

**STATE OF MINNESOTA  
CONTRACT RELEASE S-863(5), EVENT # 2000008082  
SNOW PLOW TRUCK COMPONENTS & ACCESSORIES  
SPECIFICATIONS**

**INTRODUCTION**

The State of Minnesota, Department of Transportation (MnDOT), owns a fleet of over 800 snow plow trucks that operates, in part, to ensure public safety and is often deployed in situations that require emergency response. Standardization within the MnDOT fleet allows for a cost effective approach to routine and emergency maintenance by adding value in business operations, specifically in areas involving inventory management and training of internal personnel. The specification called for in MnDOT Specification defines MnDOT's equipment requirements for both individual components and individual accessories. Equipment is labeled as either "No Substitute" or "Approved Equal" to ensure that standardization within the fleet is maintained.

Responders must offer products that meet the specifications called for in MnDOT Specification or must offer product on the General Price Schedule which is available to MnDOT, other State Agencies, and Cooperative Purchasing Venture (CPV).members.

In the event that delivery of any items covered under this contract are contingent upon the successful delivery of a Cab/Chassis unit to the vendor, the state will provide the vendor with a scheduled build date for said Cab Chassis as provided by the Chassis manufacturer from which to base the build schedule for items on this contract. The state will not be bound or held responsible for any delays in the delivery of required Cab/Chassis unit caused by the manufacturing process. The vendor will be required to provide delivery of completed vehicle with 30 days of receiving Cab/Chassis.

**Changes from last Contract**

Below is a list of the changes to this year's specifications from last year's specifications listed by line numbers or sections. This may or may not be a complete list of changes. This does not include minor grammar corrections.

- 1.0 Box Specification, reformatted
- 2.0 Pre-Wet System changes for Single and Tandems
- 5.2 Front Hitch
- 5.11 Eyelets on Front Hitch for Winter Fronts
- 18.0 Auto Lube Systems
- Volume discounts for Sanders on the Price page

**SNOW PLOW TRUCK BODY  
SPECIFICATION: 330/350-612**

This specification contains twelve different sections for items which would make a Cab and Chassis into a snow plow truck as required by MnDOT. They are:

- 1.0 Dump Box (includes pre-wet tanks)
- 2.0 Hoist Section
- 3.0 Underbody Plows
- 4.0 Wing Plows Section
- 5.0 Front Hitch Section
- 6.0 Front Plows
- 7.0 Pup Hitch
- 8.0 Sanders Section
- 9.0 Hydraulics Section
- 10.0 Airbags Section
- 11.0 Anti-Icing Section
- 12.0 Wiring Harness/Switch panel Section

The last sections of the specification are for:

- 13.0 Airport Equipment Section
- 14.0 Tow Plows Section
- 15.0 Hydraulic Driven Front Axle
- 16.0 Ice Breakers
- 17.0 Vaisala BPS113 Road Temp Sensors

## 1.0 **MnDOT BOX REQUIREMENTS**

If requested by purchaser the Contract Vendor must furnish (if available) non-proprietary, electronic digital box illustration(s), in one of the following file formats; .sldasm, .asmdot, .sldprt, .step, .igs, .sat, Parasolid, ProE or AutoDesk Inventor. The purchaser must use the files as a resource in the body design process. The Contract Vendor must furnish the electronic files at no additional cost to the purchaser.

### **Both SINGLE AXLE BODIES AND TANDEM BODIES – HYDRAULIC REQUIREMENTS:**

All hydraulic hose ends must be JIC 37 degree female swivel – male pipe hose ends are not acceptable.

Galvanized hydraulic fittings are not acceptable. Any deviation must be approved in writing by MnDOT prior to the build.

- 1.1 MnDOT dump boxes are required to operate for 15 years minimum in the up position at speeds of 50 MPH with sand and salt being the main product hauled. Variances from the MnDOT Box Specifications must be acceptable. If responders want to offer a box to MnDOT with variances from the MnDOT specification they must produce a to-scale drawing, as well as identify which specifications they are varying from.
- 1.2 Front panel, side panels, tailgate reinforcing, and rear corner posts, must be constructed of hot rolled 304 stainless steel materials. The rear apron, rounds, flats, and flame-cuts must be constructed of hot rolled 304 stainless steel materials.
- 1.3 A self-storing foldaway access ladder must be fabricated and installed as per similar sample at MnDOT Central Shop, 6000 Minnehaha Avenue, St. Paul, MN 55111.  
The ladder must be a two-piece design, with the upper portion fixed to the side of the dump body, and the lower portion movable. The lower portion must require the operator to lift it out of its locking slot, wing outward and down for usage resting at 175 degrees from vertical. The ladder must be constructed of .375" thick hot rolled 304 stainless steel material with 15.5" wide 3 row (3 hole pattern) perforated stainless steel ladder rungs. The top portion of the ladder must be fitted with a removable (RH to LH) grab handle assembly, retained with a quick pin for safety. The lower pivot of the ladder must be accomplished with use of grade-8 (plated) fasteners, and steel locking nuts, to allow removal or replacement of damaged unit. The ladder must be constructed entirely of stainless steel and be mounted within the legal width of the truck. The number of rungs and the spacing must conform to OSHA standards for access type ladders. All hand grab surfaces must have edges ground to a 1/64" radius minimum to protect snow plow operator's hands in case of a slip or fall.
- 1.4 Box must have a minimum of a two-year warranty on parts, labor, workmanship, cracking, or bending.
- 1.5 Box must be mounted on truck Chassis behind Cab depending on Cab and Chassis exhaust system dimensions from the January, 2010 diesel engine emissions requirements per MnDOT approval. Box must be mounted without drilling into flange part of truck frame.
- 1.6 Floor of body must be constructed of 1/4" thick high alloy, low carbon (.14) 180,000 PSI tensile, 400 HB hardness steel (values are nominal average). Floor must be 1 piece construction, approximately 48" to 50" wide, allowing for an overlap of side panel to floor sheet, of 1.5" along each side edge.
- 1.7 The lower tailgate latches to be constructed of (2) each 1/2" thick stainless steel support saddles, with a 1" thick stainless steel latching finger. Latching finger must be removable via pin or fastener, and must contain a grease point at the pivot. Split latches will not be acceptable. Lower latch system must be independently adjustable, and incorporate an over-center mechanism at each latch. Rear cross-shaft, cross-shaft pivots, and linkage parts are not required to be constructed of stainless steel material. Components can be plated, or must be able to be finish-painted with the underside of the dump body (See Paint Requirements). Tailgate must have 3/8" zinc plated alloy spreader chains long enough to provide 90 degree (horizontal) tailgate opening to back of sander. Tailgate spreader chains must be removable via fasteners. Tailgate chains must be sleeved. Tailgate must be fitted with external (removable) type sander flow plates, which will support the gate in an open position, utilizing the lower latch mechanism and lower gate pins. Flow plates must be constructed of .25" thick stainless steel, and must be compatible with sander hopper opening per MnDOT approval prior to build.

- 1.8 Tailgate must be fitted with the following items represented in a Drawing titled **Single Axle Tailgate** or **Tandem Tailgate** (with positioning to be approved by MnDOT in writing prior to the build) depending which tailgate you are looking at:
- Flush mounted tailgate hook to facilitate lowering or removing tailgate made of 3/4" stainless steel bar stock.
  - 2 each chain hooks made of 1/2" stainless steel bar stock.
  - 2 each flow plate braces made of 2" x 1/4" stainless steel.
  - 4" x 13" x 3/16" stainless steel plate with the MnDOT truck unit number (measuring 3" tall) cut out by laser or plasma mounted in upper right corner.
  - The two tailgate chains are to each be 46 inches in length for the single axle and the chain length for the tandem is 74 inches.
- 1.9 Rear apron must be full depth to long sills and full width of box, constructed of .25" thick 304 stainless steel, fully attached to rear corner posts and floor. Rear apron must be formed into a channel profile, with ends of channel gusseted by 7 gauge or better gussets fully attached to channel ends and boxed such that they are flush and do not protrude past outside dimension of box. Apron must be smooth and flush with back of box from outside to outside of box with no clearance light provisions. Tailgate sander will be mounted in this area.
- 1.10 Long sills must be constructed of S10" x 25.0 lb. /ft. structural I-Beams (carbon steel), and be continuous welded to floor and rear apron, utilizing carbon steel gussets as required per MnDOT approval. Long sills must be cut at an angle at the front of the body to match sub frame length (spec 2.18). The underbody hoist attaching hardware must be provided and incorporated into the long sills compatible for mating up to hoist as specified in section 2.0 of this specification.
- 1.11 The following items must be accomplished and or installed per similar sample box located at MnDOT Central Shop, 6000 Minnehaha Avenue, St. Paul, MN 55111.
- Provide finished 2.50" radius/round access wiring hole on top rear of left and right long sills.
  - Provide stainless steel stand offs on right and left side for securing wiring harnesses. **See Drawing Wiring Stand offs.**
  - Provide finished 4" hole between the end of the sub frame/ long sill and the apron on right and left side for running hydraulic hoses through.
  - Provide (stainless steel) sander mounting tabs, on the right and left side of box.
- 1.12 All fasteners (bolts, washers and nuts) used on the box and attached items must be grade 8 with steel locking nuts (nyloc type nuts will not be accepted).
- 1.13 A pilot inspection of dump box and mounting of dump box is required. Prior to building a pilot dump box, a pre-build meeting is required at MnDOT Central Shop, 6000 Minnehaha Avenue, St. Paul, MN 55111.
- 1.14 Installation of box must be compatible and mate properly with hoist system MnDOT selects.
- 1.15 Responder must submit scale drawing of tandem axle elliptical box being bid with solicitation response.
- 1.16 Installation of box must include converting FMVSS incomplete vehicle manufacturer's certificate to a completed FMVSS vehicle certificate.

#### **Painting of Box Requirements**

- 1.17 The following items must be painted black with zinc based lead free paint:
- Underside of box, including long sills, between long sills, and 8" minimum past lapping seam of stainless steel side and floor.
  - All non-plated carbon steel components on underside of body, or any exterior surface.
  - Hoist assembly and Sub-frame
  - Main-frame of truck to be over-sprayed from rear of truck Cab to rear frame of truck.
  - Front plow hitch and bumper extensions
  - Miscellaneous hoist sub-frame to frame attaching brackets.
- 1.18 Contract Vendor must complete all touch-up paint of truck from underside of body and mounted components to ground level.
- 1.19 All items painted must be media blasted to bare metal except the following:
- Main frames of truck from rear of Cab to end of frame.
- 1.20 Paint facility must meet all Federal, State, and EPA requirements.

## **TAILGATE AIR LATCH AND BOX VIBRATOR**

- 1.21 Provide air operated tailgate latch mechanism with double acting air cylinder, offset to street side, between frame rails on dump box with Cab controlled air valve utilizing 3/8" O.D. air lines, location to be approved by MnDOT in writing prior to the build.
- 1.22 Box vibrator must be Cougar Model DC-3200 or MNDOT approved equal with mounting to be approved by MnDOT in writing prior to the build. All wires and solenoids to be covered and secure, with ground Cable for box vibrator properly sized and located inboard street side box hinge as approved by MnDOT. All electrical wires to be run through properly supported loom and all wire connections to have heat-shrink close-end connectors.

## **MnDOT STAINLESS STEEL 10' & 11' ELLIPTICAL SINGLE AXLE BOX**

- 1.23 Box must be 10' or 11' long by 96" wide overall, semi-elliptical style. Interior must be 83-5/8" to 84" wide.
- 1.24 Floor must be 1 piece construction, approximately 48" wide minimum, allowing for an overlap of side panel to floor sheet, of 1.5" along each side edge.
- 1.25 Front panel must be 30.5" to 31" inside height, 10 gauge thick with reinforced (enclosed) top lip and horizontal bracing at mid-point. The top lip must include (6) .44 diameter holes – centered and drilled into the top surface, spaced according to MnDOT requirements, with (6) 1" diameter access holes in the underside of the top lip, located directly under the .44 inch diameter holes. Top surface of front panel must be flat with no material or weld protrusions in order to ensure flush fit for box wiper or tarp.
- 1.26 Side panels must be 30.5 to 31 inch high inside, 7 gauge thick with 45° (self-cleaning) formed and enclosed box top rails to shed dirt. Sides must incorporate an 18" radius from the attaching point at the floor, to the vertical point of the side panel. Forming and enclosure of the top rails must be done such that welds are exposed only to the interior of the body. Radius of sides must be roll formed or step formed, but must not exceed an 18" radius profile, for future up fit of pre-wetting tanks. There must be a minimum of 1" clearance between the top of the pre-wet tanks fill cap and any obstruction above the cover and 1/2" clearance on the sides of the cover at all times including during the removal of the fill cover. The clearance when the cover is in place must be 2- 3/4" minimum above and 1/2" to the side of the cover.
- 1.27 Tailgate and reinforcing must be 30.5" to 31" high inside, 7 gauge thick with bottom air operated latching mechanism. The lower latches are to be constructed of (2) each. 1/2" thick stainless steel support saddles, with a 1" thick stainless steel latching finger. Latching finger must be removable via pin or fastener, and must contain a grease point at the pivot. Split latches will not be acceptable. Lower latch system must be independently adjustable, and incorporate an over-center mechanism at each latch. Rear cross-shaft, cross-shaft pivots, and linkage parts are not required to be constructed of stainless steel material. Components can be plated, or must be able to be finish painted with the underside of the dump body (See Paint Requirements). Top and bottom hinge pins must be 1.25" diameter 304 stainless steel round stock, with no part of hinge or pin protruding above box top surface. Mechanism must be positive lock type. Top pin must be grease able and have 1/2" of taper and protrude through hinge block so there is full contact of pin shaft on hinge block. Pin sleeve retracting tube must have grease zerk. Tailgate must have 3/8" zinc plated alloy spreader chains long enough to provide 90 degree (horizontal) tailgate opening. Tailgate spreader chains must be removable via fasteners. Tailgate chains must be sleeved. Tailgate top must have formed edge and angled dirt deflector. Tailgate must have reinforcement welded horizontally at midpoint. Tailgate upper handle must have a stop mechanism. Tailgate handle and mechanism must be constructed of 304 stainless steel materials. Fasteners and/or pins used in mechanism must be cadmium or zinc plated (no raw carbon steel parts allowed). Tailgate must be fitted with external (removable) type sander flow plates, which will support the gate in an open position, utilizing the lower latch mechanism and lower gate pins. Flow plates must be constructed of 1/4" thick 304 stainless steel, and must be compatible with sander hopper opening per MnDOT approval.
- 1.28 Corner posts must be 7 gauge thick full height of back panel, and provide space and access for agency strobe lighting mounting with no sideboard pockets. All rear corner posts must be completely open at the bottom. Each rear corner post must include the following light cut outs, one 3.0" round marker and two oval series 60 clearance light per MnDOT approval in writing prior to the build. Additionally the front side of corner posts flange to box (both sides) must have 4 holes provided for sander hydraulic fittings.

### **MnDOT STAINLESS STEEL 14' 6" OR 15' ELLIPTICAL TANDEM AXLE BOX**

- 1.29 Box must be 14' 6" or 15' long by 96" wide (over-all) Semi-Elliptical style. Interior width must be approximately 83-5/8" wide, but not to exceed 84" wide.
- 1.30 Front panel must be 45" to 46" inside height, 10 gauge thick with reinforced (enclosed) top lip and horizontal bracing at the 1/3 point down. The top lip must include (6) .44" diameter holes – centered and drilled into the top surface, spaced according to MnDOT requirements, with (6) 1" diameter access holes in the underside of the top lip, located directly under the .44" diameter holes. Top surface of front panel must be flat with no material or weld protrusions to ensure flush fit for box wiper or tarp.
- 1.31 Side panels must be 45" to 46" high inside, 7 gauge thick with 45° (self-cleaning) formed and enclosed box top rails to shed dirt. Sides must incorporate an 18" radius from the attaching point at the floor, to the vertical point of the side panel. Forming and enclosure of the top rails must be done such that welds are exposed only to the interior of the body. Radius of side must be roll formed or step formed, but must not exceed an 18" radius profile, for future fit-up of pre-wetting tanks.
- 1.32 Tailgate and reinforcing must be 45" to 46" inside height, main panel (interior) must be constructed of 3/16" thick high alloy, low carbon (.14) 180,000 PSI tensile, 400 HB hardness steel (values are nominal average). Outer reinforcements/panel(s) must be constructed of 10 gauge thick 304 stainless steel material, and must cover the carbon-steel interior panel in its entirety (double wall design).

Tailgate must include bottom air operated latching mechanism. Bottom hinge pins must be 1.25" diameter 304 stainless steel round stock, and top hinge pins must be 1.50" diameter. 304 stainless steel round stock, greaseable from the center (outer) point, and retained on the interior of the body against rotation. Top hinges must be located on top of the rear corner posts, and constructed of .50" thick 304 stainless steel. Upper tailgate hinge ears must be of the offset design, and constructed of 1.50" thick 304 stainless steel. Tailgate top must have formed (enclosed) edge with integral angled dirt deflector.
- 1.33 Corner posts must be 7 gauge thick full height of back panel, and provide space and access for agency strobe lighting mounting with no sideboard pockets. All rear corner posts must be completely open of the bottom. Each rear corner post must include the following light cut outs, one 3.0" round marker and four oval 60 series clearance lights per MnDOT approval. Additionally, the front side of corner posts flange to box (both sides) must have 4 holes provided for sander hydraulic fittings.
- 1.34 One step to be installed inside dump body on the back side of the ladder to be used to get out of box onto ladder, step to be same step material as the ladder (positioning to be approved by MnDOT).

### **120 & 200 GALLON SIDE-MOUNT PRE-WETTING SYSTEM**

- 1.35 Pre-wetting systems must be "Side of Body" type, and available in either single tank or dual tank systems. System provided must not interfere with body access ladder, or rear corner posts, and must be form fit to side of body, such that the overall width of components do not exceed the DOT maximum legal width of 102".
- 1.36 Pre-wet systems must include installation on box and installation of tank vent line per MnDOT approval. See attached vent line picture.

### **SINGLE AXLE SYSTEM**

- 1.37 The system tanks must consist of two 60-gallon polyethylene rotationally molded tanks, which are U.V. protected with a minimum specific gravity rating of 1.9. The tanks must weigh approximately 56 pounds each. The tanks must be designed to fit a dump body with an 18" radius. Tank dimensions must be: 20.75" H x 15.50" W x 76" L. The tanks must include two 5 inch non-vented spin-on lids. Tanks must be vented with a 90° elbow installed at mid-point with vent line and stainless steel bracket welded to box per MnDOT approval in writing prior to the build. There must be a minimum of 1" clearance between the top of the tanks fill cap and any obstruction above the cover and 1/2" inch clearance on the sides of the cover at all times including during the removal of the fill cover. The clearance when the cover is in place must be 2-3/4" minimum above and 1/2" to the side of the cover. The inner and outer surfaces of the back, front, and bottom of tank must be smooth to insure that replaceable polypropylene bulkhead adapters can be installed to achieve a watertight seal. (MnDOT will install adapters.)
- 1.38 All hose, which is supplied, must be nylon reinforced PVC hose with a working pressure of no less than 200 psi with maximum temperature rating of 100° F.

- 1.39 Mounting hardware must consist of 2" square receiver tube type mounts welded to dump body underside, and hook style upper brackets. The tank(s) must be supported from the underside and outer sides. The tank supports must insure that the tank cannot move forward or rearward with momentum of contents. Mounts must be substantial enough to allow full elevation of the dump body, with the pre-wet tanks attached and full. All stainless steel mounting components, both sheet and structural, must be manufactured to ASTM standards. The stainless steel brackets must be held in place with 5/8" stainless steel pins.
- 1.40 There must be a vent hose and elbow supplied to match the attached picture routing.

### **TANDEM AXLE SYSTEM**

- 1.41 The system tanks must consist of two 100-gallon polyethylene rotationally molded tanks, which are U.V. protected with a minimum specific gravity rating of 1.9. The tanks must weigh approximately 86 pounds each. The tanks must be designed to fit a dump body with an 18" radius. Tank dimensions must be: 20.75" H x 15.50" W x 120" L. The tanks must include two 5" non-vented spin-on lids. Tanks must be vented with a 90° elbow installed at midpoint with vent line. Stainless steel bracket welded to box per MnDOT approval.  
The inner and outer surfaces of the back, front, and bottom of tank must be smooth to insure that replaceable polypropylene bulkhead adapters can be installed to achieve a watertight seal. (MnDOT will install adapters.)
- 1.42 All hose, which is supplied, must be nylon reinforced PVC hose with a working pressure of no less than 200 psi with max temperature rating of 100°F.
- 1.43 Mounting hardware must consist of 2" square receiver tube type mounts welded to dump body underside, and hook style upper brackets. The tank(s) must be supported from the underside and outer sides. The tank supports must insure that the tank cannot move forward or rearward with momentum of contents. Mounts must be substantial enough to allow full elevation of the dump body, with the pre-wet tanks attached and full. All stainless steel mounting components, both sheet and structural, must be manufactured to ASTM standards. The stainless steel brackets must be held in place with 5/8" stainless steel pins.
- 1.44 There must be a vent hose and elbow supplied to match the attached picture routing.

### **2.0 HOIST REQUIREMENTS:**

If requested by purchaser the Contract Vendor must furnish (if available) non-proprietary, electronic digital hoist illustration(s), in one of the following file formats; .sldasm, .asmdot, .sldprt, .step, .igs, .sat, Parasolid, ProE or AutoDesk Inventor. The purchaser must use the files as a resource in the body design process. The Contract Vendor must furnish the electronic files at no additional cost to the purchaser.

### **11' BOX HOIST SYSTEM**

- 2.1 **Hydraulic requirements:** All hydraulic hose ends must be JIC 37 degree female swivel – male pipe hose ends are not acceptable. Galvanized hydraulic fittings are not acceptable. Any deviation must be approved by MnDOT.
- 2.2 Hoist must be underbody NTEA Class 50, Type V, double arm with sub frame rated at 17.8 tons minimum, 2000 psi maximum operating pressure.
- 2.3 Unit must be installed on an 11' dump body with 12" maximum hinge point overhang and be capable of a 45° maximum dump angle.
- 2.4 Cylinder must be an 8" diameter bore by 20" stroke.
- 2.5 Piston rod must be a minimum of 2-1/2" diameter machined from AISI 4140 material
- 2.6 Piston rods must have a nitrated finish coating.
- 2.7 Sub frame must be constructed of 5" x 2" x 1/4" wall, rectangular tubing, 65,000 PSI tensile strength steel. The sub frame must be 12 inches shorter than box length to allow for routing of hydraulic hoses
- 2.8 Hoist must have two permanently installed safety props (any kind of tubing in the props is not allowed) and solid block rear hinge point. Box hinge pins must be grease able hinge pins with grease zerks, readily accessible when box is raised and must be approved by MnDOT.
- 2.9 All pivot points must have grease fittings.
- 2.10 Hoist must be warranted for a minimum of two years against leakage, scoring, or corrosion on cylinder piston rod.

- 2.11 Hoist must include installation on box and Cab and Chassis, and be primed and ready to accept hydraulic hookup. Hoist to frame steel attachment plates must be a minimum thickness of 1/2" and a minimum width of 4". Mounting must be approved by MnDOT at pilot inspection.

### **15' BOX HOIST SYSTEM**

- 2.12 **Hydraulic requirements:** All hydraulic hose ends must be JIC 37 degree female swivel – male pipe hose ends are not acceptable. Galvanized hydraulic fittings are not acceptable. Any deviation must be approved by MnDOT.
- 2.13 Hoist must be an underbody NTEA Class 100 Type V, double arm with sub frame, rated at a minimum of 32.3 tons capacity, 2000 psi maximum operating pressure.
- 2.14 Unit must be installed on a 15' dump body with 12" maximum hinge point overhang and be capable of a 45° maximum dump angle.
- 2.15 Cylinders must be a twin 8" bore by 24" stroke.
- 2.16 Piston rods must be a minimum of 2-1/2" diameter machined from AISI 4140 material
- 2.17 Piston rods must have a nitrated finish coating.
- 2.18 Sub frame must be constructed of 6" x 3" x 5/16" wall, rectangular tubing, 65,000 PSI tensile strength steel. The sub frame must be 12" shorter than box length to allow for routing of hydraulic hoses.
- 2.19 Hoist must have two permanently installed safety props (any kind of tubing in the props is not allowed) and solid block rear hinge point. Box hinge pins must be grease able hinge pins with grease zerks, readily accessible when box is raised and must be approved by MnDOT.
- 2.20 All pivot points must have grease fittings.
- 2.21 Hoist warranty must be for a minimum of two years against leakage, scoring, or corrosion on cylinder piston rod.
- 2.22 Hoist must include installation on box and Cab and Chassis, and be primed and ready to accept hydraulic hook up. Hoist to frame steel attachment plates must be a minimum thickness of 1/2" and a minimum width of 4 inches. Mounting must be approved by MnDOT at pilot inspection meeting.

### **3.0 MnDOT UNDERBODY PLOW REQUIREMENTS:**

If requested by purchaser the Contract Vendor must furnish (if available) non-proprietary, electronic digital underbody plow illustration(s), in one of the following file formats; .sldasm, .asmdot, .sldprt, .step, .igs, .sat, Parasolid, ProE or AutoDesk Inventor. The purchaser must use the files as a resource in the body design process. The Contract Vendor must furnish the electronic files at no additional cost to the purchaser.

### **MnDOT ONE PIECE FIXED ANGLE UNDERBODY PLOW REQUIREMENTS:**

- 3.1 **Hydraulic requirements:** All hydraulic hose ends must be JIC 37 degree female swivel – male pipe hose ends are not acceptable. Galvanized hydraulic fittings are not acceptable. Any deviation must be approved by MnDOT in writing prior to the build.
- 3.2 Unit must be Root Model F-5 or Monroe Model MF-5, fully assembled, ready to install. Other similar underbodies should be offered on the non-MnDOT pricing pages.
- 3.3 Unit must have 11' moldboard, 5/8" thick, 20" high, heat treated high carbon steel with heavy duty spring shock absorbing assemblies.
- 3.4 All hydraulic cylinders must be nitrated steel plated, 3" or better diameter.
- 3.5 Hydraulic cylinders must have cushion spring shock absorbing assembly.
- 3.6 Hangers for one piece, fixed angle underbody plow must be bid separate from plow & priced per mount.
- 3.7 Moldboard to be complete with bolt on carbide cutting edge punched with 11/16" square holes, AASHTO carbide spacing, Kennametal PB700 series or MnDOT approved equal. All bolts, washers, and torque nuts to be grade 8, nylon locknuts not acceptable.
- 3.8 All moving parts must have easy access to grease zerks.
- 3.9 All functions of underbody plow must be controlled from Cab.
- 3.10 Paint must be manufacturer's standard color and lead free.

### **MnDOT ONE PIECE REVERSIBLE ANGLE UNDERBODY PLOW REQUIREMENTS:**

- 3.11 **Hydraulic requirements:** All hydraulic hose ends must be JIC 37 degree female swivel – male pipe hose ends are not acceptable. Galvanized hydraulic fittings are not acceptable. Any deviation must be approved by MnDOT in writing prior to the build.
- 3.12 Unit must be Root F-89 or Monroe Model 3500, fully assembled, ready to install. Other similar underbodies should be offered on the non-MnDOT pricing pages.

- 3.13 Unit must have 11' moldboard 1" thick by 20" high, heat treated high carbon steel with heavy duty spring shock absorber assemblies, actuated by two double acting 3" cylinders or better. Actuating cylinders must be equipped with external double screw locks on cylinder head and be poly pack/seal, gland nut not accepted.
- 3.14 Hydraulic cylinders must be one piece nitrated steel plated one piece.
- 3.15 Circle must be solid and 1" thick with two power reverse double acting 4" cylinders. It must also have circle clamps with poly shims, and no circle drive locking cylinders.
- 3.16 Hangers for one piece, reversing angle underbody plow must be bid separate from plow and priced per mount.
- 3.17 Moldboard to be complete with carbide insert cutting edge punched with 11/16" square holes, AASHTO carbide spacing, Kennametal PB700 series or MnDOT approved equal, all bolts, washers and torque nuts to be grade 8. Nylon lock is not acceptable.
- 3.18 All moving parts must have easy access to grease zerks. Hydraulic hoses must have external loom and be routed through square channel guard on plow back side.
- 3.19 All functions of underbody plow must be controlled from Cab.
- 3.20 Paint must be manufacturer's standard color and lead free.

**MnDOT FOLDING REVERSIBLE ANGLE UNDERBODY PLOW REQUIREMENTS:**

- 3.21 **Hydraulic requirements:** All hydraulic hose ends must be JIC 37 degree female swivel – male pipe hose ends are not acceptable. Galvanized hydraulic fittings are not acceptable. Any deviation must be approved by MnDOT in writing prior to the build.
- 3.22 Unit must be a Heavy-duty Root Model I-66 underbody scraper 11' in length, or Monroe FM B-11, fully assembled, ready to install. Other similar underbodies should be offered on the non-MnDOT pricing pages. Circle must be 1" thick solid steel and 1 piece notch less. The center pivot hole must have a welded bushing. The circle ears must have 3/4" gussets reinforcing a 3" O.D. boss for accepting the live end of the reversing cylinder. The anchor end pin must be 2" with a 5/8" x 4" bolt retaining the pin to the boss. The truck to underbody plow bracket that is welded to the top of the circle must have 4 holes installed in it per MnDOT approval. This underbody plow must not have any truck-to-plow brackets provided. Contract Vendors must supply a separate price for hangers that must be bolt on type, MnDOT approved as designed on **Drawing UB Mount Brk.**
- 3.23 Hangerboard must be a minimum of 1" x 10" Corten heavy-duty steel. The rear of the hangerboard must have a 1" x 2" x 3/16" channel welded to enclose the hydraulic hoses. Hydraulic hoses must have external loom and be routed through square channel guard on plow back side.
- 3.24 Moldboard must consist of 1/2" x 10" steel, 11' length; top half hinged with a 3/4" x 9" heat-treated high carbon steel bottom half. The bottom must be drilled to accept carbide insert cutting edges. Back plate for Moldboard must be of 5/8" material with a 1" hinge shaft. Ends to be reinforced with 3/4" thick clevis.  
Hinge tube to be 1-1/2" O.D. x 7/32" W with a 1" thick hinge shaft cold roll steel with 3/4" x 5" hinge gussets.  
Moldboard must be cushioned by four heavy-duty long travel springs attached directly to the back of the blade.  
Main actuating hinge line to be 111 linear inches with an additional moldboard hinge line for vertical operations. Main actuating hinge to be 1-1/2" with grease zerks.
- 3.25 Actuating cylinders must be two 3" diameter, double acting hydraulic cylinders with nitrated piston rods. The cylinders must be equipped with external double screw locks. The cylinder heads must be poly pack seal type (gland nuts are not acceptable).
- 3.26 Circle clamps must be 20.5" wide with a 1" thick top plate. The lower plate must be welded to the hangerboard. The top plate and polyethylene shim must bolt to the lower plate with 3 – 1" grade 8 bolts with steel locknuts.
- 3.27 Power reversing must be accomplished using two 4" bore by 14-1/2" stroke double acting cylinders working in tandem and providing positive hydraulic locking. The piston rods must be nitrated CR steel 2" in diameter. The live ends must be connected to the hangerboard by 2 greaseable rod end clevises. The hanger board bosses must be 3" O.D. tubing, solid welded top and bottom of the hangerboard and have a 2" pin serve as a clevis pin. Both anchor and live end pins must be held in place by a 5/8" grade 8 bolt with nut and washer. The anchor and live end of the cylinders must have 2" thick wear blocks.
- 3.28 Circle center pin must be 5" diameter machined, attached to hangerboard with three 3/4" x 4" Grade 8 bolts. Center pin must be equipped with a grease zerk.

- 3.29 Blade must be one Kennametal PB736H and two PB748H carbide insert cutting edges per unit or MnDOT approved equal.
- 3.30 There must be a mechanical lock to keep the underbody plow from creeping down. There must be one 1/2" lockable pin on each side to lock the plow in place, see attached picture.
- 3.31 Paint must be lead free and manufacturer's standard color.
- 3.32 Price must be provided for 10' version of underbody plow spec 3.21 – 3.31 on MnDOT pricing page.

#### **INSTALLATION OF UNDERBODY PLOWS**

- 3.34 Installation must be with bolt on hardware and does not include plumbing to hydraulics.
- 3.35 Location to be approved by agency.

#### **4.0 BENCHING WING REQUIREMENTS:**

If requested by purchaser the Contract Vendor must furnish (if available) non-proprietary, electronic digital benching wing illustration(s), in one of the following file formats; .sldasm, .asmdot, .sldprt, .step, .igs, .sat, Parasolid, ProE or AutoDesk Inventor. The purchaser must use the files as a resource in the body design process. The Contract Vendor must furnish the electronic files at no additional cost to the purchaser.

- 4.1 **Hydraulic requirements:** All hydraulic hose ends must be JIC 37 degree female swivel– male pipe hose ends are not acceptable. Galvanized hydraulic fittings are not acceptable. Any deviation must be approved by MnDOT in writing prior to the build.
- 4.2 Unit must be Falls Model W12-T, other MnDOT approved equal Models of truck mount benching wing plow should be offered on the non-MnDOT pricing pages.
- 4.3 Overall length must not exceed 12' 6".
- 4.4 Cutting edge must be 1/2" x 6" x 12' AASHTO punched.
- 4.5 Overall height front and rear must not be less than 30".
- 4.6 Moldboard must be smooth rolled design. Moldboard and moldboard reinforcement must be constructed of not less than 10 gauge thick high strength carbon steel A607-50 or MNDOT approved equal. Mild-steel is not acceptable. Moldboard must be reinforced across the full length by two double formed box sections; the one section must be overlapped by the other and must be welded together for additional strength. The top flange must be double formed or otherwise reinforced for rigidity. The discharge end must be additionally reinforced with 1/2" diameter round bar. The bottom moldboard support structure must be constructed of not less than 1/2" x 7" high carbon plate, M1044 or MNDOT approved equal, ribbed and reinforced at the bolt holes.
- 4.7 Moldboard must be rolled to a radius of 16-1/2".
- 4.8 Pivot bolt must be not less than 1-1/2" diameter.
- 4.9 Weight of moldboard must be not less than 725 pounds.
- 4.10 All mounting must be of the heaviest design practical. Total weight of snow wing mounting system must not exceed a maximum 1370 pounds.
- 4.11 The front wing post vertical 7" x 15.0# beam must be constructed of T-1® steel. Beam must be attached to a cross member of a minimum 7" x 5" x 3/8" wall rectangular tubing. Front wing post must incorporate a tubular slide capable of a minimum 54" of lift. Front post must be equipped with a lower limit setting and safety chain. Down pressure must not be used to hold wing on front post.
- 4.12 Front wing post must have hydraulic side shifting to allow for full tilt hood. Unit must be installed so full range of side shift travel can be used. Cylinder must have nitrate treated rod meeting specification stated in 2.15.
- 4.13 The rear wing post vertical 7" x 15.0# beam must be constructed of T-1® steel. Beam must be attached to 5" H-beam. Rear wing post must house the two single acting lift cylinders required for operation of snow wing. Housing must not require more than 9" of clear space between the rearmost projection of the Cab and the foremost projection of the dump body (Cab shield not included). Rear post to provide hydraulic height adjustment for the push arm. Hydraulic cylinder to be minimum 3" diameter x 24" stroke with 1-1/2" nitrate treated rod meeting specification stated in 2.15. Hydraulic cylinder to be certified to twice the working pressure of the vehicle. Safety retaining chain must be provided to secure wing in the transport position.
- 4.14 Lift height at the outer end or heel of the snow wing must be 104".
- 4.15 Single acting hydraulic cylinders must be minimum 4" diameter with 3" nitrate treated rod meeting specification stated in 2.15. Rams must be tubular.

- 4.16 Wing must be equipped with one telescoping push bar, which must be spring buffered. Buffer spring must be easily replaceable.  
Push bar must have safety shear pin. The included angle of the moldboard must be 30 degrees at minimum position and must be adjustable to at least 50 degrees of the extended position.
- 4.17 Wing plow must be installed, fully functional, ready to operate from Cab; hydraulic side shift with full range of motion and electric valve connections must be included. Hydraulic side shift of benching wing must be operated by front plow reversing section.
- 4.18 Installation must include plumbing, diverter valve, hoses, and hydraulic hookup. Hoses, fittings, etc., must be rated at 2500 PSI minimum. Electric diverter valve must be located between frame rails behind front bumper and must be connected to front plow reversing valve section. Additionally, there must be quick couplers on hydraulic side shift benching wing hoses for easy removal when converting truck to summer use.
- 4.19 Hookup must include all electrical connections. Connections must be weatherproof.
- 4.20 Installation of wing plow must include mounting of MnDOT supplied Cab shield. Any needed alterations to Cab shield must be included in installation.
- 4.21 Installation must include painting with lead free paint. All parts must be painted with primer and finished paint coat.
- 4.22 MnDOT must approve all installation procedures in writing prior to build.
- 4.23 Completed installation must be such that all plow functions and movement ranges can be executed to the fullest range/travel the equipment is manufactured to achieve.
- 4.24 Cab hood must be able to be opened when wing is completely installed.

#### **5.0 FRONT HITCH REQUIREMENT:**

If requested by purchaser the Contract Vendor must furnish (if available) non-proprietary, electronic digital front hitch illustration(s), in one of the following file formats; .sldasm, .asmdot, .sldprt, .step, .igs, .sat, Parasolid, ProE or AutoDesk Inventor. The purchaser must use the files as a resource in the body design process. The Contract Vendor must furnish the electronic files at no additional cost to the purchaser.

- 5.1 **Hydraulic requirements:** All hydraulic hose ends must be JIC 37 degree female swivel – male pipe hose ends are not acceptable. Galvanized hydraulic fittings are not acceptable. Any deviation must be approved by MnDOT.
- 5.2 Front hitch must be Falls heavy duty custom frame #46B or Monroe #46B-MN, and must be compatible with Falls #46B push bar or MnDOT approved equal. Front hitch must be a one piece assembly after installation, whether welded before or after installed. Front hitch must be Huck bolted to frame.
- 5.3 Snow plow connection mechanism must be rapid push bar quick coupler or MnDOT approved equal. Additionally, pin retract lever must have MnDOT approved locking device.
- 5.4 Quick coupler system must have push arm receptor sockets for proper pin alignment.
- 5.5 Mounting system must adapt to and not require more than 20" of mounting space of front frame extension as measured from front edge of front spring shackle.
- 5.6 Vertical risers and plow lifting yoke must be low profile to allow clearance for tilting hood without tilting or disconnection plow/wing lift hitch.
- 5.7 Plow lift cylinder must be 4" x 10" single acting with nitrate treated rod, certified to at least 4000 psi, head gland must be 65-45-12 ductile iron and zinc phosphate plated, all internal threads to be assembled with Loctite.
- 5.8 Hitch must be reinforced with bumpers and painted with lead free gloss black per MnDOT approval. See Drawings and Pictures, titled "**RT Front Bumper Coupler**" and also "**LF Front Bumper Coupler**".
- 5.9 Unit must have return spring for the lifting cylinder.
- 5.10 There must be Grease Zerks and lines for remote greasing of push lock bar pins. Hoses are to be routed to a common location that is to be MnDOT approved. Grease lines/hoses and fittings must be rated to more than 2000 psi.
- 5.11 There must be two eyelets installed for attaching the engine winter fronts. See attached pictures in the "Drawings and Picture" file for a visual of the location. Both eyelets must be the same. In addition, both sides must be the same location on the front hitch. The eyelets must be even with the vertical face of the hood.

## **6.0 MnDOT FRONT PLOW REQUIREMENTS:**

If requested by purchaser the Contract Vendor must furnish (if available) non-proprietary, electronic digital front plow illustration(s), in one of the following file formats; .sldasm, .asmdot, .sldprt, .step, .igs, .sat, Parasolid, ProE or AutoDesk Inventor. The purchaser must use the files as a resource in the body design process. The Contract Vendor must furnish the electronic files at no additional cost to the purchaser.

- 6.1 **Hydraulic requirements:** All hydraulic hose ends must be JIC 37 degree female swivel – male pipe hose ends are not acceptable. Galvanized hydraulic fittings are not acceptable. Any deviation must be approved by MnDOT in writing prior to the build.

## **MnDOT ONE WAY SNOW PLOW REQUIREMENTS:**

- 6.2 Unit must be Falls 312 MHD 12' R.H., fully assembled ready to install or MnDOT approved equal. Other similar one-way plows should be offered on the non-MnDOT pricing pages.
- 6.3 MnDOT plow must have special nose section constructed per **Drawing #6.2**.
- 6.4 Plow must be constructed per **Drawing #6.3 and #6.4**.
- 6.5 Moldboard must have square hole for mounting bolt on cutting edge in lieu of round holes.
- 6.6 Base unit plow must not include shoes, cutting edge, plow unit push bar, parking stand, snow deflector, and curb protector or 411H moldboard option. These items must be priced out separately on MnDOT pricing page. Nitrate rods must be standard on all hydraulic cylinders.
- 6.7 Price must be provided for reversible one-way plow option on MnDOT pricing page.
- 6.8 Cutting edge option must be a quantity of 3 each 3/4" x 6" x 4' carbide steel, AASHTO punched.

## **MnDOT TWO WAY REVERSIBLE PLOW REQUIREMENTS:**

- 6.9 Unit must be Falls PR1243 12' reversible plow, fully assembled ready to install with the two reversing hydraulic hoses being 44" long minimum or MnDOT approved equal. Other similar reversible plows should be offered on the non-MnDOT pricing pages.
- 6.10 Reversible A-frame must be 4" x 2" x 3/16" A-500B tubular construction minimum, pivot pin must be a minimum 1-1/2" diameter. A-frame must be doubled, so it straddles the push frame.
- 6.11 Moldboard must have square holes for mounting bolt on cutting edge in lieu of round holes.
- 6.12 Base unit plow must not include shoes, cutting edge, push bar, adjustable screw wheel assembly or curb protectors. These items must be priced out separately on MnDOT pricing page. Nitrate rods must be standard on all hydraulic cylinders.
- 6.13 Cutting edge option must be a quantity of 3 each 3/6" x 6" x 4' with carbide inserts, AASHTO punched.

## **MnDOT TWO WAY REVESIBLE HIGH WING DISCHARGE PLOW REQUIREMENT:**

- 6.14 Unit must be Falls XPR-12 two way reversible high wing discharge plow, fully assembled ready to install or MnDOT approved equal. Other similar equal two way reversible high wing discharge plows should be offered on the non-MnDOT pricing pages.
- 6.15 Moldboard must have square holes for mounting bolt on cutting edge in lieu of round holes.
- 6.16 Base unit plow must not include shoes, cutting edge, push bar, adjustable screw wheel assembly or curb protectors. These items must be priced out separately on MnDOT pricing page. Nitrate rods must be standard on all hydraulic cylinders.
- 6.17 Cutting edge option must be a quantity of 3 each 3/4" x 6" x 4' with carbide inserts, AASHTO punched.

## **MnDOT SNOW V - PLOW REQUIREMENTS:**

- 6.18 Unit must be Falls V-90 with 9' 8" cutting width minimum, fully assembled ready to install or MnDOT approved equal. Other similar V- plows should be offered on the non-MnDOT pricing pages.
- 6.19 Moldboard must have square holes for mounting bolt or cutting edge in lieu of round holes.
- 6.20 V- plow must have replaceable nose piece and metal spring loaded snow deflector and cutting edges included.
- 6.21 Base unit plow must not include push bar or adjustable screw wheel assembly. These items must be priced out separately on MnDOT pricing pages.

## **MnDOT REVERSIBLE/ADJUSTABLE POLY PLOW REQUIREMENTS:**

- 6.22 Unit must be 12' Frink RAC 3351-12-RR85, fully assembled ready to install. Other similar reversible/adjustable poly plows should be offered on the non-MnDOT pricing pages.

- 6.23 Plow must include push bar and mounting hardware and be compatible with Falls or Monroe #46B quick hitch system.
- 6.24 Cutting edge must be 3/4" x 8" x 12' C 1090 steel, AASHTO punched supported by 4" x 4" x 3/4" reinforcement angle steel. Holes to be stamped at 3" to provide additional 3/4" wear on cutting edge.
- 6.25 Base unit must not include spray guard, wrap around bumpers or underbody style mount hitch system. These items must be priced out separately on MnDOT pricing page. Nitrate rods must be standard on all hydraulic cylinders.
- 6.26 Poly plow must have replaceable bushings on pivot points.
- 6.27 Moldboard hydraulic cylinders must have lock valves which hold curvature of moldboard.
- 6.28 Moldboard must have square holes for mounting bolt or cutting edge in lieu of round holes.

### **7.0 PUP HITCH REQUIREMENTS:**

If requested by purchaser the Contract Vendor must furnish (if available) non-proprietary, electronic digital Pup hitch illustration(s), in one of the following file formats; .sldasm, .asmdot, .sldprt, .step, .igs, .sat, Parasolid, ProE or AutoDesk Inventor. The purchaser must use the files as a resource in the body design process. The Contract Vendor must furnish the electronic files at no additional cost to the purchaser.

- 7.1 **Hydraulic requirements:** All hydraulic hose ends must be JIC 37 degree female swivel – male pipe hose ends are not acceptable. Galvanized hydraulic fittings are not acceptable. Any deviation must be approved by MnDOT in writing prior to build.
- 7.2 Unit must have 3/4" thick A572-50 steel pull plate with 1/2" thick side gussets installed at rear of truck frame per MnDOT approval in writing prior to the build.
- 7.3 Unit must be able to bolt in to the truck with eight 1" grade 8 fasteners, washers and steel lock nuts minimum. There must be other grade 8 bolts, washers and steel lock nuts sized as necessary for Chassis parts as needed.
- 7.4 Hitch assembly must be per Drawing titled **Pup Hitch**. Hitch must have air-cushioned pintle hook with a minimum of 18,000 lbs. vertical tongue weight and 90,000 lbs. horizontal pull weight, and a latching tensile of 20,000 lbs.
- 7.5 Relocation of the Cab and Chassis provided air glad hands and electric socket to hitch plate must be included per MnDOT approval in writing prior to the build.
- 7.6 The Contract Vendor must provide and install a 1" R2 hydraulic line from valve body to hitch plate and terminated with a capped off 1" male bulkhead connector.
- 7.7 The hitch must conform to proper engineering standards. The hitch must slide into the Chassis frame, and the C channel that fits inside of the frame (see Drawing mentioned above) must not be less than 3/8" in thickness.
- 7.8 Hitch must include safety chain loops, installed, with proper rating to match hitch rating.

### **8.0 MNDOT UNDER TAILGATE SAND SPREADER REQUIREMENTS:**

If requested by purchaser the Contract Vendor must furnish (if available) non-proprietary, electronic digital sand spreader illustration(s), in one of the following file formats; .sldasm, .asmdot, .sldprt, .step, .igs, .sat, Parasolid, ProE or AutoDesk Inventor. The purchaser must use the files as a resource in the body design process. The Contract Vendor must furnish the electronic files at no additional cost to the purchaser.

- 8.1 **Hydraulic requirements:** All hydraulic hose ends must be JIC 37 degree female swivel – male pipe hose ends are not acceptable. Galvanized hydraulic fittings are not acceptable. Any deviation must be approved by MnDOT in writing prior to the build.
- 8.2 Sander must be Swenson Model UAMD-6" or 9" or demonstrated MNDOT approved equal.
- 8.3 Rotary disc spinner and/or salt chute must be located on side of dump body tailgate that customer requests.
- 8.4 Spinner assembly to be adjustable from side to side throughout full range of the spreader vanes.
- 8.5 Spinner assembly and or salt chute mechanism must have quick detachment capabilities.
- 8.6 Spinner disc to be one way type, one piece cast elastomer with curved vanes, fabricated of abrasion resistant polyurethane with cast in steel or A-304 stainless steel center plate.
- 8.7 Elastomeric spinner disc vanes at base and base plate must have 272.1 Bars (4000 PSI), a shear hardness of 93, and a tear strength of 226.8 Kg (500 lbs.). These mechanical characteristics are constant over an operating temperature range of -45.6° C (-50° F) to 82.2° (180° F).

- 8.8 Spinner disc flights must be for one way operation.
- 8.9 Sander unit must be furnished with a removable pin type quick detachable installation and removable mounting mechanism. Mounting bracket must have to be offset so pin can be removed easily, depending on box type. Contract Vendor is responsible for taking final measurements from dump truck box.
- 8.10 Sander unit and equipment, when installed, must not interfere with dump box sand dumping operations. Sander must be fillable by tilting dump box.
- 8.11 Sander unit must be adjustable to the width of the dump box by use of mounting brackets.
- 8.12 Sander unit must not exceed 244 cm (8') wide excluding mounting mechanism. Sander must be sized for mounting on a 244 cm (8') wide dump body.
- 8.13 All sharp edges must be removed from all edges of sander surfaces.
- 8.14 Sander must have a combination one piece removable rear panel wall and cover with safety device to prevent loss of cover.
- 8.15 Line 8.15 Not Applicable.
- 8.16 Cover and rear panel wall must be easily handled by one person. It must be capable of being swung out of the closed position to completely expose the auger and hopper for removal of any obstructions while spreader hopper and dump body are filled with material.
- 8.17 Rear panel must be supported by the sander side brackets and must be locked in place by a positive locking mechanism with a manual control lever. Furnish quick disconnect safety pins with chain retainers for locking control lever in closed position and locking panel in cover position.
- 8.18 Hinged type removable panel mechanism is not acceptable.
- 8.19 There must be a quantity of 3 hydraulic hose loops located on the back and bottom of sander per MnDOT approval in writing prior to build. It must also be sized to allow hoses and quick couplers to slip through easily. Quick coupler outside diameter must be 2". Hose outside diameter must be 7/8".
- 8.20 Front of sander hopper to have upper lip to eliminate space between dump box and sander.
- 8.21 Construction of end panels must be as shown on **Drawing titled "Sander Side Plate"**, constructed of 1/4" A-304 stainless steel. Mounting brackets must be made of the same material.
- 8.22 Sander unit must be constructed of 7 gauge or greater A-304 stainless steel. All welds must be continuous.
- 8.23 Furnish sander with a 1.9 cm (3/4" I.D.) A-304 stainless steel pipe with 4 each .32 cm (1/8") holes centered between the ends of the auger, installed through the left end plate of sander. 1/8" holes to be pointed down. A stainless steel pipe is to be welded securely to front plate of the sander trough, the left end of pipe to have standard pipe threads for attaching pre-wetting liquid tubing. The design and installation must be approved by MnDOT in writing prior to the build.
- 8.24 Sander must be furnished with direct drive hydraulic motor for auger and spinner, which is powered by the truck hydraulic system.
- 8.25 Auger drive motor must be a White RE Model #83301R with #10 O-ring ports or MnDOT approved equal. The spinner motor must have #10 O-ring ports.
- 8.26 Auger drive motor must have a minimum torque of 8052 cm-kg (7000 inch/lbs.) at 81.6 bar (1200 PSI). It must have a minimum of 737 cc (45 cu in) displacement.
- 8.27 Auger drive motor must operate at 70-75 RPM and at a flow rate of 90.8 liter (24 gallons per minute).
- 8.28 Auger drive motor must have an internal overload protection system designed to protect the motor and auger without need for any sheer bolts.
- 8.29 Price must be provided for an end-of-auger shaft sensor with stainless steel protective case.
- 8.30 Auger drive motor must have a side (radial) load capacity of a minimum of 1134 Kg (2500 lbs.).
- 8.31 Motor to have a minimum thrust load capacity of 453.6 Kg (1000 lbs.).
- 8.32 Auger drive motor must be mounted to end plates with a minimum quantity of 4 each with a 1.27 cm (1/2") diameter bolts.
- 8.33 Clearance between the end plate and the bearing face with a minimum quantity of 1.6 cm (5/8") to allow salt/sand to fall clear.
- 8.34 Motor must couple directly to auger via a drive sleeve and have a shaft diameter with a minimum 3.18 cm (1.25").
- 8.35 Motor must not extend out past mounting brackets. Overall width of sander must not exceed 244 cm (96"), excluding mounting brackets.
- 8.36 Motor must be capable of turning an auger of 15.2 cm (6") and an/or an auger of 22.9 cm (9") diameter full of 2,161 Kg/m<sup>3</sup> (135#/cu. ft.) of wet sand.

- 8.37 Auger free end to run on self-aligning sealed anti-friction, four bolt type, SealMaster #1 1/4 SF20 bearing or MnDOT approved equal. A 2-1/2" grease extension pipe and zerk must be installed on the bearing, facing downward, to allow for greasing of the bearing.
- 8.38 Inlet and outlet openings on the hydraulic motor must face towards the front of truck.
- 8.39 Sander must be furnished with either a 6" or 9" diameter auger.
- 8.40 6" O.D. diameter auger must have .95 cm (3/8") nominal flight thickness and 15.2 cm (6") pitch. Auger to be capable of delivering from 56.1 Kg/Km (200 lbs./mile) of 50% salt - 50% sand to 300 Kg/Km (1000 lbs./mile) of sand at 32 kilometers per mile (20 mph). Assume sand at a density of 2,082 Kg/m<sup>3</sup> (130 lbs. /cubic ft.) and salt at 1,233 Kg/m<sup>3</sup> (77 lbs. /cu ft.).
- 8.41 9" O.D. auger must have 1.27 cm (1/2") nominal flight thickness and 4" pitch capable of delivering about 19 lbs. per revolution of 2,082 Kg/m<sup>3</sup> density sand, designed for left or right hand discharge.
- 8.42 Auger to be constructed of mild steel flight with 6.35 cm (2-1/2") I.D. schedule 40 center tube, supported by 2.86 cm (1-1/4") steel shaft at the free end. The drive end must have a coupler to drive motor.
- 8.43 Outside of auger to inside of trough clearance minimum of 1.3 cm (1/2") or a maximum of 1.9 cm (3/4") each side.
- 8.44 9" and 6" sander units must be furnished with right hand and left hand drop part.
- 8.45 Sanders must not include a R.H. berm chute, it must be offered as an option on Pricing Pages.
- 8.46 9" and 6" sander must include dual anti-flow plates over each end of the auger for a distance sufficient to prevent free flow of salt/sand when auger is not operating. Plates must be a minimum of 10 gauge stainless steel and are to be easily removed.
- 8.47 Each 9" and 6" sander unit must include one spinner/motor assembly, right hand or left hand as required by customer.
- 8.48 6" and 9" sander must include an external fill plate to cover spinner hole that is not used.
- 8.49 All pins, fasteners, etc., must be made of A-304 stainless steel.
- 8.50 Responder must provide price for providing addition spinner assembly either right hand or left hand so unit has dual spinners.
- 8.51 Responder must supply price for 6" and 9" split auger sander with two drive motors and center bearing support. Sander must be independently operated (left hand only, right hand only or left hand and right hand operation at the same time). Unit must include right hand and left hand spinner assemblies.
- 8.52 Responder must provide credit pricing for sander unit made of A-36 steel with 1/4" end panels and 7 gauge on box.

**9.0 HYDRAULIC REQUIREMENTS:**

- 9.1 **Hydraulic requirements:** All hydraulic hose ends must be JIC 37 degree female swivel – male pipe hose ends are not acceptable. Galvanized hydraulic fittings are not acceptable. Any deviation must be approved by MnDOT in writing prior to the build.
- 9.2 The hydraulic system must have a transmission mounted load sensing pump, Model # TXV92-R-KIT or MnDOT approved equal, 5.61 cu. In. displacement, DIN shaft 14x8x32x35 spline, DIN 5462B-4 Bolt, CW rotation. Pump must include all fittings and mounting hardware to direct mount to PTO and requires rear of pump to have a support bracket to the transmission. If the transmission is an Allison 3000 RDS, PTO must be Chelsea Hot Shift 280XGGFJW-B3ZY. If the transmission is Allison 4500 RDS, PTO must be Chelsea Hot Shift 280GCFJW-B3ZY or MnDOT approved equal.
- 9.3 System must include a Parker high pressure filter Model #30P210QBH1SK161 or MnDOT approved equal. Double length element and SAE #16 ports installed between pump and valve body. Filter must include a condition indicator with wire leads. Installation of Parker filter must be approved by MnDOT in writing prior to build.

- 9.4 Hydraulic reservoir must be a 30 gallon capacity 10 gauge stainless steel per MnDOT approval in writing prior to the build and equipped with the following:
- Non-vented filler cap.
  - Breather must be a Donaldson Model P564669 mounted on a 1 inch NPT 10 inch riser or MnDOT approval in writing or MnDOT approved equal.
  - Flush mount on outside bottom of tank 2" NPT suction with 100 mesh screen type filter, Model ZIN TFS-2030-0-3 or MnDOT approved equal.
  - Separate 3/4" NPT port, below fluid level, for control case drain line with 3/4" ball valve installed as close as possible to reservoir.
  - Separate 1/2" NPT drain port, rear face, right side of tank.
  - All locations of above reservoir ports must be approved at time of order.
  - Sight gauge externally mounted, 0.25" I.D. clear plastic tubing, temp rating.
  - 2" brass suction line shut-off valve.
  - Electric oil level/temperature sending unit #S2-TS010-L212-AC-DN-SS or MnDOT approved equal.
  - Provisions for tank mount filter. ZIN kit TS-1600-25- 1-0/ZSRE-409-10E with absolute element #ZIN ZSRE-409-10 or MnDOT approved equal.
- 9.5 Hydraulic oil filter must be mounted in the reservoir. Hydraulic filter must be 10 micron and a minimum rating of 50 gallons per minute. Filter must be Model TS-1200-25-1-0/ZSRE-409-10/PS-25-WD with bypass switch and signal sender, and close nipple. Additionally a Force America Model C-10038 or MnDOT approved equal, return oil manifold must be installed on truck per MnDOT approval in writing prior to build (manifold has 3 entrance lines, underbody plow, valve bank 1, and valve bank 2, and one larger exit line which goes to hydraulic return oil filter).
- 9.6 Pump pressure line must be a 100-R2, 1" with working pressure of 2000 PSI, suction line 100-R4, 2", working pressure of 100 PSI and bursting pressure of 400 PSI, return line 100-R1, 1-1/4", working pressure of 500 PSI and bursting pressure of 2000 PSI, and load sense line 100-R2, 1/4" with working pressure of 3000 PSI. All hoses must be cleaned out before final plumbing assembly takes place. Additionally, all hydraulic hoses must be sleeved with TEXS brand or MnDOT approved equal hose wrapping.
- 9.7 Hydraulic fluid must be ATF or MnDOT approved equal.
- 9.8 Each valve assembly must be mounted in a weather-tight enclosure. The valve enclosure must be fabricated of 12 gauge stainless steel minimum. Enclosure must be designed to not allow humidity to be trapped inside. Valve to be mounted vertically with all ports coming out towards inside of truck frame allowing for hose adapter fitting. Enclosure will allow for bulkhead style Cable to enter bottom of the base. Valve will be "Boxed In" with the cover and not the base. The cover must be hinged at the bottom of the enclosure and be held closed by two heavy rubber latches. All plumbing must be external, directly out the rear of the valve enclosure.
- 9.9 Controls for valve functions will be integrated into a single, self-contained control center. The control center must have a padded armrest style that is ergonomically designed. Control center must be modular in design for ease of installation and service, and wiring and connectors must be color coded throughout. All components must be durable for long life and trouble free operation. Multi-stick communication electronics must include as standard the capability to control (9) proportional outputs simultaneously. The control must be supplied in 3-stick, 4-stick, or a 5-stick configuration according to the chart below. The front plow lift and angle and the underbody up/down and the blade angle functions must not be 8-way controllable, but must be gated to confine functions to 4-way only.

Style	Function / Joystick Type				
Position:	1	2	3	4	5
<b>3 stick</b>	HOIST Type 1	PLOW Type 2 Gated	WING Type 3	BLANK PLATE	BLANK PLATE
<b>4 stick</b>	HOIST Type 1	PLOW Type 2 Gated	UNDERBODY W/Float Type 3 GATED	WING Type 4	BLANK PLATE
<b>5 Stick</b>	HOIST Type 1	PLOW Type 2 Gated	UNDERBODY W/Float Type 3 GATED	WING Type 4	Tow Plow Gated

AUX = Benching Wing, Push-Pull Wing, or Pup Trailer depending on application

Note: Float function to have "Enable/Disable" switch.

#### Joystick Types:

Type	Description
1	Single Axis with Pushbutton (Hoist Joystick)
2	Dual Axis with Pushbutton – GATED (Plow Joystick)
3	Dual Axis –GATED (Scraper Joystick)
4	Dual Axis (Wing Joystick)
5	Dual Axis (Tow Plow Joystick)

For ease of operation the multi-stick control must include the following features: a momentary push-button at the top of the hoist stick to provide hoist-interlock. A solid-state red LED labeled "Hoist" must illuminate when the driver disengages the hoist interlock. The "Hoist" LED must remain illuminated while the hoist is under operation. The "Hoist" LED must be integrated into the communication control circuit. Plow joystick must include a momentary pushbutton for activation of the truck body vibrator.

Hardware/software must include multi-stick communication integral float options. Add-on float modules will be unacceptable. For flexibility of use the integral float programming must have the following standard features: (4) axis functional float on any of the (9) outputs with selectable forward/back, left/right functionality, compatible with three-way or four-way hydraulic functions, selectable (3) second float delay timer and optional float enable switch inputs. A dead-front nomenclature, backlit in red by a solid-state LED, must indicate that the float function is active. To insure longevity of performance all lighting to be solid-state LED technology. Incandescent lamps or EL backlighting not acceptable. Functional joysticks must be of contact less design and offer up to a 5-Million cycle life. Potentiometers must be unacceptable.

To insure safe operation joystick communication hardware/software must include the following standard features: input power monitor circuitry and output shutdown during over-voltage or low-voltage condition, power-on joystick input off center checking and output shutdown, joystick out of range checking and output shutdown and true outputs off with joystick centered. Multi-stick control must employ solid-state LED backlit nomenclatures on positions 1, 2, 3, and 4.

For ease of service the multi-stick control must be easily adjusted using built in software and interface components. The joystick calibration data must be retained on-board and must be easily transferable between joystick system components. The MIN/MAX, Output duty cycle thresholds, dead bands and error thresholds for each joystick input are all adjustable. To insure longevity multi-stick control must have self-diagnostic valve output drivers that automatically protect against over current and over temperature conditions. For ease of service multi-stick control must have solid-state self-resetting overload protection on auxiliary functions. Fuses or bi-metal breakers are unacceptable. The unit must be supplied with separate Cable assembly with plug ends that connects controller to valve control connection and main power connection. The center must also be supplied with color-coded wiring throughout. Heavy-duty pre-wire valve harness must be included for cylinder function valve assembly and the auger/reverse spinner/dual valve assembly. Control to be Modular Multi-Stick Proportional Control by FORCE America or MnDOT approved equal. Approved equals must be compliant with existing wiring, hydraulic fittings or fitting locations.

### **MnDOT Systems**

All valve systems must be electric controlled hydraulic valve must be of modular manifold design with spool, zero leak 3-way cartridge and zero leak 4-way type valves. Each hydraulic function requires an individual manifold stacked together to form the manifold base. The hydraulic control spool valves (hoist, front plow angle, auger/reverse and spinner/dual) must be capable of being pulse-width modulated, proportionally controlled with stroke limiter.

Additionally each of these valves must be equipped with a rack and pinion manual override except for the auger and spinner sections. The hydraulic control zero leak 3 way cartridge type valve with proportional cartridge poppet valves for down functions and cartridge spool valves for up functions (front plow up/down, wing toe and wing heel) must have pull and release style manual override. The high flow valve sections part number is 9661A-001 or MnDOT approved equal. Each hydraulic valve segment must be individually mounted to a manifold base assembly and be serviceable without removing any hydraulic hoses or any other hydraulic valve segments.

All Systems must have a Force America 6100 system or MnDOT approved equal and be ground orientated. The sander controls must include an auger speed sensor, wiring harness for transmission and electromagnetic hydraulic valve, so unit can be installed and made functional with no additional materials required. There must also be a system authorization module to communicate with the MnDOT AVL system.

### **Hydraulic System Installation**

Responder must provide pricing for installation of the hydraulic system.

MnDOT will be responsible for mounting the valve body assembly on the truck and all components located in the Cab of the truck before the truck is shipped to the installer.

### **Basic 7 Section**

Valves must be arranged as follows: Hoist, Plow Lift, Plow Reverse, Wing Toe, Wing Heel, Sander Auger with reverse and Dual Spinners.

### **Underbody Scraper**

Equipment for controlling Underbody Scraper plow.

One proportional 4-way valve section for Plow Reverse.

One 4-way valve section for Plow Lift, section includes plow float, counter balance valves for lock valve function all internal to the valve with no external plumbing.

Accumulator with pressure reducing valve to control down pressure.

Pressure transducer in down pressure circuit to provide down pressure.

Valve GPM and arrangement to be approved by MnDOT in writing prior to the build.

### **Benching Wing or Hydraulic Push Pole**

One proportional 4-way valve section.

Valve GPM and arrangement to be approved by MnDOT in writing prior to the build.

### **Pup Hoist**

One proportional 4-way valve section.

Valve GPM and arrangement to be approved by MnDOT in writing prior to the build.

### **Tow Plow**

One proportional 4-way valve section for steering tow plow.

One proportional 3-way valve section for plow lift.

Valve GPM and arrangement to be approved by MnDOT in writing prior to the build.

### **Zero Velocity Spinners**

One proportional 4-way valve section for spinner motor.

One proportional 4-way valve section for direction control.

Valve GPM and arrangement to be approved by MnDOT in writing prior to the build.

### **Slurry Pump Section**

One proportional 4-way section for slurry pump.

Valve GPM and arrangement to be approved by MnDOT in writing prior to the build.

### **Second Auger Section**

One proportional 4-way section for auger motor.

Valve GPM and arrangement to be approved by MnDOT in writing prior to the build.

### **Second Spinner Section**

One proportional 4-way section for spinner motor.

Valve GPM and arrangement to be approved by MnDOT in writing prior to the build.

### **Front Mounted PTO**

List the amount of credit on price page for the deletion of PTO and hydraulic pump in specification 9.2. As an alternative to the transmission pump, the Contract Vendor should price out a hydraulic pump that is a U.S. manufactured axial piston pressure and flow compensated load-sensing type approved by MnDOT. The pump must be cast iron construction and rated to 6.00 cubic inches per revolution at maximum stroke which will deliver 24.7 gpm @ 1000 engine rpm. The pump must be rated for 3000 PSI maximum and 2500 PSI continuous. The pump must have a severe duty, high-pressure outboard Teflon shaft seal that protects the pump shaft bearing and seal from external contamination and salt spray. The pump must have a 1-1/4" keyed drive shaft and SAE type C mounting flange. The pump must be Force America FASD45 or MnDOT approved equal. A single normally open, two position, two way, poppet style solenoid valve capable of stopping oil flow to the hydraulic system when actuated, must be installed at the discharge port of the pump. The valve assembly must also incorporate a high pressure relief valve to protect the system from over pressurizing during system shut down. This solenoid valve must be wired to a float type level sensor that is mounted through the top of the reservoir. The system must be designed so that when the float contacts close, the solenoid valve stops the flow of oil to the system. At the same time, a signal must be sent to an indicator light on the control panel that alerts the operator of system shutdown. The control panel must also incorporate a momentary override switch wired to de-energize the shutdown system to facilitate diagnostics and equipment storage.

The front PTO drive shaft must be a 1310 series shaft and include grease fittings on both U-joints and slip yoke.

### **Underbody Plow Hydraulics Installation**

Responder must provide pricing for hydraulic hook up of fixed angle under body plow and reversing angle folding moldboard underbody plow. Hydraulic hook up of MnDOT underbodies must include installing the accumulator, pressure reducing valve, hoses, fittings, additional hydraulic fluid, and labor as shown on **Drawing Titled U1**. The underbody scraper plow is connected to hydraulic valve body and must be complete with no further parts or labor required.

### **10.0 MnDOT FRONT SUSPENSION ASSIST REQUIREMENTS:**

If requested by purchaser, the Contract Vendor must furnish (if available) non-proprietary, electronic digital suspension assist illustration(s), in one of the following file formats; .sldasm, .asmdot, .sldprt, .step, .igs, .sat, Parasolid, ProE or AutoDesk Inventor. The purchaser must use the files as a resource in the body design process. The Contract Vendor must furnish the electronic files at no additional cost to the purchaser.

- 10.1 Air bag must be Canadian Loadshare Suspensions Inc., Model HS manual or MnDOT approved equal. It must include 1 each double convolute air spring.
- 10.2 Bottom mounting bracket must be cast iron.
- 10.3 Air bag must be located between axle and vehicle frame.
- 10.4 Air pressure must be controlled by pressure regulator which is manually adjusted from truck Cab, control location within easy access from driver position.
- 10.5 Unit must include a pressure gauge located in Cab within easy view of driver station.
- 10.6 Air must be supplied via Cab and Chassis air compressor.

### **11.0 MnDOT ANTI-ICING REQUIREMENTS**

- 11.1 **Hydraulic requirements:** All hydraulic hose ends must be JIC 37 degree female swivel – male pipe hose ends are not acceptable. Any deviation must be approved by MnDOT in writing prior to the build.
- 11.2 MnDOT has no specific anti-icing specifications.
- 11.3 Anti-icing systems must be offered on Non-MnDOT State of MN Pricing Pages, Section 11.0.
- 11.4 Anti-icing systems must not be vegetation spray systems with anti-icing spray bar option.
- 11.5 Anti-icing systems must not have more than one tank, and have the ability to spray different chemicals without emptying the tank and changing the chemical that is in the tank.
- 11.6 Anti-icing systems must be able to handle all deicing chemicals offered by vendors.
- 11.7 Anti-icing section is where portable water tank options should be listed and priced out.

### **12.0 MnDOT WIRING HARNESS AND SWITCH PANEL**

- 12.1 Items must be MNSTAR brand or MnDOT approved equal.

### **13.0 AIRPORT AIRFIELD MAINTENANCE EQUIPMENT:**

- 13.1 Airport Airfield Maintenance Equipment offered in this section must be specifically built and intended for airport airfield maintenance functions only. It must not be the type of equipment which can be offered on other existing equipment contracts listed on the [www.dot.state.mn.us/equipment](http://www.dot.state.mn.us/equipment) web site.
- 13.2 Airport Airfield Maintenance Equipment must be designed and built to accomplish its intended function within the size and scope of an airport environment and must not be a lesser piece of equipment adapted from other intended uses.
- 13.3 Airport Airfield Maintenance Equipment offered in this section must not be designed, built, intended or practical for highway use.
- 13.4 Any truck Chassis offered on this contract must meet the current EPA Tier standards or be approved by the EPA for off road use only. The Chassis must not be able to meet the specifications of contract T-647 Truck Single & Tandem Axle Cab & Chassis 26,000 and Larger.
- 13.5 Airport Airfield Maintenance Equipment must be offered on Non-MnDOT State of MN Pricing Pages, Section 13.0.

### **14.0 Tow Behind Type Plow**

- 14.1 Plow must be between 24.5' to 26' in length.
- 14.2 Moldboard must have round holes for mounting cutting edge with AASHTO carbide spacing.
- 14.3 Dual axles must be rated at 16,000 lbs. each, hydraulic steerable with connecting linkage.
- 14.4 Unit must be equipped with ABS brakes and poly fenders.
- 14.5 Unit must be equipped with either a 1,100 gallon ploy tank or material hopper for ballast.
- 14.6 Trailer must meet all current Federal and Minnesota safety codes.
- 14.7 Lights must remain perpendicular to the travel lane when plow is in operation.
- 14.8 Unit must include a parts and instruction manual in either digital or paper format

## **15.0 Hydraulic Driven Front Axle**

- 15.1 The front wheel drive system (the system) must include its own hydraulic pump, PTO, hydraulic tank, filters, axle hardware for driving the front wheels, and lines.
- 15.2 The system can be automatic or manual control. The operator must be able to turn the system on and off from the driver's seat.
- 15.3 The system must not interfere with the original turning radius of the truck Chassis and use the original tires
- 15.4 The Hydraulic drive system must not change the Chassis frame height.
- 15.5 The system must not change the original manufactures original braking system.
- 15.6 The system must not lower the original manufactures GVW rating.
- 15.7 If the system requires different rims for the tires, the new rims must be sized for the original tires and be painted. If the rims are different than original, there must be rims listed on the price page so customer can purchase rims for spare tires.
- 15.8 The system must be able to be used in combination with the rear drive line. It must also be able to drive the truck with the transmission in neutral if needed.
- 15.9 The system must work both in forward and reverse.
- 15.10 When the system is not in use, the front wheels must be able free wheel to conserve fuel.
- 15.11 The system cost must include one extra set of filters for the system and the truck must be delivered to the customer with the extra set of filters.
- 15.12 The cost of the equipment must include training to up to 10 of the customer's employees. The training must include, but is not limited to, equipment operating preventive maintenance and safety instructions. The Contract Vendor will provide the training before the purchase of equipment will be considered complete. No additional training fees must be charged to the customer.
- 15.13 There must be a Parts, Operator, and Repair manuals included at the time of delivery. The manuals can also be in a digital format.

## **16.0 Ice Breakers**

- 16.1 The ice breaking equipment must be available in sizes up to 8' 6" or greater.
- 16.2 The ice breaker is to have an option to have a blade behind the ice breaker for clearing the road. The blade should be listed as an option with an installed price.
- 16.3 The ice breaker is to have a hitch to install on MnDOT plow trucks in place of a front plow. The hitch is to be the same as a Falls 46B.
- 16.4 The ice breaker is to be able to remove ice on pavement with minimal or no damage to the road.
- 16.5 The ice breaker must be able to be lifted when on the truck, by the truck hydraulics into a transport position, where it is not in contact with the road.
- 16.6 The unit must be able to work in a "float" position for trucks with no down pressure.
- 16.7 Ice breakers must be able to have optional tilt cylinders.
- 16.8 Ice breakers must be designed so to be able to follow the contours of the road.
- 16.9 Roller elements must be replaceable.
- 16.10 Roller elements must have replaceable bearings.
- 16.11 Spiked roller elements must be able to be replaced as a single unit or as a complete unit.
- 16.12 Unit must have a stand so unit can be easily coupled to truck.
- 16.13 Ice breaker must come with a parts, repair and operators manual or manuals in digital or paper formats.
- 16.14 The must be an option to not have hydraulic tilt from side to side and be free floating with no rams.

## **17.0 Vaisala DPS113 Temperature Sensors**

- 17.1 Vaisala Surface Patrol Pavement Temperature Sensor Model #73000600 or MnDOT approved equal. Please list prices for lots for 0-50 and more than 50 on price page.
- 17.2 Probe Assembly with Conexal Connector Model #67050125 or MnDOT approved equal.
- 17.3 Surface Patrol Analog Display Unit (Surface Patrol Analog Display Unit) Model # 3000750 or MnDOT approved equal.
- 17.4 Surface Patrol Digital Display Unit (Dashboard display – RJ14 & Digital Daughter Board) Model #73000700 or MnDOT approved equal.
- 17.5 Analog PCB (Analog Daughter Board Interfaces with Display Unit) Model #70109405 or MnDOT approved equal.
- 17.6 Surface Patrol Display Unit (Dashboard Display – W/RJ14) Model #64010200 or MnDOT approved equal.
- 17.7 Spreader Control Interface (Interface Box Only – for Spreader controls Model #57050150 or MnDOT approved equal.
- 17.8 Spreader Cable DB9, Conexal -Standard Interface (Cable to Connect Probe to Spreader Control and 3rd Party Spreader) Cable to connect probe to spreader control and 3rd party spreader.
- 17.9 Spreader Cable DB9, Conexal -Standard Interface Cable to Connect Probe to Spreader Control and 3rd Party Spreader) Model # 60939360 or MnDOT approved equal.
- 17.10 Spreader Cable Conexal -Force America Cable to Connect Probe to Spreader Control and 3rd Party Spreader) Model # 60939380 or MnDOT approved equal.
- 7.11 Digital PCB (Digital daughter board interfaces with Display Unit) Model# 70109400 or MnDOT approved equal.
- 17.12 Surface Patrol IR Cable Part # 50939210 or MnDOT approved equal.
- 17.13 Ambient Temperature Sensor and Cable part #67051829 or MnDOT approved equal.
- 17.14 Ambient Cable Assembly - Spreader Model # 50939300 or MnDOT approved equal.
- 17.15 Surface Patrol Calibration Cable - Spreader Model # 50939370 or MnDOT approved equal.
- 17.16 Surface Patrol Display Bracket (Optional Bracket for Dashboard mount) Model #15042915 or MnDOT approved equal.
- 17.17 Ambient Sensor Module - Spreader Model # 50939350 or MnDOT approved equal. It must be compliant with all other parts specified herein.

## **18.0 Auto Lube System**

- 18.1 The pump must be able to pump grease to 1800 psi.
- 18.2 The pump must be able to provide .5in<sup>3</sup>. It is of grease per minute at 1800 psi.
- 18.3 The pump must come with an adjustable timer to program the lubrication system on and off time.
- 18.4 The pump system must have an electrical over load protection for the motor, which shuts down the motor and must be electrically or manually reset.
- 18.5 The pump must have a low temperature protection to stop the pump when the grease would be too cold to pump.
- 18.6 The pump must be connected to the ignition system on the truck so the pump will be inactive when the ignition switch is off.
- 18.7 The pump must be rated for IP69K intrusion protection or better.
- 18.8 The pump must be able resist UV, chemical and corrosive environment exposure.
- 18.9 The pump must have a low grease or out of grease shut down that will not re-set until refilled.
- 18.10 The pump system must have at least one main grease line that distributes to grease to modules that have adjustable metering devices controlling the grease dispense. The modules must be close to the locations being greased to keep the individual lines of grease as short as possible.
- 18.11 The system lubricant supply lines must be connected with compression-style, NPT, JIC, SAE-ORB or equivalent connections.
- 18.12 The modules must be able to adjust the amount of grease that goes to each greaseable item on the Chassis
- 18.13 All wires must be crimped or soldered and sealed to protect from water getting into the connection. Both positive and negative connections to the Chassis to be approved by customer before installation begins.
- 18.14 Additional insurance will be required if installation is done at a MnDOT facility.
- 18.15 A parts and Service manual must be provided in electronic or paper formats with each set of trucks that have a lube system installed. MnDOT must be able to reproduce or distribute multiple copies to multiple MnDOT locations around the state of Minnesota. If the customer cannot reproduce the manuals then a copy must be provided with each system, whether the customer installs the system or not.

**18.16 Installation**

- 18.17 The vendor must work out the installation schedule, the start date and end delivery date before the work starts. In the case of MnDOT Snow Plow trucks, the installation can be done in stages. The stages and timing should be worked out with the MnDOT Shop supervisor in writing prior to the build. The schedule could change due to shop schedule, staffing, weather, and part availability.
- 18.18 All grease lines and electrical wires must be tied or clamped down to prevent the movement or rubbing of the grease line to prevent a hole being worn in the grease line. In the case of a high likelihood of rubbing there should be protective covering installed on the grease line or wire insulation.
- 18.19 All modules and pump must be bolted to the Chassis frame or a customer approved location. For MnDOT Plow trucks the locations should be approved in writing before installation begins due to MnDOT may be having to install more equipment after the greasing system. Additionally, make sure modules, pumps and grease lines are not in the way or interfering with other MnDOT equipment that will be installed later.