Mayo

RECIRCULATING TANK

OPERATORS MANUAL

MAYO MANUFACTURING, INC. LIMITED WARRANTY

THE FOLLOWING WARRANTIES FOR MACHINERY, EQUIPMENT OR PARTS SOLD BY MAYO MANUFACTURING, INC. ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, OR THOSE WARRANTIES IMPOSED BY STATUE, INCLUDING, BUT NOT LIMITED TO ANY AND ALL IMPLIED WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND OF ANY AND ALL OTHER WARRANTY OBLIGATIONS ON THE PART OF MAYO MANUFACTURING, INC. (The Company).

The Company warrants the machinery, equipment or parts delivered against faulty workmanship or the use of parts delivered against faulty workmanship or the use of defective materials for a period of one (1) year from the date of shipment.

The Company's warranties set forth above are the only warranties made by the Company and shall not be enlarged, diminished or affected by, and no obligation or liability shall arise outfox the Company's rendering technical or other advice or service in connection with the machinery, equipment or parts.

Parts or components furnished to the Company by third persons are guaranteed only to the extent of the original manufacturer's guarantee to the Company, a copy of which will be supplied to the Purchaser upon written request to the Company.

LIABILITY

THE COMPANY'S SOLE AND EXCLUSIVE MAXIMUM LIABILITY, AND PURCHASER'S SOLE AND EXCLUSIVE REMEDY under the above warranty shall be, at the Company's option, the repair, or replacement of the machine, equipment or part which is found to be defective due to faulty workmanship or defective materials, and is returned by the Purchaser to the Company within the warranty period. Shipment both ways and in transit damage shall be at the purchaser's risk and expense. If the Company elects to repair or replace the machine, equipment, or part, the Company will have a reasonable time within which to do so.

The remedies set forth above are available upon the following conditions:

1. Purchaser has promptly notified Company upon discovery that the machinery, equipment, or parts are defective due to faulty workmanship or defective materials; and
2. Purchaser provides Company with a detailed description of the deficiencies; and
3. Company's examination discloses that the alleged deficiencies exist and were not caused by accident, fire, misuse, neglect, alteration, or any other hazard or by Purchaser's improper installa tion, use or maintenance.

Such repair or replacement shall constitute fulfillment of all Company's liability to Purchaser, whether based on contract or tort.

This warranty does not apply to any machine that has been altered outside the factory in any way so as, in the judgement of Mayo, to affect its operation, reliability or safety, or which has been subject to misuse, neglect or accident.

In the event the Company breach any other provisions of the Purchase Agreement, the Company's EXCLUSIVE MAXIMUM LIABILITY AND PURCHASER'S EXCLUSIVE REMEDY, whether in contract or tort, otherwise shall not in any event exceed the contract price for the particular machine, piece of equipment or parts involved.

IN NO EVENT SHALL COMPANY BE LIABLE TO ANYONE FOR SPECIAL, COLLATERAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES FOR BREACH OF ANY PROVISIONS OF THIS CONTRACT OR WARRANTY. SUCH EXCLUDE DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, costs of REMOVAL AND REINSTALLATION OF ITEMS, Loss of GOODWILL, LOSS OF PROFITS, LOSS OF USE OR INTERRUPTION OF BUSINESS.

WARRANTY VOID IF NOT REGISTERED

MAYO
RECIRCULATING TANK 8000 SERIES

WARRANTY REGISTRATION FORM & INSPECTION REPORT

WARRANTY REGISTRATION (please print)

This form must be filled out by the dealer and signed by both the dealer and the customer at the time of delivery.

Customer's Name _____

Address _____

City, State/Province, Code _____

Phone Number (____) _____

Contact Name _____

Model _____

Serial Number _____

Delivery Date _____

Dealer Name _____

Address _____

City, State/Province, Code _____

Phone Number (___) _____

DEALER INSPECTION REPORT

____ Tire Pressure Checked and Wheel Bolts Torqued
____ Trash Screen Clean Inspect Electrical System
____ Water Lines and Fittings Tight
____ Machine Lubricated
____ Conveyor Tensioned and Aligned
____ Roller Chain Tensioned and Aligned
____ Speed Reducer Gearbox Oil Level Checked

SAFETY

____ All Safety Signs Installed
____ Lights, SMV Clean
____ Review Operating and Safety Instructions

I have thoroughly instructed the buyer on the above described equipment which review included the Operator's Manual content, equipment care, adjustments, safe operation and applicable warranty policy.

Date _____ Dealer's Rep. Signature _____

The above equipment and Operator's Manual have been received by me and I have been thoroughly instructed as to care, adjustments, safe operation and applicable warranty policy.

Date _____ Owner's Signature _____

WHITE	YELLOW	PINK
MAYO MFG., INC	DEALER	CUSTOMER

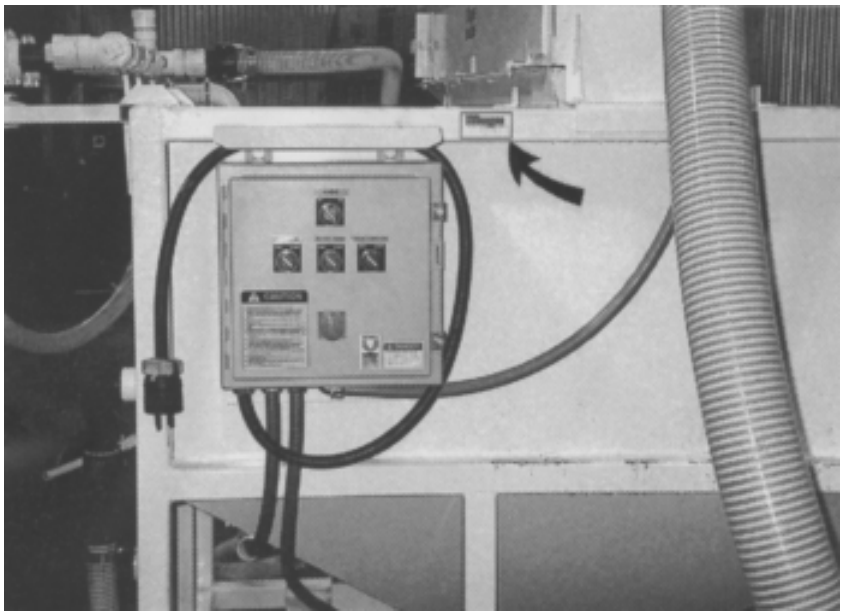
TABLE OF CONTENTS

SECTION		DESCRIPTION	PAGE
	4.9	Transport	24
	4.10	Storage	26
	4.10.1	Placing In Storage	26
	4.10.2	Removing From Storage	26
5		**Service and Maintenance**	**27**
	5.1	Service	27
	5.1.1	Fluids and Lubricants	27
	5.1.2	Greasing	27
	5.1.3	Servicing Intervals	28
	5.1.4	Service Record	35
	5.2	Maintenance	36
	5.2.1	Electrical System Inspection	36
	5.2.2	Electric Motor Restart	37
	5.2.3	Speed Reducer Gearbox Oil	38
	5.2.4	Breather Cleaning	39
	5.2.5	Trash Conveyor Chain Tension/Alignment or Replacement	40
	5.2.6	Roller Chain Drives	41
6		**Trouble Shooting**	**43**
7		**Specifications**	**44**
	7.1	Mechanical	44
	7.2	Bolt Torque	45
	7.3	Electrical Schematic	46
8		**Index**	**47**

SERIAL NUMBER LOCATION

Always give your dealer the serial number of your Mayo Recirculating Tank when ordering parts or requesting service or other information.

The serial number plate is located where indicated. Please mark the number in the space provided for easy reference.



SERIAL NUMBER LOCATION

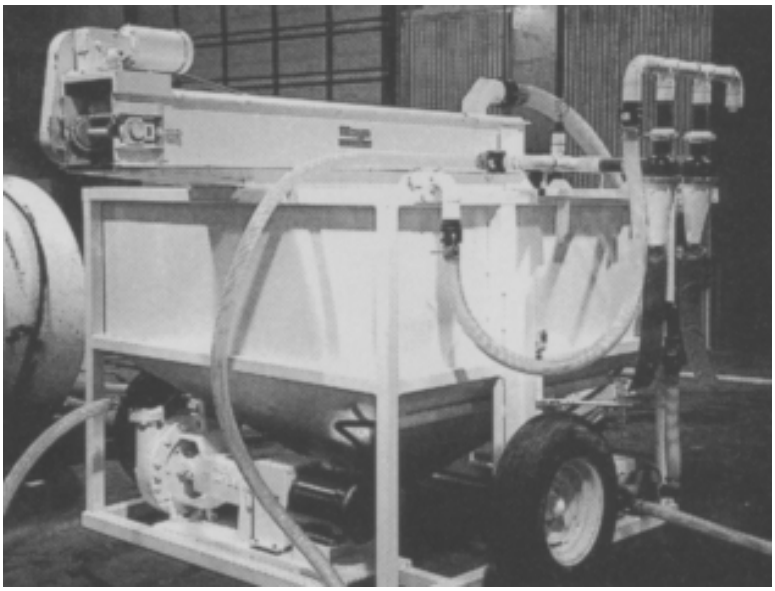
Model _____

Serial Number _____

1 INTRODUCTION

Congratulations on your choice of a Mayo Model 8000 Series Recirculating Tank and welcome to Mayo's quality line of potato handling equipment. This equipment is designed and manufactured to meet the needs of a discriminating buyer in the agricultural industry for the loading and processing of harvest yields.

Safe, efficient and trouble free operation of your new Mayo Recirculating Tank requires that you, and anyone else who will be operating or maintaining the Tank, read, understand and practice ALL of the Safety, Operation, Maintenance and Trouble Shooting recommendations contained within this Operator's Manual.



This manual applies to the Model 8000 Series Recirculating Tank manufactured by Mayo. Certain options may be available to specifically tailor the Tank to your operation and may not be included in this manual. Please contact the manufacturer regarding additional information about these options. Use the Table of Contents and Index as a guide to find specific information.

Keep this manual handy for frequent reference and so that it will be passed on to new operators or owners. Call your Mayo dealer if you need assistance, information or additional copies of this manual.

MACHINE ORIENTATION - The hitch end of the Tank is the front. All controls are on the front end.

2 SAFETY

SAFETY ALERT SYMBOL

This Safety Alert symbol means
ATTENTION! BECOME ALERT!
YOUR SAFETY IS INVOLVED!

The Safety Alert symbol identifies important safety messages on your Mayo Recirculating Tank and in the manual. When you see this symbol, be alert to the possibility of personal injury or death. Follow the instructions in the safety message.

Why is SAFETY important to you?

3 Big Reasons

Accidents Disable and Kill
Accidents Cost You Money
Accidents Can Be Avoided

SIGNAL WORDS:

Note the use of the signal words **DANGER, WARNING** and **CAUTION** with the safety messages. The appropriate signal word for each message has been selected using the following guide-lines:

DANGER - Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations, typically for machine components that, for functional purposes, cannot be guarded.

WARNING - Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury, and includes hazards that are exposed when guards are removed. It may also be used to alert against unsafe practices.

CAUTION - Indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

If you have any questions not answered in this manual or require additional copies or the manual is damaged, please contact your dealer or Mayo, P.O. Box 497, Bus Highway 2, East Grand Forks, Minnesota, 56721. (Telephone) 218-773-1234, (FAX) 218-773-6693 or toll free at 1-800-223-5873.

SAFETY

YOU are responsible for the **SAFE** operation and maintenance of your Mayo Recirculating Tank. **YOU** must ensure that you and anyone else who is going to operate, maintain or work around the Tank be familiar with the operating and maintenance procedures and related **SAFETY** information contained in this manual. This manual will take you step-by-step through your working day and alerts you to all good safety practices while operating the Tank.

Remember, **YOU** are the key to safety. Good safety practices not only protect you but, also the people around you. Make these practices a working part of your safety program. Be certain that **EVERYONE** operating this machine is familiar with the procedures recommended and follows safety precautions. Remember, most accidents can be prevented. Do not risk injury or death by ignoring good safety practices.

- Recirculating Tank owners must give operating instructions to operators or employees before allowing them to operate the Tank, and at least annually thereafter.

- The most important safety device on this equipment is a **SAFE** operator. It is the operator's responsibility to read and understand **ALL** Safety and Operating instructions in the manual and to follow these. All accidents can be avoided.

- A person who has not read and understood all operating and safety instructions is not qualified to operate this machine. An untrained operator exposes himself and bystanders to possible serious injury or death.

- Do not modify the equipment in any way. Unauthorized modification may impair the function and/or safety and could affect the life of the equipment.
- Think SAFETY! Work SAFELY!

2.1 GENERAL SAFETY

1. Read and understand the Operator's Manual and all safety signs before supplying power, operating, maintaining or adjusting Tank.

2. Only trained, competent persons shall operate the Tank. An untrained operator is not qualified to operate this machine.

3. Provide a first-aid kit for use in case of an accident. Store in a highly visible place.

4. Provide a fire extinguisher for use in case of an accident. Store in a highly visible place.

5. Wear appropriate protective gear. This list includes but is not limited to:

   - Protective shoes with slip resistant soles
   - Protective glasses or goggles
   - Heavy gloves
   - Hearing protection

6. Turn machine OFF, shut down and lockout power supply, and wait for all moving parts to stop before servicing, adjusting, maintaining, repairing or cleaning. (Safety lockout devices are available through your Mayo dealer parts department).

7. Know the emergency medical center number for your area.

8. Review safety related items with all operators annually.

2.2 INSTALLATION SAFETY

1. Disconnect and remove all mechanical locks, anchor chains and any other transport devices that would hinder or prohibit the normal functioning of the Recirculating Tank upon start up. Serious damage to the machine and/or personal injury to the operator and bystanders may result from attempting to operate the machine while mechanical locking devices are still attached.

2. Position the machine on firm, level ground before operating.

3. Have at least one extra person available to assist when elevating, moving or connecting to other equipment.

4. Make certain that sufficient amperage, at the proper voltage and frequency is available before connecting power. If you are uncertain, have a licensed electrician provide power to the machine.

5. If using Tank as part of material handling system, anchor securely to other conveying equipment before starting.

2.3 OPERATING SAFETY

1. Read and understand the Operator's Manual and all safety signs before operating, maintaining, adjusting or repairing the Recirculating Tank.

2. Turn machine OFF, shut down and lock out power supply (safety lockout devices are available through your Mayo dealer parts department), and wait for all moving parts to stop before servicing, adjusting, maintaining or repairing.

3. Install and properly secure all guards and shields before operating.

4. Keep hands, feet, hair and clothing away from all moving parts.

5. Clear the area of bystanders, especially small children, before starting.

6. Make sure all control switches are in the off position before connecting power supply.

7. Before supplying electrical power to the machine, be sure that you have adequate amperage at the proper phase and voltage to run it. If you do not know or are unsure, consult a licensed electrician.

8. Keep the working area clean and dry.

9. Review safety instructions annually.

2.4 MAINTENANCE SAFETY

1. Read and understand all the information contained in the Operator's Manual regarding operating, servicing, adjusting, maintaining and repairing.

2. Turn machine OFF, shut down and lock out power supply (safety lockout devices are available through your Mayo dealer parts department), and wait for all moving parts to stop before servicing, adjusting, maintaining or repairing.

3. Follow good shop practices:

   - Keep service area clean and dry.

   - Be sure electrical outlets and tools are properly grounded.

   - Use adequate light for the job at hand.

4. Make sure all guards and doors are in place and properly secured when operating the Recirculating Tank.

5. Do not work on Recirculating Tank electrical system unless the power cord is unplugged and the power supply is locked out.

2.5 ELECTRICAL SAFETY

1. Have only a qualified electrician supply power.

2. Make certain that the Recirculating Tank is properly grounded at the power source.

3. Make certain that all electrical switches are in the OFF position before plugging the Recirculating Tank in.

4. Turn machine OFF, shut down and lock out power supply (safety lockout devices are available through your Mayo dealer parts department), and wait for all moving parts to stop before servicing, adjusting, maintaining or repairing.

5. Disconnect power before resetting any motor or breaker overload.

6. Replace any damaged electrical plugs, cords, switches and components immediately.

7. Do not work on Tank electrical system unless the power cord is unplugged or the power supply is locked out.

2.6 TIRE SAFETY

1. Inflate tires to proper pressure as specified on the side wall of each tire. Do not overinflate or underinflate.

2. Failure to follow proper procedures when mounting a tire on a wheel or rim can produce an explosion which may result in serious injury or death.

3. Do not attempt to mount a tire unless you have the proper equipment and experience to do the job.

4. Have a qualified tire dealer or repair service perform required tire maintenance.

2.7 TRANSPORT SAFETY

1. Make certain that you are in compliance with local, state/provincial and federal regulations regarding transporting agricultural equipment on public roadways.
2. Make certain that all wheels and tires are in good repair and that tires are inflated to proper pressure. Do not underinflate or overinflate.
3. Make certain that all wheel bolts/lug nuts are tightened to proper torque specifications (refer to specification chart in Section 7.2).
4. Make certain that all mechanical locks and integral anchor chains are safely and positively connected before loading or transporting.
5. Wrap up and bind to the frame all loose water lines and electrical ends.
6. Be sure that any necessary SMV (slow moving vehicle) signs, reflectors and lights required by law are in proper place and are clearly visible to oncoming and overtaking traffic.
7. Be sure that the Recirculating Tank is positively hitched to the towing vehicle. Use a proper safety chain to assure a safe hitch hook-up when transporting.
8. Adhere to local regulations regarding maximum weight, width and length.
9. Do not exceed 20 MPH (32 Km/H). Reduce speed on rough roads and surfaces.
10. Do not allow anyone to ride on the Tank or towing vehicle during transport.
11. Always use hazard flashers on the towing vehicle when transporting.

2.8 STORAGE SAFETY

1. Store the Recirculating Tank on a firm level surface.
2. If required, make sure the unit is firmly blocked up.
3. Make certain that all mechanical locks are safely and positively connected before storing.
4. Store away from areas of human activity.
5. Do not allow children to play on or around the stored Recirculating Tank.
6. Lock out power by turning off master control panel or junction box and padlocking the door shut to prevent electrocution or unauthorized start up of the Recirculating Tank.

2.9 SAFETY SIGNS

1. Keep safety signs clean and legible at all times.
2. Replace safety signs that are missing or have become illegible.
3. Replaced parts that displayed a safety sign should also display the current sign.
4. Safety signs are available from your Distributor or the factory.

How to Install Safety Signs:

- Be sure that the installation area is clean and dry.
- Decide on the exact position before you remove the backing paper.
- Remove the smallest portion of the split backing paper.
- Align the sign over the specified area and carefully press the small portion with the exposed sticky backing in place.
- Slowly peel back the remaining paper and carefully smooth the remaining portion of the sign in place.
- Small air pockets can be pierced with a pin and smoothed out using the piece of sign backing paper.

2.10 EMPLOYEE SIGN-OFF FORM

Mayo Manufacturing, Inc. follows the general Safety Standards specified by the American Society of Agricultural Engineers (ASAE) and the Occupational Safety and Health Administration (OSHA). Anyone who will be operating and/or maintaining a Mayo built machine must read and clearly understand ALL Safety, Operating and Maintenance information presented in this manual.

Do not operate or allow anyone else to operate this equipment until such information has been reviewed. Annually review this information before the season start-up.

Make these periodic reviews of SAFETY and OPERATION a standard practice for all of your equipment. We feel that an untrained operator is unqualified to operate this machine.

A sign-off sheet is provided for your record keeping to show that all personnel who will be working with the equipment have read and understand the information in the Operator's Manual and have been instructed in the operation of the equipment.

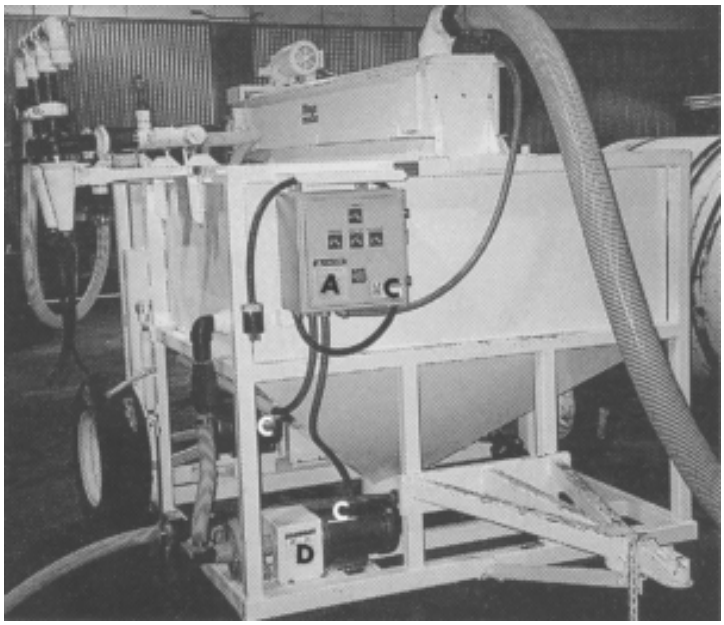
SIGN-OFF FORM

DATE	EMPLOYEE'S SIGNATURE	EMPLOYER'S SIGNATURE

3 SAFETY SIGN LOCATIONS

The types of safety signs and locations on the equipment are shown in the illustration below. Good safety requires that you familiarize yourself with the various safety signs, the type of warning and the area, or particular function related to that area, that requires your SAFETY AWARENESS.

• Think SAFETY! Work SAFELY!



A

⚠ CAUTION

1. Read Operator's Manual before starting.
2. Turn machine OFF, shut down and lock out power source, unplug power cord and wait for all moving parts to stop before servicing, adjusting, repairing or unplugging.
3. Keep all electrical components tight, dry and in good repair.
4. Keep all hydraulic components tight and in good repair.
5. Replace all worn or failed components immediately.
6. Install and secure all guards before operating.
7. Keep hands, feet, hair and clothing away from moving parts.
8. Install safety locks on the boom and elevator before transporting or working under them.
9. Lower boom and elevator to safety locks, center boom and install all safety locks before transporting.
10. Use pilot vehicles when transporting.
11. Stay away from overhead power lines and obstructions when moving. Electrocution can occur without direct contact.
12. Do not stand or climb on machine when running. Keep others off.
13. Have only a qualified electrician provide power to the machine.
14. Review safety instructions annually.

D102

B

⚠ WARNING

MISSING GUARD HAZARD

Install and secure guard before operating.

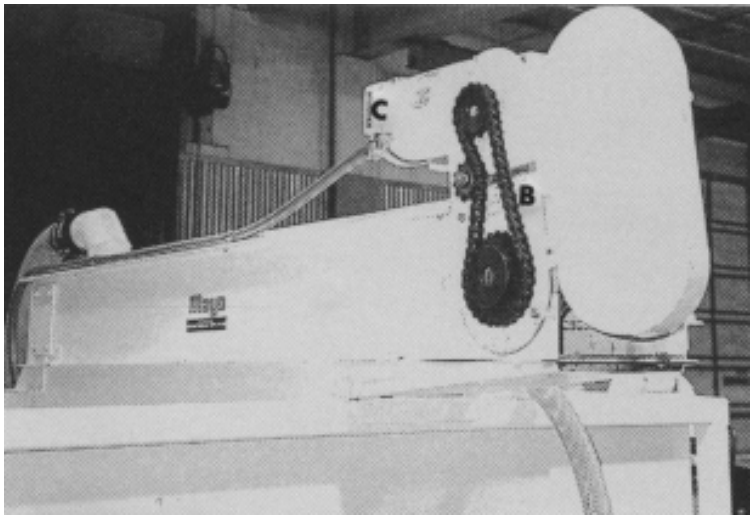
D-122

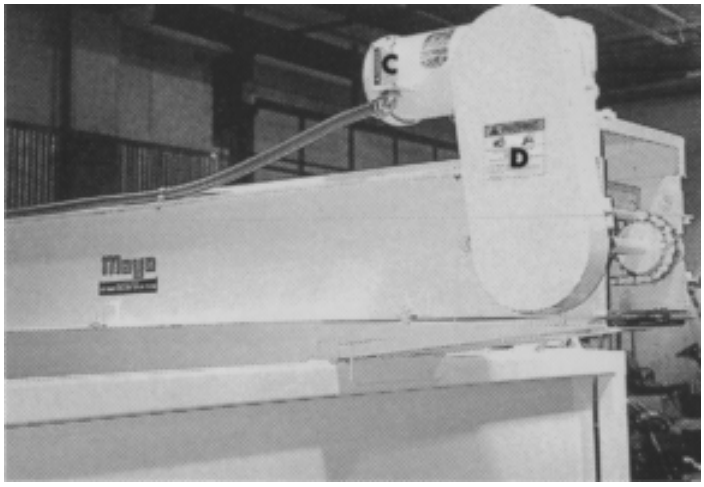
REMEMBER - If safety signs have been damaged, removed, become illegible or parts replaced without safety signs, new signs must be applied. New safety signs are available from your authorized dealer.

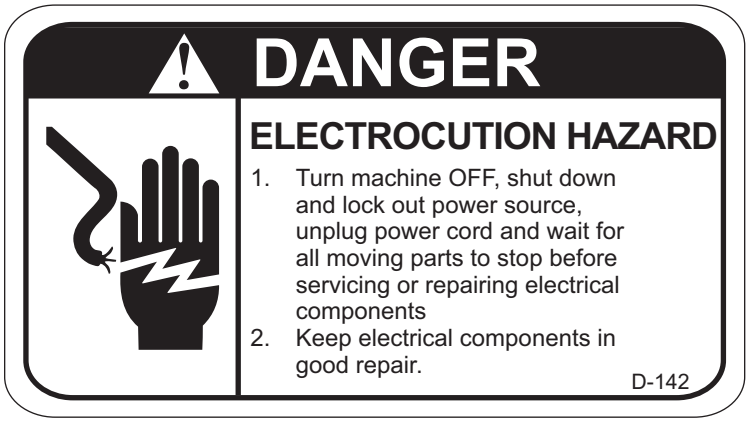
SAFETY SIGN LOCATIONS (cont'd)

The types of safety signs and locations on the equipment are shown in the illustration below. Good safety requires that you familiarize yourself with the various safety signs, the type of warning and the area, or particular function related to that area, that requires your SAFETY AWARENESS.

• Think SAFETY! Work SAFELY!







REMEMBER - If safety signs have been damaged, removed, become illegible or parts replaced without safety signs, new signs must be applied. New safety signs are available from your authorized dealer.

4 OPERATION

OPERATING SAFETY

1. Read and understand the Operator's Manual and all safety signs before operating, maintaining, adjusting or repairing the Recirculating Tank.
2. Turn machine OFF, shut down and lock out power supply (safety lockout devices are available through your Mayo dealer parts department), and wait for all moving parts to stop before servicing, adjusting, maintaining or repairing.
3. Install and properly secure all guards and shields before operating.
4. Keep hands, feet, hair and clothing away from all moving parts.
5. Clear the area of bystanders, especially small children, before starting.
6. Make sure all control switches are in the off position before connecting power supply.
7. Before supplying electrical power to the machine, be sure that you have adequate amperage at the proper phase and voltage to run it. If you do not know or are unsure, consult a licensed electrician.
8. Keep the working area clean and dry.
9. Review safety instructions annually.

4.1 TO THE NEW OPERATOR OR OWNER

The Mayo Manufacturing Recirculating Tank is designed to remove dirt, trash and large particle contaminants from wash water. Be familiar with the machine before starting.

It Is the responsibility of the owner or operator to read this manual and to train all other operators before they start working with the machine. Follow all safety Instructions exactly. Safety Is everyone's business. By following recommended procedures, a safe working environment is provided for the operator, bystanders, and the area around the worksite. Untrained operators are not qualified to operate the machine.

Many features incorporated into this machine are the result of suggestions made by customers like you. Read this manual carefully to learn how to operate the machine safely and how to set it to provide maximum efficiency. By following the operating instructions in conjunction with a good maintenance program, your Recirculating Tank will provide many years of trouble-free service.

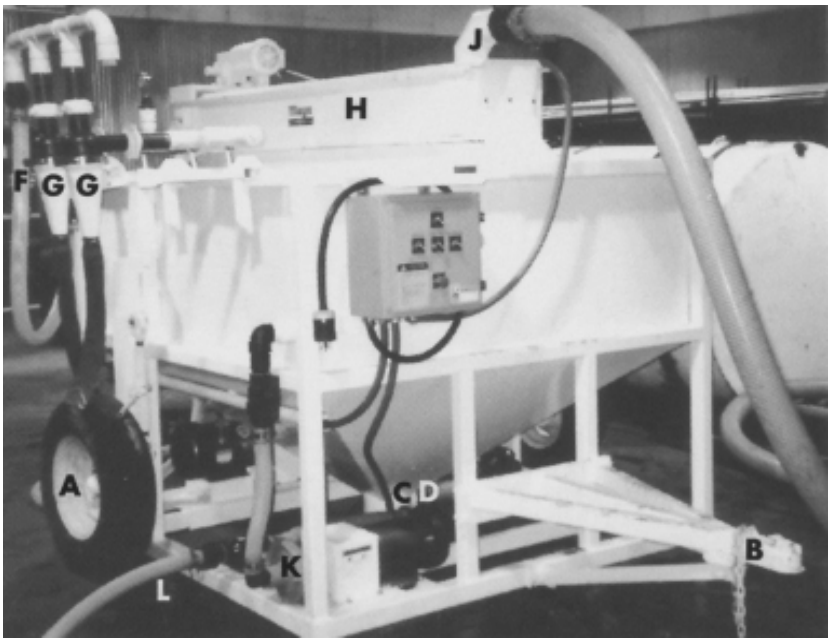
4.2 MACHINE COMPONENTS

The Mayo Manufacturing Recirculating Tank consists of a trash screen, tank, cyclone cleaners and pumps. As dirty water flows from a potato washer, it enters the machine at the trash screen where large pieces of trash and debris are removed. The water flows through the screen and drops into the tank where it is pumped from the bottom sump through the cyclones for cleaning.

Clean or recycled water is pumped from above the sump back to the washer. An overflow outlet is on the side of the tank to prevent over-filling of the system.

The controls are mounted on a central control panel next to the hitch.

The machine is equipped with wheels for moving and transporting and a removable hitch on the front end. Ratchet jacks on each wheel assembly raise the wheels and lower the frame to ground.



A Wheels
B Hitch
C Sump
D Sump Outlet
E Trash Pump
F Cyclone Lines
G Cyclones
H Trash Conveyor
J Water Intake
K Recirculation Pump
L Recirculation Line

Fig. 1 MACHINE COMPONENTS

4.3 GENERAL OPERATION THEORY

The Recirculating Tank is normally used in conjunction with a Potato Washer and is used to remove contaminants from the wash water. After the trash and large contaminants are removed, the water is recycled and pumped back to the Washer for re-use.

The customer must provide a means to collect and remove the slurry of contaminants from under the cyclone discharges and also a method to collect and remove trash from the trash conveyor on top of the machine.

It will also be necessary to provide a drain should the volume of water increase in the system from the fresh water rinse circuit.

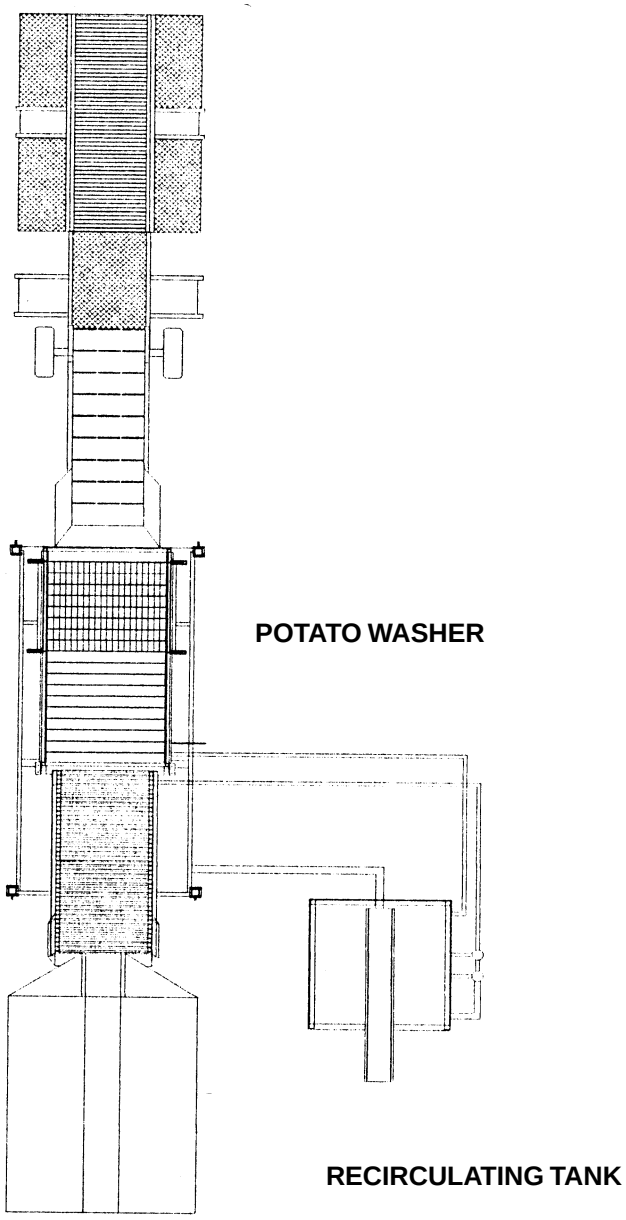


Fig. 2 POSITIONED (TYPICAL)

4.4 MACHINE BREAK-IN

Although there are no operational restrictions on the Recirculating Tank when used for the first time, it is recommended that the following mechanical items be checked:

A. Read Recirculating Tank, Washer and auxiliary equipment manuals before starting.

B. After operating for 1/2 hour:

1. Retorque all wheel bolts.
2. Retorque all fasteners and hardware.
3. Check the tension and alignment of the trash conveyor chain. Realign as required.
4. Check that all electrical connections are tight and cords are routed out of the way or protected.
5. Check for leaks in water system. Retorque fittings that leak.
6. Check that no water lines are being pinched or crimped. Reroute as required.
7. Check the alignment and tension of the drive chain. Realign or tighten as required.
8. Check all drive sprockets to make sure none have moved. Re-align and tighten any that have moved.
9. Check oil level in the speed reduction gear box. Top up as required.
10. Lubricate all grease fittings.

C. After 2,5 and 10 hours of operation:

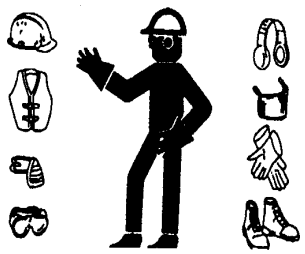
1. Retorque all fasteners and hardware.
2. Check the tension and alignment of the trash conveyor chain. Realign as required.
3. Check that all electrical connections are tight and cords are routed out of the way or pro tected.
4. Check for leaks in water system. Retorque fittings that leak.
5. Check that no water lines are being pinched or crimped. Reroute as required.
6. Check the alignment and tension of the drive chain. Realign or tighten as required.
7. Check all drive sprockets to make sure none have moved. Re-align and tighten any that have moved.
8. Check oil level in the speed reduction gear box. Top up as required.
9. Then go to the regular servicing and mainte nance schedule as defined in the Maintenance Section.

4.5 PRE-OPERATION CHECKLIST

Safe and efficient operation of your new Recirculating Tank requires that each operator reads and follows all safety precautions and operating procedures contained in this section. Performing the following pre-operation checklist is important for personal safety as well as for continued mechanical soundness and longevity of your new Mayo Tank. The checklist should be performed before operating the machine and prior to each operation thereafter.

1. Lubricate the machine according to the schedule prescribed in the “Maintenance Section”.
2. Insure that proper protective gear is in good repair and available for use by each operator. Make certain that each operator uses the protective gear. Protective gear includes but, is not limited to:

   - Leather gloves
   - Safety glasses or face shield
   - Full-length protective clothing
   - Steel toed boots with slip resistant soles.



3. Check for water leaks. Tighten fittings or reroute hoses as required to maintain a leak-free system.
4. Insure that all safety guards and shields are in good repair and securely in place.
5. Check that the conveyor chain is centered on the head and tail rollers. Adjust if necessary as outlined in the “Maintenance Section”.
6. Check for and remove all entangled material.
7. Make sure that all electrical switches are in the OFF position before supplying power.
8. Check that all electrical connections are tight and cords are routed out of the way or protected.
9. Be sure the working area is clean and dry to prevent tripping or slipping.

4.6 CONTROLS

It is recommended that all operators review this section of the manual to familiarize themselves with the location and function of all machine controls before starting. Some machines may vary slightly due to custom features but they are similar and all controls are labeled.

Fig. 3 ELECTRIC PANEL CONTROLS

1. **Master OFF/ON**

   This 2 position rotary switch controls the power to the control panel. Turn counter-clockwise to turn OFF and clockwise to turn ON. The switch must be turned ON before using any other switch or function.

2. **Cyclone Pump STOP/START**:

   This 2 position rotary switch controls the power to trash pump electric motor. Turn counterclockwise to STOP and clockwise to START. This pump removes the water from the sump at the bottom of the machine and pumps it through the cyclones for cleaning.

3. **Recirculation Pump STOP/START:**

   This 2 position rotary switch controls the power to the electric motor driving the recirculation pump. Turn counter-clockwise to STOP and clockwise to START.

4. **Trash Conveyor STOP/START:**

   This 2 position rotary switch controls the power to the electric motor that drives the trash conveyor. Turn counter-clockwise to STOP and clockwise to START.

5. **Emergency STOP Control:**

   This red push/pull button is the emergency STOP control for the machine and stops all functions. Push the control in for emergency STOP. Place all the individual controls in their OFF position. Before the machine can be restarted, the Emergency STOP button must be pulled out. If the individual controls are not all placed in their OFF position when the STOP button is pulled out, all the motors will try to start at the same time. **DO NOT use the emergency STOP switch as a master start switch.**

6. **Water System Ball Valves:**

a. **Sump Valve:**
This ball valve controls the flow of water out of the tank sump and into the cyclone cleaners. Place the handle parallel to the line to open it and at right angles to close it or stop the flow. The line is always wide open during operation.

Fig. 4 SUMP VALVE

b. **Cyclone Valve:**
This ball valve controls the system pressure through the cleaning cyclones. Close slightly and set a small back-pressure in system to remove contaminants from the water.

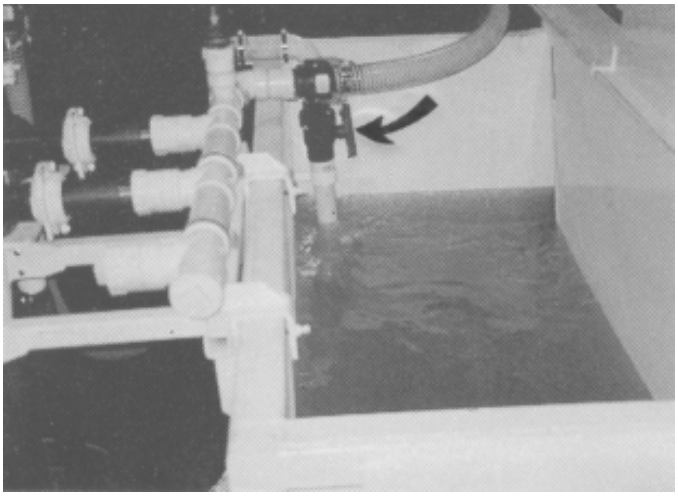


Fig. 5 CYCLONE VALVE

c. **Recirculation Tri-Valve:**
This 3 direction ball valve directs the flow of water from the recircula tion pump. Move the handle to point in the direction of flow:

i. Point toward the sump to direct the flow to the sump.

ii. Point toward the washer to direct the flow to the washer.

iii. Point toward the recirculation pump to direct the flow to both the sump and washer.

d. **Recirculation Valve:**
This valve controls the flow to the recirculation system. Place the handle parallel to the line to open the valve and provide flow. Place at right angles to the line to close the valve and stop the flow. Always open the valve during opera tion.

7. **Cyclone System Backpressure:**
This gauge measures the backpressure in the cyclone system. Use the cyclone valve to set and control the backpressure. Some pres-sure is required for the cyclones to function.

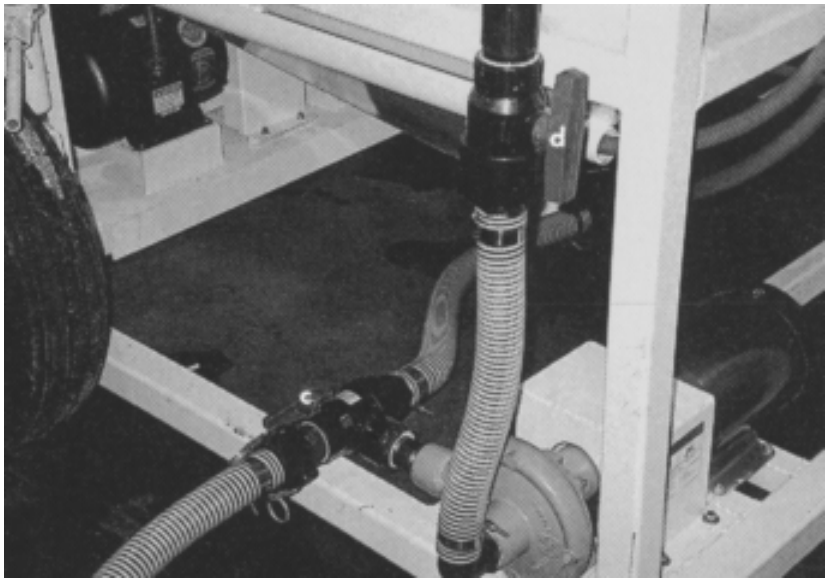


Fig. 6 RECIRCULATION SYSTEM

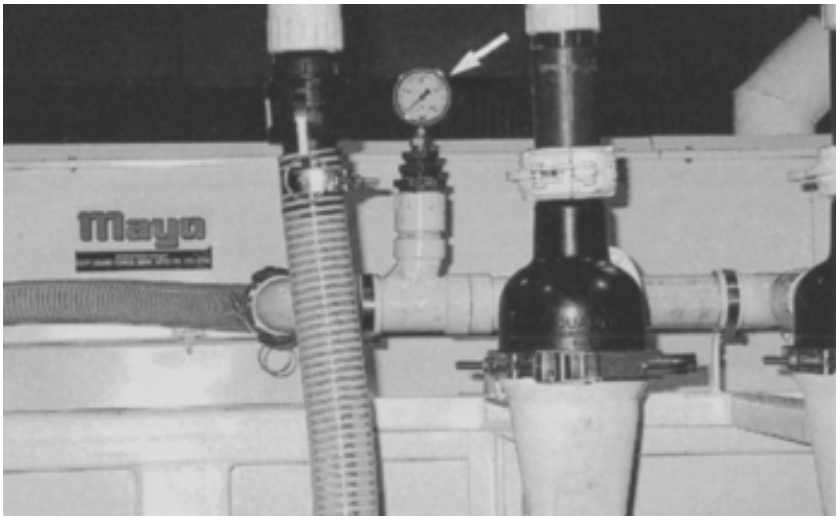


Fig. 7 PRESSURE GAUGE

4.7 MACHINE PREPARATION

The machine must be properly prepared prior to using. Before starting machine, be sure that the following items are appropriate for your machine and operating requirements:

1. **Power: Have a licensed electrician provide power at the required voltage, phase and amperage for your machine. An Improper source of power will cause damage to electrical components and could create an electrical hazard to the operator, worker or bystanders.**

   Be sure to use an extension cord of the correct specifications for the power being carried. Route the cord so that it does not interfere with the working area. Provide appropriate protection when people or equipment must go over the cord. Inspect the cord occasionally to be sure it is not damaged. Replace immediately if it is damaged.

2. **Wheel Assembly Jacks:**
   Each machine is equipped with 2 wheels for moving and transporting. The wheels are attached to an assembly that can move up and down as required and is positioned by a ratchet jack. Use the ratchet jack to raise the wheels and rest the frame on the ground during operation. Lower wheels for moving and transporting.

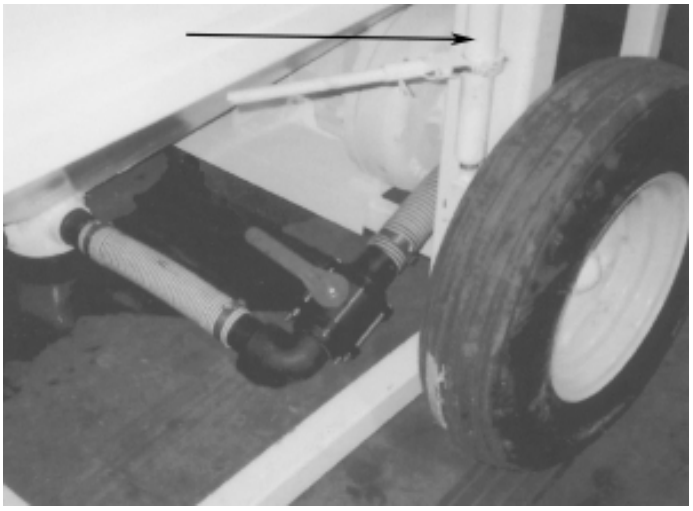


Fig. 8 WHEEL ASSEMBLY JACKS

3. **Water:**
   The machine must be filled with water until the level is just below the overflow port and covers the recirculation pump outlet a few inches. Add during operation if required to maintain this level.

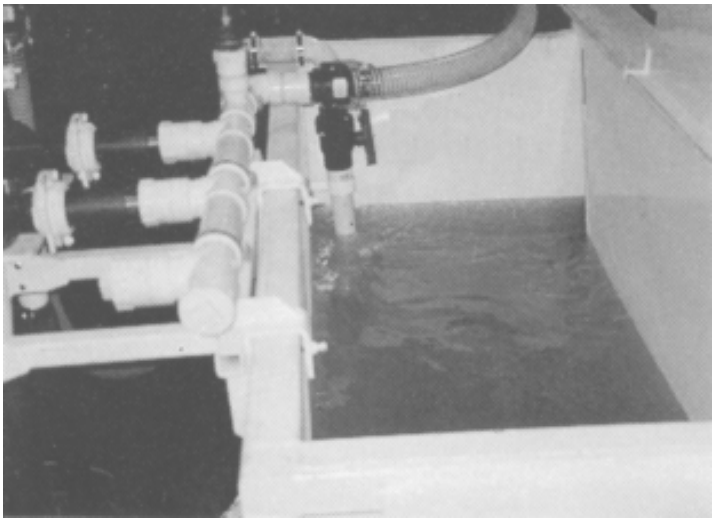


Fig. 9 WATER LEVEL

4. **Auxiliary Equipment:**
Each customer must provide a means to collect and hold the slurry being expelled by the cyclones and to remove the trash from the end of the trash conveyor.

a. A barrel(s) or tank work well to collect the slurry. 2 to 5 gallons per minute of slurry can be expected. Size your collector accordingly.

b. Use a conveyor or holding system to remove the trash.

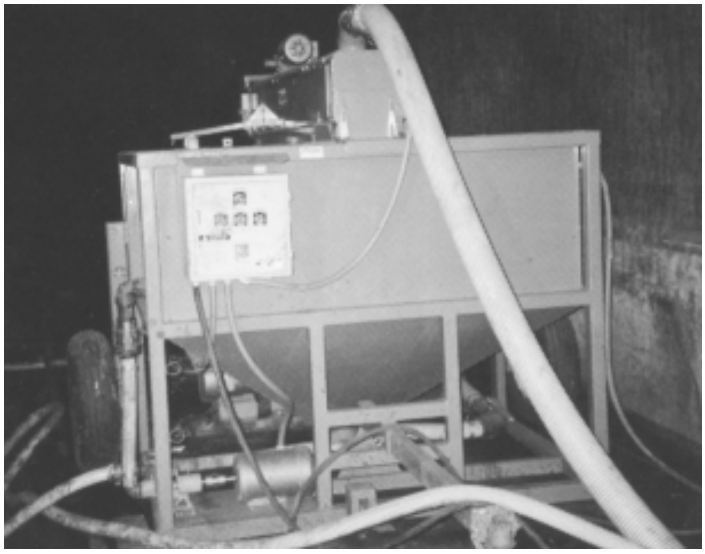


Fig. 10 AUXILIARY EQUIPMENT

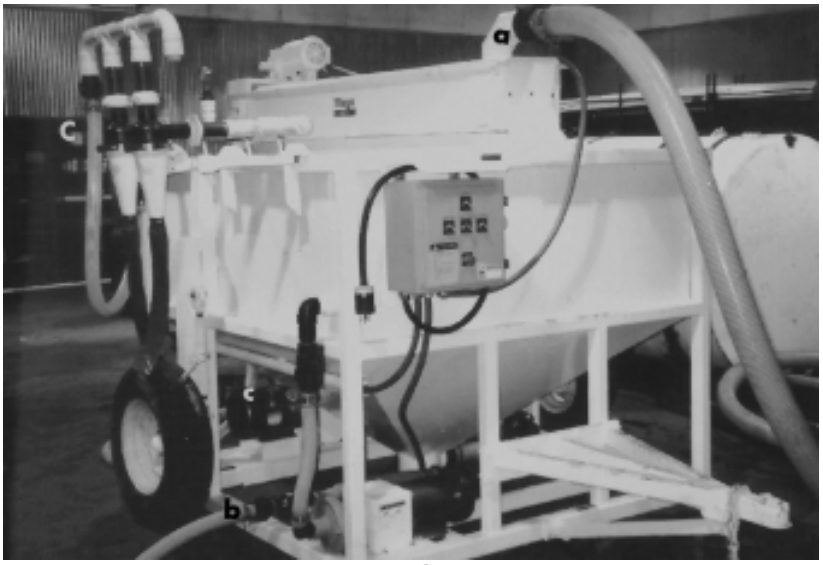
5. **Water Lines:**
Water lines must be installed between the tank and the Washer to transfer water between the two machines.

a. Connect the 4 inch line between the Washer sump and the trash conveyor intake using the cam lock coupler.

b. Connect the 2 inch recircula tion line between the recircula-tion pump and input line using the cam lock couplers.

c. Connect the 2 inch line between the cyclone pump and the cyclones using the cam lock couplers.

Washer



Tank

Fig. 11 WATER LINES

4.8 OPERATING

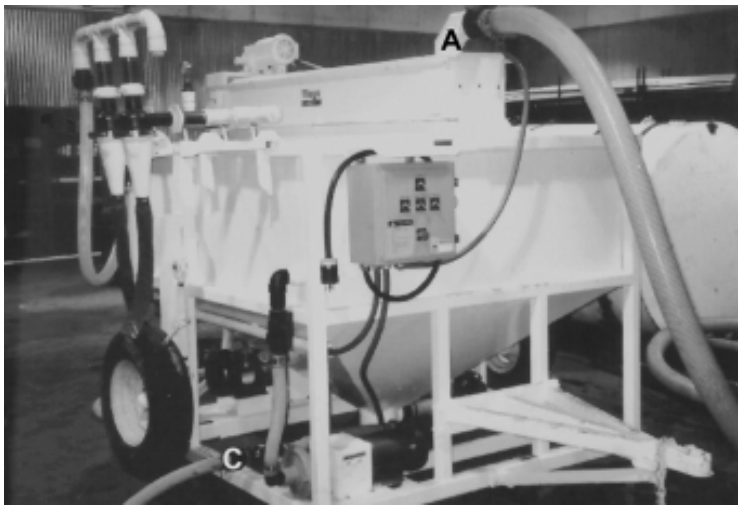
OPERATING SAFETY

1. Read and understand the Operator's Manual and all safety signs before operating, maintaining, adjusting or repairing the Recirculating Tank.
2. Turn machine OFF, shut down and lock out power supply (safety lockout devices are available through your Mayo dealer parts department), and wait for all moving parts to stop before servicing, adjusting, maintaining or repairing.
3. Install and properly secure all guards and shields before operating.
4. Keep hands, feet, hair and clothing away from all moving parts.
5. Clear the area of bystanders, especially small children, before starting.
6. Make sure all control switches are in the off position before connecting power supply.
7. Before supplying electrical power to the machine, be sure that you have adequate amperage at the proper phase and voltage to run it. If you do not know or are unsure, consult a licensed electrician.
8. Keep the working area clean and dry.
9. Review safety instructions annually.

Follow this procedure when using the Recirculating Tank:

1. Review Section 4.7 Machine Preparation and follow all the instructions.
2. Review and follow the pre-operation checklist (See Section 4.5).
3. Review the location and function of all controls (See Section 4.6).
4. **Water Line Attachment:**
   a. Attach the input line to the top of the trash conveyor and secure.
   b. Attach the input line to the Washer sump and secure.
   c. Attach the recirculation line and secure.
   d. Attach the water inlet line to Washer and secure.
   e. Attach a 3/4" fresh water hose to washer and secure.

Washer



Recirculating Tank

Fig. 12 WATER LINE ATTACHMENT

5. **Starting Recirculating Tank:**
   a. Clear the area of bystanders. Know where everyone is before starting.
   b. Place all controls in the OFF or neutral position.
   c. Turn the power to the machine ON at the master panel.
   d. Turn the master power switch ON (Refer to Section 4.7 Controls).

NOTE

Be sure the red Emergency Stop switch is pulled out.

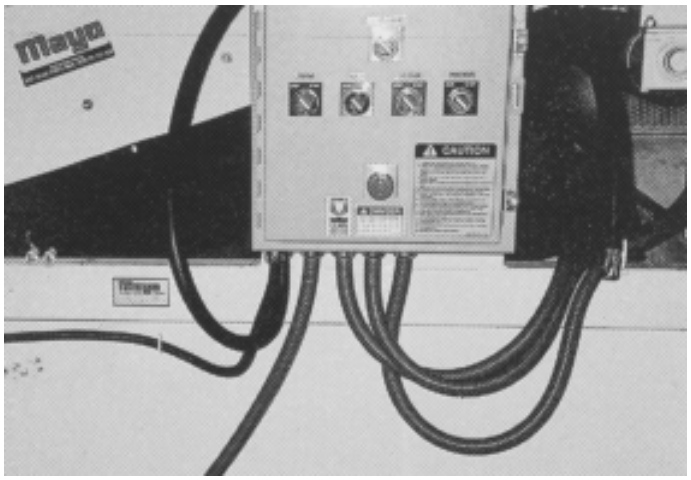
   e. Turn the cyclone pump ON.
   f. Turn the recirculation pump ON.
   g. Turn the trash conveyor ON.
   h. Turn the conveyor ON that removes trash from the trash conveyor.
   i. Turn the washer trash pump ON.

6. **Stopping machine:**
   a. Turn the Washer OFF.
   b. Turn the conveyor OFF that re moves trash from the trash con veyor.
   c. Turn the trash conveyor OFF.
   d. Turn the recirculation pump OFF.
   e. Turn the cyclone pump OFF.
   f. Turn the master power switch OFF.
   g. Turn the power OFF at the master panel and lock out.

An alternative is to depress the red Master STOP button on the control panel but then the operator must go through steps a through g to turn all the controls OFF before restarting.

7. **Emergency STOP:**
   Depress the large red STOP button on the control panel. This will stop the conveyor and pumps. Be sure to turn all the individual control switches to their OFF position and pull the Emergency Stop button out before restarting the machine.

Recirculating Tank



Washer

Fig. 13 CONTROL PANELS

8. **Start-Up:**

At the beginning of each day, it is recommended that the recirculation pump be used to flush any sludge out of the sump. After the machine sits for a time (overnight or longer), contaminants can settle out of the water and collect in the sump. Although the trash pump will eventually pull this sludge out of the sump, it works best to direct the flow from recirculation pump into the sump to remove this sludge. Use the tri-valve in the recirculation circuit to direct the flow into the sump. After 1 or 2 minutes, direct the flow back to the Washer.

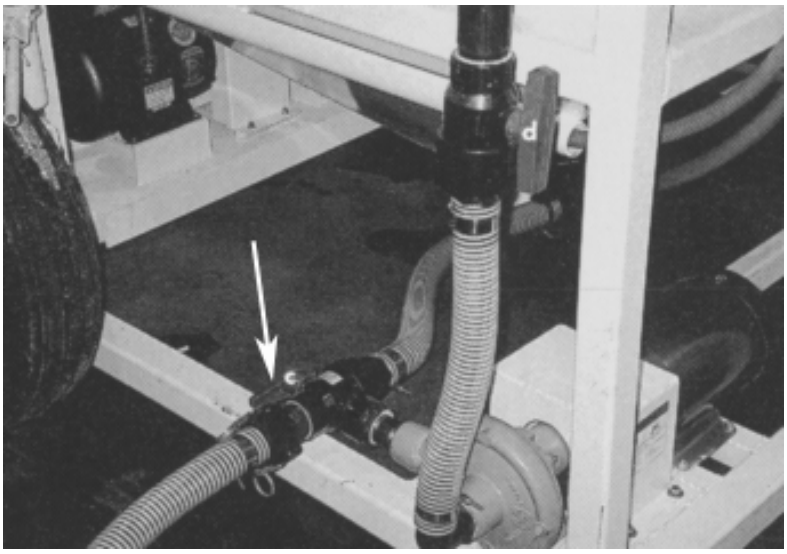


Fig. 14 TRI-VALVE

9. **Auxiliary Equipment:**

Provide a means for collecting and holding the slurry from the cyclones. Size the barrel/tank to hold the slurry (Cyclone discharge) with a 2 to 5 gpm flow rate. Provide another conveyor or system to remove the trash from the trash conveyor. Do not allow this conveyor to move. Normally connecting them keeps them from moving apart.

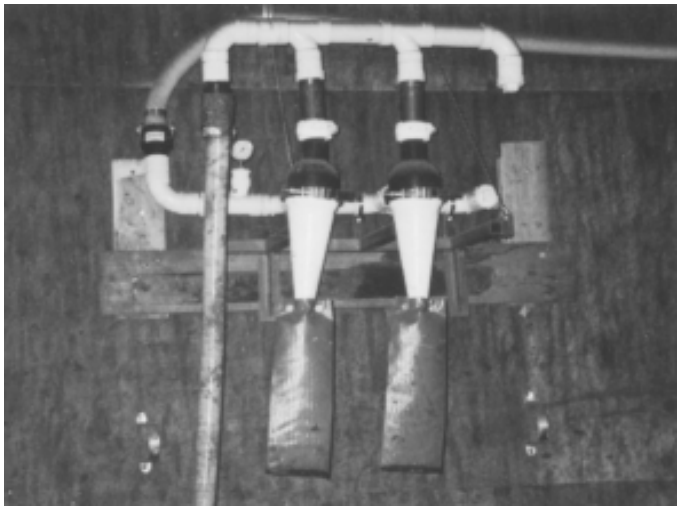


Fig. 15 AUXILIARY EQUIPMENT

10. **Moving:**

All machines are equipped with wheels that are mounted to a movable assembly. Raise the assembly and lower the frame to the ground during operation. Lower the wheels for moving. The hitch can also be removed if desired.

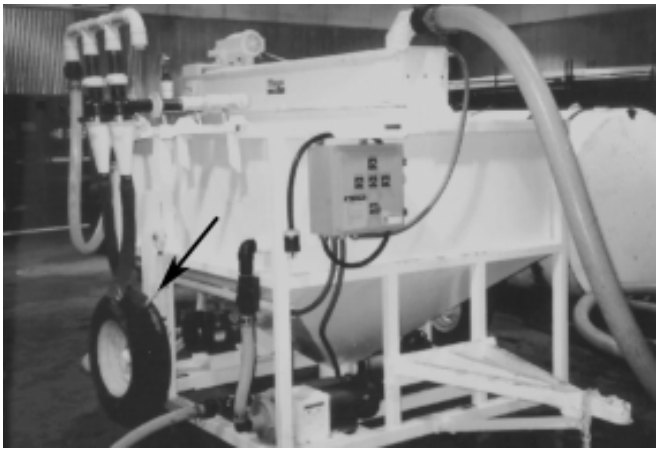


Fig. 16 MOVING

11. **Dirt Removal:**

Dirt and trash are removed from potatoes as they move through the Washer. They are conveyed to the Recirculating Tank on the flow of wash water for removal. Large particles and debris are removed by the trash conveyor on top of the tank.

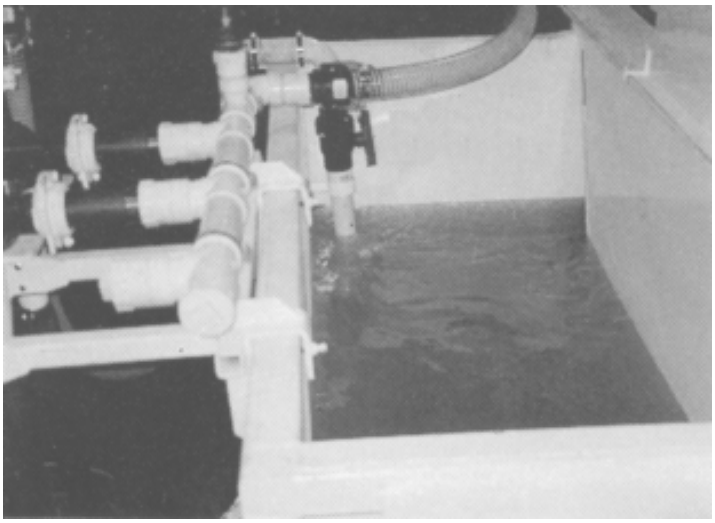
The large particles in solution are removed by the cyclones as the water is pumped through the cyclone segment of the cleaning circuit.

Set the dirt removal rate with the cyclone discharge valve. Close Slightly to provide a small back pressure in the system. This back pressure should be set to provide a flow of 2 to 5 gpm of water out of the cyclones. Flow rates that are set too low will have mud coming out of the cyclones. If too high, too much water will be pulled out of the system.

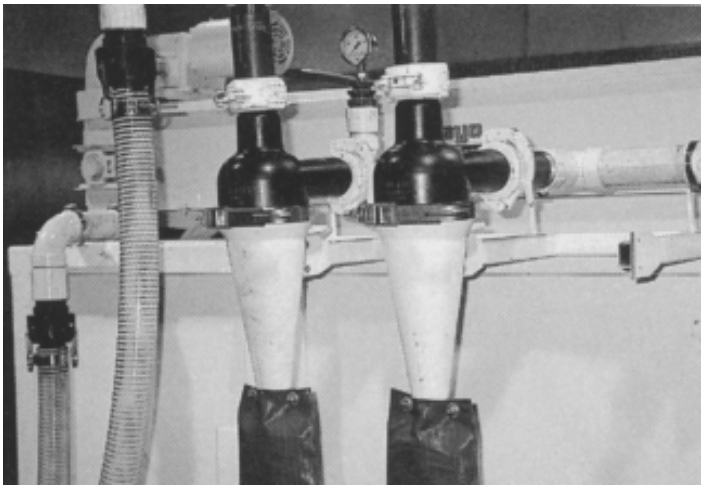
The cyclones remove the majority of the large particles in the water but not the fines. As a result, after a period of time, the fines will color the water and it will be dirty. Change the water at this time.

12. **Disposal:**

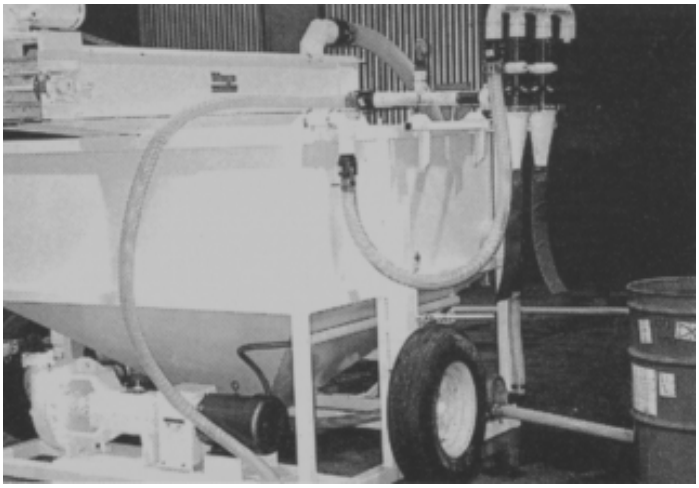
When the collecting barrels/tanks are full, dispose of the slurry in an environmentally safe manner. Dispose of dirty wash water in the same manner.



Cyclone Valve



Pressure Gauge



Collecting Barrels (Typical)

Fig. 17 DIRT REMOVAL

13. **Operating Hints:**

a. Be sure that all workers and operators are supplied with and use the required safety gear.

b. Keep the working area clean and as dry as possible to prevent slipping and tripping.

c. Train all operators before starting. An untrained operator is not qualified to operate this machine and can expose himself and others to needless haz ards.

d. Secure all water lines with the cam couplers to prevent leaks.

e. Set the cyclone system to expel 2 to 5 gpm of slurry from the cyclones for the best results.

f. Use the recirculation pump to flush the fines out of the sump at the start of each working day.

g. Replace the water when the fines get the water dirty.

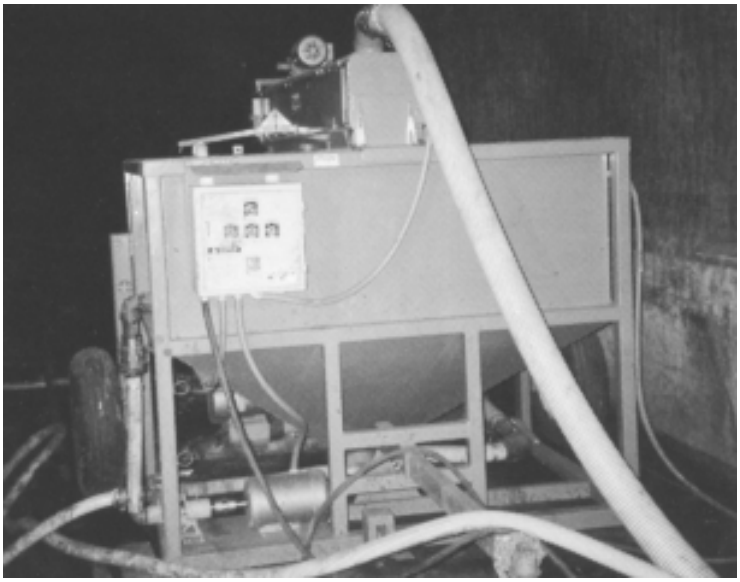


Fig. 18 OPERATING SYSTEM

4.9 TRANSPORT

TRANSPORT SAFETY

1. Make certain that you are in compliance with Local, state/provincial and federal regulations regarding transporting agricultural equipment on public roadways.
2. Make certain that all wheels and tires are in good repair and that tires are inflated to proper pressure. Do not underinflate or overinflate.
3. Make certain that all wheel bolts/lug nuts are tightened to proper torque specifications (refer to specification chart in section 7.2).
4. Make certain that all mechanical locks and integral anchor chains are safely and positively connected before loading or transporting.
5. Raise and secure all jack stands.
6. Wrap up and bind to the frame all loose water lines and electrical ends.
7. Be sure that any necessary SMV (slow moving vehicle) signs, reflectors and lights required by law are in proper place and are clearly visible to oncoming and overtaking traffic.
8. Be sure that the Recirculating Tank is positively hitched to the towing vehicle. Use a proper safety chain to assure a safe hitch hook-up when transporting.
9. Adhere to local regulations regarding maximum weight, width and length.
10. Do not exceed 20 MPH (32 Km/H). Reduce speed on rough roads and surfaces.
11. Do not allow anyone to ride on the Recirculating Tank or towing vehicle during transport.
12. Always use hazard flashers on the towing vehicle when transporting.

Mayo Recirculating Tanks are designed to be easily and conveniently moved from location to location. The term moving is used to describe the action of moving the machine within a storage facility. Transporting is used to describe when the machine is being towed by a tractor or other power unit on a public highway. When transporting, follow this procedure:

1. Disconnect and remove all auxiliary equipment from the Recirculating Tank and position so the tractor can back up to the front of the machine.
2. Turn the sump and recirculation line valves OFF and disconnect the inlet and water hoses. Drain the sump and plumbing if desired.

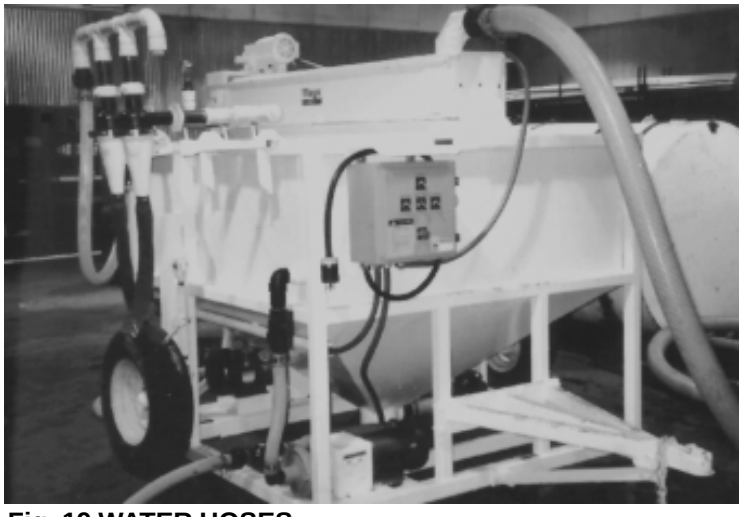


Fig. 19 WATER HOSES

4.9 TRANSPORT (cont'd)

3. Install and secure the tow hitch if removed.

4. Use the ratchet to lower the wheel assembly and raise the frame off the ground.

5. Attach the tow hitch to the ball on the tractor and close the jaws. Be sure to use a mechanical retainer through the hitch.

6. Attach a safety chain between the hitch and the drawbar cage to prevent unexpected separation.

7. Install an SMV on the rear frame.

8. Use pilot vehicles or install extra lights on the machine when transporting.

9. Clean all the reflectors.

10. Place all controls in their OFF or neutral position.

11. Turn the power OFF at the master panel and lock out.

12. Unplug and remove the power cord.

13. Be sure all bystanders are clear of the machine.

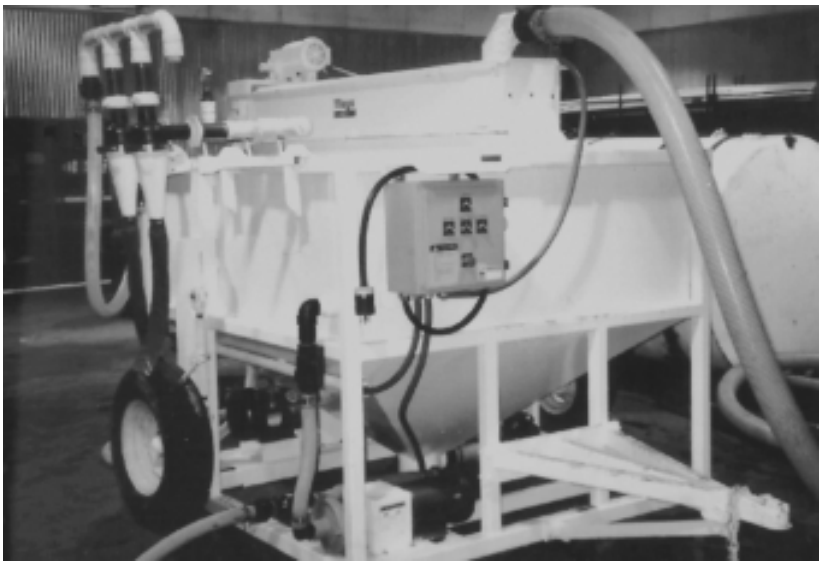
14. Keep to the right and yield the right-of-way to allow faster traffic to pass. Drive on the road shoulder, if permitted by law.

15. Make sure the SMV (Slow Moving Vehicle) emblem and all the lights and reflectors that are required by the local highway and transport authorities are in place, are clean and can be seen clearly by all overtaking and oncoming traffic.

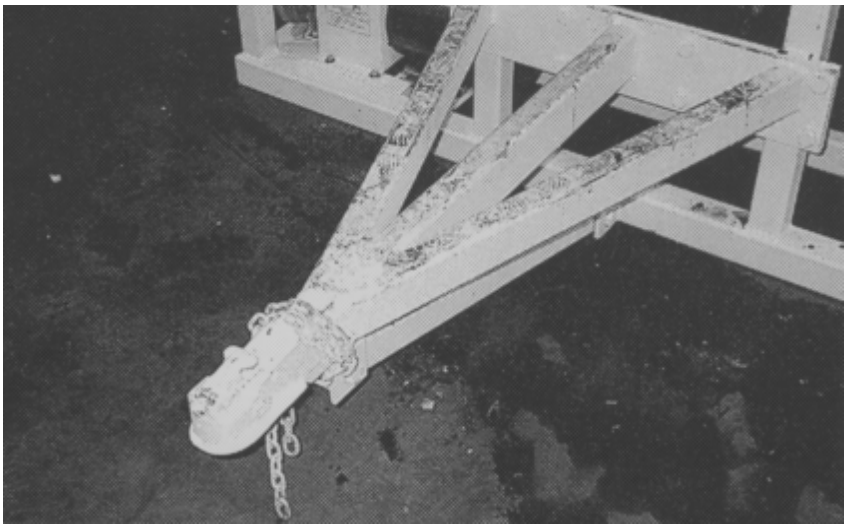
16. It is not recommended that the machine be transported faster than 15 mph (25 km/hr). Table 1 gives the acceptable transport speed as the ratio of tractor weight to Recirculating Tank

17. Do not allow riders on the machine or tractor.

18. Always use hazard flashers on the tractor when transporting unless prohibited by law.



Wheels



Tow Hitch

Fig. 20 MOVING

Table 1 Travel Speed vs Weight Ratio

Road Speed	Weight of fully equipped or loaded implement(s) relative to weight of towing machine
Up to 25 km/h (15 mph)	1 to 1, or less
Up to 16 km/h (10 mph)	2 to 1, or less
Do not tow	More than 2 to 1

4.10 STORAGE

⚠ STORAGE SAFETY

1. Store the Recirculating Tank on a firm level surface.
2. If required, make sure the unit is firmly blocked up.
3. Make certain that all mechanical locks are safely and positively connected before storing.
4. Store away from areas of human activity.
5. Do not allow children to play on or around the stored Recirculating Tank.
6. Lock out power by turning off master control panel or junction box and padlocking the door shut to prevent electrocution or unauthorized start up of the Recirculating Tank.

4.10.1 PLACING IN STORAGE

At the end of the season, the machine should be thoroughly inspected and prepared for storage. Repair or replace any worn or damaged components to prevent any unnecessary down time at the beginning of the next season. Follow this procedure:

1. Use fresh water to flush the tank and water system to remove all contaminants.
2. Check all rotating parts for entangled material. Remove.
3. Inspect the trash conveyor chain. Properly tension the chain if required.
4. Turn the power OFF at the master electrical panel and lock out.
5. Unplug and remove power cord from machine.
6. Thoroughly wash the machine using a pressure washer to remove all dirt, mud, debris or residue.
7. Lubricate all grease fittings. Make sure all grease cavities have been filled with grease to remove any water residue from the washing.
8. Inspect all the water hoses, lines, fittings and nozzles. Tighten any loose fittings. Replace any hose that is badly cut, nicked, abraded or separating from a fitting. Replace any damaged components.
9. Inspect all the electrical cords, lines, junction boxes and motors. Tighten any loose connections. Replace any cord that is badly cut, nicked or abraded. Replace any damaged components.
10. Inspect each conveyor drive system. Check the condition of the roller chain. Replace any if badly worn. Check the alignment of the sprockets. Align if required. Properly tension each drive chain.
11. Apply a light coat of oil to each roller chain to prevent rusting.
12. Touch up all paint nicks and scratches to prevent rusting.
13. Select a storage area that is dry, level and free of debris.
14. Cover with a weather-proof tarpaulin and tie down if stored outside.

4.10.2 REMOVING FROM STORAGE

When preparing to use the machine at the start of the season, follow this procedure:

1. Remove the tarpaulin if covered.
2. Transport or move to the working area.
3. Check
   a. Water and electrical systems and components.
   b. Conveyor chain and drive systems.
   c. All hardware. Tighten as required.
4. Replace any defective components.
5. Go through the pre-operation checklist (Section 4.5) before starting.

5 SERVICE AND MAINTENANCE

⚠ MAINTENANCE SAFETY

1. Read and understand all the information contained in the Operator's Manual regarding operating, servicing, adjusting, maintaining and repairing.

2. Turn machine OFF, shut down and lock out power supply (safety lockout devices are available through your Mayo dealer parts department), and wait for all moving parts to stop before servicing, adjusting, maintaining or repairing.

3. Follow good shop practices:
   - Keep service area clean and dry.
   - Be sure electrical outlets and tools are
   - properly grounded.
   - Use adequate light for the job at hand.

4. Make sure all guards and doors are in place and properly secured when operating the Recirculating Tank.

5. Do not work on Recirculating Tank electrical system unless the power cord is unplugged and the power supply is locked out.

5.1 SERVICE

5.1.1 FLUIDS AND LUBRICANTS

1. Grease
   Use an SAE multi-purpose high temperature grease with extreme pressure (EP) performance meeting or exceeding the NLGI #2 rating for all requirements.

2. Speed Reducer Gear Box Lubricant Use a Browning Worm Gear high-temperature GL32HT lubricant (AGMA Compo #8) or equivalent.

3. Roller Chain Lubricating Oil

CHAIN TYPE*	AMBIENT TEMPERATURE RANGE		
	14°F-32°F	32°F-104°F	104°F-122°F
RS-50-less	SAE 10	SAE 20	SAE 30
RS-60/RS-80	SAE 20	SAE 30	SAE 40
RS100	SAE 20	SAE 30	SAE 40
RS120/MORE	SAE 30	SAE 40	SAE 40

* Stamped on chain link side plate

4. Storing Lubricants
   Your machine can operate at top efficiency only if clean lubricants are used. Use clean containers to handle all lubricants. Store them in an area protected from dust, moisture and other contaminants.

5.1.2 GREASING

Refer to Section 5.1.1 for recommended grease. Use the Maintenance Checklist provided to keep a record of all scheduled maintenance.

1. Use only a hand-held grease gun for all greasing. Air powered greasing systems can damage the seals on bearings and lead to early bearing failure.

2. Wipe grease fitting with a clean cloth before greasing to avoid injecting dirt and grit.

3. Replace and repair broken fittings immediately.

4. If a fitting will not take grease, remove and clean thoroughly. Also clean lubricant passageway. Replace fitting if necessary.

5. **Conveyor Bearings:**
   Only sealed bearings are used on the conveyor and roller bearings. Sealed bearings should never be greased more often than weekly or every 50 hours. Do not over-grease. Do not give bearing more than 1 shot of grease each time it is greased. (Once the bearing seal is broken, the bearing must be greased each day or the bearing will fail.)

5.1.3 SERVICING INTERVALS

8 Hours or Dally

1. Oil the trash conveyor drive system roller chain (1 location).

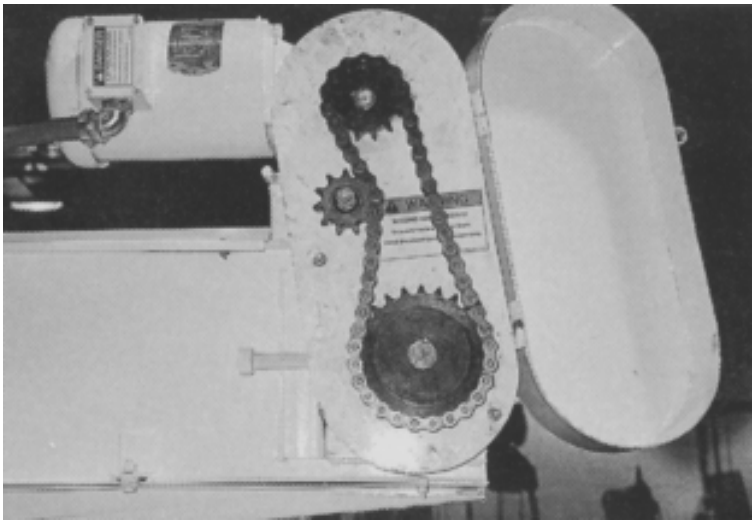


Fig. 21 TRASH CONVEYOR DRIVE

2. Check the trash conveyor tension and alignment. Tension or align as required.

3. Inspect water system and all components.

4. Inspect electrical system and all components.

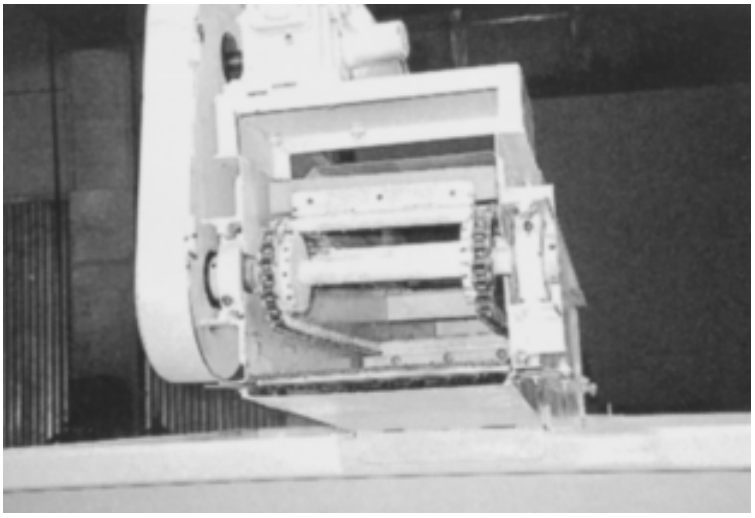


Fig. 22 TRASH CONVEYOR

Weekly or 50 Hours

1. Grease trash conveyor drive shaft bearings with 1 shot of grease (2 locations).

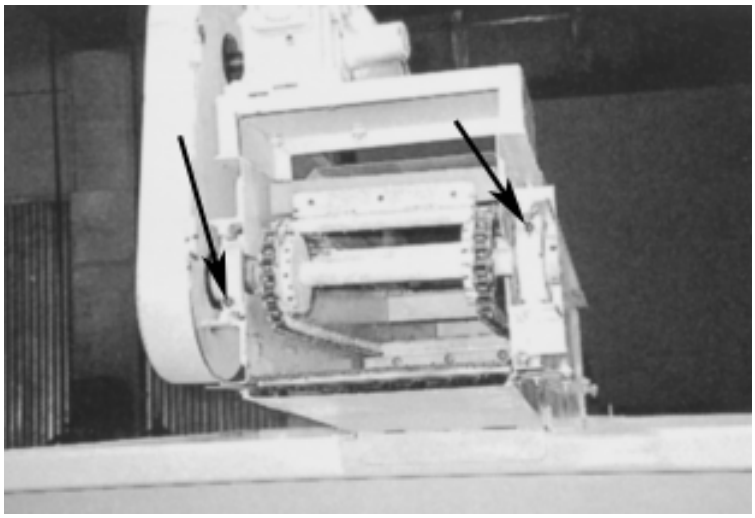


Fig. 23 TRASH CONVEYOR BEARINGS

IMPORTANT

Only sealed bearings are used on the conveyor bearings. Sealed bearings should never be greased more often than weekly or every 50 hours. Do not over-grease. Do not give bearing more than 1 shot of grease each time it is greased. Once the bearing seal is broken, the bearing must be greased each day or the bearing will fail.

2. Check the oil level in the gearbox (1 location).

Fig. 24 LEVEL PLUG

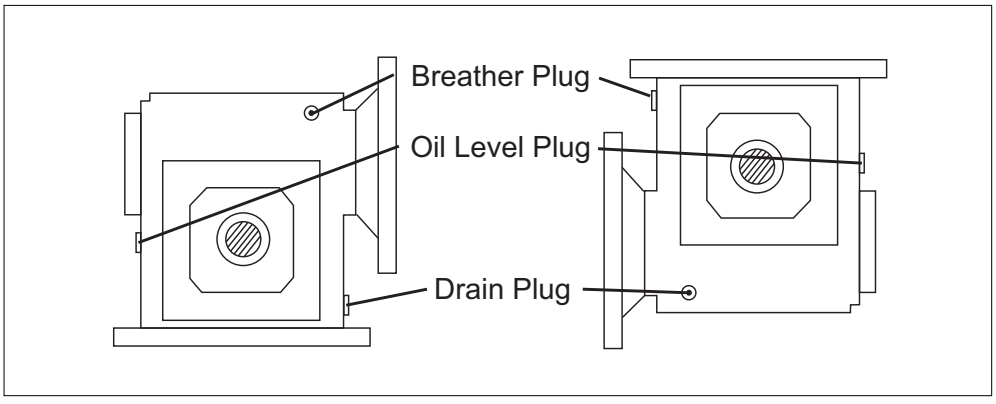


Fig. 25 GEAR BOX SCHEMATIC (TYPICAL)

Weekly or 50 Hours (cont'd)

3. Check the roller chain tension and sprocket alignment.

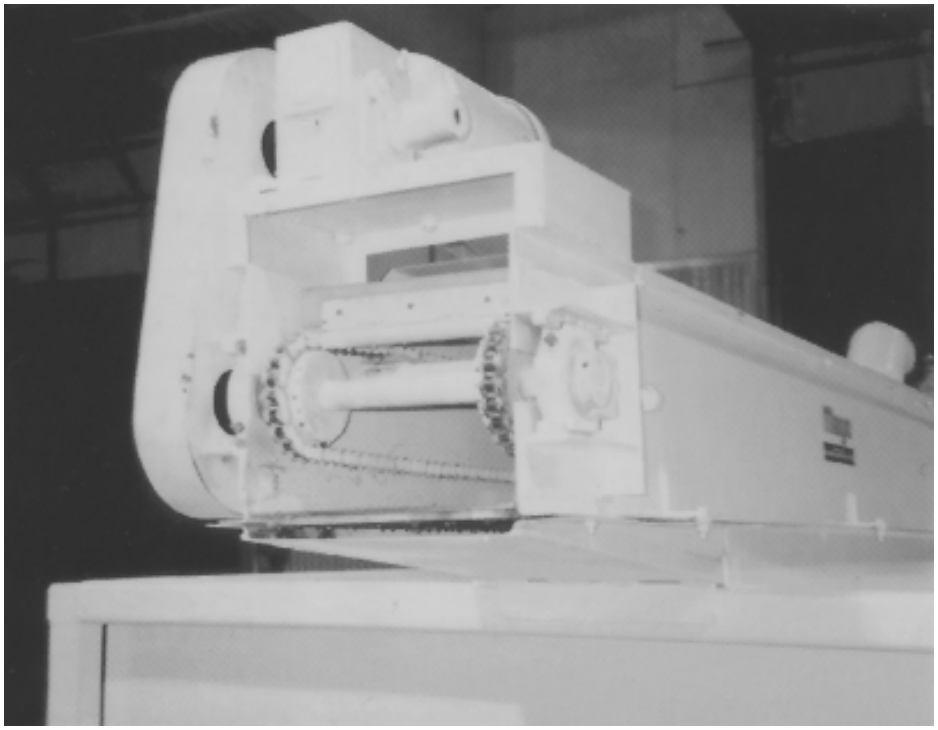


Fig. 26 ROLLER CHAIN TENSION

200 Hours or Annually

1. Grease the ratchet jacks (2 locations each jack).

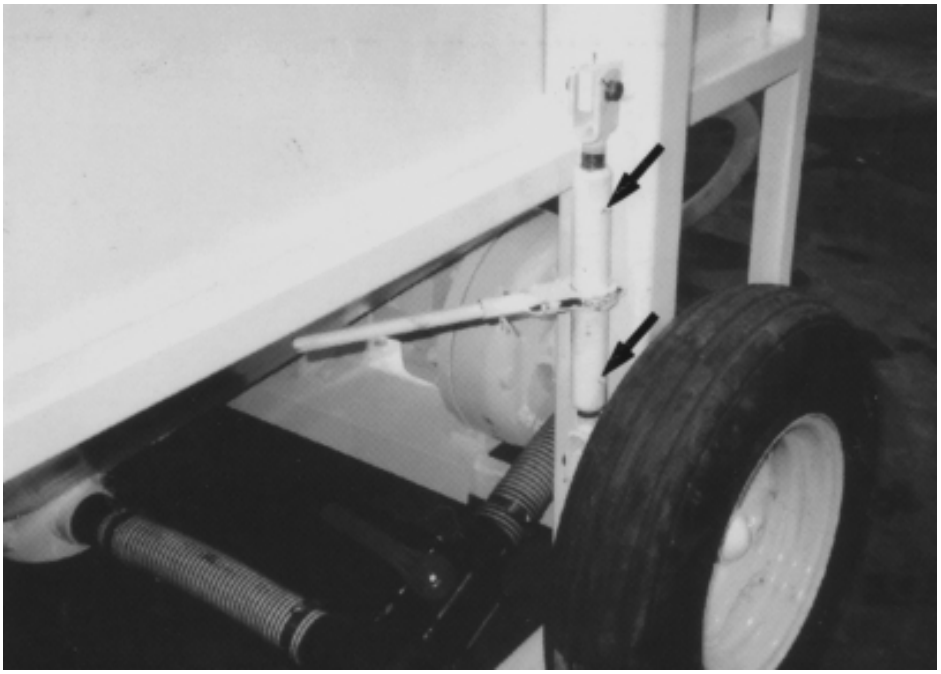
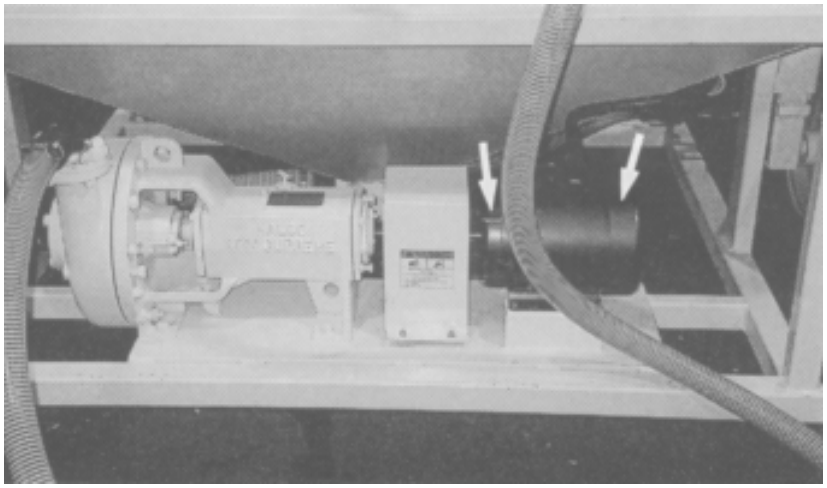


Fig. 27 RATCHET JACK (TYPICAL)

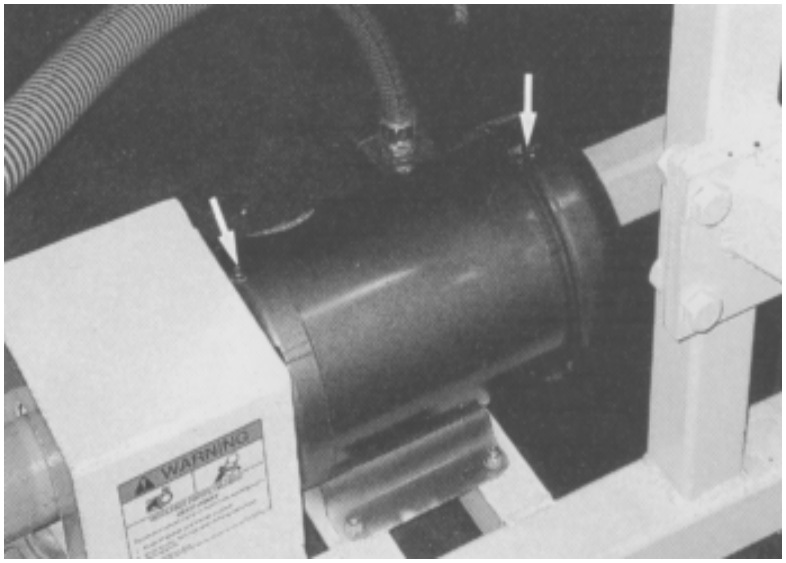
2. Grease the electric motor bear ings with 1 shot of grease (2 locations each motor).

IMPORTANT

Do not over-grease electric motors. Over-greasing can render the electric motor inoperative.



Cyclone Pump



Recirculation Pump

Fig. 28 ELECTRIC MOTORS

200 Hours or Annually (cont'd)

3. Change the oil in the speed reducing gear box in the drive system (1 location).

⚠ WARNING

Machine is shown with guards opened for illustrative purposes only. Do not operate with guards opened.

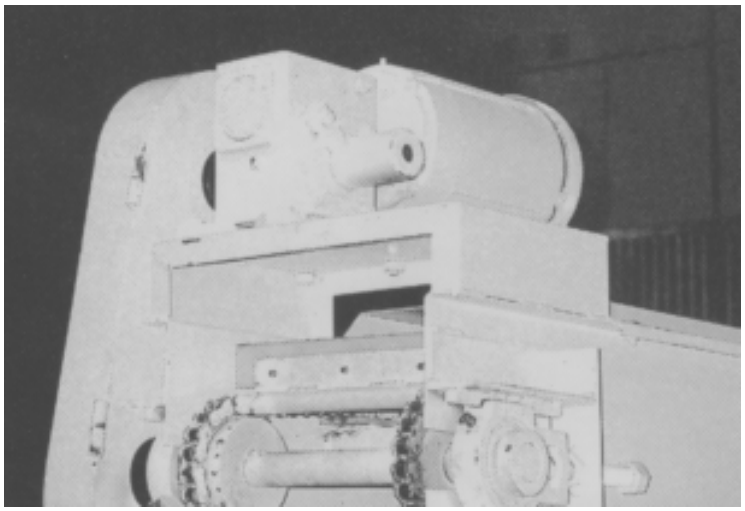


Fig. 29 GEAR BOX

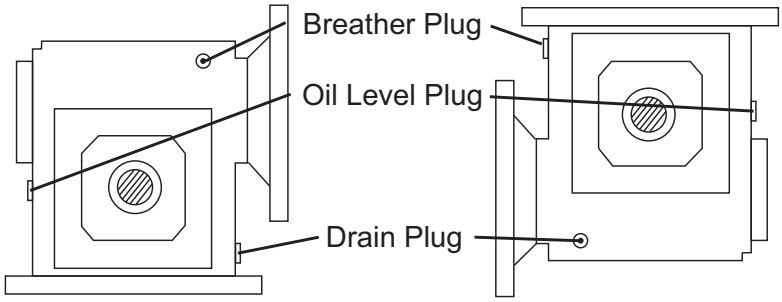
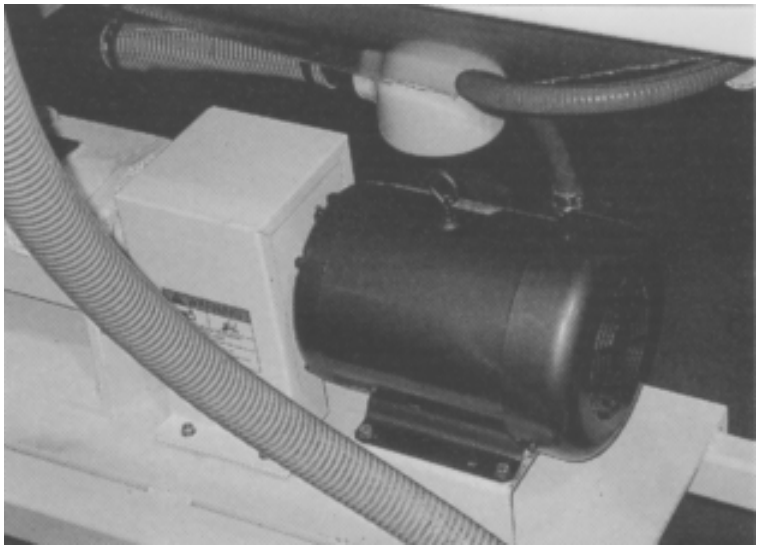


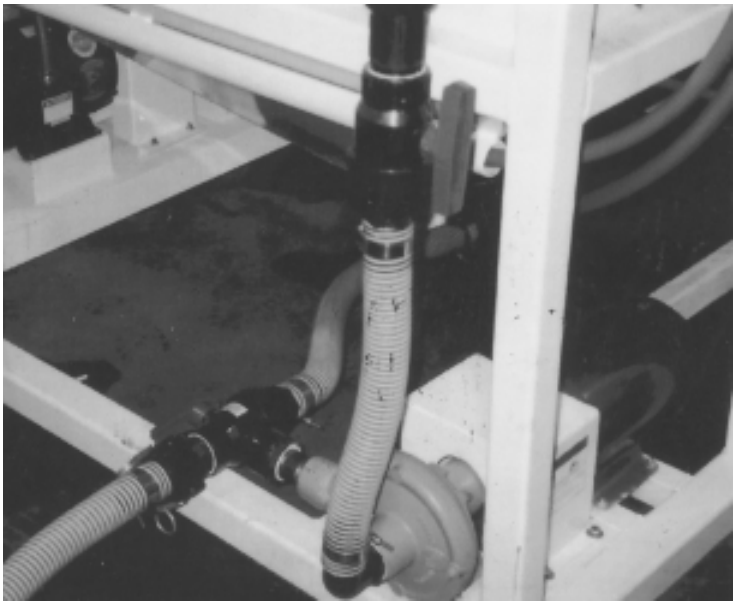
Fig. 30 GEAR BOX SCHEMATIC (TYPICAL)

200 Hours or Annually (cont'd)

4. Oil the roller chain in the pump input drive couplers (2 locations).



Cyclone Pump



Recirculation Pump

Fig. 31 PUMP INPUT DRIVE COUPLER

200 Hours or Annually (cont'd)

5. Clean the gearbox breather plug (1 plug).

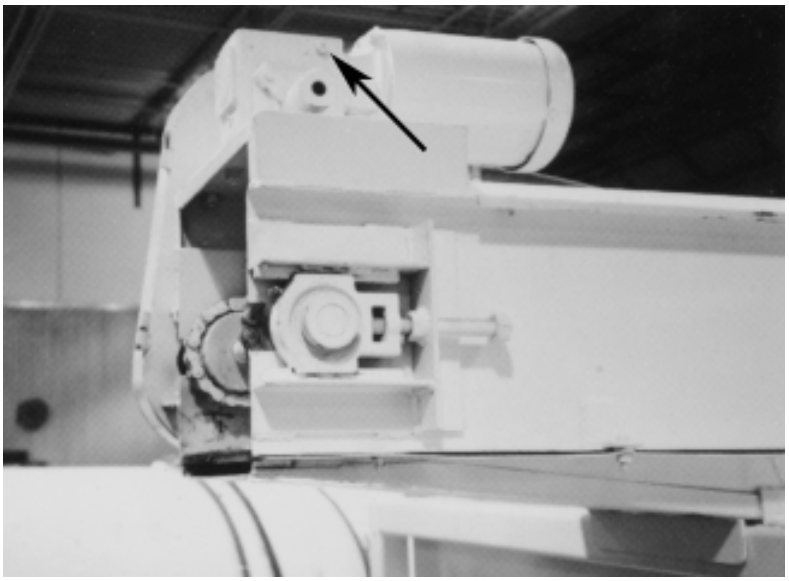


Fig. 32 BREATHER PLUG

6. Repack each wheel bearing.

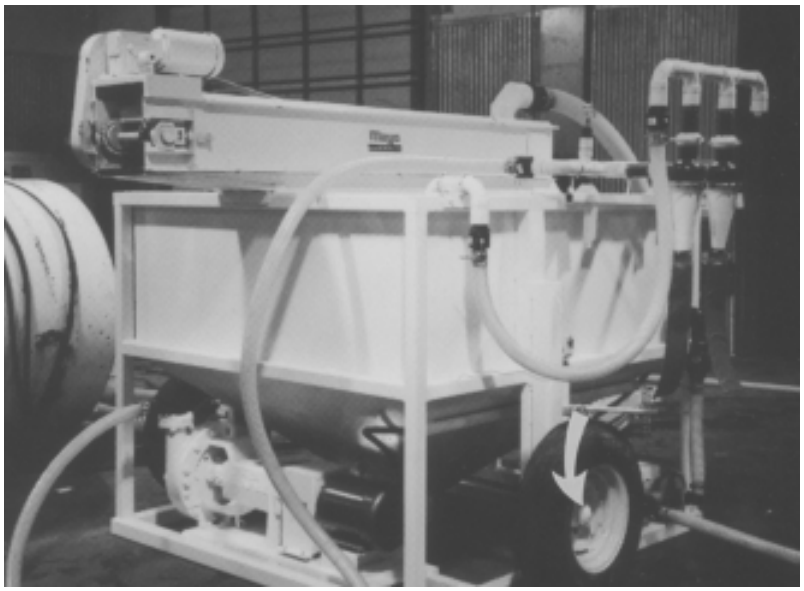


Fig. 33 WHEELS (TYPICAL)

5.1.4 SERVICE RECORD

See Lubrication and Maintenance sections for details of service. Copy this page for continuous record.

ACTION CODE: √ CHECK L LUBRICATE C CHANGE RE REMOVE CL CLEAN IN INSPECT R REPACK

HOURS / SERVICED BY / MAINTENANCE																
8 HOURS OR DAILY																
L Trash Conv Dr. Sys Roller Chain																
√ Trash Conveyor Tens & Align.																
IN Water System & Components																
IN Electrical Syst & Components																
50 HOURS OR WEEKLY																
L Trash Conveyor Dr. Shaft Brgs																
√ Oil Level in Gearbox																
√ Roller Chain Tension																
√ Sprocket Alignment																
200 HOURS OR ANNUALLY																
L Ratchet Jacks																
L Electric Motor Bearings																
C Oil in Speed Reduce Gearbox																
L Roller Chain-Pump Dr. Coupler																
CL Gearbox Breather Plug																
R Each Wheel Bearing																

5.2 MAINTENANCE

By following a careful service and maintenance program on your machine, you will enjoy many years of trouble-free use.

5.2.1 ELECTRICAL SYSTEM INSPECTION

Electricity provides power to all systems on the Recirculating Tank. To maintain the integrity of each system and provide a safe working environment for the operator, it is important that a daily inspection be done to make sure that all systems and components are in good working condition. To provide a safe working environment, have a licensed electrician provide power to the machine.

When inspecting the electrical system and components, follow this procedure:

1. Place all switches in the OFF position.

2. Turn power OFF at the master panel and lockout before starting the inspection.

⚠ WARNING

Do not operate the machine unless the master panel is equipped with a lock-out device. Always engage lock-out device before performing any maintenance work. Lock-out devices are available from your dealer or the factory.

3. Inspect all electrical components looking for:
   a. Damaged plugs.
   b. Frayed wires.
   c. Cut or cracked insulation.

4. Replace any damaged components immediately.

5. Be sure all components are grounded.

6. Be sure there is no water or moisture in any junction box or enclosure. Dry the components before turning power on. Be sure that all compartments seal properly when closed.

5.2.2 ELECTRIC MOTOR RESTART

It is recommended that only a licensed electrician perform maintenance work on the electrical system.

All electric motors are supplied with power through an individual circuit that includes a circuit breaker, switch, contactor and overload relay that are all incorporated into a single electrical component inside the control panel. The contactor is the main connecting device for power to the motor. If the current is greater than the adjustable dial of the relay, the relay will trip and cut off power to the coil of the contactor. When this happens, the contactor dial will move to a new position and indicates the cause of the overload. It must be reset before the motor can be restarted.
When a motor will not start:

1. Turn the switch to its OFF position.

2. Turn the switch to its ON position.

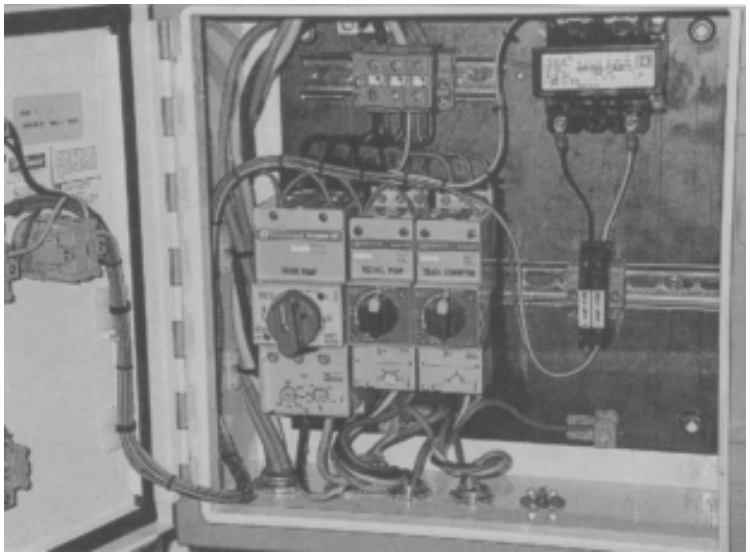
3. If the motor will not start, turn machine OFF and lock out power at the master control panel before opening the control panel.

4. Turn the contactor dial counter-clockwise to the manual reset position. Then, turn the contactor dial clockwise to the ON contactor open position.

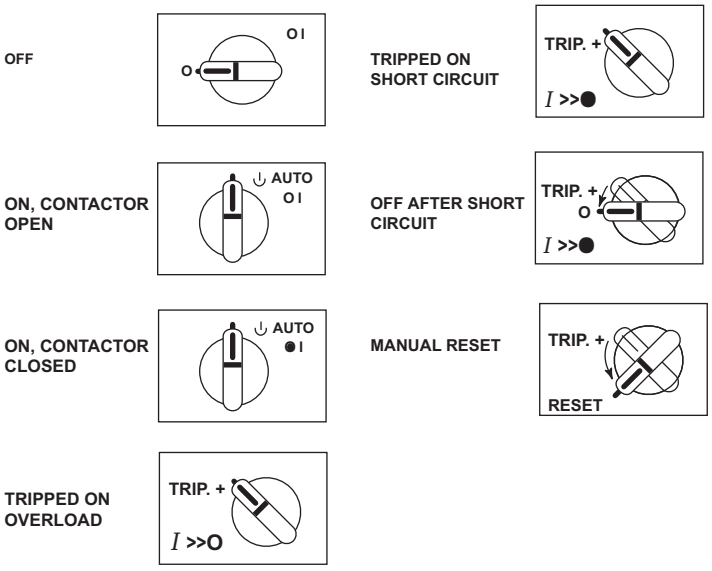
5. Close and secure the panel door and turn the power to the machine ON.

6. If the motor still will not start you have one of the following conditions:

   a. The motor is hot and must cool a period of time before attempting to restart.



Circuitry



Schematics

Fig. 34 MOTOR RESTART

NOTE

If your conveyor utilizes single phase motors, chances are good that the motor has a thermal overload located on the electrical junction box of the motor itself. If this is the case then, fully depress the reset button to make certain that the overload circuit is closed.

   b. The overload is adjusted incorrectly for the amperage of the motor and must be properly adjusted.
   c. The overload and/or contactor has fulfilled it's service life and is in need of replacement.
   d. The motor is bad and needs replacing.
   e. An electrical short exists somewhere in the circuit.

5.2.3 SPEED REDUCER GEARBOX OIL

The trash conveyor is driven by an electric motor that is attached to a high ratio speed reducing gearbox to give the required operating speed. The gearbox is equipped with a drain, level and fill plug. Every 50 hours, the oil level should be checked. Every 200 operating hours or annually, whichever comes first, the oil should be replaced. Check more frequently if there are leaks around any of the plugs or shaft seals. When checking oil level or changing oil, follow this procedure.

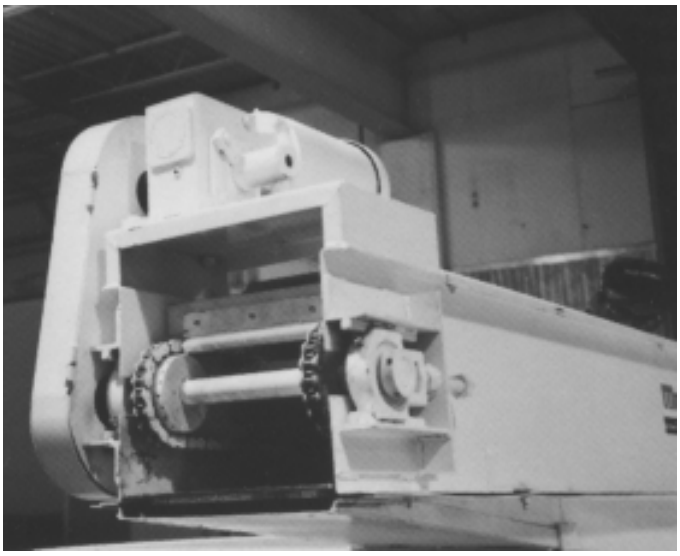


Fig. 35 GEARBOX

1. Run the trash conveyor until the gearbox is warm. Warm oil will remove more contaminants than cold stagnate oil.

2. Stop the drive.

3. Place all controls in their OFF position.

4. Turn the power OFF at the master panel and lockout.

WARNING

Machine is shown with guards opened for illustrative purposes only. Do not operate with guards opened.

5. **Checking oil level:**
   a. When the gearbox is cold, remove the level plug from the side of the gearbox.
   b. When the oil just fills the threads of the level plug, it is at the correct level.
   c. Add oil through the fill plug as required.
   d. Install and tighten level and fill plugs.

6. **Changing oil:**
   a. Place a container under the drain plug.
   b. Remove the drain, level and fill plugs.
   c. Allow 10 minutes to drain.
   d. Install and tighten the drain plug.

NOTE

It may be necessary to add teflon tape or pipe sealant to the drain plug prior to installation to prevent leaking.

   e. Add Browning Worm Gear GL 32HT lubricant or equivalent. Use the level plug to determine the proper amount of oil.

   f. Check that the air passage through the breather is open.

   g. Install and tighten the fill and level plugs.

   h. Dispose of the used oil in an environmentally safe manner.

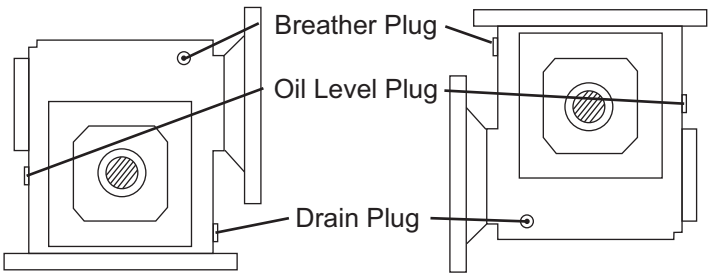


Fig. 36 GEARBOX SCHEMATIC (TYPICAL)

5.2.4 BREATHER CLEANING

The gearbox is equipped with a breather in the fill plug that vents the internal pressure to atmosphere. As the gearbox temperature increases and decreases during the operating and stopped modes, the pressure in the gearbox will increase or decrease if it is not vented to atmosphere. An increase in internal pressure will cause the shaft seals to leak until the gearbox runs low on or out of oil. To check on or clean the breather, follow this procedure:

1. Place all controls in their OFF or neutral position.
2. Turn the power OFF at the master panel and lock-out.
3. Remove the fill plug/breather from the gearbox.
4. Check that the vent passage through the plug is open.
5. If plugged, soak in a solvent over night.
6. Use a high-pressure air hose to blow the passage open. Use a probe to clear the passage if the hole is caked with dirt.
7. Install and tighten the breather plug.

IMPORTANT

Always clean the breather if any leaks are noticed around shafts.

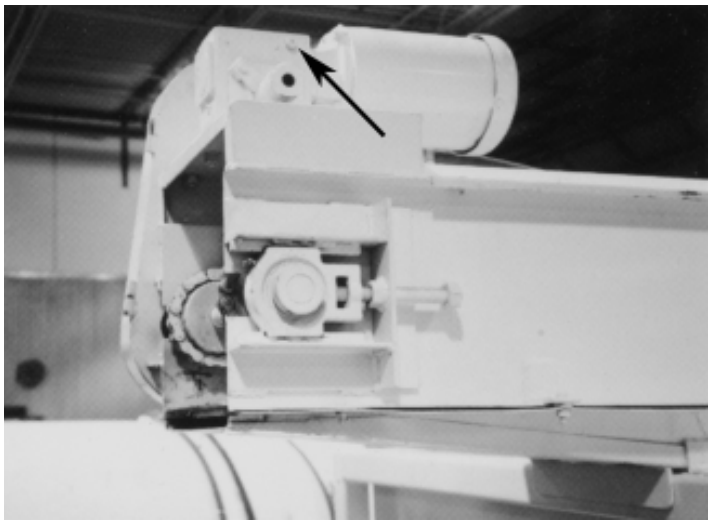


Fig. 37 BREATHER

⚠ WARNING

Machine is shown with guards opened for illustrative purposes only. Do not operate with guards opened.

5.2.5 TRASH CONVEYOR CHAIN TENSION/ALIGNMENT OR REPLACEMENT

A drag chain is used on the trash conveyor. The tension and alignment of the conveyor should be checked daily to insure proper function. Replace the conveyor chain when damaged or badly worn. To maintain conveyor, follow this procedure:

1. Turn the power OFF at the master panel and lock-out.

2. **Tension:**
   It is tensioned correctly when the cross bar link can be turned 45° when twisted.

3. **Alignment:**
   It is properly aligned when the chain links center on the drive sprockets. If the links run on the side of the sprockets, align by centering the drive sprockets in the chain links as well as the conveyor sides. Move the sprockets on the drive shaft but always maintain the proper tension.

4. **Replacement:**
   a. Move the drive shaft into its loosest position.

   b. Open the conveyor by splitting the links on the side chain.

   c. Attach the replacement chain to the end of the old chain.

   d. Slowly pull the old chain out of the machine and thread the new one into position.

   e. Disconnect the old chain and connect the ends of the new one together.

   f. Move the shaft into position to set the tension of the chain and secure the bearing assem blies.

   g. Check the tension and alignment of the chain frequently during the first 10 hours of operation and set as required. Then, go to the regular maintenance schedule. Normally a conveyor will seat itself during the first 10 hours of operation and then require less adjustment.

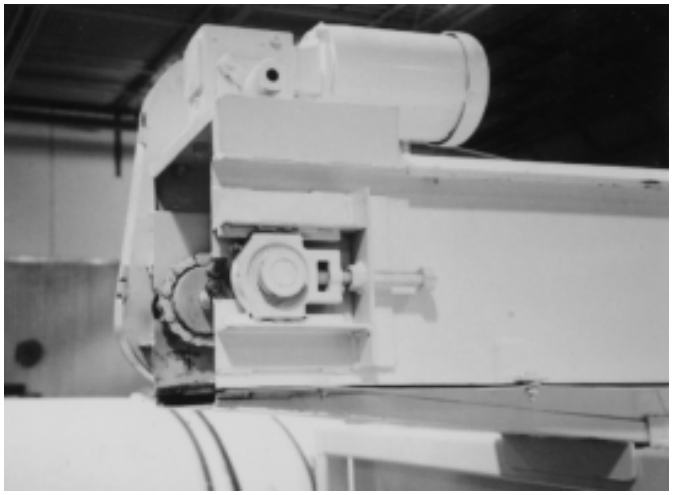


Fig. 38 TENSION ADJUSTING (TYPICAL)

⚠ WARNING

Machine is shown with guards opened for illustrative purposes only. Do not operate with guards opened.

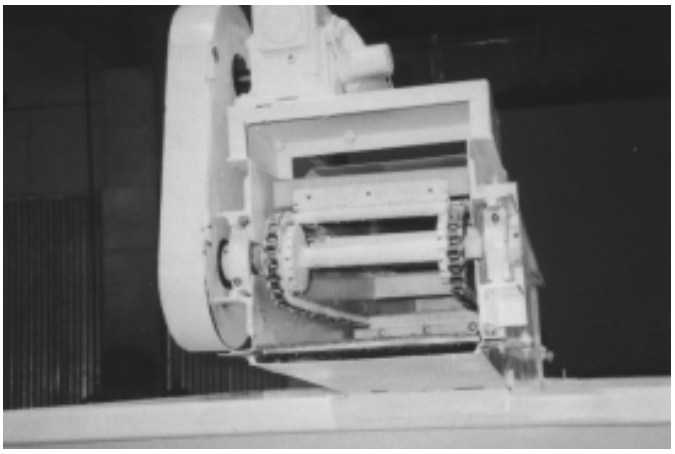


Fig. 39 CHAIN ALIGNMENT

5.2.6 ROLLER CHAIN DRIVES

The trash conveyor is driven by a roller chain system with sprockets and an idler or a tightening system. The roller chain must be oiled on a daily basis and the tension and alignment checked weekly during the season. When maintaining the roller chain, follow this procedure:

1. **Daily Oiling:**
   a. Open the guard over the roller chain drive system.

   b. Use an oil can or brush to apply oil to the slack side of the chain.

⚠ WARNING

Use special care when working around exposed moving parts.

   c. Refer to the following table for oil type.

CHAIN TYPE*	AMBIENT TEMPERATURE RANGE		
	14°F-32°F	32°F-104°F	104°F-122°F
RS-50-less	SAE 10	SAE 20	SAE 30
RS-60/RS-80	SAE 20	SAE 30	SAE 40
RS100	SAE 20	SAE 30	SAE 40
RS120/MORE	SAE 30	SAE 40	SAE 40

* Stamped on chain link side plate

   d. Close and secure the guard.

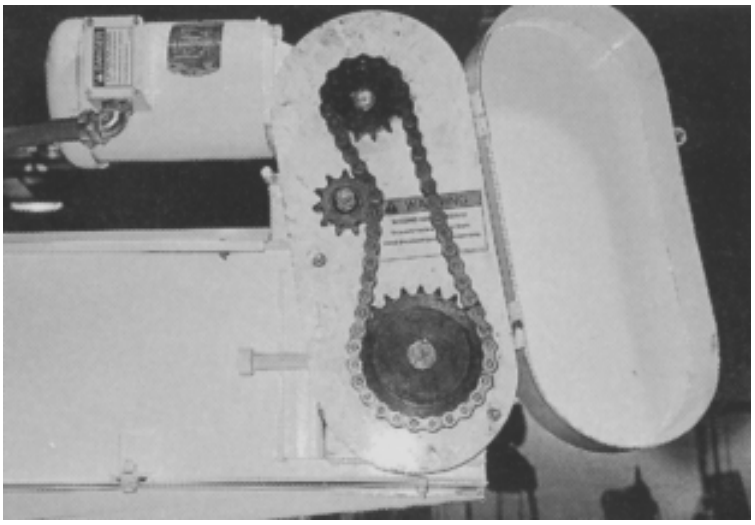
2. **Weekly Sprocket Alignment:**
   a. Check alignment by:
      i. Lay a straightedge across the faces of the sprockets. When the straightedge is flush with the faces of the sprockets, they are aligned, or
      ii. Visually sight across the faces of the sprockets. If sprockets are in the same plane they are aligned.

   b. Loosen set screw in sprocket hub if alignment is required.

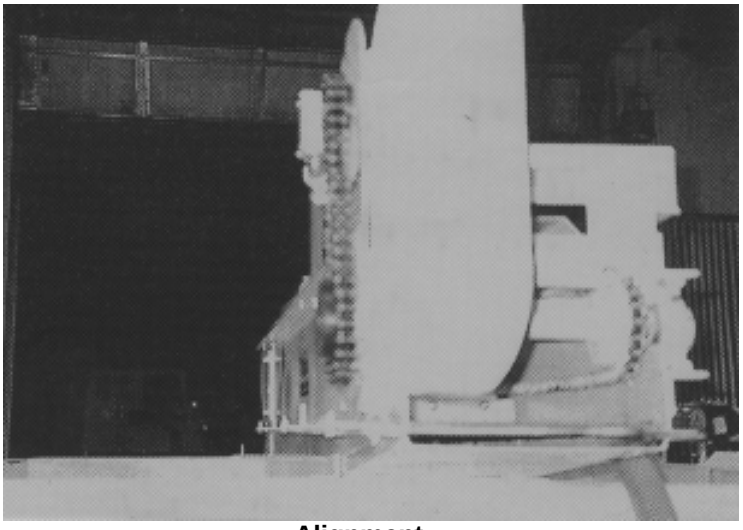
   c. Move sprocket to required position.

   d. Tighten set screw's to their specified torque.

   e. Close and secure all the guards.



Tension



Alignment

Fig. 40 ROLLER CHAIN

⚠ WARNING

Machine is shown with guards opened for illustrative purposes only. Do not operate with guards opened.

5.2.6 ROLLER CHAIN DRIVES (cont'd)

3. **Weekly Roller Chain Tension:**
   Each roller chain drive system is equipped with an idler sprocket to maintain the required tension on the chain during operation. Check the idler when the machine is OFF and not moving. The chain should be snug when the machine is at rest. Without being snug when stopped, there will not be sufficient tension on the system during operation. Set the tension by:

   a. Loosening the idler sprocket anchor bolt nut.

   b. Move idler sprocket to its required position.

   c. Tighten anchor bolt nut to its specified torque.

6 TROUBLE SHOOTING

The Mayo Recirculating Tank uses a flow of water through cyclones to remove the dirt in solution. It is a simple and reliable system that requires minimum maintenance.
In the following section, we have listed many of the problems, causes and solutions to the problems that you may encounter.
If you encounter a problem that is difficult to solve, even after having read through this trouble shooting section, please contact your local Mayo dealer or the factory. Before you call, please have this Operator's Manual and the serial number from your machine ready.

PROBLEM	CAUSE	SOLUTION
Recirculating Tank won' run.	No power.	Plug machine in. Turn power ON at master panel.
	Tripped circuit breaker.	Reset circuit breaker.
	Tripped motor starter.	Reset starter.
Trash conveyor won' run.	No power.	Plug machine in. Turn conveyor ON.
	Tripped motor starter.	Reset starter.
	Failed drive chain.	Replace drive chain if broken. Install chain on sprockets and set tension.
	Conveyor binding.	Align drag chain.
Recirculation pump surging.	Low water level.	Add water to system to bring over sucton outlet.
Cyclone pump not running.	No power.	Turn pump ON.
	Tripped motor starter.	Reset starter.
Water not clean.	Dirt not being expelled from cyclones.	Close cyclone valve to increase back pressure and expel more dirt/slurry.
	Water full of fines.	Replace water.

7 SPECIFICATIONS

7.1 MECHANICAL

DIMENSIONS	
Length:	9'5"
Width:	8'9-1/2"
Height:	Wheels Retracted: 7'6"
	Wheels Extended: 8'2"
POWER	
Type:	1 ph, 230v, 63a
	3 ph, 23Ov, 40.3a
Conveyor:	1-1/2 HP
Cyclone Pump:	7-1/2 HP
Recirculation Pump:	5 HP
WATER SYSTEM	
Total Volume:	710 Gallons
TIRES	
Size:	7.60-15
Pressure:	30 psi

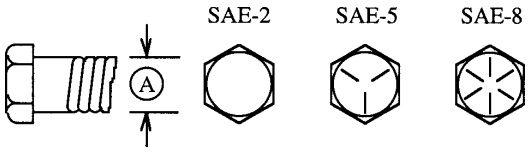
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

7.2 BOLT TORQUE

The tables shown below give correct torque values for various bolts and cap screws. Tighten all bolts to the torques specified in chart unless otherwise noted. Check tightness of bolts periodically, using bolt torque chart as a guide. Replace hardware with the same strength bolt.

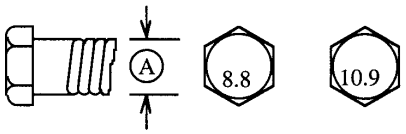
ENGLISH TORQUE SPECIFICATIONS

Bolt Diameter "A"	Bolt Torque					
	SAE 2		SAE 5		SAE 8	
	(N.m)	(ft-lb)	(N.m)	(ft-lb)	(N.m)	(ft-lb)
1/4"	8	6	12	9	17	12
5/16"	13	10	25	19	36	27
3/8"	27	20	45	33	63	45
7/16"	41	30	72	53	100	75
1/2"	61	45	110	80	155	115
9/16"	95	60	155	115	220	165
5/8"	128	95	215	160	305	220
3/4"	225	165	390	290	540	400
7/8"	230	170	570	420	880	650
1"	345	225	850	630	1320	970



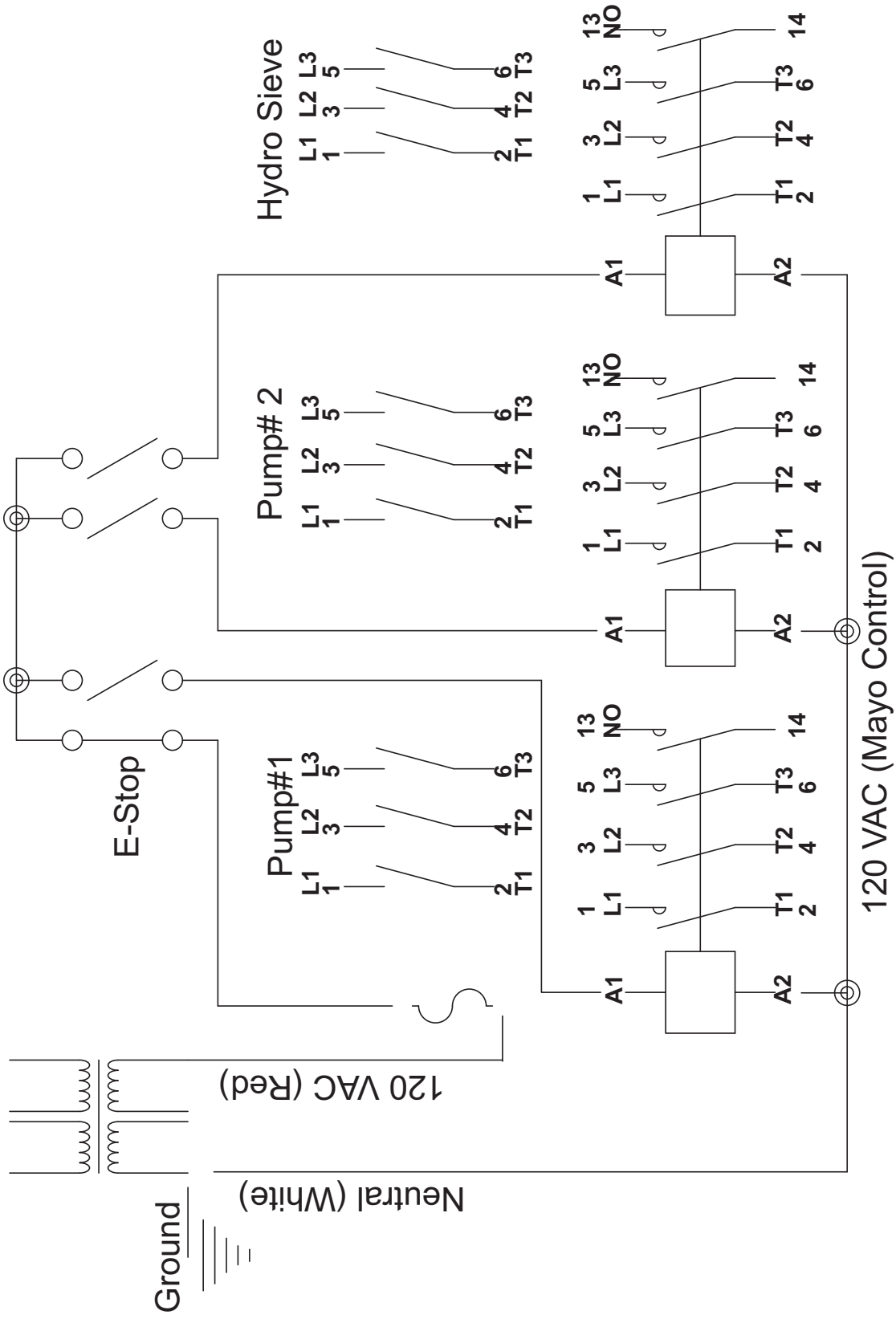
METRIC TORQUE SPECIFICATIONS

Bolt Diameter "A"	Bolt Torque			
	8.8		10.9	
	(N.m)	(ft-lb)	(N.m)	(ft-lb)
M3	.5	.4	1.8	1.3
M4	3	2.2	4.5	3.3
M5	6	4	9	7
M6	10	7	15	11
M8	25	18	35	26
M10	50	37	70	52
M12	90	66	125	92
M14	140	103	200	148
M16	225	166	310	229
M20	435	321	610	450
M24	750	553	1050	774
M30	1495	1103	575	1550
M36	2600	1917	3675	2710



Torque figures indicated are valid for non-greased or non-oiled threads and heads unless otherwise specified. Therefore, do not grease or oil bolts or cap screws unless otherwise specified in this manual. When using locking elements, increase torque values by 5%.

7.3 ELECTRICAL SCHEMATIC



MAYO WASHER / RECIRCULATION SYSTEM SPECIFICATIONS

- SYSTEM START UP / AFTER INITIAL SET UP
  - TURN THREE-WAY VALVE ON SPRAY BAR PUMP TO DIRECT WATER INTO THE BOTTOM OF THE TANK TO AGITATE SETTLED OUT MUD.
  - TURN ON CYCLONE PUMP.
  - REVERSE THREE-WAY VALVE ON SPRAY BAR PUMP TO DIRECT WATER TO SPRAY BARS.
  - TURN ON HYDROSEIVE CONVEYOR.
  - TURN ON WASHER TRASH PUMP.
  - TURN ON FRESH WATER SPRAY.
  - START FLOW OF POTATOES
- SYSTEM SHUT DOWN
  - AFTER FINAL LOAD ALLOW WATER SYSTEM TO RUN AND CLEAN ITSELF. (15-30 MIN) THIS WILL HELP PREVENT ANY PLUGGIN IN THE SYSTEM.

CYCLONE SYSTEM

- 2X3X13 HALCO PUMP MAX GPM AT 40 PSI = 150 GPM)

- 1 MODEL 240 CYCLONE HAS A CAPACITY OF 50 GPM

- GPM OF CYCLONE SYSTEM IS DETERMINED BY THE NUMBER OF CYCLONES NEEDED
  - CYCLONE CLEANING EFFICIENCY CAN BE ADJUSTED BY TIGHTENING OR LOOSENING THE FLANGE ON THE BOTTOM OF THE CYCLONE.
    - TIGHTENING THE FLANGE WILL REDUCE WATER DISCHARGE INCREASING EFFICIENCY BUT REDUCING AMOUNT OF PARTICLES DISCHARGED. THE MORE WATER OUT THE BOTTOM THE MORE PARTICLES OUT THE BOTTOM OR VICE VERSA.
  - ALSO OPENING OR CLOSING THE VALVE OFF OF THE TOP WATER TO CREATE BACK PRESSURE.
    - CLOSING THE VALVE WILL INCREASE BACK PRESSURE AND FORCE MORE WATER AND PARTICLES OUT THE BOTTOM OF THE CYCLONES BUT AT THE SAME TIME WILL REDUCE WATER TO THE PRE SOAK BARS.

SPRAY BAR SYSTEM

- 2X3X13 HALCO PUMP MAX GPM AT 40 PSI = 150 GPM)

- GPM ON SPRAY BARS = NUMBER OF SPRAY NOZZELS X CAPACITY OF NOZZLES. 32 NOZZELS AT 4GPM = 144 GPM SPRAY BARS.

FRESH WATER SYSTEM

- FRESH WATER ADDED NEEDS TO BALANCE WITH THE DISCHARGE OF THE CYCLONES, THE EXCESS WATER ON THE POTATOES, AS WELL AS THE WATER THAT MAY COME OUT IN THE HYDROSEIVE.

- FRESH WATER SPRAY BARS MAY BE CALCULATED BY THE NUMBER OF NOZZLES X CAPACITY OF NOZZLES. 11 NOZZLES AT .5 GPM = 5.5 GPM FRESH SPRAY BARS.

- IF FRESH WATER ADDED IN AT THE SPRAY BARS IS NOT ENOUGH WATER CAN BE ADDED INTO THE TANK, THE SIZE OF THE NOZZLES CAN BE INCREASED, OR THE NUMBER OF NOZZLES CAN BE INCREASED.

- IF FRESH WATER ADDED IN AT THE SPRAY BARS IS TOO MUCH: THE SIZE OF THE NOZZLES CAN BE DECREASED, THE NUMBER OF NOZZLES CAN BE DECREASED, OR A VALVE CAN BE ADDED ON THE FRESH WATER LINE.

SYSTEM OBJECTIVES

- CLEAN POTATOES TO AN ACCEPTABLE LEVEL.
    - MORE WATER
        - LARGER SPRAY NOZZLES ON RECIRC SPRAY BARS
        - LARGER FRESH WATER SPRAY NOZZLES
    - SPEED UP BRUSHES
        - ADJUST VARIABLE SPEED DRIVE
- RECYCLE AS MUCH WATER AS POSSIBLE.
    - ADJUST CYCLONE AS EFFICIENTLY AS POSSIBLE AND STILL TAKE DESIRED PARTICLES OUT OF WATER.

CONTROLLING FOAM

- USE NECESSARY AMOUNT OF
    - COOKING OIL AVAILABLE AT ANY GROCERY STORE
    - DEFOAMING AGENT CAN BE SOURCED FROM FRITO LAY
        - DEFOAMING AGENT WILL ACT FASTER BUT COOKING OIL HAS BEEN NOTICED TO LAST LONGER. GROWERS CHOICE AS TO WHICH ONE TO USE.
- ADD EITHER TYPE OF DEFOAMER INTO THE TRASH PUMP OF THE WASHER TO MIX IT INTO THE SYSTEM AS WELL AS TO THE TOP OF THE RECYCLING TANK.

Management of hydrocyclone based water recycling systems

The key to maximizing the performance of hydrocyclone based water recycling systems is balancing the cyclone discharge with the fresh rinse water being added to the system to maximize solids removal. As cyclones are adjusted (with larger orifice size and/or topwater back pressure) to produce more underflow, they also become more efficient at removing the smaller particles as well as reducing the chances of rope flow. Rope flow is when the bottom water no longer sprays out the bottom and just runs out as highly concentrated mud due to excessive silt loading. During rope flow, the cyclone's efficiency (ability to capture fine solids) is drastically reduced and typically allows silt to pass out with the topwater - thus rope flow avoided. The desirable flow type is referred to as spraying flow. There are three ways to change the performance of hydrocyclones:

1) Change the orifice size on bottom of cyclone. This is accomplished by tightening or loosening (increasing orifice size) flange on bottom of the Quality Solids model 240 cyclones. There are "W" (wet) and "D" versions of this cyclone. The 240D is the original oil field version with a 5/8" orifice which typically produces ~1 gpm and up to 1.5 gpm with moderate back pressure on the top water. The 240W has recently been introduced to address the wide range of silt loading experienced in potato washing systems and is identical to the original 240 except the cone liner has a ¾" maximum orifice size which allows for typical underflows of ~2 gpm and up to 3 gpm with moderate back pressure. By tightening the flange, either model's orifice size (underflow) can be reduced farther than necessary. Orifice adjustment is helpful when matching he underflow concentration of cyclones on a manifold. The last cyclone on the manifold typically gets more silt than the first ones and thus should have a slightly larger orifice to avoid being the first cyclone to go into rope flow. If the concentration of the underflow of the cyclones are matched, the whole group can be run closer to rope flow, thus conserving water. It should be noted that the 240W can be adjusted to perform identically to the 240D.
2) Apply or increase back pressure on the topwater. Cyclones are designed to run without any pressure on the topwater. However, if more underflow is desired, back pressure supplied by closing a valve on the water returning to the system will shift the pressure balance within the cyclone toward the bottom and increase the underflow. This should only be done with the maximum orifice size. If rope flow occurs, the operator should apply back pressure (close valve partially) to clear the silt in the bottom of the cone and then readjust the back pressure to maintain spraying underflow.
3) Reduce the concentration of silt in the feed water. This can be accomplished by either reducing the rate of silt entering the system (more dry dirt elimination or reduce the flow of potatoes) or by increasing the number of cyclones. Increasing the number of cyclones simply dilutes the same amount of silt into more gallons per minute. A persistent need to use back pressure in increase underflow may be signaling the need for another cyclone.

System optimization example: A typical washer may be using 5 gpm to rinse the potatoes before they contact the sponge rollers. Of this, 1 gpm may get carried off with the potatoes leaving 4 gpm to be divided between the cyclone discharge (underflow) and the recirculation tank overflow. Since the cyclone's efficiency at removing the finest silt increases with increasing underflow, it is advantageous to minimize the overflow by increasing the underflow, thereby utilizing the cyclones to their full potential. Therefore, this system will run best with 2 cyclones running at 1.4 gpm each leaving just a trickle for the overflow. A system requiring 10 gpm fresh water may require 3-5 cyclones removing a total of 8 gpm etc. The advantage of running extra cyclones is that when severe conditions are encountered, underflow and fresh water can be increased to accommodate without reducing washer throughput. The disadvantage is that extra cyclones require more power to operate. Take care not to run the system dry. If the system is running thicker than desired, simply increase the flow of the rinse until the concentration of clay in the recycled water is acceptable. The recycled water can be very dark, but should only be thickened slightly in the typical system.

HALCO

Installation, Operation and Maintenance Instructions For HALCO 2500 SUPREME PUMPS

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Table Of Contents

BULLETIN S103

Introduction

This manual contains instructions for the installation, operation and maintenance of the **HALCO 2500 SUPREME** Pump. As pump service conditions and specifications vary considerably in pump installation, this manual cannot possibly cover every situation, but it is hoped that the information included will serve as a guide. Should questions arise, or start-up problems occur, it is suggested that you contact the HALCO Pump Distributor or Salesman in your area.

The **2500 SUPREME** pump generation is an improved version of the older 2 1/2 INCH shaft pumps. The **2500 SUPREME** pump is designed to give longer service life through wear pad replacement casing, oil bearing lubrication, stainless shaft and casing nuts.

There are many principles of proper pump installation and application as well as special considerations for the **2500 SUPREME** design which, if followed, will further enhance the performance of your **2500 SUPREME** pump.

This document will deal with both general and specific recommendations for improved **2500 SUPREME** performance in both oilfield and industrial applications.

General Instruction

1. Operate the pump only in the performance range for which it was designed.
2. The pump driver must drive the pump CLOCKWISE when viewed from coupling end. Reversing the rotation will damage the pump.
3. Do not operate the pump with the suction or discharge valves closed.
4. Adjust the packing so that a small amount of leakage remains for lubrication and cooling.
5. When operating in drilling mud, prevent packing drippage from clogging the drip pan and hardening around the slinger and front seal area.
6. See Section E for Mechanical Seal Installation.

PART I INSTALLATION

Interchangeability

2500 SUPREME horizontal centrifugal pump outside envelope dimensions are the same as older 2.5 inch pumps of the same nominal size so the models can be interchanged without changing existing piping, couplings or bases.

Location

The pump should be located near to the liquid source so that the suction line may be short and direct. The pump should be located below the level of the liquid to eliminate the necessity of priming.

Foundation

The foundation should be sufficiently rigid and substantial to absorb any vibration and support the base plate at all points. A concrete foundation, poured on a solid footing of adequate thickness to support the pumping unit, provides the most satisfactory foundation. The base plate should be installed in a level position.

Note: A detailed description of proper Procedures for grouting base plates may be found in the Hydraulic Institute Standards, 13th Edition, Pages 116, 117.

The rugged design of the frame and fluid end makes the **2500 SUPREME** more tolerant of improper foundations than many other pumps. When fabricated bases or fabricated skid bases are utilized, the foundation should be sufficiently rigid and leveled properly to absorb any vibration and support the base at all points.

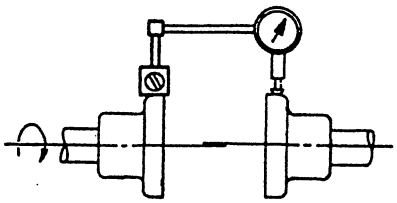
Coupling Alignment

Good service life of the pump and driver depends upon good alignment through the flexible coupling. If the electric motor was mounted at the factory, the pump and motor were in alignment when shipped. **The alignment between the driver and pump should be inspected after installation to ensure that transportation or other handling has not caused misalignment of the unit.** Poor alignment may cause failure of the coupling, or pump or motor bearings.

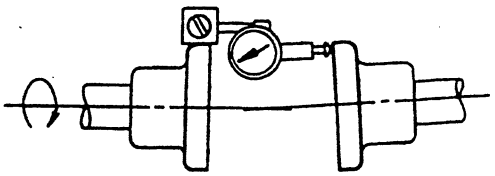
Alignment must not be attempted until the base is in position and the mounting and FLANGE BOLTS have been tightened.

The recommended procedure for coupling alignment is by the use of a dial indicator, as illustrated in Figures 1 and 2. The dial indicator is attached to one coupling half with the indicator button resting on the O. D. of the other coupling half to measure offset misalignment. To measure angular misalign-

ment, the indicator is positioned so that the buttons rest on the face, near the O.D., of the other coupling half. Rotate the shaft and dial indicator one full revolution while the other shaft remains stationary and note the T.I.R. Unless otherwise specified by the coupling manufacturer, offset misalignment should be limited to 0.005 inches T.I.R. Adjust alignment by loosening driver or pump mounting bolts and re-tightening or shimming as required.



Measuring Offset Misalignment
Figure 1



Measuring Angular Misalignment
Figure 2

In areas where a dial indicator arrangement is not available, an adequate job of alignment can be done with a straight edge. This method is especially useful if the coupling used contains a rubber drive element.

To check offset misalignment, lay the straight edge in line with the shafts on the O.D.'s of the coupling halves. There should be no gaps under the straight edge. Check two locations 90 degrees apart. Angular Misalignment can be checked by measuring the gap between coupling half faces. There should be no more than a 1/64" gap under the straight edge or 1/64" variation in the gap between coupling halves.

See Figures 1A and 2A.

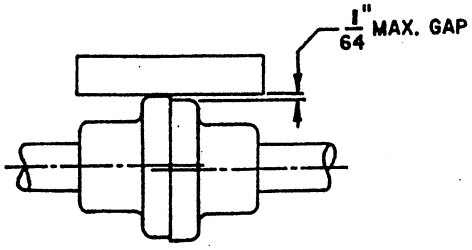


Figure 1A

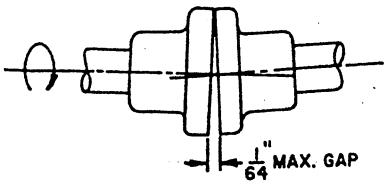


Figure 2A

Note: Further reference on coupling alignment can be found in Hydraulic Institute, 13th Edition, Pages 117, 120.

Piping (General)

Note: Piping must not be connected to the pump until the grout has hardened and foundation bolts and pump hold down bolts have been tightened.

Piping should be anchored independently of the pump and as near to it as possible. Pipe companion flanges should line up naturally with pump flanges. **Do not draw the pipe to the pump with flange bolts.**

Piping (Suction)

Properly selected and installed suction piping is extremely important to eliminate vibration and cavitation in the pump. Vibration can cause packing problems, mechanical seal damage or undue bearing loads.

The suction line should be equal to or larger than the pump suction.

The capacity of a centrifugal pump should never be adjusted by throttling the suction line. A positive shut-off valve of a type to cause minimum turbulence should be installed in the suction line to permit the closing of the line and removal of the pump for inspection and maintenance.

The suction line should be designed to eliminate any air pockets. The piping should gradually slope downwards to the source of supply to eliminate air pockets.

The suction line should have a straight section in to the pump of a length equivalent to at least two (2) times its diameter; i.e., four (4) inch suction; eight (8) inch straight run.

For temporary hook-up, where flexible hose is used, a non-collapsing hose is essential since the suction line pressure is often below atmospheric pressure. A collapsing suction line will result in below average or complete loss of flow.

Piping (Discharge)

A positive shut-off valve should be located in the discharge piping to permit inspection and maintenance of the pump.

All piping should be independently supported and accurately aligned. **The pump must not support the weight of the pipe or compensate for misalignment.**

If operating conditions are not known with sufficient accuracy, it will be necessary to provide a throttle valve in the discharge line to ensure that the pump operates at the design point.

If the pump is connected to a pressurized system, it is important to install a check valve between the pump discharge and the throttling valve. The check valve will prevent back flow through the pump. Back flow may cause the impeller to become loose on the shaft. A loose impeller will likely result in mechanical damage and fluid leakage beneath the shaft sleeve.

PART II. PREPARATION FOR OPERATION

Initial Lubrication

Standard pumps are shipped with oil in reservoirs. **Oil level must be checked and oil added before operating the pump if necessary.** A good grade of SAE 10W 30 oil may be used.

The air vent should be kept clean to prevent pressure build-up because of normal heating that occurs in operation. There is a dip stick that shows correct oil level.

There are plugs in the front and rear bearing caps that can be removed and grease fittings installed to grease the bearings should the pumps be mounted in a vertical position or if grease lubrication is preferred.

Mechanical Seals

When mechanical seals are furnished they are installed and adjusted at the factory. The H22451-1 or new H25001-1 tungsten carbide mechanical seal normally used in drilling muds does not require external flush.

To properly prepare special or industrial mechanical seals for operation, various cooling and flushing flows may have to be connected. Liquid from an outside source may be required. If outside flushing is required connect necessary cooling or flushing lines to seal and be sure it is turned on before starting the pump. See seal drawings and instructions if special seals are used.

Start-Up

CHECK ROTATION

Most pumps purchased are clockwise when viewed from coupling end. The correct rotation can be found by an arrow on the casing.

It is very important that the pump is not started up and then go and see if the pump is turning the correct rotation. If the **2500 SUPREME** model is turned backward the impeller may unscrew. This will not happen in the keyed models, but the packing or mechanical seal can run dry and be destroyed.

The best way to check rotation is to disconnect the coupling before testing rotation, but it can be checked without disconnecting the coupling. One person should be at the pump watching the shaft, while the second person pushes the start button on the starter and immediately pushes the stop button so the shaft barely turns over.

PRIMING

Be sure the pump has fluid in its casing before running. If the pump is operated without fluid, the

mechanical seal or packing can be destroyed in one minute. Vent air from the suction line and fill with liquid. Start pump with discharge valve cracked open. After discharge pressure stabilizes, gradually open discharge valve to required position. If flow is lost, close discharge valve and wait a few seconds for discharge pressure to build. Continued flow difficulty indicates an improper selection or installation.

Running the pump with improper prime may destroy the sealing faces of the mechanical seal due to over heating or mechanical damage from pulsation between rotating and stationary components. Do not run the pump with suction valve closed ANYTIME; thermal shock may crack the stationary seat if temperature is raised from room temperature to 250 degree Fahrenheit in less than 30 seconds. Run with discharge valves closed only for short periods of time. The energy going into the pump heats the fluid in the casing. If the pump needs to operate shut in some of the time, be sure to have a small line (1/4 or 1/2") back to the suction tank between the discharge valve and pump for cooling.

ON PACKED PUMPS LOOSEN PACKING ON STARTUP

The gland bolt nut should be only finger tight. New packing will expand faster with heat than older packing. Therefore, new packing must be adjusted more slowly than old packing: Too tight and it will not leak. With no cooling it will burn and be no good for sealing. **2500 SUPREME** pumps with mechanical seals have back up packing. This packing should be very loose and not tightened until seal failure occurs.

ON MECHANICAL SEAL PUMPS

Be sure pump is never started dry. Seal faces will Gaul in one minute if run dry. The backup packing is shipped in a cloth sack. Do not install packing until seal starts to fail. The packing can then be installed and the pump run until scheduled repair of mechanical seal can be done.

FINAL START-UP CHECK

1. Pump rotates freely be hand.
2. Coupling aligned.
3. Oiler full and oil level correct.
4. Suction valve fully open.
5. Pump and suction line full of fluid.
6. Discharge valve slightly open not full open. Fully open discharge valve after pump is running.

PART III. OPERATION

Maximum Operating Conditions

Note: These maximum operating conditions apply to pumps which are exposed to room temperatures without external insulation.

1. Cast Iron: Maximum working pressure 175 psig at 150 degree Fahrenheit or 150 psig at 250 degree Fahrenheit. Interpolate for pressure between 150 degree Fahrenheit and 250 degree Fahrenheit maximum.
2. Steel: Maximum working pressure and test pressure in accordance with Tables 2.1 through 2.23 and Table 3, ANSI B 16.5- 1973.
3. For H-30 and SUPREME HARD Alloy: contact HALCO Distributor.
4. Cooling water through the lantern ring is required when the fluid being pumped is between 150 degree Fahrenheit and 250 degree Fahrenheit. In addition, it may be necessary to run water over the exposed shaft to prevent excessive heat at lip seals and bearings.
5. Maximum hydraulic performance in accordance with published performance curves for individual sizes.

Pump Records

Maintain data cards or pump records whenever possible. This will provide ready access to information for ordering spare parts, and for evaluating pump and mechanical seal performance.

Information to be included in these records should be:

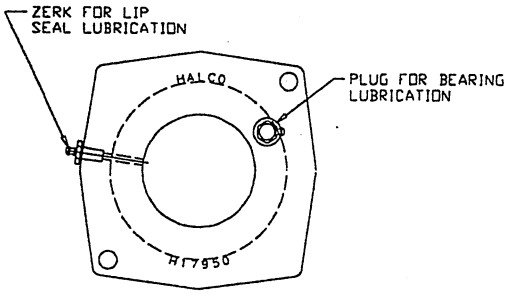
1. Pump size and serial number.
2. Pump model number, impeller diameter, material of construction.
3. Mechanical seal manufacturer, type, code, and drawing number.
4. Motor horsepower and speed of operation.
5. Service conditions.
6. Frequency of operation.
7. Record of maintenance, including parts usage and general condition of pump.

8. Nomenclature and part number of replacement items.

Lubrication (Bearings)

FACTORY LUBRICATION Standard pumps have bearings OIL lubricated from the factory to lower bearing temperatures and wear. If the pump is mounted in a vertical position or other position that oil is not suitable; the bearing caps are drilled and tapped for grease fittings. Grease can be used for speeds up to 2400 RPM. There is a dip stick to check for the correct oil level. Use a good grade of 10W30 weight motor oil. There is also a plug on the side of the bearing frame. You can remove the plug and pour oil in the top of the frame and the oil will be at the correct height when it runs out of plug hole.

Plugs are mounted in the bearing caps. These plugs can be removed and grease fittings installed if grease lubrication is preferred. Grease we recommend used in the bearings are Exxon Unirex N2, Chevron SRI-2, Texaco Premium RB, Shell Dolium-R, American Oil Company's Rycon Premium Grease and Mobilux EP multi-service grease are acceptable. Greases that are available in tubes are best. When using the premium bearing greases listed above or their equivalent, five shots of grease, with a standard size hand operated grease gun, in each bearing once each month, will be sufficient in a twenty-four hour per day operation.



Front View Of Inboard Bearing Cover
Figure 3

Lubrication (Inboard Lip Seals)

The inboard bearing cover is supplied with a zerk fitting between 10 and 11 o'clock facing the suction. This is designed to create a grease barrier between the inboard lip seals and should be greased prior to washdown and at least once a week with five (5) shots of general purpose or water pump grease. See **Figure 3.**

PART IV. MAINTENANCE

Refer to Exploded Section Drawing

Disassembly

1. Loosen packing gland nuts (6B) and swing gland bolts to side. Remove packing gland halves (4).
2. Remove casing bolt nuts (1B).
3. Remove casing (1).
4. Remove the impeller.

Note: HALCO Impeller Removal Wrench, Part No. H20952, is very useful. The wrench fits over motor end of shaft and key. Turn the impeller very fast and when the wrench hits the work bench and stops a impact force either tightens or loosens the impeller depending on the direction of rotation.

If you do not have a wrench, restrain the shaft at the coupling end to prevent rotation while removing the impeller. Put a block of wood against the web between impeller vanes. Hit wooden block with hammer to **turn impeller counterclockwise as viewed from suction end.**

5. Remove stuffing box cover bolts.
6. Remove stuffing box cover (3) from frame by hammering on the back side in the area where the box fits into the frame (9).

Note: If the disassembly being performed does not require the replacement of the mechanical seal, the stationary seat (Item 1 on Figure 9) must not be removed from the stuffing box.

7. Pull packing (5) from stuffing box bore.
8. Remove shaft sleeve (7A). A wedge may be driven between end of sleeve and shoulder on shaft to free the sleeve. If the pump has a mechanical seal that does not need to be replaced, care must be taken

to avoid damaging or dropping the rotary seal ring when removing the sleeve.

Note: If the disassembly is being performed to replace or install a mechanical seal and/or shaft sleeve only, no further disassembly is required. See mechanical seal installation instructions below.

9. Remove deflector (8).

10. Remove plug from inboard bearing cover (10A).

11. Remove the two through bolts (12B) on the outboard bearing housing (12). **These are the bolts threaded into the frame (9).**

12. The complete shaft and bearing sub-assembly can now be pulled from the frame.

13. Remove outboard bearing cover (13).

14. Bend tab on lockwasher (14A) back and remove locknut (14B) and lockwasher.

15. Remove bearing housing (12) and bearings (14) from shaft.

Note: Impacting of entire shaft assembly against a board on the ground will remove the outboard bearing assembly.

16. Inboard bearing (11) may now be pressed off shaft.

Note: A piece of 3" standard wall pipe slipped over shaft and impacted against the inner race of bearing works exceptionally well.

INSPECTION

Impeller---Replace if impeller shows excessive erosion (especially on pump-out vanes on back side of impeller), corrosion, extreme wear, or vane breakage.

Shaft -- Check for runout to see that shaft has not been bent. If runout exceeds 0.002 in., replace shaft. Bearing seats and oil seal area must be smooth and free of scratches or grooves. Shaft threads must be in good condition. Replace shaft, if necessary.

Shaft Sleeve -- Sleeve surface in stuffing box must be smooth and free of grooves. If grooved, replace.

Mechanical Seal -- Seal faces, gaskets, and shaft sealing member must be in perfect condition or excessive leakage may result. Replace worn or damaged parts.

Ball Bearings -- Replace if worn, loose or rough and noisy when rotated. New bearings should not be unwrapped until ready for use. Replacement bearings must be of the proper size and type as supplied with original equipment.

Seals -- It is recommended that all O-ring and gasket seals removed during disassembly be replaced. In those cases where new seals are not available, the old ones can be re-used if they are not torn or otherwise damaged.

General -- All parts should be clean before assembly. This is especially important at retaining ring and O-ring grooves, threads, gasket surfaces, and bearings and bearing lubricated areas. Any burrs should be removed with crocus cloth.

ASSEMBLY

Numbers following part name refer to the part as shown on the exploded view drawing,

A. Shaft and Bearing Sub-Assembly

Note: Installation of the bearings with a press is an acceptable substitute for the following method. Apply load to the inner race only, when pressing the bearings onto the shaft.

1. Heat bearings to 300 degrees Fahrenheit.

Note: One-half hour in an oven at 300 degrees Fahrenheit will work nicely.

2. Slip large, double row inboard bearing (11) onto the shaft. **Caution: Bearings must shoulder against the shaft.**

3. With bearing housing seal (12A) in place, slide the bearing housing (12) onto the shaft from the coupling end. The large O.D. of the bearing housing should be facing the coupling end.

4. Slip outboard bearings (14) onto the shaft.

Note: Outboard bearings are to be mounted back to back. (that is, the sides of the bearings with the manufacturer's name and the bearing number are placed together.) Improper bearing orientation will result in bearing failure. Check the installation requirements provided in the box, and markings on the bearings to help to identify the "back-to-back" arrangement.

Caution: Bearings must shoulder against the shaft. Allow bearings to cool. With lockwasher (14A) in place, tighten locknut (14B) with the bevel positioned against the bearings. Tighten locknut to 250 ft./lb. torque. Bend one tab of lockwasher into nut.

5. IF grease lubrication is being used rather than oil, pack the bearings (14 & 11) full with grease,

preferable Exxon Unirex N2 or any of the aforementioned greases.

6. Grease or oil outboard bearing (14) O.D.'s and pull bearing housing over them into place. The outer races may be pushed in with a hand push or with light tapping **applied only to the outer race.**

7. Install lip seal (13C) in outboard bearing cover (13) with the lip aimed inward toward the bearings. Generously lubricate the rubber lip and the shaft in the sealing area. Fill the space behind the lip on the seal and half the bearing cover with grease.

8. Put cover seal O-ring (13B) in place. Slide the outboard bearing cover over the shaft. **Caution: be careful not to cut the oil seal on the edge of the shaft keyway.** Secure over two (13D) bolts (3/8D x 1-1/4") and tightened evenly to approximately 20 ft./lb. torque.

B. Power Frame Sub-Assembly

1. Install inboard bearing cover seal (10C) into inboard bearing cover (10) flush with the backside of the cover. Install the exclusion seal (10F) flush with the outside of the cover. **The sealing lips on both seals should be pointed outward (away) from the bearings for grease lubrication, the lip of (10C) points inward for oil lubrication.** Pack the area between the lip seals full with grease. Using grease to hold it in place, put the inboard bearing cover gasket (10B) on the cover.

2. The bores of the bearing frame must be clean. Lightly oil the bores to facilitate the insertion of the bearing train. Insert the shaft and bearing sub-assembly into the frame (9) until the threaded end of the shaft extends approximately halfway into the drip pan area.

3. The bearing train will slip in relatively easy by pushing coupling end with one hand and pulling the opposite end with the other. A rubber mallet may be used to pound on the end of the shaft assembly to help it align. DO NOT USE EXCESSIVE FORCE. If installation is difficult it indicates lack of concentricity between bearings and frame. Excessive pounding will damage the bearings.

4. Slip inboard bearing cover assembly (10A) over the end of the shaft. Continue installing the shaft and bearing assembly in the frame until the gap between the frame and outboard bearing housing flange is approximately 1/4".

5. Install two (12B) bolts (1/2D x 1-1/2") with jam nuts (12C) in the threaded holes in the bearing housing. Install the remaining two (12B) bolts through the unthreaded holes in the bearing housing and thread them into the frame. **Do not tighten any bolts.**

6. Bolt inboard cover to frame with (10D) bolts (3/8D x 2") and (10E) nuts.

7. Lubricate ID of deflector . Slip deflector on the shaft with cup side facing away from the bearing cover.

8. Slip shaft sleeve seal (7C) onto the shaft and push it to the shoulder where the sleeve will seat. For pumps with a mechanical seal, see mechanical seal installation instructions on next page for assembling the remainder of the pump.

9. The sleeved area of the shaft must be lightly coated with an anti-seize compound before installing the sleeve. Install sleeve (7A) with a twisting motion to spread anti-seize compound. The gap between the sleeve and the shaft shoulder will be approximately 1/32".

C. Assembly of Fluid End to Power Frame

1. Lubricate the inside of the frame where the stuffing box cover slips in with an anti-seize compound. Install stuffing box cover (3) and secure with two bolts (3A)(1/2D X 1-1/4").

2. Lubricate shaft threads and face of shaft sleeve with anti- seize compound. Wash off the "O" Ring with clean shop solvent and pat dry with a clean cloth. Install the "O" Ring into the Impeller. Thread the impeller (2) with impeller seal O-ring (2A) onto the shaft. Tighten to approximately 160 ft./lb. torque.

3. Loosen the two through bolts (12B).

4. Draw the bearing housing rearward with the jam bolts (12B), while rotating the impeller. Stop when the impeller just touches the stuffing box cover.

5. Bring the through bolts up finger tight.

6. Loosen the jam bolts.

7. Tighten the through bolts (12B) until a clearance of .020" exists between the impeller (2) back vanes and stuffing box cover (3). A hack saw blade is about .020" thick and can be used as a gauge when no better tooling is available.

8. Advance both jam bolts (12B) until they touch the frame finger tight, then tighten the jam nuts (12C).

9. Now tighten the through bolts down evenly. Rotate the shaft. **The impeller should turn freely without rubbing.**

10. Install casing gasket (1A). Hold it in place with grease if necessary.

11. Apply a coat of anti-seize compound on all the stuffing box cover diameters.

12. Install casing (1) on the frame using studs (1C) and nuts (1D). Put a small quantity of anti-seize lubricant on the threads on the nut end of the studs. Tighten nuts to 140 ft./lb. torque using a criss-cross tightening pattern.

D. Packing The Pump

1. Grease all five (5) shaft packing rings (5). Insert three packing rings alternating the splits in the rings from top to bottom starting with the split on the first ring at the bottom. If King type packing is being used (FIG. 8), the rings should be installed with lips toward the impeller.

2. Install the lantern ring with the split in the vertical position. The two halves of the packing gland (4) may be used to push packing and lantern ring together and to the bottom of the box.

3. Insert the final two packing rings. If King packing is being used (FIG. 8), insert the final King ring with the lip toward the outside and split on top and follow with the single ring of square packing split down.

4. With the packing gland (4) in position, swing gland bolts in to place. Tighten the gland lightly against the packing using the gland bolt nuts. **Caution: tighten gland against packing finger tight only. If packing is over tightened it may be burned when the pump is started.**

E. Mechanical Seal Assembly Instructions

CHANGING THE NEW H22451-1 MECHANICAL SEAL

1. If the impeller and/or stuffing box is being replaced adjust the impeller clearance BEFORE installing seal. Back the through bolts (12B) out approximately 1/4". Tighten the jam bolts (12B) until a clearance of 0.015" - 0.020" between the back of the impeller (2) and stuffing box (3) is obtained. Alternately tighten the through bolts and jam bolts making sure that the clearance set above is maintained. Tighten the jam nuts and recheck the clearance.

2. Make sure the shoulder where the stationary will sit and the inside of the stuffing box (3) is clean and that the 30 degree bevel on the 3-3/8" I.D. is free from burrs and sharp edges. Coat the I.D. of the stuffing box stationary seat packet with oil. Place the stuffing box on a table or other flat surface with the impeller side facing up.

3. The slotted side must be installed away from the impeller or down when the stuffing box is positioned as described in step #2. Coat the O.D. of the stationary seat and O-ring with a thin film of oil.

4. Carefully install the stationary seat into the stuffing box. Be sure groove of stationary fits properly over drive pin. Be sure that the stationary seats evenly against the stuffing box shoulder.

Hint: Wrap the end of a wooden hammer handle with a rag. Press firmly on the face of the stationary. Do not strike. Push gently on a side alternating from side to side until the stationary is all the way down.

Coat the stationary seat face with light oil, then wipe off the majority of the oil with a clean cloth leaving only a light film.

5. Lubricate the inside of the frame (9) where the stuffing box (3) slips in with an anti-seize compound. Install the stuffing box and secure with the two bolts (1/2B X 1-1/4"). Care should be taken to prevent bumping the stationary seat on the shaft end.

6. Remove the rotating seal ring (Item 4A of Figure 9) if it is not glued in position and store in a safe place. Whether it is glued or not can be determined by pulling on it gently. Coat the O.D. of the shaft sleeve (7A) and the I.D. of the rubber bellows (Item 4B of Figure 9) with a thin coat of oil.

7. Place the sleeve (7A) with impeller end up on a table. The impeller end is the end with the smallest I.D. With the sealing face of the rotary unit facing down and the rubber end up, gently ease the rubber bellows over the sleeve and push it to the bottom half of the sleeve. (Not necessary to push all the way to the bottom). If the rotating seal ring (4A) has been removed, lightly coat the face of the bellows (Item 4B of Figure 9) with grease. (This is necessary to hold the rotating seal ring in place during assembly.)

Reinstall the rotating seal ring into the cage assembly (Item 4C of Figure 9).

8. Make sure no foreign material is on the seal faces. Make sure the shaft (7) is free of necks and burns and is clean and dry. The sleeve area of the shaft, the shaft threads and shaft face must be lightly coated with an anti-seize compound before installing the sleeve (7A). Install sleeve with a twisting motion. As the seal faces make contact continue to push the sleeve through the I.D. of the rotary seal element until the gap between the sleeve and the shaft shoulder is approximately 1/32".

9. Install the spring retainer (Item 9 of Figure 9) and the impeller O-ring (2A) in its groove and coat with anti-seize compound. Place the mechanical seal spring (Item 6 of Figure 9) over rotary unit of the seal. (which is inside the stuffing box cover.)

10. Thread the impeller (2) onto the shaft (7). Be sure that the spring engages in the retainer on the impeller. Tighten to approximately 160 ft./lb. torque.

11. Install casing gasket (1A). Hold it in place with grease if necessary. Apply a light coat of anti-seize compound on the 14- 1/8" diameter of the stuffing box cover. Install casing (1) on the frame using studs (1C) and nuts (1B). Put a small quantity of anti-seize lubricant on the threads on the nut end of the studs. Tighten nuts to 140 ft./lb. torque using a criss-cross tightening pattern.

12. We recommend that the three (3) shaft packing rings (5). are not installed until the seal fails. The rings are for emergency backup until time can be scheduled for replacement of seal. When they are installed, first grease them then insert all packing rings alternating the splits from top to bottom starting with the split on the first ring at the bottom.

CHANGING THE H25001-1 MECHANICAL SEAL

1. Follow the instructions 1-5 above to install the stationary.

2. Place the impeller suction side down and hub side up.

3. Lubricate the inside of rubber bellows of the seal. Firmly slide the entire rotating seal assembly onto the impeller hub until the back of the seal's rubber bellows butts against the back of the impeller.

4. Make sure no foreign material is on the seal faces.

5. Thread the impeller (2) onto the shaft (7). Tighten to approximately 160 ft./lb. torque. It is easier with a HALCO impeller wrench part number H20592.

6. Install casing gasket (1A). Hold it in place with grease if necessary. Apply a light coat of anti-seize compound on the 14- 1/8" diameter of the stuffing box cover. Install casing (1) on the frame using studs (1C) and nuts (1B). Put a small quantity of anti-seize lubricant on the threads on the nut end of the studs. Tighten nuts to 140 ft./lb. torque using a criss-cross tightening pattern.

PUMP RECORDS

Maintain data cards or pump records whenever possible. This will provide ready access to information for ordering spare parts, and for evaluating pump and mechanical seal performance.

Information to be included on these records should be:

1. Pump size
2. Pump model number, impeller diameter, material of construction.
3. Mechanical seal manufacturer, type, code, and drawing number.
4. Motor horsepower and speed of operation.
5. Service conditions.
6. Frequency of operation.
7. Record of maintenance, including parts usage and general condition of pump.
8. Nomenclature and part number of replacement items.

ON HALCO BUILT PUMP PACKAGES WE PUT A NAMEPLATE ON THE BASE WITH A JOB NUMBER. WITH THIS JOB NUMBER WE CAN TELL YOU EVERYTHING ABOUT THE PUMP PACKAGES, INCLUDING ANYTHING SPECIAL ON THE MOTOR, COUPLING TYPE AND SIZE, IMPELLER SIZE, ETC. WITH THIS INFORMATION YOU HAVE MORE INFORMATION THAN THE EIGHT ABOVE.

RE-PACKING THE STUFFING BOX

MOST EARLY PACKING FAILURES ARE CAUSED BY OVER-TIGHTENING OR POOR INSTALLATION.

PACKING APPEARANCE

If the packing being removed is hard and brittle, it has been run dry sometime during its life. This is often done in the first hour of service. The packing has more ability to grow with heat during its early life. Even if the packing is adjusted just right before starting the pump, in the first few minutes the packing will grow with heat and become over-tight. It then will run drop tight and burn the packing. ONCE PACKING IS BURNED IT WILL NEVER SEAL RIGHT AGAIN. On new packing let it leak more in the first few hours, then adjust it to 10-12 drops per minute.

WHERE EXCESSIVE Packing Leakage and Rapid Packing Failure occurs, the shaft or shaft sleeve may be worn out. Remove the packing. Slide a wire, with a short section of the tip bent 90 degrees into the stuffing box. Run the stylus tip of the wire along the shaft. If deep grooves are noted, the shaft or shaft sleeve must be replaced. Excessive tightening of the packing will cause rapid shaft failure.

PACKING BURNED; If the packing is burned and hard when removed, it has been over-tightened at some time and the lack of leakage caused the packing to burn. Once packing has burned and is no longer soft and pliable, it will not seal properly. I have had people tell me they tighten packing until it smokes, then loosen it up. When it smoked, it was highly damaged and the life was greatly reduced. Initial over-tightening and attempting to run packing without leakage will cause the packing to burn.

Lubrication (Packing)

The stuffing box may be re-lubricated with grease as often as necessary to prevent the packing from over-heating. It should be lubricated at least once a day. It is best to install a spring loaded grease cup (HALCO PART NUMBER G1509) to automatically lubricate packing. As you fill the grease cup a spring is compressed and a stem rises. As the grease is used up the spring refills the grease to the packing and the stem lowers. When the stem is low the cup needs refilling.

The first 30 minutes of operation is the critical "RUN IN" time for the packing. Adjust the packing to stabilize the leakage at a higher rate than normal for the first 30 minutes. The packing normally expands in the first 30 minutes and if you adjust it to the correct drippage initially, the packing may run dry when the packing expands.

Grease should be pumped into the box while turning the shaft until it comes out around the packing gland (approximately twenty shots).

If the packing leakage is excessive, a thick water pump grease should be used rather than the general purpose grease. In most cases, general purpose grease will be acceptable.

CORRECT INSTALLATION OF PACKING:

Make sure the box is clean of all old packing and the plastic lantern ring. BEND A WIRE AND PULL IT DOWN THE SHAFT or shaft sleeve TO BE SURE IT IS SMOOTH FOR GOOD PACKING LIFE.

INSTALLING PACKING

Place the first three rings of packing in the front of the box with the splits alternated. The first split to be down, the second split up, and the third split down. Then insert the lantern ring and compress this assembly forward with the gland halves. Then install the last two rings split up then split down. The object is to have the last split down so leakage will drip down, not run along the shaft and maybe into the bearings.

After the packing has been installed, install the packing gland and tighten hard to compress the packing assembly. Back off the gland bolts and re-tighten only finger tight.

ADJUSTING THE PACKING:

Packing must have cooling, THEREFORE IT MUST LEAK. When adjusting the packing always adjust only one flat on the nut at a time, waiting for the packing to heat before adjusting tighter. THE PACKING MUST LEAK 10-12 DROPS PER MINUTE TO REMAIN COOL.

LUBRICATION AND COOLING OF PACKING WITH WATER

It is best to inject water into the lantern ring from an external source on drilling mud. This will keep most of the solids out of the packing. PACKING AND SHAFT LIFE WILL BE INCREASED UP TO 500%. Also the water leakage from the packing will not be as objectionable as mud.

INSTALLING WATER FLUSH SYSTEM TO BE ACCEPTABLE WITH OIL COMPANIES.

Many oil operators will not allow water to be put on the packing because of the excess amount of water getting into the mud, due to poorly designed and maintained systems. Two major problems cause this complaint. (1) too much line pressure and (2) not turning water off when pump is not in use.

CONTROLLING WATER PRESSURE TO PACKING

The water pressure is usually too high. The brake cooling pump is normally used, which has pressures from 50 to 75 PSI. Only 5-10 PSI water is needed to cool and lubricate the packing, and a pressure regulator needs to be installed to reduce the pressure on the packing. One regulator can supply all centrifugal pumps from a central system.

CONTROLLING WHEN TO USE WATER ON PACKING.

LARGE VOLUMES of water get into the mud when the pump is NOT OPERATING, because when the pump is running, the shaft deflects, and when stopped, the shaft straightens up and a gap occurs down one side of the shaft between the packing and the shaft, allowing a stream of water to enter the mud. You can manually turn off the water when the pump is shut down, but a better way is to install a solenoid valve in the water supply line that turns the water on and off as the motor is turned on and off. ONLY a small amount of water (a few drops per minute) which gets into the mud while the pump is running should not be objectionable to the oil companies.

GREASE LUBRICATION OF PACKING

If water can not be used, the next best addition to the packing would be grease from an automatic spring loaded grease cup (HALCO PART G1509). This grease cup will help keep the packing soft. There is a visual indication when the cup no longer has any grease. The stored grease normally lasts a week or more if the packing is adjusted correctly.

BEARING FAILURES:

EXCEPT FOR CAVITATION PROBLEMS, BEARING FAILURE IS THE GREATEST CAUSE OF INCREASED PUMP OPERATING COST.

IF YOU CONTINUE TO RUN A PUMP WHEN BEARING FAILURES OCCUR, THERE IS AN EXCELLENT CHANCE THE WHOLE PUMP WILL BE DESTROYED. Therefore, it is very important to change the bearings when failure **STARTS.** If you wait for complete failure, other fluid end parts will be damaged.

Bearing failure is more often caused by LUBRICATION FAILURE than by normal bearing wear.

MISALIGNMENT BETWEEN PUMP AND DRIVER

A MAJOR CAUSE OF BEARING FAILURES IS MISALIGNMENT. ALIGNMENT BETWEEN THE PUMP AND MOTOR SHOULD ALWAYS BE CHECKED AFTER SHIPMENT AND PERIODICALLY RECHECKED.

PART V. Miscellanous Information

OPERATING LIMITS OF RIG CENTRIFUGAL PUMPS

AS WITH ANY TYPE EQUIPMENT, CENTRIFUGAL PUMPS HAVE OPERATING LIMITS, IF YOU ARE GOING TO RECEIVE GOOD LIFE.

SUCTION LINE VELOCITY

SUCTION LINE VELOCITY SHOULD NOT EXCEED 10 FEET/SECOND FOR REASONABLE PUMP LIFE. This means the maximum flow for a 6 inch suction is 900 GPM and an 8 inch suction is 1600 GPM. If you want to flow more than 1600 GPM install a 10 inch or larger suction pipe.

NPSH

THE SYSTEM MUST HAVE ENOUGH NPSH FOR THE PUMP REQUIREMENTS OR THE PUMP WILL CAVITATE AND HAVE A VERY SHORT LIFE.

It appears that most installations do not have enough NPSH to run a 5X6 pump at flows above 1400 GPM even with an 8 inch suction. (THIS DOES NOT MEAN THAT NO ONE HAS ENOUGH NPSH) The result of not enough NPSH is cavitation and early pump failure.

Through observation, the greatest problem with NPSH is the mud mixing pumps. Most companies do not change the nozzles in the mud guns often enough. On a one inch nozzle, 1/16 inch wear per side will increase flow by 26%. EXAMPLE: FROM A REQUIRED VOLUME OF 1500 GPM TO 1890 GPM. A wear of 1/8" increases flow by 56%, or from 1500 GPM to 2340 GPM. If sized correctly when new, the mud mixing pumps will soon be required to furnish a greatly increased volume and maybe more than the maximum limit of that pump size. I have found customers running 6X5 pumps on mud mixing, experiencing much higher maintenance cost than those running 8X6 pumps. Companies running 6X5 pumps at 1750 RPM on mud mixing often have high maintenance every six months, while customers running 8X6 pumps at 1150 RPM often do not require major repair before two years. Looking at the failures it appears the problem is not enough NPSH available at the higher volumes, probably caused by nozzle wear **(HALCO manufactures rubber mud gun nozzles to prevent most of the wear.)** AT 1500 GPM A 6X5 PUMP RUNNING 1750 RPM REQUIRES UP TO 26 FEET NPSH, WHILE A 8X6 2500 SUPREME AT 1500 GPM RUNNING 1150 RPM REQUIRES ONLY 7 FEET NPSH. NEARLY ANY SYSTEM WILL HAVE 7 FEET AVAILABLE, ALMOST NO SYSTEM WILL HAVE 26 FEET AVAILABLE, ESPECIALLY IF THE MUD TEMPERATURE REACHES 140 DEGREES F.

We normally do not see the cavitation problem as much with the desander and desilter pumps because the rubber cones do not wear as much as the steel nozzles and normally the volume requirements are closer to 800 to 1000 GPM.

CAPACITY LIMITS FOR PUMPS LISTED BELOW DOES NOT CONSIDER SUCTION LINE VELOCITY NOR NPSH CALCULATIONS WHICH MUST BE MADE FOR EVERY INSTALLATION.

PUMP SIZE	MAXIMUM GPM
3X2X13	450
4X3X13	750
5X4X14	1100
6X5X14	1800
8X6X14	2400

CAPACITY REQUIREMENTS OF EQUIPMENT IN RIG APPLICATIONS

The chart below list the normal design requirements when the equipment is new with no wear.

EQUIPMENT	DESIGN VOLUME
4" CONE	45-60 GPM
4H (5") CONE	80 GPM
6" CONE	125 GPM
8" CONE	250 GPM
12" CONE	450-500 GPM
6"MUD HOPPER	550 GPM
3/4" NOZZLE	80 GPM
1" NOZZLE	140 GPM
1.5" NOZZLE	300 GPM
2" NOZZLE	550-600 GPM
MECHANICAL BRAKES	40-50 GPM
ELECTRIC BRAKES	50-200 GPM
SWACO DEGASSER	400 GPM
WELCO DEGASSER	700 GPM
BRANDT DG5 DEGASSER	500 GPM
BRANDT DG10 DEGASSER	1000 GPM

LONG TERM PUMP AND MOTOR STORAGE

1 Pump packages should be stored indoors in a clean, dry and protected environment.

2. The storage area is to be free from any vibration and from extremes in temperature.

3. Motor and pump shafts are to be rotated manually every 2 months. A record of the rotation should be made.

4. Grease in the motor and pump bearings is to be purged at the time of removal from storage, making sure that an ample supply of fresh grease is in each grease cavity.

5. Motor winding should be megged at the time equipment is put in storage. At the time of removal from storage, the resistance reading must not have dropped more than 50% from the initial reading. Any drop below this point necessitates electrical or mechanical drying of the motor windings. Condensation from hot days and cool nights can fill the motor haif full of water. This is a greater potential problem in damp areas.

6. If the pumps are to be stored outside, the pump suction and discharge openings should be sealed to prevent any water from entering the pump housing, causing rust of the fluid end during storage.

A FEW EASY AND FUN WAYS TO KILL YOUR PUMPS

OVERLOAD IT

Your pump was designed for certain specified conditions of capacity and speed. Be a slave driver. Open all the discharge valves you can find to be sure you exceed its design capacity. Over work the bearings and increase the shaft deflection, thus lowering the life. If you do it right you can probably kill the pump in 1/4 the time. You can probably overload the motor, so increase the heater size in the starter to be sure the motor burns up.

CHOKE IT

Your pump only breathes liquid into its suction. Choke it with air. There are lots of ways; some are:

a. Be sure the suction has air leaks.

b. Lower the suction tank level so a vortex forms to feed it air.

c. Pipe return mud lines over the pump suction and let the mud drop onto the mud surface, trapping air to feed into pump suction.

d. Partially close a suction valve until the fluid boils right in the pump suction.

e. Feed two pumps from the same suction.

f. Be sure to put plenty of tees, ells and valves in the suction.

THIS CAN BE GREAT FUN. OFTEN THE PUMP SHAKES AND VIBRATES AND SOUNDS LIKE IT IS GARGLING WITH ROCKS. Picture the pieces of metal being knocked out of the impeller and casing.

MASH IT

Tighten the packing until no leakage comes out to cool it. If you are lucky you can watch it smoke. As soon as it is burned, cracked and hard it will never come back to life. If you can not burn the packing in less than 30 minutes, shame on you.

WHIP IT AROUND

Don't check the alignment after moving or don't align it when replacing it after repair. The misalignment of the coupling can easily overload the bearings and cause failure.

GIVE IT THE DIRT TREATMENT

Be sure to use the grease from the opened 5 gallon bucket so you can be sure to get dirt and water into the bearing. Dirt and water work wonders for the bearing lubrication. You can grind the balls down and rust the heat treated parts. Also, lubricate them every day until the bearing housing is full of grease, holding the heat in. Failure is probably only a month away.

REPAIR

You will have to figure out how to stick your buddy with the repair work when you succeed. Don't wait too long to figure it our, because you now know how to kill the pump quickly.

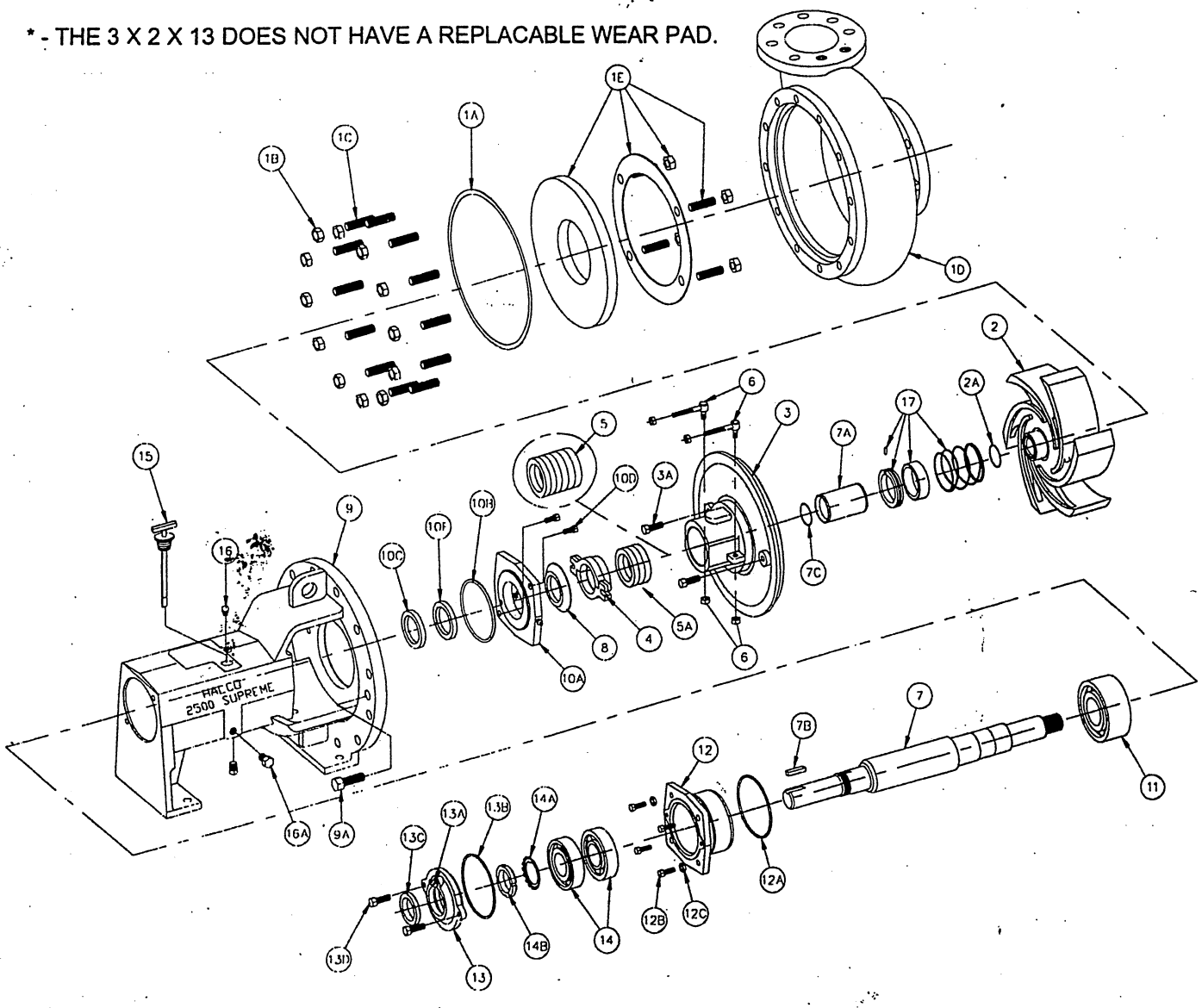
ITEM	QTY.	PART NUMBER	PART NAME	MATERIAL
1	1	SEE NEXT PAGE	CASING + ITEM 1A-1E	HARD IRON
1A*	1	H10399-46-1	GASKET, CASING	FIBER
1B	12	H3932-61	NUT, CASING STUDS	STAINLESS, 3/4-10 HEX HEAD
1C	8	H2507-3	STUD, CASING	STEEL, 3/4-10 X 3-1/4" LONG
1C	4	H3862-76	STUD, CASING	STEEL, 3/4-10 X 3" LONG
1D	1	SEE NEXT PAGE	CASING LESS WEAR PAD KIT	HARD IRON
1E	1	SEE NEXT PAGE	WEAR PAD	HARD IRON
2	1	SEE NEXT PAGE	IMPELLER	HARD IRON
2A*	1	H19110-72	SEAL, IMPELLER	VITON
3	1	H22223-01-30A	STUFFING BOX COVER, SEAL	HARD IRON
3	1	H20614-01-30A	STUFFING BOX COVER, PACKED	HARD IRON
3A	2	H3861-117	BOLT, STUFFING BOX	STEEL, 1/2-13 X 1-1/4"
4	1	H20622A	GLAND SET	300 STAINLESS STEEL
5	1	H8264-24-1A	PACKING 5 RINGS & LANT. RING	GRAPHITE ASBESTOS
5A	1	H2537-24A	PACKING 3 RINGS FOR SEAL	GRAPHITE ASBESTOS
6	2	H3701A	BOLT, GLAND ASSEMBLY	300 STAINLESS STEEL
7	1	H20612-02-33	SHAFT	4140
7A	1	H20613-21G7A	SLEEVE, SHAFT	416 SS, CERAMIC COATED
7B	1	H4372-5-21	KEY, COUPLING END	416 STAINLESS STEEL
7C*	1	H7496-236	SEAL, SHAFT SLEEVE	BUNA-N
8	1	H22210-1	DEFLECTOR	RUBBER
9	1	H17444	FRAME	CAST IRON
9A	2	H2538-1	JACK BOLTS	STAINLESS STEEL
10A	1	H17950	COVER, INBOARD BEARING	CAST IRON
10B*	1	H20625	GASKET, INBOARD BRG. COVER	ASBESTOS
10C*	1	H20619-01	OIL SEAL, INBOARD BRG. COVER	BUNA-N
10D	2	H3861-1	BOLT-INBOARD, BEARING COVER	STEEL, 1/2"-13 X 1-1/2" LONG
10F*	1	H20620-01	EXCLUSION SEAL, INBD. BRG.	BUNA-N
11	1	H20615-1	BEARING, INBOARD	FAFNIR 5313 WBR., MRC5313
12	1	H20624-01-01	HOUSING, OUTBOARD BEARING	CAST IRON
12A*	1	H7496-253	SEAL, BEARING HOUSING	BUNA-N
12B	4	H3861-138	BOLTS, BEARING HOUSING	STEEL, 1/2"-13 X 1-1/2" LONG
12C	2	H3932-62	NUTS, BEARING HOUSING	300 S.S.1/2-13 JAM NUT
13	1	H20617-01-01	COVER, OUTBOARD BEARING	DUCTILE IRON
13B*	1	H7496-26	SEAL, OUTBOARD BRG. COVER	BUNA-N
13C*	1	H20619-02	OIL SEAL, OUTBOARD BRG. CVR.	BUNA-N
13D	2	H3861-139	BOLT, OUTBOARD BRG. COVER	300 SS, 3/8-16 X 1" LONG
14	2	H20616-1	BEARING, OUTBOARD	FAFNIR 7311 PW-BR-SU, MR731
14A*	1	H6124-4	LOCK WASHER, BEARING	SKF-W1" (STEEL)
14B*	1	H6123-4	LOCK NUT, BEARING	SKF-N1" (STEEL)
15	1	H2539-3	DIPSTICK	RUBBER AND STEEL
16	1	H8267-1	BREATHER	STEEL
16A	2	H8505-1	PLUG, OIL	STEEL
17	1	H22451-1A	MECHANICAL SEAL	TUNGSTEN CARBIDE

	ITEM	PART NUMBER	DESCRIPTION
*KITS:	1A, 2A, 7C	H10399-46-1A	FLUID END GASKET KIT
	10B, 12A, 13B	H20625A	POWER END GASKET KIT
	10C, 10F, 13C	H20619A	GREASE SEAL KIT
	14A,14B	H6123-4A	LOCKNUT KIT
SPECIAL TOOLS:		H20952	IMPELLER REMOVAL TOOL

ASK YOUR PURCHASING AGENT FOR GENUINE HALCO PARTS TO ENSURE YOU RECIEVE THE BEST QUALITY. ALL HALCO PARTS HAVE A HALCO PART LABEL.

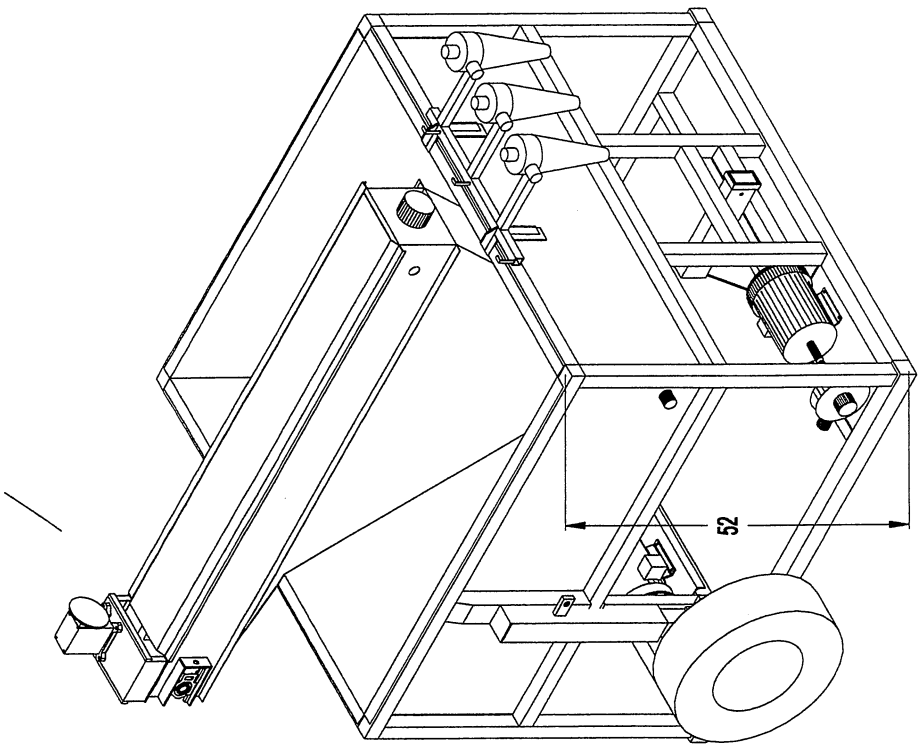
ITEM	QTY.	PART NUMBER	PART NAME	MATERIAL
1A-1E*	1	H19203-01-30A	3 X 2 X 13 CASING	HARD IRON
2	1	H19204-XX-30	3 X 2 X 13 IMPELLER	HARD IRON
1A-1E	1	H19205-01-30A	4 X 3 X 13 CASING	HARD IRON
1E	1	H2501-01-30A	4 X 3 X 13 CASING WEAR PAD	HARD IRON
2	1	H19206-XX-30	4 X 3 X 13 IMPELLER	HARD IRON
1A-1E	1	H19222-01-30A	5 X 4 X 14 CASING	HARD IRON
1E	1	H2502-01-30A	5 X 4 X 14 CASING WEAR PAD	HARD IRON
2	1	H19224-XX-30	5 X 4 X 14 IMPELLER	HARD IRON
1A-1E	1	H19122-01-30A	6 X 5 X 11 CASING	HARD IRON
1E	1	H2503-01-30A	6 X 5 X 11 CASING WEAR PAD	HARD IRON
2	1	H19121-XX-30	6 X 5 X 11 IMPELLER	HARD IRON
1A-1E	1	H19123-01-30A	6 X 5 X 14 CASING	HARD IRON
1E	1	H2504-01-30A	6 X 5 X 14 CASING WEAR PAD	HARD IRON
2	1	H19121-XX-30	6 X 5 X 14 IMPELLER	HARD IRON
1A-1E	1	H19763-01-30A	8 X 6 X 11 CASING	HARD IRON
1E	1	H2505-01-30A	8 X 6 X 11 CASING WEAR PAD	HARD IRON
2	1	H19121-XX-30	8 X 6 X 11 IMPELLER	HARD IRON
1A-1E	1	H19117-01-30A	8 X 6 X 14 CASING	HARD IRON
1E	1	H2506-01-30A	8 X 6 X 14 CASING WEAR PAD	HARD IRON
2	1	H19116-XX-30	8 X 6 X 14 IMPELLER	HARD IRON
1A-1E	1	H20937-01-30A	10 X 8 X 14 CASING	HARD IRON
1E	1	H2540-01-30A	10 X 8 X 14 CASING WEAR PAD	HARD IRON
2	1	H21867-XX-30	10 X 8 X 14 IMPELLER	HARD IRON

* - THE 3 X 2 X 13 DOES NOT HAVE A REPLACABLE WEAR PAD.



ASSEMBLY, PORTABLE RECIR. TANK (7860160)

ITEM	PART NUMBER	DESCRIPTION	QTY
1	7860120	HYDROCYCLONE ASSY	3
2	7860101W	TRIPLE CYCLONE MOUNTS	1
3	1892200	HALCO MOTOR RISER #3 FOR 215T	2
4	1891900	HALCO 3X2X13 2500 SUPREME9"IM	2
5	1892800	HALCO FLANGE KIT KFL-2X3-T	2
6	1892760	HALCO COUPLING GUARD WG2 OSHA	2
7	1892770	HALCO C3 CHANNEL BASE 15X48	2
8	1971600	M3714T 10HP3PH R/B 213T	2
9	1255900	8SX13/8 LVJOY SFLXCOUP1/	2
10	1256000	8SX17/8 LVJOY SFLXCOUP1/	2
11	1256300	8JE LVJOYSFLXCOUPINS	2
12	1979500	RIM/ TIRE 6BLT15X6 7.60X15 8 PLY	2
13	1987000	356LM COMPLETE HUB ASS'Y	2
14	1465900	SL1541GT RATCHET JACK	2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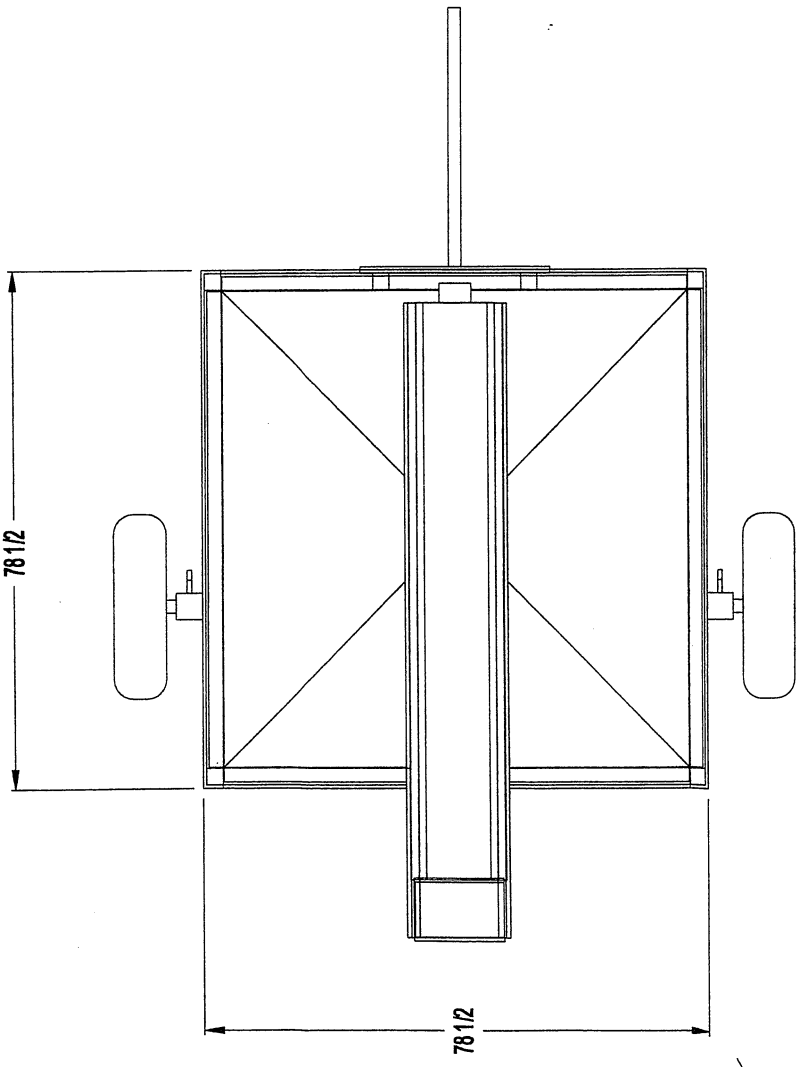
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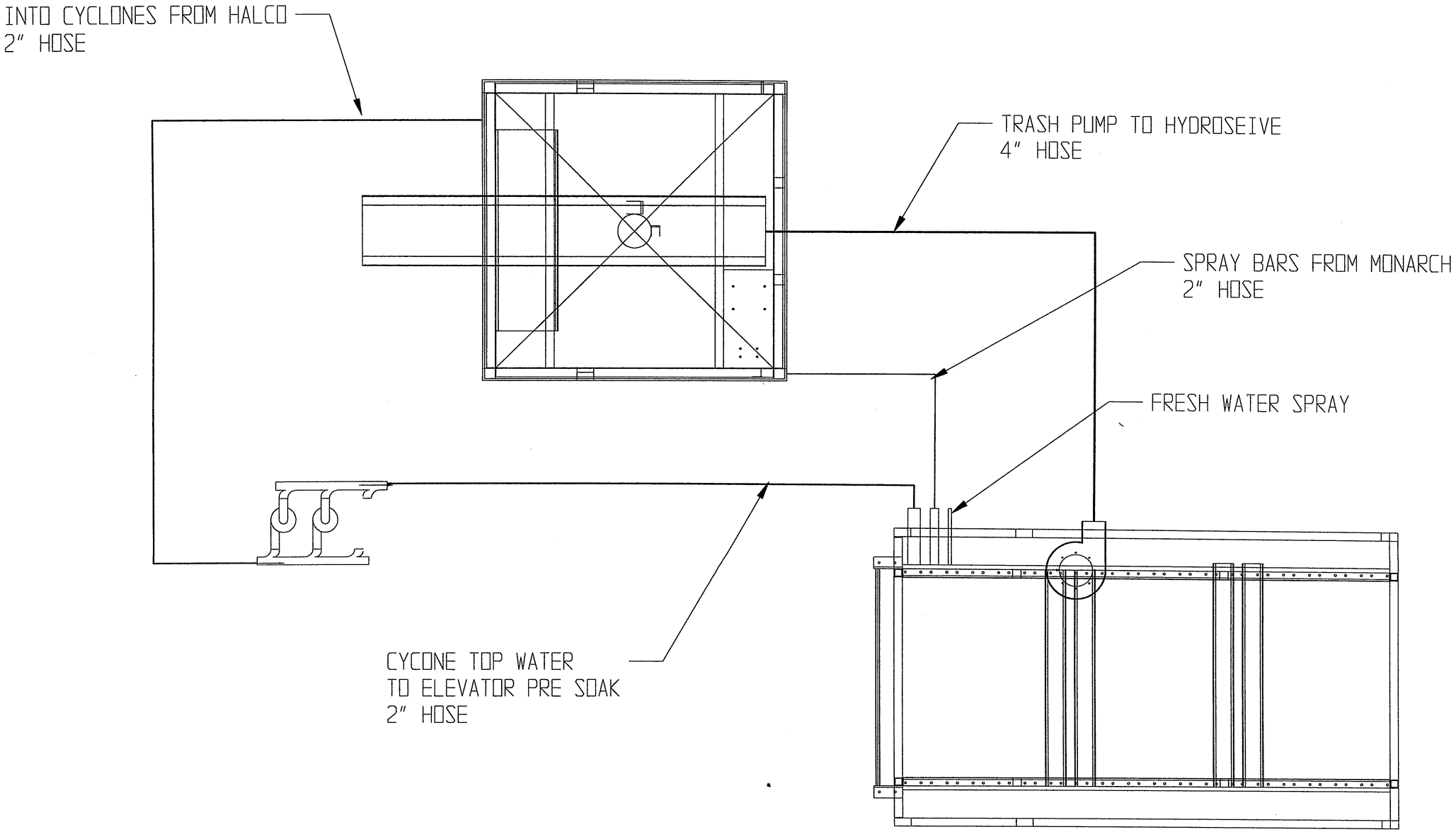
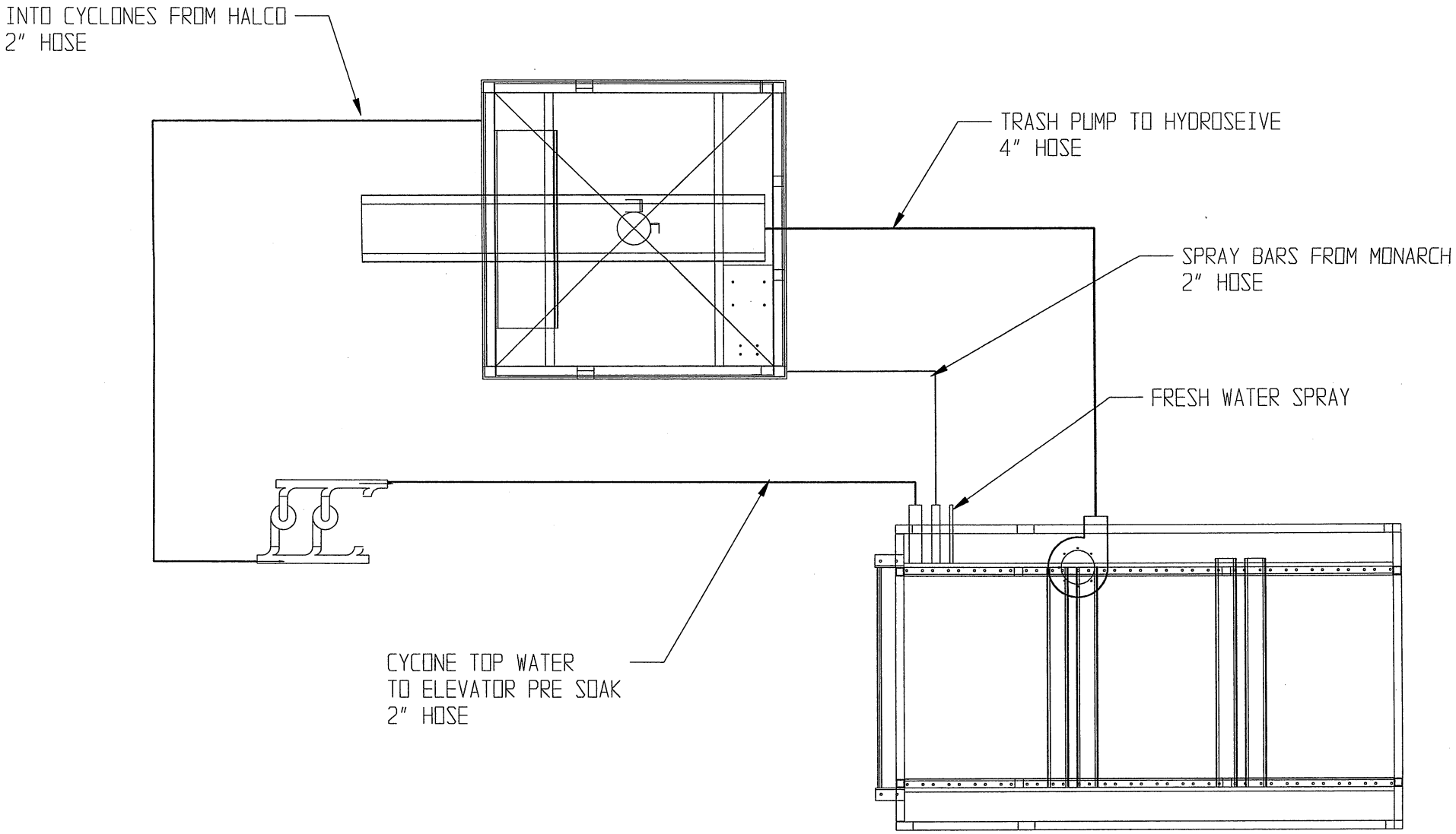
78 1/2


INTO CYCLONES FROM HALCO
2" HOSE
TRASH PUMP TO HYDROSEIVE
4" HOSE
SPRAY BARS FROM MONARCH
2" HOSE
FRESH WATER SPRAY
CYCONE TOP WATER
TO ELEVATOR PRE SOAK
2" HOSE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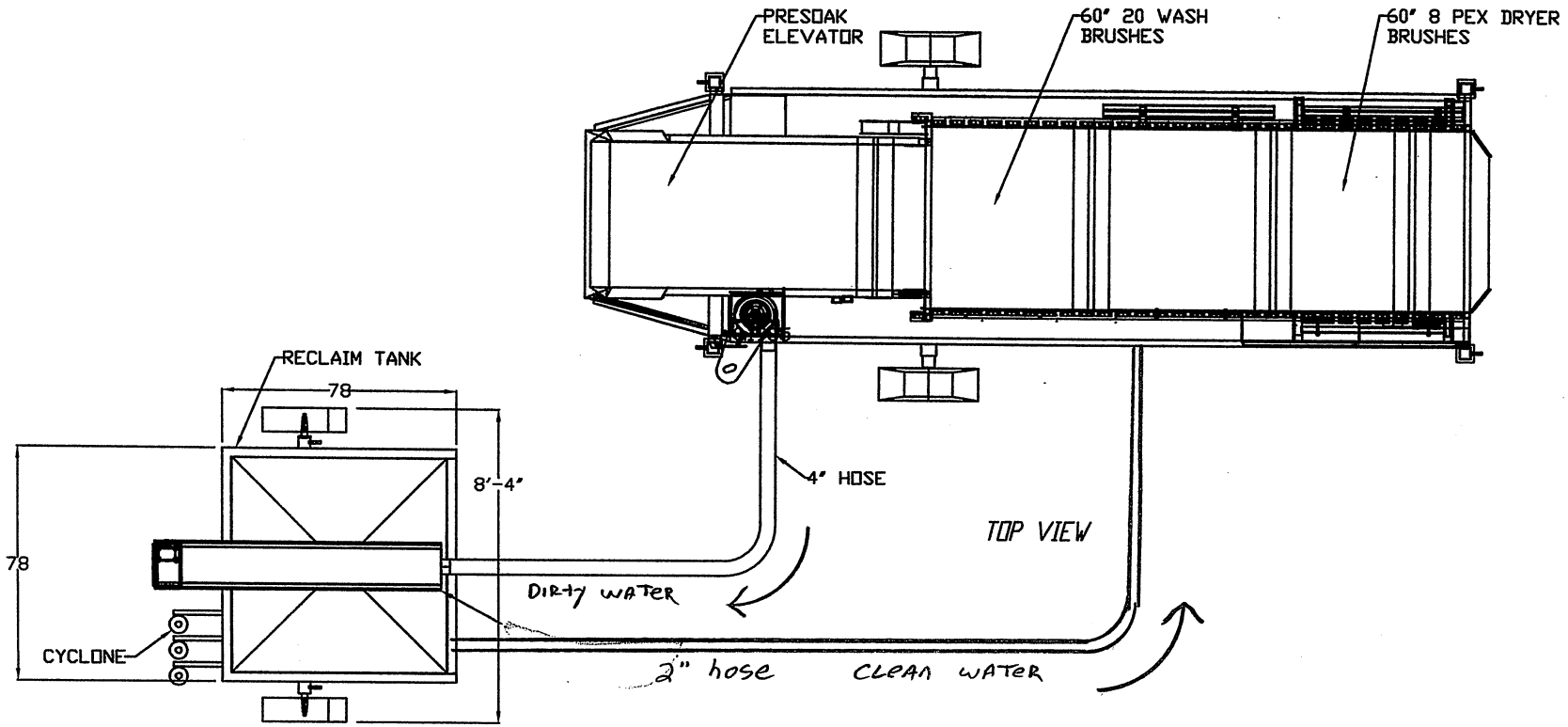

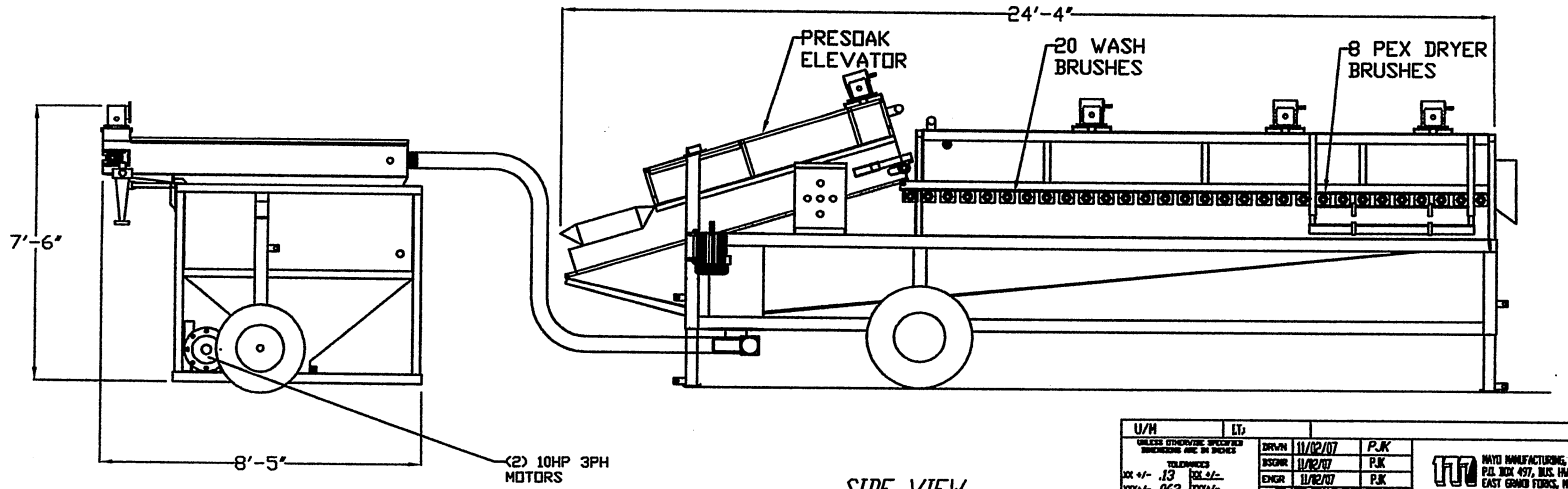

U/M	IN		
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		DRWN	11/12/07 P.JK
TOLERANCES		DSGNR	11/12/07 P.JK
XX +/- .13 XXX +/-		ENGR	11/12/07 P.JK
XXX +/- .063 XXXX +/-		DO NOT SCALE THIS DRAWING INTERPRET PER ANSI Y14.5	
∠ +/- HOLES +/-		MACHINE	
THIRD ANGLE PROJECTION		MATERIAL	
ORIGINALLY DESIGNED FOR			
PROD.			
NEXT ASSY			

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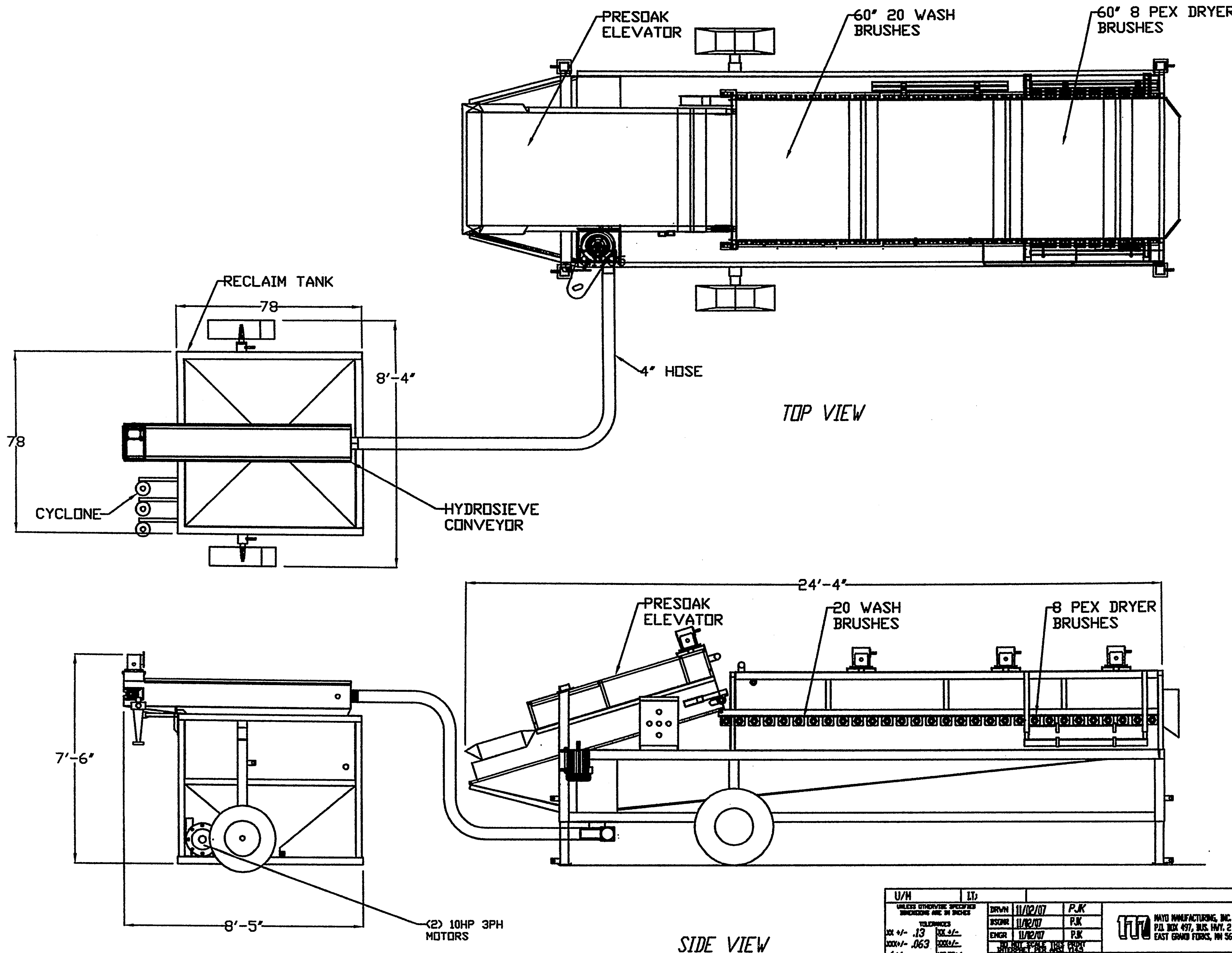
TITLE

60" WASHER SYSTEM

SIZE	SCALE	DOCUMENT NUMBER	ISSUE
D	SHEET 1 OF 1		

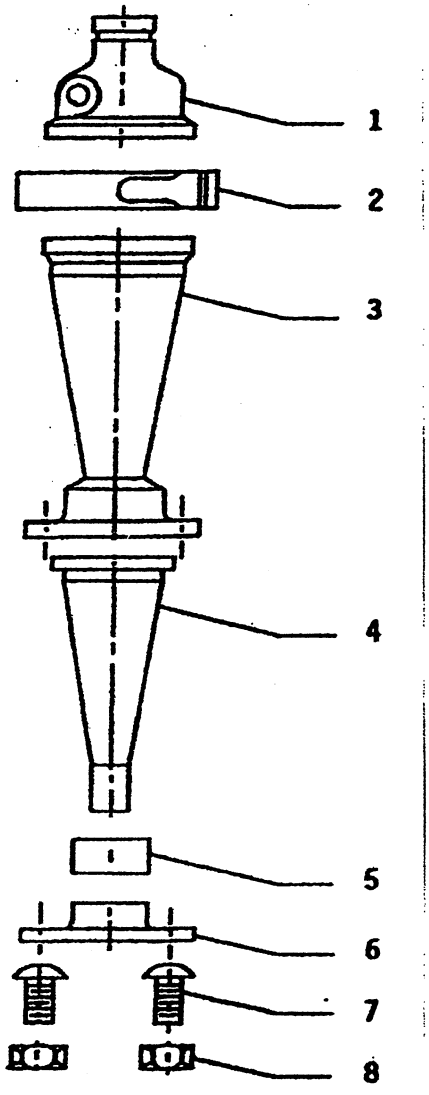


U/M	LT:			
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES .XX +/- .13 / .XXX+/- .063 / ∠+/- .X +/- / .XXXX+/- / HOLES+/-	DRWN 11/02/07 PJK DSGNR 11/02/07 PJK ENGR 11/02/07 PJK DO NOT SCALE THIS PRINT INTERPRET PER ANSI Y14.5	MAYO MANUFACTURING, INC. P.O. BOX 497, BUS. HWY. 2 EAST GRAND FORKS, MN 56721	THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF MAYO MANUFACTURING, INC. AND SHALL NOT BE REPRODUCED, DISTRIBUTED, DISCLOSED OR USED FOR MANUFACTURE OR SALE OF APPARATUS WITHOUT WRITTEN PERMISSION	
THIRD ANGLE PROJECTION	MACHINE	TITLE 60" WASHER SYSTEM		
ORIGINALLY DESIGNED FOR	MATERIAL			
PROD.		SIZE D	SCALE 1:1 / SHEET 1 OF 1	DOCUMENT NUMBER / ISSUE
NEXT ASS'Y				

PARTS LIST

MODEL 240
4" DESILTING HYDROCYCLONE

(50 GPM at 75' of Head)



Part Number	Ref.	Description
240-00	---	Desilting Hydrocyclone Assembly, Complete
240-01	1	Cone Top, Polyurethane
240-02	2	Coupling, Quick Release
240-03	3	Cone Body
240-04	4	Liner, Polyurethane
240-05	5	Squeeze Bushing, Neoprene
240-06	6	Adjusting Flange
240-07	7	Adjusting Bolt
240-08	8	Lock Nut

8 INDEX

MAYO MANUFACTURING CO.

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EAST GRAND FORKS, MN 56721

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