Edward J. Heck & Sons Company

Dustop II

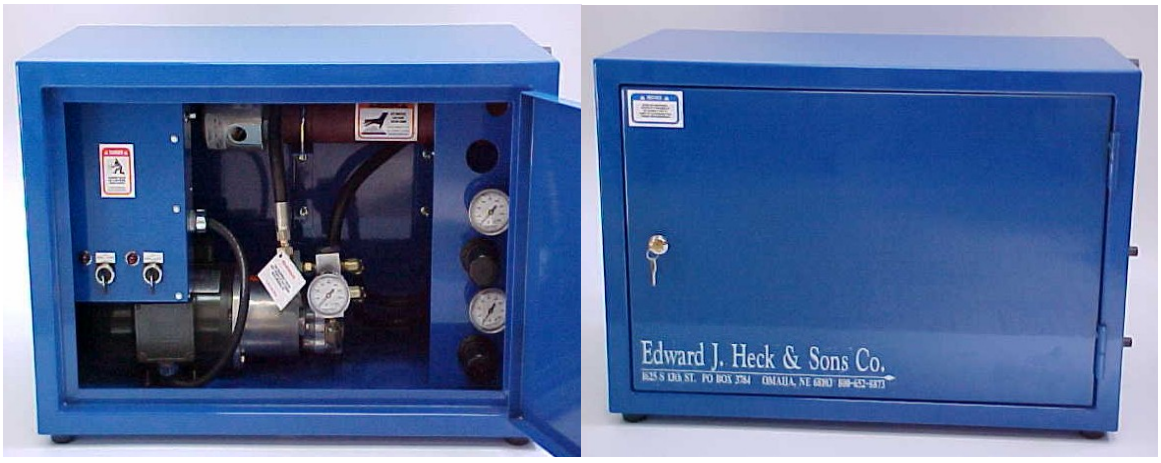
Dust Suppression System Manual

Safety

Installation

Operation

Maintenance



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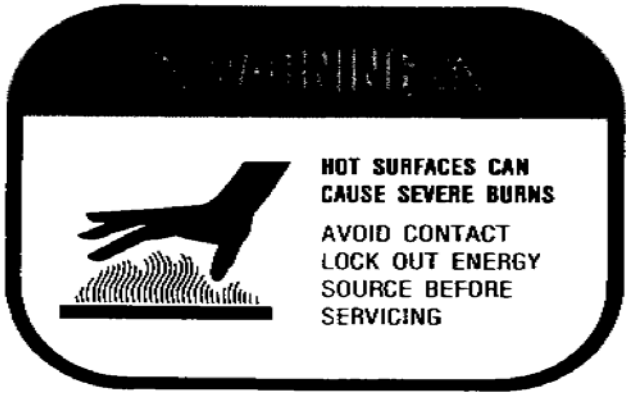
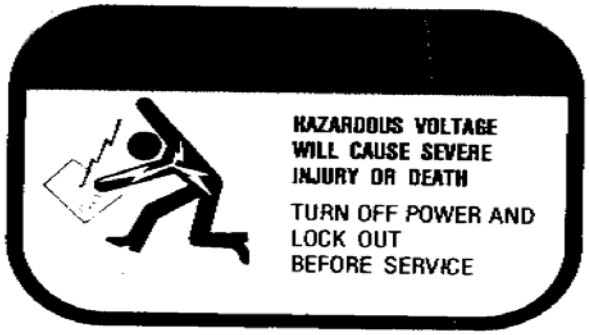


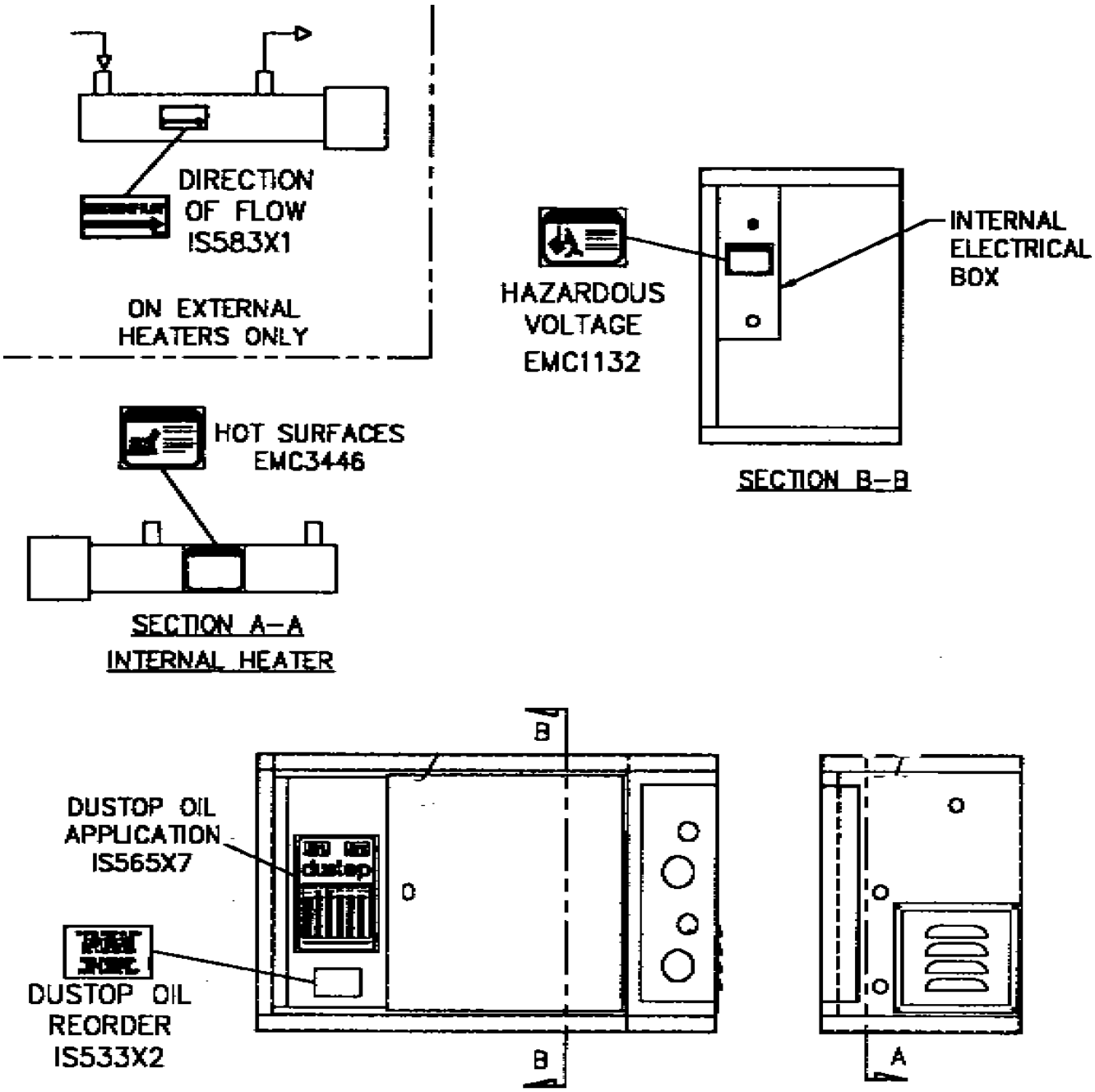


I. General Safety Information

SAFETY FIRST! The symbols shown above identify examples of the safety labels and signs to be found on E.J. Heck & Sons equipment. They are affixed to the equipment to warn of danger to persons and of possible equipment damage. These signs must never be removed, tampered with, painted over or obscured in any way. If labels are damaged or become unreadable, replacement labels are available from E.J. Heck & Sons. User must institute a continuing program to instruct all personnel in safe operating and maintenance procedures and to insure that all safety devices, guards, and covers are intact and operable and that all safety signs are legible.

FAILURE TO OBSERVE ALL SAFETY PRECAUTIONS, INCLUDING THOSE DICTATED BY ORDINARY COMMON SENSE, CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL, LOSS OF OIL, AND DAMAGE OR DESTRUCTION OF THE EQUIPMENT!

1.1 Safety Label Identification and Location



NOTE: THESE SIGNS MUST NEVER BE REMOVED, TAMPERED WITH, PAINTED OVER, OR OBSCURED IN ANY WAY. IF LABELS ARE DAMAGED OR BECOME UNREADABLE,

I. General Information

2.1 System Description

A Dustop II Oil Spraying System functions to reduce dust generation from grain handling. Among the benefits are:

- Reduction of airborne dust
- Reduction in grain shrinkage
- Reduction of health risks to workers because there is less dust in the working environment
- Reduction in power requirements for aeration equipment as there is less dust to be collected and removed

A Dustop II System draws oil from a supply tank furnished either by the user or by E.J. Heck & Sons as an option with the system. The internal system pump supplies the oil to the internal tank through suitable pressure controls to spray assemblies. A standard system will apply oil to a combined maximum of 60,000 Bushels Per Hour (BPH), based upon commodity weight of 56 Pounds Per Bushel or 48 Pounds Per Cubic Foot and a maximum of .02% oil application, by weight. Refer to Appendix A. This calculates to a maximum of 2.072 GPM or approximately 125 gallons per hour (GPH) at a maximum pressure of 100 PSI

2.2 Standard and Optional Features

2.2.1 Standard System Components

The following list itemizes the components included in a standard Dustop II System. The base system is arranged to supply ONE spray point from a common supply pipe.

Standard Dustop II Dust Suppression Unit

- Painted, lockable heavy-gauge steel enclosure
- ½ HP 115/208-230 V, 1 PH, 60 HZTEFC Motor
- 2.8 GPM Gear Pump (See Subsection 5.2 for specs)
- System Pressure Relief Valve
- System Pressure Gauge
- Single-Double-Triple Point Spray Arrangement Including:
  - (1) Nozzle Pressure Regulator
  - (1) Nozzle Pressure Gauge
  - [Nozzle Type and Size to be specified when system is ordered]
- Suction (Inlet) Strainer (40 mesh)
- Two or three illuminated MANUAL/OFF/AUTO 3-Position Selector Switches and SP/DT Relays for control of up to 3 single spray points
- Electrical Connection Box
- Internal Tank with provision for Optional Immersion Heater
- Provision for REMOTE START control of one to three spray point arrangements

Figure 2-1 shows the general layout of a typical Dustop II System including many of the available optional features. NOTE: Detail A in Figure 2-1 shows the arrangement required if a check valve is used on the supply line to the Dustop II System.

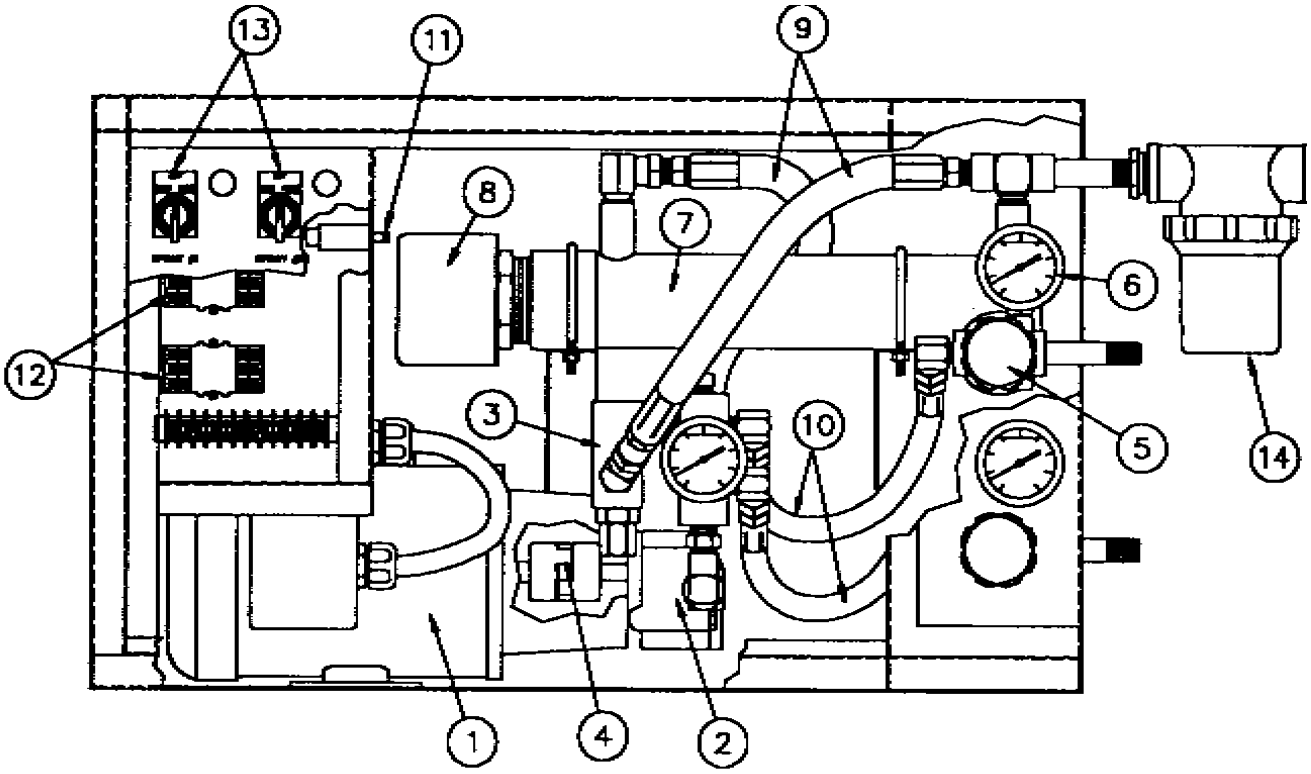
Figure 2-2 illustrates the major components of the Dustop II enclosure in more detail.

2.2.2 Optional Accessories

Any of these optional features can be supplied if ordered.

- Thermostatically-Controlled 2000 WattImmersion Heater installed in the Dustop II's internal tank-1ph 115V/220V or 3ph/440V NEMA 1.
- Mechanical Flow Meter (To show the gallons per minute flow rate)
- Electronic Flow Meter w/Remote Analog Readout in separate enclosure (Not Shown)
- In-line Immersion Heaters for supply and/or spray arrangement pressure lines -NEMA 7 1PH, 115/230V or 3PH, 440V. (Necessary when applying some oils in cold weather)
- Remote Electric Solenoid Shut-off Valves at spray points
- Remote Start Switch or Sensor Assemblies
- Accumulating Meters to measure and record oil flow delivered to the Dustop II.
- Booster Pumps for installations where the suction head at the Dustop II Enclosure prevents the internal pump from developing sufficient vacuum to draw oil from supply source.
- Spray Lance assemblies with nozzles.

Figure 2-2, major Components of Dustop Enclosure



1. ½ HP 1 PH 115/230VAC 60 HZ 1725 RPM 56C TEFC motor (50HZ optional)
2. Hydraulic pump
3. Relief Valve
4. Coupling
5. Outlet Pressure Regulator
6. Gauge 0-160 psi
7. Internal heater housing
8. 2000 watt heater NEMA 1 w/ thermostat
9. ½" NPT hose assemblies
10. 3/8" hose assemblies
11. 15 AMP circuit breaker
12. SPDT 110V relay
13. Man/Off/Auto Switch
14. 40 mesh screen filter

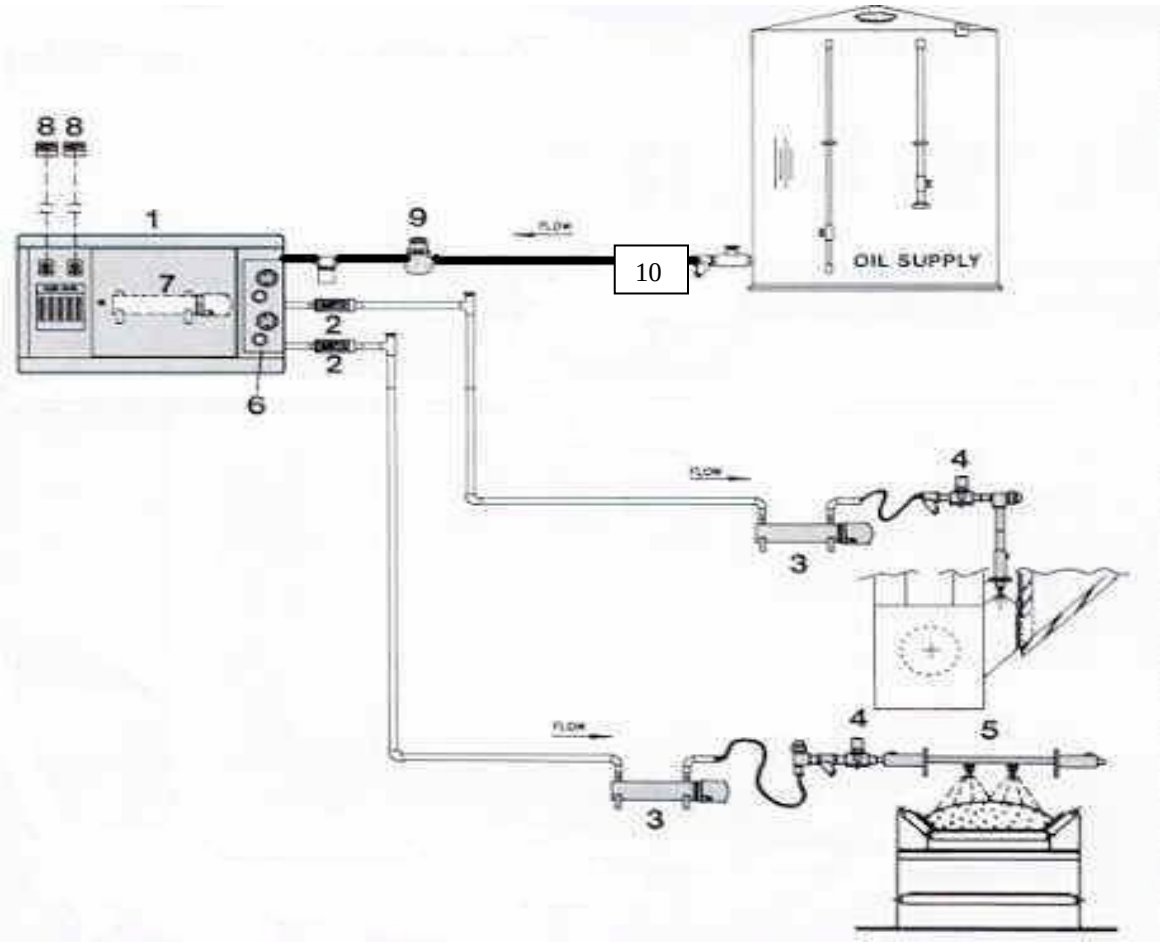


Figure 2-1 Typical Dustop System Configuration

1. **Base Unit**
2. **Mechanical Flow Meters (gallon per minute application rate**
3. **Inline Heater NEMA 7 (Required for vegetable oils -Consult Factory)**
4. **Solenoid – Class II G**
5. **Spray Lance assemble (single nozzle for spouts standard – multiple nozzles units optional)**
6. **Pressure regulator**
7. **Internal heater 115/220 1phase NEMA 1**
8. **Off/On/Auto Switches**
9. **Optional totalizing meter**
10. **Booster pump if required**

III. Installation

3.1 Receiving Inspection

Carefully inspect the shipment comprising the Dustop II System and accessories for damage as soon as it is received. Also verify that the quantity of parts or packages actually received corresponds to the quantity shown on the packing slip. A Standard Dustop II System without any of the optional items described in Paragraph 2.2.2, will arrive in one carton. The spray assembly, screen filter, and the miscellaneous fittings are separate but are packaged within the unit. Report any damage or shortage to the delivering carrier as soon as possible. E.J. Heck & Sons' responsibility for safe shipment of the equipment ended with acceptance by the delivering carrier. Refer to the bill of lading. Save all documentation furnished with the Dustop II and its components.

3.2 Pre-installation Preparation –Layout & Planning

Before beginning the installation, study this manual, any other drawings and schematic/wiring diagrams which may be provided with the equipment, the publications in Appendices, and any other applicable documents including but not limited to OSHA, FDA and FGIS Regulations and the National Electrical Code.

Plan the installation for minimum possible separation between the oil supply tank, the Dustop unit, and the spray lance assembly(s). If the oil supply tank is separated from the Dustop unit by an appreciable distance, a booster pump at the tank may be required to permit the system to deliver adequate flow and pressure at the spray points. .

If there are any questions regarding correct installation procedures or requirements, consult with E.J. Heck & Sons BEFORE starting installation.

3.2 Installation

NOTICE

- The pump motor is pre-wired to the terminal strip.
- System pressure relief valve is pre-set to 100 PSI at the factory.
- If the optional internal tank heater was ordered it will be installed but not wired.

See Figure 2-1, Typical Dustop Configuration Refer to Paragraph 3.3.5 for Field Wiring.

3.3.1 Oil Supply Vessel Location And Installation

Most Dustop installations draw oil from tanks. For all except the smallest installations, barrels are impractical and inefficient because of the constant shuttling of full and empty barrels. Oil is usually less expensive if bought in bulk.

Consult your local regulatory agencies for tank requirements and specifications.

NOTICE

SUPPLY TANK MUST BE VENTED AND VENT KEPT CLEAR. PUMP SUCTION (VACUUM) CAN CAUSE AN UNVENTED TANK OR ONE WITH AN OBSTRUCTED VENT TO BUCKLE INWARD OR COLLAPSE COMPLETELY, CAUSING INTERNAL DAMAGE TO SYSTEM COMPONENTS.

3.3.1.1 Tank Location

A tank should be located as near the Dustop unit as possible. The Dustop output will be limited if the pump is required to draw oil over a long distance (against a high head). The Dustop pump is capable of working against a head or developing suction of 10 inches of Mercury. This Corresponds to a horizontal pipe run of 100' OR a straight lift of 15'. If these restrictions are not possible, an additional booster pump may have to be provided, adding complexity and expense to the system. Consult the factory for recommended distances.

If heaters are used anywhere between the tank and the Dustop pump, there must be a free path for the oil to return to the supply tank. Thermal expansion in the oil be heaters can create tremendous pressures on the supply line. Consult the factory for recommendations.

Figure 3-6, Spray Lance Assembly in Spout Between Receiving Pit (Bucket Elevator Boot Section)

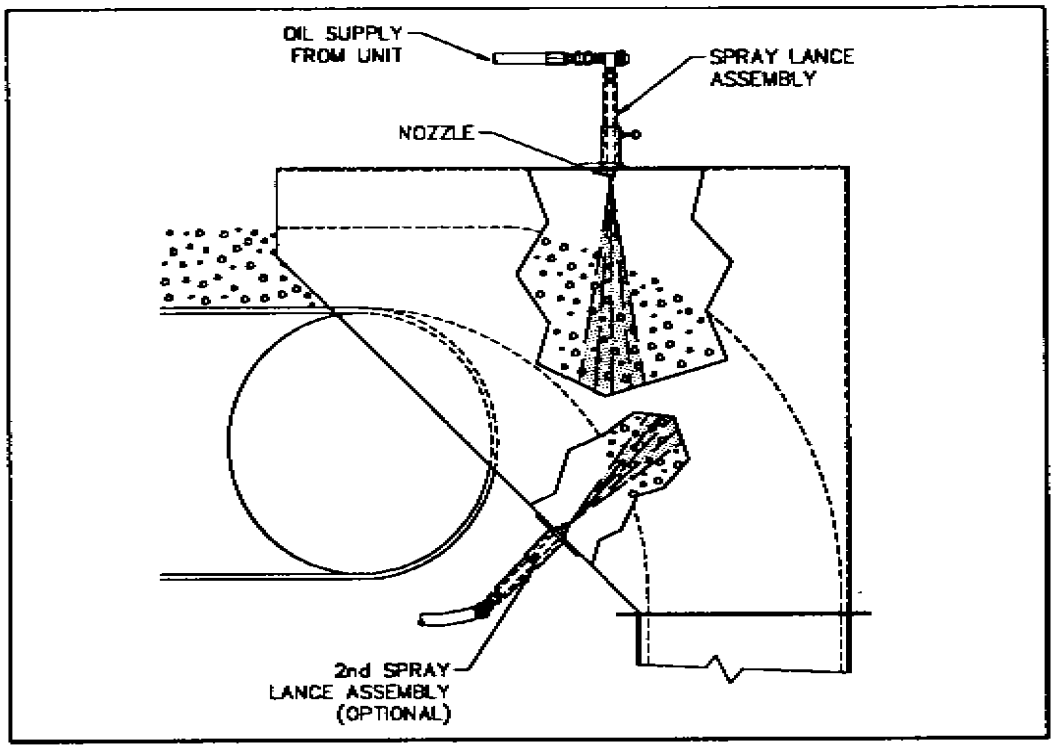
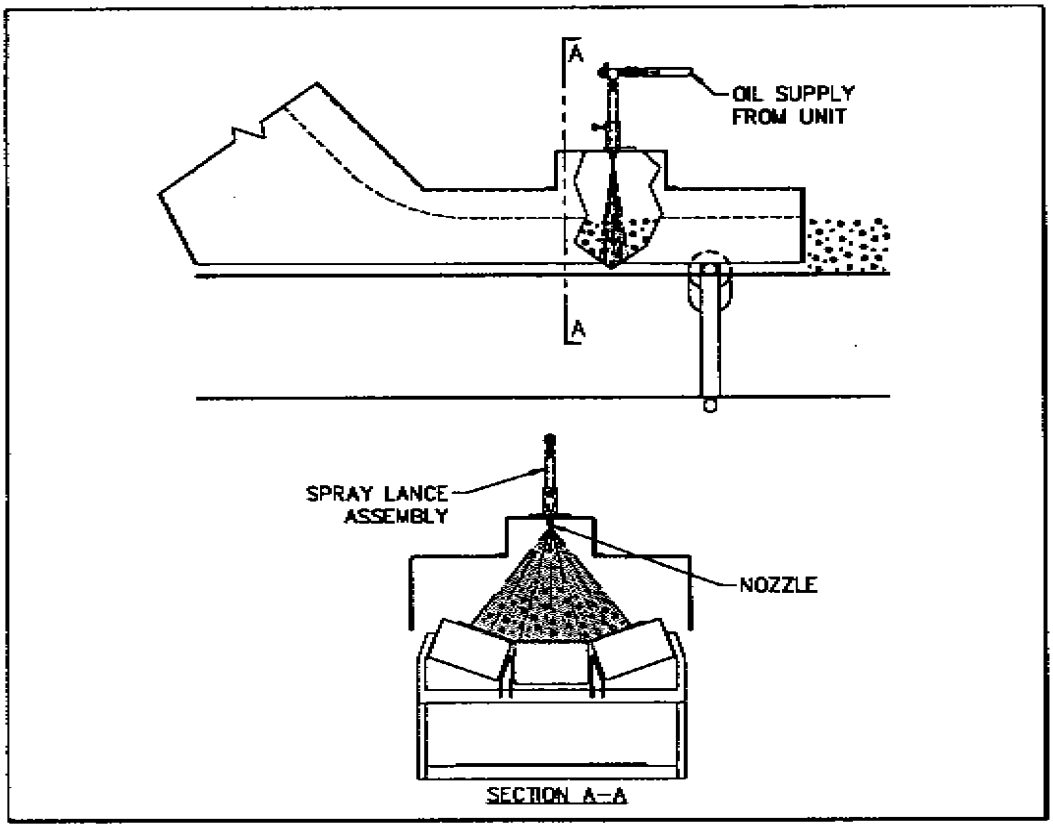
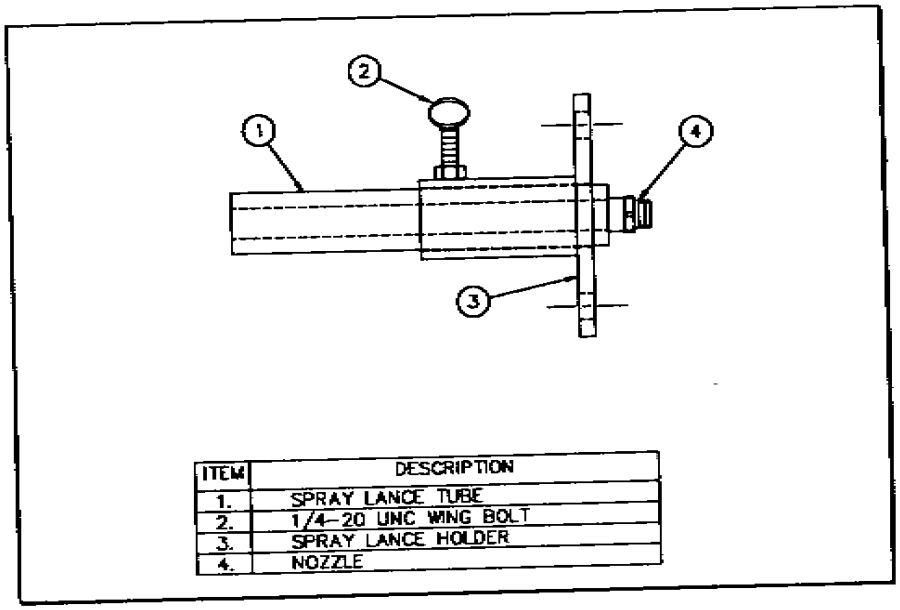


Figure 3-9, Spray Lance Assembly in Conveyor Discharge Hood



3.3.2.1 Spray Lance

Figure 3-11 shows the Spray Lance.



ITEM	DESCRIPTION
1.	SPRAY LANCE TUBE
2.	1/4–20 UNC WING BOLT
3.	SPRAY LANCE HOLDER
4.	NOZZLE

Figure 3-11, Spray Lance

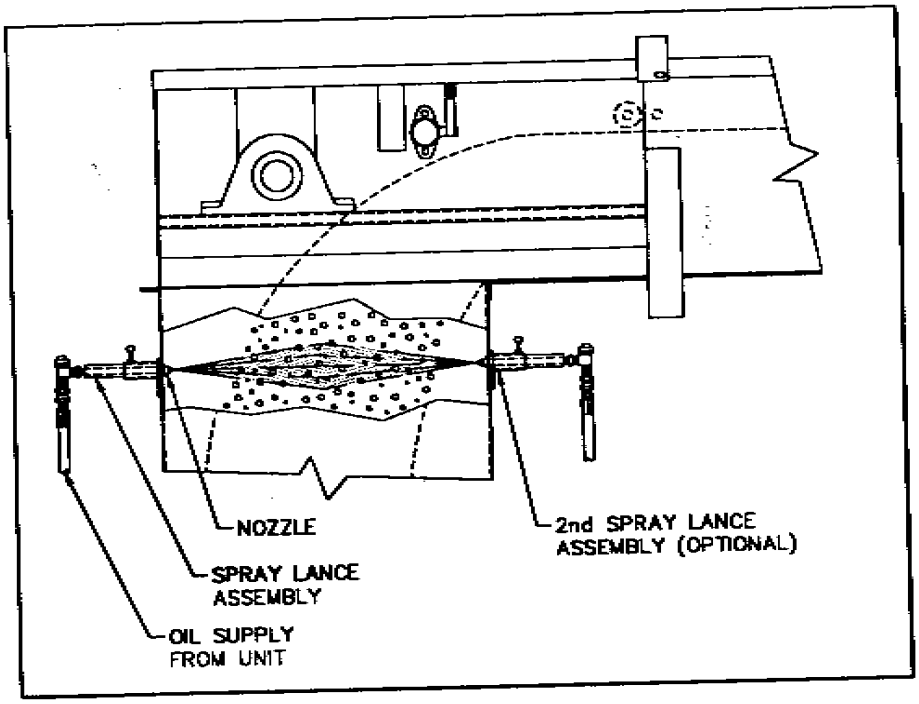


Figure 3-12, Multiple Spray Lance Assemblies in Discharge of Enmasse or Screw Conveyor

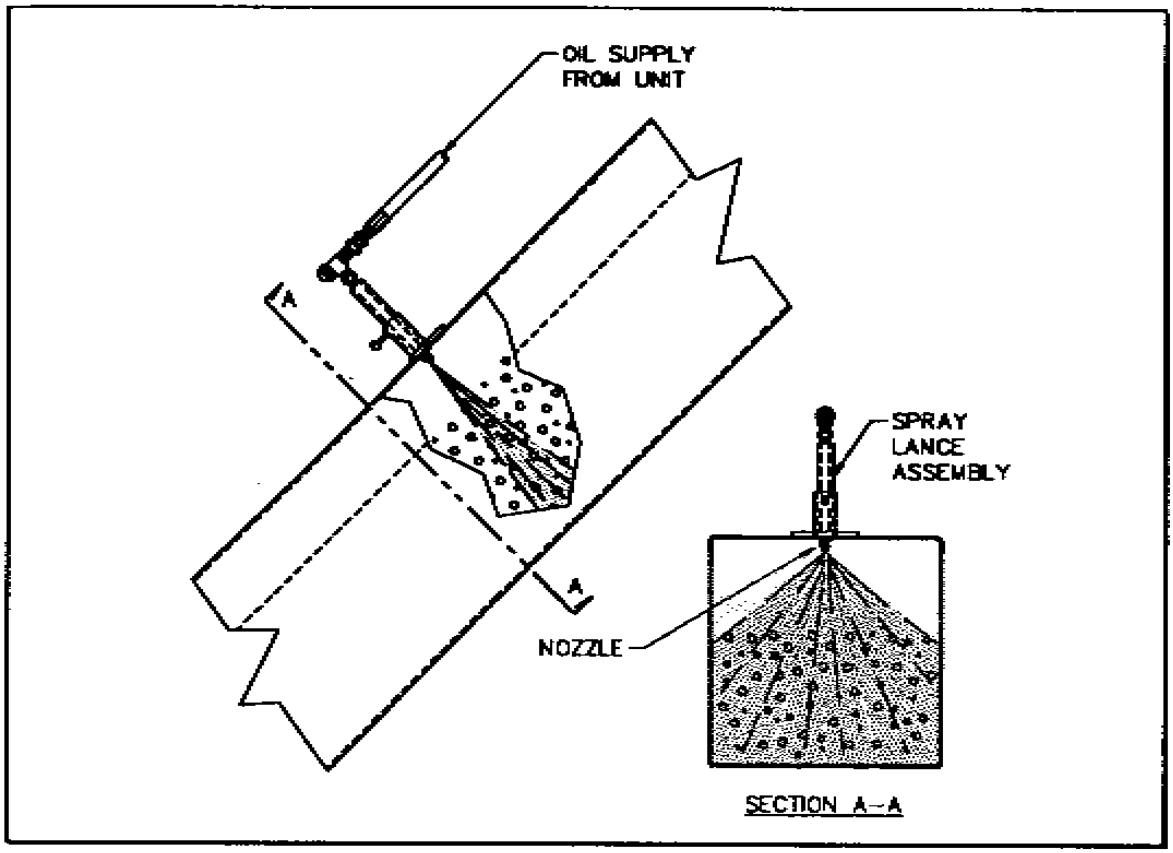


Figure 3-13, Spray Lance Assemblies in Spout

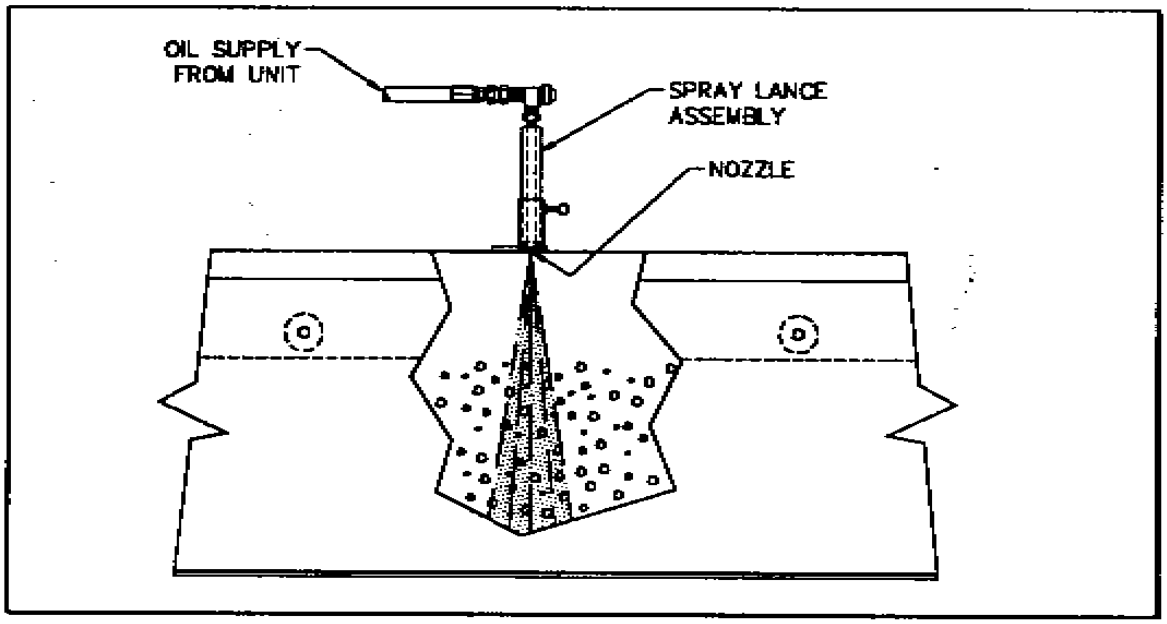


Figure 3-14, Spray Lance Asssembly in En-masse or Screw Conveyor

3.3.2.2 Spray Lance

Figure 3-15 shows the typical method of connecting a spray lance assembly and the oil pressure line from the Dustop Unit. The components described are provided with the system as either standard or optional items.

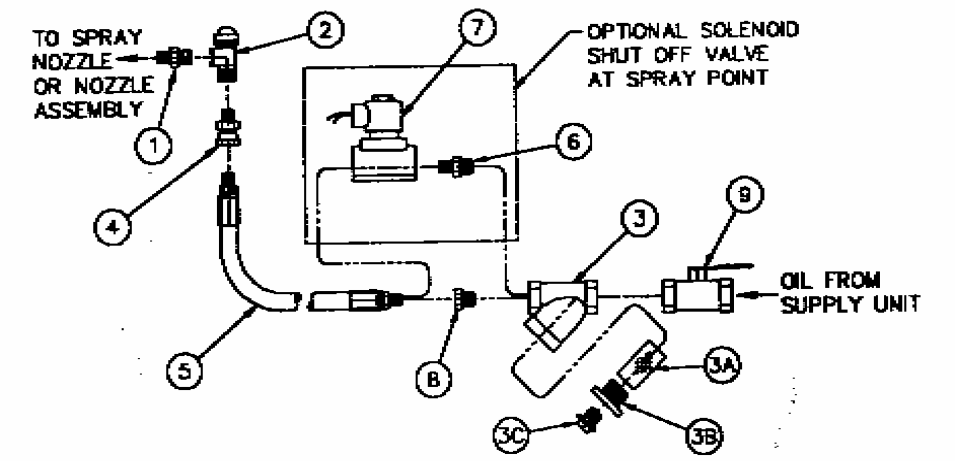
A. Check valve. Approximately 3 lbs. pressure is required to unseat the valve bonnet in the allowed flow direction. When the oil supply to the spray is shut off, the check valve prevents nozzle drip due to residual pressure in the supply line. It has a secondary purpose of preventing backflow.

B. Optional Solenoid-Operated Shutoff Valve. Allows remote control of spray assemblies, especially when there are multiple sprays. This valve also counteracts the "run on" effect when air is trapped in the supply lines.

C. Strainer Assembly, Screens oil supply to the nozzle, removing debris and minimizing the need to frequently unclog the spray nozzle and valves.

D. Hose Assembly. Provides a flexible connection between the oil pressure line from Dustop and the spray assembly. Simplifies spray assembly removal for service and isolates rigid piping from vibration.

E. E.J. Heck & Sons recommends installing a manual shutoff valve just ahead of the strainer. This allows the hose, strainer, and other downstream components to be repaired without shutting down the entire system or losing the oil in lengthy supply lines.



ITEM	DESCRIPTION
1.	HEX BUSHING 1/2 NPT x 1/2 NPT HEX BUSHING 3/8 NPT x 1/2 NPT
2.	FLOW CHECK VALVE
3.	100 MESH STRAINER ASSEMBLY
3A.	100 MESH SCREEN
3B.	SCREEN HOLDER
3C.	CLEAN OUT PLUG 3/8 NPT
4.	HOSE SWIVEL 1/2 NPT x 3/8 NPT
5.	3/8 NPT x 37" HOSE ASSEMBLY
6.	HEX BUSHING 3/8 NPT x 1/2 NPT
7.	110V SOLENOID VALVE (X-PROOF) 110V SOLENOID VALVE (GENERAL PURPOSE)
8.	BUSHING 1/2 TO 3/8
9.	SHUT OFF VALVE (BY OTHERS)

Figure 3-15, Typical Spray Lance Installation

NOTICE

DO NOT ATTEMPT TO INCREASE SYSTEM SPRAYING CAPACITY BEYOND THE MAXIMUM AS STATED IN THE SUBSECTION 2.1, 125 GALLONS PER HOUR AT100 PSI. PRESSURE SET TOO LOW CAN RESULT IN INCOMPLETE ATOMIZATION AND SPOTTY, INCONSISTENT COVERAGE. EXCESSIVE PUMP PRESSURE WILL CAUSE OIL LEAKS AND FOGGING! DO NOT ORIENT A SPRAY NOZZLE DIRECTLY AGAINST THE DIRECTION OF PRODUCT FLOW;

3.3.3 Dustop II Unit Base Unit

The dustop system should NOT be located in a hazardous area.

Locate the unit in its intended location. The enclosure is not normally fastened to its support. The rubber pads on the bottom of the enclosure help reduce transmission of vibration to surrounding structures.

Position the Dustop unit so that the front and sides of the enclosure are accessible for service and repair. The removable louver panel on the left side of the enclosure allows the optional tank heater to be removed for service or retrofitted at a later date without the necessity of removing the internal tank.

3.3.4 System Piping

NOTICE

IF BLACK SCHEDULE 40 STEEL PIPE IS USED TO PIPE THE SYSTEM, ORDER PICKLED, DESCALED, OILED, AND CAPPED PIPE. THE SLIGHT ADDITIONAL COST WILL PAY FOR ITSELF IN REDUCED MALFUCTIONS AND DOWNTIME. THE DIRT, SCALE, AND DEBRIS USUALLY FOUND IN ORDINARY PIPE QUICKLY CLOG PUMPS, REGULATORS, VALVES, NOZZLES, ETC.

IF A PIPE JOINT IS DISCONNECTED, MAKE SURE TO REMOVE ALL TRACES OF THE OLD SEAL TAPE SO THAT NO FRAGMENTS FIND THEIR WAY INTO THE SYSTEM.

IF PIPING IS TO BE INSULATED, DO NOT APPLY INSULATION UNITL AFTER STARTUP AND TESTING UNDER PRESSURE INSURES THT THERE ARE NO LEAKS TO BE REPAIRED.

The System should be piped in the sequence as given in the following paragraphs, starting at the supply tank or barrel connection point and working towards the spray points. See Figure 2-1.

A. Supply line from tank. Pipe size should be 1/2" black steel or hose. DO NOT use garden hose, plastic airline, or galvanized pipe. **Please call the factory for recommended pipe or hose sizes and types.**

B. Install a shutoff valve as close to the tank as possible, so the rest of the system can be isolated. This minimizes the possibility of a leak occurring, which would drain the entire oil supply from the tank. Maintenance and repair of downstream system components is also easier.

C. E.J. Heck & Sons supplies a strainer for the tank line. Debris in the oil supply will settle to the bottom of the tank and be drawn into the supply line to the Dustop. A strainer at the location, cleaned regularly, will protect the downstream system. Both filter ports are 1" NPT, use the enclosed ½"to 1" bushing and attach to the ½" inlet on the upper right hand corner of the cabinet.

D. If a heater is to be installed in the supply line to the Dustop unit, position it immediately after the tank shutoff valve.

E. If a booster pump is required, locate it AFTER the heater if one is located in the supply line. A pump will last longer and operate more efficiently if it is not required to pump cold oil. See Figure 2-1 and Figure 3-16.

NOTICE

IF A BOOSTER IS INSTALLED IN THE SUPPLY LINE, THE OUTFLOW FROM THE PRESSURE RELIEF VALVE MUST BE PIPED BACK TO THE TOP OF THE OIL SUPPLY TANK, NOT TO THE BOTTOM. OIL IN A TANK EXERTS SIGNIFICANT PRESSURE AT THE BOTTOM OF THE TANK. HEAD PRESSURE WOULD INTERFERE WITH RELIEF VALVE OPERATION AND WOULD DISTURB SEDIMENT ON THE TANK BOTTOM.

ADJUST THE BOOSTER PUMPS RELIEF VALVE FOR 0 PRESSURE. REFER TO SUBSECTION 5.3. TURN THE ADJUSTING SCREW FULLY COUNTER-CLOCKWISE. IF THIS IS NOT DONE, THE DUSTOP'S INTERNAL PUMP WILL BE DAMAGED WHEN THE BOOSTER PUMP IS STARTED!

BOOSTER PUMP PRESSURE SHOULD BE READJUSTED DURING INITIAL STARTUP.

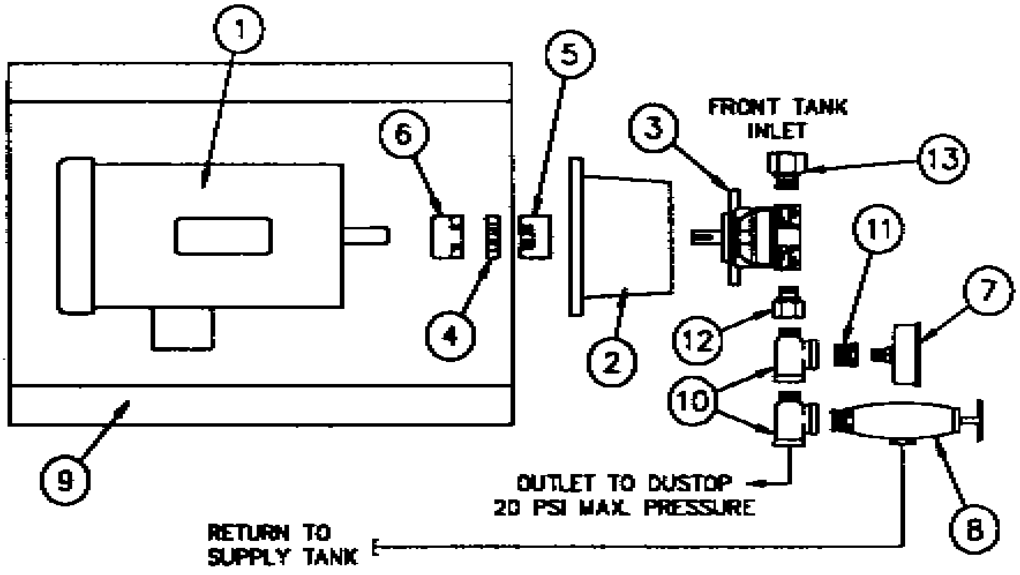
PRESSURE LINE PIPE SIZE: OIL LINES FROM THE DUSTOP UNIT TO SPRAY LANCE ASSEMBLY(S) SHOULD BE 3/8" BLACK STEEL OR HOSE. OVERLY LARGE PIPE ALLOWS AIR TO SEPARATE FROM THE OIL, AND SINCE THE OIL MOVES AT LOW VELOCITY THROUGH A LARGE PIPE, AIR BUBBLES ARE NOT CARRIED ALONG WITH THE OIL. AIR IN THE OIL LINES, CAUSES ERRATIC FLOW AND PRESSURE REGULATION, GIVING INACCURATE FLOW METER INDICATIONS AND SPOTTY SPRAY COVERAGE.

F. If an accumulating meter is to be installed to record oil flow to the Dustop unit, install it as close to the Dustop unit as possible and downstream of the tank screen filter. This way, the meter can be read easily and the filter protects it from debris in the supply line.

G. If the pressure line to a spray lance assembly is to include a flow meter, it can be installed anywhere between the Dustop and the spray assembly strainer. However, a mechanical flow meter is best located near the Dustop, so it can be monitored easily. An electric flow meter, with a remote indicator, affords considerably more freedom in installation as the indicator can be positioned near the Dustop regardless of the transmitter's location. **Check the direction of flow arrow on the flow meter**.

H. If the pressure line to a spray lance assembly is to include a heater, position it as near the lace assembly strainer as possible. The goal is to minimize the drop in oil temperature to the nozzle. Always make certain, oils flow toward the thermostat end of a heater

I. Finally, refer to Paragraph 3.3.2.2, Spray Lance Connection, for details of spray assembly installation.

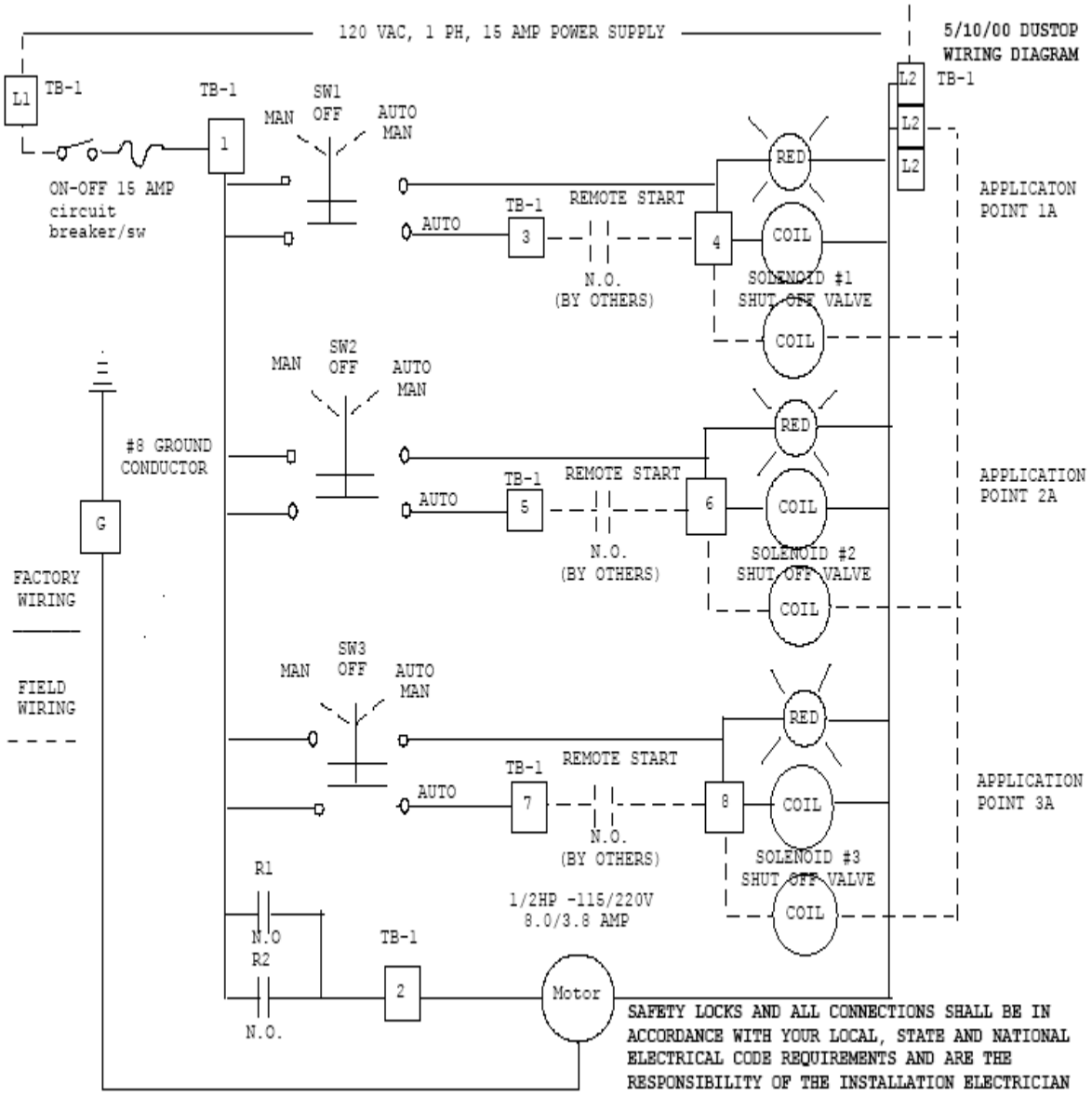


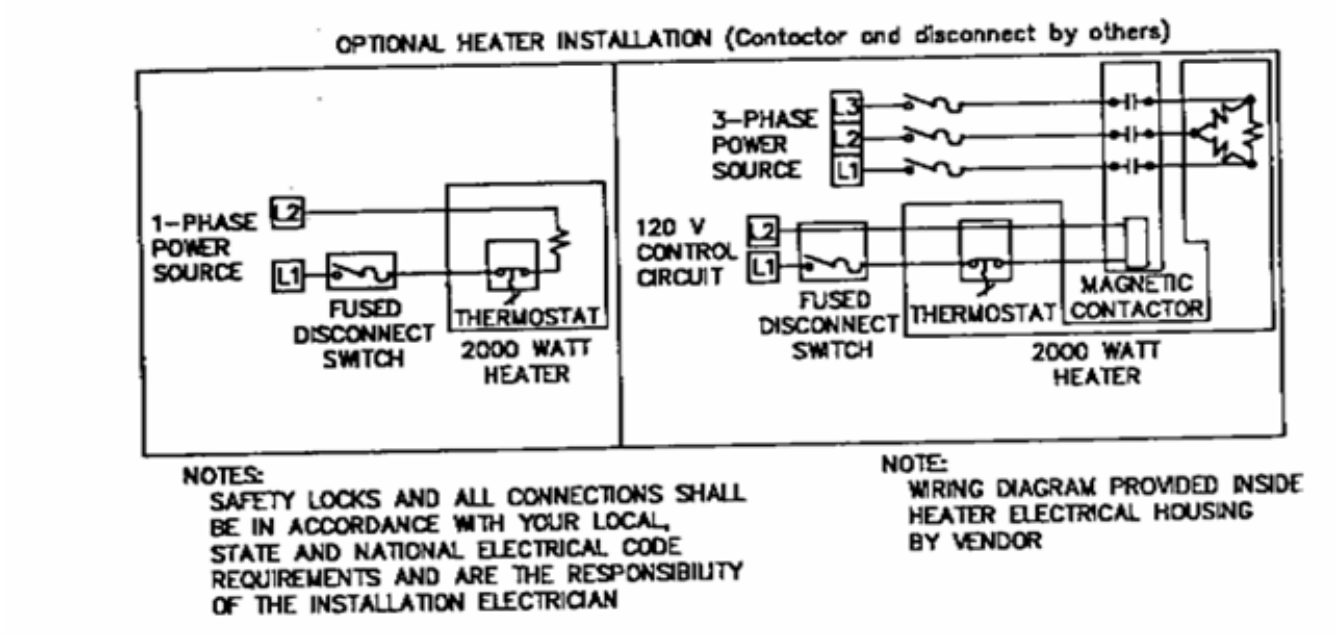
ITEM	DESCRIPTION
1.	1/2HP (1PH OR 3PH) TEFC CFACE MOTOR
2.	HYDRAULIC PUMP ADAPTER DS
3.	HYDRAULIC PUMP 2.8 GPM
4.	RUBBER SPIDER L-075
5.	1/2 COUPLING L-075
6.	5/8 COUPLING L-075
7.	160 PSI LIQUID FILLED GAGE
8.	HYDRAULIC RELIEF VALVE LOW PRESSURE
9.	UNIVERSAL MOTOR MOUNT
10.	1/2 MALE RUN TEE
11.	BLACK PIPE BUSHING 1/2 x 1/4
12.	JIC ADAPTER 1/2 FPT x 3/4-16 SAE
13.	JIC ADAPTER 1/2 FPT x 7/8-14 SAE

Figure 3-16, Optinal Booster Pump

3.3.5 Field Wiring

Figure 3-17 is the Dustop II Field Wiring Diagram. The circuits shown as solid lines indicate factory-installed wiring.





Internal Tank Heater is not wired at the factory -

3.3.5.1 Remote Automatic Start Circuitry (Ammeter or Flow/No Flow Meter)

The Dustop II includes, as standard, provision for automatic REMOTE START. Referring to the wiring diagram, Figure 3-17, a contact closure at terminals 3 and 4 or at 5 and 6, 7 and 8 of the enclosure's terminal strip starts the pump. If optional solenoid shutoff valves are connected as shown, spraying at the corresponding spray application point will begin without any operator action. Two common methods of automatic start initiation are described in the following paragraphs.

3.3.5.1.2 Current Sensitive Ammeter w/ relay card

A current sensitive relay can be wired in the drive motor circuit of the elevator or conveyor, which transports the commodity to be sprayed. When the relay senses a rise in motor current, indicating that the elevator or conveyor is beginning to carry a load, it provides a contact closure for REMOTE START.

A time delay circuit can be included to delay the initial surge of current during equipment startup. This arrangement avoids spraying oil in or on an empty elevator or conveyor. Other methods are available for remote and automatic spray control; consult E.J. Heck & Sons Co.

A Flow/No flow meter can be provided as an option for starting and stopping the system. A meter senses a flow of material in a spout and triggers a relay to start the system and shut it down when the flow stops. This is an alternative to Ammeters when there is a small difference in amp draw from idle to full load.

IV. Startup

NOTICE

IF THE SYSTEM INCLUDES A BOOSTER PUMP IN THE SUPPLY LINE TO THE DUSTOP, INITIALLY ADJUST THE PUMP'S RELIEF VALVE FOR 0 OUTPUT PRESSURE. REFER TO PARAGRAPH 5.3 FOR RELIEF VALVE ADJUSTMENT PROCEDURE. IF THIS IS NOT DONE, THE DUSTOP'S INTERNAL PUMP WILL BE DAMAGED AT STARTUP!

A. Turn the nozzle pressure regulator knob counter-clockwise until little or no resistance is on the knob. (This correlates to 0 spray point pressure). Now turn clockwise about 8 complete rotations, which will open the regulators and allow air to escape through the spray points during initial startup and priming of the lines.

B. Rremove the nozzles during startup and allow the oil to flow in to a bucket or other container. This prevents any excessive pressure buildup and helps to flush contaminants from the supply lines.

C. Open the supply tank manual shutoff valve.

D. If the system includes a booster pump in the supply line, start it first after making sure that the booster pump pressure relief valve was adjusted for 0 pressure. (SEE NOTICE) **After the pump has run for several minutes, open the gauge valve (located behind the gauge),** adjust the relief valve for an indicated output pressure of 20 PSI **and close the gauge valve**. Preceding NOTICE still applies; higher pressure will damage the Dustop's internal pump and other components.

E. **Keep the gauge shut off valves closed during this stage**. Set the MANUAL/OFF/AUTO selector switch for spray circuit #1 to MANUAL**.** The pump should start and pressure should build as the initial surge of oil mixed with air, flows through the pump and pressure fluctuates. After about 30 seconds, open the valve behind the gauges after the air passes through the system.

F. Turn the MANUAL/OFF/AUTO switch ON and OFF several times while observing the spray point gauges. Spray pressure should momentarily rise to approximately 30 PSI and then drop to 20 PSI. If the pressure rises much above 30 PSI, that is an indication that air is still trapped in the spray pressure line.

G. If the nozzles were removed, as described in Step B above, attach them now. While someone observes the spray nozzles, adjust the spray regulator so the nozzle or nozzles produce a uniform spray pattern of finely dispersed droplets. Pressure as indicated by the system pressure gauge is not to exceed 100 PSI.

NOTICE

OPERATING THE PUMP AT PRESSURES EXCEEDING 100 PSI OVERLOADS THE MOTOR, AND MAY CAUSE IT TO BURN OUT. **The system by pass valve is preset at the factory for 100 psi**

H. Measure the oil flow rate at the nozzle(s) or monitor the optional flow meter if one is installed. Verify that the required volume of oil is being sprayed. If a flow meter is not installed, a container of known capacity can be used. Simply CALCULATE the container's capacity against the time required to fill it. For instance, if it requires 15 seconds for a nozzle to fill a quart container (four quarts per gallon), then the nozzle is delivering one gallon per minute or 60 GPH.

CONTAINER	.05 Min	1.0 Min	1.5 Min	2.0 Min	2.5 Min	3.0 min
PINT	0.25 GPM	0.13 GPM	0.08 GPM	0.06 GPM	0.05 GPM	0.04 GPM
QUART	0.50 GPM	0.25 GPM	0.17 GPM	0.13 GPM	0.10 GPM	0.08 GPM
GALLON	2.00 GPM	1.00 GPM	0.67 GPM	0.50 GPM	0.40 GPM	0.33 GPM

I. Refer to Appendix A. Find the column listing the maximum allowable application (spray) rate for the commodity being treated.

NOTICE

APPENDIX A GIVES THE MAXIMUM ALLOWABLE RATES UNDER FEDERAL LAW. THESE ARE NOT THE RECOMMENDED RATES OR THE MOST EFFECTIVE RATES. REGULATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

1. If a nozzle delivers the required volume but the spray is atomized so the mist drifts away from the desired area, then a larger nozzle operated at a lower pressure is required.

2. If the pressure to a nozzle must be reduced to limit the delivery rate to or below the legal maximum and the pattern is then uneven and sputters and dribbles, a smaller nozzle operated at higher pressure is required.

3. If a nozzle emits a stream of oil rather than a spray, then the oil supply is probably too cold. Collect a sample of the oil from the nozzle. Measure the temperature; it should be at least 70° to 75° F. If the oil is too cold then the supply tank, the supply line to the Dustop unit, and/or the pressure line to the spray point may have to be heated. Refer to Paragraphs 3.3.1.2 and 3.3.5.2.

J. If a REMOTE START switch is connected, verify that it operates.

1. Set the MANUAL/OFF/AUTO switch to AUTO.

2. Actuate the REMOTE START switch or sensor. The pump will start and the solenoid operated shutoff valve at the spray point, if installed and connected, will be energized and open to supply oil to the nozzle(s).

K. If the Dustop unit supplying 2 or 3 spray circuits (spray lines), repeat Steps E through K for circuit #2 & 3

L. With ALL nozzles spraying, adjust the system relief valve to approximately 20 PSI above the highest spray point pressure. Refer to Figure 4-1, Relief Valve Diagram.

M. After the system has operated for an hour or so, shut it down. Lock out all power. Bleed any pressure from the oil supply and pressure lines. Clean out all strainers and filters. After initial startup, an appreciable amount of dirt and debris remaining in the piping will probably be trapped in the strainers. **Close all gauge valves after all pressure adjustments have been made.**

N. When initial startup has been successfully completed and any leaks or problems, which may have been discovered, have been corrected, oil supply and pressure lines can be insulated if desired.

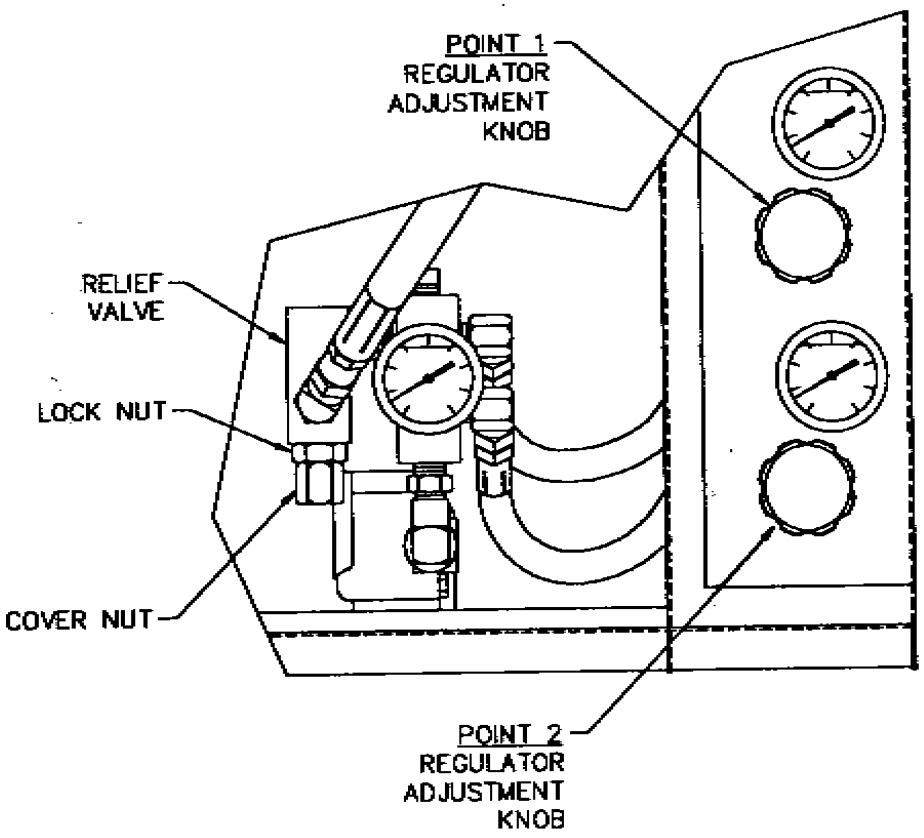


Figure 4-1, Relief Valve Diagram

V. Maintenance and Troubleshooting

NOTICE

REVIEW SECTION 1, GENERAL SAFETY INFORMATION, BEFORE PERFORMING ANY MAINTENANCE OR TROUBLESHOOTING ON DUSTOP SYSTEM.

5.1 Maintenance Requirements

A Dustop II System requires very little routine maintenance; however, the following maintenance should be performed weekly.

A. Shut the system down and lock out power. Shut off and lock the valve at the supply tank. Clean all strainer screens. The 40 mesh screen filter at the Dustop inlet has a bowl which can be unthreaded from the housing. The inline strainer assemblies in the pressure lines have cleanout plugs which allow oil and collected water to be drained from strainers. A screen holder must also be removed in order to remove and clean a screen. Strainers supplied by E. J. Heck & Sons have a 100 mesh screens.

B. Inspect the system for oil leaks. Repair any leaking component or oil line immediately.

C. If any spray nozzles are spraying erratically or are clogged, clean the fine mesh screens in the nozzle assemblies. If a "y" strainer screen requires cleaning, it is advisable to flush out the associated check valve.

5.2 Hydraulic pump

The following information was extracted from the pump manufacturer's literature.

5.2.1 Specifications

- 185 degree F Maximum operating temperature
- 10" Mercury maximum vacuum (Head) @ 1800 RPM
- 20 PSI maximum positive pressure at inlet

5.2.2 Fluid Viscosity

- 100-200 SSU continuous operating viscosity range
- 200 SSU Maximum start-up viscosity

5.2.3 Description

Gear-on-gear pumps consist of two gears that mesh inside a housing. The driving gear is an extension of the drive (input) shaft; as it rotates, it drives the second gear. As the gears rotate within the housing, fluid is swept from the inlet to the outlet. The gears must carry the full power load of the pumps and they are highly stressed at high pressures and high loads. Gears of either spur (straight) or helical configuration can be used; spur gears are most common. Fluid volume pumped through a gear pump depends on the depth of the tooth and width of the gear; the greatest output coming when the greatest tooth depth is used. Most pumps have gears with 10 or 12 teeth. As a spur gear rotates, individual "segments" of fluid are released between the teeth to the outlet, causing pulsating or rippling output pressure.

5.2.4 Troubleshooting Pumps

5.2.4.1 Excessive Noise, Low Output Pressure

Check for the following

1. Vacuum leaks in the suction (intake) line, such as a leak in a fitting or a damaged suction line.

2. Oil supply line shut off or plugged.

3. Suction leaks at the pump shaft seal if the pump is internally drained. Flooding connections with the fluid being pumped may cause the noise to stop or abate momentarily. This indicates the probable point of air entry.

4. Misalignment with drive mechanism (motor) will cause premature wear and subsequent high noise level during operation.

5. Check manufacturer's specifications relative to wear possibilities and identification of indications of wear, such as high operating noise level, etc.

6. Check compatibility of fluid being pumped with manufacturer's recommendations.

7. Relief or unloading valve set too high. Use a reliable gauge to check operating pressure. Relief valve may have been set too high with a damaged pressure gauge. Check various unloading devices to see that they are properly controlling the pump delivery.

8. Reverse rotation. This should have shown up as low or nonexistent output pressure when the pump was first started.

9. Plugged or restricted suction line or suction strainer.

10. Either the oil's viscosity too high or its temperature too low.

11. Oil pour point is too high.

12. Air leak in suction line or fittings causing irregular movement (erratic operation) of control circuit.

13. Loose or worn pump parts.

14. Pump being driven is excess or rated speed.

15. Oil level in supply tank too low; air instead of oil is being drawn through supply line from tank.

16. Air bubbles in oil supply.

17. Suction filter (strainer) too small.

18. Suction line to small.

5.2.4.2 No Pump Pressure, Motor Running

Possible causes may be:

1. Shaft coupling broken.

2. Incorrect direction of pump rotation. Arrow embossed on the pump housing indicates correct direction of pump rotation.

3. Relief valve set for 0 pressure, all fluid being unloaded to return line.

4. Shutoff valve at tank is closed, preventing flow of oil to pump.

5. Cold oil may starve pump.

6. Supply tank empty.

5.2.4.3 Dustop Pump Seals Failing

If the supply line has a booster pump, check to see that the booster's output DOES NOT exceed 20 PSI.

If the Dustop enclosure is exposed to very cold temperatures freezing or below while it is shut down, at night for instance, the oil may congeal. Extremely high fluid viscosity at startup may blow seals. Consider adding a thermostatically-controlled heater to pump housing. Finally, perform sediment test on the oil to see if it contains abrasive particles.

Positive pressure from supply line due to thermal expansion by heat sources can blow out pump seals. Confirm free oil flowing back to tank by maintaining open shut off valves and removing one-way check valves without relief. Refer to Figure 2-1, detail A, for more information.

5.3 Hydraulic Relief (Unloader) Valve

5.3.1 Specifications

The following information was extracted from the valve manufacturer's literature.

5.3.1.1 General Safety Information

A. Do not operate the valve at more than 100 PSI. Dustop II Systems Only; system pressure pump (in enclosure), 80 PSI Maximum. Booster pumps, 20 PSI Maximum.

B. Over-pressure may cause sudden failure.

C. Do not touch valve body during or immediately after operation as the valve may be hot.

D. Check for proper relief pressure at startup and recheck at frequent intervals.

E. Do not attempt to service valve before locking out power and releasing (bleeding off) pressure in the system.

F. Consult the E.J.Heck & Sons for recommended oils and capacities to be pumped.

G. Be sure all components are pressure rated for pressures equal to or exceeding those experienced in the system in which the components are installed and operated.

5.3.1.2 Installation

A. Lock out power and relieve all hydraulic system pressure before removing or installing a relief valve OR ANY OTHER HYDRAULIC COMPONENT.

B. Be sure the relief (return) line to the supply tank or internal tank is open and unobstructed. The relief valve WILL NOT function as intended if there is back-pressure at the relief valve's relief or exhaust port. If the relief port is blocked, spray circuit pressure will increase unit it equals pump output pressure.

C. The entire hydraulic system must be clean to avoid contamination problems.

5.3.1.3 Maintenance

Clean hydraulic fluid adds to the life of all system components. In the case of a Dustop II Spraying System, this mainly involves keeping contaminants out of the oil in the supply tank since oil is not recirculated to any appreciable degree.

Before performing any maintenance or repair on a relief valve, consider the following factors:

A. Be sure you have the proper replacement (spare) parts on hand.

B. Lock out power and relieve all pressure on the hydraulic system.

C. When the relief valve is being removed, plug all openings to prevent infiltration of dirt and debris.

D. After reinstalling a relief valve, adjust relief pressure per Paragraph 5.3.1.4.

5.3.1.4 Valve Operation

A. The hydraulic relief valve's main function in a system is to provide relief (unloading) of oil pressure by allowing excess oil to flow back to the reservoir at or above the desired system pressure.

B. During initial startup, check to verify that the relief valve is adjusted to the desired setting and that the entire system is functioning properly.

C. Adjustment Procedure (Refer to Figure 4-1)

1. Loosen the black lock ring on the valve

2. Use the black ring on the end of the valve and slowly turn the stem clockwise to INCREASE relief pressure or counter-clockwise to DECREASE relief pressure.

3. When the desired relief pressure setting has been obtained, tighten the black lock ring to lock the valve in adjustment while preventing the stem from turning.

4. All air entrapped in the hydraulic system must be bled off in order for the relief valve to operate properly.

5.3.1.5 Valve Troubleshooting Guide

SYMPTON	POSSIBLE CAUSE	CORRECTIVE ACTION
Low Pressure	Out of adjustment	Readjust valve and retighten lock ring
Differential between valve cracking pressure and wide open pressure is too great - more than 175 PSI	1. Spring has taken a set or is broken	Replace valve
	2. Valve seat worn	Replace valve
Erratic Pressure	Valve is dirty	Clean valve

5.4 Spray Application Point-Pressure Regulators

Each Dustop II unit contains one (Standard) or two (Optional) pressure regulators. A regulator maintains a nearly constant outlet pressure despite changes in pump output and downstream flow requirements. Regulator outlet pressure is adjusted by means of the adjustment knob.

5.4.1 Theory Of Operation

When the knob is rotated fully counter-clockwise, it exerts no pressure to the regulating spring which bears on the diaphragm. Turning the knob clockwise compresses the regulating spring, exerting pressure on the diaphragm. In response to the pressure, the diaphragm and valve pin force the valve poppet off its seat, allowing oil to flow through the regulator's outlet to the downstream system.

As outlet pressure increases in the regulator's sensing chamber and in the downstream system, pressure is applied to the bottom of the diaphragm. Then the valve bonnet, the valve pin, and the diaphragm move against the regulating spring. Diaphragm movement ceases when the forces on both sides of the diaphragm (spring and fluid pressure) are balanced.

When there is NO downstream demand, the forces acting on the diaphragm are balanced when the valve bonnet is closed. When there IS some downstream demand, the forces are balanced when the valve bonnet has opened sufficiently to compensate for the demand (a new state of equilibrium is reached); thus the desired outlet pressure and flow is maintained providing the regulators capacity and/or pressure limits are not exceeded.

5.4.2 Non-Relieving Type Regulator

The regulators supplied in Dustop II Spraying Systems are the non-relieving type. Outlet pressure can not be reduced if and when the system is dead-ended as when no spray nozzles are operating. This means the pump experiences maximum load and wastes energy. This is the reason for the REMOTE START circuitry; When connected and operated as intended, the pump stops when the REMOTE START circuits are interrupted (opened).

5.4.3 Regulator Adjustment (Refer to Figure 4-1)

A. Prior to turning on the Dustop, rotate the regulator knob or knobs fully counter-clockwise to remove all load or pressure from the regulating spring(s).

B. Turn the system ON.

C. Slowly rotate the regulator knob clockwise until the desired outlet pressure is indicated.

D. When adjusting a regulator, always approach the desired pressure from a lower pressure; this method avoids minor readjustments after making the initial pressure adjustment. In a similar vein, if the outlet pressure is to be reduced, lower the pressure BELOW the desired final pressure and then raise pressure again to the new setting.

E. Locking regulator adjustment. On regulators with a T-handle or certain knobs, tighten the jam nut.

Other regulators with knobs can be locked in adjustment by pushing inward on a locking ring. Pulling outward on a locking ring frees the knob. The adjustment of these regulators can be made tamper-resistant by installing a seal wire in the groove above the lock ring.

5.4.4 Cleaning

A. After shutting off dustop system and locking out power, disassemble the regulator.

B. Clean parts using warm water and soap. DO NOT submerge knob-type bonnets in the soapy water as the lubricant will be removed.

C. Rinse all parts thoroughly in clean water. Dry completely.

D. Inspect all parts.

E. Replace any worn or damaged parts.

5.5 General Dustop Troubleshooting

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Motor does not Start in MANUAL	Circuit breaker is open.	Reset Breaker
	Thermal overload in motor is open.	Allow motor to cool down, then if motor has manual reset, press it OR if motor has auto reset, it should reset automatically.
Erratic pressure fluctuation	Air in oil lines	See Paragraph 5.2.4.1
Motor does not start in AUTO	Circuit breaker or thermal overload.	Same as MANUAL
	REMOTE START switch is defective.	Replace switch
	REMOTE START relay is defective.	Replace relay
	START circuit wired incorrectly or is damaged.	Rewire circuit
Oil won't spray	Cold oil; obtain sample and measure oil temperature.	Refer to Paragraph 3.3.1.3, 3.3.1.4, and 3.3.5.2
	No pressure at nozzle.	Clean filters and strainers.
	Low pressure on spray point gauge.	Adjust regulator. Also check System pressure to verify ther is Sufficient pressure in inlet of Regulator.
	Nozzle size is too large for volume required.	Replace nozzle with one having a smaller orifice.
	Shut off valve closed	Open
	Supply tank empty	Refill tank

VI. Spare Parts

6.1 Ordering Parts

Parts orders or requests for technical assistance to your sales representative or to:

Edward J. Heck & Sons Company
1625 South 13th Street
Omaha, NE 68108
Phone 800-652-8873
FAX (402) 341-6927

Please have available the Model Number and Serial Number of the equipment in question, as well as the location where the equipment is INSTALLED.

VII. Warranty

E.J. Heck & Sons reserves the right to make changes in design or in construction of equipment and components without obligation to incorporate such changes in equipment and components previously ordered.

WARRANTY, LIMITATION OF LIABILITY, DISCLAIMER OF IMPLIED WARRANTIES: E.J. Heck & Sons Co. manufactured equipment and components are guaranteed against defects in workmanship or materials for one year from date of shipment. The obligation of E. J. Heck & Sons Co. with respect to any goods is limited to replacement or repair of defective parts and equipment provided those parts are returned, shipping costs prepaid, to E.J. Heck & Sons' factory and provided the product has not been subject to misuse, negligence, or accident, or repaired or altered outside our factory, or other than by an Authorized Service Representative. This warranty does not cover the replacement of parts inoperative because of wear occasioned by use, the cost of replacing parts by a person rather than an E.J Heck & Sons employee or an Authorized Service Representative, or the adjustment or a product where the product was improperly adjusted by the purchaser. In addition, this warranty does not cover components manufactured by others such as motors, drives, clutches, cylinders, valves, blowers, and the like. On those components the standard Manufactures warranty applies. In any event, liability is limited to the purchase price paid, and E.J. Heck & Sons Co. will, under no circumstances, be responsible for special or consequential damages, or for incidental damages.

EDWARD J HECK & SONS COMPANY NEITHER MAKES NOR AUTHORIZES ANY WARRANTY OTHER THAN AS HEREIN CONTAINED. THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THOSE OF MERCHANTABLITY AND FITNESS FOR A PARTICULAR PURPOSE.

2/29/08

Appendix A

dustop STOP

DUSTOP oil gallons per minute flow

BU HR	CORN MILO 56#/bu	SOYBEANS WHEAT 60#/bu	OATS 32#/bu	RICE 45#/bu	SUNFLOWERS 20#/bu
3000	.077	.083	.044	.062	.038
4000	.104	.111	.059	.083	.051
5000	.130	.139	.074	.104	.064
6000	.156	.167	.088	.125	.077
7000	.181	.194	.104	.146	.090
8000	.207	.222	.119	.167	.104
9000	.233	.250	.133	.188	.117
10000	.259	.278	.148	.208	.130
11000	.285	.306	.163	.229	.143
12000	.311	.333	.178	.250	.156
13000	.337	.361	.193	.271	.169
14000	.363	.389	.207	.292	.181
15000	.389	.417	.222	.313	.194
20000	.519	.556	.296	.417	.259
25000	.648	.694	.370	.521	.324
30000	.778	.833	.444	.625	.389
35000	.907	.972	.519	.729	.454
40000	1.037	1.111	.593	.833	.519
45000	1.167	1.250	.667	.938	.583
50000	1.296	1.389	.741	1.042	.648
55000	1.426	1.528	.815	1.146	.713
60000	1.556	1.667	.889	1.250	.778

Based on oil weight of 7.2 #/gallon and .02% by weight application
FDA regulations for application subject to change without notice.

Appendix B

Nozzles

Theoretical coverage width (in inches) at various distances from nozzle orifice (oil at 80 degrees F)				
	Distance			
Theoretical spray angle / psi	4"	6"	8"	10"
80 degrees / 40 psi	2.7"	4.0"	5.7"	7.0"
80 degrees / 60 psi	4.0"	6.0"	8.7"	9.5"
100 degrees / 40 psi	8.8"	11.5"	14.3"	16.3"
100 degrees / 60 psi	10.0"	14.0"	16.8"	18.0"

Theoretical oil gallons per minute at various psi with nozzle markings in water (oil at 80 degrees F)							
NOZZLE	800050	800067	800100	800150	800200	800300	800400
20 psi	0.048 GPM	0.055 GPM	0.076 GPM	0.120 GPM	0.153 GPM	0.229 GPM	0.305 GPM
40 psi	0.055 GPM	0.073 GPM	0.109 GPM	0.164 GPM	0.218 GPM	0.327 GPM	0.436 GPM
60 psi	0.065 GPM	0.087 GPM	0.131 GPM	0.196 GPM	0.273 GPM	0.403 GPM	0.534 GPM

Theoretical oil gallons per minute at various psi with nozzle markings in water (oil at 80 degrees F)							
NOZZLE	110010	110015	110020	110030	110040	110050	110060
20 psi	0.076 GPM	0.121 GPM	0.152 GPM	0.229 GPM	0.306 GPM	0.382 GPM	0.308 GPM
40 psi	0.110 GPM	0.163 GPM	0.218 GPM	0.328 GPM	0.436 GPM	0.545 GPM	0.654 GPM
60 psi	0.130 GPM	0.196 GPM	0.273 GPM	0.403 GPM	0.535 GPM	0.664 GPM	0.796 GPM