

# ***norweco***<sup>®</sup>

## **PLANT OPERATOR'S MANUAL**

### **MECHANICAL EQUIPMENT MAINTENANCE**

#### **BLOWERS**

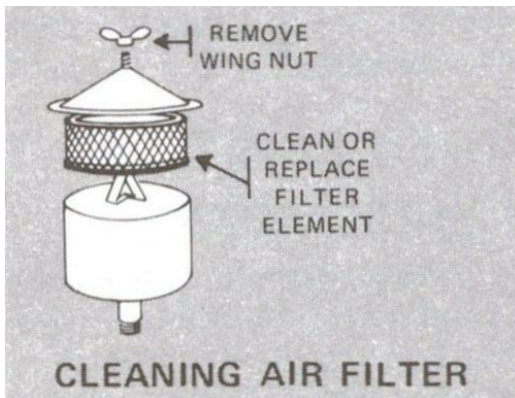
Positive displacement blowers are used to supply air to the individual elements within the treatment facility. The blowers contain two impellers mounted on parallel shafts and they rotate in opposite directions. As one impeller passes the inlet of the blower it traps a quantity of air and carries it around to the outlet where it is discharged. Timing gears are installed on the end of each shaft to regulate the position of the impellers and maintain the clearances they need to ensure maximum efficiency. Always be sure the pulley on the blower is properly aligned with the motor pulley so that no undue stress or wear is placed on the blower.

#### **MOTORS**

Electric motors are used to drive the individual blower units. When they are well maintained they normally do not require repair. However, if a problem does develop with a motor, fast dependable service can be obtained from the local Norweco distributor. All dust should be cleaned away from the ventilating openings in the motor shell at least once a month. At the same time be sure to check the pulley on the motor shaft to see that it is aligned with the blower pulley and properly tightened.

#### **AIR FILTER**

An inlet air filter/silencer is installed on each blower unit in the treatment plant. It is installed on the inlet of the blower to filter the air and trap foreign objects that might enter the blower. To enable the blower to produce the air intended, the filter must be kept clean at all times. Check the filter element once a month and clean it as necessary.



The best way to clean an air filter is to purchase a second one and rotate operation of the filters. This will permit the operator to install a clean filter and keep the plant in operation while the dirty element is soaked in kerosene and cleaned.

#### **PRESSURE RELIEF VALVE**

A pressure relief valve is installed in the air discharge piping of the mechanical unit. The relief valves are weighted type valves that lift up to discharge air if the pressure in the system becomes too great. The proper number of weights are placed on the system when it is installed and they should not be removed or changed. Remove and oil the inside of the relief valve cap once a month to ensure free operation of the valve.

#### **AIR VALVES**

Inspect the air valves in the treatment plant to be sure they are properly adjusted. After the plant and equipment is adjusted and running as intended, each valve in the system should be marked so that it is easy to determine if the valves are correctly set.

#### **DIFFUSERS**

Evenair diffuser bars in the treatment plant should be inspected once a year. Disconnect the union at the top of the individual air drop pipes and lift out the entire assembly. Check to be sure that all fittings are in place and properly tightened and that each air opening in the diffuser assembly is clean and free of any foreign material.

#### **SLUDGE RETURN**

Inspect the air lift sludge return to be sure it is returning at least  $\frac{1}{3}$  of a pipe full. Any return rate above the  $\frac{1}{3}$  mark may be used if it improves operation of the plant. Sludge returns should pump continuously - the plant should never be in operation unless the sludge return is operating.

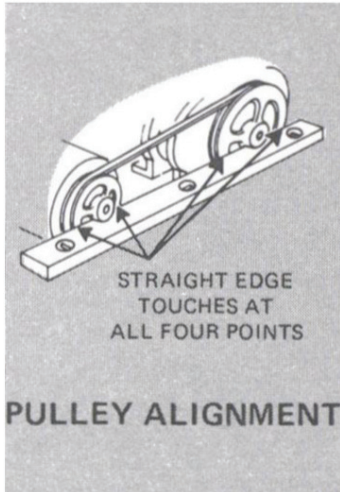
#### **SURFACE SKIMMER**

Check the skimmer inlet fitting bi-weekly to see that it is set level  $\frac{1}{8}$  of an inch under the surface of the water. It should not be set deeper because it will pump too much liquid and be less effective. Skimmers should return only about  $\frac{1}{3}$  of a pipe full. Turn them on long enough to remove solids from the surface of the settling tank, but do not let them run on a continuous basis.

# PLANT OPERATOR'S MANUAL (Cont.)

## EFFLUENT WEIR

The final effluent weir in the settling/clarification chamber of the treatment plant should be kept clean as necessary. Any sludge or grease particles that have accumulated along the edge of the effluent weir should be removed with the squeegee or a dip net. The degree of settling obtained in the clarifier is, to a large degree, dependant upon the size and adjustment of the wier. Inspect the weir at least once a week to be sure that it is level and skimming evenly along the entire length on both sides. To adjust the weir, loosen the bolts on the side of the weir plate. It is not necessary to pump the tank down or use special tools for this adjustment. Once a year the weir should be wire brushed and painted as required.

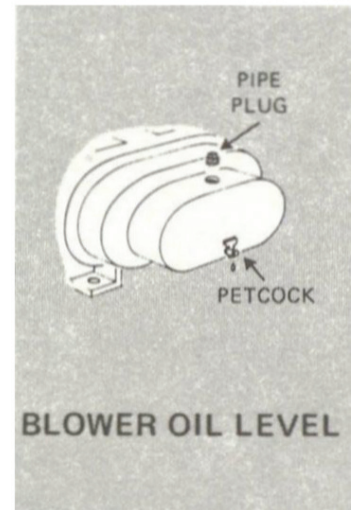


## V-BELTS & PULLEYS

Pulleys on the motor and blower connected by a v-belt are used to drive the unit and provide the air required for the treatment process. The pulleys should always be kept in perfect alignment to eliminate unnecessary wear on the v-belt and bearings. To check the pulleys for alignment, place a straight edge against the front face of the motor pulley and let it extend over and against the front of the blower pulley. Slide the straight edge down so that it is resting on top of the motor and blower shaft. If the pulleys are properly aligned the straight edge will touch all four points along the front face of the pulleys. If they are improperly aligned they can be adjusted by loosening the mounting bolts on the back of the motor and shifting the motor until they align. Check the pulleys for proper alignment once a month and at the same time inspect the v-belt for wear. Once every two weeks check the v-belt to ensure that it is not slipping. To do this, shut the motor off and let the unit come to a complete stop. Now turn the unit on momentarily. If the v-belt is loose the blower pulley will not begin to turn until after the motor pulley has turned several revolutions. If this happens the motor mounts must be loosened and the motor must be moved away from the blower to obtain more belt tension. Naturally, when this is done it will be necessary to recheck the pulleys for proper alignment. Most plant operators find it convenient to keep a spare v-belt on hand so they can replace the belt when necessary without interrupting operation of the plant. One spare belt is supplied with each Norweco system and it should be kept in a convenient place for the operator. New v-belts have a tendency to stretch slightly and wear during the first few weeks of operation. Therefore, operators must always check for v-belt slippage in any new system.

## STAND-BY UNIT

Stand-by mechanical equipment is provided on all large treatment plants and in many cases, the smaller ones as well. Norweco stand-by equipment is a complete second set of motors, blowers and electrical controls supplied to provide a duplicate set of equipment in case of a mechanical or electrical failure. Plant operators should perform maintenance on the stand-by equipment at the same intervals specified for the primary unit in the treatment plant. Most systems are wired to alternate automatically and it is generally accepted that the best way to obtain long equipment life is to permit units to alternate operation.



## EQUIPMENT LUBRICATION

### BLOWERS

Check the oil level in the blower once every 30 days. To do this open the small brass petcock on the back of the blower and remove the square pipe plug on the top of the blower gear housing. With the unit idle, pour oil slowly into the pipe plug opening until it begins to drip from the open petcock. Leave the petcock open until the oil has stopped running out. This will avoid over lubrication. Too much oil causes heating and oil leakage. Remember to close the petcock after checking the oil level or filling the unit. Use only SAE40 lubrication oil in the blower gear housing.

Bearings at the gear end of the blower are lubricated by splash from the gears but the bearings at the drive end are packed with grease prior to shipment. Replace the grease with a good grade high temperature ball bearing grease (drop temperature of 275 degree F or better) at regular 30 day intervals. If the unit is fitted with a grease cup, remove the grease drain plug on the bottom of the bearing housing and turn the cap gradually until fresh grease appears at the drain. If the unit is fitted for a pressure gun, do not pack the bearings too tightly. Remember to replace the drain plugs.

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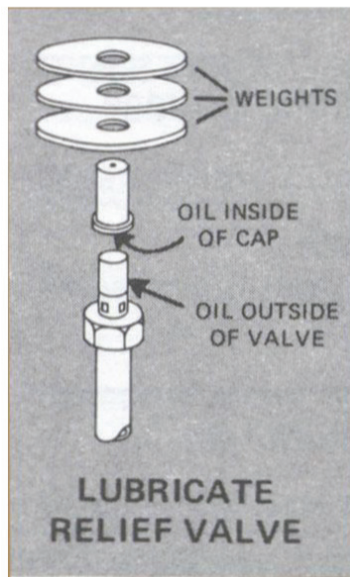
*Engineering the future of water  
and wastewater treatment*

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## PLANT OPERATOR'S MANUAL (Cont.)

### MOTORS

Norweco motors, used to drive the blowers, are pre-lubricated for the life of the unit. Operators should clean all the dust away from ventilating openings on the motor every 30 days and check the motor mounting fasteners to be sure they are tight. If trouble with a motor does occur the operator should contact his Norweco distributor immediately. The distributor will isolate the problem and provide fast dependable service for the unit.



### PRESSURE RELIEF VALVE

Pressure relief valves are installed on the discharge piping from the blower to eliminate the possibility of pressure build up. The valves are simple in construction and require very little attention. They should be kept clean and checked periodically to make sure rust or dirt does not interfere with their free operation. At least monthly the relief valve weight and cap should be removed from the valve body (lift straight up) and the inside of the cap and outside of the body should be covered with a light coat of oil to ensure free operation of the valve.

### VALVES

All air and sludge valves in the treatment plant should be checked twice a year for leaks. Naturally any leak in the sludge return valves can be detected by visual inspection. Air valves, however, may need to be sprayed with leak detector. Although leak detector is commercially available, a rich solution of soapy water will do the job. Any valve that is leaking should be disassembled and repacked with grease or, in the case of the small air valves for the sludge return and surface skimmer, it may be necessary to install a new rubber washer. Be sure to note all valve settings before repacking so they can be quickly readjusted after the maintenance is complete.

### AIR FILTERS

Inlet air filter/silencers are installed at the inlet of each blower to reduce the noise level and clean the incoming air. They must be kept clean so they will not create resistance to the free air flow into the blower. The wire mesh screen on the air filter should be coated with oil after each cleaning. It is recommended that plant operators keep an extra filter on

hand so that it can be placed into service while the dirty unit is being cleaned. To clean the wire screen in the filter, remove it from the filter body and place it in a container of kerosene. After it has soaked for a day or two blow it dry with an air gun and recoat the mesh with oil. Inspect each air filter every 30 days for cleaning.

### ELECTRICAL EQUIPMENT MAINTENANCE

Generally maintenance of the electrical apparatus should be performed by an electrician. If any of the electrical equipment malfunctions, contact the Norweco distributor and he will have his electrician repair the equipment.

Electrical leads should be checked once a year to be sure they are not frayed or subject to undue vibration. In addition, the time clock, if provided, should be checked once every 2 weeks to see that it is set to the proper time of day. At the same time, all circuit breakers, fuses and resets should be inspected. Circuit breakers should be reset as necessary and blown fuses should be replaced by the operator as required. CAUTION: Shut off all electrical power at the power source before replacing fuses or inspecting electrical wiring.

REMEMBER: Repair and replacement of electrical equipment should be done by a qualified electrician.

### PLANT SHUT DOWN

Occasionally it is necessary to shut down a wastewater treatment system for an extended period of time. For example, plants serving schools located in rural areas are often shut down for the entire summer period. Recreational areas such as campsites may be shut down during the winter months in colder regions of the country. Any plant that will be shut down for longer than 72 hours should receive special care. When the shut down will be for a relatively short time, such as a week to two, it is only necessary to flush the insides of the blower unit with 50-50 mixture of kerosene and oil. To do this simply remove the air filter from the top of the blower unit and pour the mixture into the top of the blower while rotating it by hand. Be sure to reinstall the air filter. Do not leave the top of the blower open or exposed during the shut down period! If the shut down is to be extended several additional precautions should be taken.

Remove the blower unit and store it in a dry place. In the case of plants installed in colder regions, it is also recommended that individual drop pipes and diffuser bar assemblies be removed so that they will not be damaged if the contents of the tank freeze. Naturally, any shut down, whether short or extended, requires flushing of the blowers with kerosene and oil. Always rotate the blower several times by hand before placing the system back into operation. If the system has been down for an extended period it will be necessary to readjust the equipment and go through the procedures outlined in the start-up section of this manual.

## PLANT OPERATOR'S MANUAL (Cont.)

<b>Visual Check</b>			
CONDITION	APPEARANCE	COMMENTS	ADJUSTMENT
Good operation	Chocolate brown color, little or no foaming	Plant properly adjusted	None
Excessive foaming	Foam accumulating on surface of aeration chamber	Plant underloaded	Install or operate foam control spray system.
Solids in effluent	Solids going over edge of effluent weir	Sludge not settling or insufficient settling rate	Shut off surface skimmer and spray system. Reduce sludge return rate. Increase frequency of hopper scraping.
Floating solids in settling compartment	Lumps of sludge floating to surface of settling tank	Surface skimmer improperly adjusted. Sludge build up in hopper.	Place skimmer into operation. Scrape hopper.
No sludge return	Good except plant is not returning sludge	Insufficient air to air lift or clogged sludge return	Increase sludge return rate. Backwash sludge return.
Overmixing	Large amounts of slimy brown sludge on surface of settling tank	Plant may be underloaded	Reduce aeration rate.
Insufficient aeration	Black or dark brown aeration chamber, septic odor	Aeration rate too low or a diffuser bar may be clogged	Increase aeration rate. Open all valves to individual diffuser bar assemblies.
Floating grease in settling tank	Gray material on the surface of the settling tank	Too much grease is entering plant	Install or clean grease trap. Operate surface skimmer.
Sludge blanket too high	Layer of sludge near surface of settling tank.	Sludge return inadequate	Scrape hopper. Increase sludge return rate.
Plant underloaded	Light brown color in aeration, floating slime in settling chamber	Not enough solids in plant	Reduce aeration rate. Skim surface by hand.
Inadequate return of sludge	Return sludge dark brown or black	Heavy black sludge in bottom of hopper	Increase sludge return rate. Scrape hopper.
Uneven tank roll	Air is not rising evenly along entire sidewall of aeration chamber	Check valves for proper adjustment	Clean individual diffuser bars.
Overaeration	Light brown sludge with finely divided particles that do not settle	Strong musty odor	Reduce aeration rate
No air rising - blower not running	Tank contents black, no mixing or sludge return	Mechanical failure	Check for electrical failure. Press reset button on motor starter, check v-belt.
Septic sewage	Black sewage coming into plant	Influent sewage has septic odor	Maximum aeration rate. Check incoming flow for toxic material.

**PROGRESS THROUGH**

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## PLANT OPERATOR'S MANUAL (Cont.)

<b>Maintenance Schedule</b>				
CAUTION: Shut off all electrical power before working on mechanical or electrical equipment				
ITEM	BI-WEEKLY	MONTHLY	SEMI-ANNUALLY	YEARLY
Go through visual check	<b>X</b>			
Inspect trash trap			<b>X</b>	
Check mixing in aeration	<b>X</b>			
Check time clock setting if provided	<b>X</b>			
Check valves for leaks			<b>X</b>	
Wash plant sidewalls	<b>X</b>			
Check aeration for color and odor	<b>X</b>			
Check sludge return	<b>X</b>			
Check effluent weir level	<b>X</b>			
Clean effluent weir	<b>X</b>			
Scrape hopper	<b>X</b>			
Operate surface skimmer	<b>X</b>			
Clean away dust from motor		<b>X</b>		
Check pulley alignment		<b>X</b>		
Clean air filter		<b>X</b>		
Oil pressure relief valve		<b>X</b>		
Check air valve settings	<b>X</b>			
Check diffusers				<b>X</b>

(Continued)

## PLANT OPERATOR'S MANUAL (Cont.)

<b>Maintenance Schedule (Cont.)</b>				
Item	Bi-Weekly	Montly	Semi-Annually	Yearly
Check skimmer inlet setting	<b>X</b>			
Inspect v-belt for wear		<b>X</b>		
Inspect v-belt for slippage	<b>X</b>			
Check electrical leads				<b>X</b>
Inspect breakers, fuses and resets		<b>X</b>		
Check blower oil levels		<b>X</b>		
Grease blower bearings		<b>X</b>		
Check motor mounting bolts		<b>X</b>		
Clean and repaint metal surfaces				<b>X</b>
Optional				

Note: Replace and lock all panels, covers and gates after performing maintenance on the plant.

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