STATE OF ALASKA

**DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES**

**STATE EQUIPMENT FLEET HEADQUARTERS**

**2200 EAST 42ND AVE (RM#319)**

# **ANCHORAGE, ALASKA 99508**

**AMENDMENT No: One (1) February 17, 2015**

INVITATION TO BID: SEF- 1950 Single Engine Snow Blowers

The following changes are required:

NEW BID OPENING: March 4, 2015 @ 2:30 PM

Section III-Specifications:

Replace in its entirety (Page 2 – 31 of this amendment)

A signed copy of this amendment must accompany the bid or be received by the STATE

EQUIPMENT FLEET, 2200 East 42nd Ave (Rm#319), Anchorage, Alaska 99508, prior to the

time set for the opening of the bid.

This amendment consists of Thirty One (31) pages.

Kristi Futrel

HQ State Equipment Fleet

Contracting Officer III

(907) 269-0793

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Name of Company

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_

Authorized Signature Date

**SPECIFICATION 757-2600 AIP**

November 4, 2014

This specification provides information for purchasing and delivery of one 2,600 Tons per Hour Front Mount Snow Blower and Heavy Duty Single Engine, 4X4, All wheel steer Chassis with Forward Mounted Cab. Snow Blower shall be capable of 2,600 TPH minimum @ 75 ft. min. casting distance at a speed of 11 MPH.

**GENERAL SPECIFICATION:**

It is the purpose of this specification to describe a new, and of the manufacturer’s latest current year production model and design, All Wheel Drive carrier for airport use. Carrier is to include a two speed hydrostatic chassis drive system.

A quick attach system is required; it is to allow removal of the blower head for maintenance with only minimal time involved.

The carrier shall be a cab forward configuration but positioned behind the blower chute. Cab forward of blower chute is not acceptable.

The chassis shall have a minimum 38,000 pound GVW rating at the ground and an approximate wheel base of 96 to 120 inches. The total engine horsepower on board shall be 475 hp minimum. The configuration shall be front mounted attachment, forward mounted cab design with near center steering and rear mounted engine.

This snow removal vehicle shall be designed for one man operation and used up to 25 MPH in transport and up to 11 mph during snow removal operations. The design of this unit shall ensure positive tire-to-ground tractive effort while clearing snow. The unit shall have a net minimum cutting width of 102 inches.

Unit is to include all factory standard equipment, unless specified otherwise.

 Unit is to comply with requirements of FAA Advisory Circular #150/5220-20 including any and all changes and updates. This specification will supersede the circular.

 All parts and components of this unit shall be engineered to sustain the maximum load limits and severe operating conditions encountered in snow removal, while resulting in minimum wear and failure.

 These specifications require the doing of all things necessary or proper for, or incidental to the furnishing of said unit. All items of design and equipment not listed in these specifications, but involved in carrying out their intent, are required to be furnished by the bidder, the same as if these items were specifically mentioned and described in these specifications. The unit must be fully assembled and tested prior to delivery by a qualified factory representative.

 The front attachment to front axle dimension shall be kept as close as possible. This cab location and the minimized axle to attachment dimension are necessary in order to have the operator as far forward as good engineering practices will permit, allowing greater visibility and maneuverability while clearing snow.

 The chassis shall be designed to permit easy and safe mounting and dismounting of the unit for operators and service personnel. Grab bars shall be installed as required for safe mounting and dismounting by personnel following OSHA standards of 3-point contact during all mount and dismount activities. This shall include a minimum 1-inch diameter vertical grab bar behind each door, to include round tactile material for improved grip. The inside of each door shall include a minimum 1-foot grab handle positioned under the window. It shall be made of minimum 1-inch diameter material, round only (no sharp edges or corners) for safety. All sheet metal, cowling, steps and fenders shall be free of sharp edges and protrusions, and include ample supports and bracing to prevent distortion and cracking. All steps or walkways shall be raised lug or expanded metal type construction.

**APPLICATION:**

 This equipment will be utilized for winter snow removal operations at airports on runways, ramps, and taxiways, with travel speeds up to 25 MPH.

 Unit will be subject to varying terrain and weather conditions to -40 ℉.

**DOCUMENTATION REQUIRED:**

 A basic manufacturer's product brochure(s) describing the unit(s) being bid is (are) to be provided.

 In addition, specifications marked with an asterisk (\*) require supporting documentation, which indicates specifically what the bidder intends to supply in regard to said items and/or how specifications will be met. In order to help prevent technical errors, following each asterisked item is space that may be used to address all of the asterisked items. It is required that a letter of clarification or the space behind the asterisked items be used to supply the required information. You may use the area behind the asterisked item to refer to a product brochure, manufacturer’s technical data sheet, or letter of clarification, which indicates specifically what you, the bidder, intend to supply in regard to said items and/or how specifications are met.

**TYPICAL MANUFACTURER:**

 *OSHKOSH Single Engine Snow Blower* or *M-Bco. NorthStar Single Engine Snow Blower or others*. Provided all of the following minimum specifications are met.

1. **POWER TRAIN – CARRIER:**
	1. Engine – Carrier:
		1. (\*) Diesel, water-cooled, four (4) cycle, 11.9 liter minimum displacement, electronically controlled, 475 SAE gross horsepower minimum, 1,544 pound foot Torque minimum. Not to exceed 2,100 rpm.

* 1. Engine, General:
		1. (\*) Engine to be mounted to rear of chassis for unit balance and to allow for minimum noise injection into cab and shall be equipped with latest diesel electronic control and engine management system.

* + 1. Governor will be of the correct type to control and limit engine speeds as recommended by the engine, driveline, and power train component manufacturers, for its intended use in this vehicle.
		2. To be equipped with electronic high idle circuit, to maintain approximately 1200 RPM (for warm-up purposes). Cable control is not acceptable.
		3. (\*) Engine shall meet EPA emission requirements as per AIP.

* 1. To be equipped with manufacturers latest electronic controls for fuel injection and engine management including an automatic shutdown system with manual override and an electrical connector for *CAT* diagnostic system, or equivalent.
	2. Engine Air Intake System:
		1. Must have two (2) stage (dual element) air cleaner.
		2. Air filter restriction indicator, dash display mounted.
			1. (\*) Air intake shall include a manually or electronically switched inside and outside intake air system that will allow inside air intake when outside ambient temperature is 40 ℉ or below, or outside air intake when outside ambient temperature is above 40 ℉. The process of changing from inside to outside or vice versa shall not require any tools other than a standard Crescent type wrench if manual. Electronic switching shall either be operator initiated from the cab or automatically by thermostatically controlled switch. Time involved should not take more than five (5) minutes, even in the most extreme weather conditions for the manual system.

* + - 1. Outside air system must include a cyclonic type pre-cleaner.
	1. Engine Exhaust System:
		1. Exhaust system to be designed to prevent rain, snow, or slush from entering exhaust system.
		2. Exhaust piping to be located away from cab providing maximum visibility and be heat shielded if vulnerable to maintenance personnel.
		3. Horizontal exhaust piping shall be shielded to prevent spilled flammable fluids from contacting surface, where applicable.
		4. Exhaust after-treatment and or muffler and tailpipe shall be designed to minimize noise without causing excessive backpressure.
	2. Engine Cooling System:
		1. The cooling system shall consist of a heavy duty side by side combination charge air cooler, engine coolant radiator, and hydraulic system cooler with vertical flow for maximum cooling with the top & bottom tanks, and side members welded together to form a rigid frame.
		2. The tanks and the core shall be constructed of aluminum or steel tanks with brass cores. The radiator and cooler assembly shall be mounted with vibration isolators.
		3. The hydraulic fluid cooler shall have a low temperature bypass to allow rapid warm up of the hydraulic and hydrostatic system.
		4. Certification and proof of carrier engine cooling tests is required with the delivery of the unit.
		5. Coolant to be extended life type antifreeze, affording protection to -60 ℉. The coolant shall be *DELO* Extended Life coolant (red), or compatible.
		6. A coolant circulation bypass will be provided to allow coolant to circulate within the engine block while thermostat is closed.
		7. Drain cock(s) will be provided at the low point(s) of the cooling system providing maximum drainage.
		8. Clamps utilized on all coolant hoses, one (1) inch inside diameter or larger, are to be “Constant Torque” design, stainless steel. Some engine manufacturers may not allow changing of all clamps due to warranty. Non-constant torque clamps utilized on one (1) inch and larger hoses need to include engine manufacturer's statement that constant torque clamps on these one (1) inch and larger hoses will void warranty. (Statement shall be due at pilot inspection). Engine shall have manufacturers certification (supplied no later than time of pilot inspection) that the engine will maintain, but not exceed, a continuous operating temperature, as an operational unit, with a wide range of ambient temperatures to as low as -40 ℉.
		9. Safe and easy access to radiator fill shall be provided (hand rails with built-on ladder if necessary).
		10. Engine coolant level sight gauge, easily seen by maintenance personnel when checking engine oil, etc.
		11. Hoses: OEM silicone or better to be provided on all radiator and heater hoses.
		12. Daily maintenance points shall be clustered at the right side and shall be easily accessed.
	3. Engine Fuel System:
		1. Capacity: 200 gallon min.
		2. When more than one (1) tank is furnished, dual fuel tanks shall be interconnected with a single side fuel fill, 30 GPM fill rate with shut-off valves at each end. A heated fuel/water separator shall be installed in the supply line.
		3. Filter(s):
			1. To be spin-on or cartridge type.
			2. To include ¼ turn ball valve(s), check valves, or high mounted to prevent excessive leakage when changing fuel filter(s).
			3. To be located in engine compartment.
		4. Fuel tank(s) to be frame mounted so as not to affect the balance of the unit (full or empty).
		5. A protective framework of channel and steel sheet shall be provided on the outer side of the tanks to fend off damage from snow banks encountered during operations.
		6. Fuel fill, minimum four (4) inch diameter with chained cap and removable strainer basket, shall permit easy fill operation, including access room, by all ground personnel (short or tall in height). Tight caps may require “Wings” to permit easy removal/installation.
		7. Fuel line(s) shall be securely fastened in place, installed to prevent strains, and protected by grommets where lines project through aperture(s) in metal.
		8. Fuel Drain:
			1. To be equipped with brass tank drain plug on each tank.
	4. Engine Oil Filtration: Oil filters to be spin-on or cartridge type.
	5. Engine Oil Drain:
		1. To be equipped with a ¼ (one-quarter) turn ball shut-off valve (easily accessed). An extension hose, or piping, may be required to allow draining of oil into a bucket or pan that would be positioned at ground level.
		2. The ball valve, end of the hose, or piping would require a threaded cap or plug.
	6. Engine Cold Starting Aids:
		1. Glow plug system or air intake ribbon type heater or automatic electronic single shot canister type. Ether single shot system to be KBI Dieselmatic or *TURNER* Quick Start.
			1. If Automatic Ether System:
				1. To be wired through starter button.
				2. To include an engine sensor switch.
				3. System to be installed in engine compartment and to have maximum protection from the elements.
		2. Engine Coolant Block Heater: Immersion type, 120-volt AC, with highest wattage available by OEM engine manufacturer.
		3. Engine oil pan heater, one (1) each, 300 watt, 120 volt AC, immersion type.
1. **DRIVE TRAIN - CARRIER:**
	1. Design: To be two (2) axles, single tire, 4x4.
	2. Transport Speed: With snow blower head in transport position, shall be capable of maintaining a continuous forward speed of not less than 25 MPH on dry level pavement.
	3. Carrier Transmission:
		1. Chassis movement shall be accomplished by means of hydrostatic drive over mechanical components.
		2. The main hydrostatic pump shall be direct driven from the crankshaft end of the engine, and shall be a Danfoss H1 Series or state approved equivalent 100cc variable displacement axial piston pump or equal. It shall be linked to a variable displacement 160 cc Danfoss or state approved equivalent bent axis piston motor that provides the input to a two-speed mechanical transfer case to accomplish all wheel drive and power to both axles.
	4. Transfer Case:
		1. A two speed transfer case shall be supplied
		2. The transfer case shall provide for constant drive power to the front wheels with air controlled couple/decouple to the rear axle when additional tractive effort is needed by the operator.
		3. The hi-low range selection shall be electric over air actuated and operated from the cab and equipped to eliminate range shifting at excessive speeds.
			1. Switch shall be stage bump type, moving the shift from low to high or high to low.
			2. For vehicle and equipment protection, if the shift is not completed by the electric/hydraulic system within one (1) minute, the system shall cease attempts at range shift and notify the operator of the failure by flashing light at the control switch.
			3. Operating range of the transfer case to be displayed on the main dash LCD screen or back lit switch.
	5. Axles:
		1. The steering-drive wheel ends shall be bolted to and removable from the center section of the axle housing.
		2. The permanently lubricated cardan drive type joints shall be enclosed in a ball and socket or the Oshkosh cage ring style steering ends with the heat treated shafts are acceptable.
		3. The trunnion pins shall be supported by high capacity low friction sealed spherical bushings or the Oshkosh cage ring style steering ends with the heat treated shafts are acceptable.
		4. Front:
			1. The front axle shall be a single tire design with a single reduction hypoid gear design.
			2. Minimum 29,000 pound GAWR for the MB or 27,000 pound GAWR for the Oshkosh.
			3. 10" ground clearance minimum.
			4. Capable of withstanding the loads of the unit being bid.
			5. A limited slip differential or driver controlled differential lock is required in the front axle.
		5. Rear:
			1. The rear axle shall be a single tire design with a single reduction hypoid gear design.
			2. Minimum 27,000 pound GAWR for the MB or 23,000 pound GAWR for the Oshkosh.
			3. Minimum 10" ground clearance.
			4. Capable of withstanding the loads of the unit being bid.
			5. A limited slip differential or driver controlled differential lock is required in the rear axle.
		6. Front and rear tread widths shall not vary more than two (2) inches. Wheel spacers shall not be used to obtain correct tread widths.
		7. Must have sufficient weight on front axle to provide adequate steering and braking control when Tapley or MU values are at 0.20.
		8. Vehicles equipped with driver controlled differential locks shall have a single dash mounted switch operating both locks.
	6. Drive Lines: Shall include shielding or guards to prevent damage to specialized components, such as hydraulic components, in case of driveline failure.
2. **CHASSIS:**
	1. (\*) GVWR: 38,000 pounds minimum.

* 1. (\*) Wheelbase: approximately 96 to 120 inches.

* 1. (\*) Ground Clearance: Minimum of ten (10) inches.

* 1. Frame:
		1. Straight steel frame.
		2. (\*) Yield Strength: 110,000 PSI, minimum.

* + 1. (\*) RBM: 2,500,000inch pounds minimum.

* + 1. (\*) Overall frame width to be between 34 and 39 inches nominal to minimize wracking and torsional stress during operation.

* + 1. Frame assembly to include cross members in addition to engine and drive train components to provide lateral frame stability.
		2. An integral front frame extension shall be provided.
		3. Cross members are to be bolt-on (welded is not acceptable).
		4. Frame liners, wrappers, fish plating, and bolt-on extensions are not acceptable.
		5. Welding to the frame is not acceptable.
	1. A full width rear bumper is required to protect the rear of the vehicle.
		1. Bumper shall have a minimum height of 24 inches to offer ample protection at rear of the vehicle.
		2. Bumper shall include ballast as required for weight and balance.
	2. There shall be two tow eyes mounted on the rear of the vehicle frame and a pintle hook in the center.
		1. Tow eyes shall be capable of pulling the vehicle off the roadway without inflicting damage to the vehicle.
		2. Pintle hook shall be rated minimum 5 ton (2,000 MVL, 10,000 MGTW).
	3. Mud flaps shall be provided behind both axles and in front of the rear axle.
		1. Mud flaps shall be full width of the tire (sidewall to sidewall) and extend to within 12 (twelve) inches of the ground.
		2. Mud flaps shall be anti-sail type.
	4. Steering:
		1. Front axle steering shall include integral hydraulic power assist gear. The steering gear shall be rated for heavy duty service.
		2. For safety, a mechanical linkage shall be maintained between the operator’s steering wheel and front axle, allowing manual steering in the event of a hydraulic or electrical system failure.
	5. Four Wheel steering is required:
		1. Four wheel steering shall be electronically coordinated through the standard steering wheel.
		2. All of the four wheel steering systems controls are to be located in the cab easily accessed by the operator.
		3. The operator shall have the ability to select the desired mode of operation “on the go” with provisions made for safe transition from one mode to the other.
		4. A selector switch within easy reach of the operator shall provide the option of front steer only, crab steer, or coordinated front/rear steer.
		5. Additionally, a thumb switch control on the joystick shall be provided for controlling rear steer only.
		6. The system shall include safety provisions for progressively dampening of all wheel steer effects as speed increases, but it shall also allow full operation while the vehicle is moving at lower speeds.
		7. An indicator shall be provided in the cab to display mode selected and rear wheel position.
		8. A mechanical or hydraulic locking system shall immobilize rear axle in the event of failure or deactivation.
		9. The driver must have the option to select one of the following modes of operation “on the go” based on the driving conditions at hand:
			1. Front Steer: When in the front mode the vehicle behaves like a conventionally steered vehicle. In this mode, the rear axle is locked and does not steer.
			2. Coordinated Steer: When the front axle is steered, the rear axle turns in the opposite direction of the front, reducing turning radius. This mode also has a dead band feature. Dead band allows the vehicle front axle to be turned a predetermined number of degrees in either direction before the rear axle steers. The dead band will vary according to the speed of the vehicle.
			3. Crab Steer: When the front axle is steered, the rear axle steers in the same direction as the front axle. This mode also has a speed controlled variable dead band.
			4. Operator Controlled Rear Steer: The rear axle shall be controlled only by a dedicated control in the cab, independent of the front wheel position. The hydraulic locks shall remain operational; however, the mechanical lock is disengaged (unlocked) at all times in this mode.
			5. Auto-center feature: Assists in relocating the rear axle to the straight ahead position after use of the operator controlled rear steer mode.
			6. Switching Between Modes: The mode switch shall be active at all times. However, the ECU shall not switch modes unless the front axle crosses center for operator safety. If the front axle does not cross center the system shall remain in the previous mode until the front axle crosses center. The rear wheels must also be in the straight ahead position before the mode change occurs.
			7. Mode Indicator: The mode indicator feature shall consist of one of four icons on the operator display indicating which mode is selected and whether rear axle is locked.
			8. A lockout shall be provided which will allow supervisory personnel to “lockout” or “enable” operation of the all- wheel steer system.
1. **BRAKES:**
	1. Service Brakes:
		1. The service brakes shall be fully air actuated, drum and shoe type.
		2. S-cam type brakes are required front and rear.
		3. The air system for this unit shall be equipped with a frame mounted, heated Bendix AD-IS, or approved equal, air drier system.
		4. DISC BRAKES AND DRIVELINE BRAKES ARE NOT ACCEPTABLE.
		5. To include ABS 4S4M system.
		6. Foot operated control, suspended or treadle type.
	2. Parking Brakes:
		1. The parking brakes shall be spring actuated, air released at the rear service brake air chambers with the air switch mounted within the cab and in easy reach of the operator.
	3. Brakes shall be enclosed and shielded to help protect against moisture and sand.
	4. Air System:
		1. Air Compressor: 15 cubic foot per minute (minimum).
		2. Air Filtering Device: To include a Puraguard System Filter installed between the engine air compressor and the air dryer.
		3. Quick release or relay valves to be included for front and rear brakes.
		4. Air Reservoir Tanks:
			1. Heavy-duty, steel construction, primary and secondary Installed in protected locations.
			2. Primary air tank, to include a ¼ (one-quarter) turn ball valve with 3/8 (0.375) inch NPT threads. The ball valve shall be mounted on the outside of the left-hand side frame rail, easily accessible. Ball valve is to include a threaded plug.
			3. Air tanks to have quick-drain to drain moisture from system, easily accessible from side of unit by ground personnel (a lanyard type cord may be necessary).
			4. Safety overload valves to be included on air tanks or air compressor.
	5. Tires and Wheels:
		1. (\*) Five (5) each, including spare, radial tires, mounted on 10 hole rims.
			1. All tires shall be of tubeless design.
		2. This unit shall be equipped with proper sized wheels and tires for the GVW rating of the unit being bid.
		3. Single wheels shall be furnished for the front and rear axles. Disc type hub piloted wheels are required.
		4. The tires shall be Bridgestone L315 open shoulder traction tread 445/65R22.5 or State approved equal.
		5. Supplied tires must be readily available from commercial truck tire outlets.
		6. **SPARE** tire with mounted wheel to be shipped loose. Spare must fit both axles.
		7. All tires to be identical.
	6. Suspension:
		1. The unit shall have alloy steel springs of the parabolic taper leaf type.
		2. Minimum 29,000 lb. front and 29,000 lb. rear ratings for the MB and 27,000 lb. for the front and 23,000 lbs. for the rear on the Oshkosh.
		3. The spring hangers, pins and supports shall be heavy duty to give long life.
			1. The pins shall be of the greaseable type with substantial bronze bushings.
		4. Suspension will be designed to allow for proper operation of specified attachment.
		5. All fasteners to be grade eight (8), per SAE J429.
2. **ELECTRICAL:**
	1. Electrical system shall be multiplex technology for efficiency and maximization of control parameters.
	2. All electrical control switches to be direct current rated.
	3. All instruments and controls shall be labeled in a manner to remain legible for the life of the unit and shall be illuminated.
	4. All OEM wiring shall be either harness, cable, split loomed, or shrink-wrapped. All wiring shall be color-coded, wire numbered matching drawing schematics and terminal strip, and labeled every 12 inches as to what it is used for. The gauge wire and processes shall be in accordance with common wiring practices.
	5. Required circuit breakers for analog circuits shall be easily accessible.
	6. All digitally controlled electrical circuits shall be protected by solid state circuitry and logic.
	7. Power supplies to control modules shall be protected by manual and automatic reset circuit breakers.
	8. Master wiring circuitry boxes shall be mounted behind operator.
	9. Routing through structural members to be protected by grommets and located for maximum protection from snow and ice build-up, grease, oil, fuel, and heat from engine and components.
	10. To be secured by clips at intervals to prevent rubbing or chafing due to movement.
	11. All applicable junction boxes, light housings, etc. to be constructed of corrosion proof material.
	12. Spade and bullet connectors are not acceptable.
	13. Outside of the cab OEM wiring:
		1. All connectors to be corrosion resistant and waterproof. THERMOSEAL and WEATHER-PACK type connectors or state approved equivalent shall be supplied at junction points with totally sealed wiring harness (no plastic split loom) to help prevent corrosion from magnesium chloride or urea.
	14. Non-Factory Wiring:
		1. All dealer/vendor installed items, which require connecting into the vehicle’s electrical system shall be done using an OEM factory modified wiring kit whenever possible. All non-factory wire connections (splices, connectors, etc.”) shall be soldered and shrink tube insulated with adhesive/metable sealant, thick wall polyolefin shrink tubing (3M EPS-300 or equal). No non-factory crimp connections allowed. No cutting or splicing into the factory wiring harnesses allowed. All electrical connectors shall have dielectric grease applied to terminals to help reduce corrosion.
		2. All accessories (strobe lights, operator controls, Light bars, etc. shall be wired through a 12-volt DC constant duty solenoid and controlled by bus bar mounted and permanently labeled auto-resetting circuit breakers. The solenoid shall be wired to the key switched side of the system.
		3. All non-factory exterior wiring shall be encased in a totally sealed wiring harness (no plastic split loom) to help prevent corrosion from magnesium chloride or urea. The wiring harness shall be well secured to the truck with neoprene aircraft stainless steel adel clamps. Rubber grommets shall be used at all areas where the wiring passes through areas that could damage the wiring.
	15. Master Electrical Switch:
		1. Single or dual high ampere master electric switch(es) to cut off power source from battery to the ground and remainder of electrical system. If positive side switch(es) are used, positive lugs on switch shall be protected against accidental arching or shorting to ground.
		2. Located driver’s side, in cab or near battery location, easily accessed, but not ordinarily visible to persons unfamiliar with vehicle.
		3. Key type starter switch for chassis engine with integrated safety checks shall prevent starting when an unsafe condition is detected.
	16. Batteries:
		1. Four 12-volt maintenance free batteries with a minimum total of 3600 cold cranking amperes.
		2. Batteries shall be installed in a frame mounted compartment with corrosion resistant interior.
		3. To include jump start lugs at or near the battery box.
			1. Lugs to be shielded or enclosed to prevent inadvertent shorting.
			2. Polarity shall be marked by color and signage.
	17. Charging System:
		1. Alternator: Minimum 240 AMP engine driven.
			1. If an inverter is utilized in the system, (such as A/C type heated windshield) the alternator size is to be minimum 270 AMP.
		2. (\*) High amperage draw (DC) heated windshield(s).

* + 1. (\*) Any inverters used to power a 110-volt heated windshield are to provide an output waveform that has a pure sine wave and also that the unit supplied is to be UL approved.

1. **Lighting System:**
	1. All lighting shall conform to FMVSS and shall be 12 volts, and shall include, but not be limited to, the following:
	2. Two fender or cab mounted Halogen headlights, with High/Low beam and w/ integral turn signals per FMVSS.
	3. Two headlights with high/low beam and integral turn signals mounted near front outside corners of cab near leading edge or on a light bar. Light bar shall be vertical and made of round material to allow infinite positioning and aiming of auxiliary lighting as specified.
	4. Dual LED stop, tail, turn, clearance and backup lights to be TRUCK-LITE Model Super 44 LED or equivalent.
	5. Driving Lights: Typically “WHELEN pioneer plus Dual beam” Two (2) each, LED, each having a combination spot/flood beam positioned on the outermost upper forward corners of the cab preferably on a light bar.
		1. A switch, common to both lights, shall have positions for: OFF/FLOOD/SPOT/BOTH.
	6. Two LED cab dome lights. Light is to come on when opening door(s) and is to also be operated by a separately driver controlled switch.
	7. Variable intensity instrument lighting, with ramp up push button control.
	8. Deutsch type sealed connector required at each light bar to pass electrical connections through cab shell.
	9. Four LED flood lights to be mounted under chassis engine hood.
	10. One switched LED flood light in shear bolt area.
	11. An LED license plate bracket and light are required.
	12. Turn Signals: Self-canceling with 4-way flashers.
	13. Spot Lights:
		1. Two (2) each, *GO-LITE* Model 3067, to be located on left and right side of upper cab area (preferably on a light bar system. Remote controls to be provided and placed on upper or lower dash, easily accessed by operator.
	14. Work Lights:
		1. Two (2) each, eight (8) inch x three (3) inch (minimum size), LED flood (typically WHELEN pioneer flood) mounted left and right, mounted mid-ship (center of vehicle facing right and left) and 3,500 lumens each minimum output. These lights are to include their own switch.
		2. Two (2) each 3,500 lumen flood, (typically WHELEN pioneer flood) mounted left and right, rear of unit. To be facing rearward. These lights are to include their own switch.
		3. All flood and spot lights shall have adjustable mounts (left, right, up, down).
	15. LED Beacons:
		1. Two (2) each, WHELEN Micro edge 400 led strobe lights mounted on cab roof, visible from all directions.
		2. Two (2) each, WHELEN Single light 400 linear rear box LED strobe lights inset mounted top rear of unit, shielded to prevent flashing of light into operator’s cab.
		3. All strobes: Left lenses color to be amber, right lenses to be blue.
		4. Switch control center for LED strobes with “OFF/LOW/HIGH” to be within easy reach of operator.
		5. All cabling, flashers, modules, etc. required for a complete functioning system are required.
		6. Synchronized flash pattern shall be end user specified.
		7. WHELEN contact: Kent Bruce, phone #206-510-2060.
2. **CAB:**
	1. This unit shall have a fully enclosed, thermally and acoustically insulated (85 db. max. as measured 6" from the drivers ear at full engine RPM), fiberglass, aluminum or steel, and glass cab.
	2. The operator shall be positioned slightly right of center.
	3. Two Coat hooks, rear of cab, are required.
	4. Two cup holder’s minimum shall be located between the seats.
	5. Adequate space for the convenient installation of a communication radio shall be provided. Master connection point for radios shall be in the center of the cab, below the windshield, within easy reach of operator and passenger.
	6. Minimum cab height shall be 132" as measured from the ground to the top of the cab to insure good visibility over front mounted attachment.
	7. The cab shall be positioned behind the blower chute or volute; cab in front of blower is not acceptable.
	8. (\*) Cab Shoulder Width: Minimum 56 inches and maximum of 80 inches, wide enough for a two (2) man cab, but narrow enough for adequate visibility to the left and right for the operator.

* + 1. The floor of the cab shall be insulated with thermal-acoustical sound barrier floor mat.
		2. A top layer of Rubber matting on floor shall be slip resistant.
	1. Heater and Defroster:
		1. High output, fresh air type heater/defroster with multispeed fan motor, mounted behind the operator to minimize visibility obstructions to the front.
		2. Must keep cab temperature at 50 ℉ while exterior is at -40 ℉.
		3. The Heater/Ventilation shall include a screened and filtered inlet vent near cab rear for fresh air intake into the HV unit.
		4. Air flow of 380 CFM minimum required.
		5. Vent controls shall be provided from panel selection including inside or outside air intake.
		6. Defroster ducts to front windshields and right and left side windows minimum.
		7. Auxiliary Heater:
			1. To be fresh air type.
			2. May be an independent core and controls or utilize a second heater core next (married, plumbed in parallel) to the primary.
		8. Heaters (independent) are to include independent temperature settings (utilizing carrier’s hot engine coolant).
			1. Main heater to include minimum three (3) speed fan motor(s).
			2. Auxiliary (independent) heater may be single speed.
		9. Heater hoses are to include valves near the inlets and outlets of the heater cores for use when maintenance is required on the heater preventing excessive coolant loss. Valves are to be easily accessed gate or quarter turn full flow type.
		10. Caged Defroster Fans: Two (2) each, upper windshield mounted, each having two (2) speeds, independently controlled.
	2. Air conditioning:
		1. To be internal. Roof mounted is not acceptable.
		2. Not applicable with auxiliary heater (Married core type).
	3. Glass/Windows:
		1. A multi section or single piece windshield is acceptable, minimum 3000 square inches is required.
		2. Side windows shall be power up/down type, one on each side of cab in each door, 6 square feet each minimum.
		3. Rear window shall be minimum 3 sq. ft., stationary type.
		4. Rear corners of cab shall include sight windows for visibility of processed surface, approximately 250 square inches each or a full rear window allowing a seated operator to view the processed material is required.
		5. Four sight windows, approximately 550 square inches total, are required in the cab front fascia below the windshield to assist operator in monitoring blower and casters. Casters easily visible from the seated operators position shall not require the four sight windows above.
		6. Side sight windows required in lower portion of each door, 150 square inches each.
		7. All windows shall be tinted safety glass, DOT approved and marked.
		8. Front windshield(s) shall be heated by electrical lamination. Glue-on heat strips are not acceptable.
		9. Front windshield and side windows to include driver’s area sun visor, fold-up style, green or gray tinted visor.
	4. Wipers:
		1. Electric 2-speed minimum with variable intermittent wipers for front wrapped windshield, providing operator absolute clear line of vision, minimum 75% swept surface of the windshield is required.
		2. (\*) Optional Item pricing required: Heated windshield wipers, operator switched and thermostatically controlled.
		3. Six quart reservoir for wet arm wipers required. System shall include an automated sequence which soaks the windshield and performs wiper sweep with the press of a single button, minimizing dry wipe.
		4. Side window wipers (on both left and right) are required.
		5. Side wipers are to be heated. Wipers are to have a timer setup for off when vehicle parking brake is active.
		6. Door window wipers are to have an auto-park when window is opened.
	5. Deluge System:
		1. Minimum 16 gallon capacity system is required with dedicated pump for visibility enhancement. The washer solvent shall be directed at each side window, each outside mirror, and the front cab glass by means of a minimum six (6) each dedicated nozzles. This is in addition to normal wet arm wiper systems.
	6. Seats:
		1. The operator seat shall be air ride, high back, fully adjustable in the horizontal and vertical positions, left side arm rest, adjustable lumbar support, cloth covered, load adjustable and furnished with 3 point type safety belts.
		2. Custom right side adjustable arm rest shall contain a joystick for blower and independent rear steer control.
			1. Arm rest control shall include a vertical stow feature to facilitate easy egress/ingress of operator.
			2. A gas strut or manual lock shall hold arm rest in the stowed position, with release control provided for operator.
		3. Passenger seat shall be an air ride, high back, fully adjustable in the horizontal and vertical positions, adjustable lumbar support provided to the left of the driver. It shall also be equipped with three point type safety belts; arm rests are not required.
		4. Seat upholstery to be fabric (cloth). Naugahyde or vinyl not acceptable.
	7. Entry:
		1. To have raised lug or expanded metal construction steps.
		2. Grab handles to be provided to assist in entering or leaving cab, or gaining access to catwalk(s) around engine compartment (if so equipped).
		3. Cab doors shall be provided with stainless steel piano type hinges. Hinges shall be bolted to the door and bolted to the cab frame. Hinges shall not be welded to doors and/or cab. Interior lower panels of doors shall include a nonmetallic liner to assist in sound absorption.
		4. Door stop webbing, minimum two (2) each, on each door or one (1) webbing and one (1) shock absorber, to prevent strong winds from “over opening” doors.
	8. Rear View Mirrors:
		1. *Dual West coast style* exterior rear view mirrors, heated, electrically powered (vertically and horizontally), combination including upper standard lens and lower convex lens, fully adjustable, 15x8 inches minimum. Mirrors to include stainless steel or painted steel brackets, at a minimum, with the mirror’s body material being stainless steel or ABS type.
		2. Electrical for heat to mirrors to include a dash mounted independent switch.
	9. Steering wheel to be tilt and telescoping type.
	10. Gauges/Indicators and Controls:
		1. Any and all gauges that show pressure, temperature, etc., are to be in U.S.A. measurements such as PSI, Fahrenheit, etc.
		2. Emergency E-Stop is required in the upper panel to immediately shut down the engine and use engine compression to assist in slowing down impeller and ribbon in emergency situations.
			1. E-stop shall be resettable from inside cab. E-stop shall be located in prominent position directly in front of and above the operator.
		3. A warning device is required to indicate door open when unit drive is engaged.
		4. Multiple access panels in upper console shall allow easy access to switch and wiring connections.
		5. Two auxiliary power outlets required near center of cab for access by operator or passenger.
	11. Instrumentation shall be centered on a color liquid crystal display mounted for easy operator viewing while working.
	12. Multiple selections of display shall be provided for operation and maintenance. Fault codes shall be “notify of failure” with operator attention drawn to the area of fault. Display shall include selectors to page through digitally displayed instrumentation for maintenance and routine pre-operation check list procedures.
	13. A summary of fault messages with most probable resolutions shall be provided in the service manuals required elsewhere in this specification.
	14. Available information shall include:
		1. Speedometer/odometer
		2. Tachometer
		3. Hour meter that registers when engine is running only.
		4. Voltmeter.
		5. Ground speed.
		6. Air pressure gauge, dual system.
		7. Time, date, and ambient temperature.
		8. Blower ribbon speed.
		9. Blower ribbon pressure.
		10. Blower impeller speed.
		11. Fuel level with low level indicated by color: yellow at 15% remaining, red with alarm at 5% remaining.
	15. Warning Icons shall be required for:
		1. Low Air Pressure.
		2. ABS Fail Indicator.
		3. ABS Communication Lost.
		4. Engine Stop.
		5. Check Engine warning.
		6. Low voltage.
		7. Engine overheat.
		8. Engine low oil pressure.
		9. Engine air intake restriction.
		10. Control system node communication lost.
		11. Parking brake applied.
		12. Ground drive direction and range.
		13. Traction lock engaged.
		14. Windshield washer fluid low level indicator.
		15. Message center for fault messages affecting operation.
		16. Hydraulic temperature warning.
		17. Hydraulic fluid level low.
		18. Left and Right turn indicators.
		19. High beam indicator.
		20. All gauges to be back lit.
		21. All switch identifications are to be back lit.
		22. All switches, gauges and controls to be properly identified.
			1. *DYMO* type tape labels are not acceptable.
			2. Stick-on type labels are not acceptable; however, labels with OEM part numbers that are parts manual listed are acceptable.
		23. Toggle switches controlling electrical components to be metal (plastic is not acceptable). Rocker type switches may be plastic or metal.
		24. Self-canceling turn signals with hazard switch.
	16. Horn: Dual air or electric with minimum 113 decibels each.
	17. Hydraulic hoses are not to enter the operator’s cab.
1. **ON BOARD DIAGNOSTIC AND ELECTIONIC CONTROL SYSYEM:**
	1. Functional control of vehicle shall be centered on an electronic control system utilizing J1939 data bus. Reliability and precision operation of the unit requires heavy reliance on solid state circuitry and components and minimized reliance on traditional multi-pin “physical switch” type relays. Electronic control systems shall include on board diagnostic assistance and other features to simplify the operation, troubleshooting, and repair of the chassis.
	2. Electronic control modules shall be of the highest reliability and durability for use in mobile equipment. System shall comply with the following:
		1. High amp manual resettable circuit breaker protection is required upstream from the electronic control modules;
		2. Y’s from the data bus to the modules shall be physically labeled in the vehicle for ease of maintenance and troubleshooting;
		3. Control boxes shall include a dual external LED tattletale, one LED displaying constant illumination indicating power supply, and one LED displaying a “heartbeat” indicating internal proper function;
		4. A timer module shall serve to keep electronic modules live for 5 minutes after last cycle of door switches indicating egress from vehicle. This unit shall maintain heartbeats and power indicators at modules and their function without the key switch on. After a 5 minute period without a change of status in door switches, unit shall automatically shut down completely.
		5. Data bus terminal resistors shall be EXTERNAL to control modules for ease and economy of replacement. Terminal resistors within the control boxes shall NOT be used as part of the electronic system structure;
		6. Certifications of testing and durability of electronic modules shall include:
			1. EMI-RFI (meeting mil-spec of 150 volts/meter)
			2. Salt spray survival for 1,000 hours minimum (ASTM B117)
			3. Water immersion
			4. High temperature tested at 125% overload for 100 hours, minimum;
			5. Vibration tested to 50 g’s
		7. ECM shall be overload and reverse polarity protected with self-diagnostic capabilities.
		8. Field Effect Transistors (FETs) shall provide power output to electrical functions, acting as a solid state relay and circuit breaker in one.
		9. FETs shall shut off automatically in the event of short to ground, cycling on and off to test for proper function to avoid damage while allowing search and repair of fault.
		10. Individual FET ratings and over-current protection to be programmed to values of 1 to 15 amps depending on task assignment.
	3. On Board Diagnostics Features and Performance:
		1. Electronic control system shall include and enable diagnosis of chassis and engine systems by means of the LCD dash display. System shall include the following at a minimum:
			1. Direct readout of codes on the display.
			2. Message area on LCD to display error message to operator as any system function fails.
			3. Available during operation on operations screen:
				1. Error message toggle if more than one failure is present.
				2. Real time operational indicator of system function on diagnostics/maintenance screens.
	4. There shall also be diagnostic connection ports for advanced chassis and engine diagnostics.
2. **BODY:**
	1. Engine Compartment(s):
		1. Fully enclosed with easily removable access doors on left and right sides, or tilt hood, or hinged doors or a right side fiberglass butterfly type enclosure with a hand pump that requires less than 20 strokes to fully open the cover. Lowering shall be accomplished by means of an orifice release to provide a slow and safe lowering of the hood. Hinged doors are to be bolt-on (welded-on doors are not acceptable. Engine Compartment is to be made of fiberglass or aluminum, or powder coated steel. Cooling system, hydraulics and other required elements of the power pack shall be protected by a hood.
	2. Shall provide adequate access to the top, left, and right sides, for maintenance.
		1. Exterior or interior walkways to be of raised lug or expanded metal construction.
		2. Exterior or interior walkways shall include minimum one (1) inch tubular, 42 inches in height, handrails or guardrails and be included for steps that access walkway.
	3. Steel fenders over front and rear wheels. Fenders to be fully undercoated.
	4. Self-tapping bolts, used in sheet metal construction, are not acceptable.
	5. Top access door, or tilting hood, or removable engine enclosure with lifting eyes to accommodate engine removal is required.
3. **Snow Blower Head Lift and WEIGHT TRANSFER SYSTEM:**
	1. The rotary head assembly shall have a hydraulic provision for raising the head from the pavement.
	2. The hydraulic lift mechanism shall be fully operable from the control cab, with hydraulic pump driven by the chassis engine and not affected by the engage/disengage condition of the blower head clutch and pump drive.
	3. The rotary head assembly shall automatically lift when the transmission is put into reverse.
	4. Minimum ground clearance shall be 8 inches under the leading edge when rotary head is at maximum height.
	5. Rotary head drive system shall not bind, rub or vibrate excessively when head is raised to maximum height and shall be able to travel a minimum of 2" below ground level with positive down pressure to clean out surface depressions.
	6. To maximize traction in the work mode, the blower shall be equipped with a weight transfer system that automatically maintains 60 % of the blower head weight on the front axle of the chassis. This shall be accomplished hydraulically by sensing the system pressure and continually adjusting the pressure via electronically controlled hydraulic metering valves.
	7. A minimum of two forged steel casters shall be provided on the blower head, one on each side. The suspension shall be a malleable polyurethane biscuit type to provide some cushion to the head and wheels during the stress of head down, snow blowing operations.
		1. OPTIONAL ITEM, PRICING REQUIRED: Pneumatic casters for locations with in ground lights.
	8. The wheels and suspension system shall be capable of functioning at the 11 mph intended operational speeds of the snow blower.
4. **Hydraulic SYSTEMS:**
	1. As a minimum, hydraulics will be provided to power auger reels for blower head, chassis drive, and hitch assembly.
	2. For high-speed transport, hydraulics shall be able to lift the blower head assembly completely off the ground.
	3. Hydraulic Reservoir(s):
		1. Designed for adequate cooling and shall be properly baffled.
		2. Suction strainer with sump area and provisions made for easy cleaning.
		3. Sight gauge located above pump level.
		4. Equipped with a filler neck with removable strainer basket and air vent.
		5. Drain to be equipped with a ¼ (one-quarter) turn ball shut-off valve (easily accessed). An extension hose, or piping, may be required to allow draining of oil into a bucket or pan that would be positioned at ground level. The ball valve, end of the hose, or piping would require a cap or plug.
		6. It shall be located above the primary hydraulic and hydrostatic pumps to assure adequate fluid supply and minimize the chance for cavitation.
	4. Hydraulic Filtration:
		1. 10 micron or finer return side filtration required.
		2. Filter may be tank mounted and accessed or exterior mounted spin-on type.
			1. If exterior mounted spin-on, mounting location, check valves, or quarter-turn full flow valves shall be utilized to minimize fluid loss during servicing.
		3. Filtration to be in compliance with SAE J931.
	5. Hydraulic Pumps:
		1. The hydraulic pump stack shall be direct driven and shall have constant power input available when the single engine is running.
			1. These pumps shall include ground drive, accessory drive/head motion and positioning, and cooling fan drive.
			2. Through-drive and pump body support shall comply with the requirements as established by the pump manufacturers.
		2. A separate hydraulic pump shall control ribbon drive.
			1. Power to this pump shall be controlled by main blower clutch engagement.
			2. The pump shall be mounted to the two speed gear case that powers the main impeller drive.
	6. To include hydraulic pump manufacturer's certification that the hydraulic system will maintain, but not exceed, a continuous operating temperature, as an operational unit, with a wide range of ambient temperatures to as low as - 40 ℉. *Certification to be provided not later than pilot inspection*.
5. **SNOW BLOWER:**
	1. To be a heavy-duty two stage high capacity system with a helical ribbon and a separately driven impeller capable of producing **2,600 TPH** (ton-per-hour) with a casting distance as measured from the blower to the point of maximum deposition under a no-wind condition of up to 75 feet based on snow density of 25 pounds per cubic foot.. Refer to SNOW BLOWER PERFORMANCE SPECIFICATIONS later in this specification.
	2. Drive System:
		1. Drive Line for impeller: To be heavy-duty, compatible with torque ratings commensurate with the load imposed.
		2. (\*) Impeller drive shall be direct mechanical.

* + 1. (\*) Helical ribbon drives to be hydrostatic.

* + 1. (\*) Shear pin(s) shall be located at the furthest point from drive mechanism so as to minimize damage to drive train components. The shear pins shall also incorporate replaceable shear pin bushings. Shear pins are to include a relief cut in the shear area (standard off the shelf bolts are not acceptable).

* + - 1. **SPARE** Shear Pins: To include 25 complete **sets** including bushings.
		1. Hydrostatically driven components shall be protected by proper hydraulic relief circuits.
1. **Snow Blower Head:**
	1. Ribbon housing:
		1. The ribbon housing shall be fabricated of heavy gauge, high wear, welded alloy steel with tungsten carbide reinforced skid shoes.
		2. The cutting width shall be not less than 102 inches.
		3. Minimum 3/8 inch side plates.
		4. Minimum 10 gauge moldboard suitable for the type of expected service and formed to the contour of the ribbon reel conveyor.
		5. Provisions on the box shall be made for the skid shoes, scraper blade, associated hardware, drives, and controls.
		6. Front opening of the blower head shall be a minimum of 45 inches high, exclusive of flexible spray shields.
	2. Helical Ribbon:
		1. The helical ribbon shall have a minimum diameter of 44 inches.
		2. There shall be a minimum of two bearing supports, one at each end of the reel, and the reel shall be driven from both ends.
		3. Single motor drive is unacceptable. Dual end drive is essential for reliability and performance.
		4. The ribbons shall be made from ASTM A572 GR 50 steel with a minimum thickness of ½ inch.
		5. The ribbon shall be constructed with a serrated curb ring.
		6. Curb ring shall be made of the same material as the ribbon sections. A minimum of clearance shall exist between the rotary head box and the ribbon to reduce snow plowing and carryover.
		7. The helical ribbon assembly including the ribbon core shall be removable for service without removing gear boxes, motors, or disconnecting hydraulic lines.
		8. All hardware attaching the helical blades to the blade supports shall be grade 8 with locking flange nuts.
		9. Ribbon speed shall be selectable by the seated operator for variable snow and operating conditions without varying the impeller speed and cast distance.
		10. The ribbon shall be driven hydrostatically and be reversible from the cab to aid in disgorging excessive or clogged snow from the head by means of momentary electric switch convenient to the operator.
		11. Pump shall be electronically controlled.
			1. Hydrostatic relief shall be provided to protect the system should ingestion of foreign objects occur.
			2. A low oil level/high oil temperature warning system shall alert the operator in the cab to abnormal conditions.
			3. A manual shut off valve shall be provided at the return filter to allow the element to be changed without losing hydraulic fluid.
			4. Hydrostatic pump for ribbon shall be driven by means of a through shaft only when main snow blower clutch is engaged to allow power to the mechanically driven impeller.
		12. Two high-speed hydrostatic motors (Sauer-Danfoss 90 series 55 cc or state approved equivalent) each connected to a planetary reduction gear box shall be mounted within the diameter of the ribbon outer ends to minimize overall width.
		13. The motors shall not support the ribbon loads and the planetary gear box shall be sealed and gear oil lubricated.
	3. Impeller (fan) Configuration:
		1. The impeller system shall have a minimum diameter of 48 inches.
		2. Minimum depth of 19.5 inches.
		3. It shall be designed to be consistent with the capacity of the in-putting ribbon.
		4. The opening, blade diameter and speed ratio shall ensure proper snow flow and discharge to the casting chute.
		5. The five impeller blades must be replaceable (bolt-on), made from T-1 steel and be attached with countersunk fasteners.
		6. All blades shall be constructed and balanced to be resistant to vibration and shock damage caused by high speed ingestion of foreign objects.
		7. The impeller shall be driven by direct mechanical means and shall have swing-bolts to facilitate quicker attachment.
		8. Shear bolt protection shall be provided, but must be located behind the rear face of the impeller housing in an area that includes lighting for field fix of broken pins.
		9. Shear protection located within the normal path of snow through the blower head is not allowed.
	4. The blower drive shall include a full torque clutch, controlled from the cab, for blower drive engagement.
		1. Clutch engagement shall be electric over hydraulic actuation and offer protection against engaging clutch when blower engine is over 800 rpm.
		2. Clutch engage selection shall automatically engage ribbon drive in forward direction.
		3. For safety, the clutch/ribbon engage button shall be illuminated GREEN when activated and the ribbon status icon on the LCD screen will clearly indicate ribbon status as a visual reminders to operator of the status.
		4. Clutch shall automatically disengage when the engine is shut off to avoid attempts at start up with impeller engaged.
	5. A two stage gear reduction system shall be provided between the blower engine and the impeller to provide proper torque and speed at the impeller while allowing the engine to operate at the RPM providing maximum efficiency.
		1. The first gear reduction shall be in a gear box directly downstream from the 3-plate clutch.
		2. It shall be a two speed type box with the first (high) gear correlated to free casting or open casting relatively long distances, and the second (low) gear correlated to close placement and truck loading operations or shorter casting requirements.
		3. Shifting of the gear box shall be possible without leaving the cab with shift limit protection included.
		4. For protection of components, the shifting from high to low and low to high speed for the impeller shall only be enabled when the blower clutch is disengaged.
		5. Automatic protection shall not allow the operator to shift the drop box gear if the clutch is engaged, but shall instead automatically control the engine speed/clutch disengage/shift/clutch reengage sequence for vehicle protection.
		6. The second gear reduction shall take place in gear box attached directly to the rear face of the impeller housing with output directly into the impeller itself.
		7. Protective shear pin location shall be between these two separately mounted gear boxes.
		8. The gear boxes shall include helical gears with pressurized lubrication system.
		9. CHAIN TYPE DROP BOXES ARE NOT ACCEPTABLE.
		10. Driveline shall be Spicer 1810 Series or equal. Twenty Five spare sets of shear bolts, including bushings, shall be supplied with the unit.
	6. The snow casting assembly shall consist of a controllable chute, impeller or turbine snow collector and a control system.
	7. The system shall be designed to accept the maximum output volume of the impeller assembly, with an interior free from sharp bends or obstructions.
	8. The impeller housing shall be built of 1/4 inch steel.
	9. The impeller housing shall be lined with a 0.25” thick AR400 steel liner to include the front and back of the housing discharge.
	10. The casting chute assembly shall rotate in a vertical plane to cast snow to the left or right side of the vehicle through a minimum arc of 140 degrees.
	11. It shall flat cast to the right.
		1. Skid Shoes:
			1. In addition to the caster wheels, the rotary head shall have **carbide** skid shoes located at each side of the rotary head, behind the cutting edge inside the width of the rotary head.
2. **Blower Hitch:**
	1. The blower hitch shall provide low friction, free flotation, shock absorbing, and weight transfer for the blower head (weight transfer, is required for proper functioning of the blower).
	2. The low friction, free flotation is required independent of blower chassis for vibrations and bounce considerations and to accommodate surface irregularities.
		1. A parallel or unequal arm system with a minimum four (4) horizontal pins shall be used.
		2. The arms shall be box or “I” beam construction for torsional stiffness with appropriate diameter pins on greaseable low friction bushings, (no metal on metal) or state approved equivalent.
		3. The pair of hydraulic cylinders shall also “free float and dampen” the parallel arms of the hitch to minimize blower bounce at high vehicle speeds.
3. **QUICK ATTACH HITCH SYSTEM (PART OF CHASSIS):**
	1. The snow blower head assembly shall mount onto the front of the carrier by means of a quick attach hitch system operated by one (1) person.
	2. Carrier:
		1. Shall allow mounting of the attachment being provided with this unit.
		2. To provide a parallel or arcing lift.
		3. Activated by two (2) each double acting cylinders, controlled from the operator’s position in the cab.
		4. All bearing surfaces shall be equipped with grease fittings.
			1. Zerk type fittings, threaded only (no press in fittings)
	3. Head (Snow Blower):
		1. Locking pins, manually installed, to be provided to hold head in relative position with vehicle.
		2. Mating, except for locking, shall be accomplished hydraulically by controls from inside the cab.
	4. Blower Head Removal:
		1. In order to keep time at a minimum for maintenance requiring snow blower head removal, a maximum of one (1) hour is allowed to perform this task by one person that is familiar with the system.
		2. Multi-Coupling Plate:
			1. The multi-coupling plate is a tool allowing the simultaneous couple and uncouple of the hydraulic lines used for all hydraulic functions.
			2. A vented coupler manifold is to be used to release residual pressure prior to disconnecting hydraulic quick-couplers.
				1. It shall also allow for displacement of fluid in the lines during connection.
				2. No more than six (6) hydraulic connections are to be made with each manifold. If more than six (6) lines need to be connected, additional manifolds are to be used (or aMulti-Coupling Plate) on all hydraulic lines that need to be separated from carrier when an attachment is removed.
			3. To be *STUCCHI or State approved equivalent type connector*.
			4. *STUCCHI* is available through *COMPONENT TECHNOLOGY*.
			5. To include quick coupler caps or plugs with cable or chain type retainer regardless of system used.
4. **Spotcast/Truck Loading Chute: OPTIONAL ITEM PRICED SEPERATELY**
	1. A three piece, heavy-duty spot casting loading chute shall be supplied.
	2. The chute shall be approximately 22 inches wide for unimpeded free flow of snow during placement operations from the 19.5 inch wide impeller.
	3. The chute shall rotate on a vertical axis a minimum of 250 degrees on a heavy-duty bearing system powered by a hydraulic motor drive (wire or cable is not acceptable).
		1. All chute functions to be operated utilizing electric over hydraulic control valves.
		2. All hydraulics shall utilize the main hydraulic system.
	4. The chute shall be equipped with a hydraulically actuated chute extension capable of discharging the snow from 25 degrees above and 66 degrees below horizontal for precision spot casting.
	5. The two extending systems shall be controlled via sequence valve:
		1. Section 1 stationary;
		2. Section 2 extending completely before section 3 extension is enabled,
		3. Section 3 retracting completely before section 2 retraction is enabled.
	6. The unit shall be capable of easily discharging into 12 to 20 cubic yard dump trucks with up to nine foot high side boards at a minimum distance of four feet away from the right or left side of the snow blower head.
	7. No hydraulics lines running from the control valves to the chute will have to be disconnected for storage.
	8. The spot casting loading chute, when mounted, shall not impede the flow of snow when bypass casting to left or right thru the impeller housing discharge.
	9. The chute shall have an AR400 bar welded at the very top, before snow would enter into the chute extensions.
		1. This will transition the snow from the chute to the chute extension, projecting the snow at a slight downward angle.
		2. The AR400 bar is to be 2.50 inches long x 3/8 thick with a taper facing the base of the chute.
		3. The inside back of the chute shall be lined with 0.19 inch thick AR-400 steel and the chute extensions shall be lined with 0.19 inch thick UHMW poly.
	10. The entire spot casting loading chute shall be able to fold to the right side for storage or shipping without removing from unit.
	11. There shall be two LED flood lights mounted on the loading chute.
	12. The spotcast/truck loading chute shall be capable of retracting to a maximum of150 inches from the ground to enable transport at a maximum overall height of 158 inches with 8 inches clearance under the blower head to the ground.
5. **VHF RADIO:**
	1. To be an ICOMModel ICA110 VHF (AM) aeronautical band and MOTOROLA XTL 1500, complete with microphone, speaker, external transmit/receive antenna mounted on cab, and to include frequency(s) if listed on the Purchase Order.
	2. The MOTOROLA XTL 1500 shall be 700/800 MHz, Model M28URS9PW1AN, with options, G788, G89.
	3. Installation:
		1. To include noise canceling microphones, external speakers (for inside cab), and cab mounted external antennas.
		2. To be installed by personnel at Anchorage International Airport when delivered in Alaska.
6. **DIMENSIONS:**
	1. (\*) Overall height, 148 inches, maximum. Highest point may be exhaust (without loading chute).

* 1. (\*) Overall transport width, Chassis 103 inches (8 foot 7 inches) maximum.

* 1. (\*) Transport width, with Blower Head, 118 inches (9 foot 9 inches) maximum.

* 1. (\*) Overall height blower head, 92 inches (7 foot 7 inches) maximum.

* 1. (\*) Turning diameter, outside wall to wall, utilizing 4-wheel steer 94 feet maximum.

1. **WEIGHT AND BALANCE:**
	1. (\*) Balance: Unit must be able to stop transversely on a 30 percent grade with no danger of overturning. This requirement must be certified by factory and submitted with bid.

* 1. (\*) Gross Weight, with **Blower Head** attachment in carry/transport position.

* 1. (\*) Weight on Front Axle: With **Blower Head** attachment in carry/transport position.

* 1. (\*) Weight on Rear Axle: With **Blower Head** attachment in carry/transport position.

* 1. Weight Scale Verification Slips:
		1. Required not later than time of delivery (when applicable).
		2. Separate total weight of carrier with blower.
		3. Separate weight on the carrier’s front tires with the snow blower in transport position.
	2. No weights at any wheel position shall exceed maximum allowable weight limits for any component (tires, wheels, axles, suspension, steering, brakes, etc.).
1. **TRAINING:**
	1. The vendor shall provide a factory certified instructor(s) within 30 days of acceptance by the State. This (these) representative(s) shall be prepared and qualified to make all necessary adjustments to the unit and give instruction to the operators to assure correct operation of the unit when it is placed in service.
		1. Please give advance notice to the person listed on the Purchase Order.
	2. Total of 16 hours at the location as noted in each individual Lot Item.
	3. To include a minimum of eight (8) hours of operator training including the following, as a minimum applicable agenda:
		1. Operating procedures per operating manual.
		2. Break-in procedures.
		3. Equipment limitations.
		4. Operator maintenance.
		5. Before operations checks and lubrication.
		6. Safety.
		7. Cold weather operations.
		8. Jump starting.
		9. Welding on equipment.
		10. Towing or transporting equipment.
		11. Instruments and controls.
		12. Gauge interpretation.
		13. Equipment operation, Do’s and Don’ts.
		14. Attachment operation, Do’s and Don’ts.
	4. To include a minimum of eight (8) hours of mechanics (Journeyman level) training including the following theory, trouble shooting, and test procedures for, as a minimum applicable agenda:
		1. Electronics.
		2. Electrical.
		3. Hydraulics.
		4. Air system.
		5. Drive train.
		6. Engine and transmission electronics.
2. **MISCELLANEOUS:**
	1. Additional Safety Features:
		1. To include the following:
			1. Master Switch assembly designed to accept standard padlock (Lock Out)
			2. Master switch is to be disconnected on positive side. Positive lugs are to be protected from accidental arching or shorting.
			3. A 10 lb. ABC fire extinguisher shall be mounted to back wall of cab. A second shall be mounted on the outside of vehicle.
			4. An automatic Fire suppression system shall be installed in the Blower Engine compartment.
			5. An OSHA approved back up alarm with auto adjustment for noise level is required.
	2. Paint:
		1. Lead free.
		2. Color to be manufacture’s standard yellow.
		3. To include sandblasting and three (3) mils of appropriate primer, including frame and wheels. Aluminum wheels shall not be painted.
		4. Metal portions of all snow heads facing the operator shall be flat black to minimize glare.
		5. The inside of the engine housing is to be painted a gloss yellow or white.
	3. Easy access to all maintenance components shall be provided for items such as air cleaners, batteries, radiator fill and drain, oil filters, oil drain (hydraulic and engine), generator, etc.
	4. Winterization: Entire unit to be winterized to provide satisfactory performance in temperatures to minus 40 degrees Fahrenheit. Antifreeze to be of permanent type only providing protection to minus 60 degrees Fahrenheit.
	5. Publications:
		1. Bidder may be required to supply samples of parts and service manuals after bid opening.
		2. Operation, parts and maintenance manuals, including chassis and all component OEM manuals. All electric and hydraulic charts shall include proper labeling and identification. Hand drawn schematics are not acceptable.
	6. Hydraulic tubes, hoses and fittings used shall conform to SAE J514, J516, J517 and J524. A minimum number of fittings, joints and connections shall be used to prevent excessive backpressure, vibration and leakage. Hydraulic lines shall be of sufficient size to permit free flow of hydraulic fluid at temperatures down to minus 40 degrees Fahrenheit.
		1. (\*) A letter of certification/approval from the manufacturer of the hydrostatic drive system components for chassis and rotary head shall be included in the bid package.

* 1. Filters: All elements where applicable to be spin on or cartridge type and easily accessible.
	2. Component Sourcing:
		1. Due to critical nature of vehicle mission and parts support, only current production componentry shall be supplied.
		2. (\*) The bidder shall provide assurance that only unused, newly manufactured components are supplied.

* + 1. (\*) In the bid package, the bidder and/or vehicle manufacturer shall certify that the engine(s), transmission(s), transfer case, drop box and axles to be supplied will be newly manufactured and purchased directly from the original component manufacturer or their authorized OEM distributor.

* + 1. Upon the request of the purchaser, the bidder shall provide copies of purchase orders and invoices properly dated after bid award to verify the source and newness of these components.
		2. Purchase orders and invoices shall reference the component manufacturer, manufacturer's model and/or part number, and the bidders and/or vehicle manufacturer's name and part number.
		3. In the event any of these components are manufactured by either the bidder or vehicle manufacturer, documentation shall be provided indicating manufacture date and chassis installation date by serial number.
		4. Failure to provide appropriate documentation of component sourcing shall be considered cause for rejecting the delivered vehicle. The burden of proof shall lay with the bidder.
1. **PERFORMANCE TESTING (SNOW BLOWER):**
	1. Testing Requirements:
		1. (\*) Bidder is to supply information with their bid as to meeting our capacity requirements as per AC 150/5220-20, CHAPTER 7. OPERATIONAL STANDARDS AND TESTING.
		2.
		3. Independent certification of casting distance at 11 MPH (75 Ft. min.) is required. Any expense incurred with the independent certification will be at the bidder’s expense.

 **End of specification**