WTT SPECIAL FEATURE

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Irrigation Pump

START UP MAINTENANCE

A WEEK TO several days prior to actual start up, an operator should remove the spark plugs and add a 50-50 mixture of diesel fuel and 10 weight oil to each engine cylinder and replace the spark plugs. At this time he should also open the seal on the suction of the pump and inject this same mixture between the eye of the impeller and the wear ring and then reseal the suction. When ready for the actual start up, the batteries should be charged and connected, taking care to clean all connecting terminals.

The tape on all engine openings should be removed, and the air cleaner refilled and replaced on the engine.

All electrical connections should be checked for tightness and corrosion and cleaned if necessary.

The spark plugs should be removed and the engine turned over slowly, without starting, to expel the oil in the cylinders. At this time the operator should insure that the pump is turning freely and is free of foreign objects. The spark plugs can then be replaced.

The suction and discharge piping and connections should be checked to be sure they are clear of foreign objects and, using new gaskets and pipe dope, can be reconnected.

The packing gland should be removed and new packing should be installed in the stuffing box as far forward as can be reached. The gland can then be installed, just tight enough to prevent the entrance of air while priming. If the stuffing box is equipped with a grease fitting, a new charge of grease should be applied.

The primer and priming valve should then be reinstalled and the pump primed.

After checking engine oil and coolant levels, the engine should now be started and slowly brought up to warm-up temperature. At this time the operator should check all of his safety switches to insure they are working. The over-temperature switch can be checked by removing a fan belt, water pump belt, or covering the radiator. During these tests the operator should watch the engine gauges very closely so that should any of the safety switches fail to work he can shut the engine down and replace or repair the switch. Since the engine oil must be drained anyway, the operator can check the low oil pressure safety switch by removing the drain plug from the engine while it is running slowly.

The engine should then be refilled with the proper oil and restarted.

To check a loss-of-prime safety switch the connection between the pump and switch can be removed allowing the pressure to drop to the switch.

The operator should then check the engine and pump for any leaks

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OPERATIONAL

THE STUFFING BOX area is of primary concern in the operational maintenance on the fluid end of the pumping unit. Most centrifugal pumps used in the irrigation field are of stuffing box construction. By its design, a stuffing box must leak a little of the fluid being pumped in order to cool and to lubricate the area where the packing contacts the shaft or shaft sleeve. If we do not allow proper leakage through the stuffing box the packing will become overheated and dry, resulting in the burning of the packing and the scoring of the shaft sleeve.

Once the packing is burned and hardened and the shaft sleeve scored, no amount of adjustment will maintain proper leakage for any length of time. The shaft or shaft sleeve must then be replaced and a full new set of packing must be installed. Proper leakage varies some among the manufacturers, but generally a leakage of 8 to 10 drops per minute is acceptable.

Although most sprinkler systems today operate at high pressures at the pump, usually in a 60 to 100 PSI range, pump manufacturers have designed most pumps used in this field so that the stuffing box of these pumps are subject to considerably lower pressures than what is felt at the pump discharge, usually only 20 to 30 PSI. This means that when tightening the packing gland of a pump that is producing

TROUBLE SHOOTING

WHEN I THINK of troubleshooting, I think of a story that was told once about a lady who had a domestic pump that had stopped working. The lady called a repairman. The man studied the pump for a couple of seconds and then hit it once with a hammer. The pump immediately started working. Several days later upon receiving a bill for $28.17, the lady called the repair shop and demanded an itemized statement.

She received the statement and it read: Repair of pump: Hitting with hammer—.17, Knowing where to hit —$28.00.

Troubleshooting a centrifugal irrigation pump is much the same as that repair job. Fixing the trouble is usually easy, knowing where to look for the trouble is the big thing. To know where to look for the trouble, a person must understand the function of a centrifugal pump.

The function of a centrifugal pump is to take the water that is delivered to the eye of the impeller and pump this water to another destination. It is **not** the function of a centrifugal pump to pull water from any source. It only pumps water that is delivered to it. Ninety-five percent of all troubles when a centrifugal pump will not perform can be found on the suction side of the pump unit; the failure to deliver water to the pump, or the failure to deliver enough water to the pump.

Let's take a case where a centrifugal is operating under a suction lift condition. The operator has a vacuum type primer on this unit and after operating the priming device for some time is unable to raise the water into the eye of the pump. This trouble is usually caused by air leaking into the pump or suction

And Engine Care

MAINTENANCE

75 PSI at the discharge you are only working against a pressure of approximately 20 PSI at the packing. Therefore, a pump of this type with the sleeve and packing in good condition and properly adjusted should not require constant readjustment, but should be checked daily.

Operators of the pumping equipment should take caution that should additional rings of packing be needed, add only the type and size of packing as recommended by the manufacturer. Different sizes or types of packing, other than recommended, might not give the proper service and might damage the shaft sleeve.

Most operators of pumping units are more familiar with the proper operational maintenance for engines than for pumps; most will check the coolant and oil levels. However, in many cases the operator, when adding to the coolant or oil, fails to add the proper materials. Most manufacturers recommend that their engines be run with a year-round antifreeze type coolant. When running an engine with just water for a coolant, you lose the advantage of the anti-rust type additive that is found in most types of antifreeze. In addition, if only water is used the manufacturers recommend that prior to winter the coolant be drained and refilled with antifreeze for winter storage.

Most engines cannot be complete-

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SHUT DOWN MAINTENANCE

THE MAINTENANCE performed on a pump and engine unit at the end of the irrigation season greatly affects the overall life expectancy of the unit. It may well make the difference between being able to get the unit in operation at the beginning of the next season.

Ideally, the pumping unit should be stored inside a protective building during long periods of shutdown. Regardless of whether the unit is stored in a building or left outside, these steps should still be followed prior to storage:

On the pump end, the suction and discharge piping should be removed, all water should be drained from the pump unit and a 50 weight oil should be injected between the eye of the impeller and the wear ring of the pump.

All openings, including the suction and discharge openings should be covered to prevent the entrance of rodents and foreign material into the pump unit.

If the unit has a diaphragm type hand primer on it, the primer should be removed, the opening into the pump plugged and the primer stored in a building.

If the unit has an intake manifold type primer made of glass or plastic, this should also be removed and stored in a building.

If the unit is equipped with a discharge priming valve that has a rubber seat or clack face, the valve should be removed and stored inside or the rubber parts should be coated with a good rubber preservative.

The stuffing box gland should be loosened and if the stuffing box is equipped with a grease cup or a grease zerk a couple of shots of grease should be applied to the stuffing box to force out remaining water and give some measure of protection to the packing.

If the unit is not equipped with grease fittings, the packing gland should be backed off and the last two rings of packing removed and grease packed into the stuffing box. The packing gland can then be tightened slightly to force the grease into the remaining rings of packing; then the gland should be again loosened.

If during the season you had encountered any difficulties with the pumping unit, such as excessive stuffing box leakage, or a serious pressure drop, indicating that your pump was wearing out, now is the time to order the necessary repair parts or remove the pump and get it to your dealer or manufacturer for necessary repairs.

This is the time of year when these people are usually at the low ebb of their season and can get your repairs accomplished. Your unit will be ready to go when you want to start your new season.

If your pump unit is connected to the driver by a flexible coupling

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line as fast as the operator is removing it. A vacuum gauge installed on the pump or suction line will tell an operator if he is actually pulling a vacuum with his primer or just moving air through his pump.

Air leaks can be found in a number of places: holes in the suction hose or pipe, cracks around welds on the suction pipe, loose or poor fitting flanges or gaskets, or cracks or holes in the pump case. If the air leak is not found in one of these areas, the operator should look at the valve on the discharge side of the pump.

Sand or other foreign objects may prevent the valve from sealing properly. The rubber face may be cracked or chipped and not seating properly. Many gatetype valves of all-metal construction will never seal properly to allow a vacuum to be applied to the pump.

The stuffing box on the pump may leak air. This is particularly true of a pump that has been out of service for some time and the packing has dried and hardened. If the pump is equipped with a grease fitting, usually a shot of grease will seal the stuffing box. If the pump is not so equipped, the packing gland might be tightened down to seal. However, the operator should be sure to loosen the packing gland again after he gets the pump going to insure proper leakage.

One other area to look for trouble is in the primer itself. Insure that it is functioning properly. On hand-type primers a check valve insures that air can be pulled out of the pump but not put in the pump. If grass or other foreign objects get into this check valve the operator may be putting air back into the pump at every stroke.

I have seen some trouble getting prime on pumps used as boosters, where a turbine pump is pumping into a centrifugal pump. On this type of installation, where a check valve is used on the discharge side

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of the centrifugal pump, I have sometimes seen where the check valve had a head of water on the upstream side of it. The turbine pump did not have sufficient pressure to push water through the centrifugal and open the check valve. Since the turbine column contained air, the air fills the centrifugal pump and will not allow the centrifugal to be primed properly to open the check valve. This type of condition is particularly prevalent where more than one turbine and booster combination are pumping into the same line. The first unit will start up because the turbine builds sufficient pressure to open the check valve against a dry line or static pressure, but the second unit cannot open the check valve against the pressure developed by the first unit.

On this type of installation, an air release valve should be installed between the discharge of the centrifugal and the check valve. This will allow the air ahead of the water in the turbine pump to escape and the centrifugal will then get prime and be able to open the check valve.

A pump that primes but will not pump sufficient water or presssure is usually the victim of failure to deliver sufficient water to the pump. All cenrtifugal pumps are designed to operate at a definite design condition of capacity and head at a certain Total Dynamic Suction Head. If the total dynamic suction head for the pump is exceeded, atmospheric pressure may not be able to get as much water to the pump as the pump is attempting to move.

We see this quite often on sprinkler pumps. A sprinkler pump may be designed to produce 900 GPM at 70 PSI for a sprinkler system. This pump, we will say, can be operated at this condition under a total dynamic suction head of 15 ft. We will also say that the suction piping and maximum lift from the water are such that at this condition the total dynamic suction head is 13 ft. The pump will operate satisfactorily under this condition. Many times, however, when this pumping unit is first started on an irrigation cycle the line to the sprinkler system is dry or at least not full and the pump is only pumping against 20 to 30 PSI.

Against this pressure the pump will try to pump 1400 or 1500 GPM; and at a condition of 1400 to 1500 GPM at 30 PSI this pump must be operated at a total dynamic suction head of not over 8 ft. At the same time the increased flow of water in the suction line has increased the friction loss to bring the total dynamic suction head up to 16 ft. Now we have a pump that is trying to pump 1500 GPM, but is only getting 1000 or 1100 GPM delivered to it. The pump will now go into a condition of cavitation and will become very noisy. We have a pump that is a victim of failure to deliver sufficient water.

Fortunately, on most sprinkler systems, this condition may exist for a very few minutes, since, as the line begins to fill, the pressure on the pump increases and the capacity decreases until the system is up to 70 PSI at 900 GPM and the pump is now getting sufficient water. If, however, the level of the water source dropped three feet, since the last time the pump had been operated, our total dynamic suction head would be exceeded and the pump would still not be getting a sufficient supply of water. This could happen when the water source is a pond.

The problem of over-production upon start up of a pump against a dry line can be cured by putting a gate valve or butterfly valve on the pump discharge. The operator keeps the valve closed down during start-up to a point where the pump is always operating against the design pressure until the system is filled. If the water level drops the pump must be moved closer to the water or the suction piping size increased until the unit is operating under the maximum suction lift for which it was designed.

A problem sometimes seen is where a pump is located on the bank of a river or ditch and the discharge line goes immediately down hill from the pump. Under this condition, in trying to start the pump, the discharge head is less than the suction head and the pump will not produce any water at all. After the pump is primed and turned on it merely splashes a little water out. This is a case where the pump is actually losing prime. The discharge head must at all times at least equal the suction head for the pump to work at all. Here again, a valve on the discharge side can be used to increase the discharge head on the pump until the line is full. (Editor's Note: This can happen to spraymen who pull water from ditches or ponds to fill spray tanks.)

At times when a centrifugal pump is being operated as a booster pump this same condition can exist. The

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turbine pump may not be delivering to the centrifugal quite as much water as the centrifugal is trying to pump. If the difference in the amount of water is slight, this might be hard to spot as the pump may not be noisy and the pressure gauge may not fluctuate much. The pressure will be just slightly under design condition. A combination, vacuum-pressure gauge on the suction line or the suction side of the pump will show the operator if he is maintaining a steady input pressure to the pump or fluctuating between pressure and vacuum on the suction side of the pump.

Many systems are being put in today with the pump having a flooded suction. This does not automatically avoid the problem of insufficient water to the pump. If the suction piping is too long and/or too small the friction losses in the line can still prevent sufficient water to get to the pump.

There are many other ways by which we can fail to get sufficient water to the pump, much too numerous to go into here.

If an operator will remember that if the impeller of the pump is free of foreign objects and is turning in the right direction—the pump is working.

If he will then go on and find out why he is not delivering water to the pump or not delivering sufficient water to the pump, he will have the $28.00 end of his trouble solved and can then go on to the .17 cure.□

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