CORNER
MODEL 6000

OWNERS MANUAL

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WARNING

As with any electrical machinery, if the power supplied to the Corner Irrigation System is not grounded properly, or if the equipment is tampered with, severe injury or death can result should an electrical malfunction occur. It is your responsibility to insure that your power supplier and/or electrical contractor has grounded the irrigation system as required by the National Electrical Code and by applicable local electrical codes.

Before attempting to adjust or trouble-shoot the electrical components of the Valley Corner Irrigation System, the following safety procedures should be observed.

1. Do not attempt to check any of the components until all power is disconnected. All components can be checked with power off.

2. The integrity of the equipment grounding conductors for the entire irrigation system should be seasonally checked by a qualified electrician.

3. Do not depend on another person to disconnect the power --- do it yourself.

4. When starting the machine, do not take for granted that system is going to run in the proper direction. (This applies to systems which are towed to auxiliary pivot points).

5. Do not oversize fuses --- they were sized for the protection of your machine.

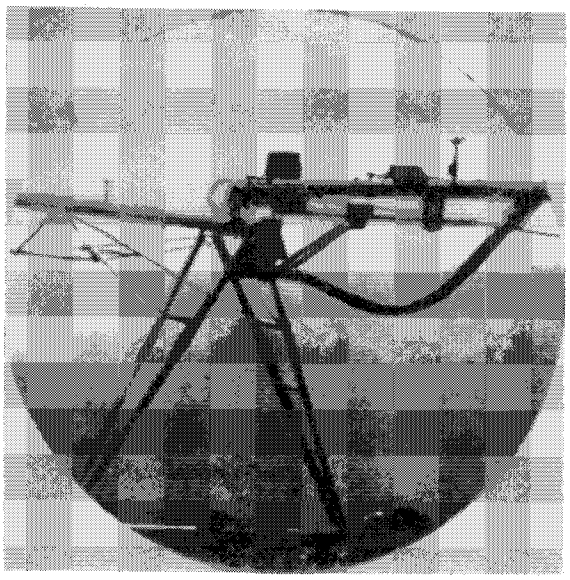
When work is performed on system electrical components, a padlock should be used to lock the main disconnect of the machine. This should be used while conducting all checks other that those on the pivot box. Make certain disconnect is open before using the OHM meter. Remember that there may be 480 volts in all boxes.

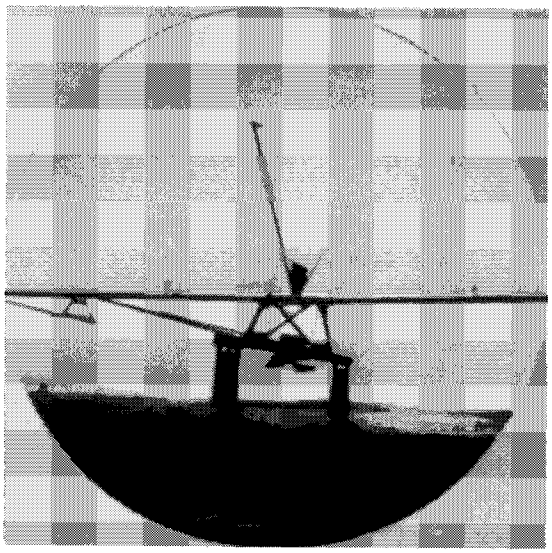
Normally, if a system is properly grounded, and fuse sizing is correct, there is very little probability of an individual being injured by electrical shock. However, if an electrical "short-circuit" exists on a system, it could be extremely hazardous.

If you have any reason to suspect that the system may have hazardous voltage on the hardware, such as physical damage to the electrical cable, recent electrical storms (lightning), or unusual operational characteristics, it is recommended that you contact a qualified electrician to check the system. If you must operate or touch the system under the above conditions, do not grasp the hardware as you would a ladder rung. Instead, quickly and lightly brush the back of your hand past a pivot or tower leg. Physical contact in this manner, with a hot system, will be felt as a "rippling tingle" or "jolt", but should not cause serious injury. However, if you do experience such a sensation, contact a qualified electrician or Valley serviceman immediately.

INTRODUCTION . . . .

The operational guidelines contained in this manual are provided for your use in operating the Valley Corner System. You, as the owner or operator, should familiarize yourself with the capabilities of the system in order to obtain optimum system performance. It will also serve as a guide to operator maintenance, minor adjustments, and winterization requirements. Should any electrical troubles be encountered, it is strongly recommended that you contact a qualified Valley serviceman or a qualified electrician. It should be remembered that the sprinkler will perform according to your knowledge of the equipment, soil and water relationships and equipment application concepts.





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THEORY OF OPERATION

The Corner System is a pivoting extension of a basic electric system. As the system enters a corner, the swing arm pivots outward, reaching into the corner. When it reaches full extension, the end gun will operate until a predesignated point, and then it will turn off and retraction of the swing arm occurs until the arm is fully retracted and in its normal trail position.

The entire operation described above begins at the pivot control panel. In the panel is a device called an oscillator, which generates a low voltage AC signal into a buried wire loop. The loop goes from the pivot to the edge of the field, all the way around the field and finally back to the pivot panel.

The corner arm hardware consists of a 170' or 185' span of pipes and trussing which is supported by an apparatus called a Steerable Drive Unit (SDU). It is attached to the basic system with a ball/socket cradle and roller assembly at the Last Regular Drive Unit. The SDU has a reference antenna that "listens" for the buried wire signal. When it "hears" the signal, it activates a device that is called the guidance control unit. This solid state electronic device translates the received signal and if that signal is of the proper strength, it will activate a relay that completes the safety circuit path.

A second antenna at the SDU performs a "where am I" function, by "hearing" the signal from a different position. The guidance control device then compares the signals to determine if a steering action is required. Incidentally, no steering can take place if the system is not moving.

Since the system must be moving to steer, we can cause the basic system to start moving by selecting some percentage timer setting, other than "0"%. For discussion purposes, let's assume a selection of 50%. This means that the last regular drive unit (LRDU) will move for 30 seconds and then rest for 30 seconds.

As the LRDU begins to move forward, it might appear that it is going to leave the corner arm standing still, but when the roller assembly reaches a point three inches behind center of the cradle, it will trip a switch in the control box mounted to the cradle. That switch will signal the SDU to begin its travel cycle.

The drive motors on the SDU are 56 RPM motors. The drive motor on the LRDU is a 30 RPM. This difference in RPM's permits the SDU to catch up to the LRDU, and actually begin to overtake the LRDU, until it reaches 3" beyond the center of the cradle when another switch tells the SDU to stop. Since both units were moving simultaneously, the 6" of roller movement may well have taken several feet of ground travel to complete one cycle of movement. The SDU will now wait until it is 3" behind before it reenters the travel cycle.

During any given travel cycle, if the steering antenna detects a location signal other than "over the wire", it will cause the Steerable Drive Unit Control Box to initiate a steering command that will return the SDU to its proper "over the wire" position. The steering action is a combination of electrical and mechanical linkage that keep the two SDU wheel assemblies perfectly parallel throughout the steer cycle, be it a steer-in or steer-out action.

Since the turning of the wheels take place while the basic system is moving forward, we cannot ever allow the wheels to get to the point of being at 90° to the basic system. Therefore, we have some steering limit switches that will prevent such an oversteer from happening. This limiting action does not shut the system off, however, which means that under some conditions, a system may wander off of the wire path, but not be able to steer back into the wire as it attempts to correct itself. If the SDU finally gets far enough off of its intended path or track, the signal received by the reference antenna will weaken to the point where it ceases to "hear" the signal. If this happens, it allows the safety relay to "drop out" thereby opening the safety circuit and shutting down the system before damaging the system hardware. A second safety is in the steering hardware in conjunction with the steer limit switches mentioned earlier. If the electrical circuitry fails to stop the steering action, there is a back-up switch that mechanically opens the safety circuit.

There is also a safety circuit that involves the cradle and roller assembly. We previously mentioned the 6" roller movement. If the SDU or the LRDU movement causes the roller assembly to approach either end of the cradle, a safety switch in the control box will open and shut the system down.

And of course, there are alignment safety switches at each tower of the basic system, to prevent structural damage.

So far, we have discussed only the "moving" operation of the Corner System. The second significant area that you should understand is the sequencing of the sprinklers/valves on the corner arm. There are two control boxes involved with the sequencing of sprinklers.

The first control box is the Solenoid Switch Box, located on the last regular span. It has a series of cams and micro switches that are operated by a sprocket/chain linkage connected to the cradle by a turnbuckle control rod. As the corner arm extends or retracts, the control rod pushes or pulls on the sprocket linkage to transmit location information to the cam stack assembly. As the corner arm extends, thereby increasing the acreage under the arm, we begin to turn on specific sprinklers to accommodate that increased acreage. Periodically, throughout the extension process, more and more sprinklers are turned on until finally the End Gun begins to operate. When the extreme point is reached, and the system begins to retract, the process reverses itself, until all of the valve controlled sprinklers are off. This is the sequencing process.

The mechanics of turning a sprinkler valve on and off involves both the Solenoid Switch Box and the Solenoid Valve Box which is located 6 feet out on the corner arm.

Step 1: The control rod "tells" the Solenoid Switch Box that the corner arm has reached a given extension point.

Step 2: 120 Volt power is removed from one of the Solenoid valves. These valves direct the routing of "control water pressure" through hydraulic tubes to sprinklers.

Step 3: A hydraulic tube from the Solenoid valve to one or more sprinklers is allowed to exhaust its control water pressure.

Step 4: Without control pressure on the top of a sprinkler valve diaphram, mainline water pressure will raise the diaphram and allow water to flow through the valve and out the sprinkler.

Step 5: During retraction the electrical power is applied to the Skinner valve which now blocks off the exhaust port and sends control line pressure to the associated valve(s).

Step 6: When the pressure differential sprinkler valve fills with control pressure water, it will seal the diaphram into the "down" position blocking mainline water from the sprinkler. Thus, the sprinkler is off.

If your system has pressure regulators installed under all sprinklers, they will compensate for the fact that you are still using the same basic pressure when the corner arm is extended or retracted, even though you are obviously irrigating more area. However, if you do not have pressure regulators, there is one final aspect of operations that needs explanation.

Since there are between 17 and 35 extra sprinklers on in the course of irrigating a corner, this means also that there is proportionately less water available to all system sprinklers. This, in turn, means that while all these extra sprinklers are on, you would be applying less water per acre than when the corner arm is retracted. The end result would be a very un favorable water distribution pattern. To overcome this potential problem, a second percentage timer is located in the Run Cycle control box that is used to slow down the movement of the entire system during the cornering phase, to compensate for the reduced water per acre. This "slow-down" maintains a favorable uniformity of distribution and is one of the functions of the Solenoid Switch Box. This second percentage timer, once set for the pressure differential between extension and retraction, need not be changed thereafter since it operates on a ratio system that is directly proportionate to the percentage of system operation selected at the Pivot Control Panel. **(Systems equipped with pressure regulators will have the second percentage timer set at 100%, eliminating the slow-down function, since the pressure regulators automatically compensate for the "extra" sprinklers during corner extensions.)**

Summary. The foregoing information has been prepared so that you will have an understanding of what the machine is supposed to do at any given time. If your machine experiences a malfunction of some type, either mechanically or electrically, that is beyond your capability to repair, it will benefit you to be able to discuss the matter with greater understanding when you contact your servicing dealer This may significantly aid in the speed of repair an save time and money. Therefore, getting to know your system can be of benefit to all concerned.

Safety

The VALLEY CORNER SYSTEM is powered by 480 volts and can be extremely dangerous if used improperly. For your maximum safety and optimum performance of the VALLEY CORNER SYSTEM, it is essential that you, your maintenance personnel, or any other operator of the system read and understand this manual before operating this product.

SAFETY FIRST. GOOD ELECTRICAL AND OPERATIONAL PRACTICES SAVE TIME, MONEY AND LIFE.

OPERATE SAFELY.

DO NOT operate system without first reading Operator's Manual.

DO NOT attempt to start system until system and electrical service is properly installed and grounded. Fig. 1.

DO NOT oversize fuses -- they were sized for the protection of your machine. Refer to the Pivot Panel Fuse Chart of this manual prior to initial start up to be certain that you have the proper size fuses.

DO NOT operate if system moves in the direction opposite to direction selected. Contact dealer.

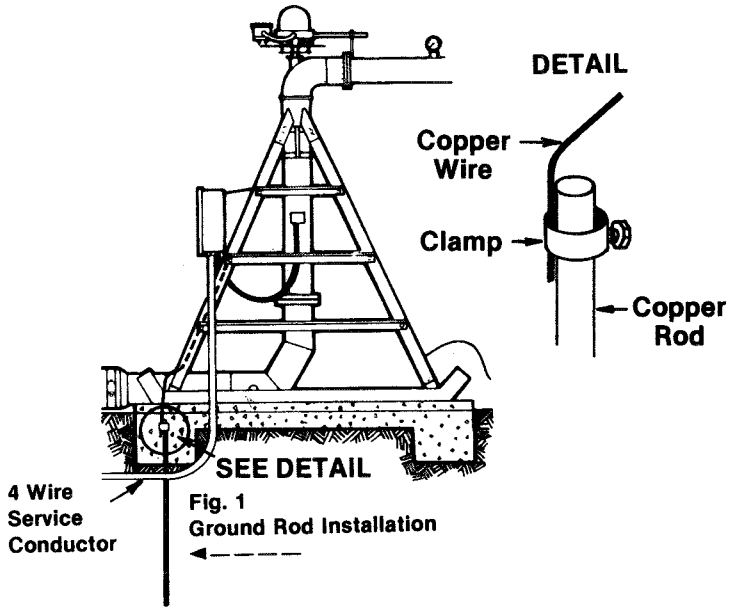


Fig. 1
Ground Rod Installation

DO NOT hold start button depressed longer than three seconds. Repeated start attempts can cause serious structural damage. Inspect entire system after each start attempt failure.

PUSH TO START

CAUTION: DO NOT HOLD BUTTON DEPRESSED LONGER THAN 3 SECONDS. REPEATED START ATTEMPTS CAN CAUSE SERIOUS STRUCTURAL DAMAGE. INSPECT ENTIRE SYSTEM AFTER EACH START ATTEMPT FAILURE.

Fig. 2 Start Button Warning Decal

AVOID exposure to system spray while chemicals are being injected into the water.

WARNING

IRRITATING TO SKIN AND EYES
CAUSES BURNS ON PROLONGED CONTACT
HARMFUL IF SWALLOWED

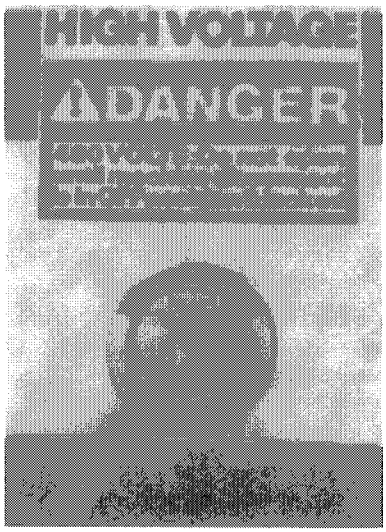
Avoid Breathing Spray Mists
Keep Out of the Reach of Children
Do Not Get in Eyes, on Skin, or on Clothing or Shoes

Fig. 3 Toxicity Warning

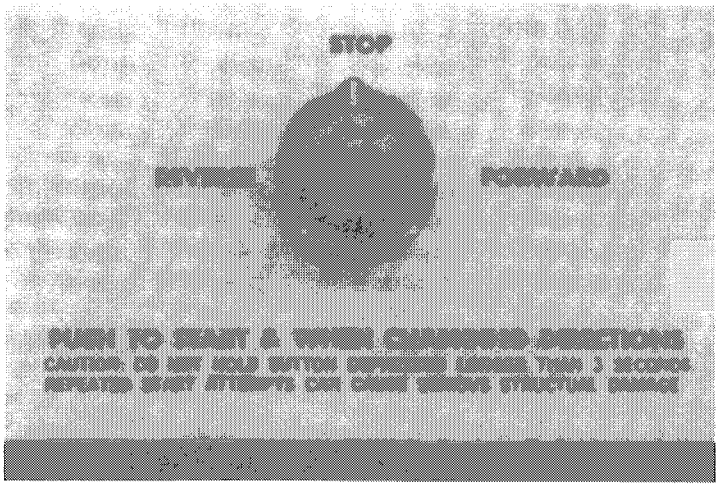
⚠DANGER: 480 VOLTS -- DO NOT OPEN THE INTERIOR PIVOT PANEL DOOR. ELECTRICAL SHOCK MAY OCCUR. ALL NEEDED CONTROLS AND MONITORING DEVICES ARE ON THE OUTSIDE OF THE INTERIOR PIVOT PANEL DOOR. SERVICE WORK DONE ON THE PIVOT PANEL IS TO BE PERFORMED BY A QUALIFIED SERVICE PERSON ONLY.

Your VALLEY CORNER SYSTEM comes equipped with several standard features. This section of your Owner/Operator Manual will discuss each feature and its purpose.

PIVOT PANEL CONTROLS

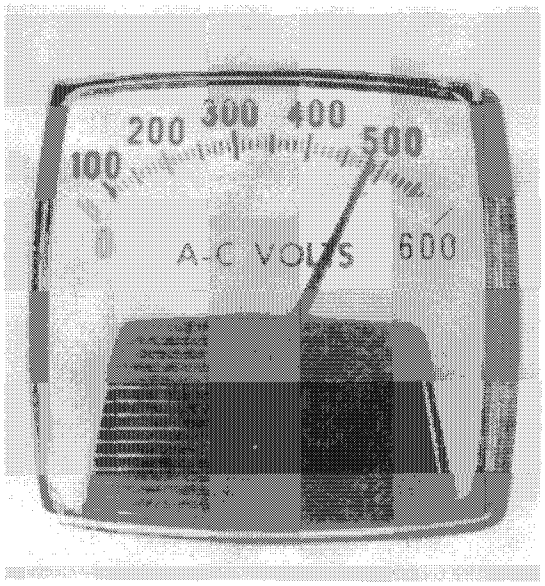


MAIN DISCONNECT. This switch disconnects all power to the system except at the incoming (upper) terminals on the Main Disconnect Switch inside the pivot panel. The function of the disconnect is to turn the power "ON" or "OFF".



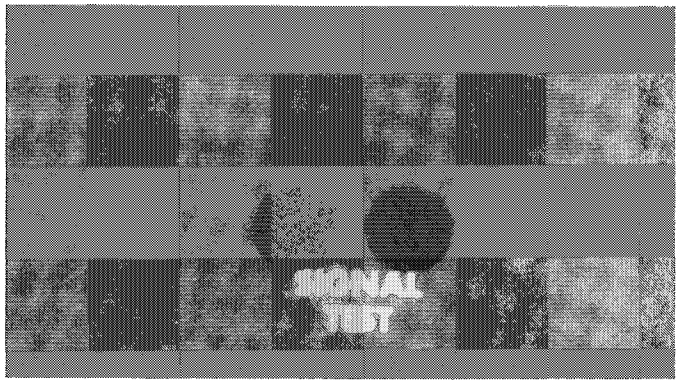
REVERSE-STOP-FORWARD SWITCH. Direction of system travel is selected by this switch. "FORWARD" means clock-wise rotation and "REVERSE" is counter-clockwise rotation. Setting this switch in the "STOP" position will stop system movement and disable the start button.

Push the center of switch for "START". This center button is used to actually start the system once the Main Disconnect is turned "ON" and direction of rotation has been selected. It should be noted that while the "START" switch is pushed **ALL** safety devices are momentarily by-passed. **Do Not Hold In For More Than Three Seconds.**

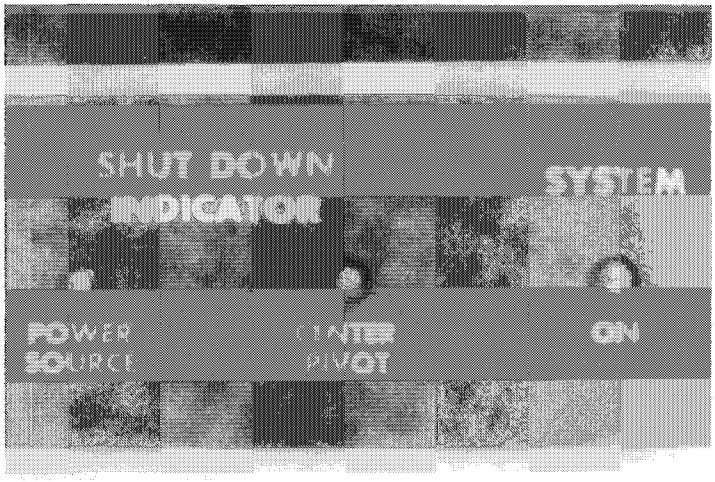


VOLTMETER. The Voltmeter is designed to monitor the voltage being delivered to the system and should read 480 volts minimum, to 505 volts maximum.

Do not operate the system if the meter reads above 505 volts or below 480 volts. Attempting to operate the system outside these limits could cause damage to the electrical components. Refer to the Trouble-Shooting causes and solutions.



SIGNAL TEST. Used to measure output voltage from the oscillator to the buried wire.



SYSTEM ON LIGHT. This light is on any time the system is operating.

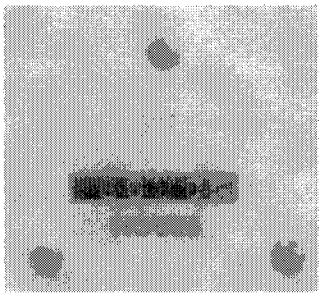
SHUTDOWN INDICATOR LIGHTS. In the event of an unexpected system shutdown, these lights will help indicate the cause of the shutdown. Power source interruptions for more than three seconds, or low voltages, will cause the system to shutdown. These shutdowns may be caused by a fluctuation in the power supplied by a public utility or a malfunction of an engine or generator. After power has been restored, the system may be manually restarted. If the "CENTER PIVOT" light is on, this indicates an electrical or mechanical malfunction with the irrigation system. Refer to the Trouble-Shooting Causes and Solutions section. If the "Power Source" light is on, the problem is with the incoming power.

BY-PASS SWITCH. By-pass switch allows operator to by-pass the low pressure and temperature safety shutdown features and/or the Stop-In-Slot option **if your VALLEY is equipped** with these options. "NORMAL" position engages all shutdown features and will turn on the adjacent indicator light.

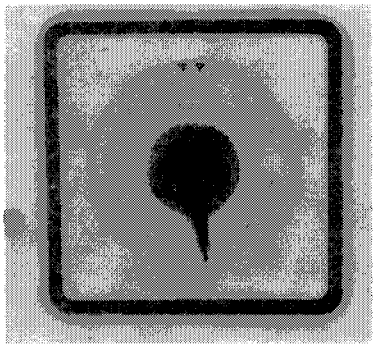
The Low Pressure System shutdown is a dual purpose feature designed to protect both the system and the pump. This device will monitor the pressure delivered by the pump. Should the pressure fall below the predetermined setting, the pressure switch will deactivate the safety circuit, shutting down the system and the pump if wired to do so.

Your dealer has qualified service personnel to set this device according to the pressure delivered by the pump. Should you decide to alter the pumping pressure, it is recommended that you contact a qualified service person to adjust the pressure switch accordingly.

Low Temperature Shutdown devices are available from other sources which can reduce the possibility of system damage due to ice buildup, and if used are wired into the safety circuit. However, Valmont Industries, Inc. does NOT offer a Low Temp shut-down device of any kind. Further, subsequent damage caused by ice buildup is not warrantable.



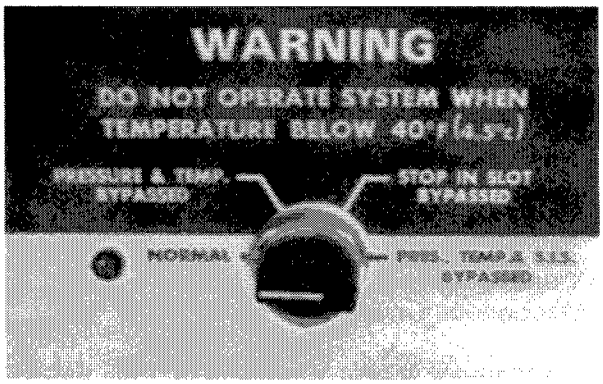
HOURMETER. This meter records the number of hours that the system has operated.



PERCENTAGE TIMER. The percentage timer regulates system revolution speed by causing the end drive unit to operate the selected percent of one minute. Regulation of the speed determines the amount of water applied during irrigation.

PERCENTAGE TIMER SETTING	SECONDS OF MOVEMENT PER ONE MINUTE OF LAST TOWER
100%	60 seconds
75%	45 seconds
50%	30 seconds
25%	15 seconds
0%	no movement

STARTING THE SYSTEM

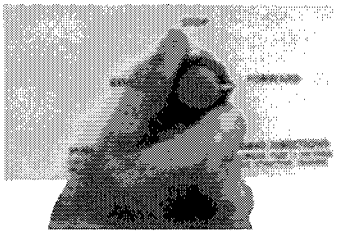


1. Turn BY-PASS SWITCH to position required. It may be necessary to select a by-pass function if:
   a. System has low pressure switch - by-pass press./temp.
   b. System has stop-in-slot option - by-pass S.I.S.
   c. System has both S.I.S. and low press. - by -pass press./temp. and S.I.S.
   d. System stopped in slot - by-pass S.I.S.
   e. System is to be operated "dry" - by-pass press./temp.

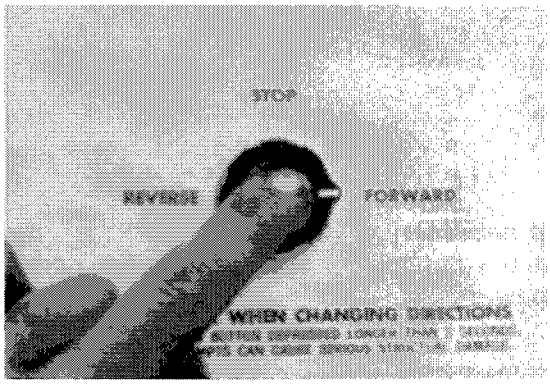
   NOTE: The "NORMAL" indicator light will be off when any function is by-passed.
2. Close mainline valve to system.
3. Start pump.
4. Slowly introduce water into system until full.

Turn DISCONNECT SWITCH to "ON". If power is supplied by engine driven generator, adjust RPM until VOLTMETER reads 480 volts to 505 volts.

6. Set PERCENTAGE TIMER (see application rate page.)



7. Turn SELECTOR-START SWITCH to direction of rotation desired.



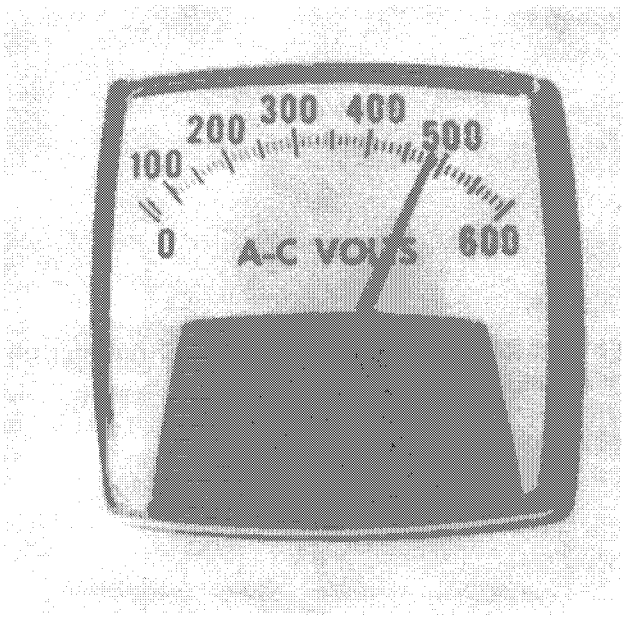
8. Push START SWITCH. Safety light should come on.

⚠ WARNING! DO NOT HOLD BUTTON DEPRESSED LONGER THAN THREE SECONDS. REPEATED START ATTEMPTS CAN CAUSE SERIOUS STRUCTURAL DAMAGE. INSPECT ENTIRE SYSTEM AFTER EACH START ATTEMPT FAILURE.

⚠ WARNING! IF THIS IS THE INITIAL START-UP OR THE FIRST RESTART AFTER ANY 480 VOLT, 3 Ø, (380 VOLT, 3 Ø,) CONNECTIONS HAVE BEEN MADE, SUCH AS REPLACEMENT OF DRIVE MOTOR, CHANGE IN POWER SOURCE, EXTREME CAUTION AND CLOSE OBSERVATION IS REQUIRED TO ASSURE THAT PHASING OR MOTOR ROTATION IS IN PROPER DIRECTION.

9. Turn BY-PASS SWITCH to "NORMAL"; or "STOP-IN-SLOT BY-PASSED" if more than one revolution is desired.

⚠ WARNING! SYSTEM DAMAGE CAUSED FROM THE INCORRECT USE OF THE BY-PASS SWITCH IS NOT A WARRANTABLE CONDITION.



10. If necessary, readjust engine RPM to maintain 480 volts to 505 volts. (N/A with commercial power).

DANGER! ALL OPERATORS OF THE VALLEY IRRIGATION SYSTEM MUST UNDERSTAND AND BE FAMILIAR WITH ALL SAFETY PRECAUTIONS WHICH, IF NEGLECTED, MAY CAUSE PERSONAL INJURY OR DEATH.

NOTE: A three-second auto restart is standard equipment built into the circuitry of your VALLEY system. In the event of a momentary power loss or voltage drop, common in some rural areas, the system will automatically restart, if power is returned within three seconds.

The system should now be running. If system did not start, check:

1. System mainline water pressure gauge for minimum pressure, or pressure by-pass selected (if appropriate).
2. Stop-In-Slot position, or Stop-In-Slot by-pass selected (if appropriate).
3. Voltmeter or power source light.
4. System alignment.
5. Visually inspect all tower boxes to insure that disconnect switches are in the "ON" position.
6. If alignment is proper (towers in line), select opposite direction and attempt restart. If system starts, shut off system, select original direction and attempt restart.
7. Pivot panel fuses after turning off disconnect switch.

If none of the above checks solve the problem and the system will not operate, contact a qualified service person to isolate and correct the problem.

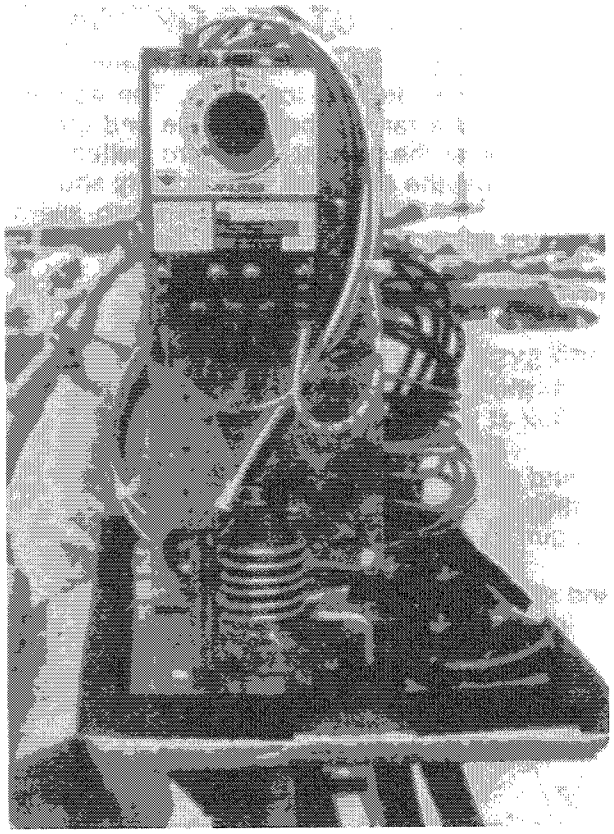
Operation - Stopping The System

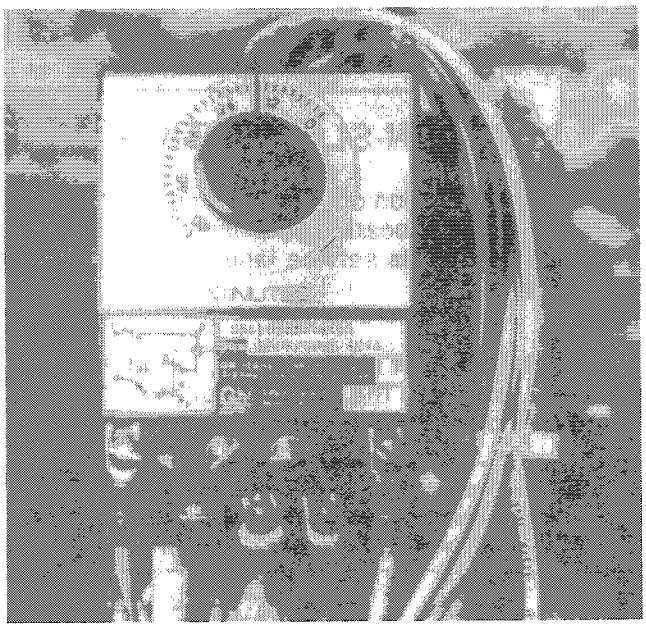
1. Turn Selector Switch (shown in Step #7) to "STOP".
2. Turn Disconnect Switch (Shown in Step 5) to "OFF".
3. Turn off pumping unit (if not automatic).

Overwatering Timer

Your irrigation system is equipped with an overwatering shut-off timer. This timer acts as a safety shut-off if the last regular drive unit fails to move.

If the system fails to move, it would continue to apply water in one area creating flooding and washout. When injecting chemicals (fertilizer, herbicides, etc.), it is **especially** important to shut-off the system and pump before field and crop damage occurs.





The overwatering timer is located in the Time Delay Watering tower box, P/N 1811265, and should be mounted on the next to last tower. Setting on the timer should be 12-15 minutes.

End Gun Shut-Off Option
Stop-In-Slot Option

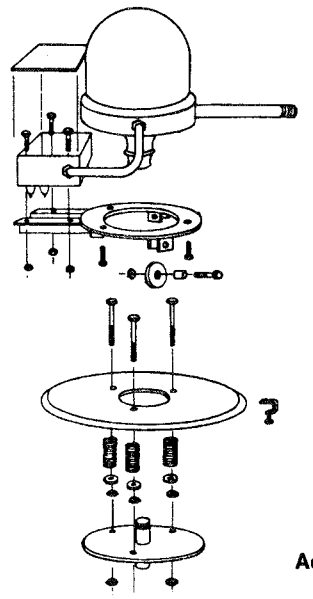
END GUN SHUT-OFF OPTION

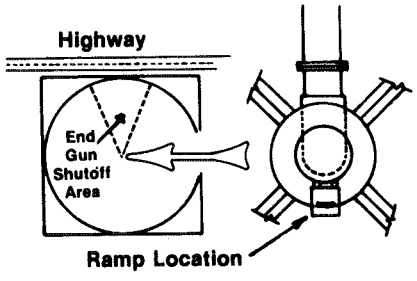
The End Gun Shut-off Option directs the end gun to turn off and on at desired locations. The actuator plate supports the ramps that turn the end gun off and on. Whenever the control box micro switch rides up on the ramps, the end gun is electrically shut-off. The end gun comes back on as the micro switch rides off the ramp. (End gun arc settings vary with different sprinkler packages. See Sprinkler Chart for arc information.)

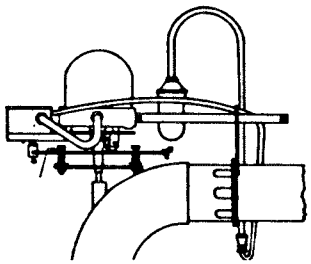
CORNER SYSTEM NOTE: (If the optional E.G.S.O. is not used, the end gun operates from the Solenoid Switch Box at uniform preset positions.)

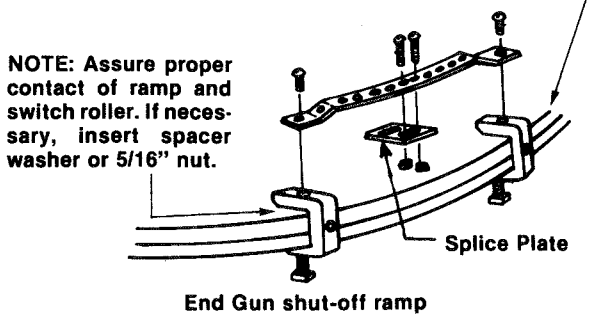
Adjust end gun shut-off by positioning ramps on actuator ring opposite action point. Duration of time the end gun is shut-off is adjusted by length of ramp.

Cut and splice ramp as necessary with splice plate, shown in diagram.







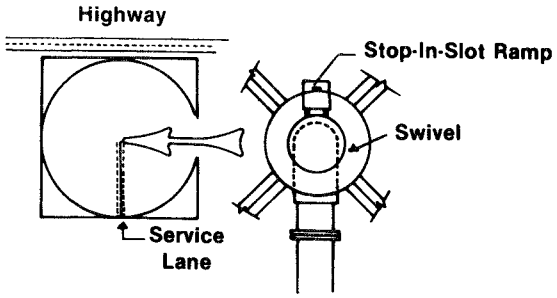


End Gun shut-off ramp

STOP-IN-SLOT OPTION

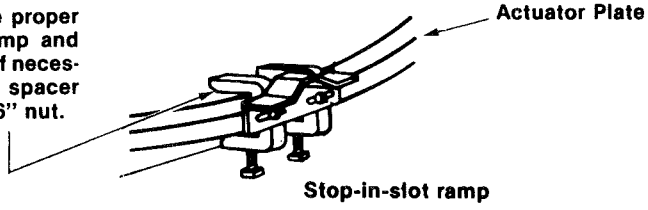
The Stop-In-Slot Option directs the system to stop at any predetermined location(s). This can be used to stop the system in its service lane or other convenient position.

When the Stop-In-Slot micro switch, mounted in the control box, contacts the Stop-In-Slot ramp, the system and pump are shut-down.



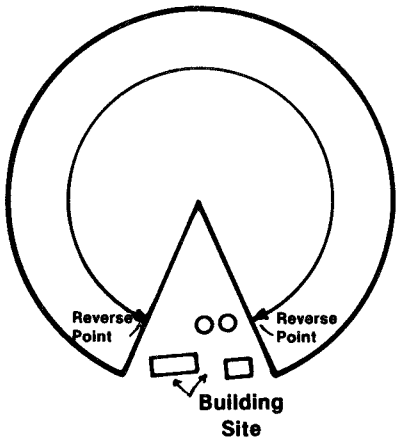
CAUTION: A very small change in location of the Stop-In-Slot ramp causes a MUCH larger change at the outer end of the system.

NOTE: The functions should occur when the switch rollers are halfway up or down the respective sloped portion of the ramp.

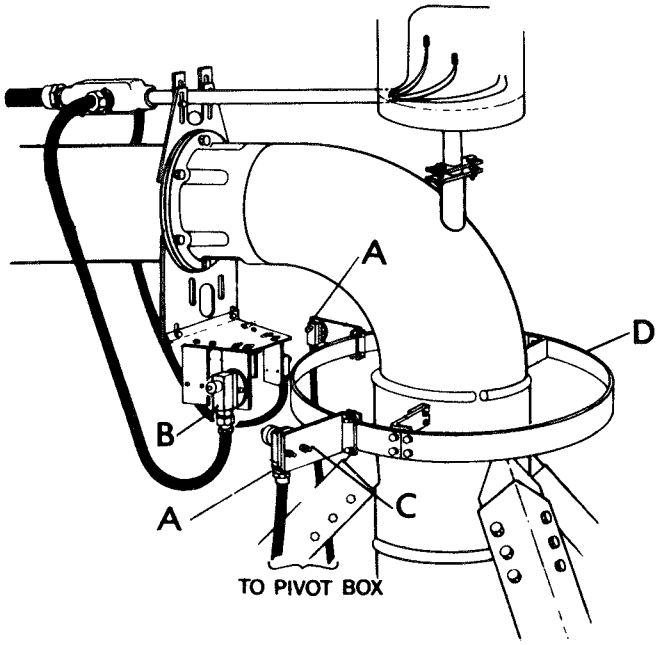


Stop-in-slot ramp

Auto Reverse Option

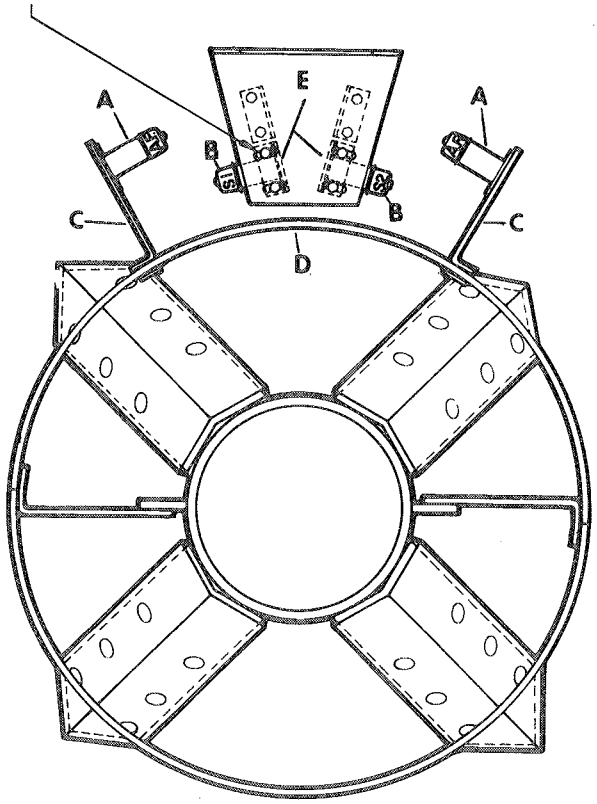


The Auto-Reverse Option can be adjusted to automatically change the system travel direction at predetermined locations, thereby causing the system to operate in a "windshield wiper" fashion.



Auto-reverse switches (A), their mounting hardware and the two safety shut-down switches (B) are mounted as shown in the illustration. Each reversing switch has a back-up safety switch which will stop the system if the reversing switch or associated circuitry fails to achieve the direction change as planned.

NOTE:
Slots in lower Switch Mount used to adjust Auto Reverse Safety. Safety Switch (1811208) to be set so the plunger contacts Actuator (1701995) just after Auto Reverse Switches hit the Plate Actuator (1702000).



ADJUSTMENT.

Adjust Auto-Reverse Switches (A) by loosening 1/4" x 1" cap screws which clamp mounting plate (C) to pivot ring (D). Position each switch to reverse the system back across the field where desired.

CAUTION: A very small change in location of either Auto-Reverse Switch causes a much larger change at the outer end of the system. For example, 1/16th inch at the pivot equates to over 6 feet at the outer end of a quarter section system.

After Auto-Reverse Switches have been installed and adjusted, observe system as it reverses direction in order to ascertain that the system does not travel beyond the desired "turn-around" point. If necessary, readjust switch until system reverses at proper point.

For installation and adjustment of the back-up safety switches, follow the procedure described below:

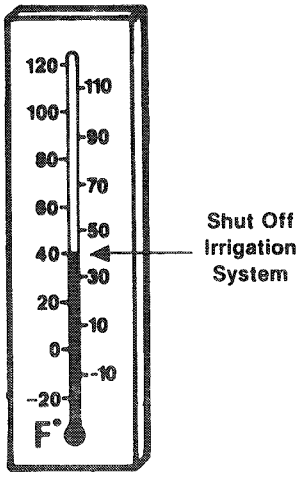
As soon as you hear the reversing contactors activate in the pivot panel, stop system movement by selecting 0% on the Percentage Timer. Loosen the back-up safety switch plate (E) and slide it toward the actuator plate (C) until you hear the contactors "drop" in the pivot panel, and then back it off until the contactor re-energizes. You have three seconds to move the switch backward after it first clicks and "drops" the contactor. Longer than this will necessitate pushing the start button again which would give you another three second interval.

At that point tighten the screws to secure the position of the safety switch. Turn the Percentage Timer to 50%, and the system should continue backing away from the switches. Turn the system off, and remove the auto-reverse switch from the mounting plate. Restart the system in the original direction toward the reversal point. Since the reversing switch is not now installed, the system should shut-down just slightly beyond the programmed reversal point when S1 or S2 (B) contact actuator plate (C). Be certain that the end tower is closely observed during this phase if there are any immovable objects that could cause damage. If the system stops properly, it will be necessary to manually change direction at the pivot panel and hold the start button in three second increments of time until the system has backed off the safety switch and re-established a safety circuit. Re-install the auto-reverse switch (A).

Repeat this procedure for the other side of the field or obstacle. If it is not practical to wait for the system to return to the second position, remove the second auto-reverse switch, position the safety switch actuator plate in a position which will stop the system slightly before its second reversal point and then go through the procedure described above.

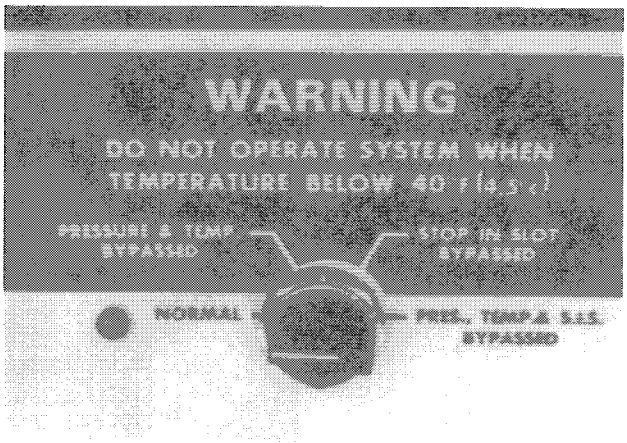
CAUTION: Damage to the system or property caused by misadjustment of auto-reverse switches or back-up safety switches is not warrantable.

Cold Weather Shut-Off



Cold Weather Shutoff

DO NOT OPERATE AT FREEZING TEMPERATURES. Spraying of water has a cooling effect and the water will freeze even though the air temperature is slightly above freezing. Shut the system down at 40 degrees Fahrenheit (4.5 degrees Celsius).



WARNING

YOUR VALLEY SYSTEM IS **NOT** FACTORY EQUIPPED WITH A COLD WEATHER SHUTOFF! The "PRES., TEMP. & S.I.S. BYPASSED" position of the Selector Switch is marked with the "TEMP" notation so that the switch may be used with a **dealer** installed cold weather shutdown control.

Cold weather shut-off controls are available from other vendor sources which will cause the system and power unit shutdown to occur when the air temperature reaches 40 degrees F. Installation of these cold weather shut-down controls should not take the place of regular checks by the operator when the system must perform during marginally cold weather (40-50 degrees F.).

WARNING!

Make certain all pipe drains function properly to prevent pipeline freeze-up and equipment damage in extremely cold weather. DAMAGE TO EQUIPMENT RESULTING FROM FREEZE-UP IS NOT COVERED UNDER WARRANTY!

CORNER SYSTEMS
Revolution Times and Water Application

Because of the numerous possible variations in field shapes, wheel/tire options, soil conditions, etc., the most practical approach to determining revolution time and water application is to accurately time the first revolution with the pivot timer at 100%, while applying water.

If the system is equipped with pressure regulators the 2nd % timer will be set at 100%. If not so equipped, it will be necessary to determine the 2nd % timer setting before running the first revolution for timing. Consult the owner manual for this procedure.

When you have determined the actual revolution time, complete the chart below by inserting the time in all blank spaces in Column A and completing the arithmetic function indicated.

The amount of water you can apply during each revolution can be calculated by using the appropriate formula below:

A. With pressure regulators

$$\text{In./Day Applic. Rate} = \frac{(\text{GPM}) \times (735.3)}{(\text{Sys Length to LRDU} + \text{Corner Arm} + \text{E.G. RAD})^2} = \_\_\_\_\_$$

B. Without pressure regulators

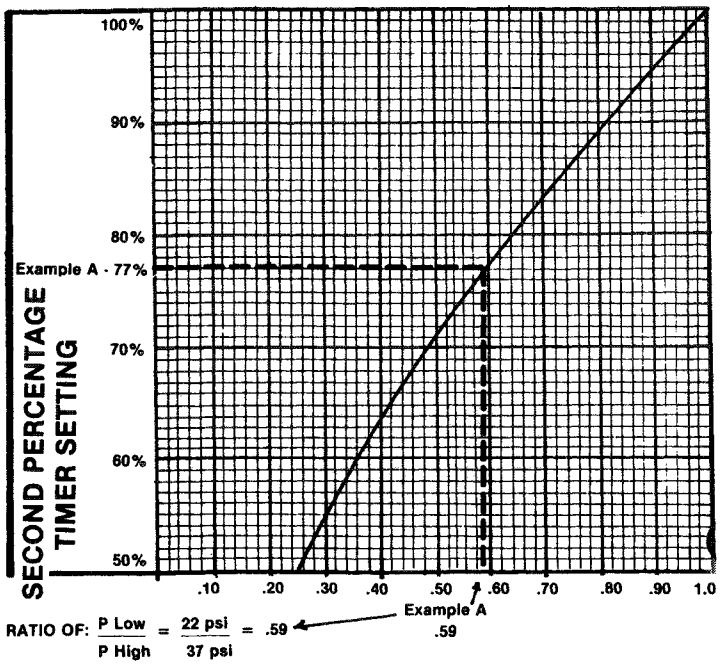
$$\text{In./Day Applic. Rate} = \left(\frac{(\text{GPM}) \times (735.3)}{(\text{S.L. to LRDU} + \text{Cor. Arm} + \text{E.G. RAD})^2}\right) \times \left(\frac{\text{1-Chart "A Factor}}{\text{2nd \% Timer Setting}} + \text{Chart "A" Factor}\right)$$

$$= \_\_\_\_\_$$

CHART A
IRRIGATION PATTERN FACTORS

DLRDU	Irrigating 4 corners	Irrigating 4 corners & 1 side	Irrigating 4 corners & 2 sides	Irrigating 4 corners & 3 sides
700'	.23	.43	.62	.81
800'	.28	.46	.64	.82
900'	.32	.49	.66	.83
1000'	.36	.52	.68	.84
1100'	.39	.54	.69	.85
1200'	.42	.56	.71	.86
1300'	.44	.58	.72	.86
1400'	.46	.59	.73	.86
1500'	.48	.61	.74	.87
1600'	.50	.62	.75	.87
1700'	.51	.63	.76	.88
1800'	.52	.64	.76	.88
1900'	.54	.65	.77	.88
2000'	.55	.66	.77	.89
2100'	.56	.67	.78	.89
2200'	.57	.68	.79	.89

CHART "B"



EXAMPLE: 1200 GPM, 1300' to LRDU, Irrig 4 Cor & 2 Sides, 85 E.G., 2nd % Timer .77.

$$\frac{(1200) \times (735.3)}{(1300 + 243 + 60)^2} \times \left(\frac{1 - .72}{.77} + .72\right) =$$

$$\left(\frac{882360}{2569609}\right) \times \left(\frac{.28}{.77} + .72\right) =$$

$.34 \times (.36 + .72) =$

$.34 \times 1.08 =$

$= .37$ In./Day

Once you have determined the Inch/Day application rate and actual revolution time at 100%, use the following formula to calculate the depth of applications.

$$\frac{(\text{Hrs./Rev.}) \times (\text{In./Day})}{24} = \text{In./Rev. @ 100\%} = \_\_\_\_\_$$

Insert the "In./Rev." figure into Column B and complete the arithmetic function indicated.

HRS./REVOLUTION

% Timer Setting	Col. A			
100% =	_____	Hrs./Revo lution		
90% =	_____	÷ (.9) =	_____	Hrs./Rev.
80% =	_____	÷ (.8) =	_____	Hrs./Rev.
70% =	_____	÷ (.7) =	_____	Hrs./Rev.
60% =	_____	÷ (.6) =	_____	Hrs./Rev.
50% =	_____	÷ (.5) =	_____	Hrs./Rev.
40% =	_____	÷ (.4) =	_____	Hrs./Rev.
30% =	_____	÷ (.3) =	_____	Hrs./Rev.
25% =	_____	÷ (.25) =	_____	Hrs./Rev.
20% =	_____	÷ (.2) =	_____	Hrs./Rev.
15% =	_____	÷ (.15) =	_____	Hrs./Rev.
10% =	_____	÷ (.1) =	_____	Hrs./Rev.
5% =	_____	÷ (.05) =	_____	Hrs./Rev.

INCHES/REVOLUTION

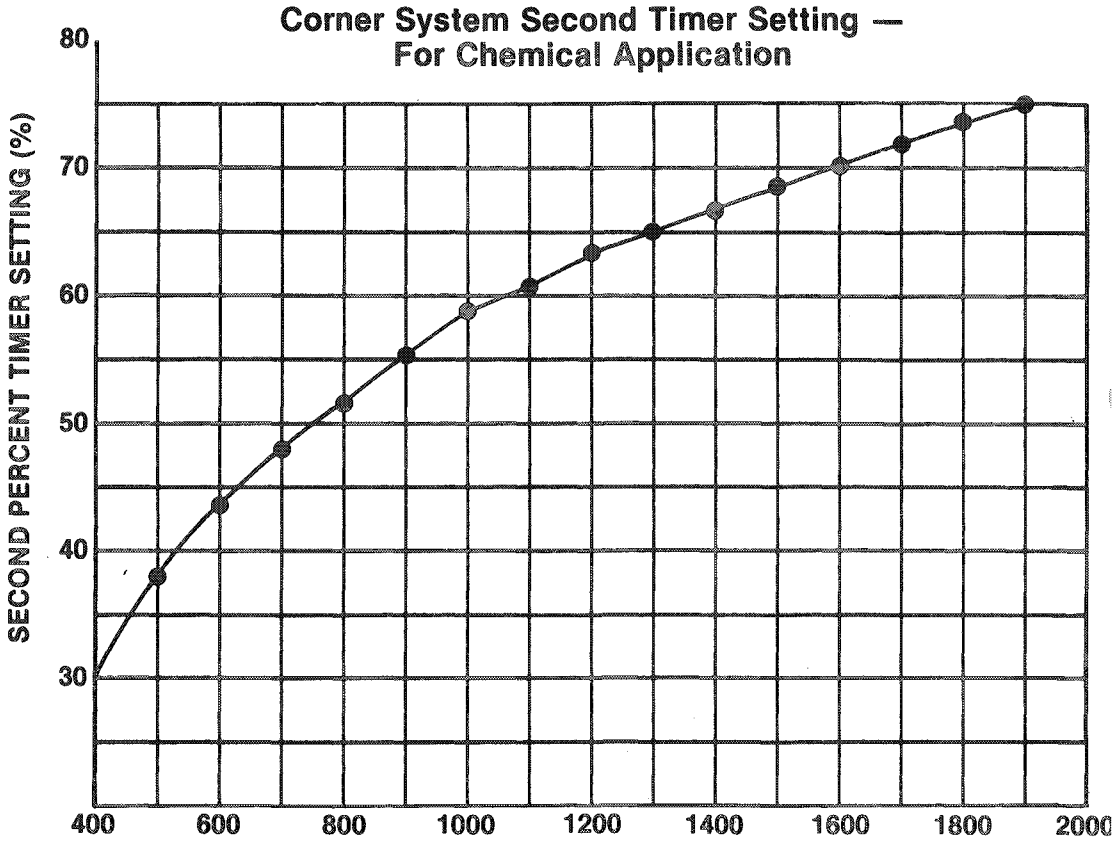
% Timer Setting	Col. B			
100% =	_____	Inches Per Revolution		
90% =	_____	÷ (.9) =	_____	In./Rev.
80% =	_____	÷ (.8) =	_____	In./Rev.
70% =	_____	÷ (.7) =	_____	In./Rev.
60% =	_____	÷ (.6) =	_____	In./Rev.
50% =	_____	÷ (.5) =	_____	In./Rev.
40% =	_____	÷ (.4) =	_____	In./Rev.
30% =	_____	÷ (.3) =	_____	In./Rev.
25% =	_____	÷ (.25) =	_____	In./Rev.
20% =	_____	÷ (.2) =	_____	In./Rev.
15% =	_____	÷ (.15) =	_____	In./Rev.
10% =	_____	÷ (.1) =	_____	In./Rev.
5% =	_____	÷ (.05) =	_____	In./Rev.

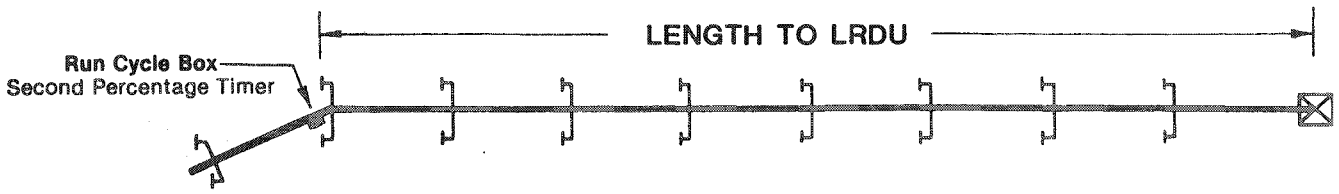
With the above 2 charts completed, you can select a desired depth of water to be applied from the In./Rev. column and determine the appropriate % timer setting. Refer to the Hrs./Rev. chart to find how long it will take for the system to complete the revolution at the speed (% timer setting) you have selected.

CORNER SYSTEM CHEMIGATION
(Corner System w/ or w/o Pressure Regulators)

Corner systems that do not have pressure regulators slow down slightly when irrigating corners to maintain even water distribution. Systems equipped with pressure regulators automatically compensate for the extra acres to be covered, so they do not slow down in corners. Injector pumps operate at a fixed rate of chemical injection. Therefore, to achieve the optimum application throughout the entire field when applying chemicals, we suggest setting the pivot percentage timer at 100% and the second percentage timer at a percentage determined from the chart below based on length of the system to the last regular drive unit.

NOTE: Prior to the first chemigation revolution, it is necessary to run one full revolution with the pivot percentage timer at 100%, and the second percentage timer at the percentage found below. Record the number of hours required for the full revolution for subsequent use in calculating chemical application rates.





PROCEDURE

1) Locate system length to the last regular drive unit and determine the second percentage timer setting. Example: 1300' to LRDU = 65% for second percentage timer.
2) Turn off all power to system at main disconnect.
3) Turn off the run cycle box disconnect (at LRDU), remove the cover and note the original setting. (The second timer must be returned to original setting after completion of chemical application.) Reset second percentage timer to the new setting.
4) Replace cover and turn on run cycle box disconnect.
5) Restore power to the system and run the chemigation revolution.
6) When chemigation is complete, turn off the injection system and flush the irrigation system for ten (10) minutes.
7) Shut off the system power and repeat Steps 1-4, returning the second percentage timer in the run cycle box (at LRDU) to the original setting.

(Chemigation Calculation)

1. **Determine type and quantity of chemical solution you wish to apply per acre** _____ **Quantity**

2. **Calculate/determine number of acres to be chemically treated** _____ **Acres**

3. **Multiply:** _____ (Step 1) x _____ (Step 2) = _____ **Total Quantity Req'd.**

4. **Determine hours per revolution of irrigation system. (See note above chemigation timer chart)** _____ **Hours/Rev.**

5. **Divide:** $\frac{\text{(Total Quantity)}}{\text{(Hrs/Rev)}}$ = **Flow Rate in Gal/Hr.** $\frac{(\quad)}{(\quad)}$ = ( )

6. **Refer to pump manufacturer's operator manual for proper flow settings.** _____ **Setting**

The above chemigation procedure is designed as a guide only. Valmont Industries, Inc. assumes no liability for its accuracy or use thereof. For specific chemical recommendations contact your chemical supplier. Any chemicals injected must be labeled and approved for application through irrigation systems.

PRACTICE SAFE MAINTENANCE

DO NOT attempt to service any component until all electrical power is disconnected.

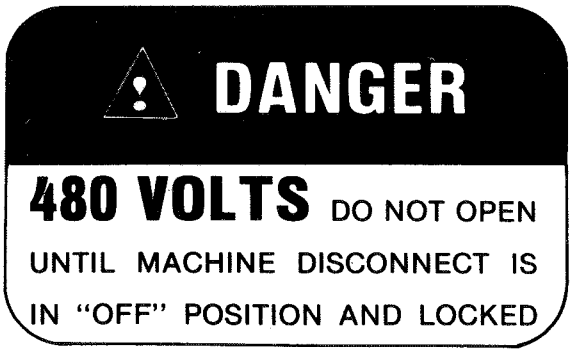
DO NOT depend on another person to disconnect the power -- DO IT YOURSELF!

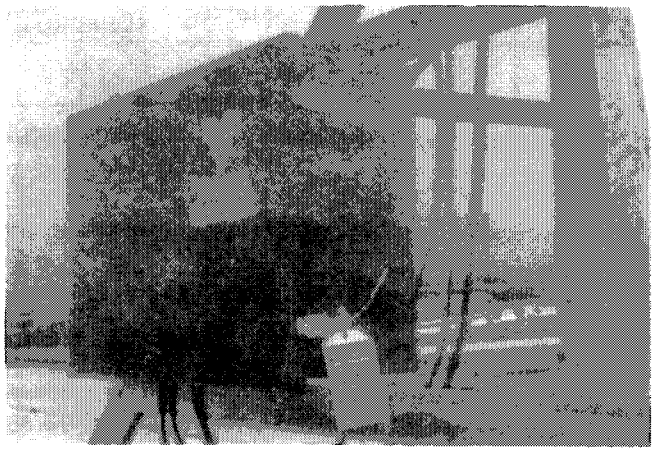
REPLACE any guards and shields removed for servicing.

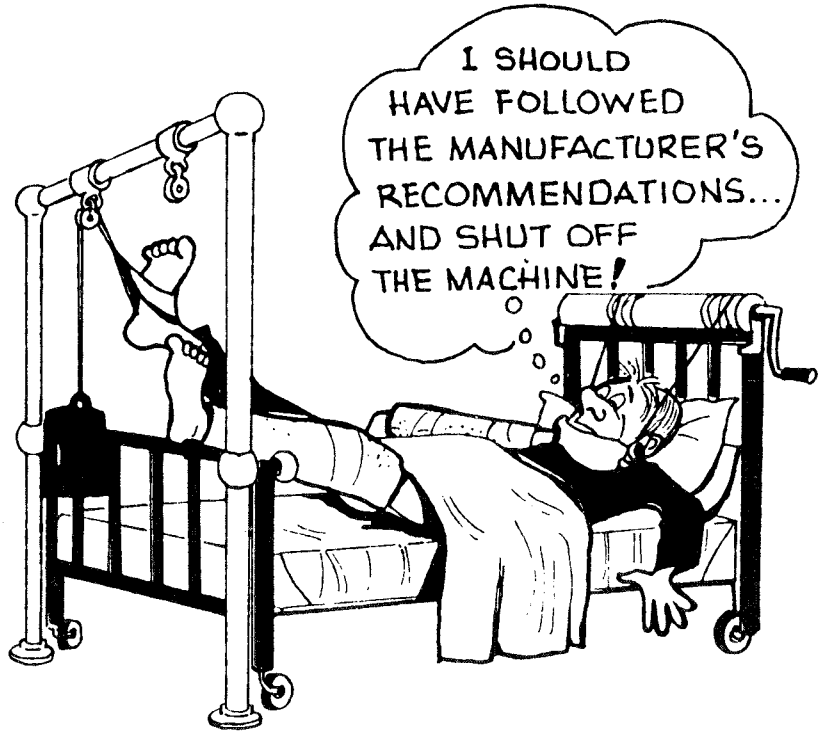
DO NOT attempt to adjust end gun as it operates.

DO NOT deep rip or chisel near the buried power service wires.

REMEMBER, a safety program is much like a chain. It is only as strong as its weakest link. As you read and use this manual, follow the safety suggestions given in each section.







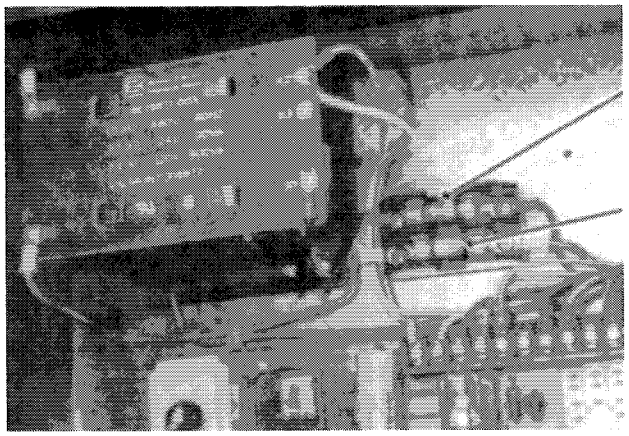
Fuses - Pivot Panel

DO NOT OVERSIZE FUSES — THEY WERE SIZED FOR THE PROTECTION OF YOUR MACHINE.

HIGH VOLTAGE

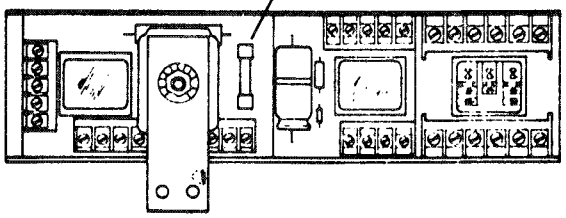
⚠ DANGER

480 VOLTS DO NOT OPEN UNTIL MACHINE DISCONNECT IS IN "OFF" POSITION AND LOCKED



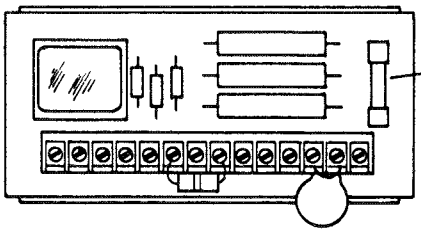
5 Amp Fuse
P/N 314243

3 Amp Fuse
P/N 314755



2.5 Amp Fuse - P/N 315595

3-Piece PCB

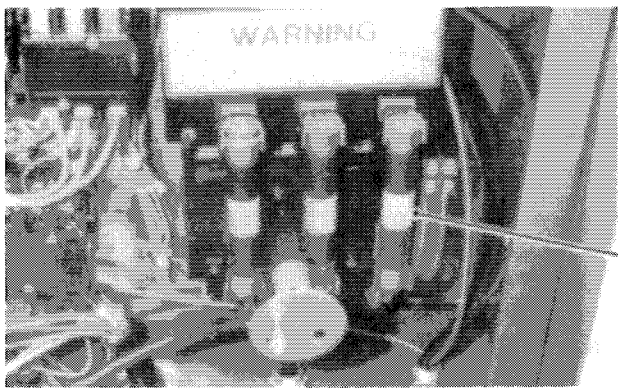


2.5 Amp Fuse
P/N 315595

Expanded Oscillator Protection PCB

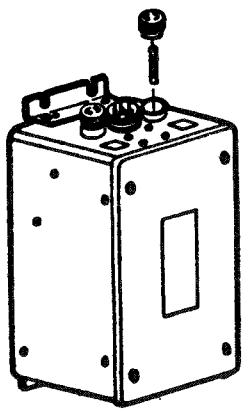
RECOMMENDED FUSE SIZES FOR PIVOT PANEL

No. of DU's	Std. Corner Sys.	Std. w/ 2 HP Booster	Std. w/ 7.5 HP Booster	High Speed Corner Sys.	Hi Spd. w/ 2 HP Booster	Hi Spd. w/ 7.5 HP Booster
4	15	20	25	17.5	25	30
5	15	20	30	20	25	30
6	17.5	25	30	20	30	45
7	17.5	25	30	25	30	45
8	20	25	30	25	30	45
9	20	25	30	25	30	45
10	20	25	45	30	45	45
11	25	30	45	30	45	45
12	25	30	45	30	45	
13	25	30	45	45	45	
14	30	30	45	45	45	
15	30	30	45	45	45	
16	30	45	45	45	45	
17	30	45		45		
18	30	45		45		
19	30	45				
20	45	45				



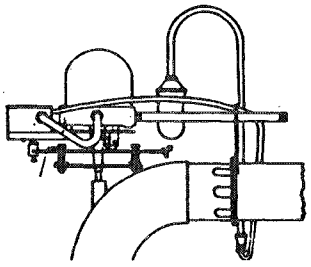
480 Volts
See Chart

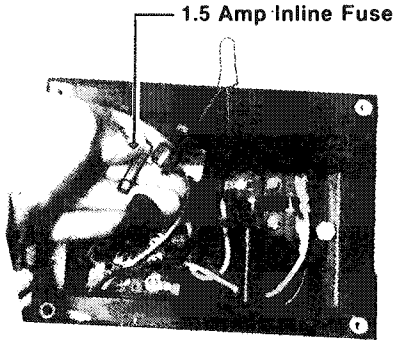
Fuses for Oscillator	
½ Amp Fuse	315180
¾ Amp Fuse	315019
Fuse Holder	315018



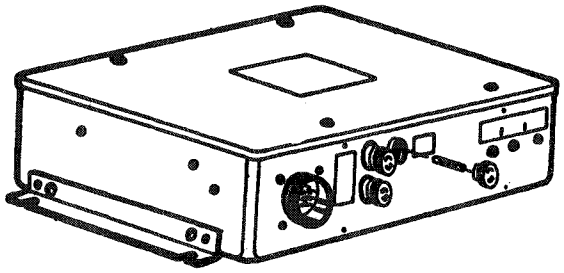
System Fuses

Anywhere the running light is wired it is fused with an inline 1.5 amp (P/N 314858) fuse. Shown in the illustration is the location of the running light fuse when wired into the Stop-In-Slot and End Gun Control Switch Box.

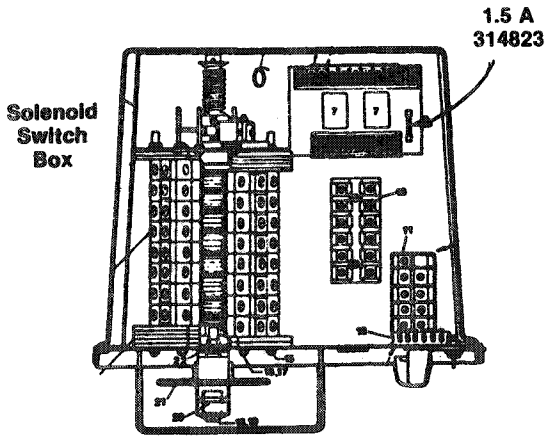


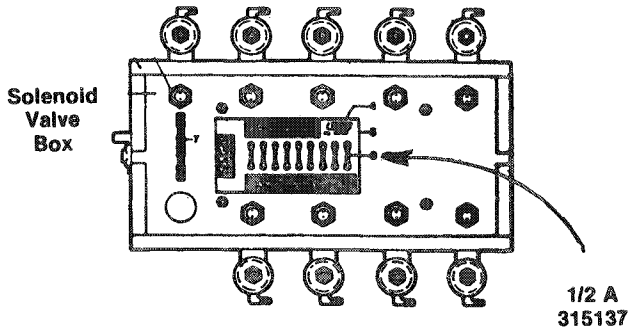


Guidance Receiver



Fuses for Receiver	
⅜ Amp Fusetron	315017
¾ Amp Fuse	315019
Safety 5 Amp	314859
Fuse Holder	315018





480 VOLT POWER

DO NOT Perform Any Services On Machine Unless Main Disconnect Switch At Pivot Panel is LOCKED in OFF Position.

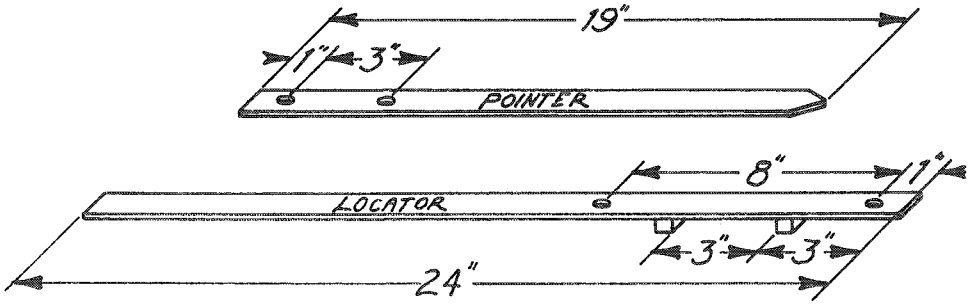
MICRO SWITCH REPLACEMENT AND ADJUSTMENT PROCEDURE

See Rainger Section for long electric systems with "Floating Alignment," or for Rainger Systems with "Floating Alignment".

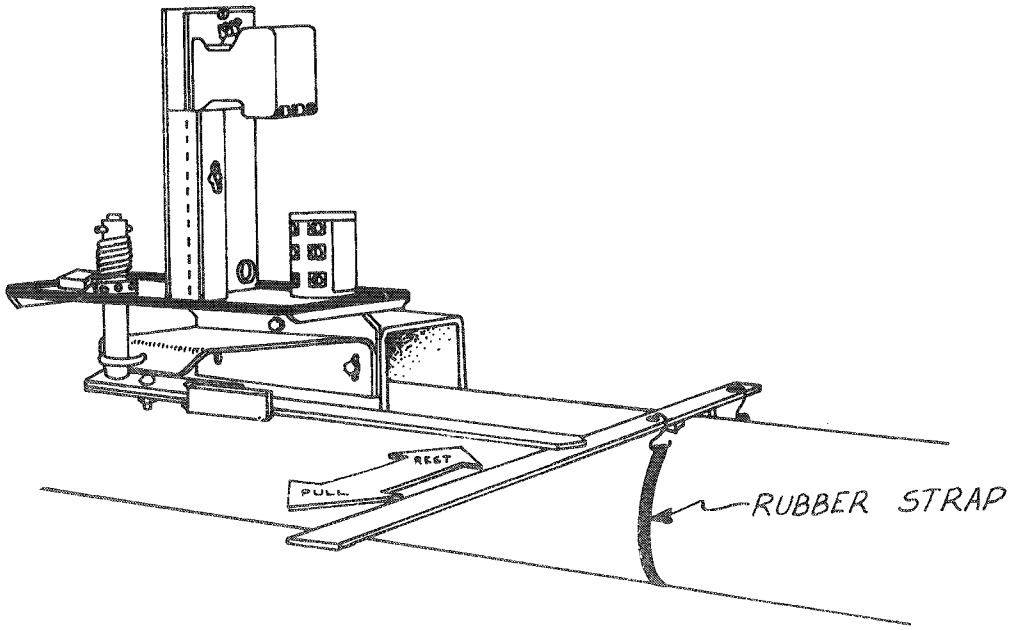
REPLACEMENT: When a micro switch (Run Switch or Safety switch) is found to be faulty, note the wire positions and disconnect the wires and remove the switch. Install the new switch, reconnect the wires and proceed with the switch adjustment as follows:

ADJUSTMENT PROCEDURE

1. Remove control bar from switch arm assembly.
2. Install Pointer Bar using 5/16" carriage bolts from control bar.
3. Mount locator bar on pipeline with rubber tie-down strap.
4. Connect a VOM to the "N.C." and "C" Terminal of Safety Switch.
5. Slowly pull pointer bar until meter shows continuity . . . continue pulling until meter shows "open." Make mark on locator bar.
6. Slowly release pointer bar. Meter will again show continuity. Continue to release until meter again indicates "open." Mark this location.
7. Measure distance between lines. Electric Systems must be adjusted to 2". Adjust Safety Switch allen screw to achieve required dimension and repeat steps 5 & 6 as often as necessary.
8. When Safety Switch is adjusted, measure and locate centerline of safety band.
9. Connect VOM to Common & N.O. of Run Switch. Pull slowly on Pointer Bar until VOM shows continuity. Mark this point on locator bar.
10. Move VOM Probe from N.O. to N.C. Contact on the Run Switch. VOM should show continuity. Pull Pointer Bar until VOM shows "OPEN," then slowly release pointer until VOM shows continuity. Mark this point. Measure and locate centerline of Run Switch "travel band." The centerline of both switches must coincide. If they do coincide, no further adjustment is necessary. If not, adjust the run switch allen screw as needed to bring the centerlines together.
11. The two switches are now electrically centered with each other, and after removing the pointer and locator bars and reinstalling the control bar, pre-adjust tower box in accordance with instructions provided in the Tower Control Box Adjustment Section of this Manual.



TWO 1/2" x 1/2" x 1" BLOCKS REQ'D TO STABILIZE LOCATOR BAR



TOWER CONTROL BOX ADJUSTMENT
(Initial Set-Up or Installation)

1.) Mount control box to "Fixed Pipe" mounting.

2.) Insert control rod in attachment ear on swivel pipe and loosely bolt plate and keeper plate to pivot arm assembly of control box, with 5/16 Carriage bolts/nuts. The threaded stud of the control bar should have one nut turned well on and the threaded portion should be placed into the adjusting tab.

3.) Rotate the switch pivot arm assembly (under the control box) until the roller of the Safety Switch rests in the "V" of the cam plate, and tighten bolt #1. Bolt #2 should be snug, but not tight.

4.) Adjust nut 3 until the run switch actuates. Tighten nut 4. The run switch will probably release.

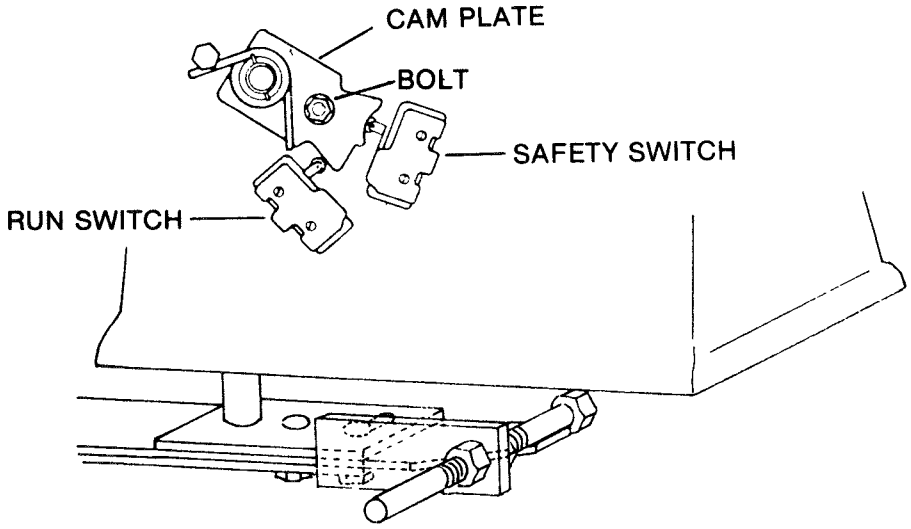
5.) Readjust 3 and 4 as needed to accomplish the following:
   A. Press control bar at A. Run switch should actuate but not release when pressure is removed.
   B. Pull control bar at B (with equal pressure as at A). The run switch should release, but should not actuate when the "pull" is removed.

6.) Tighten nut 2.

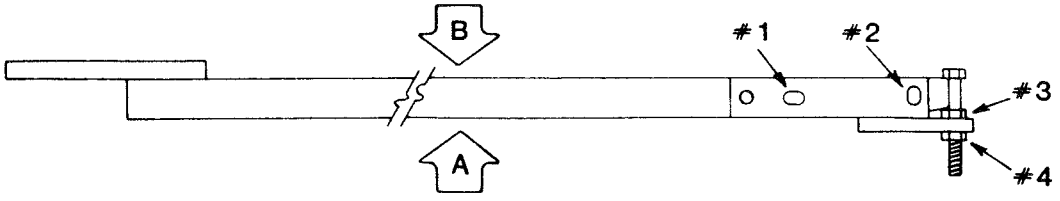
CAUTION

BEFORE ATTACHING THE CONTROL BAR TO THE SWITCH ARM ASSEMBLY (UNDER THE TOWER BOX), MANUALLY DEPRESS THE RUN SWITCH AND ROTATE THE SWITCH ARM ASSEMBLY IN BOTH DIRECTIONS TO ASCERTAIN THAT THE SAFETY SWITCH WILL ACTUATE **BEFORE** THE CAM PLATE MAKES CONTACT WITH THE BOLT IN THE CENTER OF THE CAM PLATE.

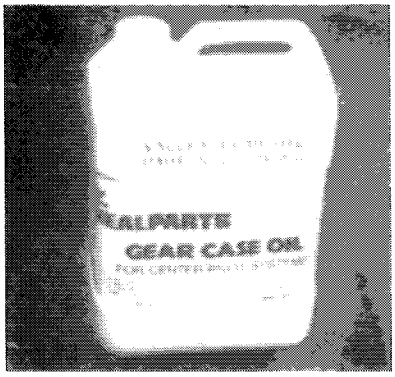
If you cannot hear the safety switch "click" in and out in both directions, do not proceed with that tower run switch adjustment until a fully qualified service technician has properly adjusted the safety switch.



NOTE: A second person, standing on the ground one tower away, can visually sight a line between three towers to advise you when you have achieved the desired alignment.

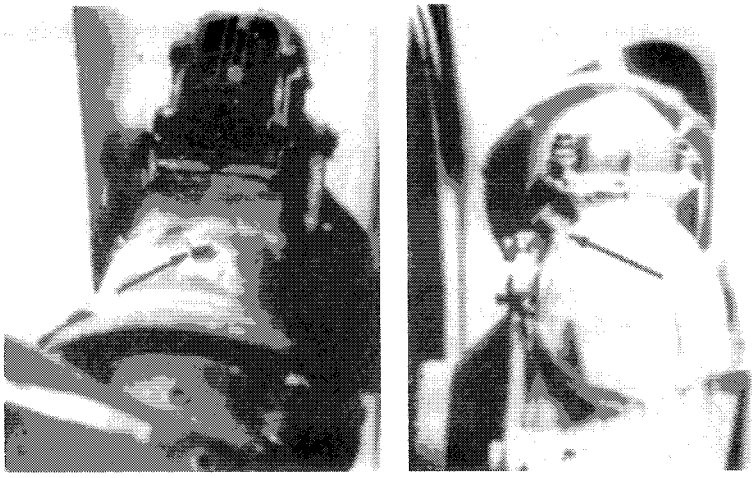


Gearbox Lubrication



IMPORTANT:
Always use VALLEY Gear Lube when replacing or adding oil to gearboxes. VALLEY Gear Lube's compounded worm gear lubricant contains non-corrosive extreme pressure additives which are specially designed to withstand high gear-case temperatures and loadings.

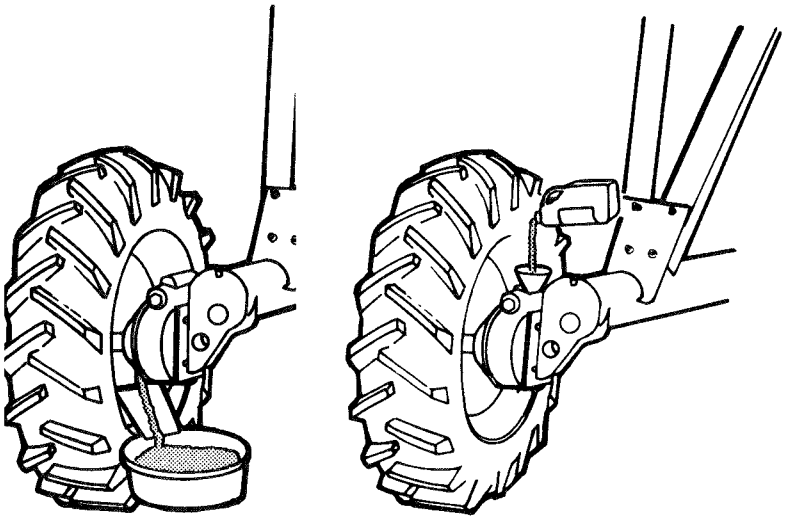
STEERABLE DRIVE UNIT GEARBOXES



Drain and refill SDU gearboxes as above thru fill plugs indicated by arrows.

VALLEY GEARBOXES

After every season drain any water that may have accumulated from the gearboxes. Do not drain gearbox empty. Replace plug. Refill gearbox thru expansion chamber until level of oil is even with the bottom of the expansion chamber.



TOWABLE HUBS

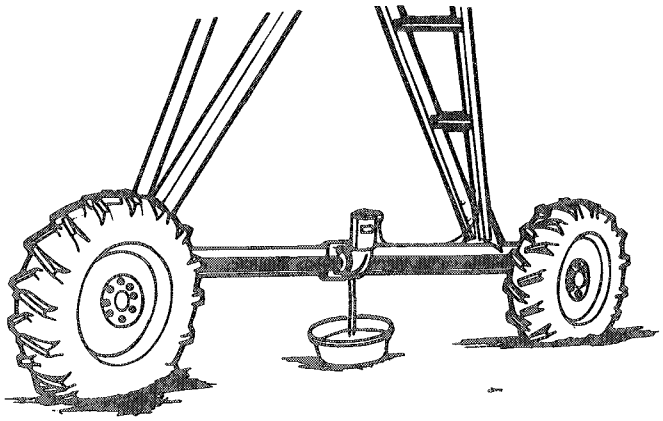
Lubricate towable hubs with VALLEY Waterproof Grease before the system is to be towed or shut down for winter and periodically during the season.

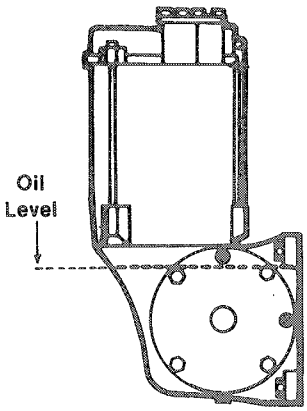
VALLEY GEARBOXES (After First Season)

After first season of operation, drain and replace oil from gearboxes. Refill the gearboxes thru expansion chamber until level of oil is even with the bottom of the expansion chamber.

Electrical Gearmotor Lubricatior

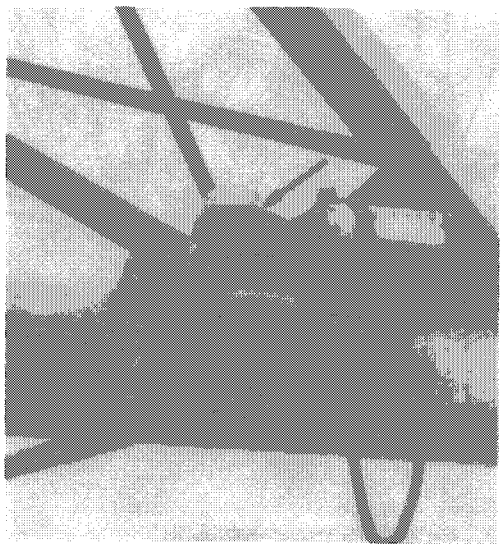
IMPORTANT: The composition of various brands of lubricants contain additives which are corrosive to bronze worm gears. Therefore, we recommend only the use of VALLEY Gear Lube, which is a compounded worm lubricant containing non-corrosive extreme pressure additives. The oil bath in worm gear cases may reach a temperature of 200° F. without alarm.





ELECTRICAL MOTOR GEARMOTORS
After every season of operation, drain oil from gear motors.

Refill the gear case to approximately 1/2" from the fill pl with VALLEY Gear Lube.



Drain and refill electric drive motor and steering motor thru fill plugs indicated by arrows.

RECOMMENDED WORM GEAR OIL/GREASE

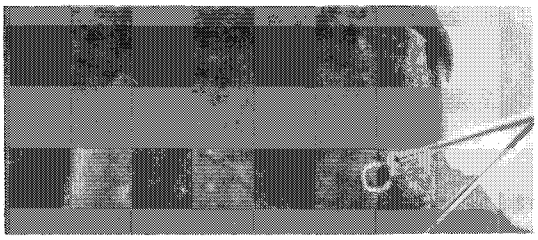
REFER TO LUBRICATION INSTRUCTION PLATE FOR PROPER VISCOSITY OF OIL REQUIRED FOR OPERATING TEMPERATURE. USE VALMONT GEAR LUBE LISTED BELOW.

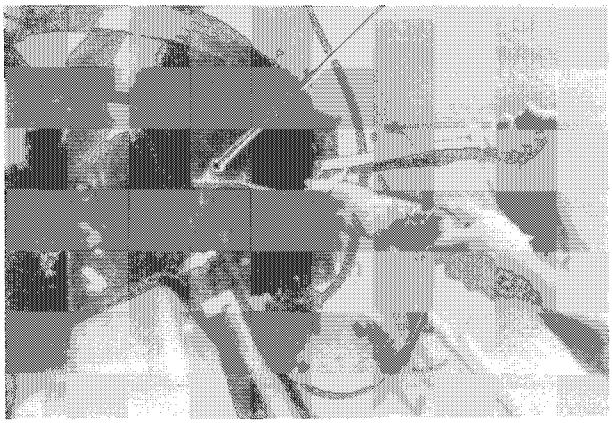
MANUFACTURER	SPECIFICATION OF WORM GEAR OIL
Valmont Gear Lube **55 Gal. 991561** **16 Gal. 991562** **5 Gal. 991563** **2 Gal. 991564**	**MIL-L2105-C**

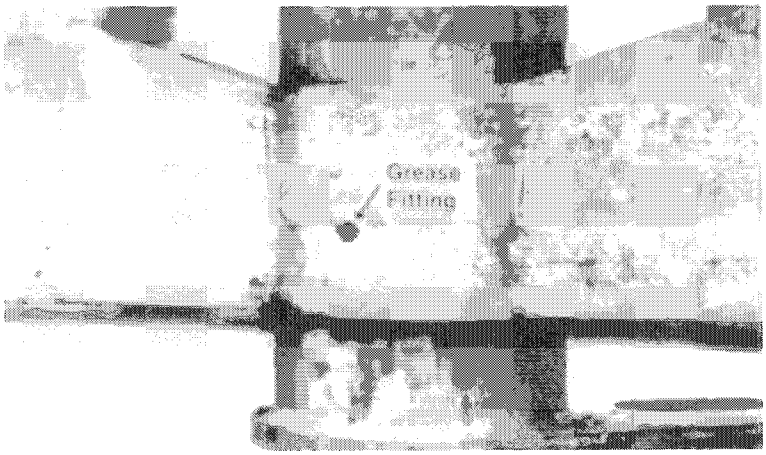
VALLEY WATER-PROOF GREASE for Lubrication of Universal Joints and Pivot Swivel

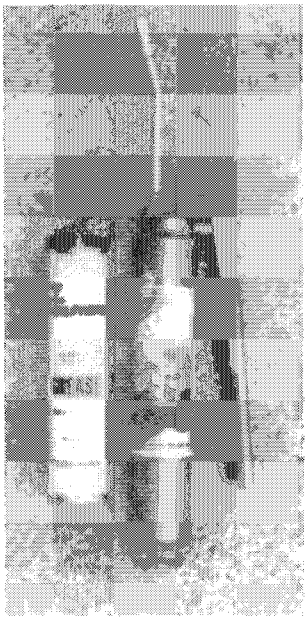
316003.....**14½ oz. Cartridge** **316002**.....**Carton of 25 14½ oz. Cartridges**

NOTE: The recommended lubricant listed above is a compounded worm lubricant containing non-corrosive extreme pressure additives. DO NOT USE lubricants containing sulfur and/or chlorine extreme pressure additives which are corrosive to worm gear bronze. The oil bath in worm gear cases may reach a temperature of 200° without alarm.



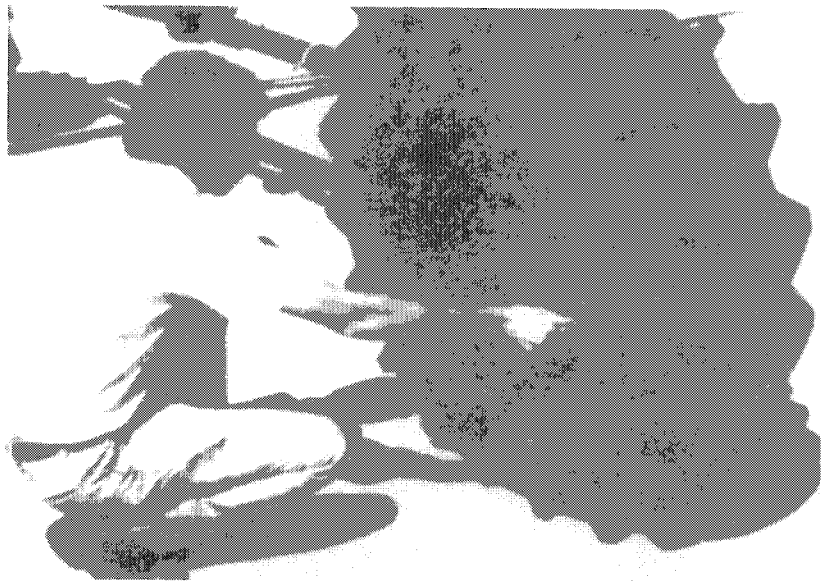






Tire Pressure

Proper tire pressure is important to the operation of the system. Operating with low tire pressure will damage tires and the drive train. Check tire pressure at least three times a year, at spring start-up, during the irrigation season, and when performing fall winterization.



All system tires which are assembled at Valmont are being shipped inflated to approximately 35 PSI. All tires are being inflated to their maximum rating to prevent the potential of flat tires through bead breakage during the handling and shipping process. Because of this procedure, it is absolutely necessary that all tires be adjusted to their recommended inflation pressure during installation. Below is a chart stating the recommended tire pressures.

TIRE SIZE (Inches)	RECOMMENDED TIRE PRESSURES		
	Pounds/Square/Inch	Kilograms/Square/Centimeter	Atmospheres
11.00 x 24.5 recap	28-32	1.97-2.25	1.91-2.18
11.2 x 24	21-23	1.48-1.62	1.43-1.56
11.2 x 24.5	21-23	1.48-1.62	1.43-1.56
14.9 x 24	14-16	.98-1.12	.95-1.09
16.9 x 24	14-16	.98-1.12	.95-1.09

Flushing Procedure

After thoroughly checking the system and correcting any problems, the system must be flushed. The purpose for flushing the system is to remove sand and debris from the pipeline. Sand is extremely abrasive and can cause undue wear to the sprinkler heads.

IMPORTANT: Excessive accumulation of sand in the system also adds weight and can cause system damage.

The Flushing Process Should Be Performed:

1. After system installation.
2. After pump repair.
3. After structural repair.
4. Prior to operating system, each spring and at end of season.
5. As often as necessary according to debris or sand content in water. Excessive sprinkler problems (clogging) could be an indication of high debris or sand content.

⚠ DANGER! DO NOT START FLUSHING PROCEDURE WHILE THE SYSTEM IS UNDER WATER PRESSURE. REMOVING SAND TRAP PLUGS WHILE THE SYSTEM IS UNDER PRESSURE MAY CAUSE PERSONAL INJURY OR DEATH.

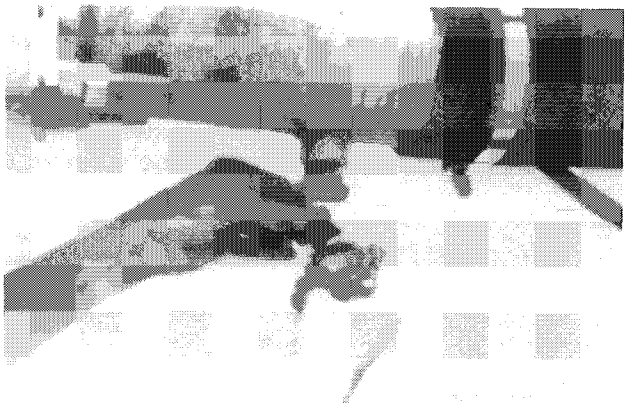
Flushing Procedure:

1. Be sure the main disconnect switch is off. Electrical power is not needed for this procedure.
2. Remove sand trap, drain caps and end caps from end of overhang.
3. Turn on pump.
4. Allow system to flush out thoroughly.
5. Turn off pump and re-install drains, sand trap and end caps on overhang.
6. After flushing for winterization, insure that all drains have allowed water out of the pipeline to prevent freezing and splitting of the pipeline.

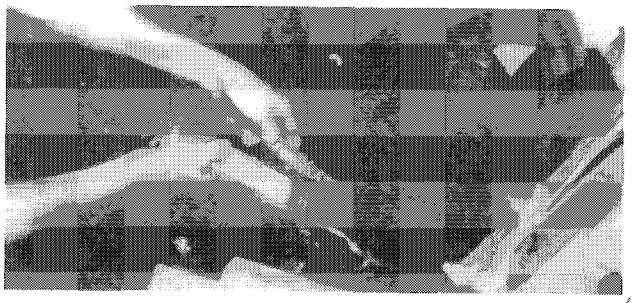
Winterizing

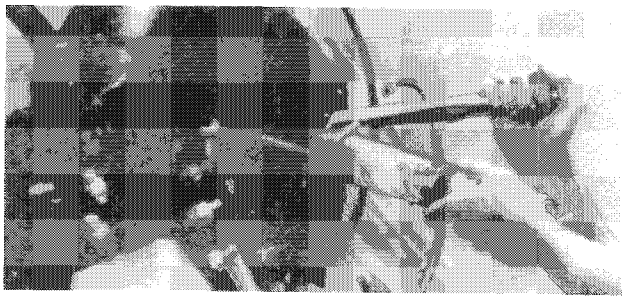
1. If the system uses underground pipe leading to the pivot, make sure the water is drained below the frost level, or pumped from the line. The 2" pipe plug should be removed to drain the riser pipe. When drainage is complete, reinstall plugs to prevent rodent infestation.

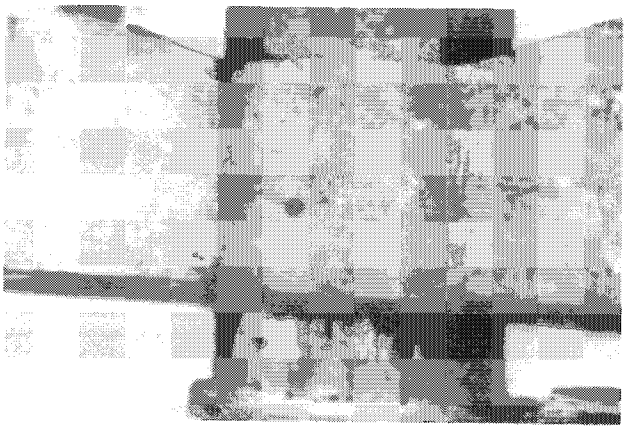
2. Remove bottom pipe drain caps. Clean sand and foreign particles from these drains, then flush. NOTE: Drain seals should be turned over when being re-installed. This will greatly increase the seal life.



3. Protect moving parts and bearing surfaces against rust and corrosion by greasing all fittings with VALLEY Waterproof Grease.







4. Remove 2" pipe plug from overhang, flush and recap.

5. Electrically operated end gun shut-off valves should have the top removed to check for drainage.

6. On systems with the manual ball valve on the end gun shut-off, make sure the valve is turned open. Clear 3/32" drain hole in the bottom of the 90° elbow below the end gun.

7. Open drain cock on Solenoid Valve Box manifold.

8. If an air compressor is available, remove each tube from the Solenoid Valve Box, and remove all manual bleed plugs from hydro valves. Then using the air compressor, blow out the water from the lines. If an air compressor is not available, simply leave the tubes hanging to let them drain. **Do not** lose the bleed plugs since they must be re-installed in the spring.

9. Visually check motor junction box to make sure drain hole in bottom is open. Check gaskets installed between the stator, junction box and cap. Replace if cracked or mis-shaped.

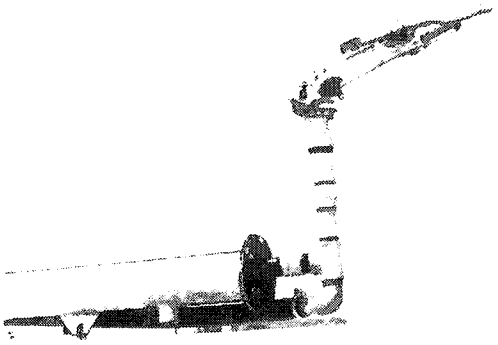
10. The oil in the electric gear motors should be changed at the end of each season. Refill the gear case to approximately 1/2" of the fill plug for proper bearing lubrication. Refer to Electric Gearmotor Lubrication page.

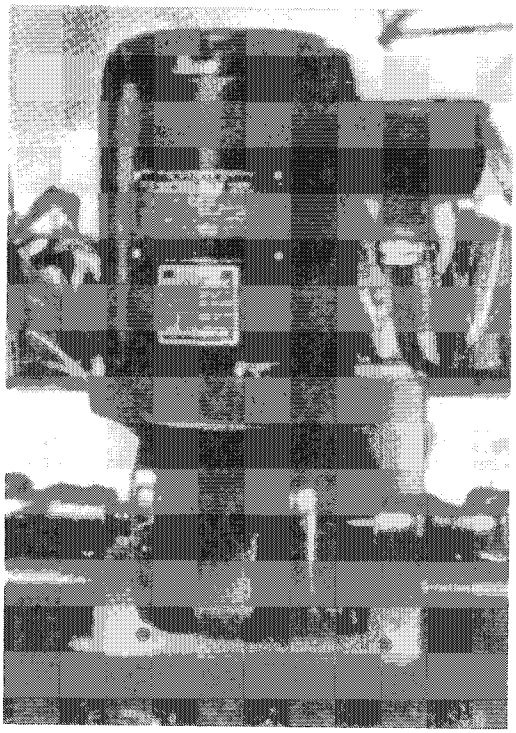
11. The water caused by condensation should be drained from worm gear boxes and refill with Valmont gear lubricant.

12. Grease all fittings on hubs on gear box drive systems.

13. Check nut tightness on all wheels.

Additional winterizing facts may be suggested by your serviceman which are common to your area. If you have questions or comments concerning winterizing procedures, please contact your VALLEY Dealer.



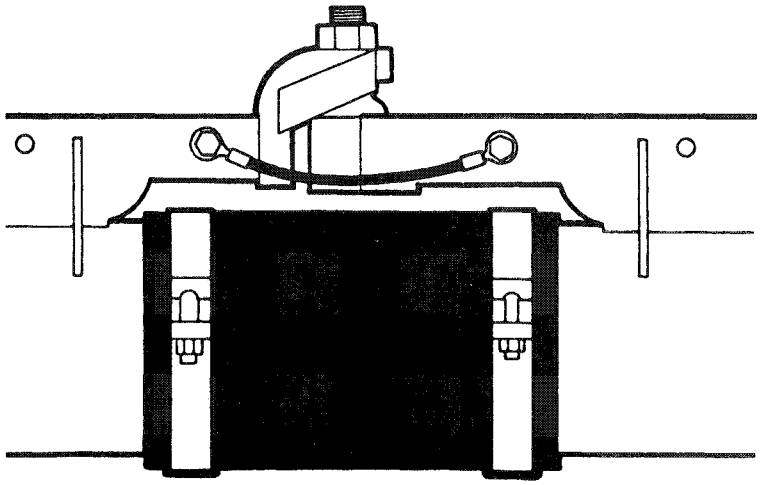


Follow manufacturer's WINTERIZATION recommendations on all auxiliary equipment such as pumps, power units, mainline pipes and hoses. Generally, this includes lubrication, clearing drains, covering openings to prevent rodent infestation and overall protection from the elements. A thorough flushing of the system with all drains removed should clean out any build-up of sand or other foreign matter. Replace all drains and don't forget to insure that the mainline is pumped clear. Any low spot in the mainline between the pump and the pivot should have a riser installed at the low point to provide access for pumping water from the line.

Flex Hoses

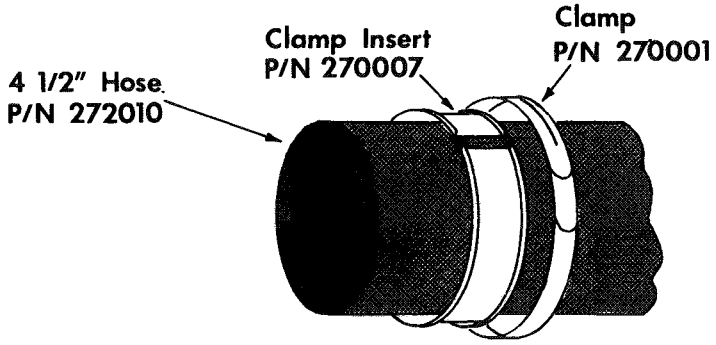
Flex hoses on Valley systems are constructed of fiber reinforced neoprene which resists weather cracking and checking, heat and water.

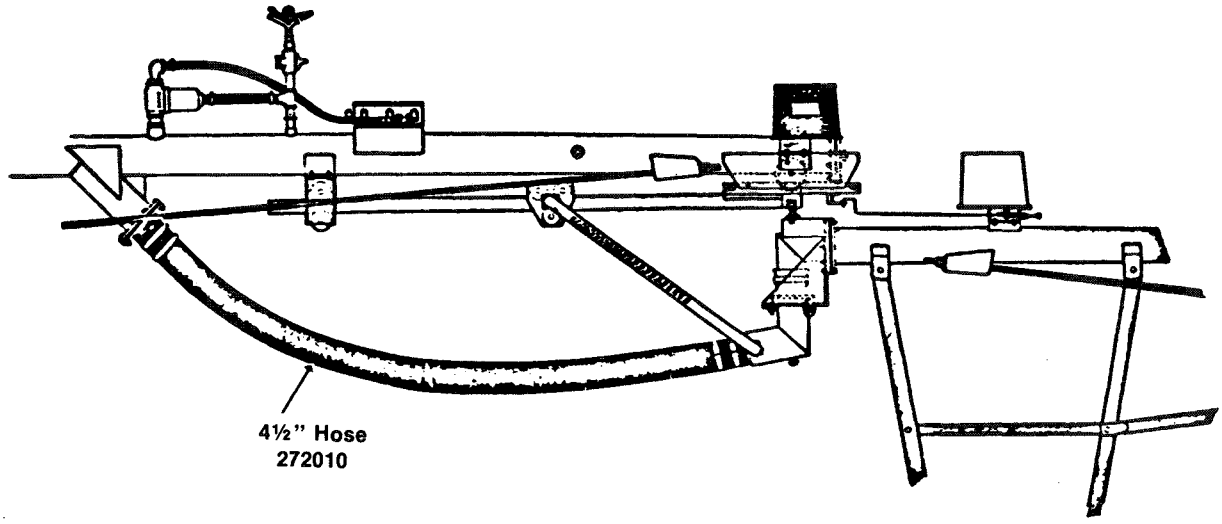
If a boot must be replaced, loosen the two clamps to remove old boot and insert the new one. No extra support is needed while making the changes.



	HOSE P/N	CLAMP P/N
8" Pipeline	1710029	991147
6 5/8" Pipeline	1800318	991087
6" Pipeline	991187	991186

Transfer Hoses





Maintenance Check List

Time, humidity, vibration, temperature, sand and system operation all contribute to wear on your VALLEY irrigation system. To keep the system operating properly with a minimum amount of down time, we urge you to establish a regular preventative maintenance program. If replacement parts are needed, use only VALLEY REALPARTS.

DANGER: 480 VOLTS. TURN OFF MAIN DISCONNECT SWITCH BEFORE CHECKING THE SYSTEM OR ATTEMPTING ANY SYSTEM REPAIR.

		1 REV.	10 REV.	SEA-SONAL	REMARKS
PIVOT GROUP	Check all Nuts and U-Bolts	X	X	X	
	Check Anchor Chains or Bolts	X	X	X	
	Check Equipment Grounding Conductors - Tighten As Required	X	X	X	
	Grease Pivot Swivel	X		X	
DRIVE UNIT GROUP	Check Flex Joint & Boot for Leaks	X		X	
	Check Condition of Motor Lead Cable	X		X	Suggest you call dealer
	Check Drain Holes for Open Flow			X	
	Drain & Replace Gearmotor Lubrication			X	
	Check Gearmotor Seals and Gaskets		X	X	
	Check & Lubricate Drive Shaft U-Joints	X	X	X	
	Drain & Replace Gearbox Lubricant*				*(see note)
	Check Gearbox Seals & Gaskets	X		X	
	Check and Tighten Wheel Lug Bolts	X	X	X	
	Check Tire Pressure	X	X	X	
PIPE & SUPPORT GROUP	Check Flanges for Leaks	X	X		
	Check Pipe Drains for Open Flow		X	X	
	Check Structural Components for Tightness	X		X	
	Check Power Cable for Breaks & Banding	X		X	Suggest you call dealer
	Check Overhang Cables for Broken Strands	X		X	
SPKR. GROUP	Check Sprinklers & Nozzles for Tightness			X	
	Check Sprinklers for Free Movement			X	
	Check Sprinkler Nozzles for Wear			X	
	Check Pressure Gauge for Proper Operation			X	
SWING SPAN GROUP	Check Cradle Roller Bearings for Excess Wear		X	X	
	Check/Tighten All Roller Bolts & Nuts	X		X	
	Check Transfer Hose & Clamps			X	
	Open Petcock Valve on Sol. Valve Box Manifold				Winterization
	Check/Adjust Steering Chain Tightness	X		X	
	Check Steering Sprockets/Linkage (SDU)	X		X	
	Check Steering Motor Oil			X	
	Grease Wheel Support Stabilizer			X	Winterization
	Drain & Clean Filter			X	Winterization

*NOTE: After first year of operation, drain completely and refill with new VALLEY Lube. Thereafter, drain condensation moisture off and top-off as required with VALLEY Lube.

Troubleshooting

During the life of the system, minor problems may arise that can be solved by the system operator. The following trouble-shooting guide is designed to assist the operator in finding the possible cause of a problem and the solution.

Problems may arise that can be corrected only by a qualified service person. If this should happen, try to describe the problem fully when talking to the service person. This may give him enough information to repair the system with greater expediency.

DANGER! 480 VOLTS -- TURN THE MACHINE DISCONNECT SWITCH OFF BEFORE MAKING ANY MECHANICAL REPAIRS OR BEFORE CHECKING FUSES. All other electrical repairs should be made by a qualified service person.

DANGER! HIGH WATER PRESSURE. TURN OFF THE PUMP AND ALLOW THE SYSTEM TO DRAIN COMPLETELY BEFORE REPAIRING THE SYSTEM.

PROBLEM	POSSIBLE CAUSE	SOLUTION
Pivot		
1. "SYSTEM ON" light on, but end unit fails to move	Flat tire	Repair or replace tire. Be sure both tires at the tower have equal pressure.
	Gearbox	Repair or replace
	Tower stuck	Remove excess soil allowing tower to move.
	Electrical component malfunction	IMPORTANT: To avoid system damage, do not operate the system under these conditions. Contact a qualified service person to correct the problem.
2. "CENTER PIVOT" shut-down indicator light on	Safety circuit	DANGER: 480 Volts. Do not attempt to repair the system. Possible electrical shock could cause injury or death. Contact a qualified service person to correct the problem.

PROBLEM	POSSIBLE CAUSE	SOLUTION
3. "POWER SOURCE" shut-down	Incoming power fluctuation/failure	Check fuel for power unit
		Check throttle "backoff"
		Attempt restart
	Generator belt slippage (If generator powered)	Adjust belt tension
4. Volt meter reads above 505 volts or below 460 volts	Generator problem (If generator powered)	Check throttle "back-off"
		Adjust engine speed
		Check belt tension
	Incorrect incoming power	Check calibration of voltmeter
		Have power company adjust power accordingly
Drive Unit Group		
5. Abnormal motor noise	Low oil	Check level - refill as needed.
	Worn U-joint	Replace.
	Worn bearings/gears	
6. Drive unit runs constantly, will not run in reverse	Intermediate control box micro switch is defective or in need of adjustment	DANGER: 480 volts. Do not attempt to repair the system. Possible electrical shock could cause injury or death.
	Contactor stuck	
7. System will not operate at a lower percentage timer setting but will operate at a higher setting. (EXAMPLE: System will not operate at 45%, but will operate at 50% setting or higher.)	Percentage timer malfunction	IMPORTANT: To avoid system damage, do not operate the system under these conditions Contact a qualified service person to correct the problem.
8. System misalignment	Inoperative drive system	Inspect U-joints, torque pins, gearbox, etc. Repair or replace as necessary.
	Drive unit control box malfunction	DANGER: 480 Volts. Do not attempt to repair the system. Possible electrical shock could cause injury or death.
		IMPORTANT: To avoid system damage, do not operate the system under these conditions. Contact a qualified service person to correct the problem.

PROBLEM	POSSIBLE CAUSE	SOLUTION
9. System stopped while maintaining alignment	Power source interruption	Restart system. Check voltage level
	Low water pressure (Low pressure shut-down option)	Check pump, well, fuel for pump engine. Restart system.
10. System will not operate after releasing start button	System safety circuit shuts-off system	DANGER: 480 Volts. Do not attempt to repair the system. Possible electrical shock could cause injury or death.
		IMPORTANT: Do not hold start button in for more than three (3) seconds at any one time. Repeated start attempts can cause serious structural damage. Inspect entire system after each start attempt failure. Contact a qualified service person to correct the problem.
Sprinkler Group		
11. Uneven water distribution	Plugged nozzles	Remove nozzle and head if necessary and clean.
	Worn or missing nozzles	Replace with nozzle of correct size.
12. Sprinklers do not rotate	Worn sprinkler head bearing	Replace bearing
	Sand-worn driver arm	Replace driver arm
	Worn nozzles	Replace with nozzles of correct size
13. End Gun not operating	End gun clogged	Flush system according to procedure (Found in this manual)
	End gun ramps improperly set. (Not engaging micro switch plunger.)	Contact a qualified service person to correct the problem

PROBLEM	POSSIBLE CAUSE	SOLUTION
Sprinklers on Corner Arm		
14. Individual valve controlled sprinkler won't come on	Plugged nozzle	Clean out
15. One group of sprinklers won't come on	Defective Solenoid	Replace
	Plugged Solenoid	Clean out
16. No sprinklers come on (except those that operate continuously)	Sequencing chain	Repair
	Linkage inoperative	Repair or call dealer
17. Individual sprinkler won't turn off	Plugged tube	Clean out/repair
	Tubing off or defective	Replace
	Manual bleeding plug loose or missing	Tighten or replace
18. Group won't go off	Tubing	Replace
	Solenoid	Call dealer
	Fuse in valve box	Call dealer
	Slipped cams	Call dealer
19. All sprinklers remain on full time	Blown fuse in sequence box	Replace/Call dealer
	Loose wires	Call dealer
	Sequencing linkage inoperative	Repair/Call dealer
	Self-flushing filter clogged	Clean

20. SYSTEM STOPPED:
Inspect entire system from pivot to SDU, looking for conditions described in Troubleshooting procedures 1 thru 10. If no unusual conditions are noted, the problem is probably in the mechanical linkages or electrical circuitry. As stated in the introduction section of this manual, it will be most helpful to the Valley Dealer if you can provide him with some specific facts about the condition and positions of the system.

A. 1. Is the SDU more than 4'-6' our of its regular wheel track?

2. Does one of the SDU wheels appear to be "digging in" and the other not?

3. Is the steering chain, sprocket and key intact?

4. Are the steering arms bent?

5. Do both SDU tires have the same tire pressure and lugs pointing same direction?

6. Are there **any** obviously burned or damaged wires?

7. Are any of the motor heaters tripped out?

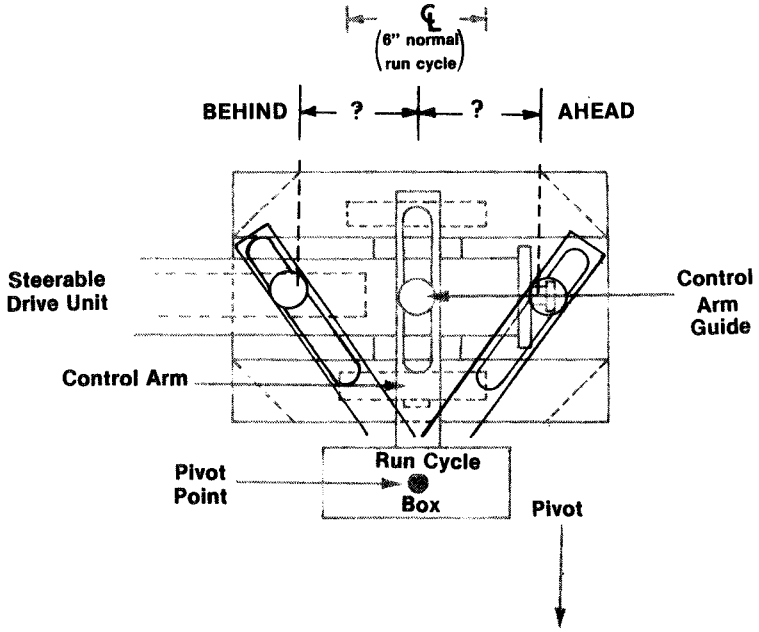
8. Are the steering contactors jammed?

9. Are all three guidance fuses good?

⚠ CAUTION: If you do elect to check inside of the STEERABLE DRIVE UNIT CONTROL BOX - Be **certain** that all power to the system has been turned OFF.

B. Cradle/Run Cycle Box Area

1. Is the center of the Run Cycle Box control arm guide more than 3" either side of the control arm pivot point? If so, how far and in which direction?



2. What direction was the system operatin when the shutdown occured? (forward = clockwise) (reverse = counter clockwise)

3. If you have attempted to restart the syster which direction did you last attempt to star the system?

4. If the checks have been made without resolv ing the problem, contact your Dealer Servic Department and relate all information that yo can.

Standards

For

Electrical Service

And

Equipment For Irrigation

ANSI/ASAE S397.2 FEB93
Approved FEB 1993 by American National Standards Institute

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Approved FEB 1993 by American National Standards Institute

Electrical Service and Equipment for Irrigation

Proposed by the Nebraska Inter-Industry Electrical Council and The Irrigation Association; reviewed by the ASAE Soil and Water Division Standards Committee; approved by the Electric Power and Processing Division Standards Committee; adopted by ASAE as a Tentative Standard December 1978; reconfirmed December 1979, December 1980, December 1981, December 1982, December 1983, December 1984; reclassified as a full Standard and revised December 1985; revised editorially July 1989; reconfirmed December 1990; revised December 1992; approved as an American National Standard February 1993.

1 Purpose and scope

1.1 The purpose of this Standard is to provide a common document for use by all those involved in electrical irrigation systems; such as electricians, power suppliers, well drillers, irrigation dealers and manufacturers, extension specialists and irrigators.

1.2 This Standard applies to three-phase, 240 V, or 480 V service, the most commonly used irrigation service voltages for irrigation pump motors, irrigation machines, and auxiliary equipment. This Standard is in accordance with ANSI/NFPA 70, and the 14th edition of Canadian Electrical Code, Part I-1990, where applicable (see C22.1-1990). All materials shall conform to Article 100 of ANSI/NFPA 70, and in Canada shall conform to Section 2-024 of Canadian Electrical Code.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Standards organizations maintain registers of currently valid standards.

ANSI/ASAE S318.10 DEC92, *Safety for Agricultural Equipment*

ANSI/ASAE S362.2 DEC92, *Wiring and Equipment for Electrically Driven or Controlled Irrigation Machines*

ANSI/ASAE S493 DEC92, *Guarding for Agricultural Equipment*

ANSI/NEMA ICS 6-1983, *Enclosures for Industrial Control and Systems*

ANSI/NEMA MG 1-1978, *Motors and Generators*

ANSI/NEMA 250-1985, *Enclosures for Electrical Equipment*

ANSI/NFPA 70-1990, *National Electrical Code*

CSA C22.1-1990, *Canadian Electrical Code*

NEMA ICS 2-449-1978, *AC Automatic Combination Irrigation Pump Controllers*

3 General equipment requirements

3.1 The minimum irrigation electrical installation consists of a circuit disconnecting means (safety switch), a motor controller (starter), a raceway or conduit for conductors, and a pump motor.

3.2 In many installations, equipment such as irrigation machines, injector pumps, compressors, lights, magnetic oilers, time switches, time-delay restart relays, and timers are used which require additional control and protective equipment.

3.3 **Clearance.** Sufficient access and working space shall be provided and maintained around all electrical equipment. A minimum of 91 cm (3 ft) is required by Article 110-16, ANSI/NFPA 70, and Section 2-308, Canadian Electrical Code, for voltages greater than 150 V. Location of enclosures, motors, and irrigation piping is important in maintaining proper access.

3.4 **Support.** Electrical installations shall be designed and constructed to provide adequate support and protection for equipment and services.

3.5 Before purchasing and installing electrical equipment, determine the type of electrical service which will be supplied. Figures 1-7 show the proper equipment to go with each specified service. Canadian Electrical Code does not permit service as shown in figures 3, 4, and 7.

4 Circuit disconnecting means

4.1 Circuit disconnecting means shall be a fused safety switch, not a circuit breaker.

4.1.1 ANSI/NFPA 70 and Canadian Electrical Code permit circuit breakers. Because of infrequent operation, breakers may be adversely affected by dust and moisture. Therefore, a fused switch is required for more positive fault protection.

4.2 Disconnecting means shall be four-wire, three-pole, solid neutral, horsepower rated and rated as service equipment.

4.2.1 Three fuses shall be used when service has all ungrounded phase conductors (see figures 1, 2, 4, and 6). Two fuses shall be used when service has a grounded phase (see figures 3, 4, and 7).

4.3 **Enclosure.** Enclosures shall meet National Electrical Manufacturers Association 3R rating for outdoor installation and NEMA 1 rating for indoor installation (see ANSI/NEMA ICS 6 and ANSI/NEMA 250).

4.4 All service disconnects shall be permanently labeled as to their function in accordance with Article 230-70, ANSI/NFPA 70, and Rule 6-200, Canadian Electrical Code.

5 Motor controllers (starters)

5.1 **Enclosure.** Enclosures shall meet NEMA 3R rating for outdoor installation and NEMA 1 rating for indoor installation (see ANSI/NEMA ICS 6 and ANSI/NEMA 250).

5.2 **Type.** Magnetic, manual, or solid state.

5.3 **Overload relays.** Ambient-compensated with three overload elements (heaters). In submersible pump applications, "fast-trip" heater elements may be required.

5.4 **Heater element selection.** Ambient-compensated overload heaters should be selected from the full-load current rating of the motor, and the controller manufacturer literature.

5.4.1 Where capacitors for power factor correction are added on the load side of a controller, the overload heater rating should be reduced according to the running current measured after capacitors are installed (see 11.2).

5.5 Internal motor protective devices may be used.

6 Pump panels

6.1 A circuit disconnecting means and motor controller may be mounted in a single enclosure which has been approved as an irrigation pump controller (see NEMA ICS 2-449).

7 Pump motors

7.1 **General specifications.** Most pump motors are three phase, 60 hz, squirrel cage induction, normal starting torque, 40 °C rise, with 1.15 service factor, or 50 °C rise with 1.0 service factor if non-submersible.

7.1.1 Loading. Motors shall be selected such that the load does not cause a maximum continuous current that exceeds the rated current multiplied by the service factor.

7.2 Deep-well turbine pump vertical-hollow-shaft motors. These motors shall be provided with bearings of adequate thrust capacity to equal or exceed the total thrust imposed by the pump and shall be equipped with a nonreverse ratchet to prevent operation in reverse rotation. These motors shall meet NEMA weather-protected type 1 specifications (see ANSI/NEMA MG 1-1.25).

7.3 Other motors. Motors shall be equipped with bearings suitable for the application and shall be selected from frame sizes, facing, and shaft dimensions recommended by ANSI/NEMA MG 1-Part 11.

7.3.1 Horizontal motors must meet NEMA specifications for drip-proof motors (see ANSI/NEMA MG 1-1.25).

7.3.2 When motors are used in the vertical position, they shall meet NEMA specifications for weather-protected type 1 motors (see ANSI/NEMA MG 1-1.25) and be suitable for such operation.

7.4 Rodent screens. Motors shall be protected from rodents by factory-installed screens (see ANSI/NEMA MG 1-14.09). All unused knock-outs on motor and control enclosures shall be closed.

7.5 Guarding. Guards shall be installed to adequately protect persons from accidental contact with belts, pulleys, or other rotating equipment in accordance with ANSI/ASAE S318 and ANSI/ASAE S493.

8 Other motors

8.1 Other motors, such as those used on injector pumps, hydraulic pumps, and compressors shall be suitable for use in the intended environment.

8.2 Guarding for other motors shall be in accordance with 7.5.

9 Equipment protection and sizing

9.1 Recommended sizing for fuses, switches, starters, conductors, and conduit are listed in table 1 for 230 V motors and in table 2 for 460 V motors. The circuit location of switches and protective devices is shown in all the figures.

9.1.1 Electrical service is nominally 240 or 480 V at the transformer power supply. This voltage provides the proper range for 230 and 460 V motors.

9.2 Auxiliary devices are recommended which protect motors from either phase failure or low voltage.

10 Grounding

10.1 A grounding means shall be installed at the meter and shall serve as a service ground. If the service disconnecting means is not adjacent to the meter, a separate service ground rod shall be installed for connecting a grounding conductor. See figures 1-7 for proper grounding connections.

10.2 A grounding conductor shall be provided to serve as the interconnection between equipment grounds, the service grounds, and the transformer ground.

10.3 The necessity for maintaining the integrity of the grounding connection in irrigation equipment dictates that grounding conductors be required when motors, auxiliary enclosures or equipment are involved (see figures 1-7). This is similar to requirements for marine applications in Article 555-7, ANSI/NFPA 70, except that grounding conductors are not required to be insulated.

10.4 Grounding-electrode conductors should be routed in the most direct manner, and without sharp bends, to the ground rod.

10.5 The equipment grounding conductor shall not be used as a current carrying conductor on the load side of the first disconnecting means.

11 Power factor correction

11.1 Capacitors for power factor correction are recommended for motors 7.5 kW (10 hp) and larger. The recommended size of the capacitor that should be installed is shown in table 3. Capacitors shall be installed on the motor side of the running-overcurrent device (see figures 8 and 9) or shall be protected by a disconnecting means and overcurrent protection in accordance with Article 460-8, ANSI/NFPA 70.

11.2 Size of overload heaters may need to be reduced when power factor correction is installed (see 5.4.1).

12 Lightning (surge) arrestors

12.1 Secondary lightning (surge) arrestors should be used. When used, the first surge arrestor shall be installed on the supply side, main service entrance disconnect. Additional arrestors may be installed on load side or line side of equipment (see figures 1-7).

12.2 When used, arrestors shall be installed on the exterior of enclosures.

13 Irrigation machines

13.1 Irrigation machines should comply with Article 675, ANSI/NFPA 70, and ANSI/ASAE S362.

13.2 A disconnecting means shall be provided for the main control panel of an irrigation machine.

13.3 Disconnecting means shall be provided at each supply point when a single irrigation machine is moved from one point to another.

13.4 Figures 10 and 11 indicate the recommended equipment, connections, protection and grounding for service to phase converters from 240 or 480 V supply.

13.5 Figure 12 indicates the recommended equipment connections, protection, and grounding for a three-phase generator serving an irrigation machine.

14 Interlocking

When personal hazard or property damage may be caused by the failure of any one device (such as a fertilizer injector or an irrigation machine) to function properly, protective interlocks shall be provided. When practical these interlocks shall interrupt all operations provided that such interruption will not create a hazardous condition.

15 Miscellaneous requirements, pumping plants

15.1 Control circuit for magnetic starters. The starter control circuit shall be wired with three-wire control. Two-wire control shall not be used unless "on-delay" relay protection is provided. Conductors of motor control circuits shall be protected against overcurrent in accordance with their ampacities as specified in Article 430-72(a), ANSI/NFPA 70.

15.2 Magnetic oilers. When used, magnetic oilers shall be wired from the motor terminals (see figures 8 and 9; also see Rule 14-100, Canadian Electrical Code). The conductors shall be protected by an approved raceway.

15.3 Pilot lights. A pilot light to indicate whether the motor is on or off may be used.

15.3.1 A two-pole, fused disconnect switch shall be installed in the circuit to permit de-energizing the circuit while the pump motor is running. This circuit shall be fused properly. The lampholder shall be of the type approved for outdoor installation. The conductors shall be enclosed in an approved raceway.

15.3.2 On 240 V installations the pilot lamp should be connected as shown in figure 8.

15.3.3 If a 240 or 120 V power source is not available, a 480/240 V to 120 V transformer shall be used with a fused primary and secondary to supply a standard 120 V lamp [see Article 450-3(b), ANSI/NFPA 70, and Rule 10-106, Canadian Electrical Code].

15.4 Lights and other 120 V equipment. When lighting or convenience outlets are required, a transformer to reduce the supply voltage from either 240 or 480 V to 120 V shall be installed. An auto-transformer shall not be

used. This transformer shall be fed from the line side of the service. It shall have a properly fused disconnecting means. Wire size shall not be smaller than No. 14 AWG. The switch rating, fuse size, conductor size on the load side of the transformer, and transformer capacity will be determined by the size of the load to be served (see figures 8 and 9).

15.5 Time switch, time delay, and other automatic control. Automatic starting is permitted provided that devices for starting are installed in a manner that conforms with the requirements for interlocking in accordance with 14.1. The setting of "on-delay" relays required in all "two-wire" control circuits may be determined by the electric utility. Proper setting will provide "on-delay" for staggered starting of groups of motors when a power interruption occurs as well as protection for the irrigation equipment. For siphon-tube irrigation in which "on-delay" restart is used, an "off-delay" timer is also recommended for ditch protection when power is off long enough to require repriming of siphon tubes.

15.5.1 For safety when automatic controls are used, a sign stating "Caution automatic starting" shall be posted near the motor.

15.6 Weather protection for motors and controls. Motors and controls may be installed outdoors or in an enclosure. All electrical equipment for outdoor installation shall be in accordance with ANSI/NEMA ICS 6 and ANSI/NEMA 250.

15.6.1 Protective structures. Structures may be closed or have open sides and function only as a shade. Structures should be removable to facilitate service and repair of motor and well.

15.6.1.1 Size. Structures shall be large enough to allow servicing of the motor and equipment from all sides. Clearances are specified in 3.3.

15.6.1.2 Base. For a closed structure the base should be the same size as the structure, constructed of concrete, and drained to the outside. For a shade only, the base does not need to be the size of the shade.

15.6.1.3 Ventilation. Cross ventilation of closed structures shall be provided by doors or louvers. All doors shall have positive catches to hold the door open.

15.6.1.4 Control mounting. Controls should be protected from the heat of the sun and from inclement weather. When possible, controls should be mounted on a north wall with at least 25 mm (1 in.) of air space between the control and the outside covering of the structure.

16 Main disconnecting means

16.1 Installation of a disconnecting means ahead of the main pump panel is recommended for safety and convenience. Many accessories such as irrigation machines and fertilizer injectors are often added to today's irrigation systems. These accessories shall be connected to the service side of the pump motor disconnect and shall be provided with a disconnecting means and overcurrent protection. These accessory disconnects can be installed and serviced simply if a main disconnecting means is provided ahead of the pump disconnect. A wiring trough may be added to accommodate additional connections required for accessory disconnects.

16.2 The pump motor disconnect is approved as a single motor disconnect and controller, not as a distribution panel or load center; therefore, equipment such as fertilizer injectors or irrigation machines shall not be supplied from the load side of the disconnect. Each disconnecting means becomes the service disconnect for the equipment it serves.

17 Two fuses in three-wire, three-phase equipment

The schematic drawings in figures 3, 4, and 7 do not show a fuse in series with the grounded phase conductor. Article 240-22 of ANSI/NFPA 70 specifies that no overcurrent device shall be connected in series with any conductor that is intentionally grounded unless the overcurrent device opens all conductors of the circuit, or unless, as specified in Article 430-36, the overcurrent device is used for motor overload protection. However, Article 430-36 (Part C of Article 30) does not apply when the fuses are sized for branch circuit protection (Part D of Article 430). In figures 1-7 the schematic drawings indicate that motor overload protection is provided by the motor controller. Part D of Article 430-56, ANSI/NFPA 70, which deals with branch circuit protection, refers to Article 240-20, which requires overcurrent protection in series with each ungrounded conductor.

18 Conductors

18.1 Irrigation equipment in general use is made primarily for connection to copper wire. Copper wire should be used between the starter and the pump motor.

18.2 Aluminum wire, when used, requires special care in terminating. Manufacturers' recommendations should be followed.

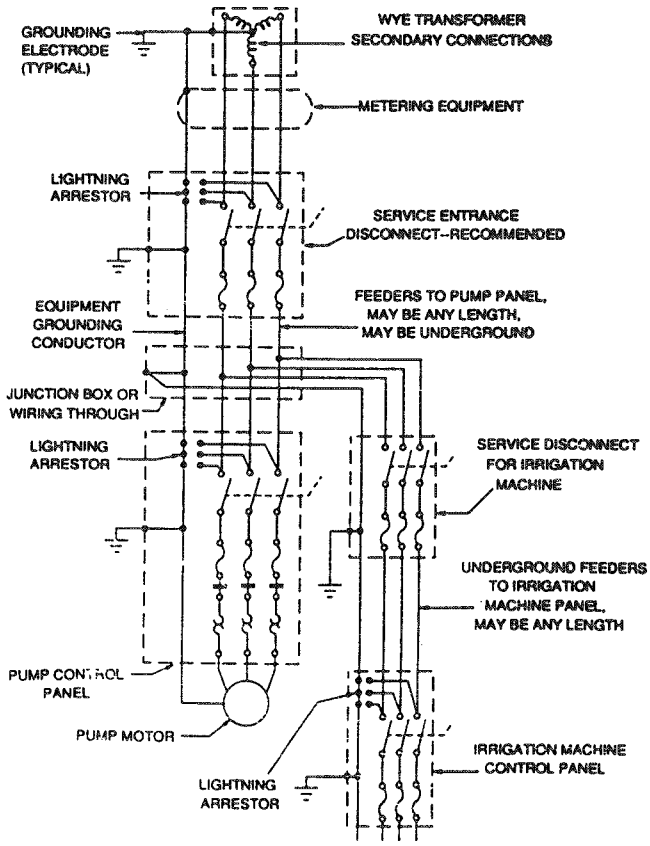
19 Three-wire service

19.1 When systems are provided with three-phase, three-wire service with a grounded phase, a bonding jumper shall be installed at the first disconnecting means as shown in figure 7. The bonding jumper shall connect the grounding conductor to the grounded (identified) conductor ahead of the disconnecting means.

19.2 When the load served is more than 15 to 30 m (50 to 100 ft) from the transformer bank, a three-phase, three-wire service with a grounded phase should not be used.

20 Workmanship

All materials and equipment shall be installed in a neat and workmanlike manner.



T **Figure 1 – Recommended equipment and grounding for wye transformer secondary connections**

Table 1 – Recommended protection and equipment sizing for three-phase 230 V motors and circuits

Size of motor			Dual-element fuse for motor overload protection (These fuses also provide branch circuit protection.)			Branch circuit protection (short-circuit protection only) (These fuses do not give motor overload protection.)					Mini-mum size of starter	Minimum size of copper wire*) AWG or MCM		Minimum size of trade conduit†)
Kilowatts	Horsepower	Ampere rating	Motor rated not over 40°C or not less than 1.15 S.F. (max. fuse 125%)	All other motors (max. fuse 115%)	Switch or fuseholder size	Class for motor starting inrush and code letter	Dual-element fuse (time delay)	Switch or fuseholder size	Non-time delay fuse	Switch or fuseholder size	NEMA size	aTHW (75°C) bTHWN (75°C) cTHHN (90°C) dXHBH (90°C)		In.
0.4	1/2	2	2 1/2	2 1/4	30	any	4	30	15	30	00	14	a,b,c,d	1/2
0.6	3/4	2.8	3 1/2	3 2/10	30	any	4	30	15	30	00	14	a,b,c,d	1/2
0.7	1	3.6	4 1/2	4	30	any	6 1/4	30	15	30	00	14	a,b,c,d	1/2
1.1	1 1/2	5.2	6 1/4	5 6/10	30	any	8	30	15	30	00	14	a,b,c,d	1/2
1.5	2	6.8	8	7	30	1 2 3-4	10 10 10	30 30 30	25 20 15	30 30 30	0	14	a,b,c,d	1/2
2.2	3	9.6	12	10	30	1 2 3 4	15 15 15 15	30 30 30 30	30 25 20 15	30 30 30 30	0	14	a,b,c,d	1/2
3.7	5	15.2	17 1/2	17 1/2	30	1 2 3 4	25 25 25 25	30 30 30 30	50 40 35 25	60 60 60 30	1	12	a,b,c,d	1/2
5.6	7 1/2	22	25	25	30	1 2 3 4	35 35 35 35	60 60 60 60	70 60 45 35	100 60 60 60	1	10	a,b,c,d	1/2
7.5	10	28	35	30	60	1 2 3 4	40 40 40 40	60 60 60 60	90 70 60 45	100 100 60 60	2	8 8	a,d b,c	3/4 1/2
11.2	15	42	50	45	60	1 2 3 4	60 60 60 60	60 60 60 60	125 110 90 70	200 200 100 100	2	6 6	a b,c,d	1 3/4
14.9	20	54	60	60	100	1 2 3 4	80 80 80 80	100 100 100 100	175 150 110 90	200 200 200 100	3	4 6	a,b c,d	1 3/4
18.7	25	68	80	70	100	1 2 3 4	100 100 100 100	100 100 100 100	225 175 150 110	400 200 200 200	3	4	a,b,c,d	1
22.4	30	80	100	90	100	1 2 3 4	125 125 125 125	200 200 200 200	250 200 175 125	400 200 200 200	3	3 3	a b,c,d	1 1/4 1

*) Equipment in general use is made primarily for connection to copper wire. Wire size shown does not compensate for voltage drop (from table 310-16 ANSI/NFPA 70).

†) Rigid metal, intermediate grade, and electrical metallic conduit are not approved for direct burial unless corrosive protection is provided. Galvanized rigid metal conduit and rigid nonmetallic conduit are recommended for direct burial.

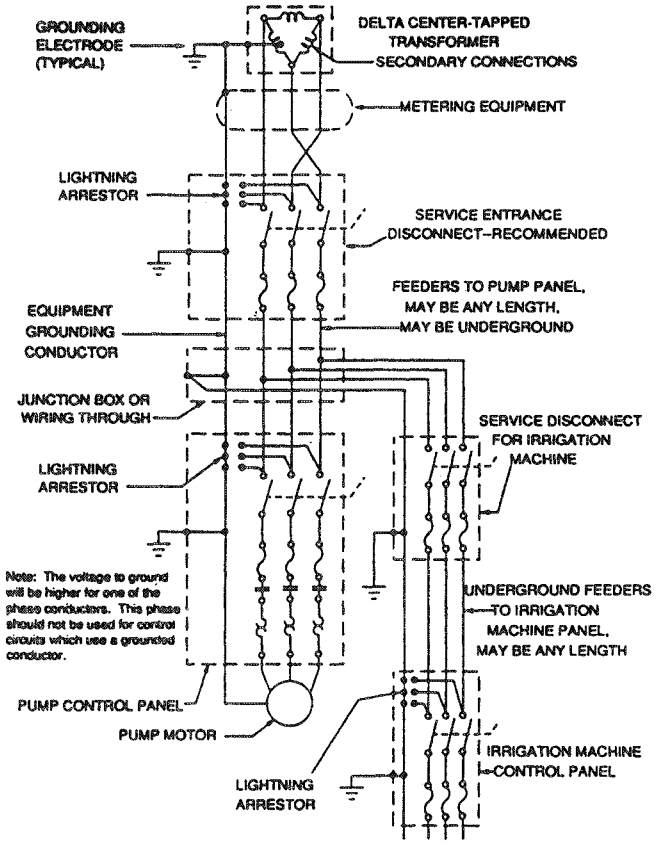


Figure 2 – Recommended equipment and grounding for delta center-tapped transformer secondary connections

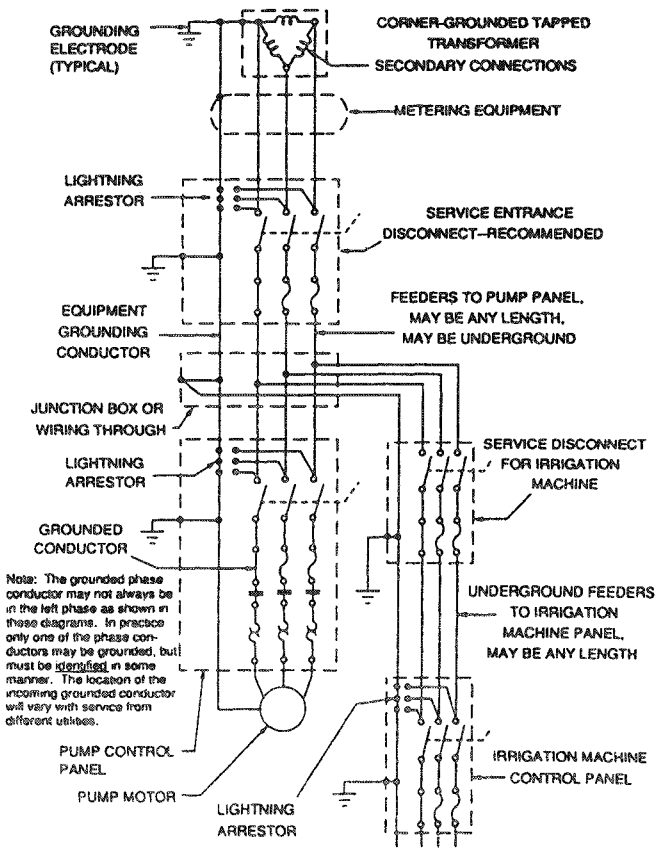


Figure 3 – Recommended equipment and grounding for a corner-grounded, delta transformer secondary connections

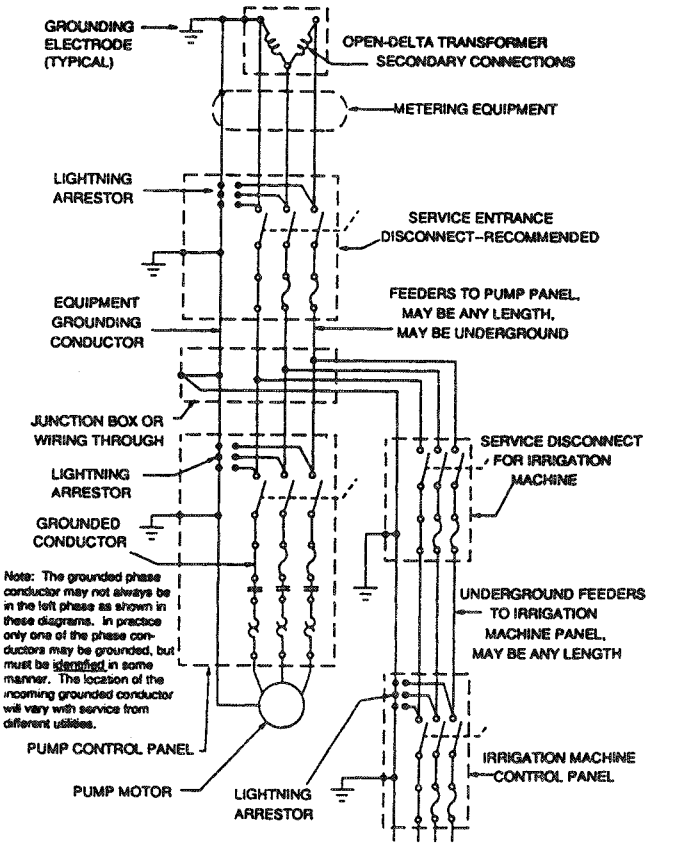


Figure 4 – Recommended equipment and grounding for a grounded phase, open-delta transformer secondary connections

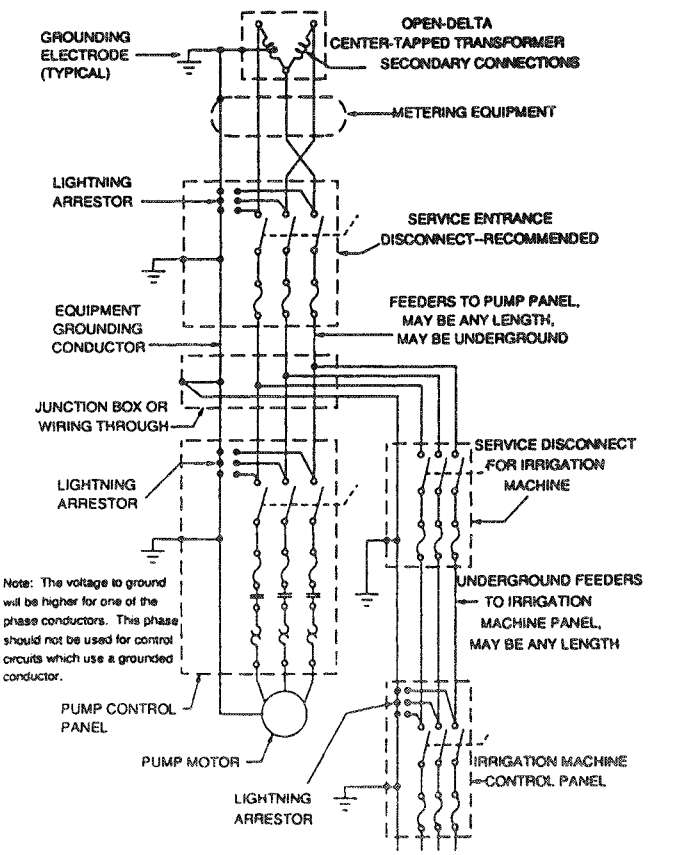


Figure 5 – Recommended equipment and grounding for open-delta, center-tapped transformer secondary connections

Table 2 – Recommended protection and equipment sizing for three-phase 460 V motors and circuits

Size of motor			Dual-element fuse for motor overload protection (These fuses also provide branch circuit protection.)			Branch circuit protection (short circuit protection only) (These fuses do not give motor overload protection.)					Minimum size of starter	Minimum size of copper wire*) AWG or MCM		Minimum size of trade conduit †)
Kilowatts	Horsepower	Ampere rating	Motor rated not over 40°C or not less than 1.15 S.F. (max. fuse 125%)	All other motors (max. fuse 115%)	Switch or fuseholder size	Class for motor starting inrush and code letter	Dual-element fuse (time delay)	Switch or fuseholder size	Non-time delay fuse	Switch or fuseholder size	NEMA size	aTHW bTHWN cTHHN dXHBH	(75°C) (75°C) (90°C) (90°C)	In.
0.4	1/2	1	1 1/4	1 1/8	30	any	2	30	15	30	00	14	a,b,c,d	1/2
0.6	3/4	1.4	1 6/10	1 6/10	30	any	2 1/2	30	15	30	00	14	a,b,c,d	1/2
0.7	1	1.8	2 1/4	2	30	any	3 2/10	30	15	30	00	14	a,b,c,d	1/2
1.1	1 1/2	2.8	3 2/10	2 8/10	30	any	4	30	15	30	00	14	a,b,c,d	1/2
1.5	2	3.4	4	3 1/2	30	any	5	30	15	30	00	14	a,b,c,d	1/2
2.2	3	4.8	5 6/10	5	30	any	8	30	15	30	0	14	a,b,c,d	1/2
3.7	5	7.6	9	8	30	1 2 3-4	15 15 15	30 30 30	25 20 15	30 30 30	0	14	a,b,c,d	1/2
5.6	7 1/2	11	12	12	30	1 2 3 4	20 20 20 20	30 30 30 30	35 30 25 20	60 30 30 30	1	14	a,b,c,d	1/2
7.5	10	14	17 1/2	15	30	1 2 3 4	20 20 20 20	30 30 30 30	45 35 30 25	60 60 30 30	1	12	a,b,c,d	1/2
11.2	15	21	25	20	30	1 2 3 4	30 30 30 30	30 30 30 30	70 60 45 35	100 60 60 60	2	10	a,b,c,d	1/2
14.9	20	27	30	30	60	1 2 3 4	40 40 40 40	60 60 60 60	90 70 60 45	100 100 60 60	2	8 8	a,d b,c	3/4 1/2
18.7	25	34	40	35	60	1 2 3 4	50 50 50 50	60 60 60 60	110 90 70 60	200 100 100 60	2	8 8	a,d b,c	3/4 1/2
22.4	30	40	50	45	60	1 2 3 4	60 60 60 60	60 60 60 60	125 100 80 60	200 100 100 60	3	6 6 8 8	a b c d	1 3/4 1/2 3/4
29.8	40	52	60	60	60	1 2 3 4	80 80 80 80	100 100 100 100	175 150 110 80	200 200 200 100	3	6 6	a b,c,d	1 3/4
37.3	50	65	80	70	100	1 2 3 4	100 100 100 100	100 100 100 100	200 175 150 100	200 200 200 100	3	4	a,b,c,d	1
44.8	60	77	90	80	100	1 2 3 4	125 125 125 125	200 200 200 200	250 200 175 125	400 200 200 200	4	3 3	a b,c,d	1 1/4 1
56.0	75	96	110	110	200	1 2 3 4	150 150 150 150	200 200 200 200	300 250 200 150	400 400 200 200	4	1 2	a,b c,d	1 1/4 1
74.6	100	124	150	125	200	1 2 3 4	200 200 200 200	200 200 200 200	400 350 250 200	400 400 400 200	4	2/0 1/0	a,b c,d	1 1/2 1 1/4
93.3	125	156	175	175	200	1 2 3 4	250 250 250 250	400 400 400 400	500 400 350 250	600 400 400 400	5	3/0 3/0	a,b c,d	2 1 1/2
114.9	150	180	225	200	400	1 2 3 4	300 300 300 300	400 400 400 400	600 450 400 300	600 600 400 400	5	4/0	a,b,c,d	2
149.2	200	240	300	250	400	1 2 3 4	400 400 400 400	400 400 400 400	600 500 400	600 600 400	5	350 300	a,b c,d	2 1/2 2

*) Equipment in general use is made primarily for connection to copper wire. Wire size shown does not compensate for voltage drop (from table 310-16 ANSI/NFPA 70).

†) Rigid metal, intermediate grade, and electrical metallic conduit are not approved for direct burial unless corrosive protection is provided. Galvanized rigid metal conduit and rigid nonmetallic conduit are recommended for direct burial.

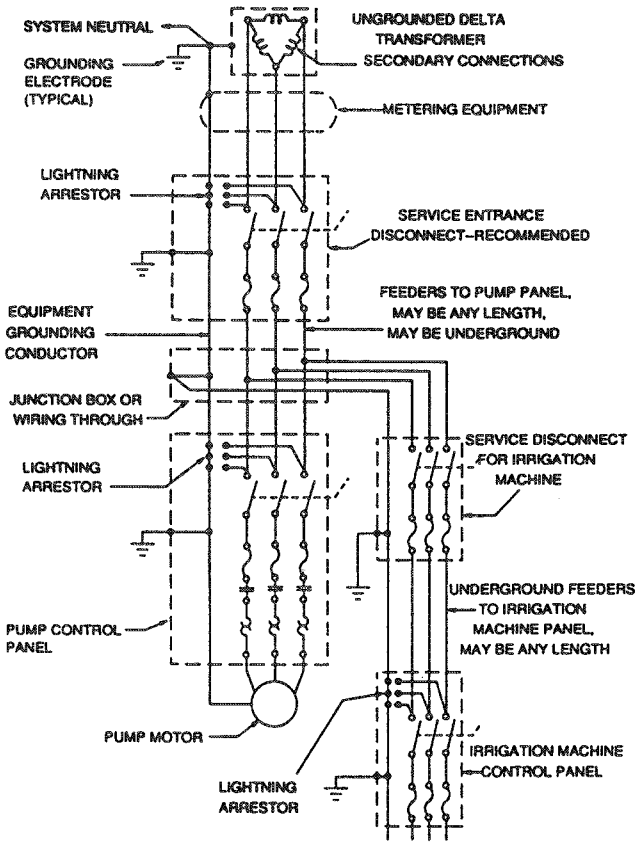


Figure 6 – Recommended equipment and grounding of three-phase, four-wire service when the transformer system is ungrounded

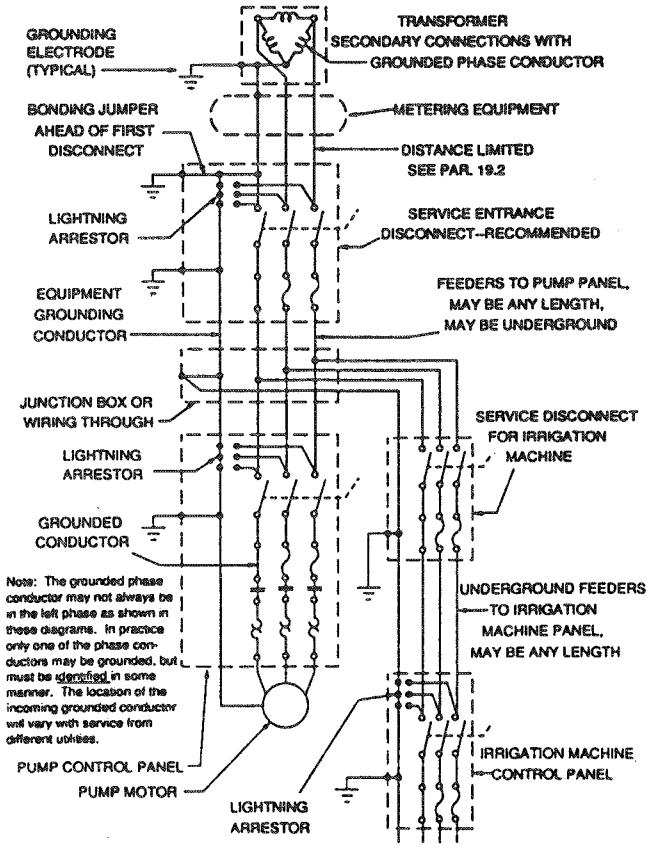


Figure 7 – Recommended equipment and grounding of three-phase, three-wire service when one of the phase conductors is grounded

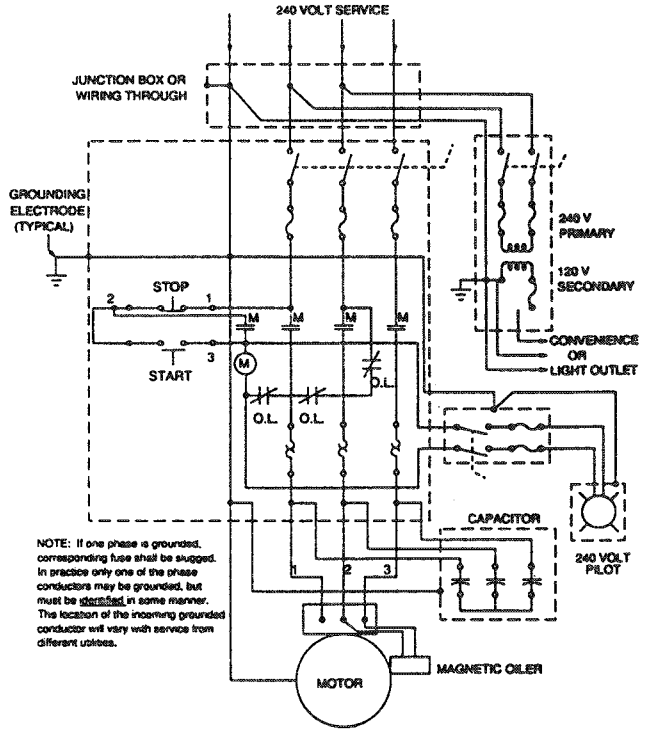


Figure 8 – Wiring diagram for capacitor installation and auxiliary equipment for 240 V service

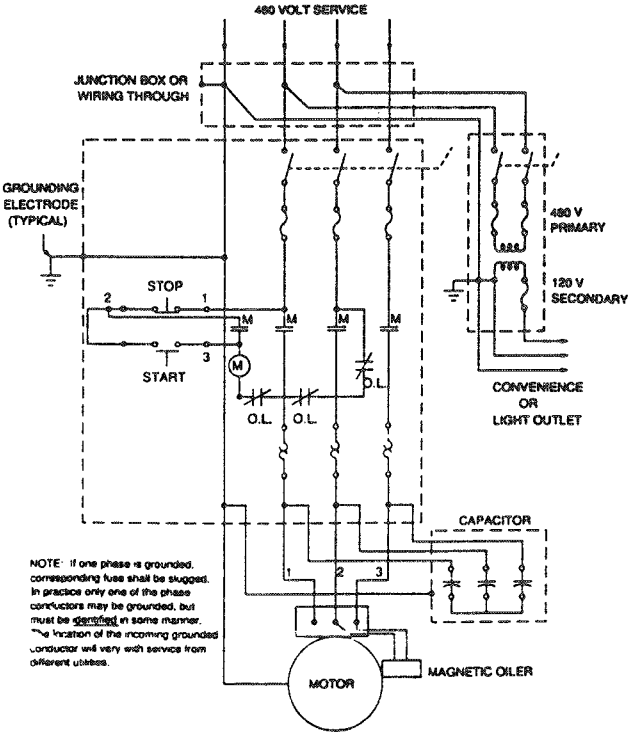


Figure 9 – Wiring diagram for capacitor installation and auxiliary equipment for 480 V service

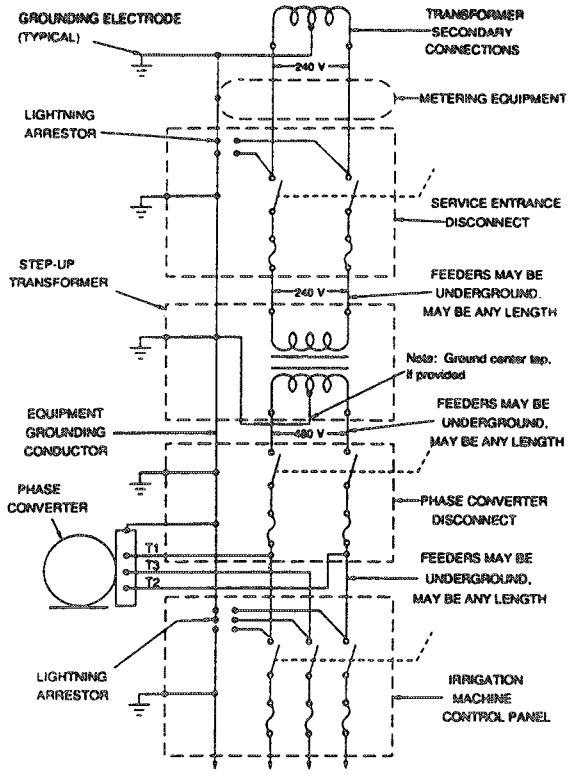


Figure 10 – Recommended equipment and grounding for service to a phase converter supplying an irrigation machine from 240 V single-phase transformer secondary connections

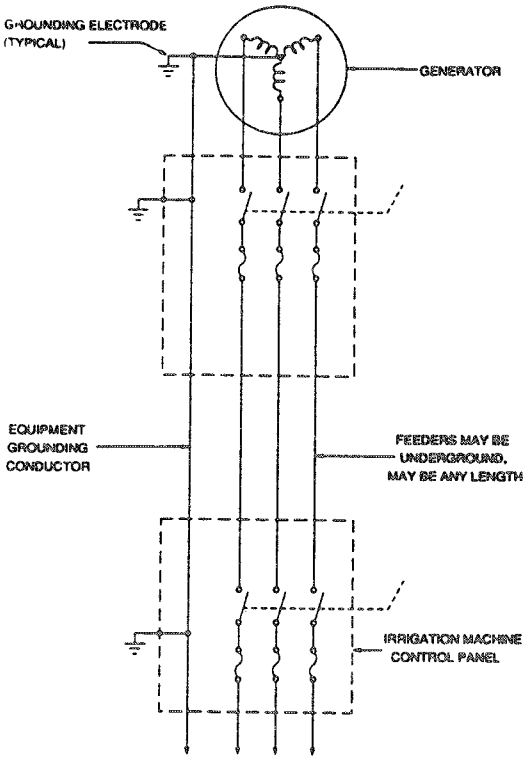


Figure 12 – Recommended equipment and grounding for a generator serving an irrigation machine

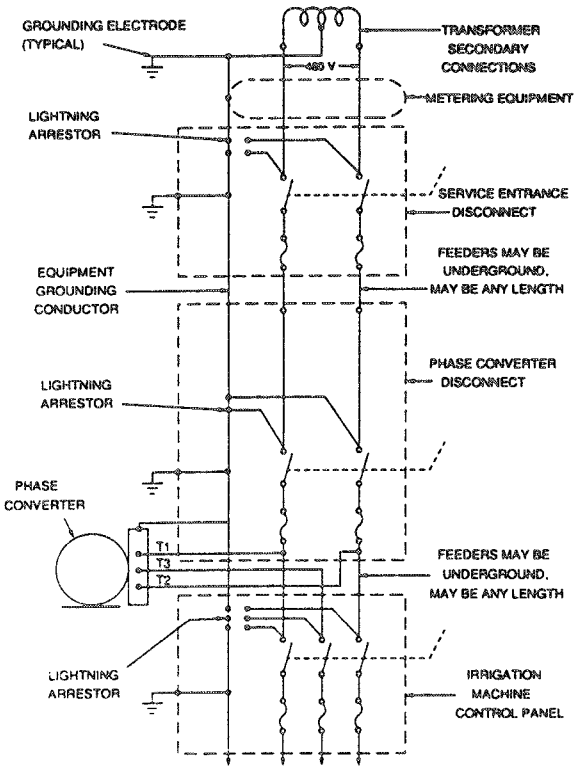
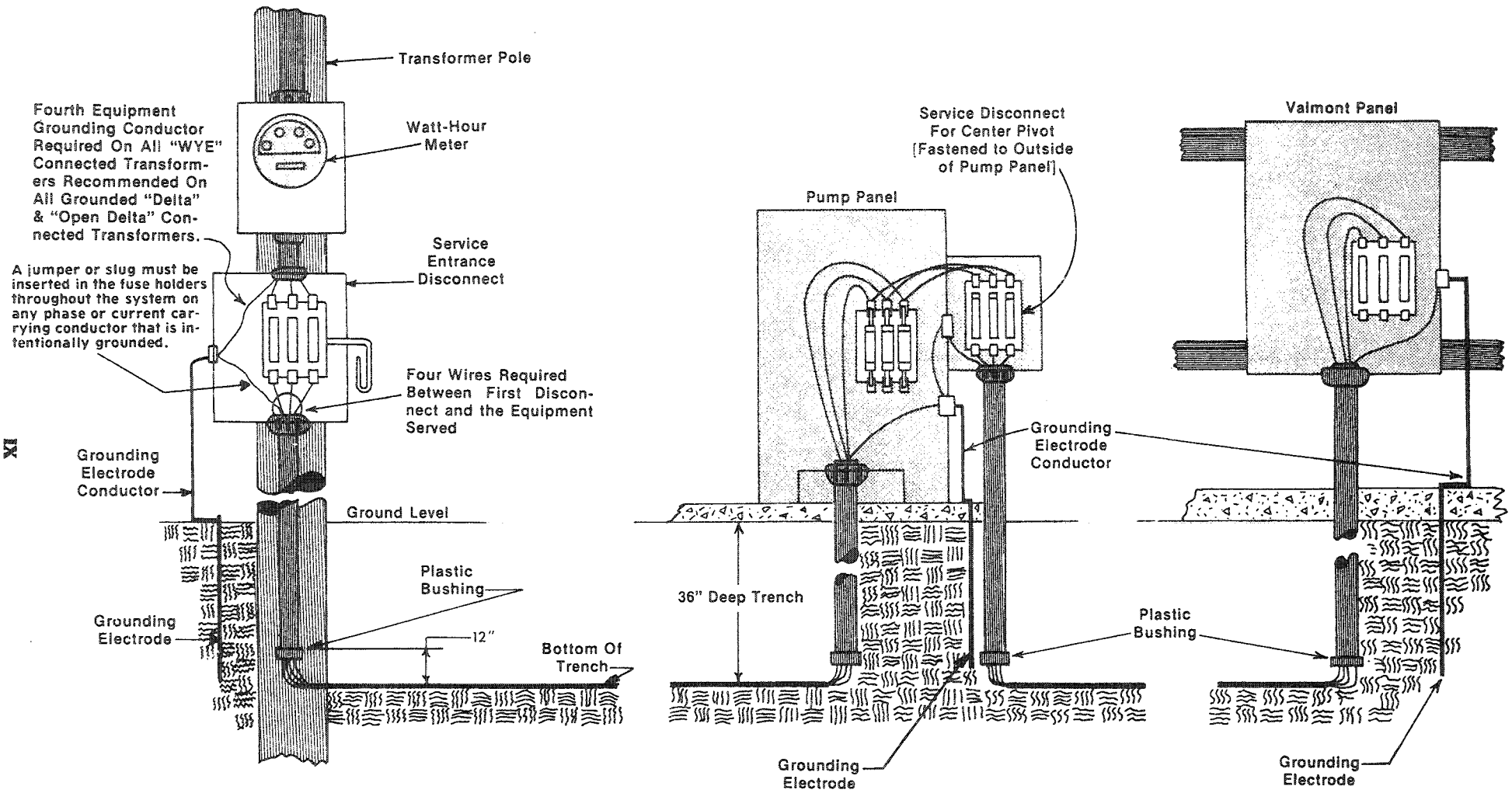


Figure 11 – Recommended equipment and grounding for service to a phase converter supplying an irrigation machine from 480 V single-phase transformer secondary connections

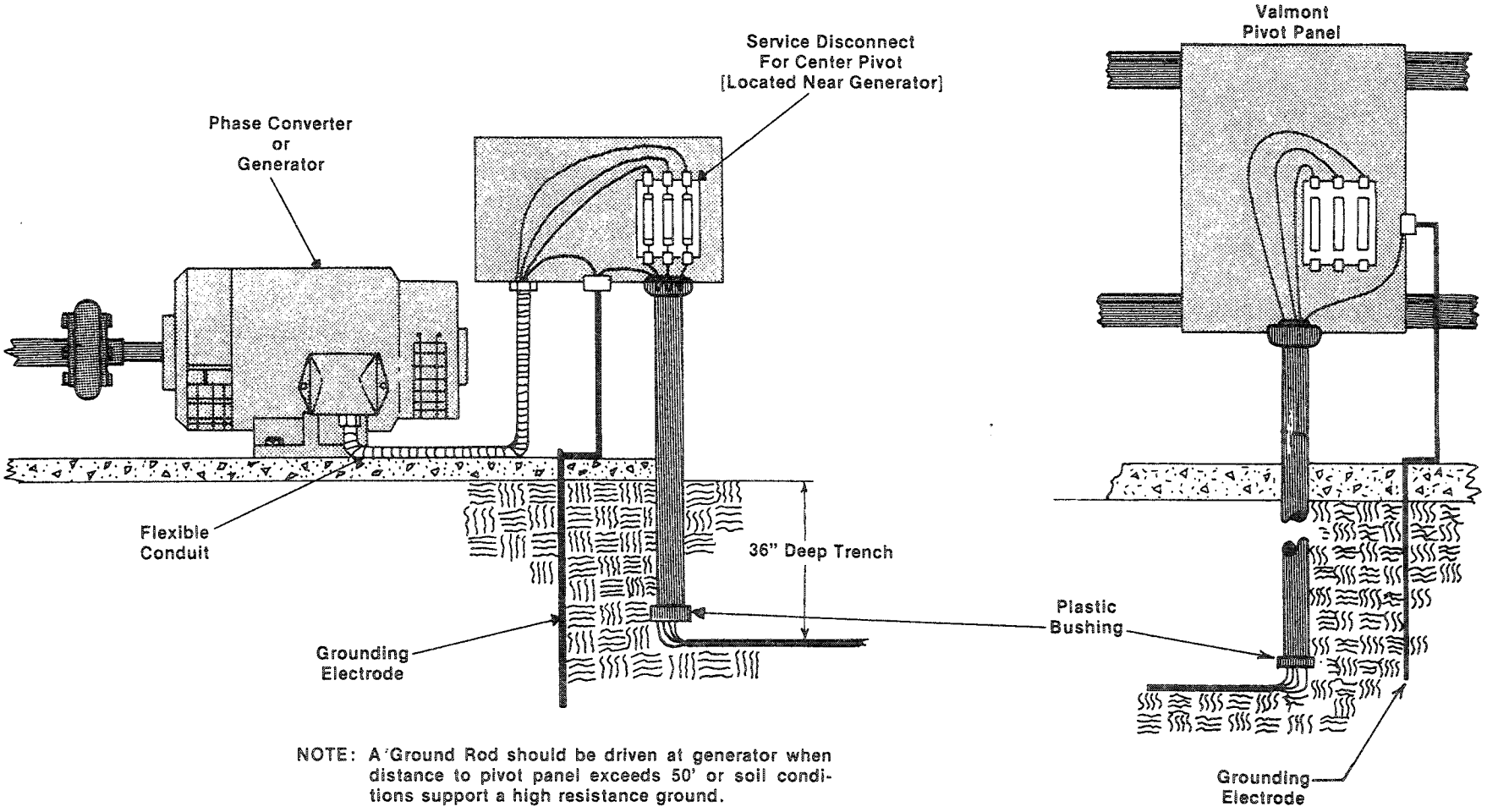
Table 3 – Recommended capacitor size (kVAr) for power factor correction for 230 and 460 V motors *)

Size of motor		T-frame motors			U-frame motors		
		Motor speed, r/min			Motor speed, r/min		
kW	hp	1800	1200	900	1800	1200	900
7.5	10	4	5	5	2	4	5
11.2	15	5	5	7.5	4	4	5
14.9	20	5	7.5	10	5	5	7.5
18.7	25	7.5	7.5	10	5	7.5	10
22.4	30	7.5	10	15	7.5	7.5	10
29.8	40	10	15	20	7.5	10	10
37.3	50	15	20	25	10	10	15
44.8	60	20	20	25	10	15	20
56.0	75	25	25	30	10	15	20
76.6	100	30	30	35	20	25	30
93.3	125	35	35	40	20	30	30
111.9	150	40	40	50	25	35	45
149.2	200	50	50	70	40	50	70
186.5	250	60	60	80	50	50	80

*) For other voltages or motor speeds consult capacitor manufacturers literature. Check size of overload heaters when capacitors are installed (see 5.4.1).



Example of Recommended Wiring Practices



NOTE: A Ground Rod should be driven at generator when distance to pivot panel exceeds 50' or soil conditions support a high resistance ground.

Example of Recommended Wiring Practices