

IOWA DEPARTMENT OF TRANSPORTATION
OFFICE OF PROCUREMENT & DISTRIBUTION
EQUIPMENT SERVICES SECTION

FY'2008

SPECIFICATIONS

for

58,000 LB. GVWR

TANDEM AXLE SNOW REMOVAL TRUCK

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TANDEM AXLE SNOW REMOVAL TRUCKS

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STANDARD SPECIFICATIONS
for
SNOW REMOVAL TRUCKS

The following specifications shall apply to common requirements for all components included in the purchase package of snow removal trucks. Included are requirements for the following:

1. EXCEPTION AND/OR APPROVED EQUAL REQUESTS
2. MANUALS, SERVICE PUBLICATIONS, & TECHNICAL SUPPORT
3. VEHICLE IDENTIFICATION SHEET
4. ELECTRONIC SHIELDING - RFI PROTECTION
5. REMOVED COMPONENTS
6. PAINT & COATINGS
7. THREADED FASTENERS
8. WARRANTY
9. PROTOTYPE TRUCK for VIEWING
10. PILOT INSPECTIONS
11. PRE-DELIVERY INSPECTION
12. POST-DELIVERY INSPECTION
13. DATA SHEET

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1. EXCEPTION AND/OR APPROVED EQUAL REQUESTS

- A. All specified chassis equipment is to be OEM installed, either as standard equipment, a line installed option or factory authorized DSO/SE installation unless otherwise specifically stated.
- B. Any items that are not available as chassis OEM installations, and/or any other component, installation, item, or equipment that a vendor wishes to bid differently than requested in these specifications will require review and approval from Equipment Services. Vendor shall submit such requests on the Exception and Approved Equal Request form according to the guidelines established in the bid package. See "Supplemental Terms and Conditions" under "Exceptions or Equals" for more details. Please include all literature, technical data and/or other 'proof' as needed to support such a request.
- C. All requests must be received by Equipment Services within the time period specified so as to allow adequate time for review and dissemination of request status to all other vendors if required. Purpose is fairness to all vendors. Late requests cannot be considered.
- D. Final approval of any vendor or manufacturer's equipment may require a demonstration, current user list, and/or tour of their facility to determine compliance and acceptability. Vendors shall make available, upon request and within one week of notification by the Department, any or all of the following:
 1. A demonstration. A typical and similar same model machine and/or component shall be provide to the Department for up to 2-working days unimpeded evaluation. A physical use demonstration may be conducted if applicable at a Department Maintenance Facility; equipment will be operated by Department personnel.
 2. Contact list. Name, address, and phone number of other customers using the same equipment within the State of Iowa that can be contacted and an unescorted visit arranged. Intent will be to see the equipment in a working environment and talk to the operators and/or owners.

3. A facility tour. Vendor shall provide a list of suitable times to the Department within regular daytime work hours when an inspection tour of their installation and/or manufacturing facility would be convenient.
- E. All costs associated with providing any or all these items are the sole responsibility of the vendor. Inability to comply with any or all will be adequate reason for bid rejection.
- F. The Department reserves the right to reject, without reservation and in our opinion, any equipment it deems:
 1. Not capable of conveniently and/or economically performing the work required.
 2. The vendor has limited or no experience with, to include components, parts, pieces or items that, previous to this bid, the vendor has not marketed, manufactured, or installed, generally meaning it is not a normal production item, installation and/or function in their facility.
 3. Does not have an adequate service and support infrastructure in place to provide continuing long term service and support for the product(s) being proposed.
- G. The Department of Transportation reserves the right to waive compliance on minor technicalities on this specification; to reject any or all bids; and to accept that bid which, in the opinion of the Department, is in the best interest of the State.
- H. All ratings, dimensions, weights, operating systems, and other applicable apparatus shall be according to/in compliance with ISO/SAE Standards and all applicable laws of the State.
- I. The Department reserves the right to waive compliance on minor technicalities; to reject any or all bids; and to accept that bid which, in the opinion of the Department, is in the best interest of the State.

2. MANUALS, SERVICE PUBLICATIONS, & TECHNICAL SUPPORT

- A. Manuals and Service Publications
 1. A complete set of manuals shall be provided for each location receiving a new truck. It is preferred that all publication be a in CD-Rom format. However, the Department will accept paper manuals or a combination of paper and CD (i.e., paper operators manual and CD service and parts manuals). Vehicle payment may be withheld until a complete manual set is received for each specific vehicle.
 2. Chassis set shall be all inclusive, containing all available chassis publications, to include at a minimum an operator's manual, service/repair instruction set (must detail all components), a complete fully illustrated parts manual (must include all components) and wiring diagrams.
 3. As an alternative to CD or paper Service and Parts, chassis vendor can provide a statewide subscription and access to their OEM electronic service and parts system. Unlimited state users. System must be available 365 days, 24 hours a day.
 4. Each chassis shall be delivered with a paper line set ticket.
 5. Snow removal equipment set shall be all inclusive, containing accurate and detailed publications on all components. They shall include at a minimum operator's manuals, service and repair instructions and complete fully illustrated parts lists.

6. CD publications must be provided in a protective case with proper identifying labels. Paper publications must be bound into manuals or installed in binders when delivered to the Department; boxed, shrink-wrapped or otherwise unbound loose pages are not acceptable.
7. In addition to a manual set for each location, 10 additional all inclusive sets must be delivered to Equipment Services. These sets will be distributed to District Mechanics, Purchasing, Warehouse, Central Repair Shop, etc. to provide long term diagnostic, repair, and parts support
8. The Department requires these service publications to include update service at the same frequency and caliber as received in a franchised dealership, delivered to or performed at the truck's assigned field location.

B. Technical Support

1. The Department requires that the successful vendor(s -chassis and snow equipment) provide basic diagnosis and repair training for all electronic systems and components on their trucks. This shall include but is not limited to: engine, transmission, chassis electrical, cab environment, spreader controls, etc.
2. All training shall be supplied gratis and at the request of the Department. If training must be conducted at the vendor's facility, or a facility as directed by them other than a Department facility, vendor shall be responsible for all costs, including but not limited to, transportation, meals, and lodging, for all Department personnel needing training.
3. In addition to this basic diagnosis and repair training, the Department's six (6) District Mechanics and one (1) Repair Shop Mechanic shall be trained and certified to do complete and in-depth diagnostic testing, adjustments, and programming on all systems, to include but not limited to: engine parameters, transmission parameters, chassis electrical system parameters, and all cab environmental parameters. Any and all required diagnostic tools, electronic components, and/or computer software or passwords must be provided. On going training shall be supplied to the Department at the same frequency and caliber as received in a franchised dealership.

3. VEHICLE IDENTIFICATION SHEET

- A. Each truck shall be delivered with an identification sheet in the cab listing the following information: 1) The truck VIN number, 2) the Department P.O. number. An example would be: VIN: 1HTWHADT23J077094
P.O. 146766 - Lines 1, 2, 3, 4, 5.
- B. Each set of truck keys (2-sets required) shall have a key tag identifying the last 6 digits of the VIN, P.O. number and P.O. line item and optional equipment.

4. ELECTRONIC SHIELDING - RFI PROTECTION

- A. Trucks will have 2-way land mobile radio transceivers installed by the Department. These transceivers will operate in high band (150 to 174 MHz). Antennas will be mounted on the roof or highest plane surface of the vehicle. All vehicle electronic circuits including but not limited to ignition, AM/FM radio receivers, computers, emission controls, alternative fuel electronic controls, regulators and/or snow removal equipment controls shall be designed to suppress, bypass or otherwise prevent interference from affecting the Department transceivers. Also, the vehicle electronic equipment shall be unaffected by the radio frequency energy generated by the (up to 125 Watt output) transmitter portion of installed transceivers.

- B. The vehicle electrical system shall be designed so that the vehicle shall not degrade the 2-way radio receiver performance. The entire electrical system shall be designed so that effective sensitivity of the VHF FM receiver shall not require more than 0.5 microvolt (-111 dbm) to produce 12 db or greater SINAD. The effective sensitivity shall not exceed 0.5 microvolt for all modes of operation, which shall include but not be limited to, engine off, engine on, (from idle to full throttle), and all vehicle systems or combinations thereof.
- C. Vehicles from each group of make and model manufactured may be tested by the Department upon delivery. These vehicles and the remainder of the order will not be accepted until they comply with these RFI requirements.
- D. The Department currently utilizes multiple frequencies from 150-163 Mhz and will test RFI in this bandwidth.

5. REMOVED COMPONENTS

All components removed from Department truck chassis and not re-installed or directly re-used on a Department chassis shall be shipped to the Department Central Repair Shop in Ames, IA. Examples would include mufflers, exhaust components, fuel tanks, brackets, and any or all other components.

6. PAINT & COATINGS

- A. All equipment shall be thoroughly cleaned and completely coated with a high quality corrosion resistant finish.
- B. Truck cab/chassis unit:
 - 1. Truck cab shall be painted with a two step factory basecoat - clearcoat process because of the increased durability this process gives.
 - 2. Frame and undercarriage shall be completely painted with a high quality black single step finish to provide maximum corrosion protection. Dealer may be required to extensively touch-up factory undercarriage paint if it is deemed inadequate to provide good corrosion protection.
 - 3. NO bare ferrous metal components shall be visible on the chassis or any components, OEM or outfitter installed. This IS a snow removal salt spreading truck!
- C. Outfitter installed equipment:
 - 1. All manufactured ferrous equipment attached to the Department chassis shall be sand or media blasted to remove all mill scale, oils, dirt, rust, shipping primer and/or other contaminants from the surfaces. This means the front plow hitch, dump body, any wing, any underbody plow or scraper, valve enclosures, and any other component that is subject to corrosion.
 - 2. All snow removal equipment must be powder coated, the only exception will be the dump body; it's finish is detailed below. Powder coating is required because of the durability of this product. The Department requires any and all components that can be powder coated to be, including the dump body if possible. Items shall be powder coated as individual components prior to any assembly.
 - 3. If the dump body cannot be powder coated, it must be completely painted, coated, and rust proofed. See additional details at the end of the Dump Body specification section. Visible exterior surfaces shall be painted to match the truck cab.

4. Visible body parts shall be painted with a premium quality polyurethane finish, consisting of approximately 2 mils dry film build corrosion resistance primer top coated with 2-3 mils dry film build paint. Primer shall be a light gray high solids low VOC polyurethane primer (PPG DPU 174 or approved equal). Paint must be multiple coats of high solids low VOC polyurethane enamel paint (PPG Delta DFHS or approved equal).
 5. All visible finishes shall be smooth, shiny, and free of runs, overspray, and/or other defects.
 6. Minimum finished application thickness, 4 mils dry film build.
 7. Paints and primers used shall be 100% lead and chromate free. MSDS on products used shall be made immediately available to the Department upon request.
- D. Regardless of finish type, these color requirements shall apply:
1. ORANGE REQUIREMENT - Standard Iowa Department of Transportation orange color is "OMAHA ORANGE". Known acceptable colors are International 0311, Sterling/Freightliner N6389EA, GM 9W4; other manufacturer's color must be approved. All components used in the fabrication of a Department truck that are required to be painted orange shall be color matched to the OEM chassis cab color.
 2. BLACK REQUIREMENT - All components used in the fabrication of a Department truck that are required to be painted black shall be matched to PPG DAR9000.
- E. After installation and before final inspection, all installed component finishes shall be touched-up to provide a uniform 'break-free' finish. Frame and underneath shall be thoroughly inspected for bare metal and appropriate corrective action shall be taken to provide maximum corrosion resistance.
- F. NO bare ferrous metal components shall be visible on the chassis or any installed components. This IS a snow removal salt spreading truck!
7. THREADED FASTENERS
- A. All threaded fastener components (bolts, washers, nuts) with a diameter designation greater than or equal to SAE 1/2 inch shall be of minimum grade 8 composition. Nuts shall be all metal self-locking, lock washers are not acceptable. A minimum of two bolt threads must extend through a nut. All components shall have grade identifier marks and a registered manufacturer's logo.
 - B. All threaded fastener components (bolts, washers, nuts) with a diameter designation greater than or equal to SAE 1/4 inch up too less than SAE 1/2 inch shall be minimum grade 5 composition. Nuts shall be self-locking, either poly-lock or all metal, lock washers are not acceptable. A minimum of two bolt threads must extend through a nut. All components shall have grade identifier marks and a registered manufacturer's logo.
 - C. All threaded fastener components (screws/bolts, washers/lock washers, nuts) with a diameter designation less than SAE 1/4 inch shall be minimum grade 2.

8. WARRANTY

- A. **TRUCK CHASSIS:** The manufacturer shall guarantee to furnish all warranty services gratis at franchised dealers within the State of Iowa. From the date the Department assigns this equipment to its requesting location, the manufacturer and/or its representative shall provide a no deductible warranty (less normal maintenance items) for:
- 1) General overall truck, all-inclusive, minimum 1 year/12,000 miles.
 - 2) Engine, minimum 3 year/150,000 miles. Must include all electronics, injectors, turbocharger, air compressor, and water pump.
 - 3) Drive train and axles, minimum 2 years/150,000 miles. Must include transmission, flywheel or flex plate, clutch or torque converter, drive shafts and hangar bearings, differential(s), power divider, housing(s), bearings, wheel ends, and steering gear(s).
 - 4) Cab structure integrity and corrosion (rust through), minimum 5 years.
 - 5) Frame integrity, rails, and crossmembers, minimum 5 years.
- B. **SNOW REMOVAL EQUIPMENT:** From the date the Department assigns this equipment to its requesting location, the manufacturer and/or its representative shall provide a no deductible all-inclusive warranty (less normal maintenance) for a minimum 1 year/12,000 chassis miles, whichever occurs first.
1. Snow removal equipment warranty shall be provided at the equipment's assigned location within the State of Iowa. If equipment must be removed from the assigned location for repair or replacement, equipment manufacturer must reimburse the Department our standard hourly/mileage rental rate for the entire time the equipment is gone from the State facility.
 2. If common repairs are required, the State will work with the vendor to the best of our ability to group vehicles together at a common location to expedite the repairs. This will, however, be done at the discretion and convenience of the Department.
 3. If through common agreement between the assigned location and the providing vendor the Department agrees to complete warranty repairs for the vendor, the Department will bill the providing vendor for all labor, shop supplies, and parts not supplied by the vendor to complete the repair. All shipping for new parts sent and warranty return parts shall be paid by the vendor. A Department Cost Memorandum Report (similar to an invoice) detailing all charges will be supplied to the vendor for payment.
- C. If any standard retail warranty exceeds any of these minimum terms, the standard warranty shall apply. A warranty certificate or card shall be supplied for each vehicle.

9. PROTOTYPE TRUCK for VIEWING

- A. A snow removal truck from the Department's most recent previous purchase will be made available for prospective vendors to view and analyze. Truck will be available at the nearest Department Maintenance facility that received one; truck may not be removed from the facility grounds. Vendors are responsible for their own costs if any are incurred to see the truck. The Department reserves the right to move and/or use the truck in an emergency. An appointment must be made through Equipment Services. Contact Tim Nordholm at 515-239-1607.
- B. Truck will illustrate the minimum acceptable design, subject to new specification changes. Any deviation from the design will require review and approval by the Equipment Services prior to award of a contract.

- C. Fabrication and installation of systems must be made in contractors own shop within the State of Iowa or other facility approved by the Iowa Department of Transportation.

10. PILOT INSPECTIONS

- A. The Department requires the ability to thoroughly inspect, test, and approve the first fully completed and operational truck, hereafter identified as the 'pilot'.
- B. Vendor shall notify Equipment Services upon completion of the pilot chassis. Vendor may be required, at the Department's discretion, to make arrangements for an inspection of the chassis at the point of manufacture.
- C. Vendor shall notify Equipment Services upon completion of the pilot chassis outfitting with snow equipment as ordered. Arrangements will be made for the Department's inspection at the place of outfitting.
- D. A written document of all inspections findings will be provided to the vendor and/or his outfitter. Discrepancies and/or findings of non-compliance will be listed and must be corrected and/or addressed to the satisfaction of the Department before the rest of the trucks are built or outfitted.

11. PRE-DELIVERY INSPECTION

Before delivery of any completed truck to the Department, vendor shall do a thorough pre-delivery inspection of each complete truck, to include the chassis and all installed snow equipment. Inspection shall be customized to reflect snow removal truck requirements, including hydraulic system individual pressure settings; a generic example is available from Equipment Services. A copy of this inspection, signed by the technician who does it, shall be placed in each truck left door pocket.

12. POST-DELIVERY INSPECTION

Once a completed truck is delivered to the Department in Ames, it will again be thoroughly inspected by Central Repair Shop personnel before it is approved for release to it's requesting location. All problems and deficiencies will be noted. Minor problems will be corrected by Department personnel and all parts and labor costs will be billed back to the providing vendor at the conclusion of the deliveries. (Minor problems should be considered things like low fluids, non-working lamps, missing wire ties, and other similar items that can be quickly corrected by Department personnel so as to not delay delivery of the truck). All problems considered not minor will be the responsibility of the providing vendor to correct within 48 hours of notification by the Department unless other arrangements agreeable to the Department are made.

13. DATA SHEET

Successful vendor shall complete a Department Vehicle Data Sheet and deliver it to Equipment Services on or before delivery of the first truck. Data sheet details the OEM part numbers for the majority of parts and serviceable components of the chassis, such as filters, belts, hoses, brakes, etc. A copy of this form may be obtained from Equipment Services in either an electronic Excel format or via fax.

SPECIFICATION
for
TANDEM AXLE TRUCK CHASSIS
58,000 lb. GVWR

1. GENERAL INFORMATION AND DIMENSIONS

- A. Conventional set-forward front axle design high-height cab suitable to provide adequate headroom, seat travel with the specified air-ride seats, and operator comfort with all specified snow equipment installed.
- B. Nominal 80-inch wide cab with over 56 inches floor-to-headliner height, minimum 18 inches operator's seat-to-floor height, and minimum 70 inches shoulder room dimension.
- C. One-piece tilting front-end engine access.
- D. Bumper-to-Back-of-Cab (BBC), 107 to 111 inches.
- E. Wheelbase (WB), 208 to 209 inches.
- F. Cab-to-Trunnion (CT), 126 to 134 inches.
- G. After-Frame (AF), 60 inch minimum.

2. ENGINE & RELATED COMPONENTS

- A. Diesel: Premium turbocharged domestic, 4-stroke liquid cooled, inline 6-cylinder only, fully electronic controlled, cast-iron skirt block with replaceable (wet) cylinder inserts.
- B. 8.8 to 9.3 liter displacement.
- C. Certified power rating minimums: 350 horsepower; 1150 lb/ft torque; 550 lb/ft clutch engagement torque.
- D. Life Miles Rating: Engine shall meet or exceed a B10 rating of 300,000 miles/B50 rating of 450,000 miles.
- E. Magnetic oil drain plug.
- F. Air intake filtration: Two dry elements meeting engine manufacturer's optimum filtration requirements.
- G. Air filter housing snow valve, operable from the operator's position, selector to allow engine intake air to be selected between the standard outside air source or diverted and drawn from under the hood. Designed to prevent air filter clogging in severe snow storms.
- H. Radiator: Largest capacity available for provided engine. If an optional increased cooling capacity option (additional row(s) of tubes/fins) is available, it must be provided. If an optional corrosion resistant radiator coating or treatment is available, it must be provided.
- I. Antifreeze: Extended Life testing to a minimum -35 degrees Fahrenheit. Low coolant warning light and alarm.
- J. Fan: Positive on-off temperature controlled clutch type. Emergency mechanical failure lockup (on) provision. Viscous not acceptable.
- K. Fan override switch, driver control, allowing driver to lock fan on.
- L. Hose clamps: Constant torque or Perma-Shrink, all coolant hoses.
- M. Throttle/Cruise control: Dash or steering wheel mounted electronic adjustable.
- N. Hydraulic Pump Drive Apparatus: Engine crankshaft front drive adapter plate suitable for installation of a Spicer No. 1310 accessory drive connector. Suitable chassis will have clearance provisions for a direct front PTO driveshaft below the front end structure and engine cooling/air intake components. Driveshaft through a radiator cut-out is not acceptable.

- O. Engine warning/shut down system: Audible buzzer and lamp warning for high engine temperature and/or low engine oil pressure with automatic engine shut down feature. System must have an emergency override.
 - P. Engine governor control wiring harness, type suitable to allow low cost Department installation of remote mounted engine speed control device(s). Necessary to power PTO driven accessories and/or hydraulic pump.
 - Q. Final engine management system electronic parameters will be determined at time of bid award.
3. TRANSMISSION & CLUTCH
- A. Automated 10-speed: Eaton Fuller AutoShift RTO-12910B-AS3.
 - B. Synthetic fluid.
 - C. Dash mounted push button type gear selector.
 - D. Alternate transmission programming: Programed to allow upshifts only at engine rated RPM, regardless of throttle position.
 - E. Eaton Fuller Solo 1402 twin plate 14 inch ceramic clutch w/adjustment free feature.
4. FRONT AXLE AND SUSPENSION
- A. Wide-track 18,000 lb. rated capacity - Dana Spicer I180w or Meritor MFS-18-133a.
 - B. Set-Forward Only. Axle set-back not to exceed 32".
 - C. Wet front oil seals, Stemco or equal.
 - D. Synthetic hub oil.
 - E. Multi-leaf spring suspension rated 18,000 lb. with highest deflection rate available.
5. REAR AXLES AND SUSPENSION
- A. Standard manufacture 40,000 lb. rated capacity.
 - B. Power divider with dash mounted switch and indicator lamp.
 - C. Synthetic differential oil.
 - D. Magnetic drain plugs.
 - E. Driver controlled differential lock in front tandem axle. Automatic speed disengage feature. Dash mounted switch and indicator lamp.
 - F. Axle Ratio adequate to meet Gradeability, Rear Wheel Torque, and provide sustained 70 MPH highway cruise at GVWR. Final determination to be at time of bid award. Estimate 4.63.
 - G. Walking beam style rear suspension, 40,000 lb. capacity, 52" spacing. Hendrickson RT-403 or Freightliner Tuf-Trac only.
6. WHEELS AND TIRES
- A. Front Wheels: Heavy service (0.5" thick) 9.00 inch steel hub piloted Budd style 10-bolt. White powdercoat finish. Nylon wheel guards. Each wheel must be rated at or above one-half front axle capacity.
 - B. Front Tires: Michelin XZA3 only. 315/80R22.5 LR "L" tubeless steer tread. Each tire must be rated at or above one-half front axle capacity. Tires cannot be speed restricted below 70 mph.
 - C. Rear Wheels: Heavy service 8.25 inch steel hub piloted Budd style 10-bolt. White powdercoat finish. Nylon wheel guards.
 - D. Rear Tires: 11R22.5 LR "G" on/off road tubeless M&S drive tread. Goodyear G164RTD or pre-approved equal providing good snow/ice traction. Rated minimum 5,840 lb. (dual) capacity each.

7. FRAME

- A. Single straight nominal 10-inch high rails - laminated, variable depth, or splayed rails are not acceptable.
- B. Minimum 110,000 PSI High Tensile Steel.
- C. Resistance to Bending Moment (RBM): Minimum 2,430,000 in/lb.
- D. Section Modulus (SM): Minimum 20.25 cu/in.
- E. Integral front frame extension: Minimum 20 inches in front of grille.
- F. Minimum ground clearance: There shall be a minimum 12 inches ground clearance under any frame mounted components, such as the fuel tank and/or its mounting brackets, steps, air tanks, battery box, etc.
- G. Cab steps: All steps shall be minimum of 28 inches long, non-slip serrated top Bustin style aluminum grating. Steps required on both sides. If any step is an integral part of a fuel tank, grating area must be at least 14 inches long. Additional steps may be required if outfitting requires relocating standard steps or fuel tank. See Optional Equipment sections.
- H. Front Bumper: Manufacturer's standard painted.

8. BRAKES

- A. Brakes: Dual full air anti-lock system rated at or to exceed axle GVWR requirements. If extended warranty is available for 'one-brand' system, it shall be optioned and provided.
- B. Cab mounted low air pressure warning buzzer and gauge.
- C. Dry reservoir tanks - pull cable on wet tank.
- D. All brakes must be cam with non-asbestos linings.
- E. Minimum 13.2 CFM compressor.
- F. Heated air dryer, Bendix AD-IP only. Air dryer must be positioned to be easily accessible and serviceable, even after snow equipment installations.
- G. Installation of the air tanks and/or dryer shall not inhibit the installation of snow removal equipment anywhere underneath the truck or behind the cab (clear frame).
- H. Parking brake: Spring set rear wheel brake chambers, all 4 positions. Rear-rear axle brake chambers must not interfere with asphalt paver rollers. Chambers must be premium quality corrosion resistant epoxy coated and sealed, Gold Seal Anchorlok or MGM TR-TS.
- I. Parking brake alarm - alarm to sound if door is opened and park brake is not set.
- J. Brake Chambers on Rear/Rear Axle Located Inside Rear Tire Envelope (Meets Asphalt Spreader/Paver Clearance Requirements).
- K. Automatic slack adjusters: All wheel positions, premium Haldex brand.
- L. Tractor brake system and combination valve for trailer air brake towing with full trailer anti-lock provisions. Air lines with glad-hands ran to rear of frame rail set-up for trailer towing. Fully installed, ready for use.

9. EXHAUST SYSTEM

- A. Exhaust system: Vertical stack on right-hand side with sweep elbow. Sweep to be flush with or no higher than 6-8 inches above top of cab.
- B. Stack must be shielded the full height of the cab.
- C. Engine compression brake with selector and on/off switch.
- D. Exhaust components/after-treatment-device must be shielded. Truck will be used on and off road, sometimes in tall grass. Exhaust system component temperature and/or vapors temperature shall not be high enough to ignite vegetation.
- E. Driver selectable manual regeneration control in cab.

- F. Exhaust system design and/or components shall not hinder the installation of snow removal equipment anywhere underneath the truck or behind the cab (clear frame). System component placement must be approved by Equipment Services and the snow equipment outfitter.

10. ELECTRICAL

- A. Gauges; dash mounted, easy operator viewing, to include at a minimum: Oil Pressure, Coolant Temperature, Air Pressure, Speedometer, Voltmeter, Fuel, Tachometer, Air Intake Restriction Indicator, Hourmeter.
- B. Restriction indicator shall be dash mounted, providing graduated intake system restriction increments from 8 to 20 inches water (Filter Minder 3781-325 or approved equal).
- C. Hourmeter shall be electronic, wired to provide a true hours-of-operation figure (either alternator excited or engine oil pressure sensor activated). Key-on activated meter is not acceptable.
- D. Fault codes/blink codes displayed in instrument cluster. No scan tool required to retrieve and view codes.
- E. Power-point 12-volt receptacle.
- F. Ignition switch: Automotive key with accessory position. 2-keys provided.
- G. Turn signal switch: self-cancelling.
- H. If available from factory, snow plow headlight wiring/switch, suitable for outfitter installation of additional auxiliary snow plow headlamps. If not available OEM, system must be outfitter installed, see Switch Panel & Electrical Instructions section.
- I. Body builder harness connector for outfitter installed body lights.
- J. Pre-trip CDL light inspection switch. Cycles lights while driver walks around truck.
- K. Factory installed 7-way trailer cable (separate stop and turn lamps) with trailer anti-lock brake feed-back circuit ran to end of frame rail. Round bullet contacts.
- L. Radio: AM/FM/Weatherband stereo.
- M. Clock: Electronic digital, visible day or night, may be an integral part of radio.
- N. Courtesy lamps: Dome lamp and door hinge pillar or under dash courtesy lamps to illuminate rocker panel and cab step areas.
- O. Air Horn(s). If top of cab mounted, must include snow cover(s).
- P. Windshield wiper system: Electric with intermittent operation feature. Electric washer pump. If a heavy duty or severe service wiper system option is available, it must be included. Headlights to automatically go 'ON' whenever wipers are activated. If wipers are running when park brake is activated, they shall automatically go the lowest intermittent speed.
- Q. Electrical protection: Circuit breakers in lieu of fuses.
- R. Alternator: Delco 22SI, minimum 145 Ampere.
- S. Four batteries, maintenance free, minimum 2600 CCA @ 0 degrees Fahrenheit. Non-splice battery cables. Dimensional size and specific mounting of battery box shall not hinder the mounting of snow removal equipment, either by the outfitter or later by the state. If the OEM battery box dimensional size and/or mounting is cause for concern, vendor shall work out a mutually agreeable solution with the outfitter and the state before bidding.
- T. External of battery box jump start stud.

11. FUEL SYSTEM

- A. Fuel tank: Single tank, non-polished aluminum, minimum 100-gallon fuel capacity, left side mounted under cab, with integral step(s). Stainless steel mounting straps.

- B. Dimensional size and specific mounting of tank shall not hinder the mounting of snow removal equipment, either by the outfitter or later by the state. If the OEM tank dimensional size and/or mounting is cause for concern, vendor shall work out a mutually agreeable solution with the outfitter and the state before bidding.
- C. In-tank circulating engine coolant type fuel heater (Arctic Fox) with thermostat controlled by-pass.
- D. Fuel maintenance system: Fuel-water separator/filter with thermostatic fuel temperature controlled electric heater, and filter restriction/change indicator, with water-in-fuel sensor. Components shall be factory installed ahead of fuel primer and other fuel filter(s).

12. CAB - INTERIOR

- A. Interior trim/insulation package: Mid-level, to include a full headliner and back-of-cab trim panel(s). Color shall be medium brown or gray.
- B. Floor covering: Heavy duty rubber/vinyl floor mat with sound deadening backing covering entire floor, dark color.
- C. All pedals suspended from cowl. Floor mounted pedals are not acceptable.
- D. Glass: All tinted.
- E. Power window: Minimum right side, operable from both sides. If a full power window/power door lock package is provided, power door lock automatic engagement at set speed shall be disabled
- F. Operable wing vent windows: Both doors.
- G. Air conditioning, heater and defroster. Highest BTU capacity available. Automatic automotive style outside air source/in-cab recirculation design. All available HVAC system air intake filters - cab cowl inlet and evaporator module if available.
- H. Sun visors: Left and right.
- I. Grab handles: Cab entrance/exit assist, both sides. Arm rests on both doors.
- J. Seats: Driver/passenger vinyl covered premium quality high-back air suspension with 3-point seat belts, tethered to allow free suspension movement. Each shall have an adjustable lumbar support, lower cushion angle, and minimum inboard armrest (National or approved equal).
- K. Power steering: Dual integral gears. Ram system not acceptable.
- L. Tilt/Telescope steering column. Smallest diameter steering wheel for the front axle specified.
- M. Storage areas: Map pocket in door, overhead storage bin, or other storage area(s) suitable for manuals, small hand tools and other incidentals. Must not be mounted to or be part of back-of-cab interior liner.
- N. Overhead console: Suitable for center installation of a Department 2-way radio.

13. CAB & HOOD - EXTERIOR

- A. Air ride rear cab suspension for increased cab and cab component longevity.
- B. Mirrors: West Coast Sr. heated, left and right, set for 102 inch trailer. Convex mirror head (minimum 48 in²), heated, directly below each.
- C. Fender mirrors: Low profile with 8-inch round convex head, installed to provide full-side-of-vehicle rear view, front-to-rear, without causing excessive blind spot.
- D. Front grille: Stationary to clear front snow plow hitch.
- E. OEM stone guard/bug screen behind grille.
- F. Front hood tilt assist mechanism if available.
- G. Exterior cab entrance grab handles, left & right. Right may be dealer mounted to reinforced exhaust shield.

- H. Paint: Omaha Orange (DuPont #31; color must be approved by Equipment Services). Frame and undercarriage shall be black. See Standard Specifications section D.
- I. Wiper blades: Winter Anco model #29 or equal. Dealer installed if not available from factory.

14. PERFORMANCE PARAMETERS

- A. Gradeability %: High Gear, minimum 2.5%. Low Gear, minimum 51%. (Calculated @ Maximum GVWR @ Peak Engine Torque). To calculate gradeability the following formula shall be used: $\text{Gradeability} = ((K \times M \times R \times T) - 1) / \text{GVW}$.
- B. Rear Wheel Torque: High Gear, minimum 3,900 lb/ft. Low Gear, minimum 58,300 lb/ft. (Calculated @ Peak Engine Torque). To calculate rear wheel torque the following formula shall be used: $\text{Rear wheel torque} = R \times T$.

Where: K = Constant, .104. M = Tire revolutions per mile, constant 497.
 R = Ratio of reduction at axle shafts. Calculated by multiplying appropriate gear ratio (times torque converter ratio if not locked in automatic) times the numerical axle ratio.
 T = Engine torque. GVW = Total weight vehicle, constant 58,000.

NOTE: Optional Equipment That May Be Required (pages 45 through 60) contains chassis information. Certain options are cause for chassis specification changes, effecting items such as front springs, fuel tank, steps, transmission, etc. It is advised that prospective chassis vendors review the entire specification for these items, but especially the Optional Equipment sections.

SUPPLEMENTAL SPECIFICATIONS
for
VENDOR PREPARATION OF TANDEM SNOW REMOVAL TRUCKS

1. FRAME MODIFICATION

- A. Tandem axle truck longitudinal frame members are to be cut off 28-29 inches behind the vertical centerline of the rear-rear axle. Cutoff edges of the truck frame shall be ground smooth.
- B. An heavy duty and substantial pintle hitch and safety chain trailer towing assembly shall be install at the rear of the frame. Plate shall be minimum 1 inch thick solid steel, cut-out and fit onto the ends of the frame rails so it can be fully welded all around on both faces.
- C. Pintle hitch shall be a Premier 2200A. Operation shall be with an air service chamber. Hitch shall be rated 100,000 lb. gross trailer rating, maximum tongue weight 20,000 lbs., latch capacity 60,000 lbs., designed for a 3 inch pintle eye. The center of the pintle hook shall be set at 31 inches up from the ground.
- D. Air pintle latch system shall be plumbed into the truck parking brake switch.
- E. Two swinging trailer type D-ring assemblies shall be welded to the plate, one on each side of the hitch, suitable for 20 ton GVWR trailer safety chain connectors.
- F. Air brake trailer towing gladhand couplers as well as a 7-pole trailer electrical connector, 6-pole trailer lighting connector, and a 4-pole electric trailer brake connector shall be installed through the plate, allowing proper and convenient connections.
- G. Gladhand couplers shall be removed and placed in truck cab. Bulkhead couplers in tow plate shall be plugged with a flush brass plug liberally coated with anti-sieze.
- H. A removable rear ICC bumper shall be installed on the truck, set at 20 inches off the ground. Bumper shall be fabricated from 3-inch schedule 40 black pipe and be 80 inches in length. Sufficient 3/8 inch steel loops shall be installed to the bumper to allow the material spreader hydraulic hoses and liquid lines to be easily ran through and secured.
- I. The bumper and mounting apparatus must be removable from the truck frame, necessary for tending an asphalt paver. However, since bumper also serves as the mounting support for the material spreader spinner(s) or zero-velocity applicator. Bumper must be substantial enough to support these when banging down the road. Design shall not allow bumper to roll-under or flex from the weight. Appropriate measure shall be taken to prevent aging droop.
- J. When the bumper is removed the truck frame must be free and clear of obstructions. The ends of the bumper shall be permanently capped.
- K. All frame modification work shall be thoroughly cleaned, primed and painted black. All fabricated components shall be properly prepared and powder coated black.

2. NON-STRUCTURAL MODIFICATIONS

- A. An electronic back up alarm with automatic volume adjustment from 82-107 dB(A) shall be installed between the truck frame rails at the rear of the truck, wired into the back up lamps (Ecco SA901, Target Tech 210504 or approved equal). Alarm must not be blocked or inhibited by licence plate or any other component.
- B. Air brake system must include a self-sealing nipple with dust cap for charging the truck air brake system. Nipple shall be easily accessible without starting truck or raising body, installed at the air dryer inlet or on the wet air tank.

- C. Air lines cannot be spliced. If the air dryer or any of the air brake reservoirs/other components are relocated and the OEM line is too short, the entire length of line must be changed to an appropriate length.
- D. A Draw-Tite Activator II electronic trailer brake controller shall be installed in the truck cab. Installation or position of control shall not interfere with the operator's comfort or the operation of the truck. Controller shall have proper circuit overload protection and pulse preventer.
- E. If the truck exhaust system must be modified, any and all changes must be approved in writing by the OEM chassis manufacturer. All modified or added components must be of non-rusting stainless steel.

3. DUMP BODY MOUNTING & ACCESSORIES

- A. Dump body shall be mounted on the truck approximately 57 inches back from the vertical centerline of the suspension trunnion, measured from the centerline to the rear vertical face of the dump body (not tailgate).
- B. Dump body subframe shall be bolted to each side of the truck's main frame rail at a minimum of three mounting points. Welding dump body mounts or rear hinges to a Department truck frame or cross members is strictly prohibited.
- C. Each dump body sub-frame rear corner will need three hydraulic bulkhead fittings installed through it. These fittings are necessary for installation and routing of rear spreader and liquid system hydraulic lines. See Hydraulic System section, sub-section Hoses & Fittings.
- D. Each rear dump body rub rail will need a hydraulic manifold plate installed. Each manifold plate will have three bulkhead fittings installed through it. Short easy to replace hoses shall be ran to this plate from the sub-frame mounted bulkhead fittings. Manifold plate shall be bolted to each body side so it is removable.
- E. The dump body raise/lower control shall be a single axis Wescon mechanical joy stick operating a Morse series 40 Redline cable. The dump body vibrator control switch shall be an integral part of the Wescon control. Control grip shall be a pistol style with the vibrator button built into the end for easy thumb activation.
- F. Dump body control system shall incorporate a body height indicator light and alarm. The limiter system shall allow easy adjustment of the body tilt angle from 15 degrees up to 45 degrees before the alarm is activated. Alarm shall have an intermittent on/off operation, clearly audible in the cab above all other noises. Warning lamp shall have a red lens and flash. This limiter system shall be turned on and off by the Winter/Summer switch in the modular switch panel (see section entitled Electrical Instructions).
- G. The dump body is to be equipped with heavy plastic fixed fenders to cover the rear drive tires, and full rear mud flaps.
 1. Plastic fenders shall be custom Life-Time PF400-120x or equal, installed at 4-6 inches off tires, attached to the truck frame. Front half shall be 39", rear half of assembly 27" for paver roller clearance.
 2. Mud flap hanger installation shall prevent debris from being thrown up into the rear dump box corner post. Installations shall not block or inhibit the wash out of debris from the longitudinal body members.
 3. Mud flaps shall be 1/2 inch thick fabric reinforced rubber, 24" x 30", hanging from a continuous press support (guard sandwiched between support bracket and continuous metal strip with the rubber flap to the outside or away from the tire). Flaps shall be free of lettering and have 8 inches of ground clearance when the truck is fully loaded.

4. The rear splash guard design shall keep them out of the rear tires when the body is raised. The rear flap and hanger shall be removable by sliding out a 25-inch long 3/8 inch stainless steel rod secured in place by a 1/8 inch hair spring pin.
- H. A Cougar/Rhino DC3200 or approved equal dump body vibrator shall be attached to the center front underside of the dump body. The vibrator mounting area shall be adequately reinforced to prevent dump body floor from flexing and ultimately cracking. The vibrator shall be mounted so it can be easily removed.
- I. A cab protection shield shall be an integral part of the dump body. See Dump Body with Hydraulic Hoist section for details.
- J. An adjustable amber light bar pole bracket shall be incorporated into the design of the cab protector shield. A receiver tube fabricated from a piece of 1-1/4 inch black pipe shall extend through and be welded into the center of the front edge of the shield.
- K. Design shall allow a pole of 1-inch schedule 80 to be easily slid up-or-down in the receiver tube to allow height adjustment for the amber light bar. Light bar shall be height adjustable from the top of the shield (approximately 10-feet) up to a top height of approximately 13-feet.
- L. Adjustable pole shall be held at the desired vertical height by a pair of 3/8 inch square head set screws with knurled points. Set screws shall screw into a 3/8 inch nut welded to the outside of the receiver tube, aimed to the left side of the truck. A 3/8" x 4" long piece of steel rod shall be welded to each set screw to act a "T" handle. Handles shall be easy to reach and operate, they shall not interfere with each other or contact any other part of the body.
- M. Amber light bar shall be mounted on a gimbal bracket that, in its lowest position, will place the top of the lamp around 10-feet up from ground level.
- N. The gimbal bracket shall pivot on sealed 1-3/8"OD x 1/2"ID shoulder ball bearings available as part #BRBSF0822 from Standard Bearing Company.
- O. The light bar shall be attached to the gimbal bracket by four vibration dampeners, McMaster-Carr #9311K143 ribbed bushing in conjunction with #9311K145 ribbed ring. Mounting bolts used to attach lamp to the gimbal shall be carriage style. The carriage bolts shall be secured into position onto the bottom of the lamp by a flat washer and jam nut. After the jam nut another washer shall be installed, then the vibration dampener. Vibration dampeners shall be installed through the metal bracket. A final washer shall then be installed followed by a locknut. Locknuts shall be tightened enough secure the lamp but not enough to counteract the effect of the dampeners.
- P. A rubber dampener shall be installed to absorb the shock of the gimbal bracket striking the swing stop. Necessary to lessen damage to the lamp bulbs.
- Q. The Department will make available to the successful vendor a prototype mounting and gimbal bracket assembly.
- R. A 4-gauge battery cable ground strap shall be installed from the dump body to the truck frame by means of a 5/16 inch cadmium plated bolt. Star washers shall be installed on both sides of the strap eye to insure a good ground.
- S. All chassis, body and snow equipment grease fittings shall be lubricated before delivery to the Department.

4. FRONT SNOWPLOW HITCH

- A. Truck shall be equipped with a heavy duty front snow plow hitch. Design shall be suitable to allow the installation and use of a Department standard type snow plow, a heavy duty "V" plow and also withstand all stresses imposed by the heavy duty wing assembly.
- B. OEM front bumper shall be modified, the center shall be removed where plow hitch mounts. Remaining side wings shall be structurally reinstalled to fill in the area below the tilt hood.
- C. Plow hitch apparatus and bumper wings shall be powder coated black to match the truck frame.
- D. The hitch and all subassemblies shall be of welded and bolted construction, able to be disassembled into manageable components to facilitate accident repair or replacement.
- E. Front hitch installation shall not inhibit the hood tilt function. Support tubes or apparatus shall be arranged so that the hood will still go over-center and remain so unassisted. All normal engine maintenance points shall remain serviceable (air filter, lubrication addition and checks, washer fluid, radiator, etc.).
- F. The mounting arrangement shall be built with sufficient flexibility for the plow to follow the curvature of the pavement at all times. It shall be of heavy plate and angle construction as follows:
 - 1. Upper vertical lift horn angle iron mount 1/2" x 4" x 4".
 - 2. Top horizontal angle iron 1/2" x 4" x 4".
 - 3. Outside vertical angle irons 1/2" x 4" x 4".
 - 4. Inside vertical flat irons between upper and lower lift ram mounts 1/2" x 3".
 - 5. Front wing cross member/bumper 7-inch Ship & Car channel around 88 inches overall width.
 - 6. Bottom horizontal angle iron lower ram mount 5/8" x 4" x 5".
 - 7. Lower push bars 1" thick x 4" tall x 46" back, secured to the front hitch and the frame mounted reinforcement angles.
 - 8. Lower push bars shall attach to truck frame angle iron reinforcements. Angle iron reinforcements shall be 1/2" x 4" x 6" x minimum 24" long. Reinforcement angle irons shall extend from as far forward as practical (steering gear, crossmember) to as far back as practical (rear spring hangar, frame reinforcement).
- G. The hitch attachment side plates shall be 1/2 inch thick and shall extend back as far as practical onto the front end of the truck frame rail so as to reinforce the frame and support the plow hitch and, if necessary the hydraulic pump. Hitch side plates shall be bolted to the truck frame using minimum 5/8 inch bolts. Side plates shall attach and support the upper vertical horn lift angle irons and top horizontal angle iron.
- H. There shall be two mid-mounted vertical flat iron supports from the bottom of the upper horizontal angle iron down to the lower horizontal lower ram mount. The supports shall be evenly spaced between the outer vertical angle irons.
- I. The top cross angle shall be provided at each end with a shackle and grab link so a "V" type snow plow or a reversible snow plow may be used interchangeably.
- J. The snow plow lifting arm shall be designed to give a minimum vertical lift of 16 inches with the center of the plow lift pulley starting at 26 inches above the ground line in the retracted position.

- K. Lift arm shall be manufactured from two 1/2" x 3" formed piece of bar stock, welded to a 3/8 inch formed channel designed to receive a 3-inch tube. This assembly shall enable the arm to be adjustable in length. A single piece of 1/4 inch plate shall be fashioned to match the shape of the top of the assembly and welded on for additional strength.
- L. Formed pieces of bar stock shall provide triangular reinforcement to the assembly, providing good lateral stability with a "V" plow. Rear of triangle where the pivot hinge will attach to the push frame shall be approximately 20 inches wide. A piece of 1-inch schedule 40 pipe shall be welded between the lift bars to provide a continuous bearing surface.
- M. A 1-inch cold-rolled bar shall insert through this pipe and through the mounting ears on the push frame. Where the bar passes through the angle on each side shall be reinforced with a 1 inch bore set-screw shaft collar, welded all around to the angle. Each shall also be pinned on each end with a large cotter key after the collar. Pipe shall contain multiple grease fittings to allow lubrication along it's length.
- N. Adjustable center member of the lift arm assembly shall be approximately 27 inches long. Into it five 1-1/16 inch holes shall be bored through on the centerline, the first 2-1/2 inches from the end. The underside of the tubing below this first hole shall be relieved approximately 4-3/4 inches to allow a lift pulley assembly to be installed and hang freely.
- O. The second hole shall be 9 inches from the end, the third, fourth, and fifth shall follow the second on 4-inch centers.
- P. The front of the adjustable center member shall have three banjo type chain eyes punched in 1/2 inch plate that will accept 1/2 inch chain welded to it. Plate shall be formed so the side banjo eyes are at an approximate 15° swept back angle from the flat front banjo eye. Assembly shall be of sufficient design to support the weight of any plow.
- Q. Snow plow lift will be accomplished with a 4-inch diameter by 10-inch stroke single acting ram. Ram piston rod shall be hard chrome plated. Rod seal shall be a standard polypak with O-ring style spring backer, moly coated (Parker standard molythane gray PolyPak or approved equal). The ram shall be installed in a normally inverted position with the barrel attached to the plow lift arm and the rod to the plow hitch so contamination debris will fall away from the wiper seal.
- R. The plow attachment ears are 1-inch thick and set on 33-1/2 inch centers. Each pocket shall be a 2-inch space with 1/2 inch thick ears or sides. Choice of three plow push point heights spaced on 4-inch centers shall be offered. Plow push height of the bottom hole on the hitch shall be 14 inches above the ground line.
- S. Plow attachment pins shall be provided; pins shall be 6 inches long by 1-1/4 inches in diameter with 3/16 inch lynch pin retainer. The pins shall be tapered back 3/4 inch and down to a 3/4 inch OD point.

5. ELECTRICAL & ILLUMINATION PREPARATION

- A. All electrical equipment shall be installed as outlined in the Electrical Instructions section.
- B. Vendor shall install a Department supplied 2-way radio antenna base on the truck cab roof. Installation requires the drilling of an approximate 7/8 inch hole in the roof, securing the base and running the coaxial cable to the accepted radio installation point. Vendor must notify Equipment Services a minimum 30 days before bases are needed to insure delivery.

- C. A modular switch panel and warning light panel shall be installed in a header mounted console directly above and in front of the operator, replacing the left side storage bin. Consoles of this type are manufactured by Wired Rite Systems, Inc. (phone 707-545-7475) and numerous other electrical component manufacturers.
- D. A Cirus SpreadSmartRX spreader control console with anti-ice lane selector shall be mounted on or into the dash near the center of the cab. Console shall be ergonomically positioned for easy operation and viewing by the operator. Placement shall not inhibit other controls, such as the air brake valves. Final position must be approved.
- E. Modular spreader, pre-wet and anti-ice control wiring harness' shall be ran from the spreader control console inside the truck cab to the rear of the truck and terminate with M12 connections for pre-wetting, anti-icing and granular sensor connections. The system shall include minimum rated IP68 connections for all "outside the cab" connections, hydraulic valve coils, and sensors. Where the M12 connectors terminate at the granular pre-wetting and anti-ice sensor will have integral LED signal indicators for both power and signal. A connector shall be installed in each rear dump body pillar. Right side shall be 12-pin female for spreader and prewet, left side to be 12-pin male for anti-ice functions.
- F. All electrical wiring shall be enclosed in a protective loom cover or conduit. All splices shall be soldered and sealed with dual wall shrink tubing with an internal sealant. Stranded wire shall be soldered (tinned) before inserting and attaching individual wire to terminals. Scotch-Loc fasteners and/or crimp butt connectors are not acceptable for any connection unless specifically stated. All connector ends (spade, ring, etc.) are to be soldered to the wires.
- G. All wiring to lamps shall be stress relived with a metal clamp securing the loom and wiring within 3 inches of the lamp.
- H. The edges of all holes through which wiring must pass shall be protected with a grommet. Wiring in a protective loom cover or in conduit is considered insulated.
- I. Electrical connections subject to constant exposure shall be factory potted or sealed with silicone RTV to prevent corrosion.
- J. In addition to the factory 7-pole trailer lighting receptacle, Midland No. 23602 and No. 23402 trailer sockets shall be mounted into the pintle hook plate next to the 7-pole. The 6-pole socket will also be wired for combination stop/turn trailer lighting and connect to rear frame junction box. The 4-pole socket shall be wired for electric trailer brakes, a multi-conductor electric cable with four 14-gauge wires shall run uninterrupted to the cab junction box. Wires installed in the connector inserts must first be tinned. After wire installation the wire side of the socket body shall be pumped full of RTV silicone and then assembled, effectively creating a sealed assembly. A minimum 6-inch piece of shrink tubing shall be installed over the cable and socket joint to further seal the connection. A Department wiring diagram is available upon request.
- K. A 12-inch loop of extra slack shall be included in the wiring cables to allow for future repair. Cables shall be supported by metal clamps. A Department trailer wiring diagram is available upon request.
- L. Dump body illumination shall be installed as follows:
 - 1. Clearance, stop/turn/tail and strobe lamps shall be flush mounted using Truck-Lite style shock absorbing rubber grommets. Clearance, stop/turn/tail, and backup lamps shall be hermetically sealed LED type with shock isolated bulb elements.
 - 2. The front corner posts shall have an amber 2-1/2 inch clearance lamp angularly mounted at 30 degrees near the bottom of the side rail. The lamps shall show to both the front and side of the body.

3. Each of the body rear posts shall have a 2-1/2 inch diameter clearance lamp facing to the side, mounted approximately 6 - 10 inches down from the top of the post.
 4. The rear face of each post shall have from the top down; a 2" x 6" stop/turn/ tail lamp and a 2" x 6" strobe lamp. All lamps must be fully visible over a raised spreader spill plate.
 5. Dump body shall be outfitted with a Department designed rear taillight air cleaning kit. Kit comprises of a pneumatic valve and timer, 1/4 inch plastic tubing, and brass fittings assembled as nozzles directed onto each oval dump body lamp.
 6. All wiring shall have a minimum 12 inches of looped slack when the dump body is raised.
 7. Body shall be outfitted with DOT-C2 red/white parabolic retroreflective conspicuity tape (Reflexite or equal) as per Department guidelines. Layout pattern will be provided to successful vendor. Tandem axle trucks will require approximately 40-feet.
- M. A triple ID lamp set shall be installed in the ICC rear bumper. It shall be equipped with a sealed Packard Weatherpack disconnect plug
- N. Trucks shall be outfitted with an amber strobe lamp system, consisting of an oval strobe lamp installed in each of the rear corner posts and an in-cab power supply and control switch. Cable connectors at the rear lamps shall be sealed Packard Weatherpack.
- O. System shall be a Nova XPAK-604 wired so that the quad-flash lamps work in an alternating manner.
- P. The strobe lamp switch shall be a single HIGH/OFF/LOW design, included in and matching the other switches in the modular switch panel.
- Q. A 4-inch round tail lamp and 4-inch back-up lamp shall be installed in a stainless steel mounting box to the outside of the truck frame at approximately the same height as the original OEM lamps. They shall be set 4-inch ahead of the rear of the dump body floor or as far forward as practical, but not to interfere with the mud flaps. The mounting location shall protect the lamps as much as possible when the truck is being used with an asphalt laydown machine.
- R. Auxiliary snow plow headlamps shall be mounted to the hood no higher than 74 inches from ground level and a minimum of 65 inches apart measured from bulb centers. Auxiliary headlamps shall be Arrow model 779-99074 Right / 779-99075 Left with 5-wire lead and dedicated ground, built-in turn signals, fully powder coated. Auxiliary headlamp ground circuit shall be connected into the original truck headlight ground circuit. Headlight assembly shall have a 3/32 inch water drain hole. Wiring cable inside headlight assembly shall be tied in a knot to keep it from being accidentally pulled out.
- S. The complete chassis tilt hood assembly shall be made removable. All wiring, whether OEM or added, shall have Packard Weatherpack sealed connectors installed. Connectors shall be installed near the hood hinge point.
- T. The vendor shall provide and install a PSE model 5100-H series dual rotating amber light bar to the gimbal bracket. Wiring to light bar shall be 12-gauge wired to an always hot circuit. Wiring shall be ran through the adjustable height pole. Adequate slack shall be allowed for all pole heights.

- U. The vendor shall provide and install a shock absorbing rubber housed 4-inch sealed beam tractor style sander lamp mounted under the left rear of the dump body, not attached to the spreader. Lamp shall be a Grote Par model 36 rubber tractor lamp No. 64931 or equal. If the truck is equipped with a dual discharge system, two lamps must be installed with automatic side-to-side on/off with the spreader side selector switch.

SPECIFICATIONS
for
HYDRAULIC SYSTEM DESIGN & COMPONENTS

GENERAL DESCRIPTION OF HYDRAULIC SYSTEM.

System will comprise of a variable displacement load-sense pump supplying flow to either one or two valve banks, dependent of the snow equipment specified. Valve banks shall be multi-section tie bolt stacks of load-sensing control valve sections. Cylinder functions will be manual cable controlled, orbital motor circuits shall be fully proportional electric. Combined system shall be rated for sustained 3,000 PSI operating pressure. All sections will be fully pressure and flow compensated.

All pump and valve ports shall have ORB (O-ring boss) straight threads. All hoses shall have JIC 37 degree female swivel fittings. All valves, solenoids and wires shall be protected from salt corrosion in an enclosure with removable access panels.

Contents of this section includes:

1. Suction strainer.
2. Return filter.
3. Hydraulic power source.
4. Valve circuits.
5. Cable controls.
6. Valve stack enclosures.
7. Reservoir.
8. Hoses & fittings.
9. Plow cushion valve.
10. Spreader control.
11. Hydraulic cylinders.

1. SUCTION STRAINER

- A. A Zinga TFS-2020-0-5 or approved equal full flow suction strainer shall be provided. Strainer shall have a 100 mesh element, be rated at or in excess of 49 GPM, be equipped with built-in 5 PSI bypass valve, and have 2-inch NPTF threads.
- B. Strainer shall be installed vertically into the bottom of the oil reservoir through a weld flange.
- C. A 2-inch full flow ball valve must be mounted directly to the strainer under the bottom of the reservoir. Ball valve operation lever shall be easily accessed. A heavy plastic wire tie or safety wire shall be installed to insure it physically stays in the open position unless intentionally closed.

2. RETURN FILTER

- A. Return filter shall be a full reverse flow inversion type with integral diffuser and double length element housing (MP Products MPH2503CDSAG4A10T or approved equal). Housing shall have 1-1/2 inch NPT port. Return assembly shall be rated for approximately twice the hydraulic pump maximum flow.
- B. Filter element shall be a replaceable inorganic microfiber cartridge type rated 10 micron absolute and minimum 75 Beta Ratio (MP Products MR2503A10A or approved equal). Element shall not be affected by or absorb water, which could freeze.

- C. Housing design shall incorporate a built-in bypass valve with an approximate 20 PSI setting. A gauge type return filter condition indicator shall be installed on the inlet side of the filter housing. It shall be aimed so it can be easily viewed through the cab rear window.
- D. There shall be a -16-NPT "T" fitting installed ahead of the return filter housing for the spreader return flow line.

3. HYDRAULIC POWER SOURCE

- A. Chassis will be ordered with a factory front crankshaft PTO drive adapter plate suitable for directly driving the hydraulic pump at engine crankshaft speed via a balanced Spicer No. 1310 driveshaft. Driveshaft shall pass under the engine radiator and charge air effects. The driveline grease fittings shall be easily serviced.
- B. Drive flange attachment bolts and the hydraulic pump shaft set screw shall be safety wired.
- C. Hydraulic pump shall be a minimum 5.5 cubic inch (90cc) variable displacement load-sense designed for continuous operation, such as a Rexroth A10VO90 series. The hydraulic pump shall be capable of producing a nominal 43.5 GPM flow at 1,800 engine RPM with a minimum 3,000 PSI operating pressure.
- D. System normal operating pressure shall be set and sealed at 2,450 PSI (± 50). Sense circuit standby pressure shall be set at 350 PSI.
- E. Pump pressure line shall have a normally open electric safety dump valve installed, wired to work in conjunction with the low oil level sensor system. A momentary override switch shall be installed in the switch panel to allow emergency system override to allow operator to lift ground engaging implements.

4. VALVE CIRCUITS

- A. Basic valve stack will consist of standard tie-bolted stacked working sections typically rated for a nominal 30 GPM capacity, such as a Rexroth MP-18 or approved equal. Motor circuits will comprise of a 4-circuit cartridge motor manifold that is no larger physically than two regular Rexroth sections and suitable to be installed into the tie-bolt stack in lieu of two standard sections.
- B. Inlet and outlet port sizes shall be -16 ORB. Work ports shall be ORB and sized as noted in the appropriate section below.
- C. If two valve stacks are required, the pressure hose from one valve bank to the other shall be sized to correspond to the end cap port ID's.
- D. The valve assembly(s) shall be configured with working sections as follows. The following list details the most common configurations, all combinations may not be represented. Valves shall be assembled in stacks of logical function to provide best system operation.

Base Truck. This is the base valve expected on all trucks.

Section 1s. Top ported inlet cover (aluminum highboy) dual tank ports (load sense).		
Section 2s. Hoist	35 GPM	4W/3P highboy w/A port relief @ 500 PSI
Section 3s. Plow Lift	3-30 GPM	3W/3P lowboy w/adjustable flow control compensator w/A-port detent
Section 4s. Plow Angle	3-30 GPM	4W/3P lowboy w/adjustable flow control compensator
Section 5s. LD Wing Lift	3-30 GPM	3W/3P highboy w/adjustable flow control compensator w/both relief ports plugged.
Section 6s. LD Wing Slide	3-30 GPM	4W/3P lowboy w/adjustable flow control compensator.

Section 7s. 4-circuit Motor Manifold: Described as follows. The physical size of the manifold shall be no larger than two Rexroth MP-18 valve sections and be rated to 3,500 PSI. The manifold shall be an integral part of the valve stack and shall not affect The Rexroth MP-18 circuitry performance. All cartridges and coils to be manufactured by Hydraforce. Manifold to contain four solenoid operated electrically-variable, two port, pressure compensated, spool type, normally closed when de-energized, proportional flow control cartridges with DIN coil. Each cartridge shall have a manual override. Each cartridge shall operate by a 12 volt DC coil with 6 inch leads and terminate with a Weatherpack connector. The following flows for each circuit are described as follows:

Spreader Spinner	7 GPM	Spreader Auger	15 GPM
Anti-Ice Pump	15 GPM	Prewet Pump	7 GPM

Truck with optional Underbody Snowplow (UBP) only.

Replace Section 5s in base valve with the following described section:

Section 5.1.	Scraper Curl	3-30 GPM	4W/3P section regulator set @ 500 PSI with A-port relief set @750 PSI, with A-port detent to engage regulator.
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Rename Section 6s in base valve with the following description:

Section 6.1.	Scraper Angle	3-30 GPM	4W/3P lowboy w/adjustable flow control compensator
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Truck with optional MDFW, MDRW, or HDFW Wing only.

Replace Section 5s in base valve with the following described section:

Section 5.2.	Wing Toe	3-30 GPM	4W/3P highboy w/adjustable flow control compensator w/A port relief @ 500 PSI
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Replace Section 6s in base valve with the following described section:

Section 6.2.	Wing Heel	3-30 GPM	4W/3P highboy w/A port relief @ 500 PSI
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Truck with optional MDFW, MDRW, or HDFW Wing and Underbody Snowplow (UBP).

Replace Section 5s in base valve with the following described section:

Section 5.2.	Wing Toe	3-30 GPM	4W/3P highboy w/adjustable flow control compensator w/A port relief @ 500 PSI
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Replace Section 6s in base valve with the following described section:

Section 6.2.	Wing Heel	3-30 GPM	4W/3P highboy w/A port relief @ 500 PSI
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Add two additional sections between 6.2 and 7 described as follows:

Section 6.2.3.	Scraper Curl	3-30 GPM	4W/3P section regulator set @ 500 PSI with A-port relief set @750 PSI, with A-port detent to engage regulator.
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Section 6.2.4.	Scraper Angle	3-30 GPM	4W/3P lowboy w/adjustable flow control compensator.
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Truck with optional Ice Blade (IB) and Heavy Duty Benching Wing (HDBW).

Replace Section 5s in base valve with the following described section:

Section 5.3.	HD Wing Front Post Toe	3-30 GPM	4W/3P highboy w/adjustable flow control compensator w/A port relief @ 500 PSI
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Replace Section 6s in base valve with the following described section:

Section 6.3.	HD Wing Rear Post Heel	3-30 GPM	4W/3P lowboy w/adjustable flow control compensator.
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Add an additional section between 6.3 and 7 described as follows:

Section 6.3.5. HD Wing Heel Cable 3-30 GPM 4W/3P lowboy w/adjustable flow control compensator.

Add an auxiliary valve stack with sections described as follows:

Section 8. Top ported inlet cover (aluminum highboy) dual tank ports (load sense).
 Section 9. Scraper Curl 3-30 GPM 4W/3P section regulator set @ 500 PSI with A-port relief set @750 PSI, with A- port detent to engage regulator.
 Section 10. Scraper Angle 3-30 GPM 4W/3P lowboy w/adjustable flow control compensator
 Section 11. Oscillate Lift L 3-30 GPM 4W/3P highboy w/adjustable flow control compensator w/A-port relief @ 1800 PSI
 Section 12. Oscillate Lift R 3-30 GPM 4W/3P highboy w/adjustable flow control compensator w/A-port relief @ 1800 PSI
 Section 13. Endcover

Truck with optional Zero Velocity Spinner.

Add an additional section to the main valve stack between 6 and 7 described as follows:

Section 6ZV6. ZV Spinner 15 GPM 3W/3P lowboy, 12 volt proportional w/ C2 coil - change connector to Weatherpack.

Truck with optional Down Pressure Front Plow Hitch.

Change section 3s in the base valve to the following description:

Section 3.1. Plow Lift 3-30 GPM 4W/4P section regulator set @ 1000 PSI with A-port relief set @1250 PSI, with A- port detent to engage regulator, 4th position float.

- E. All relief valves and section regulating devices shall be screw and lock-nut adjustable. All spool valves shall have feathering grooves.
- F. Remote operation of the cylinder sections will be by means of mechanical cable controls. Spreader/pump sections shall be operated by means of proportional electric solenoids and pilot piston operation to energize the spools, controlled by a closed-loop spreader control. All electric sections shall have a manual screw override to allow the section to be set if the solenoid fails.
- G. Other hydraulic functions operating shall have little or no affect on spreader operation. Spreader spinner return line shall have a 60 PSI residual check-valve installed to prevent spinner free-wheel.
- H. The valve stack work section ports shall be adapted to hose sizes as follows, or if not listed to a size appropriate for the flow:

- 1. Plow and Wing sections: 3/8 inch.
- 2. Spreader spinner section: 1/2 inch.
- 3. Spreader auger section: 3/4 inch.
- 4. Spreader prewet section: 1/2 inch.
- 5. Spreader anti-ice section: 3/4 inch.
- 6. Dump body section: 3/4 inch.

5. CABLE CONTROLS

- A. Cables shall be premium quality Morse brand (no substitutions) series 40 Redline with anti-contamination seals and direct bonnet connectors (bulkhead connectors into the valve enclosures are NOT acceptable).

- B. All controllers except the dump body unit shall be Morse 206301 for single axis and 308721 for dual axis applications. Dump body controller shall be a Wescon with pistol grip, integral vibrator button and mechanical safety lock. Cables shall be routed as per Morse specifications in regards to bend radius and installation.
- C. Controllers shall be configured as follows to correspond with the valve requirements:

Base Truck. This is the base lever bank expected on all trucks.

Lever 1.	Dump Body up/down:	Single axis with pistol grip, vibrator control electric push button switch on end of grip, and mechanical safety lock
Lever 2.	Snow Plow Up/Dn Snow Plow Reverse R/L	} Dual Axis with Detent Down
Lever 3.	LD Wing Up/Dn LD Wing Slide In/Out	} Dual Axis

Truck with optional Underbody Snowplow (UBP) only.

Replace Lever 3 in base bank as follows:

Lever 3.1.	UB Plow Up/Dn UB Plow Rotate R/L	} Dual Axis with Detent Down
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Truck with optional MDFW, MDRW, or HDFW Wing only.

Rename Lever 3 in base bank as follows:

Lever 3.2.	Wing Toe Up/Dn Wing Heel Up/Dn	} Dual Axis
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Truck with optional MDFW, MDRW, or HDFW Wing and Underbody Snowplow (UBP).

Rename Lever 3 in base bank as follows:

Lever 3.3.	Wing Toe Up/Dn Wing Heel Up/Dn	} Dual Axis
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Add Lever 4 to base bank.

Lever 4.	UB Plow Up/Dn UB Plow Rotate R/L	} Dual Axis with Detent Down
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Truck with optional Ice Blade (IB) and HD Benching Wing (HDBW).

Rename Lever 3 in base bank as follows:

Lever 3.4.	HD Wing Toe Up/Dn HD Wing Heel Up/Dn	} Dual Axis
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Add Lever 4 to base bank.

Lever 4.1.	HD Wing Cable Up/Dn	Single Axis
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Add an additional 3 lever bank behind the base row to accommodate the ice blade.

Lever 5.	Scraper Up/Dn Scraper Rotate R/L	} Dual Axis with Detent Down
Lever 6.	Scraper Lift Left	Single Axis
Lever 7.	Scraper Lift Right	Single Axis

6. VALVE STACK ENCLOSURE(S)

- A. Valve stack enclosure(s) shall be a metal box with full removable top cover, installed behind the truck cab between the frame rails. Box(es) shall be mounted to only one rail to accommodate truck frame flexing.

- B. Enclosure(s) shall be fabricated of 10-gauge steel and be, as far as practical, weathertight to protect the valves, cables, electrical solenoids, and wiring from salt corrosion. Cables shall enter boxes through sealed connections.
- C. Valve bank(s) shall be placed in the enclosures with ports facing down. A rectangular hole shall be cut into the enclosure bottom to fit the valve bank port profile. Area where valve bank meets the enclosure cut out shall be sealed.
- D. Hoses attached to the working ports must have long/short 90-degree sweep ends, necessary for clearance under the truck to other components.
- E. A full size access cover shall bolt to the top of the enclosure. It shall be easily removable via four 3/8 inch bolts, providing clear access to the valve bank, cable control ends, wiring and solenoids.

7. RESERVOIR

- A. The oil reservoir shall be a rectangular sectional design providing a 35 usable gallon oil capacity. Reservoir is to be mounted directly behind the truck cab on a rubber isolated stand, the bottom being approximately 11-1/2 inches above the top of the truck frame rail. Circular rubber isolation mounts shall be Lord Mechanical Products J-8006-10.
- B. The reservoir shall be fabricated approximately as follows. Overall size approximately 12 inches deep by 27 inches wide by 28 inches high, fabricated from low-carbon Austenitic 201, 304L, or Nitronic 30 stainless steel or aluminum.
- C. A vertical baffle shall be installed to promote peripheral circulation of oil.
- D. A return oil filter housing shall be installed into the right top of the reservoir, approximately 6 inches in from the edge. See Return Filter section above. Filter housing outlet must be on the opposite side of the vertical baffle from the suction filter. All return oil must pass through the return filter.
- E. Oil outlet to pump must pass through a suction strainer. A 2-inch NPT weld flange shall be installed through the left bottom of the tank. The suction strainer shall be installed from the outside, screwed into the weld flange. See Suction Strainer section above.
- F. An easy to see and read unbreakable oil level sight gauge with 0-250⁰F thermometer (Zinga SG-05M-T) shall be installed on the left side of the reservoir with the gauge full mark positioned at 6 inches down from the top of the reservoir.
- G. An inspection cover/access plate with an approximate net opening of 7" x 7" shall be provided in the top of the reservoir centered approximately 6 inches in from the left edge, approximately above the suction strainer. A premium quality ventilating cap/fill port with 10 micron foam filter element strainer (Zinga FB-10-40-00-0) shall be installed on the inspection cover. Filler cap shall be cast aluminum. Installation shall prevent hydraulic oil from overflowing during an operation and when the truck is working on road side slopes.
- H. Top center of reservoir shall have a 1-1/4 inch weld flange installed suitable for the installation of a Gems Sensor model LS-700-TH or Force America S2-TSM15-L217-AC-DN-SS high temperature/low oil level sensor assembly.

- I. Reservoir bottom shall be equipped with a 3/4 inch NPT weld flange to accommodate a drain mechanism. A hydraulic 3/4 inch T-fitting shall be screwed to the weld flange with a magnetic 3/4 inch NPT plug (Zinga MP-75) on the opposite straight-through port. To the 90 degree T-port a 3/4 inch ball valve shall be attached. A 3/4 inch hose barb fitting shall be screwed into the valve and directed out to the left side, passing through a hole in the reservoir mount. Purpose is to allow easy draining of the reservoir by simply sliding a hose on the barb, opening the valve and directing the oil into a receptacle. Ball valve operation lever shall have a heavy plastic wire tie or safety wire to insure it stays in the off position unless intentionally moved.
- J. Reservoir interior and exterior shall be thoroughly cleaned to remove weld slag, splatter, dirt, and any other foreign materials.
- K. Vendor shall fill the hydraulic system with premium quality Dextron III automatic transmission fluid which will serve as hydraulic oil.

8. HOSES & FITTINGS

- A. All flexible hydraulic hoses (suction, pressure and return lines) shall have JIC 37 degree female crimp-on permanent fittings.
- B. All hoses and fittings, with the exception of the suction line, shall be non-skive high bend radius with a minimum operating pressure of 3,000 PSI, regardless of size (Gates Global M3K or approved equal).
- C. Splicing of hoses is unacceptable. All hoses more than 3-feet in length shall be attached via swivel adapters. Pipe fittings, galvanized or zinc plated fittings, or the use of teflon tape is/are unacceptable anywhere in the hydraulic system.
- D. Pressure and suction lines shall attach to the hydraulic pump with a swivel fitting. Lines shall be easily unconnected for servicing the pump, fittings shall have adequate tool clearance.
- E. All hydraulic lines shall be firmly secured. Lines shall be attached to the truck and/or components by metal bands, insulated by rubber padding to prevent hose chafing and/or cutting. Hoses shall be routed away from components that could cause them to be damaged. Installation of hoses shall not interfere with or inhibit the normal servicing of the truck.
- F. Hoses shall be as follows and/or shall be sized not to exceed the recommended flow velocities published as a nomograph in the Fluid Power Handbook & Directory.
 - 1. Suction: Reservoir to pump, 2-inch ID. SAE 100R4.
 - 2. Pressure: Pump to valve assembly, 1-inch ID.
 - 3. Sense line: Pump to valve, 3/8 inch ID.
 - 4. Return: Valve assembly to reservoir return filter, 1-inch ID.
 - 5. Plow lift and reverse: 3/8 inch ID. Plow lines routed to left-hand side of grill assembly. Plow lift hose attached to the lift ram with adequate slack.
 - 6. Spreader auger/anti-ice: Valve assembly to manifold plate, 3/4 inch ID.
 - 7. Spreader spinner/injection: Valve assembly to manifold plate, 1/2 inch ID.
 - 8. Manifold plate to motors: 1/2 inch ID.
 - 9. Return from manifold plate to dual return T-fitting: 3/4 inch ID.
 - 10. Main return from T-fitting to tank: 1 inch ID.
 - 11. Dump body hoist lines: 3/4 inch ID.

- G. Spreader and liquid pump hydraulic lines shall be ran to the rear of the truck and split up as follows:
1. Lines shall be split, three per dump body side, installed in this order from front to back of truck, on the manifold plates. Right side shall be 3/4 inch return, 3/4 inch auger, and 1/2 inch prewet. Left side shall be 3/4 inch return, 3/4 inch anti-ice pump, and 1/2 inch spinner.
 2. Pressure lines shall extend from the valve bank along the truck frame and terminate at a bulkhead fittings on the inside of the dump body sub-frame rear corners. On the external side of the bulkhead fittings, a short easy to replace hose shall be ran to each dump body side manifold plate.
 3. Lines shall be matched and identified by installing different color high quality wire ties on each side of the coupler set. Operator shall be required to simply match the colors and connect the implement.
 4. Main 1 inch return line shall be ran to the rear of the truck and be split into two 3/4 inch lines, one extending to each inside sub-frame bulkhead fitting. On the external side of the sub-frame bulkhead fitting, a short easy to replace hose shall be ran to each dump body side manifold plate.
 5. Parker SM series quick couplers shall be mounted to each plate with a 90 degree elbow, so the couplers are directed down and to the rear, so water will run out.
 6. Couplers shall be as follows:

Left side.	Return:	Male 3/4" Parker SM-752-12FP
	Anti-ice Pump:	Male 1/2" Parker SM-502-8FP
	Spinner:	Female 1/2" Parker SM-501-8FP
Right side.	Return:	Male 3/4" Parker SM-752-12FP
	Auger:	Male 1/2" Parker SM-502-8FP
	Prewet:	Female 1/2" Parker SM-501-8FP
 7. 1/2 inch SM-500-8FP coupler set(s) shall be installed in the spinner lines to allow the spinner(s) to be easily removed.

9. PLOW CUSHION VALVES

- A. Cushion valves (Gresen DXV or equal) shall be installed to protect all front and under body snow plows and/or scrapers. Valves shall be spring and ball style with -10 ORB ports.
- B. Front snow plow cushion valve shall be set at 1,800 PSI. Valve shall be bolted to the plow hitch frame on the left of the plow lift ram. One outlet shall have a 30-inch long by 3/8 inch hose with a male Parker brand SM502-8FP series coupler attached to the end. A corresponding female coupler half SM501-8FP shall be installed directly into the other cushion valve outlet port. The hose with male coupler half shall be looped back and attached to the female coupler.
- C. If the truck has an optional underbody snow plow or scraper, a 1,800 PSI cushion valve shall be installed on the plow between the dual rotational cylinders.

10. SPREADER CONTROL

- A. Vendors must provide a Cirus Controls SpreadSmartRX fully electronic spreader control or pre-approved equal. To be pre approved vendors must demonstrate, that their controller has the capability to simultaneously control the application and/or distribution of four products/functions (granular, prewet or injection pump, anti-icer, and spread width or zero velocity). It must be capable of controlling the spreader hydraulic valves without separate interfaces or adapters. It shall be of current design, meaning that it shall have a manufactured date as the same year being bid.
- B. All necessary software, programs, cables (including manufactured off of the shelf extension cables for slip-in or trailerized liquid application devices) shall be provided so as to provide a complete and fully functioning spreader control system. Future upgrades and improvements shall be available free of cost through an Internet download process. Spreader control shall be no larger than 55 square inches and dash mounted in an unobstructive spot.
- C. Installation shall position the control so it is easy for the operator to see and reach. Position shall not inhibit access to other controls, such as air brake switches. Spreader controller shall have a single 6" x 3.25" vacuum formed Display. Spreader control display shall have a luminance filter and shall not wash out with daylight.
- D. Display shall be capable being toggled between 9/16" and 3/8" character text height. Display shall be capable of simultaneous display of Granular, Pre-Wet, and Anti-Ice application rates. Display shall also show other sensors (pressure, temp, GPS, gate height, etc). Display shall also show actual ground speed and all active alarms.
- E. Control must be capable of controlling the application rates of granular, pre-wetting agents, and anti-icing agents, all simultaneously or independently, regardless of vehicle speed. Control must be GPS compatible and capable of bidirectional data communication. It must be possible to re-program the controller by simply hooking up a laptop computer and downloading or re-installing a program.
- F. Controller will be capable of spreading in pounds-per-mile or pounds-per-lane-mile. Controller shall be cable of accepting and displaying temperature inputs from a road temperature sensor such as a Sprague RWSS. The system controller shall be capable of ground speed oriented, closed (zero velocity) or open loop spinner control.
- G. Anti-ice feature shall include 3-lane selective lane switches. It shall have 4-switches, the first to activate anti-ice feature, the remaining three shall be lane selection switches, left, center, and right.
- H. System shall provide a means for operator to reset and/or indicate current volume of liquid in anti-ice and pre-wet tank(s) as part of power-up routine. System shall display current liquid volume in tank(s) while pre-wet and/or anti-ice system is active. The system controller shall be capable of managing of up to three anti-ice boom operations with individual boom selection.
- I. The controller shall have ability to measure distance (in feet) and be re-settable (use to include location from intersection for sign posts).
- J. Spreader controller must provide on-screen help documentation of all main operating functions. On-screen help must be automatically updated when any new system software is updated. On-screen help shall be sufficient to enable users to operate the system by following the on screen instructions, without referring to the printed operations manual. Controller shall have built in diagnostics (using the display for checking pulse from all sensors, etc).

- K. The controller shall offer multiple layers of access control to set up files:
1. "Factory standard" password protected access to operating functions and setup files.
 2. Supervisor re-set capability for each password.
 3. "Laptop computer only" access control for higher security.
- L. System shall alarm either audibly or visually for the following conditions: off rate, sensor failure, low liquid remaining, low liquid flow shutoff.
- M. Material rates, granular or liquids shall be by toggle actuation (+/-). Toggle paddle actuation shall cause the display to respond accordingly: The first toggle touch shall cause the display to show the current rate set point. The second toggle touch and all subsequent toggle actuations shall increase or decrease the current rate set point.
- N. System shall provide up to 10 supervisor settable application rates in each of up to 10 granular, Anti-Ice, & Pre-Wet materials. Controller must provide the ability to name each material with up to five characters. Rate increments shall be individually settable for each material.
- O. The controller shall have a Blast feature. The blast feature will be activated by the use of a 3 position toggle paddle switch. Blast calibration shall be settable during setup/calibration. Blast shall be capable of operating in the following three modes: Latched On, Timed On or Momentary On. Blast is active only while operator is activating Blast switch. Blast shall be disabled in absence of ground speed signal. Blast shall also be available as a remote switch.
- P. The controller shall have a Pass Feature. The Pass feature shall be activated via the same 3-position paddle switch. The controller will default to the pass mode upon start up of the system. Pass shall be capable of operating in the following mode only: Latched On – Press "pass" switch and all spreading stops until operator presses "pass" switch again. Spreader will then return to current application rate. Pass shall also be available as a remote switch.
- Q. Wiring: The system controller shall have one lead from each hydraulic valve coil wired to a common ground point. The system must supply pulsed +12 volt power to the other lead for each individual valve coil. For safety reasons, grounding or cutting any wire at any point between any valve coil and the controller must not cause any valve to actuate.
- R. The system shall include minimum rated IP68 connections for all "outside the cab" connections, hydraulic valve coils, and sensors. M12 connections shall be provided for pre-wetting, anti-icing and granular sensor connections. M12 connectors where they terminate at the granular pre-wetting and anti-ice sensor will provide LED's for both power and signal.

11. HYDRAULIC CYLINDERS

All hydraulic cylinders and rams used for the snow plow equipment components and operators shall be designed for a minimum of 3,000 PSI system operating pressure. Components shall be rated with an adequate safety failure margin suitable for the shock loads imposed by a snow plowing operation. Snow plow lift rams shall be as called out in the plow hitch specifications. All cylinders shall be as per the following:

- A. Steel tubing ASTM A513 type 5.
 - 1. (DOM) welded & drawn over mandrel, stress relief annealed.
 - 2. Grade (UNS G10260) 1026; Class COM-SRA.
 - 3. Inside shall be honed to micro finish of 10-20 RMS.

- B. Piston rod, ASTM.
 - 1. Grade C1045/1050 ASTM A311 cold drawn shafting, stress relieved with minimum yield strength 100,000 PSI and 8% elongation (tubing not acceptable).
 - 2. Shaft to be chrome plated to a minimum thickness of 0.001 inch per side at a micro finish of 6-12 RMS.
 - 3. Chrome shaft certified as rust resistant, ASTM B117 36 hour salt spray rust test.
 - 4. Shaft shall be turned down to no less than a 1-inch diameter for piston attachment. The piston shall attach to the rod with a minimum 1-inch self-locking nut.
 - 5. Salt Nitrated shaft hardening/corrosion protection is acceptable in lieu of above chrome plating.

- C. Rod end-cap and gland.
 - 1. Cylinder barrel shall be externally threaded, end-cap shall be internally threaded and screw onto the exterior of the barrel, holding the gland in place. Cylinder barrel shall be smooth throughout, end-cap end shall be internally chamfered to allow easy non-damaging insertion of the piston seals and gland.
 - 2. End-cap shall have a positive lock to prevent vibration loosening.

- D. Seals.
 - 1. Piston seals: Standard Polypak with O-ring style spring backer, moly coated (Parker standard molythane gray Polypak) or two ring capped t-seal design (Verco Capped T-Seal).
 - 2. Piston rod seal: Standard Polypak with O-ring style spring backer, moly coated (Parker standard molythane gray Polypak) or symmetrical loaded U-Cup w/B-lip (Verco).
 - 3. Gland seals: O-ring with backer. O-ring to be minimum 70 durometer hardness Nitrile compound.
 - 4. Rod wiper: Snap-in one-piece (Parker type D or approved equal) installed in the rod end cap.

SPECIFICATIONS
FOR
8 CUBIC YARD DUMP BODY WITH HYDRAULIC HOIST

The following specifications and dimensions shall apply to the purchase of heavy duty nominal 8 cubic yard capacity truck mounted dump body and subframe assemblies. The complete dump body and subframe shall be designed for and of adequate construction to withstand all stresses incurred from use with a tailgate-mounted sander with separate tailgate mounted liquid system or integral winter tailgate spreader/liquid tank assembly.

1. GENERAL

The body to be provided shall be a Western style (smooth flat bottom no cross stringers) body with the following dimensions:

- A. Nominal capacity, 8 cubic yards.
- B. 13-feet maximum inside length.
- C. 96 inches maximum outside width.
- D. 84 inches minimum inside width.
- E. 26 inches minimum side height.
- F. 36 inch minimum front post height.
- G. 36 inch minimum rear post/tailgate heights.
- H. 6 inches hinge pin setting.
- I. 2-inch rolled section to match floor and side.

2. BODY

- A. Body sides, front bulkhead and tailgate shall be constructed of 7-gauge A570 grade 50 steel with minimum 50,000 PSI yield strength and 65,000 PSI tensile strength ratings.
- B. Body rear corner posts shall be fabricated from minimum 7-gauge low carbon Austenitic 201, 304L, or Nitronic 30 stainless steel. Rear posts shall be internally reinforced to withstand the additional weight of an optional up to 3,000 lb. winter tailgate assembly.
- C. Front of body shall be fabricated from one piece of steel, without horizontal seam, and incorporate a cab protection shield (without window slots or any opening). Front shall have adequate horizontal ribs bent into it to prevent load swelling. Shield shall be sized to basically match the truck cab, extending approximately 3-inches above the top of the truck cab roof. It shall extend forward 12-inches from the front inside face of the dump body, formed with 2-inch high front and side edge lips, bent in as a part of the main structure, the side lips can be welded on.
- D. Body side shall included a pressed-in V-longitudinal reinforcement centered between the lower and upper rails.
- E. Body floor shall be constructed of 3/16 inch plate (not gauge steel) with a nominal 100,000 PSI yield strength, 114,000 PSI tensile strength, and certified 235 hardness abrasion resistant (AR) rating.
- F. No splice joint permitted in the center of the floor. If welds in the floor are required, they shall be continuously butt welded on both sides of joint; automatic seam welded with 100% penetration would also be acceptable.
- G. All body sides, cab protector, floor and tailgate welds shall be continuous (skip welds unacceptable). All vertical and horizontal channels on the body shall be completely sealed by 100% continuous weld. If both sides are visible, both sides shall be welded.

- H. Front corner posts shall have open bottoms to allow complete drainage. Rear post shall be protectively capped at the bottom to protect it from water and mud spray from the rear tires, and also to prevent it from filling with snow and ice in the winter. They shall still have drain holes.
- I. Side rails shall be horizontal self cleaning. Top rail on the front bulkhead and both side rails and rear tailgate of the body shall have either a 2-inch rolled radius or an approximate 45-degree taper. The taper shall be to outside of body with the exception of the front bulkhead it shall taper to the inside of the body.
- J. A 2-inch ID schedule 40 black pipe shall be welded between the front and rear corner posts flush with the top of the posts. The pipe shall have three evenly spaced vertical supports welded between the bottom of the pipe and the top of the body side.
- K. A 3/4 inch diameter rerod shall be attached along the entire length of both sides of the body along the lower quarter of the sides in such a way as to function as a step the length of the body. The rod shall be welded to triangular gussets that are continuously welded to the rerod and the rub rail.
- L. The body front bulkhead and removable double acting tailgate shall be adequately reinforced to withstand heavy dumping, loading, and operating in a raised mode to charge the tailgate spreader while the truck is moving.
- M. Tailgate to have two evenly spaced balanced lift loops to allow easy removal. Loop(s) shall not protrude beyond the tailgate rear face or otherwise interfere with the installation of a tailgate mounted pre-wet sprayer system.
- N. Tailgate shall have two sets of bushings welded through it suitable for the 3/8 inch bolts that hold the sander side shields in place. Bushings shall be welded 100% around their OD.
- O. Lower tailgate pins shall position tailgate level with floor when opened.
- P. Upper tailgate pins shall pass completely through the upper corner post and be secured with a lynch pin. Pins shall be greaseable. Dead hole pin is not acceptable.
- Q. Upper corner post tailgate hinge receiver pin holes shall each have a bearing surface width equal to the tailgate member width. If the tailgate top hinge material is 1" thick, each post member shall be 1" thick or bushed to a 1" thickness.
- R. Front lower corner post shall be punched with a 2-25/32 inch diameter circular punching for the installation of a 2-1/2 inch diameter amber clearance lamps set at 30-degree angle from the side of the box, visible from the front and side.
- S. Rear face of the rear corner posts shall each be punched, from the top down, as follows: a 2" x 6" oval, tail light puffer fitting hole between, and a 2" x 6" oval. These two 2" x 6" oval punchings will be for the installation of a stop/turn/tail lamp in the upper and strobe lamp in the lower. Punched holes shall be placed as high as possible in the rear post face, but without causing the installed lamp rubber grommets to overlap.
- T. Side of the rear post shall be 2-25/32 inch circular punched for the installation of a 2-1/2 inch diameter clearance lamp approximately 6-10 inches down from the top.
- U. Lamp punchings shall be positioned high enough up in the rear face of the rear post so the stop/turn/tail lamp and strobe lamp is fully visible when the spreader auger cover is in a raised vertical position spreading mode.
- V. Front center of dump body between longitudinals shall be adequately reinforced to withstand a dump body vibrator. Reinforcement(s) must be factory installed by the body builder while the unit is being manufactured. Reinforcements must fit closely to the body understructure, weld must be continuous.
- W. Tailgate chains shall not obstruct dump body lights mounted in rear corner posts. Chains shall be grade 43 covered with a nylon or plastic netting cover.

- X. Tailgate trip mechanism, if enclosed at any point, shall be greaseable. Rear cross shaft shall have body side external grease fittings so the shaft can be easily greased. An operator shall be easily capable of releasing the tailgate with the box loaded and in the raised position.
- Y. Trip release lever shall have adequate finger/hand clearance all around in the locked position. Over-center return to lock shall not smash the operator's hand.

3. TAILGATE STIFF ARMS

A set of removable stiff arms shall be provided which will install between the dump body tailgate lower lock pins and release sockets, designed to hold the tailgate in a fixed open position during a spreader operation. Stiff arms will allow the maximum design amount of material to enter the spreader hopper. Stiff arms shall be designed to prevent material weight damage occurring to the spreader and/or spreader cover when the dump body is in the raised position charging the spreader hopper. They shall include a mechanism to hold them in a fixed position on the tailgate to allow one person to install and remove them. Note: If a winter tailgate option is specified, these stiff arms are not required.

4. BODY MONOCOQUE UNDERSTRUCTURE

- A. Body understructure longitudinal support members shall be fabricated trapezoidal shaped long sills running the entire length of the body. Trapezoid shall create a 10 inch tall member, 10 inches wide on the body floor and 2 inches wide where they meet and rest on the hoist subframe.
- B. Longitudinal members shall be constructed of formed minimum 1/4 inch thickness 70,000 PSI tensile high strength steel. All seams creating the member and attaching it to the body floor must be continuously welded to prevent salt intrusion. Metal comprising the 2-inch bottom face of the trapezoid shall overlap, effectively creating a 1/2 inch thickness where it meets the subframe and the hinges attach.

5. HOIST

- A. Standard mount, minimum NTEA Class 70 performance rating, providing a minimum 20-ton rating, capable of a dump angle of 45 to 50 degrees.
- B. Assembly shall be a twin cylinder design employing two double acting 5-inch ID cylinders designed for a 3,000 PSI working pressure system, or approved equal.
- C. Hydraulic cylinders shall have a hard chrome plated piston rod with 1.4 mils chrome thickness. Shafting shall be certified to meet ASTM B117 36 hour salt spray test requirements.
- D. Cylinders shall have a built-in port relief that operates when the cylinder reaches full stroke.
- E. The lifting forces of the cylinders shall not be applied directly to the body. Hoist shall function through a lifting arm linkage.
- F. Body must be equipped with dual OSHA approved safety struts.
- G. Hoist frame sidemembers shall be one piece, formed nominal 5 inch high by 3 inch wide channels fabricated of minimum 1/4 inch thick 70,000 PSI tensile high strength steel. Pivot hinges and/or rollers shall be bolted to allow servicing and repair. All hoist seams and joints shall be continuously welded to prevent salt intrusion.
- H. All hinge points, pivots, linkages, and/or rollers shall be fully greaseable via a standard grease fitting. Composite and/or nylon type bushings are not acceptable. Wide pivot joints must include multiple grease fittings placed radially along the joint to insure complete lubrication around the entire circumference and length of the joint.

6. SPECIAL PAINT & RUST-PROOFING REQUIREMENTS

- A. Entire dump body (inside, outside, underneath, tailgate) and entire hoist and sub-frame (except cylinder(s)) shall be completely blasted to remove all mill scale, contamination, shipping primer, paint, and any other foreign material that may effect final finish adhesion.
- B. The preferred method of body coating will be complete powder coating. If that is not possible, the following must be employed:
 - 1. After blasting, inside of body up to within 9" - 12" of the side height shall be coated with black coal tar finish. Purpose of coal tar is maximum durability and corrosion resistance.
 - 2. Body exterior shall be painted orange to match the truck cab per Standard Specification requirements.
- C. Sub-frame and hoist shall be mounted on truck frame and all attachment tabs, bolt holes and other brackets and parts welded on and pre-assembled as practical. Then entire sub-frame and hoist assembly (less cylinder) shall be disassembled, blasted to white finish, powder coated black, and re-assembled.
- D. After body installation, truck frame, bolt heads, pins, cylinder(s) and any/all other surfaces that could rust shall be 'black-out' painted for corrosion protection. Truck frame shall be over-coated to hit all areas, components, bolts, etc. recently installed or missed by manufacturing plant.
- E. Entire underside of body, inside of corner post and full length of all longitudinal members of the body and it's understructure shall also be thoroughly coated with rust-proofing compound. No bare metal shall be left exposed in the posts, rub rails or anywhere else in/on/under the body.
- F. Rust-proofing compound shall cure to a dry-to-touch state, not remain sticky.
- G. Body will be thoroughly inspected for proper finish applications and rust proofing. Any bare metal found will be immediate grounds for rejection.

SPECIFICATIONS
for
STAINLESS STEEL TAILGATE SPREADER

1. GENERAL

- A. The spreader will be used to apply granular ice control materials to a roadway surface.
- B. Spreader shall be an under-tailgate mounting with heavy duty hinge brackets and pins for attachment and removal.
- C. Spreader shall be hydraulic power driven auger design with spinner.
- D. Overall width shall not exceed 96 inches.
- E. The spreader shall be designed to have a variable delivery rate, ranging from a minimum of 60 pounds of salt to a maximum of 800 pounds of salt per lane mile at a delivery speed of 25 MPH. Salt for calibration shall be Hutchinson Salt Co. Kansas Medium Rock Salt with a bulk density of 71 lbs. per cubic foot.
- F. All components of the spreader shall be low carbon Austenitic 201, 304L, or Nitronic 30 stainless steel unless otherwise noted.

2. HOPPER

- A. The hopper shall be a trough design with 6-inch diameter cross auger discharging onto a rotating spinner.
- B. Hopper shall be a minimum 7-gauge thickness.
- C. All weldments shall be continuous on mating parts. All splatter and slag shall be removed, sharp corners and punching shall be ground smooth.
- D. A removable anti-flow cover plate shall be furnished to prevent material spillage when auger is not rotating. Cover plate shall have a welded-on auger choke plate to prevent the free flow of salt out of the spreader. Other holes and punching in the auger trough and its end plates shall not allow salt to free-flow out.
- E. The bottom of the hopper chamber shall be a full length hinged operable trough to allow complete emptying, wash out and clean-up while spreader is mounted on the truck.
- F. All hinges, latches and mounting hardware shall be heavy duty. Mounting plates attached to the dump body shall be stainless like the rest of the spreader, as shall their pins. Mounting plates shall attach with a minimum of two 1/2 inch cadmium plated (rust resistant) bolts. Bolt nuts shall be to the inside to eliminate a catch hazard. Back side of plates shall be completely covered with RTV sealant so when the plate is installed a permanent watertight seal is obtained all around the plate and it's fasteners. Excess sealant shall be removed.
- G. A minimum 10-gauge cover plate shall be furnished to cover the complete hopper. Cover shall lie flat over the hopper so material can be unloaded directly over spreader or shall be able to be raised vertically to act as a rear spill plate.

3. AUGER

- A. Auger shall measure 6 inches OD with continuous flighting, designed to promote a smooth steady flow of material to the spinner. Auger shall only move material from the right to the left side of the hopper.
- B. The auger flighting shall be 4-inch pitch heavy duty taper design, 5/16 inch thick at the outside and 3/8 inch at the core. Flighting shall be securely welded to the shaft tubing. Shaft shall be fabricated from 2-1/2 inch schedule 80 pipe.

- C. Auger tube shall be supported on both ends by minimum 1-1/4 inch shafts riding in precision self aligning greaseable ball bearings retained in an external 2-bolt mounting block. Bearing assembly shall be easy to change and service.
- D. The auger shall be driven by a high torque/low speed Parker TE series 17.9 in³ hydraulic motor with integral 30 pulse speed sensor (TE0295FS100FSAA).
- E. Motor shall drive the auger through a #60 roller chain arrangement, providing a 2.6:1 drive ratio. A 26-tooth sprocket shall be installed on the 1-1/4 inch auger drive shaft and a 10-tooth sprocket on the 1-inch Parker motor shaft. A device shall be incorporated into the design allowing the motor to be pivoted, allowing adjustment of the roller chain tension. Sprockets shall be easy to remove and change, allowing easy gear ratio changes from 2.8:1 up to a direct 1:1 drive.
- F. A light sheet metal cover shall enclose the chain drive system. It shall be easily removable to allow lubrication and inspection of the chain.

4. SPINNER ASSEMBLY

- A. The spinner assembly shall be rigidly mounted in a fixed position on the rear bumper of the truck with a 1-3/8" x 4-1/4" rectangular receiver, similar in function to an automotive trailer receiver hitch. It shall be held in place in a similar fashion, by a simple pin with hair spring cotter inserted through a choice of three depth placement holes. The complete spinner assembly shall be easily removed by disconnecting the two hydraulic quick connectors and the receiver hitch pin.
- B. The spinner shall be an 18-inch diameter polyurethane (Thombert, Fluorocarbon or approved equal) equipped with six fins.
- C. Spinner shall be driven counter clockwise by a nominal 3 in³ 4-bolt flange with 1 inch keyed shaft high torque orbital hydraulic motor attached to a precision made cast hub.
- D. The spinner assembly plate shall be mounted between 20 and 24 inches off the ground.
- E. The shield assembly shall be similar to what is commonly used on hopper spreaders, having adjustable side flaps around the spinner. A generic shield assembly will be made available to bidders for inspection.
- F. Side flaps shall be fabricated from minimum 1/4 inch polyurethane, the same material as the spinner itself.
- G. A stationary stainless steel deflector shield shall be installed in front of the spinner to protect the undercarriage of the truck.
- H. The adjustable spinner shield flaps will be used to direct the ice control material downward to the road surface. The flaps shall extend a minimum of 1-inch above the spinner fins and a minimum of 1-1/2 inches below the spinner plate. Flexible rubber corner shielding shall be installed between the flap shields.
- I. The spinner assembly, with it's shielding in the full open position, shall not extend beyond the outer edge of the truck.
- J. There shall be a set of stainless steel tailgate side shields provided with each spreader, mounted to the dump body tailgate with a minimum of two 3/8 inch stainless bolts per shield. These bolts shall go through tubing welded through the tailgate. Shields shall be large enough to stay engaged within the body sidewalls when the tailgate is raised on the top hinges to an approximate 80-degree angle from vertical. They shall be adequate to not allow granular salt to free flow out or over the spreader sides.

SPECIFICATIONS
for
140 GALLON TAILGATE MOUNTED PRE-WETTER

1. GENERAL

- A. Pre-wetter will be used to apply liquid ice control material onto granular material at the spreader spinner.
- B. Pump system shall have a design rating of 4 GPM @ 1725 RPM.
- C. Tank shall be of a trapezoidal shape with a 140 US gallon capacity.
- D. System must be fully tested and calibrated to a 15 gallon per ton rate upon delivery to the Department. System shall be flushed and winterized with a suitable antifreeze solution to prevent damage.
- E. All components, parts, pieces, fasteners, etc., shall be manufactured for nonferrous/non-rusting materials.
- F. Liquid ice control material hoses shall be 1/2 inch polyester braid reinforced clear PVC, suitable for cold weather use.
- G. All hoses and cables shall be long enough to allow the dump body tailgate to open for dumping over the spreader.

2. TANK

- A. Tank shall be purpose designed to fit a Department snow removal truck tailgate in the open spreader charging position. When installed it shall square-off the rear of the truck to a point even with the back of the installed spreader.
- B. Trapezoidal tank shall be approximately 19 inches wide at the top and 10 inches at the bottom. Height shall be 29 inches, overall length shall be 80 inches.
- C. Tank shall be constructed from rotationally molded UV stabilized polyethylene dyed opaque orange. It shall have a minimum average wall thickness of 0.400 inch. Design liquid rating shall be a minimum of 14.5 lbs. per gallon.
- D. There shall be three molded-in stiffeners, each approximately 6 inches wide, evenly spaced in the tank length.
- E. Gallon markings shall be molded into the right rear face of the tank directly above the sump where the "pump-fill" connector will be installed.
- F. Tank shall have a top center mounted 12-inch fill lid. Lid shall be tethered.
- G. A 4" x 8" x 6" sump shall be molded into the right side bottom. Sump shall have three molded-in female 1-1/4" NPT threaded ports.
- H. A suitable recess compartment shall be molded into the right tank end, large enough to hold the integral board mounted pumping system. Stainless steel bosses shall be molded into the tank to allow the entire pump system to be securely bolted into place, employing stainless steel bolts.
- I. Additional stainless steel bolt bosses shall be molded into the right end to allow the installation of a stainless steel cover door over the pump system to protect it. Cover shall have a full length vertical stainless steel piano hinge bolted into the molded-in bosses down one side. The opposite side shall latch using two stainless steel thumbscrews threading into two of the molded-in bosses. Entire cover shall be easily removed.

3. FITTINGS

- A. The left rear facing port shall have a 1-1/4 NPT plug screwed into it. It shall be for quick draining or clean-out of the tank.

- B. The left port shall have a serviceable “Y-type” mesh strainer plumbed in so all anti-icing material pumped on via the bulk fill must pass through it.
- C. Right port shall have a 1-1/4 inch three-way ball valve installed to allow bulk fill, shutoff or suction to be selected. A 1-1/2 inch male cam-lock connector shall be installed to allow bulk filling. A matching cam-lock cover cap shall be provided.
- D. A 3/4 inch 2-way valve shall be installed into the suction plumbing. When this valve is closed, normal flow of the anti-ice material shall occur. When the 3-way valve is turned to the closed position and this valve opened, flush material shall be sucked into the plumbing and pumping system, thoroughly displacing all corrosive materials. An approximate 12-inch hose piece shall be attached to this fitting to allow easy flush material introduction via a plastic jug.

4. PUMP SYSTEM WITH FLOW METER

- A. Material pump shall be a solid brass gear type, direct coupled to the hydraulic motor that will power the pre-wetter.
- B. Pre-wetter hydraulic system shall obtain its flow directly from the valve motor manifold circuit identified for this purpose.
- C. Flow control shall be electrically controlled by the spreader control in the truck cab, allowing precise metering of the oil flow.
- D. Pump system shall incorporate a calibrated Raven model RFM15 turbine style flow meter. Flow meter signal shall be sent to the spreader control, allowing a precise ground oriented liquid application rate. Rate shall be adjustable up to the limits of the pump design output.

5. MOUNTING SYSTEM

- A. Pre-wet system shall attach to the dump body tailgate via a full low carbon Austenitic 201, 304L, or Nitronic 30 stainless steel framework. Frame shall fully support the tank with three main hangar brackets.
- B. Framework shall be fully adjustable, allowing the system to be mounted on most tailgate type and designs under standard production.
- C. Polyethylene tank shall be retained in the stainless steel mounting cradle with three 2-1/2 inch wide UV stabilized nylon tie down straps. Straps shall have a heavy duty threaded t-bolt mount on each end. Bolts shall pass through the mounting framework and be tension adjustable with stainless nuts.

6. NOZZLE DELIVERY SYSTEM

- A. Pre-wet liquid shall travel from the pump out to be applied on the spreader spinner.
- B. Two brass nozzles, each rated 1.0 GPM flow shall be mounted onto a bracket, attached to the spreader spinner with stainless bolt. Nozzles shall be directed to spray on the centerline of the spinner.
- C. A suitable cam-lock style quick connector shall be installed in the delivery line running to the nozzles. It shall be positioned in the line to approximately correspond to where the hydraulic quick connectors for the spinner assembly are, allowing the entire spinner assembly to be easily removed with the nozzle bracket assembly attached.
- D. A one-way check valve system must be installed in the delivery line directly before or at the nozzles to prevent line drain down when the system is shut-off.

SWITCH PANEL & ELECTRICAL INSTRUCTIONS
for
SNOW REMOVAL TRUCKS

1. OVERHEAD SWITCH PANEL

- A. A centralized switch and indicator panel shall be mounted in the overhead console in front of the driver. Panel shall contain all switches and devices necessary to operate all added snow plow electrical equipment.
- B. Panel shall be a factory made modular Wired Rite Systems model Q-MT-80213-1-24417. Switches will have built-in bus bar connecting, silk screen backlit function indicators and magnetic automatic reset internal circuit breakers.
- C. Wiring shall include adequate slack to allow entire panel to be easily removed for service or replacement.
- D. Switch circuits will be either a battery or ignition type. Battery circuits shall be always hot. Ignition circuits will receive power through an electromagnetic relay when the ignition switch is in both the accessory or run positions.
- E. The lamps and switches shall be ordered, labeled and function, from left to right, as follows:
- | | | | |
|-----|-----------------------------------|-----------|------------------------------|
| 1. | Filter Bypass Lamp. | | Green Bezel. |
| 2. | Low Oil/High Temp Indicator Lamp. | | Blue Bezel. |
| 3. | Body Up Indicator Lamp. | | Red Bezel. |
| 4. | Blank (or Plow Lights. | Battery. | DPDT, 2 position, ON/ON.) |
| 5. | Amber Revolving Light. | Battery. | SPST, ON/OFF. |
| 6. | Wing Light. | Ignition. | SPST, ON/OFF. |
| 7. | Spreader Light. | Ignition. | SPST, ON/OFF. |
| 8. | Taillight Puffer. | Ignition. | SPST, ON/OFF. |
| 9. | Blank (or Spread Right. | Ignition | DPDT, 2 position, ON/ON.) |
| 10. | Extra Switch. | Ignition. | SPST, ON/OFF. |
| 11. | Strobe Light. | Battery. | DPDT, 3 position, ON/OFF/ON. |
| 12. | Winter/Summer: | N/A | DPDT, 2 position, ON/ON. |
| 13. | Indicator Dimmer. | Battery. | Sliding. |
- F. If an OEM chassis switch system is not available for the installation of auxiliary snow plow headlights, an additional switch must be added into the panel as switch 4 as above. The plow lights upper and lower headlamp function shall be controlled by a relay mounted on the truck fire wall. If an OEM system is available, this position shall have a blank cover.
- G. If any type of dual discharge design spreader system is optioned, an additional switch must be added into the panel as switch 9 as above. This switch shall provide the left-to-right discharge change. If a single discharge spreader is ordered, this position shall have a blank cover.
- H. The Low Oil/High Temp Indicator Lamp shall operate in conjunction with the temperature and level sender installed in the hydraulic reservoir. See Hydraulic System specification. When activated this lamp shall be constantly on until the oil temperature is reduced or the oil level raised. It shall include a constant audible alarm.

- I. The Body Up Indicator Lamp shall function as a dump body height warning system. In both the Winter and Summer mode, it shall illuminate whenever the body is raised. In addition, in the Winter mode, working through an adjustable angle mercury switch, this system shall also include a flasher and audible alarm that will engage when the body attains the pre-set height adjustment of the mercury switch. Alarm must be loud enough to be heard over any truck noise.
- J. The Winter/Summer switch shall control power to the spreader control and dump body height warning circuit. In the Winter mode it will allow power to the spreader control ON/OFF switch and power the height warning feature of the dump body up lamp circuit, causing both to function as designed. In the Summer mode, it will not allow power to the spreader control switch or the dump height warning circuit.
- K. All switches (except dimmer) shall be heavy duty standard size (7/8" x 1-1/2" rectangular mounting hole) nylon snap-in with a minimum 15 amp rating and ring terminals. Switches shall be Carlingswitch TIG series.
- L. The switch panel wiring shall be 18-gauge SAE type SXL wire, fully color coded harness with imprinted circuit description label. Wiring harness shall be enclosed in split loom. Loom shall run from the overhead console behind the left cab A-pillar cover and down behind the dash. From behind the dash it shall travel to the assigned function, being ran behind the kick panels and under the rocker panels.

2. ELECTRICAL SYSTEM POWER, JUNCTION BOX & OVERLOAD PROTECTION

- A. All vendor installed electrical circuits shall pass through a central junction in the truck cab. Box shall be installed beside the passenger seat base. Box shall be approximately 10" x 6" x 3-1/2" with clear see-through top.
- B. Main 12-volt battery feed into truck cab control box shall be protected by an 80 amp manual resetting waterproof circuit breaker (Wired Rite CB-80R or equal). The power feed line to the 80 amp breaker shall be a minimum of 4-gauge fine strand copper. The positive/negative wires into the cab from the breaker and truck frame ground shall be 8-gauge.
- C. Vibrator circuit shall be protected by a 150 amp manual resetting waterproof circuit breaker (Wired Rite CB-150R or equal).
- D. Both circuit breakers shall be mounted on a nominal 8" x 8" x 6" fiberglass NEMA weather tight electrical junction box with hinged, sealed door and stainless latch, mounted on the side of the battery box. Exterior must be marked "Main Breakers". Box shall be adequate to properly house both resettable circuit breakers and the vibrator solenoid. All wiring entering and leaving shall be weather tight sealed.
- E. The main power feed line into the cab junction box shall be split into two separate systems. One system shall be an always hot battery feed for the amber revolving lamp, 2-way radio, rear strobe system, and trailer brake control. The second shall be switched by the truck ignition through a 75 amp electromagnetic relay.
- F. Extra Switch and Extra Power Circuit shall each terminate in the junction box. They shall be labeled.
- G. Vibrator circuitry shall include an integrated circuit 50% duty cycle timer (5-seconds on, 5-seconds off).
- H. A row of manual reset circuit breakers shall be installed into the front of the junction box. They shall protect: 1) Strobe lamp system, 2) Hydraulic valve solenoids, 3) Trailer brake control, 4 & 5) both 2-way radio circuits (one controlled by ignition accessory position and the other always hot from the battery) and 6) Extra circuit (for Department accessory installation).

- I. DOT 2-way radio circuits shall be provided, requiring 6 conductors. The conductors shall be: One 30-amp 12v direct battery feed and ground wire, one 4-amp 12v ignition feed and ground wire, and two for an external speaker connection. 30-amp battery circuit power and ground wiring shall be 10-gauge. 4-amp ignition circuit power and ground wiring shall be 16-gauge. The two speaker wires shall be standard paired 14-gauge wire, ran from the radio installation location to the center of the cab back wall, there terminating with a 4-foot coil of wire.
- J. Radio and speaker wiring shall be installed as follows, dependent of chassis type:
 - 1. If the cab has an overhead compartment designed for a customer installed CB or 2-way radio, it shall be utilized. All required wiring shall be ran to this compartment and terminated with adequate slack to allow easy installation.
 - 2. If the cab design doesn't have a specific compartment allocated for a customer radio, wiring shall be ran behind the dash and terminate in an adequate position directly below the dash suitable for a radio installation. Location must be pre-approved by Equipment Services.
- K. Trailer brake controller wiring shall be minimum 12-gauge.

3. CAB WIRING

- A. Wing light wiring shall terminate outside truck cab near the rear of cab on the same side as the wing with a flange mount AMP #206430-1 connector with a cap. A label stating "Wing Light" shall be affixed near it. A mating connector half shall be provided for Department installation of a lamp, regardless if the truck is ordered with a wing or not. Mating connector half shall be fully assembled, complete with 12-inch wire pigtails.
- B. All wires shall be a minimum of 14-gauge copper unless otherwise specified.
- C. All cables going through the truck cab metal that are not part of CPC connectors shall required a rubber grommet and metal strain relief clamp.
- D. All wires on the outside of the cab shall be placed in a loom and supported approximately every 16 inches to frame or body members.
- E. All grounds shall return to the cab and be attached to common grounding lugs.
- F. Unless otherwise specified all wiring splices and connections shall be soldered and insulated with shrink tubing. All cable couplings and receptacles shall be sealed with a dual wall flexible shrink tubing. Shrink tubing used inside cab area shall be standard (no internal sealant). Shrink tubing used outside cab area shall be dual wall with an internal sealant.
- G. All CPC couplings and receptacles are to be AMP series I with type III crimp pins and sockets. The couplings and receptacles shall also have peripheral o-ring seals. All couplings and receptacles shall be nonmetallic with **gold** contacts and strain relief clamps. Unused plugs are to be capped.
- H. All cables shall be enclosed in braided expandable flame-retardant monofilament sleeving, Natvar No. E-MF-FR or equal.
- I. All internal and external pins in the couplings and receptacles shall be coated with a dielectric grease.

4. EXTERNAL WIRING & DUMP BOX LIGHTING

- A. All lamps shall be Truck-Lite LED hermetically sealed installed with a flush shock absorbing rubber grommet.
- B. Rubber grommets must be closed back type for maximum lamp and plug protection.

- C. Oval 2" x 6" red stop/turn/tail lamps for dump body shall be Truck-Lite LED model 60, #60050R.
- D. The 2-1/2" round side marker/clearance/triple ID lamps shall be a Truck-Lite LED model 10, #10050R red and #10050Y amber.
- E. Chassis mounted 4" round red stop/turn/tail lamps shall be Truck-Lite LED model 44, #44030R, 4" round clear back-up lamps shall be Truck-Lite LED model 44, #44040C.
- F. All plug-in connectors shall be liberally coated with a corrosion preventative dielectric lubricant, as in Truck-Lite NYK77 compound No. 97940 or equal.
- G. Wiring harness shall be a Truck-Lite #50938 especially designed for LED lamp systems, consisting of a multiconductor color coded cable with a second layer of insulation. All wiring shall be in a loom, supported in a welded-on stainless steel or other non-corroding conduit the length of the dump body. The conduit shall be sealed with RTV silicon sealer at both ends.
- H. Wiring at the lamps shall be stress relieved within 2 inches of a lamp with a metal clamp and bolt. All lamps shall have 4 inches of wire slack for wire repair.
- I. All wiring for the box lamps shall join in a sealed Betts Dri-Seal Circuit Box #351044 at rear of the truck. Box shall be placed for easy maintenance above the pintle hook inside the truck frame rails, facing out to the rear. All ports, plugs, and wires installed in the box shall be additionally sealed with silicone sealant as an added measure of protection.

OPTIONAL EQUIPMENT THAT MAY BE REQUIRED**OPTION NO. 1: 20,000 LB. FRONT AXLE w/425 SUPER SINGLE TIRES (20k)**

Vendors are asked to bid the cost of providing a wide track 20,000 lb. front axle (Dana Spicer I-200w or Meritor MFS-20-133a) and Michelin XZY3 or Bridgestone M844 425/65R22.5 load range L (rated minimum 11,400 lb. capacity each) super single front tires mounted on heavy duty steel wheels rated at or exceeding the tire rating and all related apparatus in lieu of the base front axle, suspension, tires and wheels. Option shall not speed restrict vehicle to less than 70 mph. Plastic or rubber front fender flare extensions must be included to cover wider tread of super single tires.

OPTION NO. 2: DUAL SPREADER (DS)

1. Vendor shall bid the cost to provide a spreader with independent dual left and right spreader discharge arrangement. Dual discharge spreader shall employ the same style auger as a left discharge model but with rotational reverse capability. Both left and right anti-flow plates shall be provided.
2. Spreader spinners shall be plumbed in series. Side-to-side hydraulic lines shall be ran across the ICC bumper in simple rod loops, making them easy to remove and replace. Lines shall include proper hydraulic couplers so system can be operated with just one of the two spinners in place.
3. Spreader controls (auger/spinner rates) shall cause material rates to remain approximately the same, regardless of discharge side chosen. Discharge selector shall be an 2-position 4-way electric selector valve, easily shifted by operator demand. Switch will replace the "Extra" switch in the switch panel. It shall be labeled "Spread Right/Spread Left".
4. System shall include a liquid selector valve to automatically direct the prewet solution to the same side as the dry material is discharging.
5. Dual spreader shall be equipped with dual spreader lamps, one on each side. Lamps shall be wired in conjunction with the selector switch, illuminating the material discharge side.

OPTION NO. 3: CENTER SPREADER (CS)

Vendor shall bid the cost to provide a spreader with a center material discharge and spinner in lieu of the standard left discharge and spinner. Auger shall be driven by a 5:1 ratio gear reduction box.

OPTION NO. 4: RIGHT SPREADER (RS)

Vendor shall bid the cost to provide a spreader with a right material discharge and spinner in lieu of the standard left discharge and spinner. All other aspects shall be the same as a left discharge model. Spreader lamp shall be re-positioned to the right side.

OPTION NO. 5: LEFT ZERO-VELOCITY SPREADER SYSTEM (LZV)

1. Vendor shall bid the complete cost to provide and install a complete zero velocity spreader system in lieu of the standard spreader. Known acceptable spreader is a Monroe Accu-Place, any other must be pre-approved. System shall be complete and fully operational, capable of accurate material zero velocity placement up to 55 MPH.

2. All additional components and/or changes or alterations of existing systems required to provide and operate this system must be included, specifically but not limited to additional and modified hydraulic valve sections and spreader motors.
3. Proposed system shall fully integrate with the specified spreader control without additional electronic adapters or interfaces. Design shall allow the operator to directionally control the material output and also the pattern of discharge through an integrated directional controls panel. Directional control and pattern shall be adjustable from typical lane wide broadcast down to a narrow single wheel-track band.
4. A color review camera system shall be installed in the truck cab so the operator can visually see the direction of the ZV unit and confirm material output. Camera system to be:
 - A.. Color rearview mirror image camera system complete - single camera provided. 12VDC designed for mobile operations. Minimum 30 feet night visibility - NM Infrared. 0.000 LUX. 420 Lines Resolution. Nominal 3.6 mm lens. Weatherproof housing.
 - B. Minimum 6" flat panel monitor, minimum 2 camera inputs, easily switched between images. Dimming control or automatic light adjusting. Dash mounted swivel bracket. Auto power ON.
 - C. Fully shielded single waterproof IP68 rated cable and connectors of adequate and proper length to allow correct cable routing and slack.
 - D. An air line shall be installed into the taillight puffer line and routed to the camera lens to keep it clear of, same as the taillights.
5. ZV application head shall be easily removable like a regular spinner. Mounting system shall employ an automotive style 2" square receiver hitch, allowing head to be removed by simply removing a hitch pin and sliding the square out of the receiver. All hydraulic and electrical connectors shall junction in a common spot.

OPTION NO. 6: RIGHT ZERO-VELOCITY SPREADER SYSTEM (RZV)

Vendor shall bid the cost to provide a zero-velocity spreader system with a right material discharge in lieu of the standard left discharge system. All other aspects shall be the same as a left discharge model. Spreader lamp and camera shall be re-positioned to the right side.

OPTION NO. 7: LEFT WINTER COMBINATION TAILGATE (WTG-L)

1. Vendors are asked to bid the complete cost to provide and install a left side discharge winter tailgate assembly consisting of an integral spreader and minimum 245 gallon liquid prewet tank. Known acceptable winter tailgate is a Monroe RTS86X38-6-OW (00103633). Assembly shall replace the standard dump body tailgate, spreader and liquid tank. Standard dump body tailgate only shall be included and shipped with the truck unattached.
2. The tailgate side plates listed in spreader section 4.J. are not required. The bushings through the tailgate in dumpbody section 2.O. that the side plates bolt through are also not required. Also, the tailgate stiff arms required in dumpbody section 3. are not required.
3. Spreader shall incorporate all features and meet all functional requirements of a standard left spreader. Spreader side plates shall be extended upward and be designed into a minimum 245 gallon liquid tank directly above the auger trough. Liquid system shall incorporate all functional features of a standard 140 tailgate prewet system. Pump system enclosure shall be designed into the right end of the tank, system components shall be interchangeable with those in the standard 140 prewet.

4. A chopper auger with directional interrupted flighting shall be installed into the granular material opening between the bottom of the tank and trough to assure efficient feed of material into the discharge auger, moving material either to the left or right, to the side opposite of material discharge - this action is intended to keep material evenly distributed in the spreader trough. First 12" of each end of auger shaft shall not have any flighting, they shall only be installed in the approximate center 5 feet of the auger.
5. Winter tailgate shall have an additional 17.9 cubic inch hydraulic motor installed on the left side to drive the chopper auger. It shall be plumbed in series with the standard right side auger motor, powered by the exhaust oil from the first motor. Chopper auger shall be chain driven at the same 2.6:1 chain ratio as the material auger.
6. Main material discharge auger shall be the same 4 inch pitch design as called out in spreader section 3.B.
7. Hydraulic hoses, liquid lines, and cables shall be looped up to the top hinge point, long enough to allow winter tailgate to dump like a regular tailgate without damaging them. Hoses and lines must be supported by a minimum of one rubber bungee cord at the highest point to allow for flexing.
8. All lines and hoses that must pass from one side of the body to the other shall be routed so they are not damaged during dump action. Side-to-side hydraulic lines shall be ran across the ICC bumper in simple rod loops, making them easy to remove and replace.
9. Dump action hinges shall allow winter tailgate to balance from the hangar point, allowing assembly to hang and dump vertically with gravity as the dump body is raised.
10. A liquid level sight gauge tube shall be installed the full height of the rear next to the fill control valves.
11. Winter tailgate shall be powder coated orange for visibility even though it is stainless.
12. Vendors unfamiliar with this product or concept should make arrangements to see one before bidding. Contact Tim Nordholm in Equipment Services at 515-239-1607.

OPTION NO. 8: DUAL WINTER COMBINATION TAILGATE (WTG-D)

1. Vendors are asked to bid the complete cost to provide and install a dual discharge winter tailgate assembly consisting of an integral spreader and minimum 245 gallon liquid prewet tank. Known acceptable winter tailgate is a Monroe RTS86X38-6-DD (00103640). Assembly shall replace the standard dump body tailgate, spreader and liquid tank. Standard dump body tailgate only shall be included and shipped with the truck unattached.
2. The tailgate side plates listed in spreader section 4.J. are not required. The bushings through the tailgate in dumpbody section 2.O. that the side plates bolt through are also not required. Also, the tailgate stiff arms required in dumpbody section 3. are not required.
3. This spreader system will incorporate all features of the above winter tailgate left spreader system but be additionally equipped with an independent dual left and right spreader discharge arrangement. Dual discharge spreader shall employ the same style augers as a left discharge model (interrupted chopper and 4 inch pitch material) but with rotational reverse capability. Spreader controls (auger/spinner rates) shall cause material rates to remain approximately the same, regardless of discharge side chosen. Both left and right anti-flow plates shall be provided.
4. Spreader spinners shall be plumbed in series. Side-to-side hydraulic lines shall be ran across the ICC bumper in simple rod loops, making them easy to remove and replace. Lines shall include proper hydraulic couplers so system can be operated with just one of the two spinners in place.
5. Discharge selector shall be an 2-position 4-way electric selector valve, easily shifted by operator demand. Switch will replace the "Extra" switch in the switch panel. It shall be labeled "Spread Right/Spread Left".

6. System shall include a liquid selector valve to automatically direct the prewet solution to the same side as the dry material is discharging. All lines and hoses that must pass from one side of the body to the other shall be routed so they are not damaged during dump action.
7. Dual spreader shall be equipped with dual spreader lamps, one on each side. Lamps shall be wired in conjunction with the selector switch, illuminating the material discharge side.

OPTION NO. 9: ZERO-VELOCITY WINTER COMBINATION TAILGATE (WTG-ZV)

1. Vendors are asked to bid the complete cost to provide and install a left side zero-velocity discharge winter tailgate assembly consisting of an integral spreader and minimum 245 gallon liquid prewet tank and zero-velocity spinner. Known acceptable zero-velocity winter tailgate system is a Monroe RTS86X38-6-AP. Assembly shall replace the standard dump body tailgate, spreader and liquid tank. Standard dump body tailgate only shall be included and shipped with the truck unattached.
2. The tailgate side plates listed in spreader section 4.J. are not required. The bushings through the tailgate in dumpbody section 2.O. that the side plates bolt through are also not required. Also, the tailgate stiff arms required in dumpbody section 3. are not required.
3. Spreader shall incorporate all features and meet all functional requirements of the above winter tailgate left spreader system but be equipped with a zero-velocity spinner system. Zero-velocity system shall incorporate all functional features of the above optional zero-velocity spreader system.
4. A color review camera system shall be installed in the truck cab so the operator can visually see the direction of the ZV unit and confirm material output. Camera system to be:
 - A.. Color rearview mirror image camera system complete - single camera provided. 12VDC designed for mobile operations. Minimum 30 feet night visibility - NM Infrared. 0.000 LUX. 420 Lines Resolution. Nominal 3.6 mm lens. Weatherproof housing.
 - B. Minimum 6" flat panel monitor, minimum 2 camera inputs, easily switched between images. Dimming control or automatic light adjusting. Dash mounted swivel bracket. Auto power ON.
 - C. Fully shielded single waterproof IP68 rated cable and connectors of adequate and proper length to allow correct cable routing and slack.
 - D. An air line shall be installed into the taillight puffer line and routed to the camera lens to keep it clear of, same as the taillights.

OPTION NO. 10: LIGHT DUTY MID-MOUNT WING (LDW)

1. Vendor shall bid the complete cost to provide and install an extendable tube light duty mid-mount wing. Acceptable known brands/models are the Coates TW128RL and Monroe 415-9008-000. To be considered as an approved equal, other brand wings must also be under current standard production, also being marketed on an interstate level. They must be suitable in design for use on a heavy duty snow removal truck similar to that of the Department design without major modification.
2. Wing design shall be universal, able to be mounted right or left with a straight moldboard. Design shall also be available with a specific side left or right tapered moldboard at no extra charge. Moldboard configuration will be stated at time of order.
3. Tube assembly shall not be mounted level, it shall hang slightly lower to the moldboard end to allow moisture to drain out.

4. Fully installed wing assembly shall have a minimum of 8 inches ground clearance under a new cutting edge in the tucked transport position.
5. A safety chain or other device must be provided to secure the wing in an up transport position.
6. Wing mounting plates and tubes shall be black, moldboard shall be orange.

OPTION NO. 11: MEDIUM DUTY REAR WING (MDRW)

Vendor shall bid the complete cost to provide and install a Monroe style MJW8 junior wing or approved equal wing directly in front of the tandem axle assembly. To be considered as an approved equal, other brand wings must also be under current standard production, also being marketed on an interstate level. They must be suitable in design for use on a heavy duty snow removal truck similar to that of the Department design without major modification. Cost shall be universal for either a right or left installation as specified.

1. GENERAL REQUIREMENTS

- A. Wing will have an 8-foot moldboard with 8-foot cutting edge, single pusharm and full moldboard trip.
- B. Moldboard shall be a funnel design, approximately 24 inches tall at the toe end and 36 inches tall at the heel end. It shall have 5 ribs. Cutting edge shall be a standard pattern 8-foot AASHO punched drag blade.
- C. Wing moldboard attachment must incorporate a full moldboard trip feature with automatic moldboard reset. Trip shall allow the wing moldboard to completely trip up and over an object when hit, then automatically reset. Trip edge designs are not acceptable.
- D. Trip design shall incorporate a transport pin safety device. Pin shall be painted safety red.
- E. A safety chain or other device must be provided to secure the wing in an up transport position.
- F. The wing design must incorporate a float system independent of the post hydraulic cylinder, providing approximately 3 inches of mechanical toe float.

2. INSTALLATION REQUIREMENTS

- A. Installation shall not cause the truck to exceed a 96-inch width with the moldboard removed. The toe end of the cutting edge shall be rounded to prevent gouging.
- B. An adjustable needle valve flow restrictor shall be installed in both the moldboard raise and lower to allow an operator to adjust the speed of the wing to their comfort level.
- C. Wing hydraulics shall contain a counterbalance valve to prevent hydraulic creep down, Sun part #CBCA-LHN or equal.
- D. Wing mounting shall be powder coated black, moldboard shall be orange.

3. MOUNTING

- A. The wing shall be mounted to the truck frame directly in front of the tandem axle assembly. The push arm rear attachment point weldment will mount between the rear of the tandem assembly. Attachment point shall not extend out further than the width of the tire sidewalls. Rear attachment point shall incorporate a safety chain to secure the wing in an up position.

- B. When used in conjunction with a normal 11 foot moldboard front snow plow or the optional underbody snow plow (UBP), wing shall operate in harmony with these devices. Spoils from the plows shall discharge directly into the wing path without leaving a berm strip on the road surface.
- C. Push arm shall incorporate a compression spring into its design.
- D. Push arm shall attach via a fabricated universal joint on each end, allowing independent end movement without binding in all wing positions.
- E. Forward post installation shall provide 8 inches of vertical lift (with cutting edge installed) to the toe without a cutting edge.
- F. Main moldboard pin must be tapered at end to aid moldboard installation.
- G. A wing lamp (same make/model as sander lamp) shall be provided to illuminate the wing path and discharge. It shall connect to the wing lamp receptacle. Lamp must be aimed down and not to the rear.

OPTION NO. 12: MEDIUM DUTY FRONT WING (MDFW)

Vendor shall bid the complete cost to provide and install an 8 foot moldboard front bumper wing. Known acceptable models are a Monroe MPW-8 and Schmidt-Wausau style PW9. To be considered as an approved equal, other brand wings must also be under current standard production, also being marketed on an interstate level. They must be suitable in design for use on a heavy duty snow removal truck similar to that of the Department design without major modification. Cost shall be universal for either a right or left discharge configuration as specified.

1. GENERAL REQUIREMENTS

- A. Wing will have a 9-foot moldboard with 8-foot cutting edge and single pusharm.
- B. The wing design must incorporate a float system independent of the post hydraulic cylinder, which provides approximately 3 inches mechanical toe float.
- C. Installation shall not cause the truck to exceed 96-inches with the moldboard off.
- D. The toe end of the cutting edge shall be rounded to prevent gouging.
- E. Wing hydraulics shall contain a counterbalance valve to prevent hydraulic creep down, Sun part #CBCA-LHN or equal.
- F. Wing mounting shall be powder coated black, moldboard shall be orange.
- G. Main moldboard pins must be tapered at end to aid moldboard installation.
- H. A safety chain or other device must be provided to secure the wing in an up transport position.

2. MOUNTING

- A. The Wausau wing installs to the front of the truck via a 6" x 4" rectangular tube installed through the truck snow plow hitch side plates. Tube is approximately 8-foot long with a minimum 1/2 inch wall thickness.
- B. The 6-inch width and the approximate 8-foot length shall be parallel to the ground when the wing is installed on the truck.
- C. The tube mounting height (bottom to ground) must be 18 inches. The front post shall be attached accordingly to get proper wing mounting height.
- D. The wing heel stiff-arm shall have a spring cushion installed on it.
- E. Front post installation shall provide 8 inches of vertical lift to the toe with a cutting edge installed.
- F. Installed tube/post must not interfere with the truck's tilt hood.

3. FRONT AXLE & SUSPENSION CHANGE

Requesting this wing option on any truck will require the front axle to be upgraded as per **OPTION NO. 1: 20,000 LB. FRONT AXLE w/425 SUPER SINGLE TIRES (20k)** above. In addition to the required 10,000 lb. spring, the wing moldboard side shall be supplemented with an adjustable but passive front spring assist air bag suspension booster to compensate for the wing moldboard/post weight.

4. SPECIAL CONSIDERATION for FUEL TANK

If this front bumper wing is specified in a LEFT discharge version, and the truck is also to have an underbody snowplow (UBP), special consideration must be given to the fuel tank. See Underbody Snowplow section for more details. Left side installation may require the fuel tank to be relocated to the right side or that two smaller tanks be installed.

5. SPECIAL PUSH ARM MOUNTING POINT

- A. If this front bumper wing is specified to be installed with an underbody snowplow (UBP) a special modification is required to the rear push arm mounting point to make it height adjustable and removable. Stock installation of the rear push point will not allow the UBP to fully rotate both directions.
- B. This modification will allow the push point to be removed when the moldboard is removed and allow the plow to rotate. Stock 4" x 6" cross tube shall be cut off approximately 18 inches past the truck frame.
- C. Over this stub a manufactured removable rear 'L' shaped push point shall be installed. New push point shall be manufactured from 5" x 7" tubing of the same wall thickness as the 4" x 6" that will slip directly over the 4" x 6" stub. It shall slide on completely to the truck frame and be secured with a single 3/4" bolt.
- D. Outward end shall be cut at a 45 degree angle and a mating approximate 12 inch piece of the 5" x 7" tube shall be attached.
- E. To this two flats of minimum 1/2" thick steel shall be welded. These flats shall be correctly angled and punched with appropriately sized holes to accommodate the rear push arm pin. Mounting point shall have 4 selectable positions, from horizontal to the ground on up in 3" increments.

OPTION NO. 13: HEAVY DUTY FRONT WING (HDFW)

Vendor shall bid the complete cost to provide and install an all hydraulic double function 11 foot moldboard patrol wing to the front of the truck. Cost shall be universal for either a right or left installation as specified. Monroe Snow and Ice Equipment model DFPW-11-36 is the approved equal. To be considered as an approved equal, other brand wings must also be under current standard production, also being marketed on an interstate level. They must be suitable in design for use on a heavy duty snow removal truck similar to that of the Department design without major modification.

1. GENERAL REQUIREMENTS

- A. Wing will have a 140 inch moldboard with 11-foot cutting edge and dual pusharms.
- B. Single front post design but suitable to allow limited benching up to 36 inches high. All hydraulic, no cable.
- C. Moldboard shall be a funnel design, approximately 29 inches tall at the toe end and 39 inches tall at the heel end. It shall have 7 ribs. Cutting edge shall be a standard pattern 11-foot AASHTO punched drag blade.

- D. The wing design must incorporate a float system independent of the post hydraulic cylinder, providing approximately 3 inches of mechanical toe float.

2. INSTALLATION REQUIREMENTS

- A. Installation shall not require truck CA dimension to be increased. It shall not cause the truck to exceed a 96-inch width with the moldboard removed.
- B. The toe end of the cutting edge shall be rounded to prevent gouging.
- C. An adjustable needle valve restrictor valve shall be installed in both the moldboard raise and lower to allow an operator to adjust the speed of the wing to their comfort level.
- D. Wing hydraulics shall contain a counterbalance valve to prevent hydraulic creep down, Sun part #CBCA-LHN or equal.

3. MOUNTING

- A. The wing shall be mounted into the truck front plow push frame assembly. However, it shall not be a structural or integral part of this assembly. Complete removal of the wing shall not change or impede use of the front plow hitch.
- B. The push arm rear attachment points weldment will mount directly behind the truck cab. Weldment shall be above the truck frame.
- C. A safety chain or other device must be provided to secure the wing in an up transport position.
- D. Main moldboard pin must be tapered at end to aid moldboard installation.
- E. When used in conjunction with a front snow plow the wing shall operate as a moldboard extension of this device. Spoils from the plow shall discharge directly into the wing path without leaving a berm strip on the road surface.
- F. Both push arms shall incorporate an adjustable spring cushion with safety shear pin. Arms shall have numerous holes for adjustment in-and-out to allow an adjustable moldboard position.
- G. Push arm shall attach via a fabricated universal joint on each end, allowing independent end movement without binding in all wing positions.

4. FRONT AXLE & SUSPENSION CHANGE

Requesting this wing option on any truck will require the front axle to be upgraded as per **OPTION NO. 1: 20,000 LB. FRONT AXLE w/425 SUPER SINGLE TIRES (20k)** above. In addition to the required 10,000 lb. spring, the wing moldboard side shall be supplemented with an adjustable but passive front spring assist air bag suspension booster to compensate for the wing moldboard/post weight.

OPTION NO. 14: HEAVY DUTY BENCHING WING (HDBW)

Vendor shall bid the complete cost to provide and install a two-post heavy duty benching wing, such as a Monroe Snow and Ice Equipment model HDBW-11 or one of approved equal. To be considered as an approved equal, other brand benching wings must also be under current standard production, also being marketed on an interstate level. They must be suitable in design for use on a heavy duty snow removal truck similar to that of the Department design without major modification.

1. GENERAL REQUIREMENTS

- A. Wing shall be of heavy duty design with a minimum ground clearance under the raised wing of 56 inches when the push arm is parallel to the ground line.
- B. The wing shall have sufficient cylinder length and sheave arrangement to permit the lowering of the outer wing tip to approximately 8 inches below the ground line.
- C. The wing shall be mounted so that it will work in conjunction with and overlap a "V" type snow plow.
- D. The wing shall be mounted so that it will fold in closely to the truck. Wing shall have safety chains to secure it in folded travel position.
- E. Main moldboard pin must be tapered at end to aid moldboard installation.
- F. When in the low plowing position the wing shall provide sufficient tire clearance for turning.
- G. Wing shall be installed and tested. After a successful test, moldboard shall be removed and placed in the dump body with stiff arms banded into their holders. Moldboard must be secured against movement in body.
- H. Wing mounting shall be powder coated black, moldboard shall be orange.

2. MOLDBOARD

- A. Wing moldboard shall be a fabricated double box construction manufactured from 10 gauge Domex steel with a yield strength of 100,000 KSI and a minimum tensile strength of 110,000 KSI for light weight and strength. Complete moldboard assembly shall be 100% welded.
- B. The snow plow wing shall have a 1/2 inch thick by 11-foot long 8-inch high drag blade cutting edge provided and installed.
- C. The wing shall have a minimum vertical height of 32 inches from the ground line to the top of the inner radius of the moldboard. The overall height shall be 36 inches including an 8 inch cutting edge. The moldboard shall have a rolled radius of 21 inches with a 60 degree arc (or a wing configuration pre-approved by Equipment Services).
- D. The top edge of the moldboard shall have a 1/2 inch by 12-inch reinforced rubber belting bolted to it to deflect snow down and out-and-away from the wing and truck. The belting shall angle downward along the front edge of the moldboard. It shall be held on by 1/4 inch by 1-inch flat iron and 1/4 inch bolts, flat washers and locknuts every foot.
- E. The heel iron shall be fabricated from 1/2" x 7" bar and reinforced the full length of the with 1/2" x 1-1/2" bar and also 1/4" x 2-1/2" x 8" bars. The main double box shall be integral in the support of the cutting edge providing one internal support and three external supports. The 11-foot heel iron shall be punched to accommodate a standard pattern 11-foot AASHO punched drag blade. Blade(s) shall attach using 5/8 inch diameter blade bolts.
- F. The internal cavity of the box reinforcement on the rear of the moldboard shall be rustproofed. A small hole shall be drilled in the endplate and the inside coated as per a standard rustproofing operation. Hole shall be plugged.
- G. Pusharm attachment bracket shall provide numerous adjustable horizontal positions.
- H. Hangar brackets to secure the push arms in a folded position when the wing is removed shall be installed on the back of the wing moldboard. A lifting eye shall be installed to the top edge of the moldboard in a position where the moldboard with push arms in the hangar brackets creates a balanced unit.

3. FRONT & REAR POSTS

- A. The front wing post shall be provided with a solid bolt-in bottom stop. Stop shall limit how far down the front slide plate can travel in the tower. Stop shall be easily removed by loosening bolts; it shall be easily modified to change the allowable stop point. When delivered, the stop shall hold a new horizontal cutting edge approximately 2 inches above the ground.
- B. The rear wing post will have two functions, first as an adjustable height slide for the push arms and secondly as a tower for the heel cable to operate from.
- C. Upper cable sheave on rear wing post shall rotate forward in a vertical axis so cable will not jump sheave in any wing position.

4. PUSH ARM

- A. Single push arm shall be adjustable and constructed of minimum 2-1/2 inch double strength (schedule 80) pipe which telescopes inside a 3-inch double strength pipe. The wing push arm plate shall be fabricated so that pushing forces will be transmitted throughout the moldboard and top and bottom reinforcing members.
- B. The wing push arm must be adjustable in minimum 6-inch increments between 30 degrees and 45 degrees out from the side of the truck, allowing a minimum of 6 different plowing widths.
- C. Push arm shall incorporate a compression spring into its design. Spring shall have approximately 7-1/2 coils of 9/16 inch bar and be about 3-1/2 inches in diameter, fitting over a 2-1/4 inch rod easily. Spring shall be about 6-1/2 inches in length, compressing to a solid height of about 4 inches. Spring shall have a compression rate of around 960 pounds per inch of compression, exerting a total of approximately 2500 pounds strength at full compression.
- D. Push arm shall attach via a fabricated universal joint on each end, allowing independent end movement without binding in all wing positions.

5. FRONT AXLE & SUSPENSION CHANGE

Requesting this wing option on any truck will require the front axle to be upgraded as per **OPTION NO. 1: 20,000 LB. FRONT AXLE w/425 SUPER SINGLE TIRES (20k)** above. In addition to the required 10,000 lb. spring, the wing moldboard side shall be supplemented with an adjustable but passive front spring assist air bag suspension booster to compensate for the wing moldboard/post weight.

OPTION NO. 15: UNDERBODY SNOW PLOW (UBP).

Vendors are asked to bid the complete cost for providing and installing a folding moldboard spring cushion moldboard trip underbody snowplow. Approved model is a Monroe FMB 050-9011-000IA. To be considered as an approved equal, other brand underbody snow plows must also be under current standard production, also being marketed on an interstate level. They must be suitable in design for use on a heavy duty snow removal truck similar to that of the Department design without major modification.

- 1. Moldboard shall be 11 feet long. Design and mounting shall provide a vertical moldboard attack angle to permit use of carbide insert grader blades. Moldboard shall move up and down vertically via a parallel linkage arrangement.
- 2. Plow shall have a solid mounted non-moving one piece circle cut from 1 inch thick steel. Bottom of circle shall be mounted no lower than 20 inches from ground level. This is a critical dimension.

3. Rotational center pin shall be 5 inch diameter with grease fitting for lubrication.
4. Rotation circle hold-down block shall be lined with 3/8 inch UHMW poly wear material insert to ease circle movement.
5. The moldboard shall consist of two primary components. The upper deflector shall be of 5/8 inch plate formed to a 13.250 inch radius. The lower deflector shall be 3/4" x 9" plate formed to a 13.250 inch radius also providing connection point to the moldboard. The lower and upper deflector must be mated together with a hinge assembly of 1-1/4"OD x 0.219" wall thickness DOM high strength tube. The inner hinge rod shall be 3/4 inch stainless steel shaft with encapsulated ends. The chord measurement with the moldboard in the open position shall be 20 inches not including the cutting edge. The moldboard shall be manufactured from 3/4 inch steel and shall be heat treated and provide an offset for cutting edge and moldboard support.
6. Moldboard design shall include provisions to prevent hinge seizing, either non-corroding components or adequate lubrication features for both hinge assemblies. If grease fittings are employed, they shall be positioned to prevent damage during all movements.
7. Moldboard offset shall be suitable for attaching 7/8 inch thick by 5 inch carbide grader blade assemblies. Moldboard shall have standard AASHO blade pattern punching to accept one 3-foot section and two 4-foot sections, with the 3-foot blade in the center. Blade(s) shall attach using 5/8 inch diameter blade bolts. The Department will supply and install the carbide cutting edges.
8. Plow will have dual 4-inch reversing cylinders with a 1,800 PSI hydraulic cushion block mounted between the cylinders.
9. Hoses ran along the back of the moldboard shall be retained by hydraulic tubing clamps, not ran in corrosion prone steel tubing. Tubing clamps shall have a welded-on bolt plate, plastic multi-tube insert, and bolt-on top plate.
10. Moldboard rotation stops will need to be installed to prevent the plow from being rotated beyond the stroke of the cylinders, preventing damage to them.
11. When rotated into a transport position, no point of the plow or moldboard shall extend beyond the width of the truck tire sidewalls. This shall be determined by running a string line from the front tire sidewall to the rear tire sidewall. No plow part can extend beyond this line.
12. Vendor shall bid to install the snowplow as per specialized Department requirements. It is highly recommended that prospective vendors see and thoroughly research this installation. Vendors are encouraged to view a recent Department installation, which will set the minimum acceptable level of workmanship, design and performance. Arrangements to view an installed plow may be made by contacting Tim Nordholm in Equipment Services at 515-239-1607.
13. Underbody snowplow shall be powder coated black to match the truck frame.
14. The following items may need to be modified or taken into consideration for the correct installation of the under body plow. Vendor must work these details out with the equipment provider/outfitter before the bid is submitted. Solution shall be submitted to Equipment Services for pre-approval.
 - A. Special consideration shall be given to the fuel tank. Because of the moldboard length and swing arc, the standard fuel tank may be too low. Factory fuel tank may simply have to be raised, or it may have to be changed to a slim tank of approximately the same capacity. Suggested size is 16 inches tall by 25 inches wide by 60 inches long with an approximate 100 gallon draw capacity. Known acceptable tank is manufactured by Riverside Tank of St. Clair, MI.

- B. Special consideration must be given to the cab access steps. When the factory steps and/or fuel tank are moved up, relocated, or replaced, additional cab steps are required. Ground level to first step height shall be nominally 16 inches, distance between all subsequent steps shall not exceed 16 inches. Step gating shall be non-slip Bustin grating.
- C. Installation of this underbody snowplow with a left side medium duty front wing (MDFW), special consideration must be given to placement of the wing rear pusharm frame mount tube, the fuel tank, and the underbody snowplow rotational arc. Fuel tank may need to be swapped to the right side of the truck. See MDFW section.
- D. Consideration shall be given to other equipment to be used in conjunction with this plow. If the plow is installed on a truck with a right discharge wing, the plow should store in a left position. And vice-versa. If the truck has a left wing, the plow should store in a right position.

OPTION NO. 16: NON-CONVENTIONAL ICE BLADE (NIB).

Vendor shall bid the cost to provide and install a heavy duty underbody ice scraper equipped with a non-conventional style oscillation lift system. This scraper will not have a front pull point or rear stabilization bar, but will have independent left and right vertical oscillation. Known scraper to offer this option is a Monroe Snow and Ice Equipment 3500 series. Other brands offering this same feature may be approved as equal. To be considered as an approved equal, other scrapers must also be under current standard production, also being marketed on an interstate level. They must be suitable in design for use on a heavy duty snow removal truck similar to that of the Department design without major modification.

1. GENERAL

- A. Scraper must be suitable for year round use. It must be capable of handling high volumes of snow and ice pack at all plowing speeds required, as well as being able to do gravel road and shoulder maintenance grading throughout the year.
- B. Hydraulic cylinders of manufacturers standard design are acceptable.
- C. Scraper shall be center mounted on the truck frame providing even moldboard length to both sides.
- D. This scraper will require four each 4-way hydraulic valve sections. They shall be: 1) scraper lift right, 2) scraper lift left, 3) scraper rotate, and 4) moldboard curl. It will require three control levers. They shall be: 1) scraper moldboard up/down and rotate left/right, 2) scraper lift left, and 3) scraper lift right.
- E. When installed on a fully loaded truck with the grader blade installed and the plow raised into the transport position, there shall be a minimum of 8 inches of ground clearance at all points under the plow.
- F. When rotated into a transport position, no point of the plow or moldboard shall extend beyond the width of the truck tire sidewalls. This shall be determined by running a string line from the front tire sidewall to the rear tire sidewall. No plow part can extend beyond this line.
- G. Scraper shall be powder coated black to match the truck frame.

2. MOLDBOARD

- A. The moldboard shall be a contoured one piece 1 inch thick by 15 inches in height heat treated carbon steel, 9 feet in length.

- B. Moldboard shall be punched in a modified AASHTO pattern, having bolt holes in from each end on 3" center, 3" center, then 6" centers from then on until reaching the other end, then again on 3" centers for the last 2.
- C. A 9' x 3/4" x 8" one piece top punched double beveled curved grader blade shall be provided and installed. Cutting edge shall also have a modified AASHTO pattern matching the moldboard. Blade(s) shall attach using 5/8 inch diameter blade bolts.
- D. No cutting edge bolt shall be installed in a method or position so that it cannot be easily removed with a standard pneumatic impact wrench.

3. REVERSING CIRCLE

- A. The reversing table shall be a solid one piece 1 inch thick piece of steel, with infinite plowing positions up to 45 degrees each direction. Moldboard rotation stops will need to be installed to prevent the plow from being rotated beyond the stroke of the cylinders and damaging them or any component of the truck.
- B. Reversing will be accomplished by two 4 inch ID double acting cylinders. Cylinders will provide a hydraulic lock to hold moldboard in place while in use. A cross over relief valve (Gresen DXV or equal) set at 1,800 PSI shall be furnished and installed between the cylinders.
- C. Cylinder rods shall be 2 inch diameter with a hard chrome finish. Cylinders will be mounted on 2 inch pivot pins. Cylinder ends shall have a grease fitting to allow lubrication of the pins.
- D. Reversing circle shall pivot on a 5 inch center pin attached by three 3/4 inch mounting bolts to prevent hole elongation. Center pin shall have a grease fitting to allow lubrication of the pivot.
- E. Circle hold down blocks shall be 20-1/2 inches in length by 7 inches in depth, bolted to the hangar board as close to the circle as possible for maximum strength. Shape of hold down blocks shall follow the contour of the circle.
- F. Each hold down block shall be lined with a replaceable piece of 3/8 inch thick UHMW polyethylene plastic to act as a sacrificial wear plate and to allow easy movement of the circle.

4. MOLDBOARD OSCILLATION SYSTEM

- A. Scraper hangar system shall be designed to allow independent left and/or right vertical moldboard height oscillation. Scraper will be a variable pitch 6-way design with power up and down, power left and right, and power tilt left to right and right to left independently.
- B. The circle oscillation system shall attach to the truck frame on 1/2 inch thick steel side plates.
- C. Side plates shall incorporate a 1-1/2 inch thick slide mechanism consisting of a 3/4 inch steel plate and 3/8 inch thick UHMW polyethylene plastic attached to both sides of the mating surface designed to prevent excess wear and a non-stick surface that does not require lubrication.
- D. The side plate will have a 28 inch long heavy duty piano style hinge with 1-1/2 inch diameter pin that will allow the scraper to oscillate without binding.
- E. Independent hydraulic oscillation will be accomplished using two 4" ID x 8" double acting heavy duty cylinders with nitrated 2 inch rods. Cylinder attachment to the oscillating side plates will utilize a heavy duty clevis on the rod end and a heavy duty tube in the base end. All metal-to-metal moving parts must have a grease fitting to allow lubrication.

5. HANGAR BOARD AND HINGE

- A. Hangar board shall be manufactured from 1/2 inch formed plate, reinforced by 1/2" x 7-1/2" flat plate and 2-piece 3/4" x 2" bar on edge.
- B. Three heavy duty hinges shall be positioned to minimize stress along the hangar board for maximum strength.
- C. The hinge line shall be a solid shaft, minimum 96 inches in length, with three moldboard anchor points.
- D. The hinge shaft shall be 2-1/2 inch diameter cold rolled 1018 steel. The two outer hinges shall be 3-1/4 inch OD by 6 inch long. Center hinge shall be 3-1/4 inch OD by 10-3/4 inch in length, of 0.344 inch wall thickness mechanical tubing.
- E. Hinges shall be reinforced with one wrap around 1/2 inch gusset on the outer two hinges and two gussets on the inner hinge.
- F. Center hinge shall have two wear plates to prevent side-to-side shifting of the moldboard.
- G. There shall be grease fittings in the hinge shaft tubing to allow thorough lubrication.
- H. Moldboard articulation shall be accomplished by two 3-1/2 inch ID double action cylinders with 2 inch hard chrome plated shafts, installed into spring shock absorbing canister assemblies.
- I. Shock absorber canisters shall be trunnion mounted to allow articulation throughout the moldboard articulation arc. Trunnion brackets shall be 3/4 inch thick. Trunnion bearings shall be 2-3/4 inch by 0.344 inch wall thickness mechanical tubing.
- J. Each of the 4 trunnion mounts shall have a grease fitting. Both cylinder rod ends shall have a grease fitting.
- K. Shock absorbing internally mounted spring shall be rated 586 lbs. compression per inch, fabricated from 0.8125 OD spring wire conforming to AISI 5161 standard.
- L. Hydraulic steel tubing shall be externally mounted in poly mounting block assemblies.

6. MOUNTING CONSIDERATIONS

- A. The following items may need to be modified or taken into consideration for the correct installation of the ice blade. Vendor must work these details out with the equipment provider/outfitter before the bid is submitted. Solution shall be submitted to Equipment Services for pre-approval.
- B. Special consideration shall be given to the fuel tank. Because of the moldboard length and swing arc, the standard fuel tank may be too low. Factory fuel tank may simply have to be raised, or it may have to be changed to a slim tank of approximately the same capacity. Suggested size is 16 inches tall by 25 inches wide by 60 inches long with an approximate 100 gallon draw capacity. Known acceptable tank is manufactured by Riverside Tank of St. Clair, MI.
- C. Special consideration must be given to the cab access steps. When the factory steps and/or fuel tank are moved up, relocated, or replaced, additional cab steps are required. Ground level to first step height shall be nominally 16 inches, distance between all subsequent steps shall not exceed 16 inches. Step gating shall be non-slip Bustin grating.
- D. Consideration shall be given to other equipment to be used in conjunction with this ice blade to assure proper operation.

OPTION NO. 17: SCHMIDT/WAUSAU SQH FRONT PLOW HITCH SYSTEM (SQH)

Vendors are asked to bid the complete cost from providing and installing an OEM Schmidt/Wausau SQH front plow hitch system in lieu of the standard front hitch and snow plow lift system. Any brand or design other than an OEM hitch purchased from Schmidt/Wausau is not acceptable. Hitch system shall include the spring loaded quick attachment pin apparatus to allow no-tool plow attachment. All hydraulic hoses shall terminate at the front of the truck with appropriately sized and marked full flow pintle style Parker SM series quick couplers. Hitch shall be a bolt-on system, set at 38 inches to the top when delivered. It must be height adjustable \pm 4 inches in approximate 1 inch increments.

The Department intends to separately purchase and install a 12 foot to 14 foot long European style Wausau sectional trip plow for use on trucks ordered with this hitch. Attachment methods and components shall be of adequate size and strength for plows of this size.

Truck hydraulic system plow raise and lower section shall be modified. Section shall be configured to provide the following functions:

Change section 3s in the base valve to the following description:

Section 3.1.	Plow Lift	3-30 GPM	4W/4P section regulator set @ 1000 PSI with A-port relief set @1250 PSI, with A-port detent to engage regulator, 4 th position float.
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1. Plow reverse circuit does not require a cushion valve as this comes with the plow.
2. The four plow hydraulic couplers shall be mounted behind the hitch plate, 2 on each side on top of the truck frame facing outward and slightly back so water will not sit in them. A simple 2-hole plate shall be welded to each side of the truck frame with bulkhead fitting installed through it. On the inside of the frame the hose shall attach, on the outside.
3. Parker SM-500 series couplers shall be installed as follows:

Left frame rail from front:	Plow Down - female Parker SM-501-8FP
	Plow Up - male Parker SM-502-8FP
Right frame rail from front:	Plow Right - female Parker SM-501-8FP
	Plow Left - male Parker SM-502-8FP

Top of frame rail shall be marked beside each coupler as to it's function - L, R & UP, DN.
4. Hitch assembly shall be powder coated black.

OPTION NO. 18: AUTOMATIC TIRE CHAINS (TC)

Vendors are asked to bid the complete cost for providing and installing a set of Insta-Chain 12-strand automatic tire chains. Kit shall be the manufacturers model recommended for the chassis rear suspension. Kit shall be installed according to manufacturers instructions. Insta-Chain: 801-489-9000.

OPTION NO. 19: AUTOMATIC TARP (AT)

Vendors are asked to bid the complete cost for providing and installing an automatic electric tarp system on the dump body. Tarp system shall be a front-to-back style with folding side flaps sized to correctly fit the body length, width, and side height. Side flaps shall completely cover and protect salt load in body. Tarp material shall be waterproof and able to stand use with hot asphalt (400-500 degrees) in summer use. Side flap tie down brackets and straps shall be provided and correctly installed on the dump body sides. System shall include bolt on external body side mount springs, galvanized steel arms, offset elbows and tension bow, tarp spool with wind deflector shield, mounted on the dump body cab protector. Electric motor shall be manufacturer's best heavy duty weather sealed design. Switch to be installed in truck cab, circuit properly overload protected. Approved equal is a U.S. Tarp 11526.