# BALANCING SYSTEM DETAILS FOR ALL WATER BALANCED OPEN POCKET RIGID AND HYDRO-CUSHION WASHER-EXTRACTORS

- **Basic concept**
- **Balancing System Safety Features for Both Rigid and HYDRO-CUSHION Machines**
- **Monitoring the Balancing System**
- **Balancing System Adjustments and Maintenance**

## Basic Concept

The water balancing system consists of means to sense the location and magnitude of the imbalance in the cylinder and to inject water into the cylinder rib or ribs opposite the imbalance, thus re-balancing the cylinder. The basic components of the system include (1) the BALANCE SENSING SWITCH which senses when, where, and how much imbalance exists, (2) the COMMUTATOR which sends the BALANCE SENSING SWITCH signals to the correct water valves, and (3) the three BALANCING WATER VALVES each of which adds water to its cylinder rib via three individual pickup rings located on the back of the rotating cylinder.

**Why the Balancing System Works (FIGURES 1A & 1B)**—In a rigid washer-extractor, an unbalanced cylinder will rotate about a center 180$^{o}$ away from the unbalance - thus "heavy side out" as depicted in FIGURE 1A.

In a flexibly supported (HYDRO-CUSHION) washer-extractor, after the initial excursion at the onset of extraction, the unbalanced cylinder will rotate about a center near the site of the unbalance, with the "light side out" and the "heavy side in", as shown in FIGURE 1B.

The balancing system uses these phenomena to know where (and how much) counterbalancing water to add.

**Balance Sensing Switch (SMEBS)**—SMEBS is attached to a rigid and non-rotating part of the machine which does not itself move in response to an imbalance in the cylinder during extraction.

In a rigidly supported machine, the centrifugal force generated by the imbalance will actually bend the machine frame sufficiently to actuate SMEBS each time the cylinder rotates, while in a flexibly mounted machine, the outer shell of the machine will move outwardly sufficiently to operate SMEBS each time the cylinder rotates. Hence SMEBS closes momentarily with each revolution, producing a pulsing signal timed exactly to the location of the imbalance. A large imbalance will cause the pulsing signal to be almost a half revolution long starting when the imbalance passes bottom dead center, and extinguishing when the imbalance approaches top dead center. Smaller imbalances will cause shorter pulsing signals, but the center of the signal always points to the center of the imbalance. Because SMEBS pulses, it is normal for the balance valves to make a repeated clicking sound, especially at lower speeds, but the water is actually delivered to the ribs in a steady stream at all but the lowest cylinder speeds.

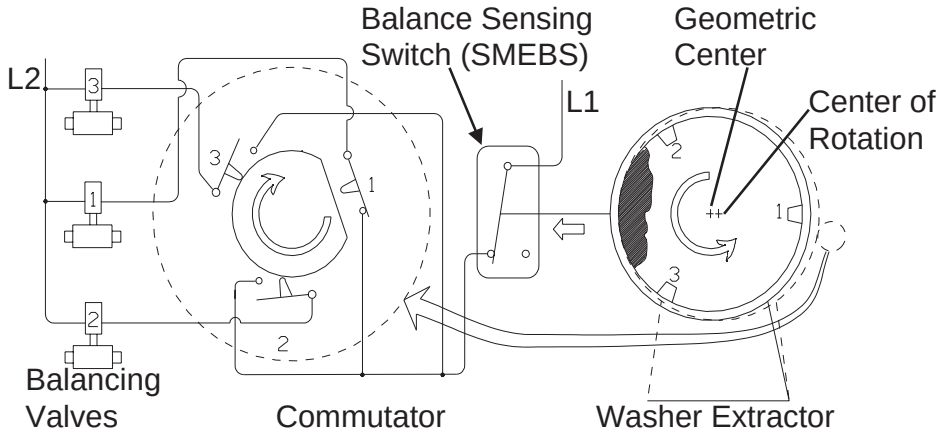



FIGURE 1A Rigid Mount Models

Both commutator and cylinder are as if viewed from REAR of machine.

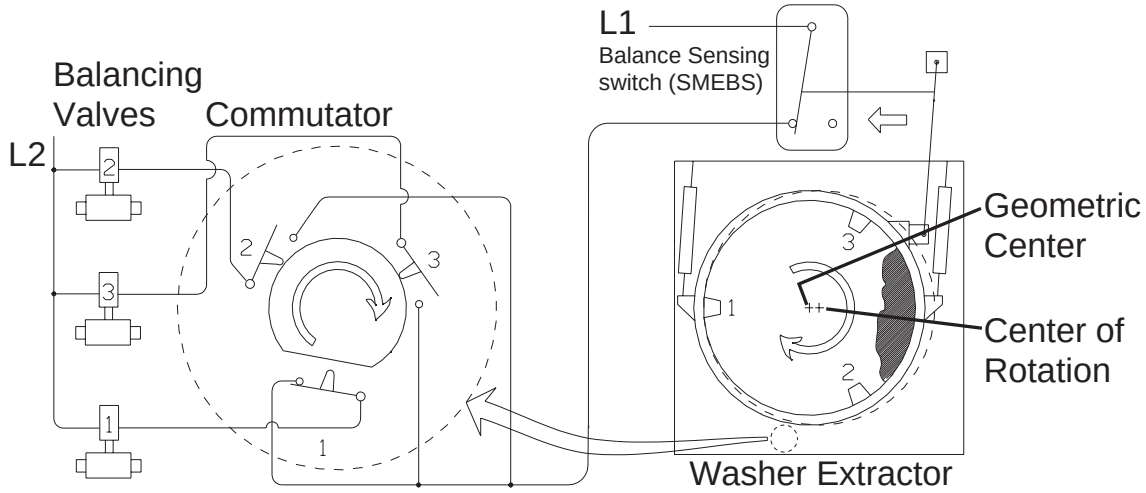



FIGURE 1B Flexibly Supported Models

Both commutator and cylinder are as if viewed from front of machine. Shown is commutator for 72044 models which faces forward. Other commutators face rearward. See "Orientation of Balancing System Components" herein.

**FIGURE 1** (MSSMA401AE)
**Concepts of Operation of Balancing System**

**NOTE: THE ABOVE DRAWINGS ARE CONCEPTUAL ONLY. SEE SPECIFIC INSTRUCTIONS FOR SPECIFIC MODELS ELSEWHERE IN THIS MANUAL SECTION.**

When the weight of the balancing water in the ribs equals the imbalance, the cylinder again rotates about its geometric center, SMEBS no longer pulses, and the balancing valve(s) thus shut off. The ribs will retain their water during the entire extraction cycle (except for perhaps a slight leakage from the ribs which will be automatically replenished).

**What the Commutator Does (FIGURE 2)**—The pulsing SMEBS signal is sent through a "commutator" (shown in FIGURE 1) which has a separate cam operated switch for each of the three balancing water valves. Each valve can add water to one of the three cylinder ribs. The cam turns at the same speed and direction as the washer cylinder and thus always sends the SMEBS signal to the correct valve(s).

FIGURES 1A and 1B depict the imbalance exactly opposite rib #1 so the nearly half- revolution SMEBS signal persists only while commutator switch #1 is closed - thus sending balancing water only to rib #1. If the imbalance falls closer to one rib, (for example, closer to rib #1 as depicted in FIGURE 2) at first both ribs #2 and #3 will receive water at the same rate. However, the added water in the rib nearest the imbalance, together with the original imbalance itself, will cause the resultant center of mass of the imbalance to shift opposite rib #2 - shutting off the water to rib #3 valve first, and permitting additional water to be added only into the farthest rib (rib #2 in FIGURE 2) until complete balance is achieved.

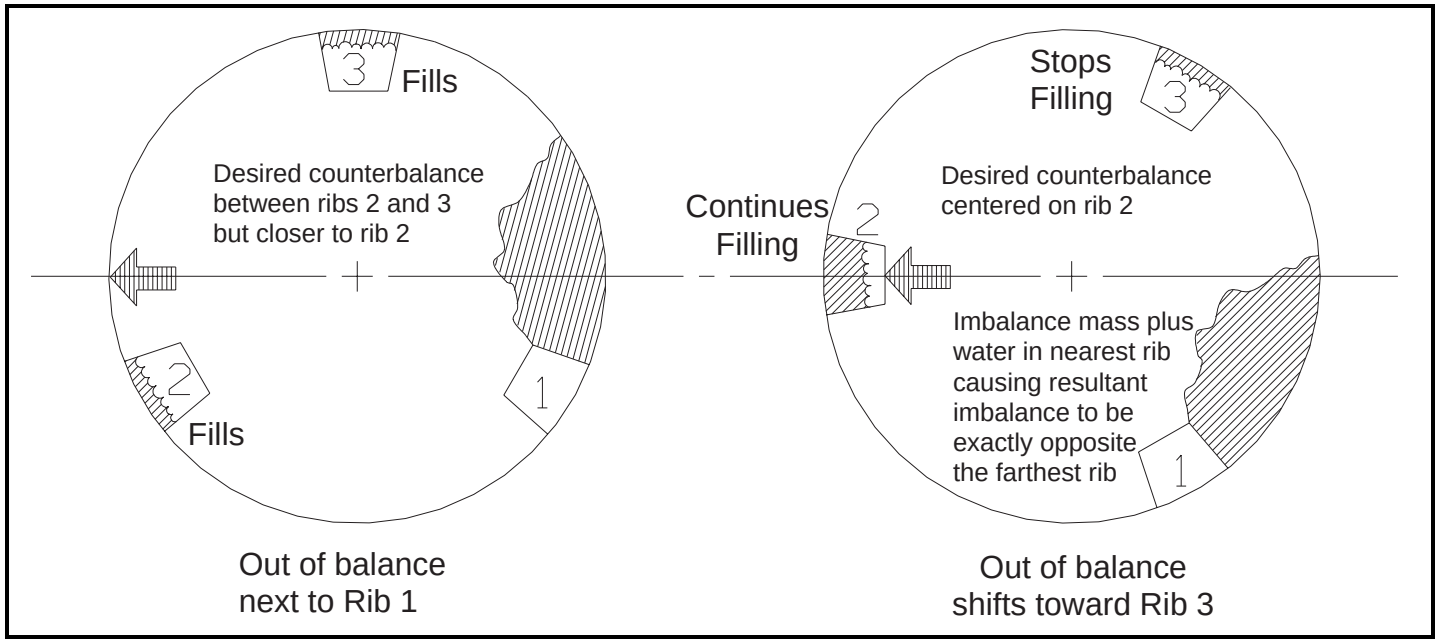



**FIGURE 2** (MSSMA401AE)
**How Water is Used to Counter an Imbalance**

**How the Water Enters the Ribs**—The water from each balancing valve enters its respective rib via an injection nozzle which is aimed into its respective pickup ring on the back of the cylinder. See FIGURE 12, "Orientation of Balance System Components" and FIGURE 13, "Aiming the Balancing Nozzles" elsewhere herein for further information.

**Aiming the Balancing Water Nozzles (FIGURE 13)**—When properly aimed and adjusted, the water nozzles correctly deliver the balancing water from each balancing water valve to its respective pickup ring which admits the water to the appropriate rib. If not aimed and adjusted correctly, the water may splash (or fall) into the wrong pickup ring and thus enter the wrong rib, rendering the system unworkable. See FIGURE 13 for how the nozzles should be aimed and adjusted in each model.

**How the Balance Sensing Device Works (FIGURES 3 & 8)**—The Balance Sensing Switch (SMEBS) is not actually actuated directly by the shell of the washer-extractor as depicted in diagrammatic FIGURES 1A and 1B. Instead, a Balance Sensing Device (FIGURES 3 & 8) is interposed between the shell and SMEBS. Its purpose is to amplify the extraction deflections or excursions caused by an imbalance. The Balance Sensing Device also actuates a second switch which is called a Coast Sensing Switch (SMERC) in rigid machines and a Coarse Balance Switch (SMERC) in flexibly supported (HYDRO-CUSHION) machines.

The Balance Sensing Device also has an adjustable bypass needle valve which permits the oil between the diaphragms to flow back and forth from the oil reservoir when the driving diaphragm is moved slowly, as under the influence of temperature-caused dimension changes, while the spring-biased driven diaphragm remains stationary against its stop. Thus the switches are not actuated by small, or slow, movements. The sensitivity of the Balance Sensing Device is affected by 1)the viscosity of the oil and 2) how much the bypass valve is open.

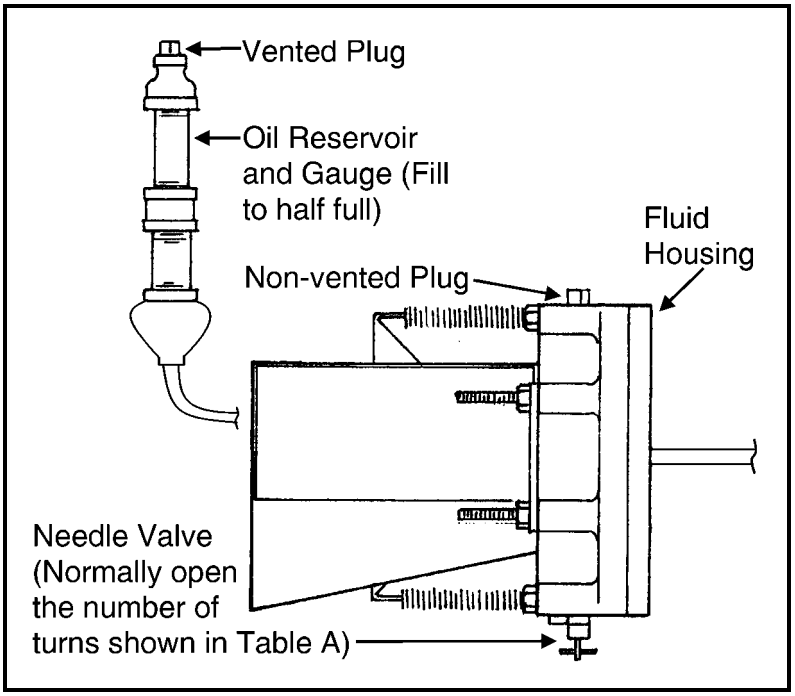



**FIGURE 3** (MSSMA401AE)
**Checking Balance Sensing Device Oil Levels**

# Balancing System Safety Features for Both Rigid and HYDRO-CUSHION Machines

Various safety features are incorporated into the balancing system to protect against damage and unsafe operation resulting from severe out of balance loads.

## For Rigid Models 30016 & 36021 Only

**Coast Safety Switch (FIGURE 8)**—If the imbalance is more than the balance system can counteract, this coarser set switch will be actuated as the cylinder accelerates. Each time it is actuated, the cylinder will coast for 7.5 seconds - thus reducing the maximum extraction speed commensurate with a safe unbalance force. (The entire extraction may thus continue at a lower speed if the balancing system never catches up with the imbalance.)

## For Microprocessor HYDRO-CUSHION Models 48032, 64042, and 72044 Only

**Recycle Circuit**—The recycle circuit automatically redistributes an excessively out of balance load. It becomes operational when extract commences and may be actuated by the Excursion Switch (SMERB, FIGURE 4) or the Coarse Balance Switch (SMERC, see FIGURE 8). Although the Excursion Switch will initiate recycle any time it is actuated during extraction, the primary purpose of this switch is to sense an excessive imbalance during the onset of extraction. The Coarse Switch initiates recycle only if an imbalance exceeds a certain permissible level a few seconds after the onset of high extract speed.

**⚠ CAUTION ⚠**

**The Excursion switch actuator, FIGURE 4, must be exactly in the center of the slotted hole - both when the machine is pushed down and when it is hanging free. If not, the switch will actuate prematurely, during the initial excursion, at the onset of extraction, causing unnecessary recycles. See "HOW THE EXCURSION SWITCH WORKS" elsewhere.**

When recycle is initiated, the cylinder comes to a full stop, it then rotates 16 seconds CCW in wash speed, 7.5 seconds in CW wash speed, 7.5 seconds in drain speed, and then re-enters extract. During recycle, program timing stops, and starts again 7.5 seconds after high extract has again been allowed. Microprocessor controlled models will recycle 5 times, then repeat the final bath (without chemicals) and re-enter extraction.

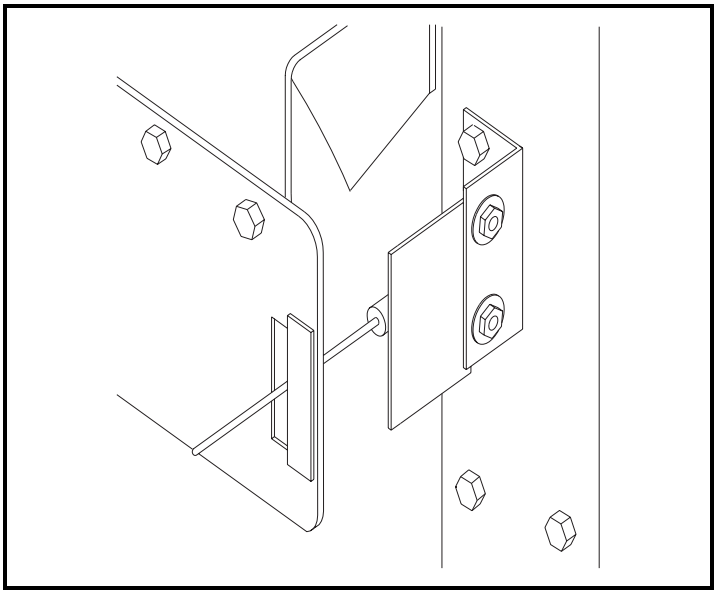


**FIGURE 4** (MSSMA401AE)
**Excursion Switch**

## For MARK 4 MILTROL HYDRO-CUSHION Model 72044 Only

**Recycle Circuit**—The recycle circuit automatically redistributes an excessively out of balance load. It becomes operational when extract commences and may be actuated by the Excursion Switch (SMERB). Although the Excursion Switch will initiate recycle any time it is actuated during extraction, the primary purpose of this switch is to sense an excessive imbalance during the onset of ex-

traction. When recycle is initiated, the cylinder comes to a full stop, it then rotates 16 seconds CCW in wash speed, 7.5 seconds in CW wash speed, 7.5 seconds in drain speed, and then re-enters extract. During recycle, program timing stops, and starts again 7.5 seconds after high extract has again been allowed.

In these MILTROL controlled models, the machine will stop (3-wire relay is disabled) should the Coarse Balance Switch be actuated after E2 (high extract speed) has commenced.

## For Both Rigid and HYDRO-CUSHION Models

**Vibration Circuit**—The Vibration Safety Switch (FIGURE 5) reacts to excessive vibration which is not contained by the balancing system, actuating a switch which de-energizes the 3 wire relay, shutting off power to the machine. When this occurs, the cause of the vibration should be determined and corrected. The start switch must be depressed to resume operation. See "VIBRATION SAFETY SWITCH ADJUSTMENTS" elsewhere.

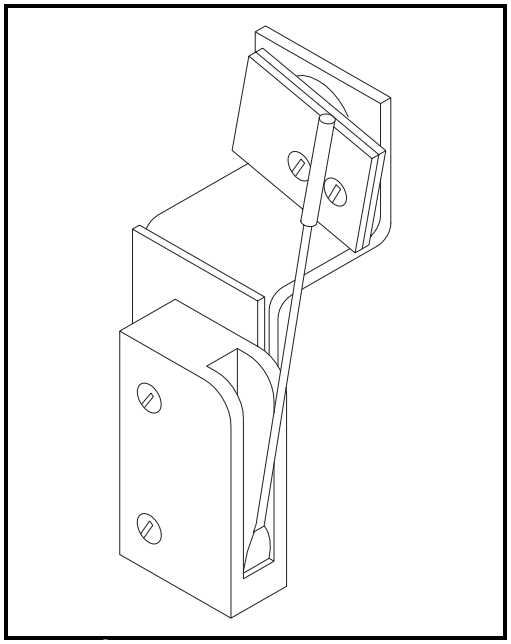


**FIGURE 5** (MSSMA401AE)
**Vibration Safety Switch**

# Monitoring the Balancing System

A panel of status lights is provided to monitor the functioning of the balancing system. This light panel is located on the front of HYDRO-CUSHION models and on a junction box on the rear or side of rigid mount models.

**Balance Sensing Switch Light**—Remains ON so long as the Balance Sensing Switch is **not** actuated and should never stay OFF while the machine is extracting. This light will normally flicker during extraction, both before and after balancing is achieved.

A continuous flashing during an occasional extraction indicates that the imbalance exceeds the machine's counter-balancing capacity.

A continuous flashing over repeated extractions may indicate 1) inadequate water supply or 2) need to service the balancing system.

**Balancing Valve Lights**—These three lights go ON and OFF with their respective balancing valves. Lights should be OFF once balancing is completed, except for intermittent valve operation as the balancing system compensates for changing imbalance (caused by varying load thicknesses, different absorption rates, etc.). A continuous flashing over repeated extractions may indicate 1) inadequate water supply or 2) need to service the balancing system. If water is required in two of the three ribs, two of these lights may flash sequentially, but never in unison (i.e., the lights must always turn on or off one after the other, and must never turn on or off simultaneously). Moreover, all three lights must never flash either sequentially or in unison, except for a brief moment at the onset of low speed extraction, and again at the onset of high speed extraction. At all other times, only one or two of the three lights should flash until balance is achieved, never all three.

**Balance Excursion Light (Microprocessor, Rigid Mount Models Only) and Extract Motor Light (MILTROL, Rigid Mount Models Only)**—This light goes ON and OFF with the extract motor and is used to monitor the Coast circuit. Up to six coasts are normal at the beginning of an extract, but ordinarily, the machine should not coast after it has been extracting for two minutes unless the imbalance exceeds the machine's counter-balancing capacity. In this event, the machine will coast throughout the entire extraction. Frequent or repetitive coasting throughout most extractions may indicate inadequate water supply or need to service the balancing system.

**Balance Excursion Light (Microprocessor, HYDRO-CUSHION Models Only)**— This light is located on the balance sensing device (and thus not visible on the machine exterior). It illuminates when extract is desired and extinguishes whenever the Coarse Balance Switch actuates. Actuation of the Coarse Balance Switch will cause a recycle if it occurs within 8 seconds after high extract is called for or between 16 seconds and 2 minutes after high extract is called for.

**High Speed Extract Light (MILTROL, HYDRO-CUSHION Models Only)**—Illuminates at the end of low speed extract, indicating that high extract is desired. The light will flash if an imbalance exceeds the machine counter-balancing capacity and extinguish while recycle is in progress. If the light remains steady ON indicating that high extract is allowed, the machine will begin to accelerate to high extract speed approximately 8.5 seconds after the light illuminates steadily.

# Balancing System Adjustments and Maintenance

All components of the balancing system are properly set and tested at the factory and should not need readjustment when the equipment is installed. If however, as a result of improper handling in shipment or installation and when as a normal consequence of use it becomes necessary to readjust this system, the following procedures should be observed. Before proceeding, review the published safety precautions for this machine. **The following procedures apply to all machine models except where noted otherwise.**

**⚠ WARNING ⚠**

**ELECTRIC SHOCK HAZARD—Except where noted otherwise, the following adjustments should be done with power locked OFF and tagged out at the machine disconnect switch (on the wall).**

**Balance Sensing Device Oil Level (FIGURE 3)**—The oil level in this device should be visually checked daily and replenished if it drops below the recommended level. The Balance Mechanism will not function if the oil level drops where air enters the fluid housing. If this is suspected, proceed as follows:

1. To check for air in the fluid housing, remove the plug on top of the housing. Oil should immediately begin flowing out of the hole if there is no trapped air in the unit. If oil does not flow out, make sure the bypass valve is open, and then add oil through the oil reservoir until it does flow out. Quickly replace the plug once oil begins to flow out.
2. The reservoir should be filled approximately half full. Use a good grade of 15W-40 motor oil. Note that 1) oil must always be added to the reservoir, never directly through the plug on top of the mechanism housing, 2) the reservoir must not be filled completely, to allow space for oil flowing out of the fluid housing during slow movement of the driving diaphragm, 3) the oil reservoir plug must be a vented plug and the plug on the mechanism housing must be non-vented, and 4) there must be no entrapped air in between the two diaphragms.
3. Check the needle valve setting per Table A below. The more it is open, the less sensitive the unit will be. It is possible to open the needle valve so wide as to render the unit completely insensitive to vibration. The plunger attached to the driven (small) diaphragm should not move while the machine is operating at wash or drain speed, but a rise and fall of the oil in the gauge during washing and draining may be observed.

## TABLE A
## Bypass Needle Valve Settings by Model Number

| **30016** | 36021 | **48032** | **64042** | **72044** |
|---|---|---|---|---|
| 1-1/2 | 1-1/2 | 1-1/2 | 1-1/2 | 4 |

**Data shown is number of turns open**

## ⚠ WARNING ⚠

**ELECTRIC SHOCK HAZARD—When the machine power is on, the exposed terminals on the switches in the Balance Sensing Device may be energized up to 250 VAC. You can be killed or severely injured by contact with these energized conductors.**

- ☞ **Make certain power is locked OFF and tagged out at the external disconnect switch (on the wall) before servicing the Balancing Sensing Device.**
- ☞ **Do not touch the switch terminals or the wires going to them when servicing the Balance Sensing Device.**
- ☞ **When adjusting the Balancing Sensing Device on a HYDRO-CUSHION Machine, it is important to have machine power off because the cylinder must be hanging free, not pushed down.**

**Outer (Driving) Diaphragm Adjustment (FIGURE 6)**—This diaphragm must be centered as shown in FIGURE 6A. Note that the total length of travel of the input shaft is approximately 1/32" (0.8mm) in rigid models and about 1/8" (3.2mm) in HYDRO-CUSHION models. If adjustment is necessary, loosen the nuts on each side of the arm to which the shaft is attached and extend or retract the shaft as required to reposition it at the center of travel. There must never be a ripple or wavy condition in the driving diaphragm as this will seriously lessen the sensitivity of the unit.

**On HYDRO-CUSHION models, the conditions shown in FIGURE 6B and 6C are prevented by properly aligning the Balance Sensing Device actuator bar and properly setting the bar springs. See instructions and Caution on next page.**

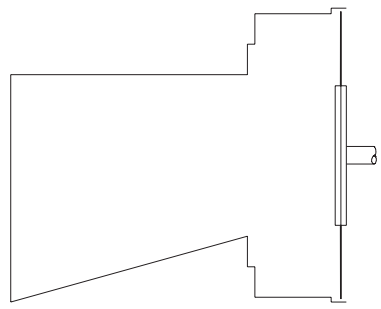


FIGURE 6A - CORRECT

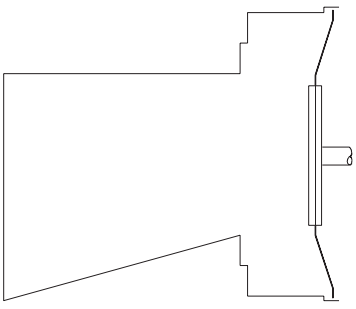


FIGURE 6B - INCORRECT

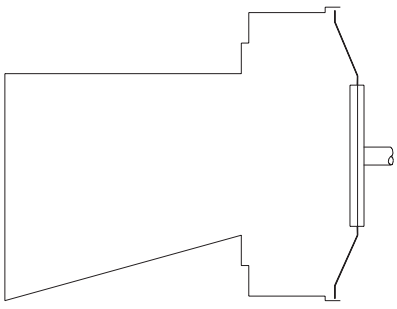


FIGURE 6C - INCORRECT

**FIGURE 6** (MSSMA401AE)
**Driving Diaphragm Alignment**

## (FOR HYDRO-CUSHION Models Only) Aligning the Balance Sensing Device Actuator Bars and Setting the Horizontal Bar Springs (FIGURE 7)

**1.** Align vertical bar perpendicular to Sensing Device.

**2.** Align vertical bar lower ball joint, apply Loctite and tighten.

**3.** Set horizontal bar springs as per Table B below.

**⚠ CAUTION ⚠**

**With the machine hanging free, the compressed height of both springs must be equal and the diaphragm must be centered as depicted in FIGURE 6A, not pulled to one side as in FIGURE 6B or 6C.**

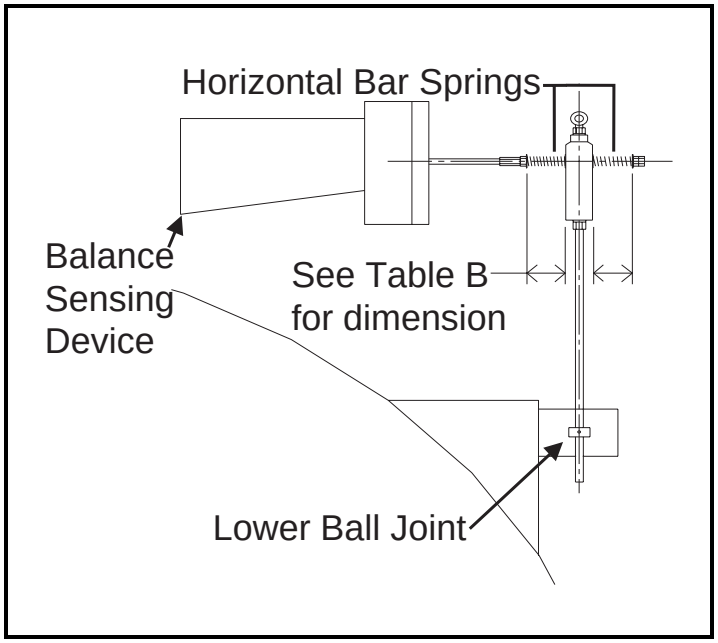



**FIGURE 7** (MSSMA401AE)
**Adjusting the Actuator Bar Assembly**

### TABLE B
### Horizontal Bar Springs Setting

| 30016 | 36021 | 48032 | 64042 | 72044 |
|---|---|---|---|---|
| N/A | N/A | 15/16" (24mm) | 2" (51mm) | 3-7/8" (98mm) |

**Inner (Drive) Diaphragm Replacement**—Although the driven diaphragm is available as a repair part, its installation is not very simple because there must never be a ripple or wavy condition in the driving diaphragm as this will seriously lessen the sensitivity of the unit. The mating dished surfaces of the plunger and the washer serve to stretch the diaphragm for this purpose. Should a new driven diaphragm be field-installed, be sure that this condition does not occur. (Since the driven diaphragm rarely fails as long as the balancing system is retained in proper working order, it is usually better to install a new assembly should the need ever arise.)

**Adjusting the Switches on the Balance Sensing Device (FIGURE 8)**—This device must be adjusted so that the Balance Sensing Switch (SMEBS) and the Coast Sensing Switch or Coarse Balance Switch (SMERC) will actuate when the driven diaphragm plunger has travelled a certain distance. These adjustments are as follows.

## Setting the Balance Sensing Switch (SMEBS)

**1.** Connect an ohm meter across the common and the normally open terminals on the Balance Sensing Switch SMEBS. See FIGURE 9 to identify the common and the normally open terminals on this switch. The ohm meter should read a finite resistance (a resistance significantly greater than zero) - or turn the balance sensing screw CCW until a finite resistance is read. Now actuate the SMEBS by hand and observe that the resistance goes to substantially zero, (thus indicating that the normally open contacts have closed and only the resistance of the closed contacts themselves is being read by the meter).

**NOTE:** If the plunger on SMEBS is free (not depressed) and a finite resistance cannot be read, the switch is shorted closed and must be replaced.

**2.** Next, slowly turn the balance sensing screw CW until the ohm meter resistance reads zero. (This will happen when the common and normally open contacts on SMEBS close.)

**3.** Now slowly turn the balance sensing screw CCW until the ohm meter again reads a finite resistance. (This point is where the normally open contact on SMEBS has just opened.)

**4.** Now turn the balance sensing screw CCW the additional number of turns mentioned in TABLE C below.

### TABLE C
### Adjusting the Balance Sensing Switch
### (number of additional CCW turns of Balance Sensing Screw after the normally open contact on SMEBS has just opened)

| 30016 | 36021 | 48032 | 64042 | 72044 |
|---|---|---|---|---|
| 1/4 | 1/4 | 1-3/4 | 1-1/2 | 4-3/4 |

**5.** While holding the balance sensing screw in position, tighten the lock nut, verify that this does not cause the screw to turn otherwise the adjustment will be lost.

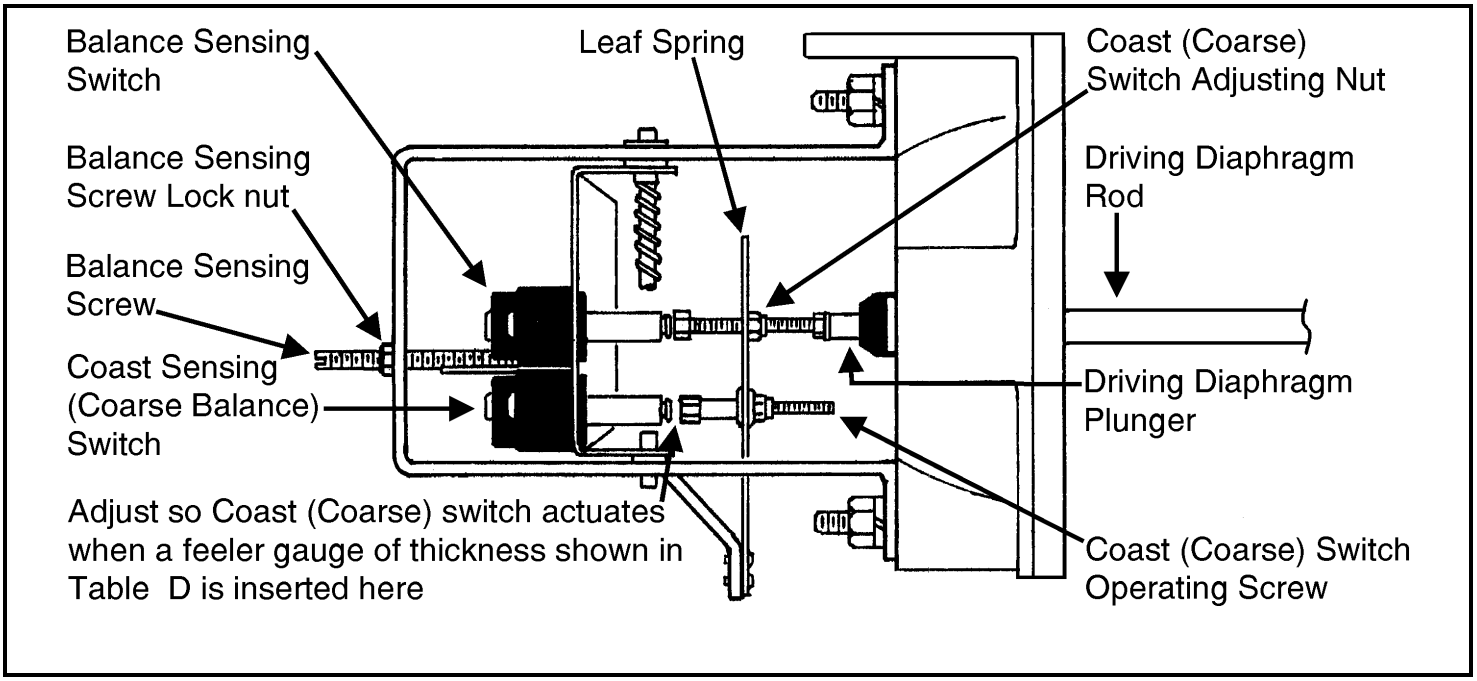



**FIGURE 8** (MSSMA401AE)
**Adjusting the Balance Sensing Device**

## Setting The Coast Sensing Switch (SMERC if a Rigid Machine) or the Coarse Balance Switch (SMERC if a HYDRO-CUSHION Machine)

—Connect an ohm meter across the normally open terminals on the Coast Sensing Switch or the Coarse Balance Switch. The ohm meter should read a finite resistance (a resistance significantly greater than zero). Now adjust the Coast (Coarse) Switch by turning the adjusting nut which is located on the driven diaphragm plunger as shown in FIGURE 8 - so that when a feeler gauge of the thickness mentioned in Table D below is inserted where shown on FIGURE 8, the ohm meter resistance becomes substantially zero, thus indicating that the normally open contacts have closed and only the resistance of the closed contacts themselves is being read by the meter.

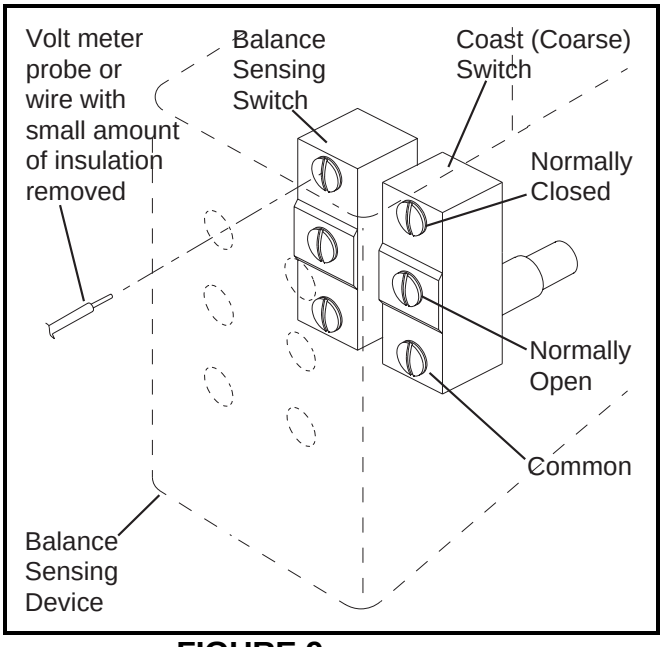



**FIGURE 9** (MSSMA401AE)
**Accessing Terminals on Micro Switches**

**TABLE D**
**Feeler Gauge Thickness Required when Setting Coast (Coarse) Switch**

| 30016 | 36021 | 48032 | 64042 | 72044 |
|---|---|---|---|---|
| .010" (0.254mm) | .010" (0.254mm) | .015" (0.381mm) | .015" (0.381mm) | .027" (0.686mm) |

## Adjusting the Commutator

**NOTE:** The following adjustment procedure is equally applicable to both rigidly mounted and flexibly supported (HYDRO-CUSHION) models.

**⚠ WARNING ⚠**

**ELECTRIC SHOCK HAZARD—Except where noted otherwise, the following adjustments should be made only with power locked OFF and tagged out at the external disconnect switch (on the wall).**

## Setting the Gap in the Commutator Switch Breaker Points (FIGURE 10)

Each breaker point gap must be .015" (0.38mm) when the plastic cam follower on the switch is riding on the high portion of the cam. Precise breaker point gaps are necessary both to insure the proper current interruption when the switch is open, and also to adjust the switch so that it remains closed the exact portion of one complete cylinder revolution that is necessary for proper operation of the balancing device. Both adjustments are simultaneously achieved when the breaker points are set at .015" (0.38mm) open, as described below.

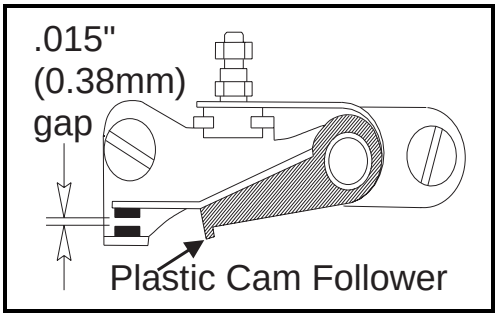



**FIGURE 10** (MSSMA401AE)
**Breaker Point Switch Setting**

**⚠ WARNING ⚠**

**ELECTRIC SHOCK HAZARD—Since it is necessary to use power to rotate the cylinder, station a safety lookout behind the machine to guard against someone accidentally touching the high voltage in commutator while power is ON.**
**Be sure electric power to the machine is OFF at the wall disconnect before removing or replacing the commutator cover, and before touching anything inside the commutator.**

1. Rotate cylinder until cam follower is riding on large diameter of cam.
2. Loosen the breaker point mounting screws and insert a .015" (0.38mm) feeler gauge between the contacts (FIGURE 10).
3. Tighten the mounting screws, checking to insure that the gap clearance does not change while the screws are being tightened. (Readjust if necessary. Breaker point clearance must be .015" (0.38mm).
4. Repeat this procedure for each of the three breaker point switches.

**Timing the Commutator (FIGURES 11A & 11B)**—The Commutator must be timed so that the flat on the cam is in the proper relationship to the ribs in the cylinder. For example, (FIGURE 11A) **when the #1 rib is in the 9 o'clock position as viewed from the front (through the door), the flat on the cam must be exactly centered under the cam follower for the #1 switch** as shown in FIGURE 11B.

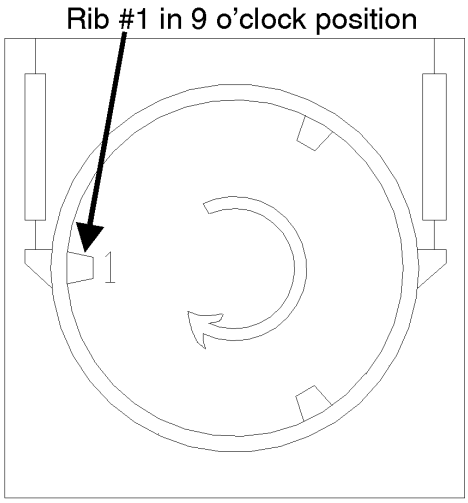



FIGURE 11A
Looking at FRONT of machine

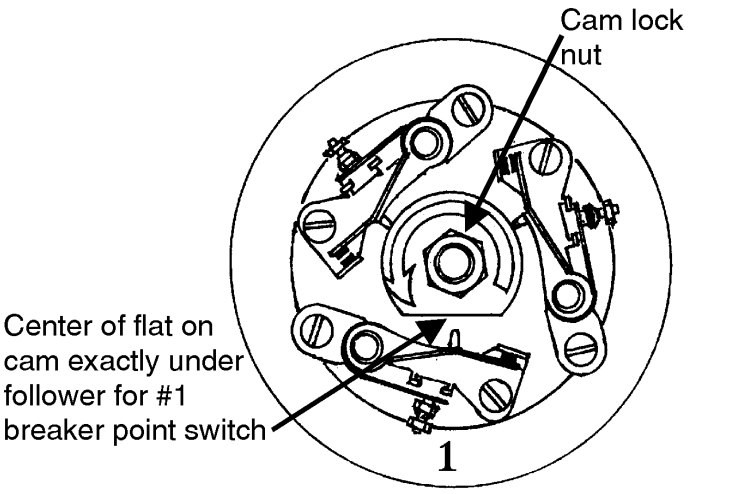



FIGURE 11B
Commutator (72044 orientation shown)
Looking at FRONT of machine

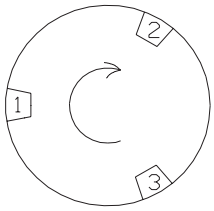
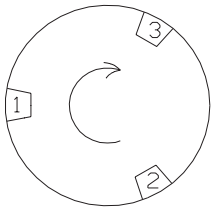
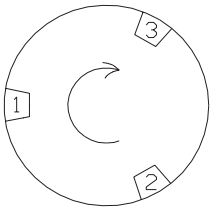
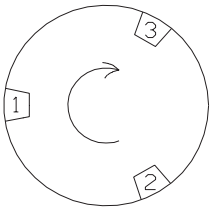
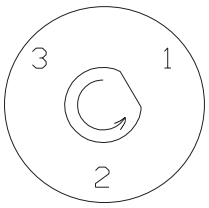
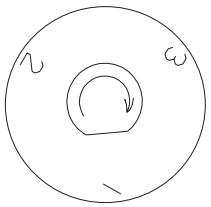
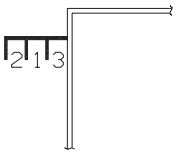
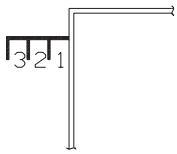
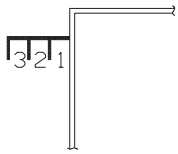
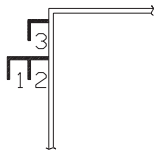
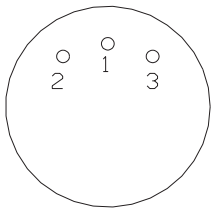
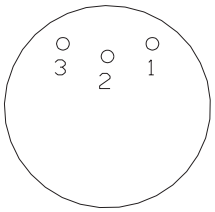
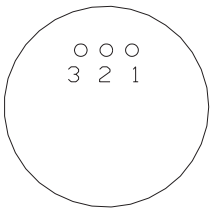
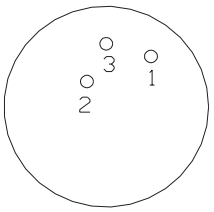
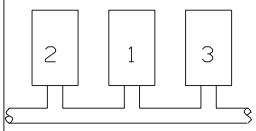
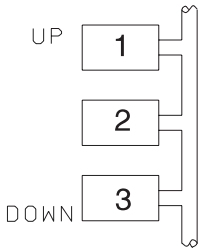
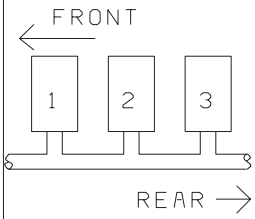
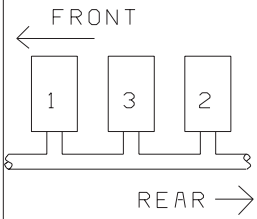
**FIGURE 11** (MSSMA401AE)
**Timing the Commutator**

**Refer to FIGURE 12 "Orientation of Balancing System Components" (elsewhere herein), before reading paragraphs A & B following.**

**A**. Rib numbers are identified by punch marks (1, 2 or 3) on top of each rib, near the front of the basket.

If the rib number marks have worn away, one can still readily determine the rib number by determining its pickup ring. To do this, remove the hand holes on the rear of the machine to gain access to the pickup ring. Now use a bent coat hanger to find the radial hole in the pickup ring that communicates with one of the ribs, and identify the rib number by referring to the appropriate chart in FIGURE 12 "Orientation of Balancing System Components." This is necessary because the location of the pickup rings is not the same for all models.

**B.** Depending on the machine model, the commutator switches will be numbered either 1, 2, and 3 or A1, B2, and C3. On some models the commutator faces rearward and thus is seen to rotate counter-clockwise in extraction when viewed from the rear while the cylinder is seen to rotate clockwise in extraction when viewed from the front. On other models, the commutator faces forward and is thus seen to rotate clockwise in extraction, the same as the cylinder. (The cylinder always rotates clockwise in extract when viewed from front.)

| | RIGID MODELS 30016 36021 | HYDRO - CUSHION MODELS 48032 | 64042 | 72044 |
|---|---|---|---|---|
| Cylinder rib numbering scheme looking at front of machine (viewed through the loading door). All cylinders rotate clockwise when viewed through the load door. |  |  |  |  |
| Position of commutator switches as mounted in machine. Arrow depicts cam rotation direction in extraction, when looking at switches. Rearward facing commutators are seen to rotate counter clockwise while forward facing commutators are seen to rotate clockwise. (See **NOTE** below.) |  faces rearward P/N 02 - 10406 |  faces rearward P/N 02 - 10406R |  faces rearward P/N 02 - 10406R |  faces rearward P/N 02 - 10406 |
| Cylinder pickup ring location |  |  |  |  |
| Balancing water nozzle location when viewing rear of machine. |  |  |  |  |
| Balancing water valve locations. |  When viewed from rear of machine |  When viewing accessible side |  When viewing accessible side |  When viewing accessible side |

**NOTE:** The cam flat faces switch 1 when rib 1 is at the 9 o'clock position (as viewed through the loading door).

**FIGURE 12** (MSSMA401AE)
**Orientation of Balancing System Components**

**When the commutator is properly timed, each time a rib passes the 9 o'clock position as viewed through the door, the exact center of the flat on the cam will be passing under the center of the switch follower for that rib.** If not, the cam must be repositioned by rotating it about its shaft. To do this, proceed as follows:

1. Make sure that the timing belt drive is properly adjusted without excessive slack (but not "banjo string" tight). Excessive slack in the timing belt will permit the belt cogs to slip over the ridges on the pulleys and put the unit "out-of-time".
2. Rotate the empty cylinder until any rib is exactly in the 9 o'clock position. In other words, the rib should be to the left when facing the **front of the machine** and an imaginary line drawn from the center of the rib to the center of the cylinder should exactly parallel the floor. (FIGURE 11A shows rib #1 at the 9 o'clock position but any rib will do as long as the rib number is known.)

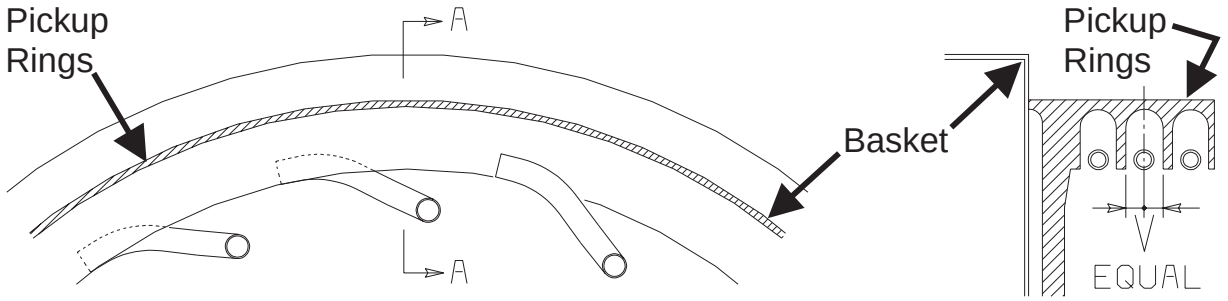
**⚠ WARNING ⚠**

**ELECTRIC SHOCK HAZARD—Since it is necessary to use power to rotate the cylinder, station a safety lookout behind the machine to guard against someone accidentally touching the high voltage in the commutator while the power is ON.**
**Be sure electric power to the machine is OFF at the wall disconnect before removing or replacing the commutator cover, and before touching anything inside the commutator.**

3. Loosen the commutator cam lock nut and rotate the cam so its flat is exactly centered under the follower for that rib switch. (FIGURE 11B shows the flat exactly under the switch for rib #1 - thus corresponding to the illustration in FIGURE 11A.)
4. While holding the cam, re-tighten the lock nut making sure the cam does not turn as the lock nut is tightened.
5. Recheck cam alignment before replacing the commutator cover. Re-adjust the cam if necessary.

**Lubricating the Commutator Cam and Breaker Points**—The commutator switches are actually special automobile breaker points and, as in automobiles, must be lubricated, otherwise the surface of both the cam and the plastic cam follower will wear, closing the switch gaps and rendering the balancing system inoperative. Use enough lubricant to coat the cam surface and to build up a small deposit of the lubricant on each plastic cam follower. A tube of cam lubricant (MILNOR P/N 20H016) was supplied with the machine, and should last many years.

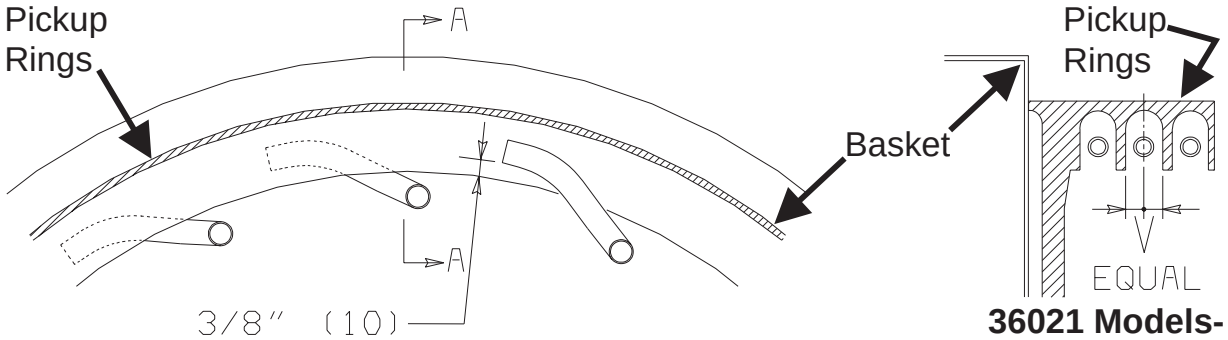
**Aiming the Balancing Nozzles (FIGURE 13)**—When properly aimed, the balancing nozzles will fit into the pickup rings approximately as shown in FIGURE 13. Aim the nozzles so that the water streams gently into the intended ring. Make sure that they are exactly centered in the pickup ring, as shown in Section A-A. Any splashing will cause at least some water to enter the wrong ring, thus rendering the system inoperative.




**30016 Models - Rear view of balancing nozzles**



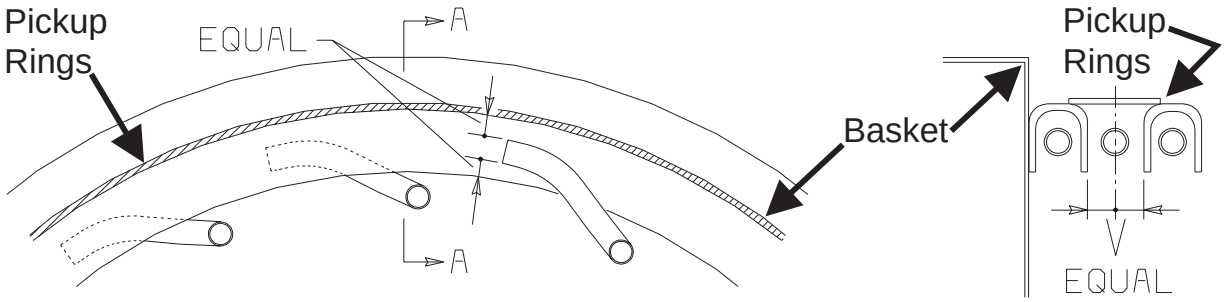

**30016 Models- Section A-A**




**36021 Models - Rear view of balancing nozzles**




**36021 Models- Section A-A**




**All Hydro-Cushion Models - Rear view of balancing nozzles (48032 shown)**




**All Hydro-cushion Models - Section A-A (48032 shown)**

**FIGURE 13** (MSSMA401AE)
**Aiming the Balancing Nozzles**