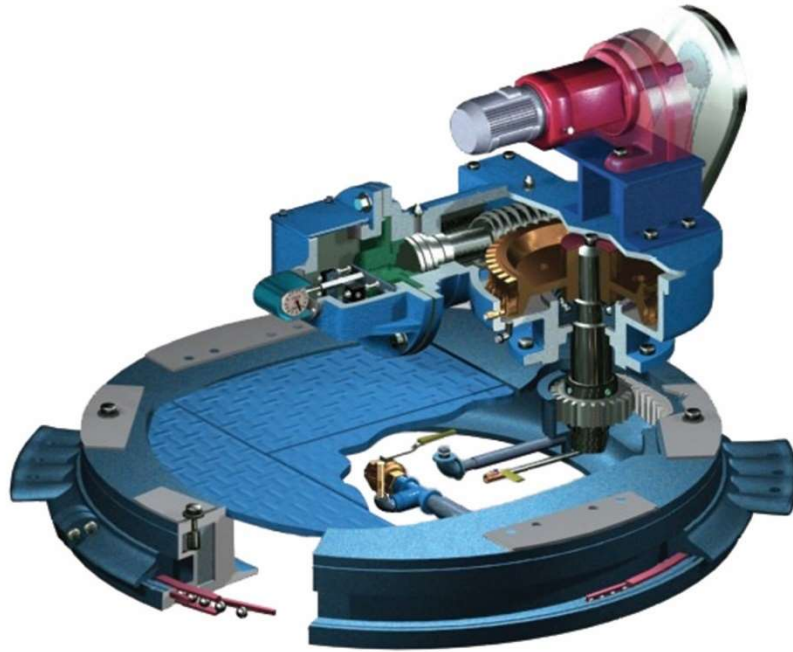


MAINTENANCE MANUAL



CIRCULAR COLLECTOR F16 DRIVE FULL BRIDGE



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CIRCULAR SLUDGE COLLECTOR - F-16 DRIVE, FULL BRIDGE**SAFETY PRECAUTIONS**

The primary hazards associated with maintaining circular collectors are identified below.

POWER SOURCE LOCK-OUT

Failure to lock out all sources of power during maintenance procedures may result in serious personal injury. Following are the steps of a typical lock-out procedure that can be used by maintenance and repair crews:

1. Alert the operator and supervisor.
2. Identify all sources of residual energy.
3. Before starting work, place padlocks on the switch, lever or valve, locking it in the "off" position, installing tags at such locations to indicate maintenance in progress.
4. Insure that all power sources are off and "bleed off" hydraulic or pneumatic pressure or "bleed off" any electrical current (capacitance), as required, so machine components will not accidentally move.
5. Test operator controls.
6. After maintenance is completed, all machine safeguards that were removed should be replaced, secured and checked to be sure they are functioning properly.
7. Only after ascertaining that the machine is ready to perform safely should padlocks be removed and the machine cleared for operation.

(From Concepts and Techniques of Machine Safeguarding, 1980; U.S. Dept. of Labor OSHA).

TORQUE OVERLOAD CONTROL BOX

Electrical circuits may be energized in the torque overload control box even though the main power is off. Always check for live contacts before making adjustments within the box.

CHAIN GUARDS



Guards cover several points on circular collectors to prevent personal injury from moving parts. If guards must be removed during maintenance procedures, use caution when operating equipment and replace guards when maintenance has been completed.

OPERATING ENVIRONMENT



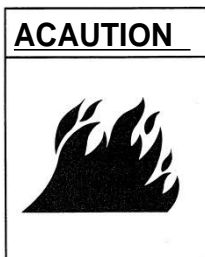
Circular collectors are usually exposed to the elements. The bridge and other access points may become slippery when wet or icy. Handrails and other safeguards must be in place when working on the equipment. Use care when access is necessary. **Do not work outside of the bridge handrails.** Wipe up grease and oil spills.

VENTILATION



Noxious fumes can be generated by septic sewage. Provide forced ventilation and exhaust facilities when workmen are in a drained tank.

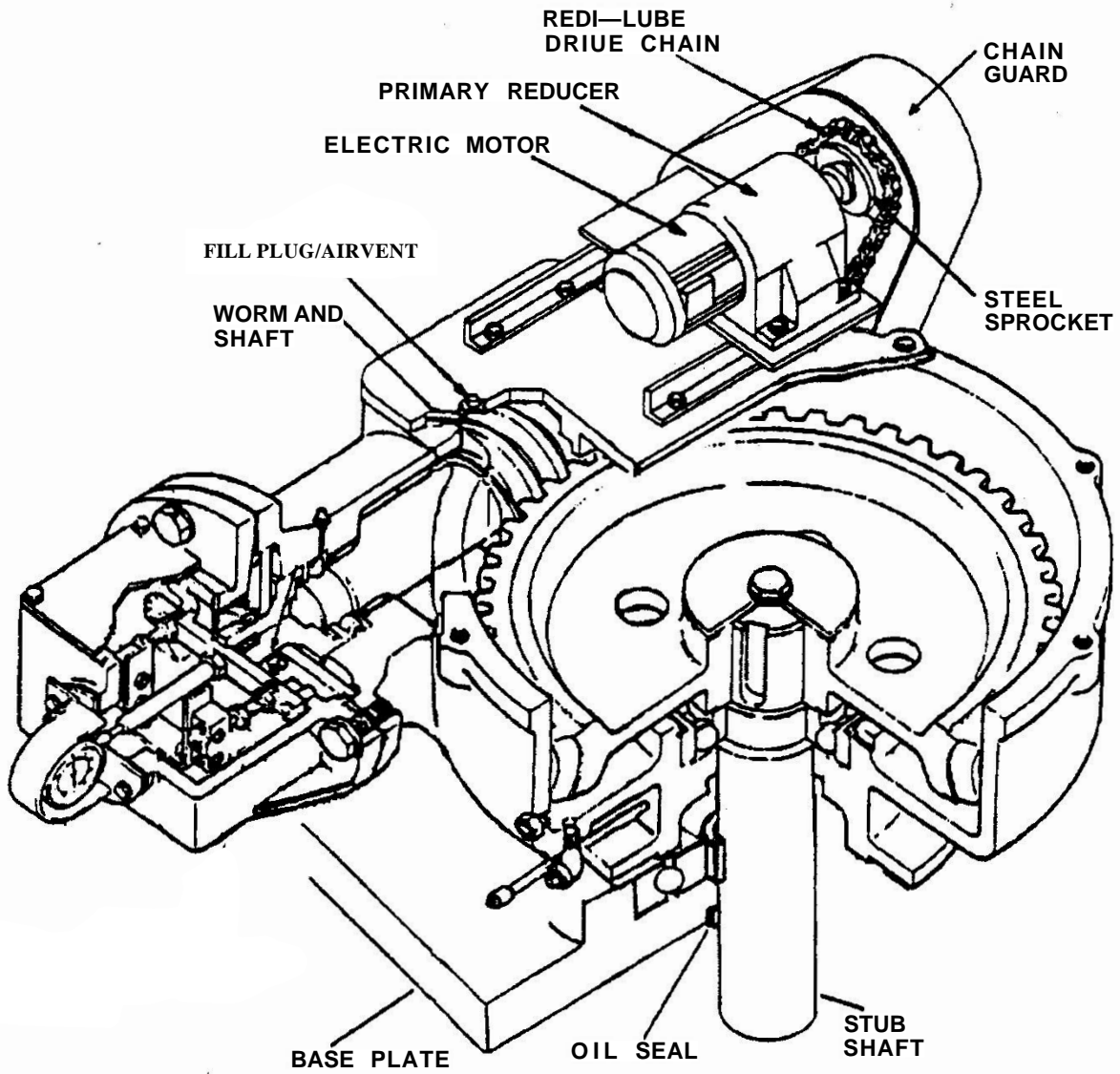
FIRE



Torch cutting, welding and the use of solvents present fire hazards. Use care in these operations and provide fire control equipment in the working area.

EQUIPMENT PRECAUTIONS

1. Refer to the drawings and/or the **Evoqua** manual when reassembling. Operating elevations should be restored. If weight has been added or subtracted from rotating machinery, check the static balance of the rotating machinery - see service manual instructions.
2. Realign all sprockets moved or replaced before start-up.
3. Replace all housings and guards.
4. Retension chain **before** start-up.
5. Check electrically any torque overload devices **before** start-up.



EVOQUAF-16 DRIVE
Figure 9

PREVENTIVE MAINTENANCE

To obtain maximum equipment life, it is necessary to perform the preventive maintenance services outlined in this section. Maintenance recommendations are a guide for average operating conditions. Conditions which impose greater wear, loads or strain on the equipment may dictate increased maintenance. If needed, develop a revised schedule for site-specific requirements. Refer to the manufacturers' bulletins for equipment not manufactured by **Evoqua**. These instructions take precedence over those in this manual should any discrepancy be noted.

The maintenance instructions incorporated throughout this manual are to be used by qualified service personnel only. Do not attempt to adjust or repair any components without thorough knowledge of this equipment. Read this manual completely. Practice preventive maintenance.

Check the oil level of the reducer at 30-day intervals. Also check for water condensation in the oil. If water is present, drain completely - flush out and refill to the correct level with new oil.

When reducers are idle for an extended period of time, they should be completely filled with oil to prevent internal condensation. Drain down to proper level before restarting.

The flow should be diverted and the tank drained once every six months. After the tank is drained:

1. Clean the tank - hose down walls, floor and all the submerged parts of the unit.
2. Check channel struts of the unit.
3. Check scraper arm(s) for:
 - a. Missing, broken or badly bent squeegees.
 - b. Clearance between floor and bottom of squeegee - if this clearance is not uniform around the tank, use a high pressure hose on all the rotating machinery normally submerged so as to remove any build-up of heavy bodied sludge, slime or lime. Then, adjust the scraper blades for uniform clearance.

- c. Rotation in a true plane.

If, after taking the above actions, the scraping arms are found to be rotating in other than a horizontal plane, refer to "Establishing True Plane Rotation" and "Readjusting the Rotating Members for Slope" in the INSTALLATION section and adjust the drive on the bridge accordingly.

If, since the unit was first installed, any of the rotating parts, such as a surface skimmer, has been removed, the balance of the machine will have been affected. A readjustment of counterweights will be necessary to rebalance the unit.

4. Check surface skimmer counterweights wherever located. Loss of the original weights will affect both the skimming and scraping function.
5. Check the surface skimmer for proper action on the scum beach and proper scraping along the vertical baffle walls. The skimmer blade should be partially submerged (about 3" [76 mm]) as it approaches the inclined beach. The skimmer should re-enter the water without splashing. Skimmer blade should contact the whole of the inclined beach surface. All the above-mentioned skimming and scraping surfaces are flexible and can be adjusted.
6. Check torque overload switches.
7. Check drive chain and sprockets for wear and alignment.

Refill tank and begin normal operation.

RECOMMENDED LITHIUM BASED GREASES

Any major brand of Lithium based grease No. 2 is recommended unless other lubricants are defined for specific applications in the INSTALLATION or MAINTENANCE sections of this manual.

For vendor-supplied components (i.e. reducer, motor, etc.), see VENDOR INFORMATION section of this manual for suggested lubricant type and frequency.

LUBRICATION SUMMARY

Recommended lubricants for **Evoqua** Final Drive Housing:

SUMMER: 40° F (4° C) or higher, Mobil Co. Mobil SHC-630* or equal

WINTER: 40° F (4° C) or lower, Mobil Co. Mobil SHC-629** or equal

Recommended lubricants for the primary reducer are in their bulletin in the **VENDOR INFORMATION** section of this manual.

Evoqua Drive Size	Approximate Oil Capacity Drive Housing
F16LT&HT	5 Quarts (4.7 Ltr.)

NOTE: Due to the viscosity of the oil, it can take several hours for a true reading to occur at the sight gauge. Overfilling of oil will result in oil leaking into the collector.

*Viscosity: 1045/1165 SUS @ 100° F (38° C)
ISO Viscosity Grade 220

**Viscosity: 710/790 SUS @ 100° F (38° C)
ISO Viscosity Grade 150

ROUTINE MAINTENANCE

ITEM	DESCRIPTION	INTERVAL
SURFACE SKIMMER	Check for smooth action on scum beach and re-entry into tank. Check for binding against scum baffle. During winter months, when icing becomes prevalent, place skimmer in lock-out position.	D
	Hose off the skimmer assembly and inspect. Tighten all loose connections; adjust for proper skimmer blade submergence (3" [76 mm] below maximum water surface or as indicated on the General Arrangement Drawings). The spring loaded hinged guide should just contact the inner wall of the scum beach	SA
	Replace any lost or worn parts, such as neoprene wipers, poly wear block or springs, if necessary.	SA
WORM GEAR MAIN DRIVE	Check oil level at sight gauge located on side of worm gear housing.	W*
	<p>If low, check for leaking shaft seals at worm shaft near sprockets or remove torque overload housing cover and inspect inside for oil. Replace seals as required. Add oil to proper level. **</p> <p>If high, check for evidence of condensate (water) in oil. Drain small amount of oil from housing and inspect. If clear water is present, drain until oil is draining. Refill to sight gauge with proper grade of oil. **</p> <p>Check for damaged gasket, vent/fill plug, loose or missing cover bolts.</p>	

*Or after severe weather or wash-down procedures.

**Due to the viscosity of the oil, it can take several hours for a true reading to occur at the sight gauge. Overfilling of oil will result in oil leaking into the collector.

D - Daily

W - Weekly

M - Monthly

SA - Semi-Annually

ITEM	DESCRIPTION	INTERVAL
WORM GEAR MAIN DRIVE (Continued)	Inspect and clean, if necessary, worm gear housing air vent	M
	Grease worm gear bearings with a Lithium based #2 grease. Two fittings are located over worm gear on top of housing. Clean fittings, add approximately two pumps from grease gun to each fitting.	M
	Check condition of oil for condensate or other contaminants by draining a small amount and visual inspection.	M
	Grease lower stub shaft bearing. The fitting is located above the base plate near the bottom of the worm gear housing. Clean fitting and add approximately two pumps from grease gun.	M
	If clear water is present, drain until oil becomes present and refill oil to proper level.** Check for damaged gasket, air vent, loose or missing cover bolts. If oil is milky in color, drain, flush and refill with fresh oil.** Check for damaged gasket, air vent, loose or missing cover bolts.	
	If metal contaminants are present, remove chain guard, chain, primary gear reducer and worm gear housing cover and inspect for damaged or worn parts. Flush, per procedure at end of this section, and clean housing, replace parts as necessary, re-assemble. Add oil to proper level.**	

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ITEM	DESCRIPTION	INTERVAL
WORM GEAR MAIN DRIVE (Continued)	<p>Seasonal change of oil. In preparation for changing the oil, drain out approximately 5% (1 quart [.95 liter]) and replace with Mobil Oil Corp. Mobil System Cleaner. Run the drive unit at minimum load condition (reduce sludge blanket) for approximately 48 hours. Shut off drive unit and drain. Replace with oil with proper viscosity for anticipated seasonal conditions.**</p> <p>Summer: Mobil SHC-630 Winter: Mobil SHC-629</p> <p>Drain by removing plug in street elbow located in underside of worm gear housing.</p> <p>Air vent/filler plug is located in cover plate.</p>	SA
TORQUE OVERLOAD SWITCHES	<p>Remove cover and inspect inside of housing for signs of condensate or oil.</p> <p>Inspect switches for signs of corrosion. Trip microswitch by placing screw driver in gap to verify alarm/shut-off systems are functional. Review warnings listed on the next page.</p>	SA

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ITEM	DESCRIPTION	INTERVAL
TORQUE OVERLOAD SWITCHES (Continued)	<p>DO NOT ADJUST GAPS WITHOUT CONSULTING FACTORY. Gap settings can only be verified after residual load against spring p by draining the tank and removing any impediments or if draining is not possible, then motor and rotating the input shaft of the primary reducer, releasing tension on drive Continue to rotate input shaft until final gear starts to move opposite of normal rotation. Further rotation of input shaft will cause damage. Gap settings are indicated on the inside torque overload housing cover or on the General Arrangement Specification Drawing.</p> <p>WARNING: DO NOT OPERATE DRIVE IN THE REVERSE ROTATION. Torque overload switches are NOT operative during reverse rotation. Severe damage can occur to mechanism's structure and drive unit. Use reversing switch, if furnished, only for momentary jog to dislodge the rake arm from hang-up or to unload the drive unit.</p>	
DRIVE CHAIN SPROCKETS	Check for loose bolts, setscrews or keys. If necessary, retorque to the correct torque value. Check teeth for wear. Replace when tooth wear presents an observable hooked profile.	M
DRIVE CHAIN	Check chain for excessive slack. Shift primary gear reducer or remove link when required. Check sprocket alignment by placing a straight edge across the machined surfaces of the sprockets. Check chain for wear.	M

D - Daily

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MAINTENANCE

ITEM	DESCRIPTION	INTERVAL
SHEAR PIN SPROCKET	Grease fitting located on hub of shear pin sprocket. Check safety collar. Check for or loose key. Check teeth for wear. Replace when tooth wear presents an observable hooked profile.	M
	Remove chain and shear pin. Rotate hub to expose shear faces. Clean faces and swab with Lithium based #2 grease. Reassemble pin and chain.	SA
	<u>CAUTION:</u> When reinstalling shear pin, necked down portion must be aligned in the shear plane.	
MOTOR	Refer to manufacturer's bulletins in VENDOR INFORMATION section.	M
PRIMARY REDUCER	Refer to manufacturer's bulletins in VENDOR INFORMATION section.	M
BRIDGE COMPONENTS	Check for and tighten any loose fasteners following the Fastener Installation Instructions. Special attention should be given to locating loose handrail and/or grating/floor plate connections.	M
	<u>NOTE:</u> Inspect and verify bridge base plate expansion connection is free to allow movement for the thermal expansion/contraction of the bridge structure.	

D - Daily

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ITEM	DESCRIPTION	INTERVAL
SCUM TROUGH, WEIRS	<p>Before tank drain-down, inspect weirs for consistent water depth. Inspect one full rota skimmer assembly, checking if any binding occurs. At tank drain-down, hose off all components. Make any necessary adjustments. Replace and tighten any missing or loose bolts. Any mastic sealer or grouting that has cracked or come loose should be replaced.</p>	SA
SCRAPER ARMS	<p>When tank is drained for semi-annual inspection, remove all slime or sludge with a high pressure hose.</p> <p>Examine all bolted connections for loose or missing bolts or shims. Tighten and replace as necessary.</p> <p>Inspect plow blades and squeegees. Replace any that are missing, badly bent or worn.</p>	SA
OIL FLUSHING PROCEDURE FOR EVOQUA WORM GEAR HOUSING ONLY	<p>Reduce loading on clarifier mechanism by lowering sludge blanket as a minimum. It is preferred to drain and clean tank. Stop and lock out drive motor. Drain existing oil. Refill with a mixture of 50% Mobil Oil Corp. Mobil System Cleaner and 50% of any gear lube oil. Run unit for 4 hours. Stop and drain. Refill with proper viscosity oil for anticipated weather.**</p> <p>For other gear reducers, see manufacturer's bulletins in VENDOR INFORMATION section.</p>	As Required

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TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
DRIVE OVERHEATING	Oil level too low. Oil level too high.	Fill to correct level. Check for condensation or water present in oil reservoirs.
	Low oil level in high speed gear case.	Fill to proper level.
BROKEN SHEAR PINS OR ALARM BEING SET OFF	Solids build-up in tank. Large debris in tank.	Drain tank and clean. Drain tank and remove.
	Grout on tank floor raised.	Drain tank, repair floor and regROUT.
	Ball bearings in drive damaged.	Call sales representative for service.
	Scraper making contact with tank floor.	Drain tank and adjust properly. Check for proper rotation of scraper for correct clearance.
	Bridge being locked down.	Loosen and check expansion slots for movement.
SKIMMER NOT SKIMMING PROPERLY	Blade not adjusted correctly. Build-up of material on beach.	Adjust blade so it makes full contact with beach. Clean and remove fibrous material.