DESCRIPTION AND MAINTENANCE OF THE ELECTRONIC BALANCING SYSTEM FOR WASHER-EXTRACTORS AND TEXTILE MACHINES

Components of the Balancing System

The water balancing system consists of electrical and mechanical components which sense the location and magnitude of an imbalance in the cylinder, and by injecting water into the rib (or ribs) opposite that imbalance, re-balance the cylinder. The basic components (FIGURE 1) include:

- *The accelerometer and balance filter board.*
- *The proximity switch and target.*
- *The analog to digital balance board.*
- *Balancing water valves, rings, and ribs.*

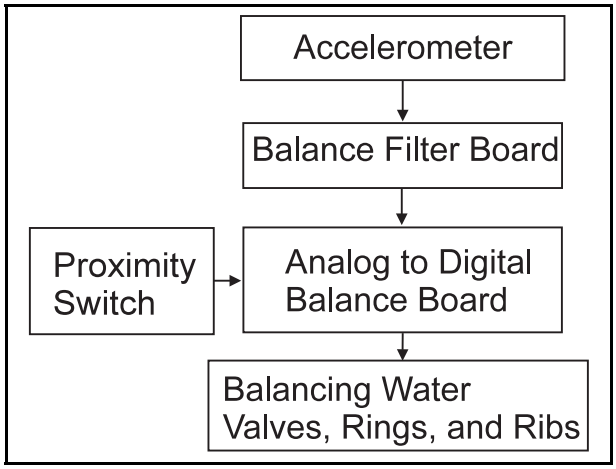


FIGURE 1 (MSSMA401BE)
System Components

Accelerometer and Balance Filter Board— In a flexibly supported washer-extractor (after an initial excursion at the onset of extraction), the unbalanced cylinder rotates about the center of mass resulting in the "light side out" and the "heavy side in" as shown in FIGURE 2. This causes the shell front to oscillate. The door-latch mounted accelerometer (FIGURE 12), and the filter board produce a voltage which fluctuates with this occillation. The fluctuating voltage can be represented as a sine wave (FIGURES 6 and 7).

Proximity Switch and Target—The target passes the proximity switch once per revolution (see FIGURE 4), thus producing a timing signal.

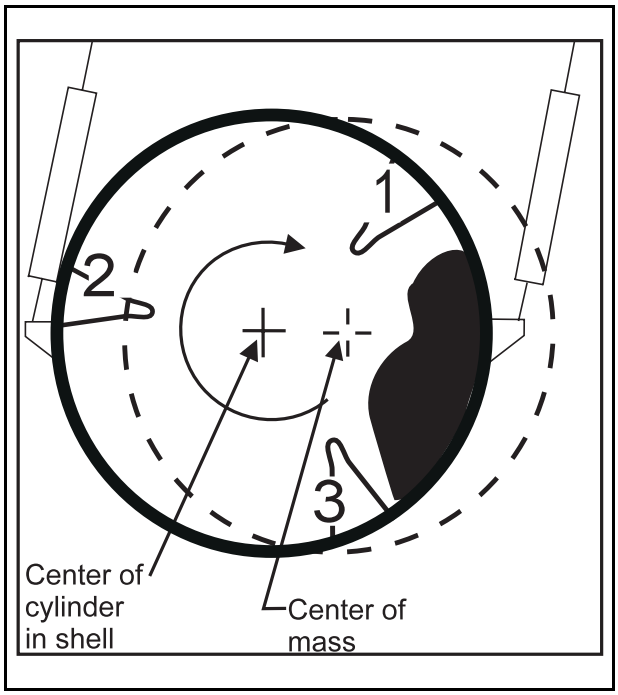


FIGURE 2 (MSSMA401BE)
Flexibly Supported Machine (Hydro-cushion® shown)

Analog to Digital Balance Board—This board uses the accelerometer sine wave and the timing signal to determine the magnitude and location of the imbalance, and in turn control the balancing valve and safety relays mounted on the board (see FIGURE 3), the three balancing water valve relays add water to the individual ribs opposite the imbalance. The machine excursion relay (not used on ExN, JxN, TxN machines) and balance excursion relay make a microprocessor input, causing a

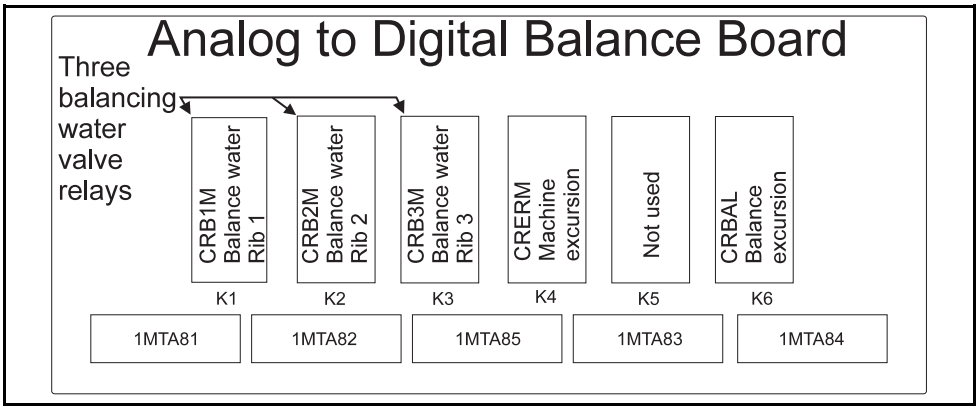


FIGURE 3 (MSSMA401BE)
Balance Board Details

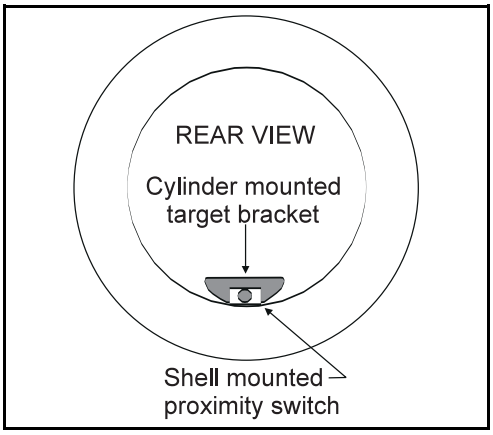


FIGURE 4 (MSSMA401BE)
Proximity Switch and Target (64046 E6N shown)

recycle, if shell excursions or an out-of-balance condition exceed acceptable limits. The machine excursion input causes a recycle at any time in extract, whereas the balance excursion input is checked just before the onset of high speed extraction, and then again from a few seconds after the onset of high speed extract throughout the remainder of extraction.

Balancing Water Valves, Rings, and Ribs—The water from balancing water valves enters the ribs via individual injection nozzles aimed into respective pick-up rings on the back of the cylinder. Corresponding valves, nozzles, and rings must be connected as shown in FIGURE 5.

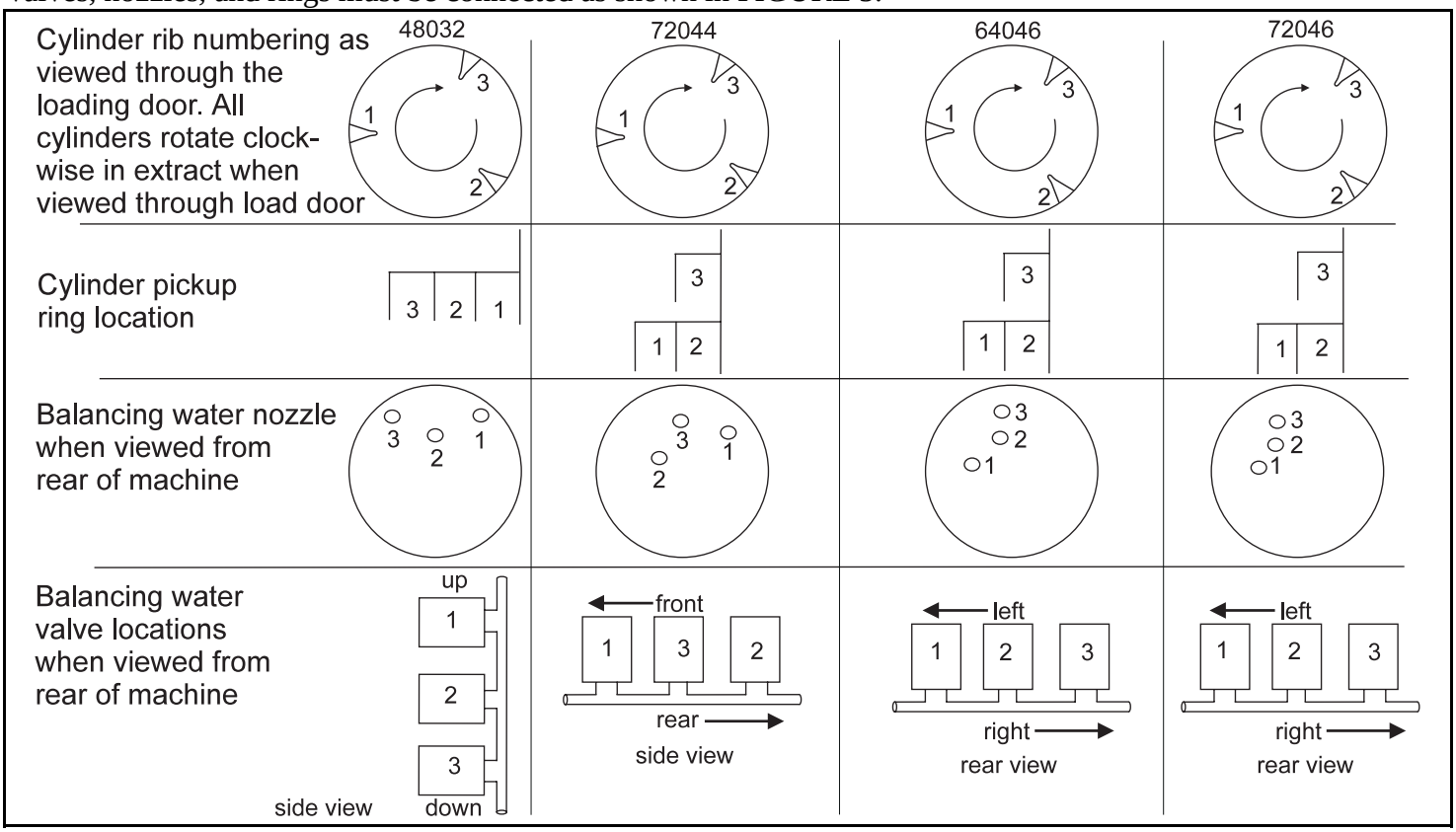


FIGURE 5 (MSSMA401BE)
Hydro-cushion and Suspended Machines

How the Balancing System Works

Determining where the imbalance is and correcting the imbalance takes place in two steps over several revolutions. FIGURE 6, *Step One—Finding the Imbalance*, describes in detail how the machine determines the location of the imbalance.

FIGURE 7, *Step Two—Cancelling the Imbalance*, explains how the machine cancels the imbalance in two stages. During the *first stage*, the machine adds water at the same rate to both ribs opposite the imbalance. The added water in the rib nearest the imbalance, together with the original imbalance, causes the center of mass to shift exactly opposite a rib. During the *second stage*, additional water is added to the counterbalancing rib until the cylinder again rotates about its geometric center. This causes accelerometer sine waves to again fall within the normal (balanced) range and shut off the balancing water valves. The ribs retain their water during the remainder of the extraction cycle, (except for some slight leakage from the ribs which is automatically replenished).

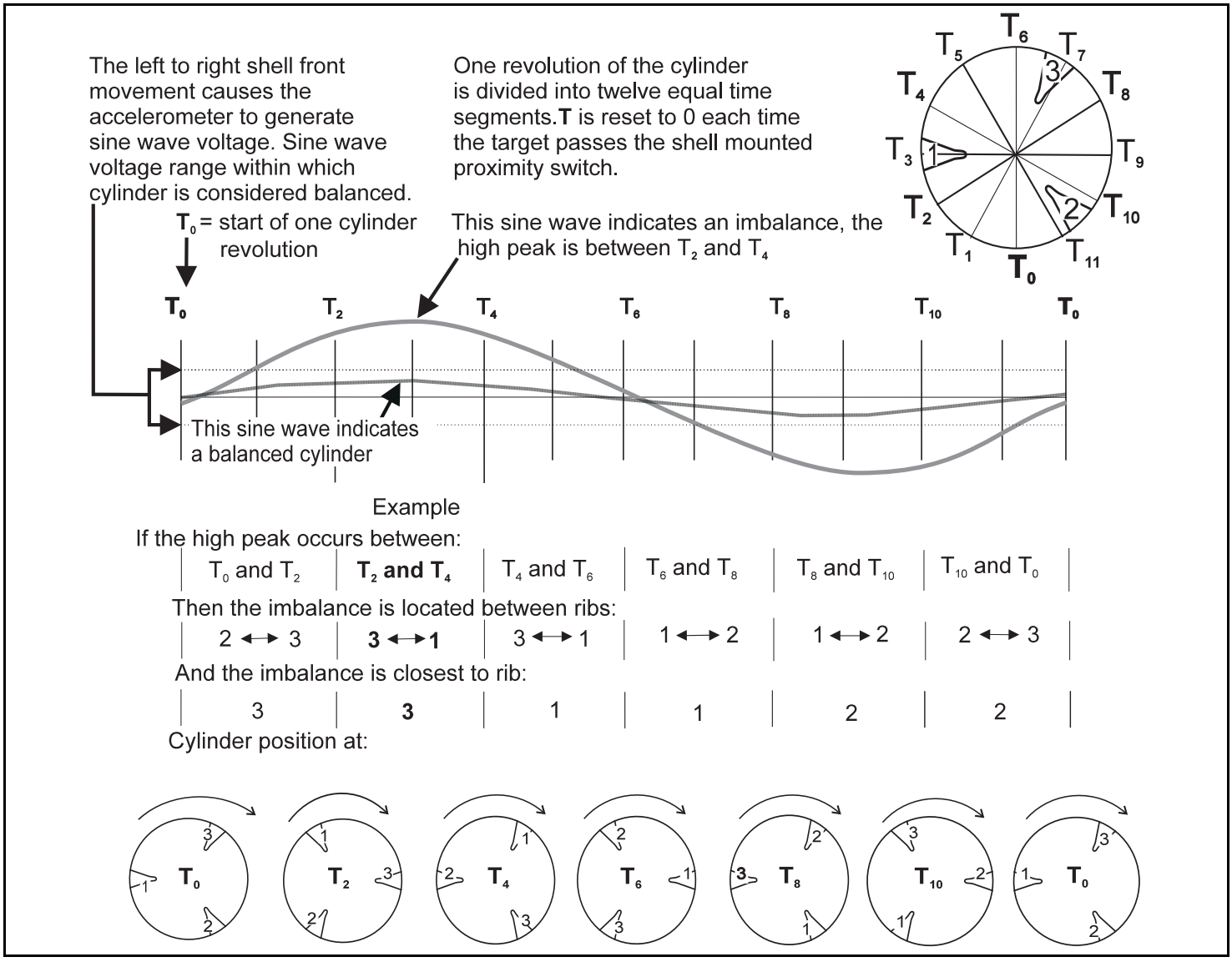
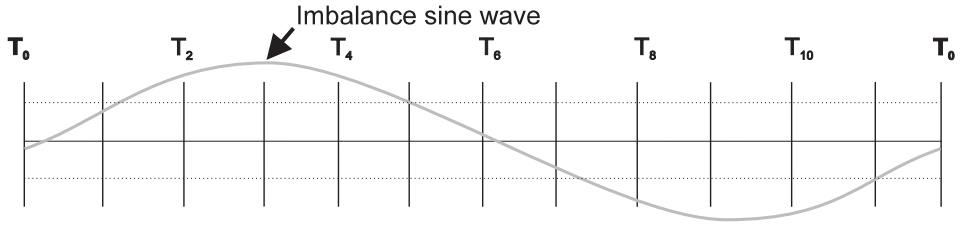
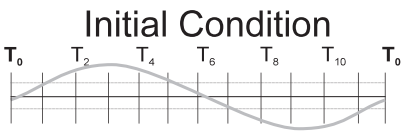
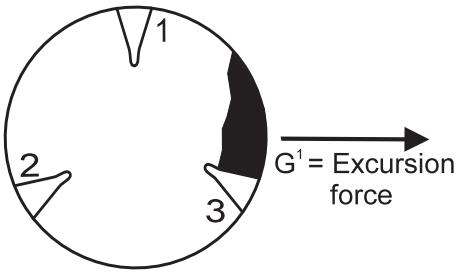


FIGURE 6 (MSSMA401BE)
Step 1—Finding the Imbalance

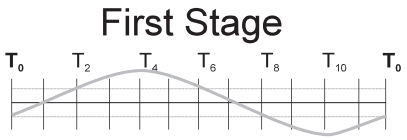
In this example, the high peak of the sine wave occurs at T_3, telling the balancing system that an imbalance is located between ribs 1 and 3, and the imbalance is closest to rib 3. Self balancing takes place in two stages over several revolutions.

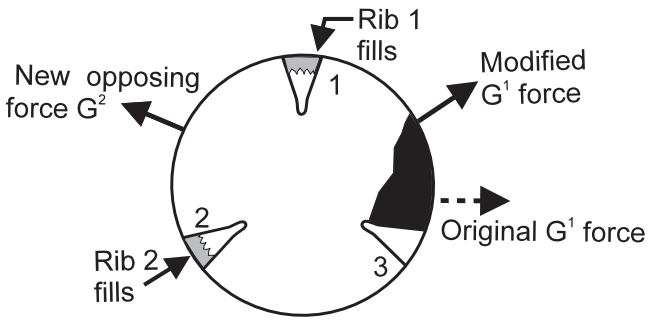




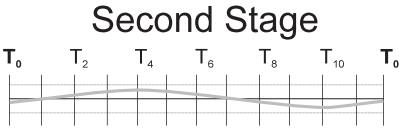


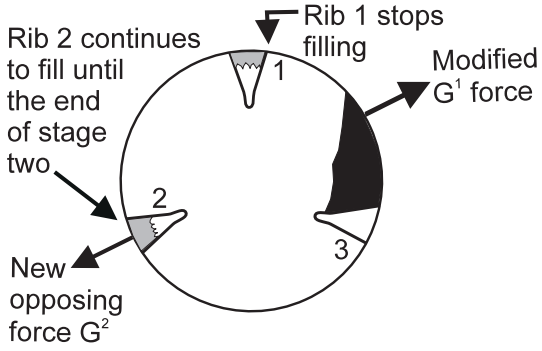
The maximum excursion force G^1, occurs next to rib 3, exactly at the area of maximum imbalance. Since no counterbalancing rib is exactly opposite the imbalance, (a requirement for balancing) the maximum excursion force must be moved to a point opposite a rib.





Simultaneously filling ribs 1 and 2 creates a new opposing excursion force G^2. This new G^2 force modifies the vector of the original force G^1 as shown above, resulting in moving the G^1 force to a point opposite rib 2. The second stage of balancing can now begin.





At the onset of the second stage of balancing, Rib 1 stops filling while Rib 2 continues to fill. This results in moving the opposing G^2 force to a point opposite the original G^1 force. Ultimately the, two forces equalize, reducing the shell front excursion, and the amplitude of the resulting accelerometer sine waves. All water valves shut off when sine waves fall within normal (balanced operation) range and the balancing system resumes monitoring operation.

FIGURE 7 (MSSMA401BE)
Step 2—Cancelling the Imbalance

Monitoring the Balancing System

Status panel lamps monitor balancing system functions. This status panel (FIGURE 8), includes:

Balance Excursion Lamp—This lamp illuminates whenever the three wire circuit is energized. If this lamp extinguishes during E1 (low extract), the machine will not enter E2 (high extract), but recycles instead (see “Recycle Circuit” in this section).

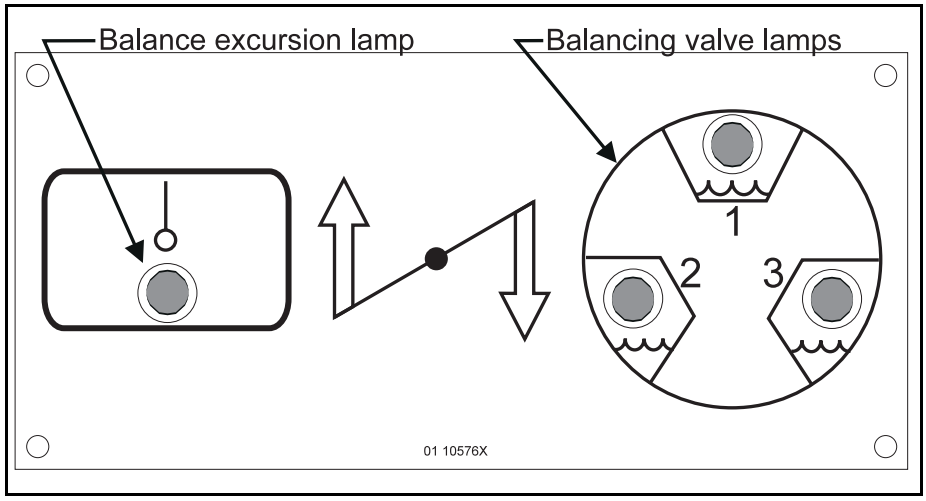


FIGURE 8 (MSSMA401BE)
Balancing System Status Panel

Balancing Valve Lamps—These three lamps go ON and OFF with their respective balancing valves. Lamps should be OFF once balancing is completed, except for intermittent valve operation as the balancing system compensates for changing imbalances (caused by varying load thickness, different absorption rates, etc.). All three lamps should never illuminate except at the onset of low speed extraction and again at the onset of high extraction. At all other times, only one or two of the three lamps should illuminate until balance is achieved, never all three. Continuous recyling over several loads may indicate a need for service.

Balancing System Maintenance

Aiming Injection Nozzles—When properly aimed and adjusted, the injection nozzles correctly deliver balancing water from each balancing water valve to the pickup ring for the appropriate rib. If not aimed or adjusted correctly, water may splash (or fall) into the wrong pick-up ring and enter the wrong rib, rendering the system unworkable. 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 FIGURE 9. Any splashing causes water to enter the wrong ring, rendering the system inoperative. Periodically check nozzle alignment and for cracks, clogs, and debris in the rings.

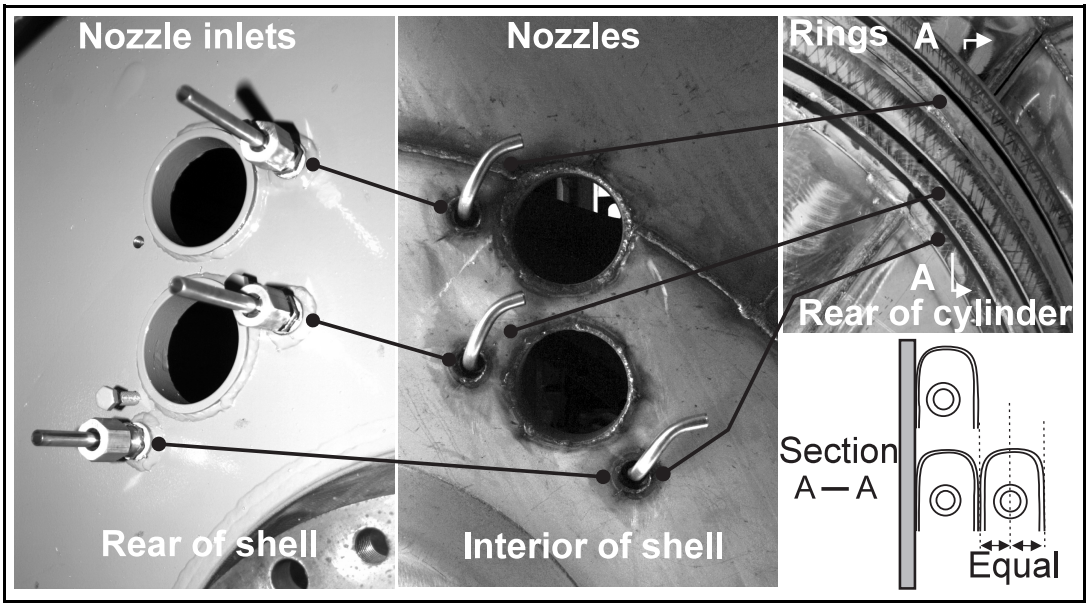


FIGURE 9 (MSSMA401BE)
Aiming the Balancing Nozzles

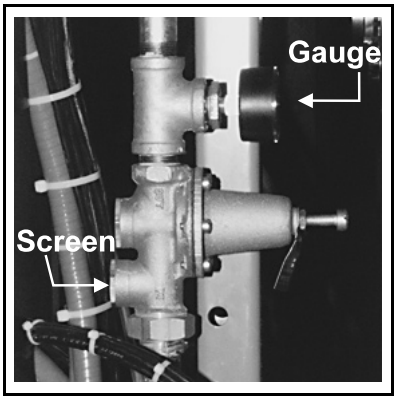


FIGURE 10 (MSSMA401BE)
Water Pressure Gauge

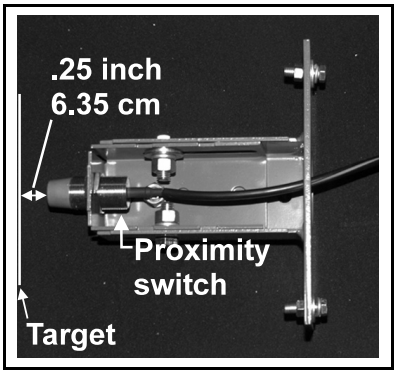


FIGURE 11 (MSSMA401BE)
Proximity Switch

Checking Water Pressure—Check pressure regulator for 28 PSI (1.96 Kg/sq cm) water pressure when there is no water flow and approximately 10 - 15 PSI (0.70 - 1.05 Kg/sq cm) when water valves are operating. Clean screen and/or adjust regulator as required (FIGURE 10).

Positioning the Proximity Switch—Adjust a replacement proximity switch, (FIGURE 11), .187 - .25 inch (4.75 - 6.35) from the target plate.

Preparing to Set Accelerometer—Accelerometer voltage must be adjusted with the shellfront in the drain/extract position. In order to do this, put the machine in a valid formula and stop in an wash step. The machine will drain with the shellfront at the 10 degree tilt necessary for setting the accelerometer. The following displays are typical. They may appear differently according to machine model and/or options.

RUN FORMULA 00 OR OK POWER OFF	Machine is ready for load and the *Run Formula menu* is displayed, as shown at left, ENTER NEXT **Accesses *formula 00* .**
FILLING MACHINE	Machine filling with water
RUN FORMULA 00 FORMULA 00	① **Silences the operator signal and starts the process.**
10:38 F0005S03 2:37 dF=A055/D140 * HC3	Alternates With 10:38 STEP01 2:37 WAIT FOR LEVEL HC3

DRAINING TO SEWER

CANCEL ESCAPE Cancels step. The water, chemical, and steam valves close, the drain opens (machines with normally open drain valves), and the shellfront tilts to the angle necessary for the correct adjustment of the accelerometer. Machines with normally closed drain valves must be drained before continuing (See VIEWING INPUTS/OUTPUTS AND ACTUATING OUTPUTS ON THE MARK III MICROPROCESSOR CONTROL...).

3 WIRE DISABLED FAULT: SEE MANUAL

0 Disables the three wire circuit, preventing machine from entering intermediate extract, and displaying an error message. CANCEL ESCAPE cancels the formula, *Cancel button*, silences the operator signal.

Adjusting the Accelerometer—Measure accelerometer voltage at balance filter board connector from 1MTA 86-4 to 1MTA 86-5 with the machine in a formula and the cylinder tilted to the drain/extract position as described in "Preparing to Set Accelerometer" in this section. The accelerometer is adjusted by the screw (FIGURE 12). Set accelerometer voltage between 2.3 - 2.5 VDC, the higher the voltage, the more sensitive the circuit. Output voltages beyond 5 VDC indicate a defective unit.

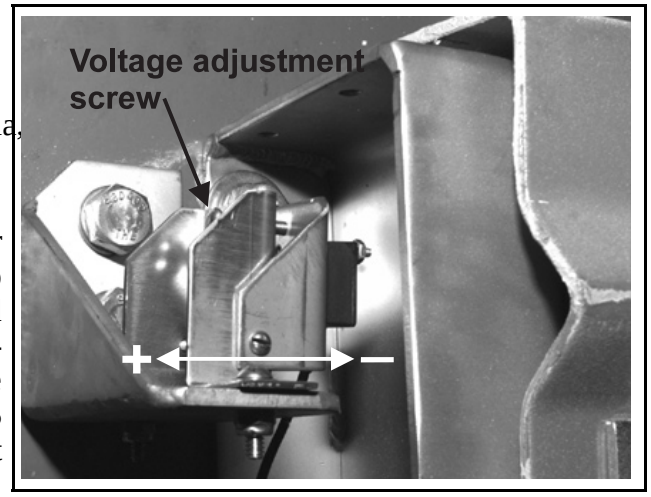


FIGURE 12 MSSMA401BE
Accelerometer

Additional Protection for Excessive Imbalance

Two devices, the recycle and the vibration circuits, independent of the balancing system, protect the machine from excessive imbalances.

Recycle Circuit—The recycle circuit automatically redistributes an out of balance load. It becomes operational when extract commences and is actuated by the machine excursion switch (FIGURE 13). Although the excursion switch initiates a recycle anytime it is actuated during extraction, the primary purpose of this switch is to sense an excessive imbalance during the onset of extraction. When a recycle is initiated, the cylinder comes to a full stop, rotates 16 seconds CCW in wash speed, 7.5 seconds in CW wash speed, and 7.5 seconds in drain speed, then re-enters extract. During a recycle, the program timing stops, and starts again 7.5 seconds after high extract has again been achieved. The machine recycles up to five times, before repeating the final bath (without chemicals) and re-entering extraction.

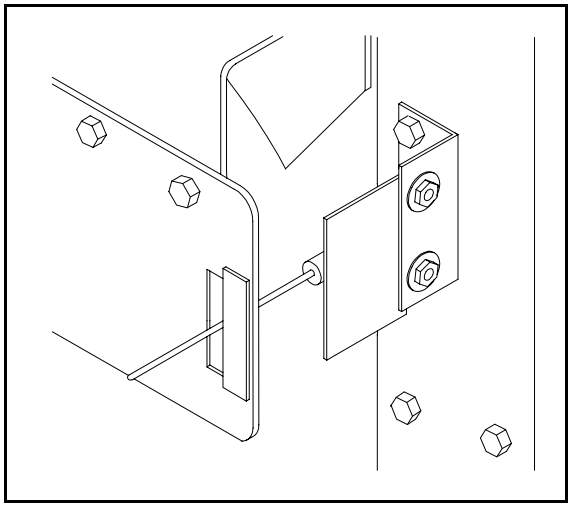


FIGURE 13 (MSSMA401BE)
Excursion Switch

NOTICE

The excursion switch actuator 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.

Vibration Circuit—The vibration safety switch (FIGURE 14) reacts to excessive vibration which is not contained by the balancing system, actuating a switch which de-energizes the three wire relay. When this occurs, the cause of the vibration should be determined and corrected. See "VIBRATION SAFETY SWITCH ADJUSTMENTS" elsewhere in this manual.

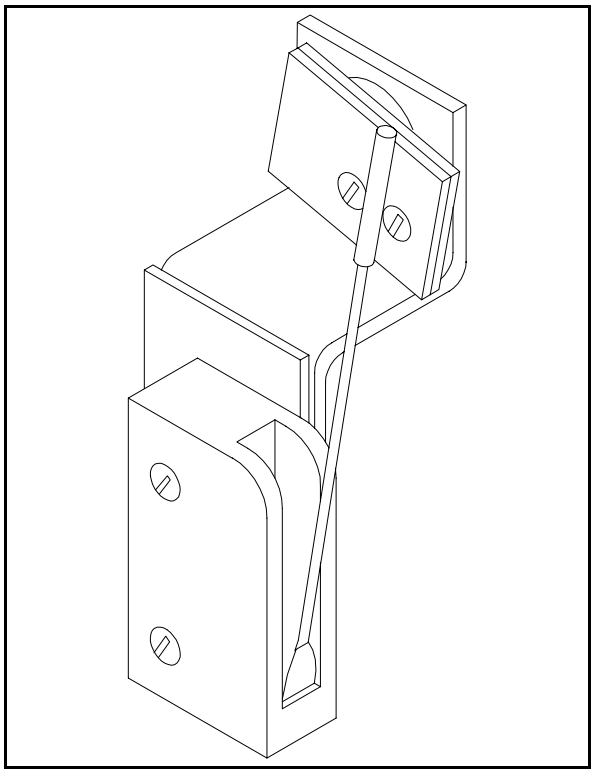


FIGURE 14 (MSSMA401BE)
Vibration Safety Switch