electrical wiring shall be located in protected positions properly attached to the frame or body structure. Wherever these lines pass through structural members, they shall be protected with looms or grommets except where a through-frame connector is necessary.

## **PART 2 - REFERENCES**

### **2.1 APPLICABLE DOCUMENTS.**

Documents and publications referenced or described in AC 150/5210-5D, 150/5220-20A and SAE ARP5539 are incorporated by reference.

### **2.2 DEFINITIONS.**

Definitions shall be per AC 150/5210-5D, 150/5220-20A and SAE ARP5539.

## **PART 3 - PERFORMANCE REQUIREMENTS**

### **3.1 ROTARY PLOW MINIMUM PERFORMANCE REQUIREMENTS.**

The Bidder shall certify that the rotary plow complies with the following performance requirements for capacity and casting distance. Testing shall be in accordance with SAE ARP5539, Rotary Plow with Carrier Vehicle.

- A. Capacity.** When operating in snow having a density of 25 pounds per cubic foot, the rotary plow unit shall cast snow at an average of 5,000 tons per hour through a distance of not less than 100 feet.
- B. Casting.** Demonstrate variable casting distance from 0 to 100 feet. Casting performance shall be attained in a no wind condition, both left and right of unit.
- C. Clearing.** The snow removal unit shall clear a swath of not less than 102 inches wide in one pass.
- D. Visual Tests.** During the capacity tests, the rotary snow blower shall be visually evaluated. The swath that is cut shall be even and regular and show less than 5 percent snow spillage.
- E. Operating Speed.** The snow removal equipment shall be able to operate at speeds of up to 40 mph.

### 3.2 ENGINE PERFORMANCE REQUIREMENTS.

- A. Carrier Vehicle Engine Performance.** The engine shall develop sufficient torque and horsepower to meet normal operational requirements. Horsepower for carrier vehicle drive engine shall be a **minimum of 495 rated HP**.
- B. Rotary Plow Engine Performance.** The engine shall develop sufficient torque and horsepower to meet normal operational requirements. Horsepower for rotary plow engine shall be a **minimum of 755 rated HP**.
- C. Emissions.** Both carrier vehicle drive engine and rotary plow engine shall meet EPA TIER IV Final emission standards.

### 3.3 TEST PROCEDURES AND AIRPORT/CONTRACTOR OBLIGATIONS.

The Owner reserves the right to his own operational, performance, and capacity tests on equipment prior to acceptance. The manufacturer shall have the opportunity to witness the performance of these tests, but interpretation of results is the sole responsibility of the Owner. The Owner will notify the Contractor of the date scheduled for testing. Weather conditions and/or lack of snow may delay performance testing and will delay Owner's acceptance and final payment.

The Owner shall not accept equipment that fails to comply with the performance requirements of this specification or the requirements of FAA Advisory Circular 150/5220- 20 or SAE ARP5539

Performance testing conducted by the Owner shall comply with the requirements of AC 5220-20A and SAE ARP5539.

### 3.4 ADDITIONAL TESTS.

The Owner may conduct his own operational, performance, and capacity tests on equipment prior to acceptance. The manufacturer shall have the opportunity to witness the performance of these tests, but interpretation of results is the sole responsibility of the Owner. The Owner shall not accept equipment that fails to comply with the performance requirements of the specification or the requirements of FAA Advisory Circular 150/5220- 20.

## **PART 4 - ROTARY PLOW AND CARRIER VEHICLE**

Per AC 5220-20A rotary plows must be in accordance with SAE ARP5539 Rotary Snowplow with Carrier Vehicle. The following section summarizes the requirements for the self-contained mountable rotary snowplow from SAE ARP5539. The paragraph numbers correspond to SAE ARP5539. The rotary snowplow and carrier vehicle shall meet the requirements and as modified below.

### 4.3 TWO STAGE ROTATRY

**4.3.1 Rotary-Head Box:** Fabrication shall be of heavy gauge welded alloy steel designed for the type of expected service using best engineering practices. The rotary-head box shall have provisions for vehicle mounts, shoe or caster brackets, scraper blades, drive lines, controls, augers, and impeller bearing mounts and other mechanical hardware. A scraper blade shall be fitted to the lower leading edge of the box which shall be removable and made of polyurethane. The blade shall run the entire width of the box. Wear shoes must be adjustable.

The cutting width shall be a minimum of 102 inches. The cutting height shall be a minimum of 52 inches.



The rotary plow shall attach to the carrier vehicle via Oshkosh style "J" hooks, or approved equals.

**4.3.2 Input Auger:** The auger(s) shall have a minimum of two bearing supports. The ribbon blades shall be easily replaceable and made of high tensile steel.

They shall be bolted or otherwise attached to the auger shaft and balanced to reduce vibration using best engineering practices. Ribbon blades shall be serrated.

**4.3.3 Input Auger (Solid):** The solid auger shall have multiple cutter blades mounted on the auger drive shaft. Input auger shall be designed to feed snow to the discharge impeller to be cast away from the vehicle. The solid auger drive shaft(s) shall be balanced and supported by ball bearings, at each end of the auger shaft.

**4.3.4 Discharge Impeller System:** The impeller capacity shall be at least equal to the capacity of the input auger(s). The impeller blades shall be made of high tensile steel using best engineering practices and be balanced to reduce vibration and shock damage.

**4.3.5 Operation of the Rotary System:** The operation of turbines shall be by hydraulic, hydrostatic, or mechanical means with the speed controlled by a single operator in the vehicle cab. Power shall be transmitted to these systems via mechanisms located on either side of or in the middle of the rotary head box. To ensure efficient snow flow where an auger and impeller share the same drive shaft there shall be a reduction gear system between the two to provide a proper meshing of impeller speed and auger speed.

**4.3.6 Snow Casting Assembly:** The snow casting assembly shall consist of a casting chute that can be directionally controlled, an impeller, and a control system. The casting chute shall be able to rotate in either a vertical or horizontal plane, or both, as required by the purchaser. Casting distances shall range from zero to the maximum cast distance as specified by the purchaser. The snow casting chute(s) shall be designed and positioned so as to provide maximum operator visibility. Chutes shall be controllable by a single operator from within the vehicle cab.

The rotary plow shall have ability to cast snow the minimum specified distance on each side. The minimum casting distance of 100 feet shall be in no wind conditions. The minimum casting distance shall be as measured from the longitudinal centerline of the snow removal unit to the center of mass within the perimeter of the cast pattern. The performance requirement is based on snow with a unit weight of 25 pounds per cubic foot.

**4.3.7 Rotary Head Assembly:** The rotary head assembly shall be equipped with a device that is capable of raising it a minimum of 8 inches from the pavement. The locking device shall be activated through the use of conveniently located controls in the vehicle cab. The drive system shall not bind, rub, or vibrate excessively when the assembly is being moved. When the vehicle is traveling, the assembly shall have a means to be locked in the raised position.

**4.3.8 Drive Protection System:** All auger and impeller assemblies shall be protected against sudden stops or damage that may be caused from foreign objects. Protection may be in the form of automatic clutches, release overrides, and/or shear fasteners. Consideration shall be given to the location of protection devices to minimize the requirement to remove snow in order to gain access to and reset or replace the protection device.

**4.3.9 Blower Head Drive Train:** Drive shafts, universal joints and other mechanical components of the drive train shall continue to provide power to the head assembly under normal operating conditions through the operating range of the blower head without physical damage.

#### 4.4 MINIMUM PERFORMANCE REQUIREMENTS

See Part 3.

#### 4.6 CARRIER VEHICLE DESCRIPTION.

The design of the carrier vehicle shall be an all-wheel drive chassis with gross vehicle weight (GVW) rated for a minimum 56,000 pounds, front axle rated for 29,000 pound and the rear axle rated for 27,000 pounds. The carrier vehicle shall comply with all applicable Federal Motor Carrier Safety Regulations and the following Federal Motor Vehicle Safety Standards:

- FMVSS 101 Controls & Displays
- FMVSS 102 Transmission Shift Lever Sequence, Starter Interlock & Transmission Braking Effect
- FMVSS 103 Windshield Defrosting & Defogging Systems
- FMVSS 104 Windshield Wiping & Washing Systems FMVSS
- 105 Hydraulic & Electric Brake Systems
- FMVSS 106 Brake Hoses
- FMVSS 108 Lamps, Reflective Devices, & Associated Equipment FMVSS 111
- Rearview Mirrors
- FMVSS 113 Hood Latch Systems FMVSS
- 116 Motor Vehicle Brake Fluids FMVSS 119
- New Pneumatic Tires
- FMVSS 120 Tire Selection & Rims for Vehicles Other Than Passenger cars FMVSS 121
- Air Brake Systems
- FMVSS 124 Accelerator Control Systems
- FMVSS 201 Occupant Protection in Interior Impacts FMVSS 205
- Glazing Materials
- FMVSS 206 Door Locks & Door Retention Components FMVSS
- 207 Seating Systems
- FMVSS 208 Occupant Crash Protection
- FMVSS 209 Seat Belt Assemblies
- FMVSS 210 Seat Belt Assembly Anchorages FMVSS 302
- Flammability of Interior Materials

**4.6.1 Materials:** Materials used on a carrier vehicle shall conform to the specifications listed in the appropriate sections of Title 49, Chapter III, Federal Motor Carrier Safety Regulations. When not specifically listed, materials shall be of the best quality available for their intended commercial use. Component parts shall be new, unused, of current production to the satisfaction of the purchaser. They shall be free of all defects and imperfections that could affect the serviceability of the finished product.

**4.6.2 Design:** Equipment shall be developed in accordance with the best engineering practices available. This includes the incorporation of ergonomic designs specifically directed at the vehicle's cab environment. Vehicle design shall include current state-of-the-art procedures that consider improved cab visibility, communications systems, interior lighting and the mitigation of noise and vibration. Design and installation of equipment shall permit easy accessibility for maintenance and service. All vehicle stress points shall be designed to distribute and dissipate shock forces.

**4.6.3 Construction:** Vehicle construction shall provide maximum protection against structural member failures. Equipment shall withstand the cold, moisture, strains, jars, vibration, and other conditions that are likely to be encountered during operation. All components and assemblies shall be free of hazardous protrusions, sharp edges, cracks, or other elements that might cause injury to personnel or damage to equipment. Location of all oil, hydraulic, and air lines and electrical wiring shall be in protected positions properly attached to the frame or body structure. Wherever these lines pass through apertures they shall be protected with looms or grommets except where a through-frame connector is necessary.

## **4.7 CHASSIS.**

The design of the vehicle chassis shall be based on an all-wheel drive concept for optimized performance and safety. It shall have power assisted steering and a transmission with suitable load and speed ranges to accommodate normal operating conditions. Vehicles shall have heavy duty tow hooks, tow eyes, or other suitable tow connections attached to the rear of the vehicle. The tow hooks, eyes, or other suitable tow connections shall be attached to the frame or structure of the vehicle and provide adequate strength to allow lifting and/or pulling the vehicle for emergency recovery situations. A pintle hook, rated at not less than the GVWR shall be permanently attached to the rear frame structure capable of towing a vehicle. All installed parts and accessories necessary for the safe operation of the vehicle shall conform to applicable provisions of Title 49.

**4.7.1 Structural Members:** The frame shall be made of either pressed or structural steel shape and reinforced as required to prevent distortion under maximum load conditions. All frames and stiffeners shall be treated with a corrosion inhibitor and shall be primed and painted before assembly.

**4.7.2 Dimensions and Clearances:** Carrier vehicles with snow removal attachments shall have the following overall dimensions:

- A. Minimum Ground Clearance:** The minimum ground clearance of a vehicle chassis shall be 8 inches.
- B. Maximum Overall Height:** The maximum overall height of a vehicle including discharge chutes, lights, and exhaust stacks (with rain cap up if so equipped) shall not exceed 13 feet. A placard shall be installed in the vehicle cab stating the maximum overall height. If practical, the placard should be located at the top of the windshield as nearly over the steering wheel as possible to be immediately visible to the operator when looking upwards.
- C. Maximum Overall Width:** 9' 0"
- D. Maximum Overall Length:** 40' 0"

**4.7.3 Weight Distribution:** The gross vehicle weight of the vehicle shall be distributed over its axles in accordance with best engineering practices. The center of gravity shall be kept as low as possible under maximum load conditions. While it is loaded the vehicle shall be capable of resting on a 20% transverse grade without danger of overturning. A copy of the calculated weight distribution shall be provided to the customer prior to construction, and the produced vehicle shall not deviate from the calculated weight distribution by more than 5% on any axle, or for the gross weight as determined by weighing the unit at a public certified scale.

## **4.8 ENGINES.**

Engine and vehicle manufacturers shall provide an application approval, at the time of vehicle delivery that states the engines are suitable for use in the vehicle as configured and that the installation is approved by the engine manufacturer. Diesel engines shall be designed and tuned for operation using ASTM D 2 diesel fuel. Anti-freeze, crankcase and gear oils, greases, automatic

transmission fluid, and hydraulic oils shall be as per current SAE, API, or ASTM specifications and not proprietary products. Engines shall meet the performance characteristics specified herein on commercial grade fuel. Dual engine vehicles shall use a common fuel. The engines shall develop sufficient torque and horsepower to meet its normal operational requirements without exceeding the no-load speed at the peak of its certified gross brake horsepower curve. Engine noise and vibration shall be reduced in the vehicle cab by use of best engineering practices and machine layout. Idle time limiters or other automatic shutdown devices designed to limit emissions, conserve fuel, or enhance operating costs must be permanently disabled if such devices could leave a unit disabled on a taxiway or runway. Permanently disabled means the disabling must be done in such a manner so as not to be easily or accidentally re-activated.

If available, install remote drains for all fluids (coolants, oil, etc.)

**4.8.1 Cooling System:** The engines shall be liquid cooled. Internal temperatures of liquid cooled engines shall be controlled by a by-pass thermostat that regulates the flow of engine coolant. Drain cocks shall be installed at the lowest point of the cooling system and at other points necessary to completely drain the system. A sight glass or other device is required in all liquid cooling systems to allow the operator to determine that there is sufficient fluid for normal and safe operation without the need to open the system.

**4.8.2 Coolant Temperatures:** The design and installation of the system shall assure that coolant temperatures shall remain within the engine manufacturer's operational specification (both high and low) when properly maintained and operated in ambient temperatures during snow removal operations. The following equipment is required for both the carrier vehicle engine and rotary plow engine:

- A. Engine Jacket Water Heater:** Provide manufacturer's standard catalog thermostatically controlled engine coolant heater, minimum 1,500 watts.
- B. Engine Oil Pan Heater:** Provide manufacturer's standard catalog engine oil pan heater, 300 watts.
- C. Battery Heater:** Provide manufacturer's standard catalog battery warmer pad, 50- 100 watts per battery.

**4.8.3 Fuel System:** The fuel system shall comply with Title 49 and include all components necessary for a complete operational system.

**4.8.4 Fuel Tank(s) and Lines:** The minimum fuel capacity shall be 250 gallons. Dual tanks shall be interconnected to allow equalized fuel level in both tanks. If dual tanks are used, the supply system shall be designed to ensure an uninterrupted flow of fuel to the engine(s) without input by the operator, and to allow shutoff of each tank should the crossover lines of either tank be damaged. Dual tanks shall also have adequately sized crossover lines to allow refilling both tanks from one location. Fuel lines shall be securely fastened in place, installed to prevent chafing or strain and protected by grommets where lines project through metal apertures. Each fuel tank is to be equipped with an accessible bronze or brass drain plug or a quick drain. A properly rated fuel water separator with integral heater shall be installed in an accessible location near the tank. If the engine requires a boost pump to assure adequate fuel flow to the engine, a pressure operated switch with in-cab warning light shall be furnished to warn the operator of low boost pump pressure. The boost pump should be installed to shut off when the engine is turned off, or to have an emergency shutoff switch or circuit breaker located near the light to allow the operator to shut off the boost pump in the event of fuel leakage downstream of the boost pump.

**4.8.5 Fuel Filler Pipe:** The fuel filler pipe(s) shall be located outside of the vehicle cab in an area accessible for refueling from the ground. A light chain shall be attached near its opening and to the filler cap to prevent loss of the cap. The filler neck shall include a screen to prevent the entry of

foreign objects into the tank. The fuel filler cap shall be painted a color appropriate for the type of fuel, and a permanent label shall be affixed as close as practical to the fill neck(s), in an area visible to the person refueling the vehicle, stating the appropriate fuel and capacity of the tank(s). A label shall also be installed in the cab near the fuel gauge indicating which side of the vehicle must be positioned towards the fuel pumps (e.g., Fuel Fill →).

**4.8.6 Air Cleaner:** Air cleaners shall be two-stage dry type with restriction indicator. The air cleaner intake shall be positioned in a manner to limit the ingestion of snow and other contaminants.

**4.8.7 Exhaust System and Muffler:** Engines shall be equipped with an efficient and safe exhaust system including mufflers. Its location shall minimize noise and exhaust gases entering the vehicle cab under all operating conditions. Further noise reduction by noise suppression materials, such as muffler insulation, is encouraged. Horizontal portions of exhaust systems shall be protected, whenever possible, from corrosive agents and fuel spills. Mufflers and exhaust components positioned in or near normal operator work areas shall include appropriate guards to minimize the burn risk to airport personnel. Exhaust systems shall be positioned on the vehicle in a manner to minimize contact with slush and snow. Muffler(s) are to be made of aluminum, aluminized steel, stainless steel, or materials coated with ceramics. Devices shall be installed to prevent snow and slush from entering vertical exhaust stacks.

**4.8.8 Governor:** Engine speed shall be regulated by a governor set to provide the maximum operating speed recommended by the engine, driveline, and power train manufacturers.

**4.8.9 Lubrication:** An engine's lubricating system shall be equipped with standard production fittings and accessories. Engine oil filter(s) shall be engine manufacturers approved design and able to accept commercial replacement elements. All engine(s) shall receive lubrication prior to delivery with lubricants designated for use under ambient temperature conditions at the point of delivery. The unit(s) shall be tagged to identify the proper lubricants and their temperature ranges.

**4.8.9.1 Auto Greaser:** If available, an auto greaser shall be installed on the unit. The auto greaser shall ensure consistent lubrication without manual interruption. The auto greaser shall be designed to withstand harsh operating conditions.

**Components:**

Pump: electric or pneumatic

Reservoir capacity: 6 or 8 liters

Control Unit: Timer or brake counter

Distribution System: Tubing and fittings at each lubrication point

Grease Output: Variable depending on system resistance and tubing length

Low-Level Switch: to alert when lubrication levels are low

**4.8.10 Engine Protection:** An automatic engine protection system to prevent engine damage due to low engine pressure, high coolant temperature, or low coolant level is required. Shutdown systems shall include a manual override feature to allow for use/movement in emergency situations. The engine manufacturer's warranty shall not be voided if necessary to override automatic shutdown in emergency situation

**4.8.11 Accessibility:**

- A. Component Location:** Engine and chassis components shall be positioned to allow easy access for inspection and maintenance purposes. Components that historically present maintenance problems or those that have the potential to cause operational problems should particularly be located in unobstructed areas. Locks, controls and fasteners shall be designed to prevent over-torquing. Fluid capacities that must be checked during a pre-trip inspection, such as hydraulic oil level(s), windshield washer fluid level, and diesel fuel level shall be visually observable or otherwise capable of being checked without the need for

tools, and without requiring work stands, portable ladders, or other equipment to check the service levels. To the extent practical lighting in these areas shall be adequate to perform the checks without the need for flashlights or other portable lighting.

## **4.9 DRIVE TRAIN.**

**4.9.1 Transmission:** Transmission and vehicle manufacturers shall provide an application approval, at the time of vehicle delivery that states the transmission is suitable for use in the vehicle as configured and that the installation is approved by the transmission manufacturer. The transmission shall operate smoothly and efficiently and be capable of transmitting the maximum gross torque generated by the engine to the drive wheels through all gear reductions. Safety interlocks to prevent starting the engine unless the transmission is in neutral, or, the clutch is disengaged, shall be installed. Drive trains shall be in conformance with SAE requirements and shall be designed to minimize the number of joints. The transmission shall be automatic as follows:

Transmission shall be full power shift automatic with torque converter. Designs utilizing torque converters shall have a suitable torque ratio for the expected load ranges. The torque converter shall not operate at less than 70% efficiency. Shifting shall be accomplished via a shift control within easy reach of the operator. The gear or range selector shall have forward, neutral and reverse positions clearly identified.

**A. Transmission Cooler.** A transmission cooler shall be installed. The cooling system shall be as recommended by the transmission manufacturer.

**4.9.2 Transfer Case:** The vehicle and transfer case manufacturers shall provide an application approval at the time of vehicle delivery that states the transfer case is suitable for use in the vehicle, as configured. Transfer case assemblies shall provide positive drive to the front and rear axle(s) and may be of single or multi-speed design. Vehicles equipped with a transmission with 4 forward speeds shall have a two-speed transfer case. Vehicles equipped with a transmission with 6 forward speeds shall have a single speed or two- speed transfer case. The range of transfer case and transmission gear ratios shall provide power to operate at low speeds and the ability to operate at speeds up to 40 mph depending on conditions. The transfer case shall be automatic torque proportioning differential type.

**4.9.3 Axles:** The axle and vehicle manufacturers shall provide an application approval at the time of vehicle delivery that states the front and rear axles are suitable for use in the vehicle, as configured. The axle manufacturer's published rating shall at the least be equal to the load imposed at ground level when the vehicle and/or each component is in its maximum load configuration (i.e., rotary plow up and rotary plow down; and/or a material body, if any, loaded to its cubic rated volume). When appropriate, manual lockout controls shall be located in the vehicle cab. The torque capacity of each axle and differential shall be at least 10% in excess of the maximum torque that the axle may experience under any GVW operating condition. The power transmitting shaft on each steering axle shall incorporate steering joints that do not produce objectionable steering characteristics while the vehicle is operating on uneven surfaces.

### **A. Front Axle.**

1. A driver controlled limited slip differential, or traction differential unit is required in the front axle.
2. Minimum 29,000 pound GVW rating at the ground.

### **B. Rear Axle.**

1. A driver controlled limited slip differential, or traction differential unit is required in the

rear axle.

2. Minimum 27,000 pound GVW rating at the ground.

#### 4.10 BRAKE SYSTEM.

Carrier vehicle service and emergency braking systems shall meet Title 49 requirements for vehicles of similar design. Brake systems shall be complete with all necessary equipment to safely control, stop and hold a fully equipped vehicle under all normal operating conditions. Both systems shall be readily accessible for external adjustment. Antilock brakes shall be installed for improved safety on the airport operational areas. Brakes shall meet the following requirements:

- A. Service Brakes.** The service brakes shall be as approved by the axle manufacturer for this application.
- B. Air Compressor.** Provide manufacturer's standard catalog air compressor.
- C. Antilock Brakes.** Vehicle shall be equipped with 4S/4M electronic antilock brake system.
- D. Air Dryer.** Brake system shall have air dryer and heated air tanks with drain.
- E. Disconnect.** Provide a quick connect coupler to allow introduction of shop air into air system upstream of the air dryer for filling on board system with air.
- F. Remote Cable Drains.** Remote cable drains shall be provided for each air tank.
- G. Parking Brake.** Chassis shall be equipped with parking brake with warning light or buzzer. Parking brake shall be independent of service brakes.

#### 4.11 STEERING MECHANISM.

The vehicle shall have a steering mechanism that is operated from the driver's seat. During normal operations, the mechanism shall be capable of controlling the vehicle with all equipment operating. Steering equipped with power assistance shall revert to manual operation in the event of power assist system failure or be equipped with a dual power steering system that operates in a fail-safe manner so that the failure of one system will not lead to a loss of steering. The design of the steering mechanism should, in the event of a power assist failure, be capable of safely maneuvering the vehicle off the primary operational areas of the airport and to a park position from the maximum design speed allowed on the airport.

- A. All wheel steering.** All wheel steering is required. Operator shall have the ability to electronically switch between front wheel steer, rear steer, crab steer, AND coordinated steer. Current steering mode shall be indicated in the cab of the vehicle.
1. The all-wheel steering system shall be preprogrammed with multiple steering modes. The driver shall have the option to select one of the following modes of operation while in motion based on the driving conditions at hand.
    - a. **Front Steer.** When in front-steer mode the vehicle shall behave like a conventionally steered vehicle. The axle lock shall remain in the locked position and the rear axle does not steer.
    - b. **Coordinated Steer.** This mode shall allow the tightest turning radius of any of the available modes. When the front axle is steered, the rear axle turns in the opposite

direction of the front, reducing the turning radius and enhancing maneuverability.

- c. **Crab Steer.** When the front axle is steered, the rear axle steers in the same direction as the front axle. This makes the vehicle travel in a diagonal motion.
- d. **Joystick or Manual Rear Steer.** When in this mode, the rear axle is controlled only by the joystick, independently of the front wheel position.
- e. **Switching Between Modes.** Front and rear wheels must be within 4 degrees of straight-ahead position before mode change occurs.
- f. **Mode Lights.** The all-wheel steer system shall have mode indicator lights.
- g. **Rear Wheel Position Gauge.** The all-wheel steer system shall include a rear wheel position gauge.

#### 4.12 SUSPENSION SYSTEM.

Vehicles shall be equipped with a current production model suspension system having a minimum rated capacity equal to the GVW of the carrier vehicle. When required, front and rear axles shall have auxiliary suspension springs. Manufacturer's capacity ratings may not be arbitrarily raised to conform to the requirements of this specification. The suspension system shall exhibit no permanent set after the load is removed.

#### 4.13 WHEELS, RIMS, TIRES, AND TUBES.

- A. Wheels, rim and tire ratings shall conform to The Tire and Rim Association's published recommendations.
- B. **Tires.** Each tire shall have a rated carrying capacity at least equal to the loads imposed on them in the maximum load configuration (i.e., rotary plow up and rotary plow down). Tires on each individual axle shall be of the same size. Tires between axles may vary due to loads, configurations, and engineered gearing sets. In such cases, care must be taken and all components must be viewed as a system that provides an acceptable speed match between driven axles. Tires shall have an aggressive tire tread. Tires (and tubes when applicable) shall meet the first line commercial grade requirements for the speed and type of service required. The front and rear tread widths shall not vary by more than 4%.
- C. **Spare Rim/Tire.** One spare rim and tire shall be provided for each type, size and configuration on the vehicle. **This shall include a spare caster wheel.**

#### 4.14 HYDRAULIC SYSTEM.

The hydraulic system shall consist of appropriate rams, pumps, piping, fittings, valves, controls, fluid reservoirs, filters, coolers, and other parts essential to its full operation. The system shall be capable of hydraulically positioning equipment through the entire range of its design limits. It shall be capable of operating all controls simultaneously without a noticeable reduction in power response. All hydraulic controls shall be located in the vehicle cab. The equipment manufacturer shall avoid high pressure hydraulic lines within the cab by means of remote cable or electric over hydraulic controls whenever possible. If a high pressure line must be located within the cab, it shall be properly shielded to protect the operator to the satisfaction of the purchaser. The system shall be ruggedly constructed and able to withstand all loads imposed on it without relying on the use of mechanical locks. Adequate cooling must be included to maintain acceptable hydraulic oil temperatures throughout expected vehicle operational ranges. Filters within the hydraulic system shall conform to SAE J931.



**4.14.1 Pump(s) and Power Takeoff:** The pump(s) shall be ruggedly constructed and powered by the engine through a power takeoff. It shall have sufficient capacity to operate the hydraulic equipment specified herein under all operating conditions and speeds. Belt driven pumps should be avoided whenever possible.

**4.14.2 Lines and Fittings:** Only commercial quality hydraulic lines, hoses, and fittings that are capable of withstanding system working pressures under load are acceptable. Hydraulic hoses shall have a bursting pressure of three times their rated working pressure. The use of fittings, joints, and connections shall be kept to a minimum. Where local climatic conditions require, the purchaser should consider requiring arctic type hoses with temperature ratings appropriate for the location. Test gauge connection fittings shall be provided at all suitable points throughout system for maintenance and trouble-shooting. All hydraulic system components are to be shielded from engine exhaust heat, and heat shields shall be installed on the engine exhaust system to divert any possible leakage from the hydraulic system. Hoses shall be installed inside steel tubing wherever necessary to deflect the flow of fluid from exhaust and electrical system components in the event of hose rupture or leakage.

**4.14.3 Fluid Tank:** The hydraulic fluid tank shall have a filler neck consisting of a strainer, drain plug, shutoff valve, air vent and baffles. Its capacity shall exceed the volume of oil required for the operation of any combination of attachments by 50%. A sight glass or other device shall be provided to allow the operator to verify that fluid level is sufficient for safe operation without the necessity of opening the system. An oil level warning device shall be provided in the cab for all hydraulic systems. A label shall be installed as close as practical to the filler neck indicating the proper fluid for servicing the hydraulic system, and the capacity of the tank.

**4.14.4 System Winterization:** Hydraulic systems shall be designed and operated in accordance with the requirements specified in ARP1247. The hydraulic system shall meet the same low temperature requirements as the engine coolant system. Where appropriate, properly sized shutoff valves shall be installed on each side of all filters to facilitate filter changing with minimal fluid loss. If filters are installed in compartments or other areas where fluid collection is possible, drain holes will be installed to allow fluid drainage during servicing.

## **4.15 ELECTRICAL SYSTEM.**

The electrical system shall be negatively grounded and installed in accordance with current state-of-the-art practices and appropriate Federal requirements. All vehicle wiring shall be in accordance with SAE J1292. All vehicle body electrical equipment, components, and wiring shall meet the requirements set forth in ARP1247. All parts of the electrical system shall be waterproof, easily accessible, securely mounted, and protected against extreme temperatures, physical damage, snow, oil, and corrosion. All electrical circuit wiring shall be made of stranded conductors with a capacity exceeding the anticipated maximum circuit loading. Insulation of electrical wiring shall be equal to the recommended standards established for insulation materials by the Society of Automotive Engineers (SAE). All electrical circuit wires shall be identified by color or number along their entire length. The wiring codes shall match information to be provided in the supporting service manuals.

**4.15.1** All vehicle components and systems shall operate without being affected by interference damage or disruption including detrimental effects or interference to on-board computer modules from either vehicle generated noise, or stray EMF or RMF fields encountered from any airport operations. EMF and RMF noise sources that may be generated by the vehicle, especially if such noise is detrimental to aircraft, Air Traffic Control, or air navigation equipment, shall be shielded.

**4.15.2 Power Supply:** The carrier vehicle shall be equipped with self-regulating electric alternators having an output capacity that exceeds the anticipated electrical load. The minimum idle output of the alternator shall be 20% greater than that required by the vehicle with the engine operating at idle, heater and defroster set at low fan setting, parking and/or marker lights on, communication radio(s) on, windshield wipers operating, and either hazard flashers or Vehicle

Safety Identification Lights on. The minimum output of the alternator when operating at governed engine speed shall be 20% greater than that required by the vehicle in its operating mode with the heater and defroster set to maximum settings, headlights and marker/taillights on, communication radio(s) on, windshield wipers at maximum setting, and the Vehicle Safety Identification Lights operating. An electrical load analysis worksheet shall be provided to the customer prior to construction showing the electrical loads during the above-described conditions.

**4.15.3 Batteries:** Batteries shall be securely mounted and adequately protected against physical injury, water, chemicals and exhaust heat. They shall be properly sized based on vehicle manufacturer recommendations and be readily accessible for change out and for other purposes. Enclosed battery compartments shall have adequate ventilation. Battery capacity (cranking amps, voltage, reserve power, continuous/deep cycle demand) shall be compatible with the size of the engine and the anticipated electrical load expected under normal operating conditions. An on-board self-regulating battery charger is required.

**4.15.4 Starting Device:** The vehicle shall have an electrical starter that shall not introduce a voltage drop sufficient to adversely affect the ignition system. It shall be equipped with an overload protection device if such device is available from the manufacturer of the starter. The following types of electrical systems are acceptable:

- A. 12 volt electrical and starting.
- B. 12 volt electrical/24 volt starting.
- C. 24 volt electrical and starting.

**4.15.5 Ignition System:** A high idle control for efficient engine warm up and stand by operations shall be provided. High idle switches or throttle controls shall be designed to operate only when the transmission is in neutral.

**4.15.6 Backup Alarm:** All vehicles shall be equipped with a backup alarm installed at the rear of the vehicle. The backup alarm shall be activated whenever the transmission is placed in reverse. The backup alarm shall be a SAE J994, Type B vehicle backup alarm.

**4.15.7 Horn:** The vehicle shall be equipped with an electric or air horn to allow the operator to provide an audible warning in an emergency.

#### **4.16 LIGHTING SYSTEM.**

The lighting system, including reflectors, markers identification and clearance lights, shall conform to FMVSS 108 as though the vehicle were an on-highway vehicle.

**A. Headlights:** The carrier vehicle shall be equipped with two or more sealed-beam quartz-halogen or high energy discharge type headlights with upper and lower driving beams and a foot or hand controlled switch for beam selection. If snow removal attachments obstruct forward illumination of these lights an auxiliary set of comparable lights shall be provided to overcome the obstruction. A control to select the secondary lights shall be provided in the operator cab.

**B. Backup Lights:** There shall be at least two backup lights installed at the rear of and at either side of the vehicle that will automatically be activated when the vehicle is shifted into reverse gear.

**C. Vehicle Safety Identification Lights:** The vehicle shall have an amber LED strobe light beacon mounted on cab (see AC 150/5210-5B, Painting, Marking, and Lighting of Vehicles

on an Airport). The light emitted from the beacon should not reflect off rearview mirrors and into the operator's eyes.

**D. Work Lights.** The following work lights shall be installed:

1. Two HID front mounted work lights.
2. Two amber front mounted work lights.

#### **4.17 OPERATOR'S CAB.**

**4.17.1 General:** Carrier vehicle cab shall be made of either metal or fiberglass construction and be of cab forward design. Cab shall be fully enclosed accommodating a single operator plus assistant/trainee (full cab). A definite separation shall exist between the engine and operator's compartment. All non-glass surfaces, such as the floor, sides, and roof of the cab, shall have insulation to reduce exterior noise. The maximum interior cab noise measured at the operator's seat shall not exceed 85 dBa under the following conditions: windows closed, heater and defrost systems at maximum operation, and carrier vehicle and equipment engines operating at maximum rated capacity. All cabs shall provide at least two different routes of egress to allow the operator to exit the cab in the event of rollover or overturn.

**A. Handles.** Handles shall be installed on the lower part of vehicle cab door.

**B. Tilt/Telescoping Steering Column.** Provide tilt/telescoping steering column.

**C. Power Outlets.** Two 12-volt power outlets required.

**D. Cup holders.** Two cup holders required.

**E. Clock.** Provide manufacturer's standard catalog clock.

**F. Dome Light.** Provide auxiliary cab dome light.

**4.17.2 Communications Equipment and Space:** Transceivers shall be installed in carrier vehicles to establish voice communication with other vehicles, the air traffic control tower, and snow control center and maintenance facilities. The vehicle cab shall be designed to provide convenient space near the operator for the installation of a pair of transceivers.

A tunable airport frequency two-way transceiver radio, complete with antennae and microphone shall be installed. Radio and headset to be supplied by Owner. Frequency information will be provided after contract award.

An emergency services two-way transceiver radio, complete with antennae and microphone shall be installed. Radio and headset to be supplied by Owner. Frequency information will be provided after contract award. **Basis of design/function of the emergency services two-way radios shall be Motorola P25. Other radios meeting the specifications and characteristics of the Motorola P25 series radios are acceptable, such as the JVC Kenwood Viking, BK RELM KNG2-P800, and BK-RELM BKR9000-TS.5BS**

In addition, a minimum of two external speakers shall be provided for use behind the operator. Exact location shall be coordinated with the owner.

Bidder shall have the option to program the radios at the factory or use a local vendor to complete programming at the airport. Frequency and programming information will be provided after contract

award.

**4.17.3 Fire Extinguisher(s):** The vehicle cab shall have at least one 2A-10BC interior mounted fire extinguisher that is readily accessible to the operator. Vehicles equipped with fuel tank(s), hydraulic oil tank(s), or any flammable liquid tank(s) that have a total combined volume of 200 gallons or more of flammable liquid shall be equipped with one 20 B:C: Purple K type fire extinguisher installed on the vehicle or equipment at a place readily accessible from the ground.

**4.17.4 Operator Seat:** Operator's seat to be fabric-covered, air suspension type, adjustable for operator height, weight, leg reach and back angle. Armrests shall be provided. Passenger seat shall be installed. All vehicle seats shall have three-point seat belts, certified by the vehicle manufacturer to have been tested and in conformance with FMVSS requirements.

**4.17.5 Windows and Windshield:** An electrically heated windshield shall be provided. The vehicle cab shall maximize the use of glass, including the placement of panels in the lower sections of door panels, to increase the operator's view of operational areas and ground surfaces. All installed glass shall be laminated, safety rated, and conform to all FMVSS requirements. Glass shall be tinted. The location and size of the windshield shall minimize visual obstructions to the operator. The windshield shall be designed to avoid snow build up and be equipped with one or more variable speed intermittent operating wipers (standard or wet arm). The windshield wiper system shall be capable of sweeping a clear view for all occupants up and be equipped with at least one variable speed automatically operating wiper (standard or wet) that is capable of sweeping a clear view for all occupants. The windshield washer reservoir shall have a capacity of at least 1½ gallons. Fluid applicators shall be located to provide at least 75% coverage of the windshield. The cab shall be equipped with sun visors. Windshields and other glass surfaces in the vehicle cab used in the operation of the vehicle and/or to view pavement surfaces, including rear windows if installed, shall be cleared by means of a defroster system that is part of the cab's heating system. The standard circulating air type defroster shall be complimented by electrical type heating systems for glass areas.

**A. Lower Windows:** Provide windows in lower part of cab and cab doors.

**B. Side Window Wipers.** Provide side window wipers.

**4.17.6 Exterior Rearview Mirrors:** Two electrically heated exterior rear-view mirrors of the extension arm type shall be mounted one on each side of the vehicle cab. Rear view mirrors are to be powered and remotely controlled. Each mirror shall have an area of not less than 100 in<sup>2</sup>.

**4.17.7 Heater:** The carrier vehicle cab shall have a heating system that is capable of maintaining a minimum interior temperature of 65 °F at an ambient outside temperature of -20 °F. Heat output shall be controllable from within the cab by a selector switch that is conveniently located to the operator. Under all conditions of heating and ventilation, the temperatures measured in the operator's immediate environment should be uniform within 9 °F (see SAE J1503).

**4.17.8 Ventilation:** Ventilator/heater fan shall have blower capacity equal to one cab volume per minute. Cab ventilator intakes should be screened and positioned in such a manner to minimize the entry of snow.

**A. Air Conditioning:** Provide cab air conditioning system.

**4.17.9 Hour Meters:** Every engine permanently attached to a carrier vehicle shall be equipped with an hour meter that registers engine operation time from 0 to 9999 hours. Hour meters shall be prominently displayed so that they can be easily read by an operator or service personnel. The hour meters shall be of direct read design and shall only register when the engine is running.

**4.17.10 Instrumentation:** The cab shall display an instrument panel equipped with rocker and/or toggle switches and controls (instruments) that are friendly to operators wearing bulky winter clothing. Toggle switches, where used, shall have a minimum length of 1½ inches. Frequently used instruments shall be located in direct line-of-sight and within forearm reach of a medium sized person sitting in the operator's position. All instruments shall be clearly identified with labels that indicate their function. Instruments should display urgency-of-action lights, i.e., green for normal operation, amber for warning, and red for emergency. Instruments shall be illuminated by background lighting regulated by dimmer switches capable of providing infinitely variable lighting intensities. Circuit breakers shall be grouped for easy access and convenience. Typical instruments that report and track major functions of a carrier vehicle and mounted equipment are as follows:

**A. Engine:**

1. Voltmeter.
2. Lubricating Oil Pressure Gauge(s).
3. Coolant Temperature Gauge(s).
4. Tachometer(s) including hour meter(s).
5. Starting Controls (including auxiliary cold start controls).
6. Hydraulic Oil Pressure and Temperature Gauge if applicable.
7. Transmission.

**B. Vehicle Chassis:**

1. Brake-air Pressure Gauges if applicable.
2. Low-air Pressure Warning, visual and audible type if applicable.
3. Light Switches and Headlight Beam Indicator.
4. Speedometer with Recording Odometer.
5. Fuel Quantity Gauge(s).
6. Equipment Controls.

## 4.18 SHEET METAL COMPONENTS.

**4.18.1 General:** The carrier vehicle engine, as well as its mechanical components, shall be protected wherever possible from snow, rain and other winter elements. Body and engine enclosures may be fabricated from aluminum, fiberglass, and/or steel. Self-tapping bolts are unacceptable in the construction of these enclosures.

- A. Steps:** Four-way safety tread, open design steps are required to ascend and descend high profile carrier vehicles. These steps, together with assist handles, shall provide for constant three-point contact, and shall be of ample size to ensure safe and easy access for persons wearing bulky winter clothing.
- B. Walkway:** A four-way safety tread, open design walkway shall be provided, as necessary, for access.
- C. Handrails.** Handrails shall be provided as required at all steps, walkways, and work stations. They shall be made of corrosion-resistant materials or otherwise treated to prevent corrosion.
- D. Fenders:** All carrier vehicles shall be equipped with fenders and non-sail mud flaps to prevent wheels from throwing snow and other debris. Mud flaps shall be attached to the fenders behind the front tires and in front and behind the rear tires.
- E. Drains:** Plugged or free flowing drains shall be provided at all body and compartment locations where standing water can collect. Free flowing drains shall not drain onto sensitive mechanical or electrical components or on areas anticipated to be occupied by personnel during normal operations.
- F. Doors:** Doors shall be equipped with a positive closing mechanism and, where appropriate, a locking mechanism. Top hinged compartment doors shall be held in the open position by a support arm(s).

## 4.19 PAINTING, MARKING, AND LIGHTING OF VEHICLES.

**4.19.1 Painting and Marking:** The vehicle shall be painted Chrome-Yellow in accordance with color tolerance charts that have been made available for FAA regional airport inspectors and key potential users in the aviation safety equipment industry (see AC 150/5210-5B).

**4.19.2** The carrier vehicle shall display the airport logo and vehicle number as indicated in section 1.17-A.6. Actual details for lettering and logo shall be submitted and approved by the airport management prior to vehicle completion.

**4.19.3 Preparation and Finish:** The carrier vehicle and all mounted and towed equipment shall be cleaned first, then treated with a corrosion inhibitor, primed, puttied, sanded, and finally painted. The paint shall consist of not less than two coats of Chrome-Yellow polyurethane enamel, acrylic enamel, acrylic urethane, or similar high durability, long life paint applied to produce full hiding.

**4.19.4 Quality:** The finished paint shall be free of “fisheye,” “orange peel,” chips, runs, or other imperfections that detract from the equipment’s corrosion resistance and appearance.

## 4.20 MISCELLANEOUS.

**4.20.1 Plastic Plates:** Plastic plates are acceptable only in locations that are not exposed to the elements and subject to weathering or excessive heat.

**4.20.2 Information:** Plates shall identify make, model, serial number, and any other relevant data.

**4.20.3 Technical Publications:** The manufacturer shall furnish two complete sets of manuals. One set of manuals shall consist of an Operator's manual, Parts Manual, and Maintenance and Service Manual.

**4.20.4 Operator's Manual:** The operator's manual includes lubrication charts and instructions.

**4.20.5 Parts Manual:** The parts manual identifies and lists all parts, components, and sub-assemblies used in the fabrication of the carrier vehicle and mounted equipment.

**4.20.6 Maintenance and Service Manual:** A maintenance and service manual provides guidance to non-specialists performing routine services. The manual should also describe in detail with appropriate schematics the overhaul and major maintenance procedures required to maintain and repair the vehicle. The maintenance manuals shall include complete schematics of the electrical, air, and hydraulic systems as applicable. Number codes on wires and hoses as found on the vehicle shall match those provided in the maintenance manual schematics.

**4.20.7 Accessories and Tools:** The carrier vehicle shall be equipped with tire tools, a jack, shear pins, and specialized tools as listed below. They shall be kept either in a secure and readily accessible enclosure that is permanently affixed to the vehicle or in the maintenance facilities of the airport.

**4.20.8 Tire Tools:** Lug wrench and any other special tire tool required to change a flat tire.

**4.20.9 Jack:** A jack specifically adapted to the carrier vehicle and of adequate capacity to be capable of raising it to a position where a flat tire can be changed.

**4.20.10 Shear Pins:** A minimum of six pins shall be provided in support of each shear pin located on the carrier vehicle and its auxiliary equipment.

**4.20.11 Specialized Tools:** Specialized tools required for routine servicing of the carrier vehicle and its auxiliary equipment shall be included with delivery.

## **4.21 DELIVERY.**

**4.21.1 Shipment:** The vendor (seller) is responsible for the safe and timely delivery of the vehicle and its accessories, spare parts, and tools to the agreed place of delivery.

**4.21.2 Marking:** Carrier vehicles shall be marked for shipment in accordance with instructions agreed to by the purchaser.

**4.21.3 Instruction and Training:** The manufacturer shall, at no additional cost, furnish the services of trained personnel to the purchaser at a time and place agreed to by all parties. These individuals shall provide instructions to airport personnel sufficient to familiarize themselves with the operational and maintenance characteristics of the vehicle and its auxiliary equipment.

## **PART 5 - METHOD OF MEASUREMENT**

### **5.1 GOODS.**

Goods shall be measured by the lump sum as indicated on the Bid Form. The Goods are all of the tangible personal property to be furnished under the Contract Documents and Specifications.

### **5.2 SPECIAL SERVICES.**

Special Services to consist of pre-delivery inspection, logos and numbering, field testing, startup, operations and maintenance training, and delivery of operations and maintenance manuals shall not be measured for payment but shall be considered incidental to the Goods to which they are associated.

## **PART 6 - BASIS OF PAYMENT**

### **6.1 GOODS.**

- A. Application for Payment 1.** The first Application for Payment will be submitted after delivery of the Goods has been accepted by Owner and will be accompanied by a bill of sale and other documentation satisfactory to Owner warranting that Owner has received the Goods free and clear of all liens, charges, security interests and encumbrances and Field Testing and Startup Services have been completed and accepted by Owner and Operations and Maintenance Manuals have been delivered to Owner. Such documentation shall include releases and waivers from all parties who, during CONTRACTOR's performance under the Procurement Documents, might have obtained or filed any such lien, charge, security or encumbrance. In the case of multiple deliveries of Goods, additional Applications for Payment will be submitted as Owner accepts delivery of additional items of the Goods. For Progress Payment Number 1, Owner shall pay to CONTRACTOR an amount equal to 95% of the Contract Price.
- B. Final Payment.** Final Application for Payment may be requested after completion of initial 60-day operational period. If the application and accompanying documentation are appropriate, as to form and substance, Owner shall, within 60 days after receipt thereof, pay CONTRACTOR the amount due less any sum Owner is entitled to offset, including but not limited to liquidated damages to which Owner is entitled.

### **6.2 ALTERNATE #1 – EXTENDED WARRANTY.**

- A. Alternate #1 –** As an alternate, provide pricing for an extended warranty for the carrier vehicle. The warranty shall be 60 months/5,000 powertrain hours. Contract award will be based on the base bid. The alternate will be considered separately.

**END OF SECTION**