DICKEY-john Control Point Ice Control System Specifications

Scope: The system shall have the capability to maintain a uniform application rate of granular deicing materials and liquid materials simultaneously (based on granular output). The system will have the capability of being used as a liquid only control and monitor boom shut off inputs. In addition the system shall have the flexibility of closed loop control of the spinner in order to maintain a desired spinner rpm or spread width.

A. CONSOLE

1. The control console shall have a easy to read dot matrix display which is capable of displaying a minimum of two control channel application rates, ground speed, spread width, and time/date simultaneously.

2. Control console shall contain a microprocessor and have a minimum of three control channels. One control channel will be used for application of granular material on a pounds (kilograms) per mile (km) or area based (pounds per square foot/grams per square meter). Second control channel will be used for control of liquid material on a gallon (liters) per ton based on the granular application rate or gallons (liters) per mile (km) and gallons (liters) per square yard (meter). The third channel will be used for controlling the spinner speed and be capable of utilizing a feedback sensor to close the loop in order to maintain a desired spinner rpm and spread width.

3. Console will have no more than one switch on front panel which is used to cycle display screen from operate, view accumulators, select materials and turn the unit on and off.

4. Control console shall have sufficient memory capable of recording the following information and display as current run totals and season totals:
    1. Miles (km), tons (metric/English) and gallons (liters) spread while in automatic control mode.
    2. Miles (km), tons (metric/English) and gallons (liters) spread while in BLAST mode.
    3. Total miles (km) tons (metric/English) and gallons (liter) spread in automatic control mode.
    4. Total vehicle miles (km) driven.
    5. Liquid gallons (liters) sprayed during prewetting and anti icing application.
    6. Real time spent spreading granular, spraying liquid and blasting.

5. Control console shall also record system information which includes the following:
    1. Time and date event recording of when truck was started and turned off, type of materials spread and applications rates that were selected by operator.
    2. Time and date event recording of when control system was operating in a error condition (application error, manual override, loss of feedback sensor).
    3. Time and date event recording of vehicle maximum speed alarm set point being exceeded.
    4. Time and date event recording of when control was in automatic mode of control versus off as well as when blast function was activated.

6. When the closed loop spinner is in operation and the spread width knob setting is increased or decreased, the control console will automatically adjust the amount of granular material being applied. This will provide for spreading granular material in pounds per lane mile or pounds (kilograms) per square yard (meter)

7. Control console shall have visual display of when unit is operating in application rate error, unload or blast condition, manual speed and automatic manual override condition.

8. Console will have a built in ground speed simulator.

9. Console will have capability of being switched from English units to metric units as well as multiple languages.

B. OPERATOR REMOTE SWITCH MODULE

1. A remote switch module shall be used for operator convenience which contains switches to power liquid and granular channels on or off individually, allow liquid and granular application rates to be increased or decreased separately, a momentary push button switch used for blast, master spreader switch for off, automatic and unload of granular, liquid and spinner channels and contain twenty position rotary knob for adjustment of spinner speed.

2. Remote switch module shall be backlit for visibility and use during night operation.

C. COMPONENTS (less console)

1. Granular
   a. Drop on motor actuator to adapt to fluid controls 2FFL12 or equivalent valve.
   b. Pulse width modulated dual control valves to control hydraulic flow to spinner and conveyor motors.
   c. Modulated valve drivers for adaptation to various pulse width modulated valves.
   d. Photoelectric conveyor feed rate sensor with 360 counts per revolution or compatible with sensored motors.
   e. Vehicle speed sensor will be provided by a photoelectric sensor adapting to the vehicle speedometer cable or adapt to vehicle electronic speed sensing device.

2. Liquid
   a. Flowmeter for accurate measurement of liquid sprayed
   b. Modulated valve driver (20amps) to drive electric pump for desired volume of liquid application rate.
   c. In line ball valve control capability available in 1/2", 3/4", 1" and 2" sizes. Modulated valve driver for control of pulse width modulated hydraulic valve control of hydraulic driven liquid pump.
   d. Pressure transducer for pressure based liquid control system.

D. CONSOLE PROGRAMMING FEATURES

The console will be programmed with a detachable keyboard and will have menu driven screens to aid in programming process. The keyboard is removed after programming is complete which eliminates need of lock out codes or keys.

1. Calibration Mode
    a. Automatic calibration procedures for granular and liquid channels to determine the granular spreader constant of conveyor/auger and liquid sprayer constant of flowmeter.
    b. Ground speed calibration procedure in units of 1 mile or 1 kilometer.
    c. Programmable operation frequency of pulse width modulated valves from 20 to 250 hertz.
    d. Automatic calibration procedure which will predict the PWM offset and saturation points of valve as well as system gain and enter into the consoles memory.
    e. Programmable blast timed button or on/off when blast button is press the released. Spinner calibration procedure to allow for open loop or closed loop operation of spinner to coordinate spread width knob position with a specific spread width for lane mile application of material.
    f. Calibration procedures only accessible with plug in programmable keyboard.

1. Programming Mode for entering application rates and resetting accumulators.
    a. Program independent application rates for up to four separate granular materials and four separate liquid materials. Application rates may be preset for ten fixed rates or to expand application rate choices, a preset minimum rate, preset maximum rate and rate change increments between. A blast application rate is provided for each material for control of the blast function.
    b. Reset of granular current and season accumulators.
    c. Reset of liquid current and season accumulators.
    d. Ability to lockout granular and liquid materials availability in the operate mode.
    e. Program the console for use as a granular and liquid material control, a liquid only control or a granular material only control. When liquid only control is selected the operate screen automatically configures itself and display a five segment boom shut off graph.
    f. All programmable features are only accessible with plug in keyboard.

E. SYSTEM OVERRIDE

1. System will have an automatic override feature which, in the event of loss of feed rate sensor or flowmeter signal, transfers system to open loop control with a "manual" indication flashing next to the appropriate control channel.

2. System will have a built in ground speed simulator which can be turned on only with the plug in keyboard for override of a failed ground speed sensor or operating the system while

stationary without having to raise rear tires off the ground. The system will have the capability of being programmed to allow access to manual speed for the driver.

F. GENERAL OPERATION REQUIREMENTS

1. System will have the ability to Unload/Flush both granular and liquid materials separately or simultaneously. Unload/Flush will provide for full spreader and sprayer output.
    a. The console should not accumulate granular or liquid quantities while in unload or flush.
    b. The system will not initiate unload or flush unless vehicle ground speed in zero. After unload or flush is activated, the console will allow forward movement of vehicle but for not longer than a 10 second time period. After 10 seconds console will override unload/flush command and return to automatic control.

1. The spinner will stop when the spreading of granular material is stopped. Spinner can be pre set to run or be stopped when console is in the unload mode and when ground speed is zero.

2. The console will allow a programming option (blast spinner speed). This will allow for operating the spinner at a preset speed when the blast button is pressed regardless of the current position of spread width knob on remote switch module.

4. The system will allow the spread of granular material without spraying liquid material.

5. The system will allow the application of liquid material without spreading granular material.
    a. The control console can be programmed to automatically switch between prewetting and anti icing application (gallons per ton to gallons per mile) via a switch input voltage change.
6. Each of the four liquid materials programmed into the console memory will be able to be set as either gallons(liters) per mile (km) or gallons (liters) per ton units. This will allow for the liquid channel of the console to be used in a anti icing application and for prewetting of granular material without the need for reprogramming.

7. The console will have a visual and audio indication of inaccurate application for both granular and liquid channels.

8. System shall have a programmable start up ground speed which the control will utilize until true ground speed of vehicle exceeds the start up speed value.

9. Control will be able to be used for application of liquid or granular on meters square, yards square, ft square and lane miles units of measure.

G. OPTIONS
1. RS232 port
    a. Control will have the capability to be connected with hardware which will allow the transmission of current operation information and accumulated data real time.

2. Alternate Sensor Capability
    a. Hopper level sensor
    b. Spinner rpm sensor
3. DaRT Module
    a. The DaRT Module is a data retrieval tool which downloads accumulated data from the Control Point. Data retrieval is accomplished by connecting the DaRT to the Control Point via the RS232 connection and pressing the start button on the DaRT.