Washer Extractor

Balancing Systems

Why is it Necessary

- Out of Balance conditions can cause a tremendous level of force.
  - 1 G machine that is out of balance 1 lb is 1lbf
  - 300 G machine that is 40 lbs out of balance is how many pounds of force generated?
    - 12,000 lbf

What you may find

- Vibration Safety Switch
- Excursion Switch
- Auto Balance System

Vibration Safety Switch

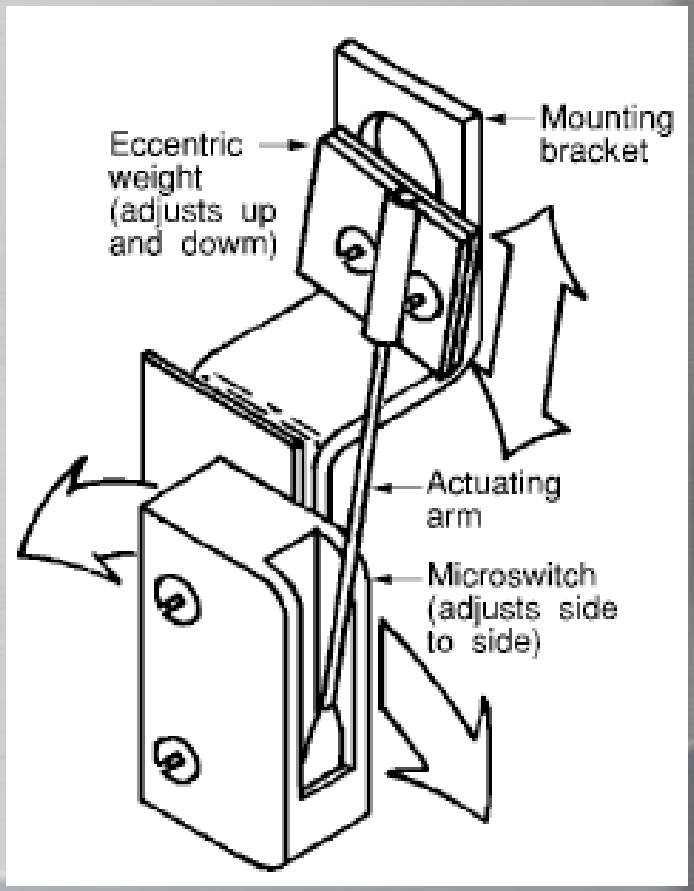
- What does it do?

Vibration Safety Switch Adjustments

Increased Sensitivity

Decreased Sensitivity

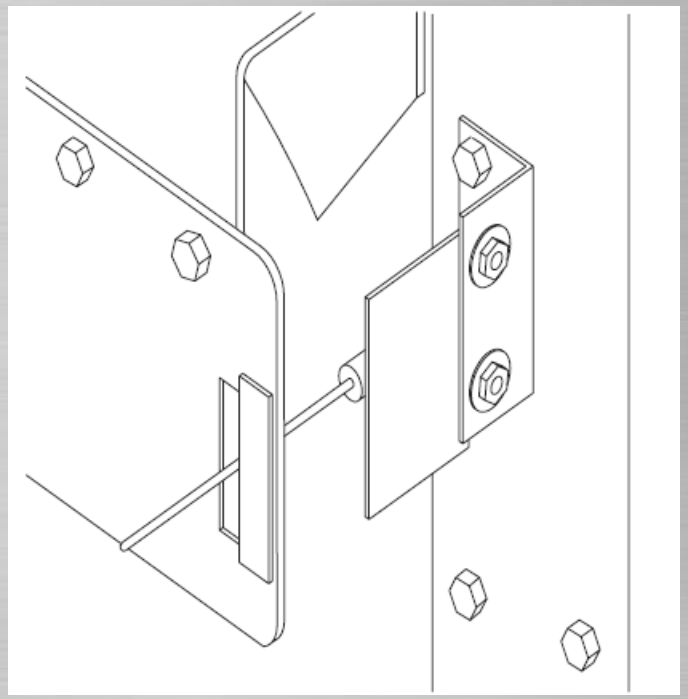
Switch Reset Point



Excursion Switch

- Whisker Switch
  - Alignment

Ensure the switch is aligned in the middle
Of the slotted hole, both when the machine
Is hanging free or pushed down.



  - Actuation

When the switch actuates, it will initiate a
Recycle sequence. The cylinder comes to
A complete stop, then rotates CCW in
Wash Speed for 16 seconds, 7.5 seconds
CW in Wash Speed, then 7.5 seconds in
Drain Speed before going back into Extract

Auto Balance System

Basic Concept---

Detect an out of balance condition (both magnitude and location)
Inject water into a rib opposite the out of balance location to re-balance the machine.

Basic Components---

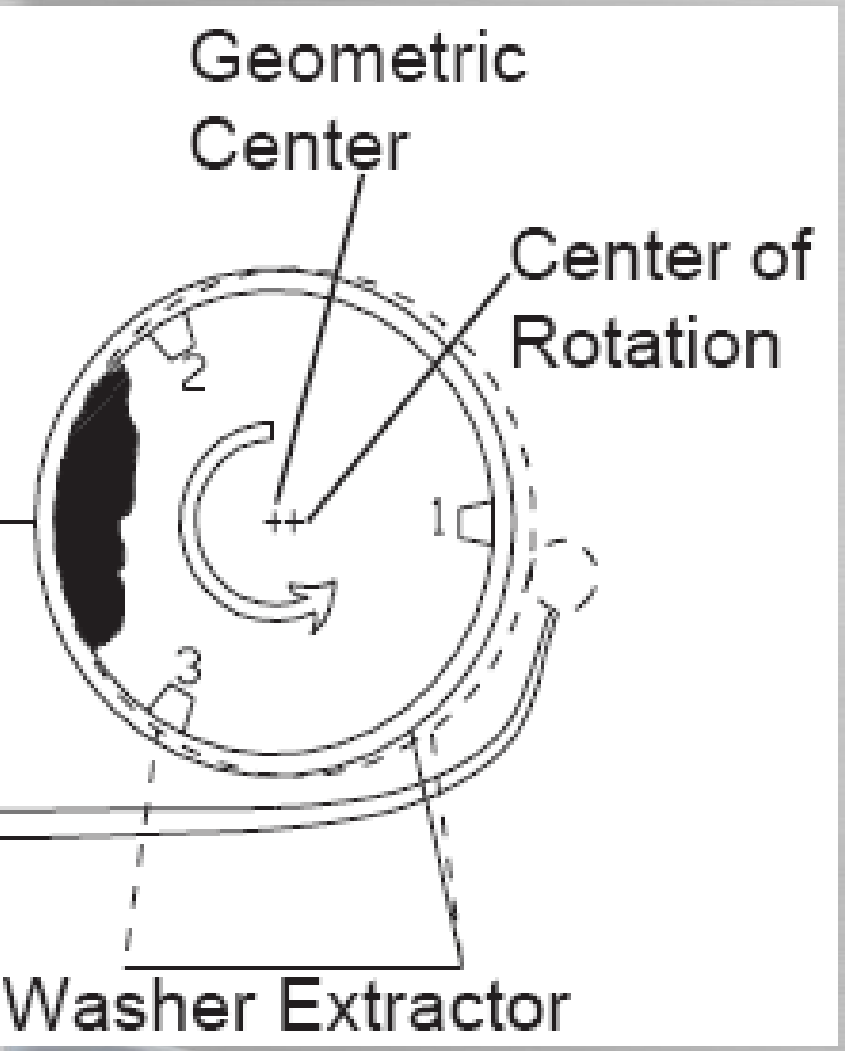
Pre-Electronic

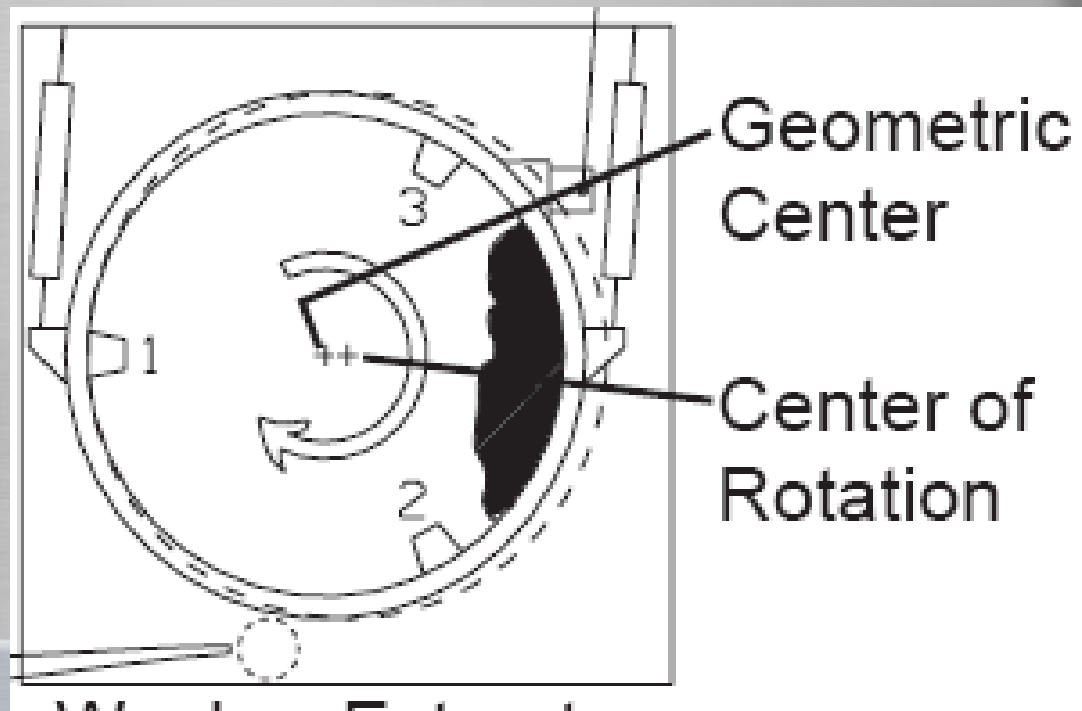
Balance Sensing Switch sense when, where, and how much of imbalance
Commutator to send the signal to the electrical signal to the water valves
3 Water Valves/Nozzles to inject water into the appropriate rib

Electronic

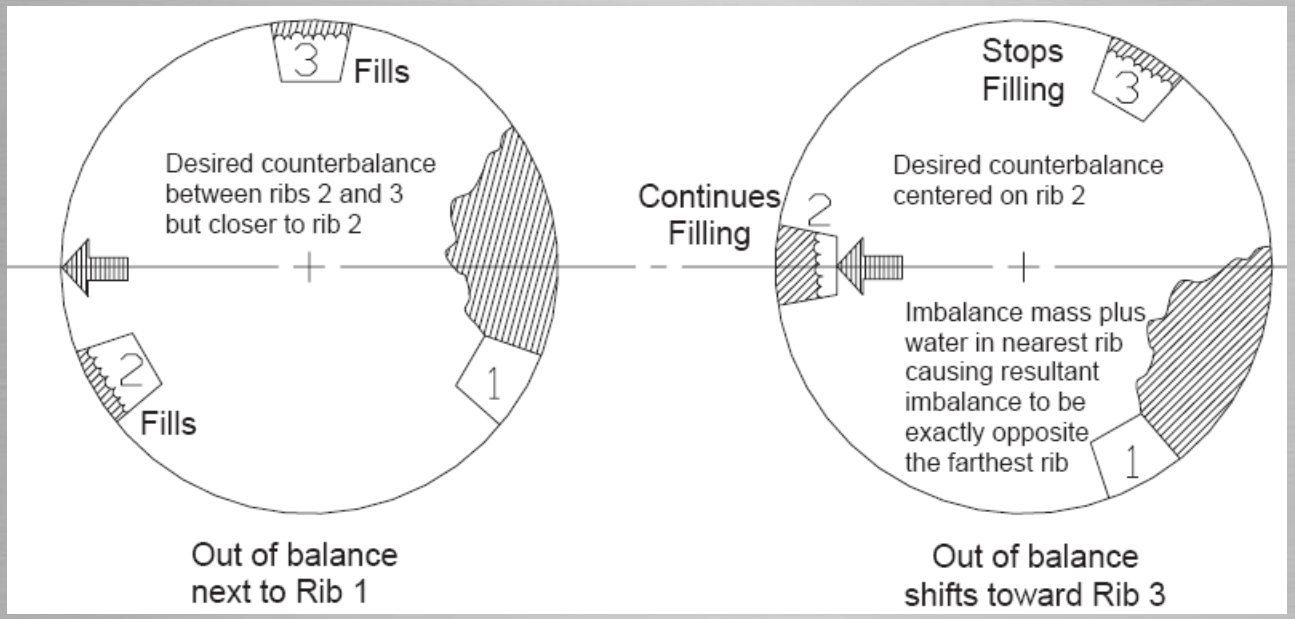
Accelerometer and Filter Board to detect out of balance condition
Proximity Switch and Board to establish a basket timing signal as it rotates
A-D Balance Board takes the imbalance signal and the timing signal to generate a signal to the water valves
3 Water Valves/Nozzles to inject water into the appropriate rib

Understanding Imbalance





Understanding Imbalance



Initially water enters ribs 2 and 3. The water in rib 3 shifts the center of mass to exactly opposite rib 2. Water will shut off to rib 3 and we continue adding water to rib 2 until the machine is back in balance.

Non-Electronic Balance System

- Concept Basis

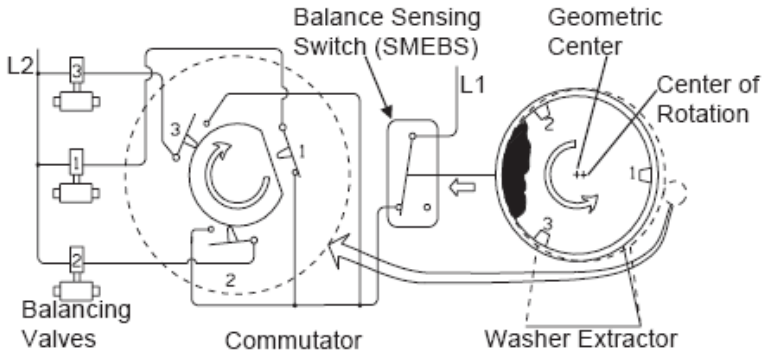


FIGURE 1A Rigid Mount Models

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

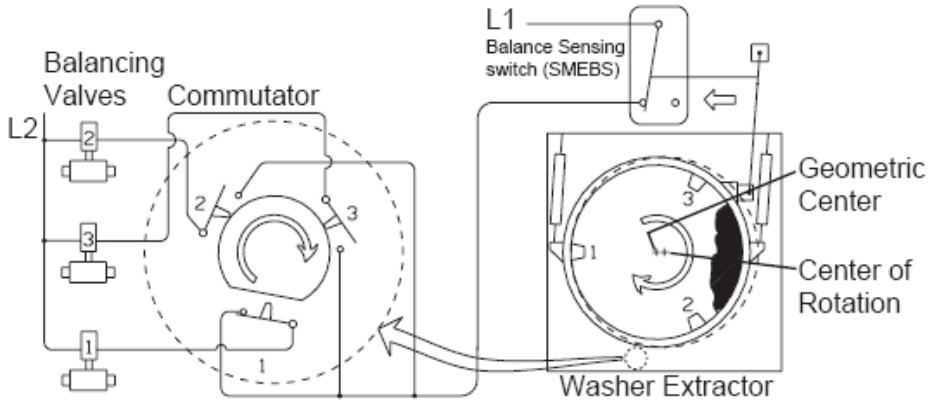


FIGURE 1B Flexibly Supported Models

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.

Sensing Out of Balance Condition

- Balance Sensing Switch
  - Attached to the frame not the basket in a rigid machine
  - Attached to the basket via actuator bars in a suspended machine
  - Generates a pulsing signal centered around an imbalance

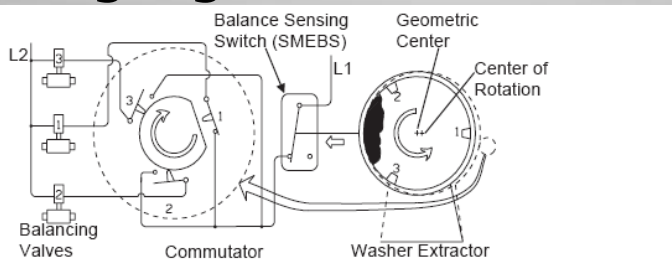


FIGURE 1A Rigid Mount Models

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

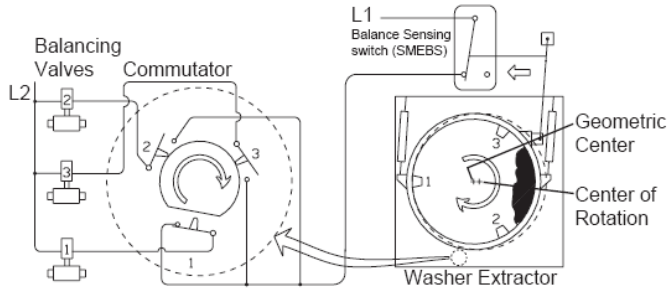
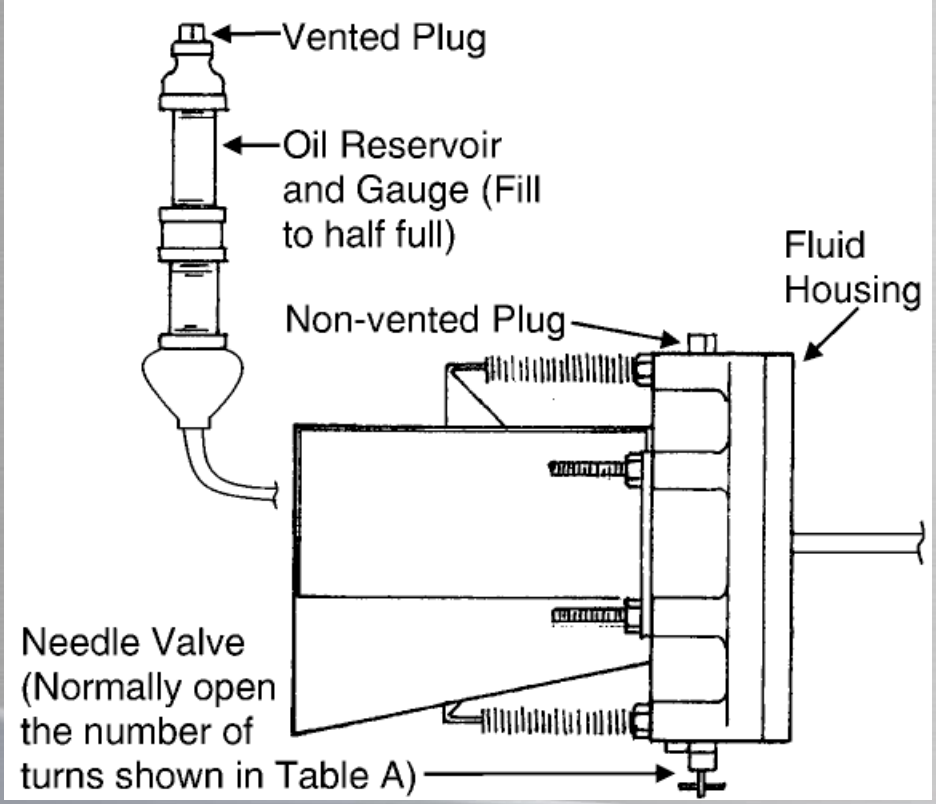


FIGURE 1B Flexibly Supported Models

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.

Sensing Out of Balance

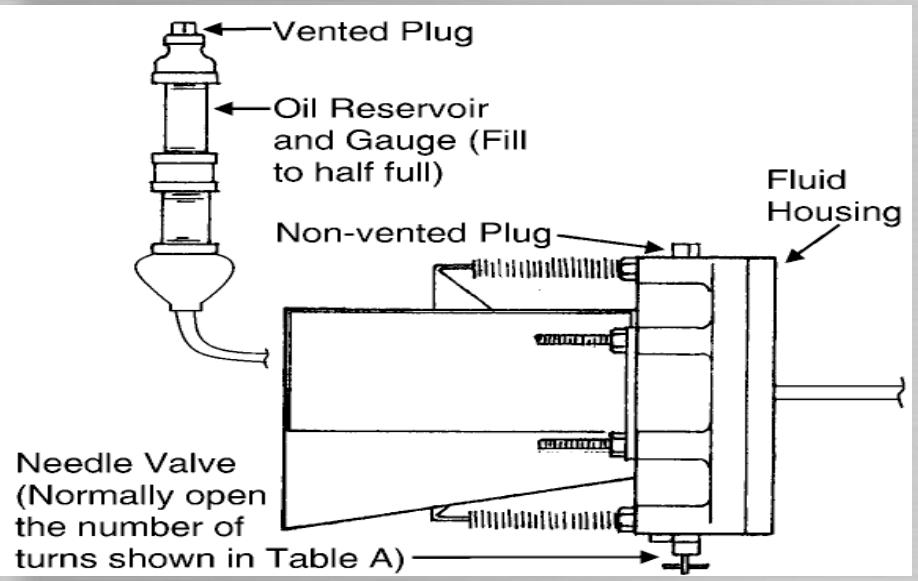
- To increase the sensitivity of the system the switch is actuated by an oil filled diaphragm called the Balance Sensing Device



The adjustable needle valve permits oil to flow back and forth from the oil reservoir and the diaphragm. Thus, small or slow movements will not actuate the switches.

Sensitivity then is affected by:
- Oil Viscosity
- Needle Valve Setting

Adjusting Balance Sensing Device



Check oil level in the oil reservoir daily. Mechanism will not function if oil level drops where air enters the fluid housing.

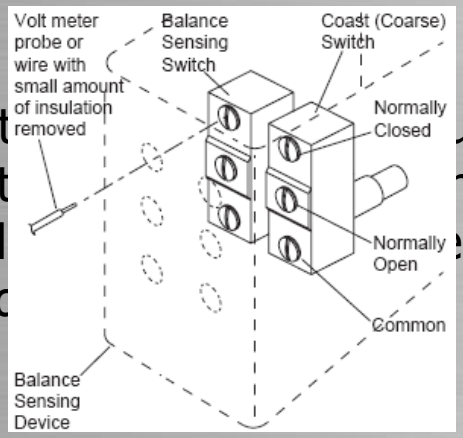
Needle valve sets the sensitivity.
More open, less sensitive
Proper setting

Needle Valve Setting				
30016	36021	48032	64042	72044
1-1/2 Turns	1-1/2 Turns	1-1/2 Turns	1-1/2 Turns	4 Turns

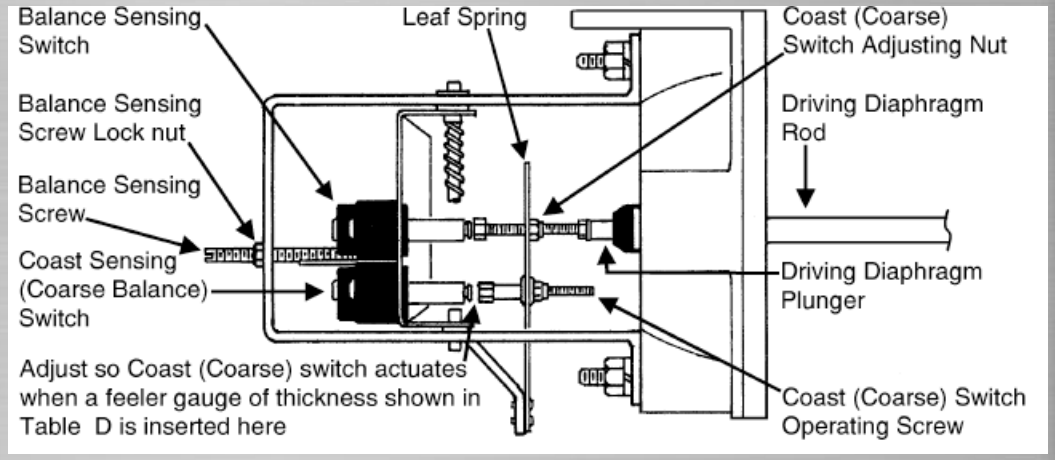
15W40 motor oil

- To check for air in the fluid housing
  - Remove the non-vented plug at the top. Oil should immediately begin flowing out. Replace the plug.
    - If oil doesn't flow out, then check the needle valve open
    - Add oil to the oil reservoir
  - Reservoir should be ½ full, never full to allow space for oil to flow from the fluid housing
    - Always add oil to the reservoir, never to the fluid housing

Balance Sensing Switch/Device



The swit usted so that t n the driven d d a certain c



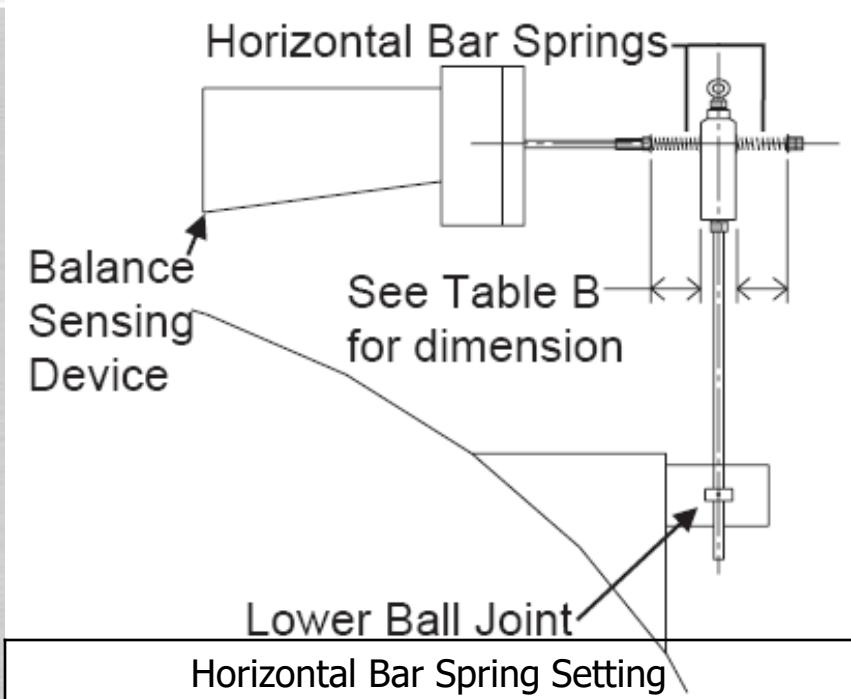
- Setting Balance/Coast Switch Activation Gap
  - Lockout Power to machine
  - Connect Ohmmeter to normally open contacts
    - » Meter should read infinite
  - Insert a feeler gauge of the proper thickness between the switch plunger and the set screw
  - Slowly turn the adjusting screw until the resistance changes to zero
    - » Indicates that the switch has closed
  - Slowly turn Balance Sensing Switch Screw CW until resistance reads zero
  - Slowly turn Balance Sensing Screw CW additional number of turns as per your model
  - Hold Balance Sensing Screw in position and tighten locknut

Balance Sensing Screw CCW Turns				
30016	36021	48032	64042	72044
¼	¼	1-3/4	1-1/2	4-3/4

Coast/Coarse Switch Feeler Gauge Thickness				
30016	36021	48032	64042	72044
.010” .254mm	.010” .254mm	.015” .381mm	.015” .381mm	.027” .686mm

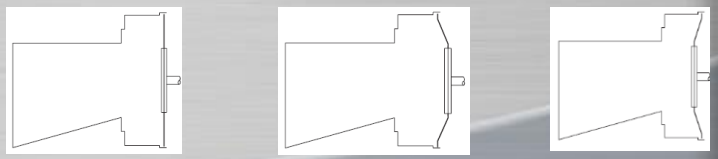
Actuator Bars

- Needs to be properly aligned
  - Align Vertical bar perpendicular to the Balance Sensing Device
  - Align vertical bar lower ball joint, apply Loctite and tighten
  - Set the Horizontal Spring spacing



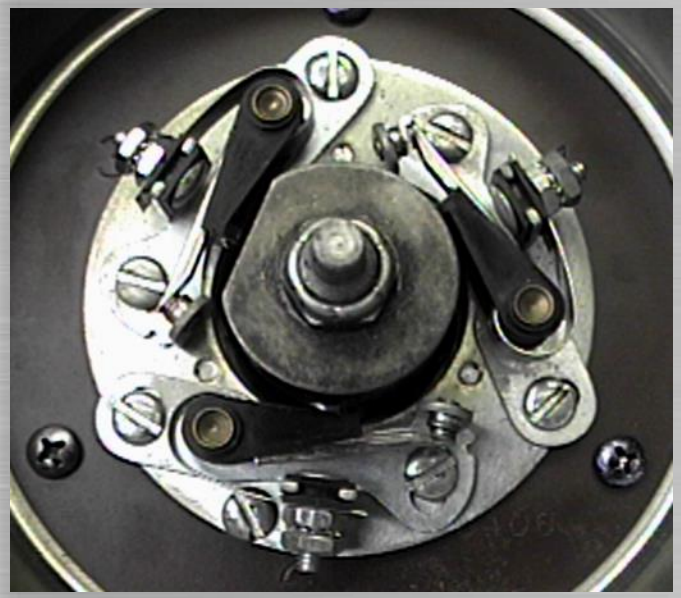
Horizontal Bar Spring Setting				
30016	36021	48032	64042	72044
n/a	n/a	15/16″ 24mm	2″ 51mm	3-7/8″ 98mm

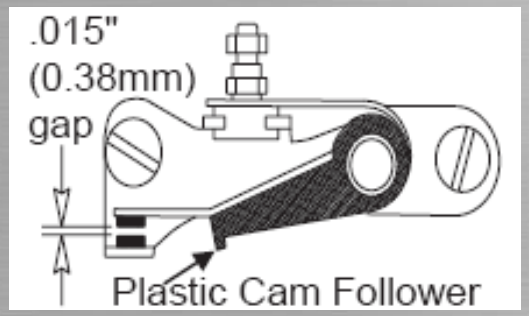
Align the assembly with the machine hanging free.
Compression of both springs should be equal.
Diaphragm should be centered not pulled to one side.



GOOD **BAD** **BAD**

Commutator





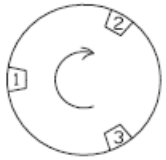
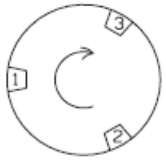
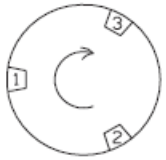
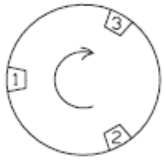
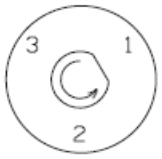
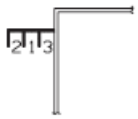
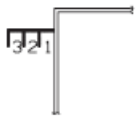
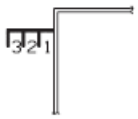
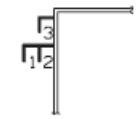
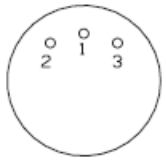
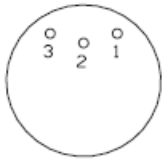
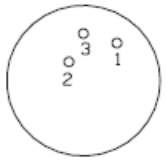
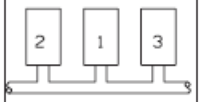
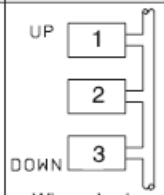
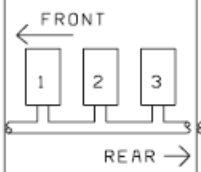
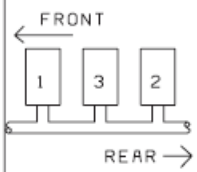
- Switch Gaps must be set

  Each switch gap point must be set to .015" (.38mm) when the plastic cam follower on the switch is riding on the high portion of the cam.

- Procedure
  - Rotate basket until cylinder cam follower is riding on large diameter of the cam
  - Loosen breaker point mounting screws and insert a feeler gage between the contacts
  - Tighten the mounting screws, checking the gap clearance doesn't change while the screws are being tightened
  - Repeat for all 3 breaker point switches

Timing the Commutator

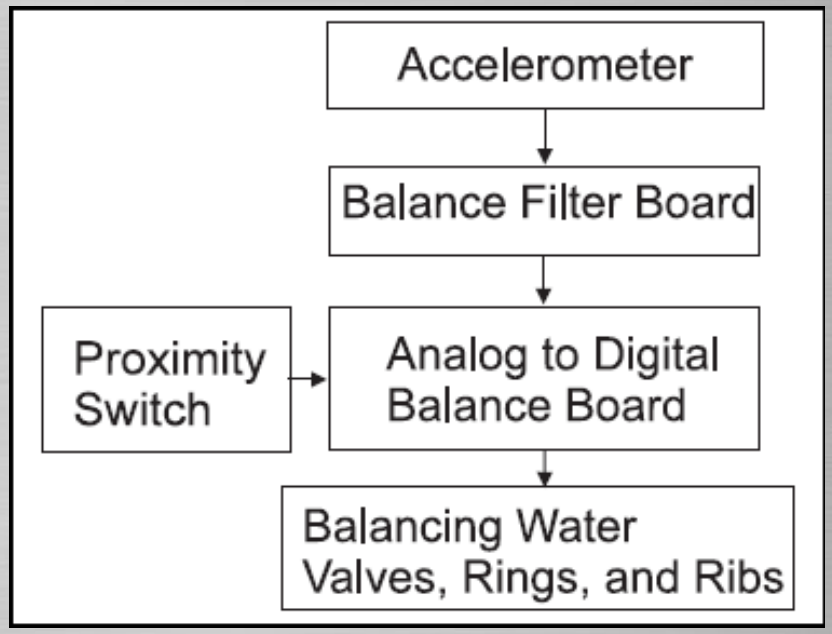
- The Comm… the flat of the cam i… he ribs in the cylind…
  - Place Ri… through the front do…
    - The ri… top of each rib, near t…
    - If the … rib number by deterr… anger find the pickup… d model number
  - Align the… eath switch 1
    - Loose… Lock the cam with t…

	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).

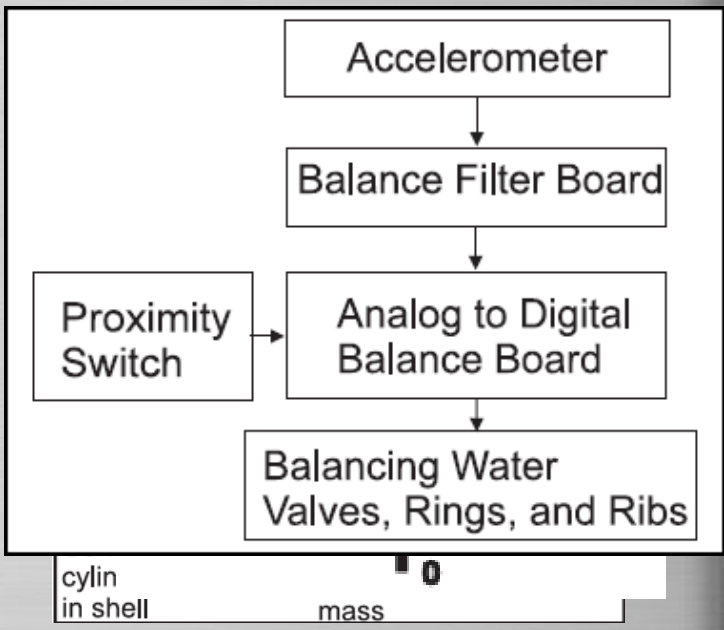
Electronic Balancing System

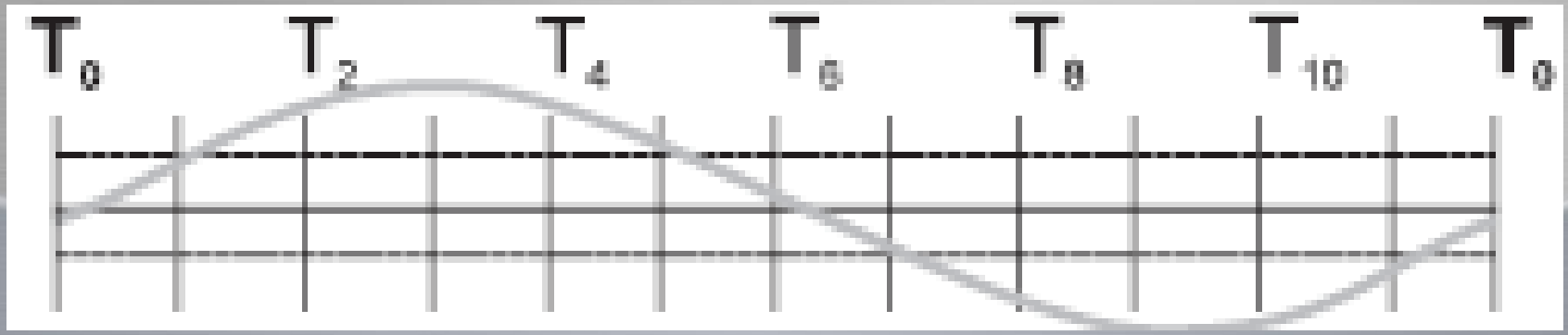
- Accelerometer and Balance Filter Board
- Proximity Switch and Target
- Analog to Digital Balance Board
- Balancing Water Valves, Rings and Ribs



Electronic Balancing System Components

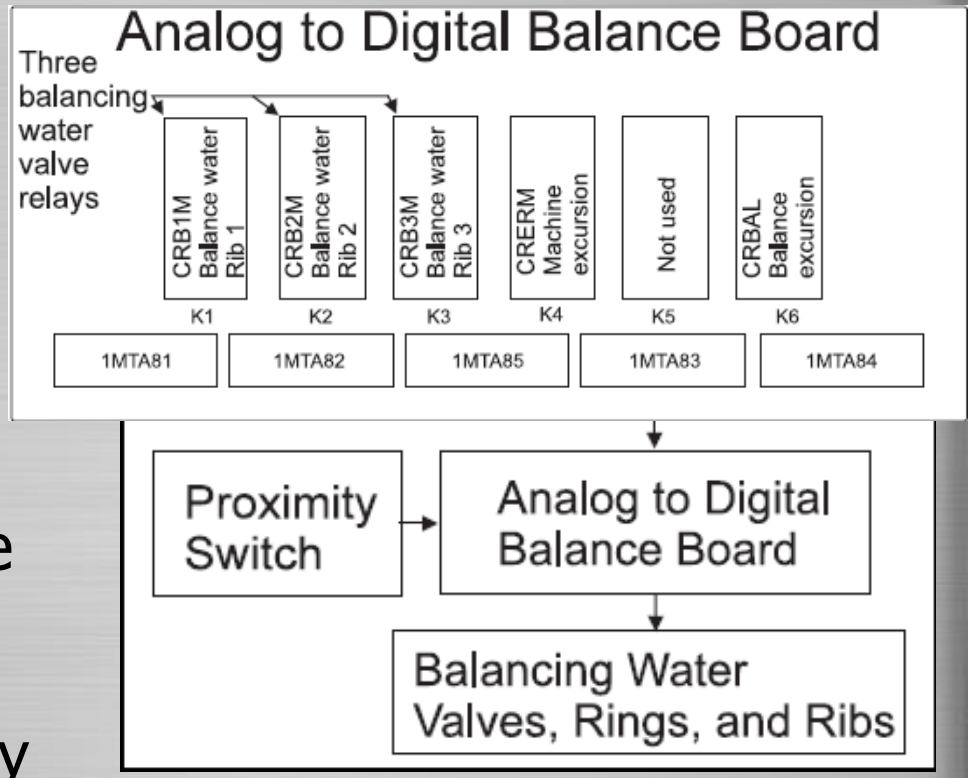
- Accelerometer and Balance Filter Board
  - Cylinder rotates about the center of mass
  - Cylinder Shell Oscillates
  - Accelerometer mounted to door latch generates a voltage through a filter board
  - This voltage will be in the form of a sinusoidal wave form





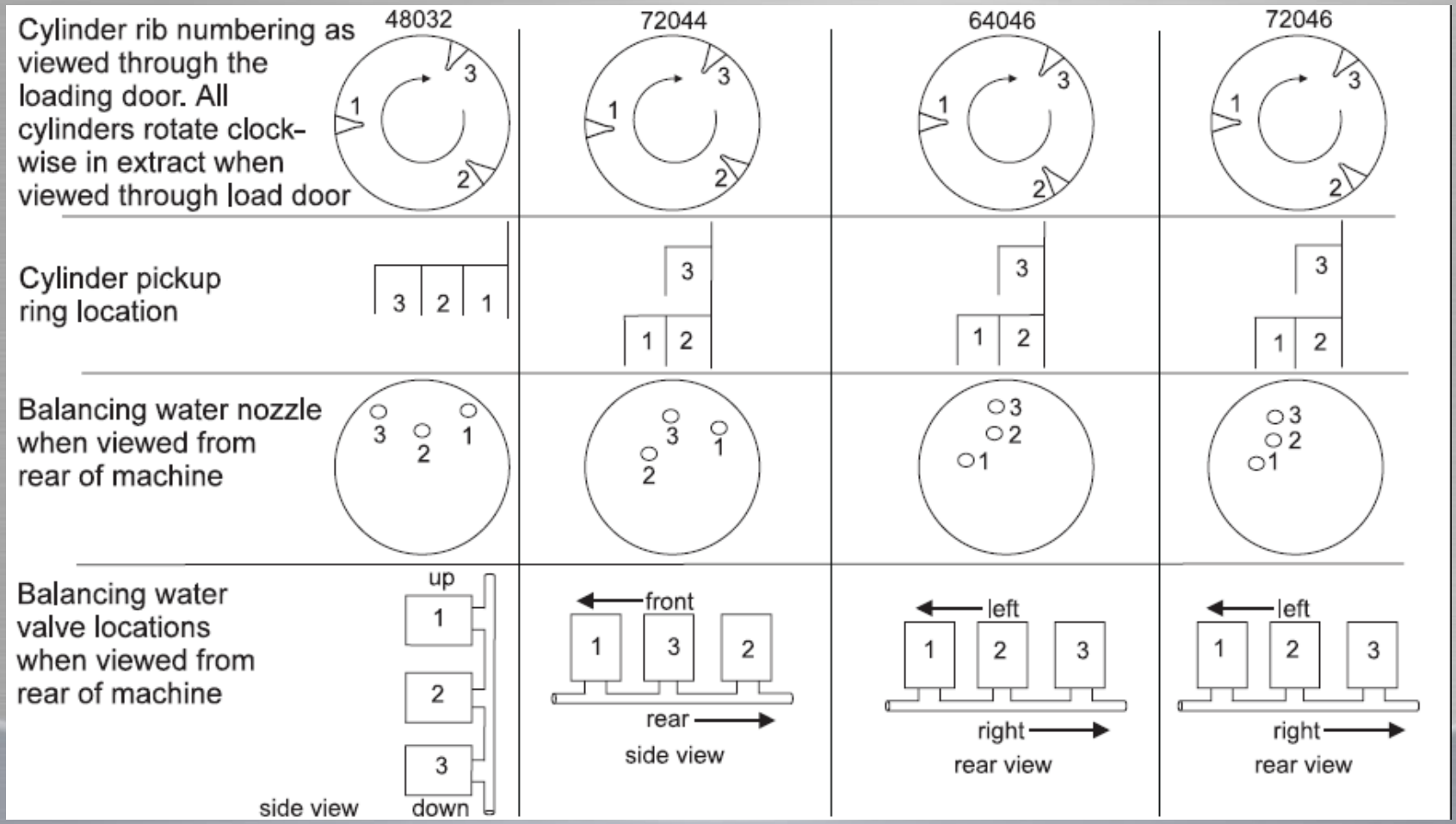
Electronic Balancing System Components

- Proximity Switch and Target
  - Create a Timing Signal of the Cylinder Position
- A-D Balancing Board
  - Uses the Accelerometer Voltage Sine Wave and the Proximity Switch Timing Signal to control the balancing valves and safety relays mounted on the board
    - Two Excursion Relays
      - Machine Excursion Relay
      - Balance Excursion Relay



Electronic Balancing System Components

- Same Ribs, Rings, Nozzles and Valves as before.



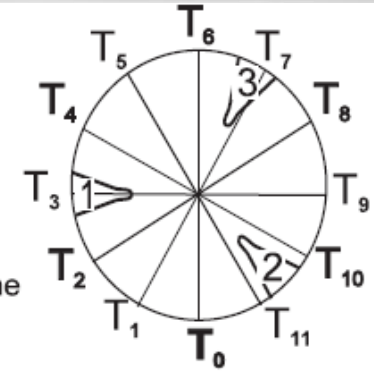
Electronic Balancing System

- How Does It Work?
  - Step One
    - Find the Imbalance
  - Step Two
    - Cancel the Imbalance

Step One—Find the Imbalance

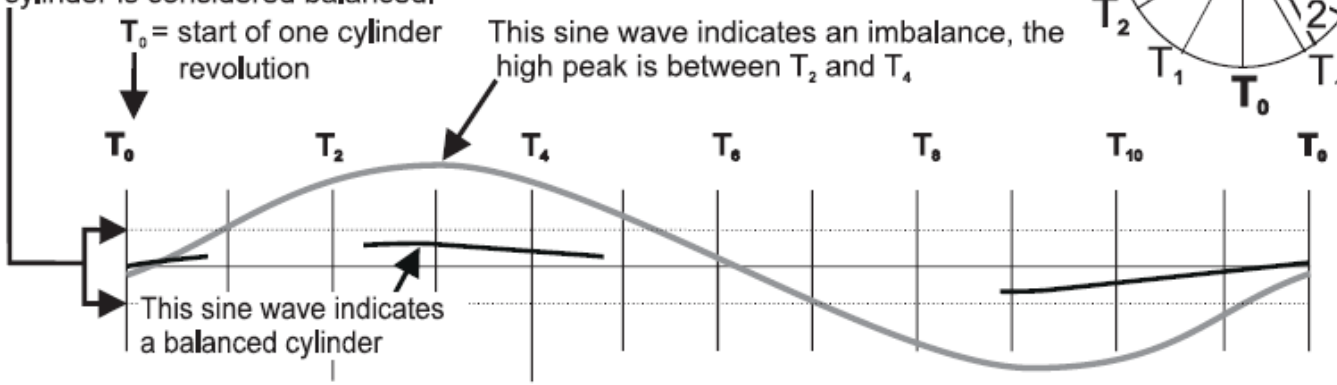
The left to right shell front movement causes the accelerometer to generate sine wave voltage. Sine wave voltage range within which cylinder is considered balanced.

One revolution of the cylinder is divided into twelve equal time segments. T is reset to 0 each time the target passes the shell mounted proximity switch.



T_0 = start of one cylinder revolution

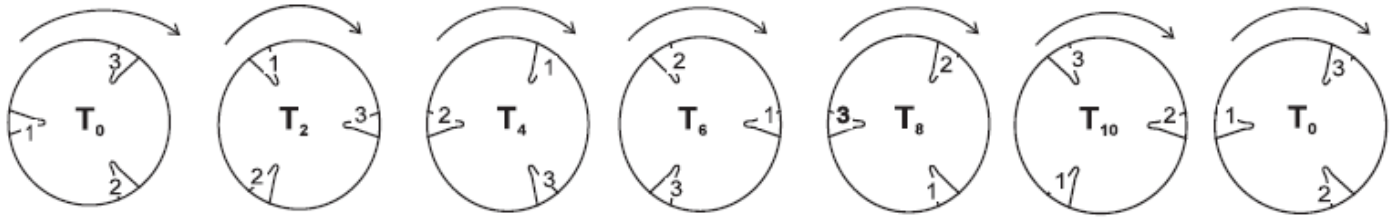
This sine wave indicates an imbalance, the high peak is between T_2 and T_4



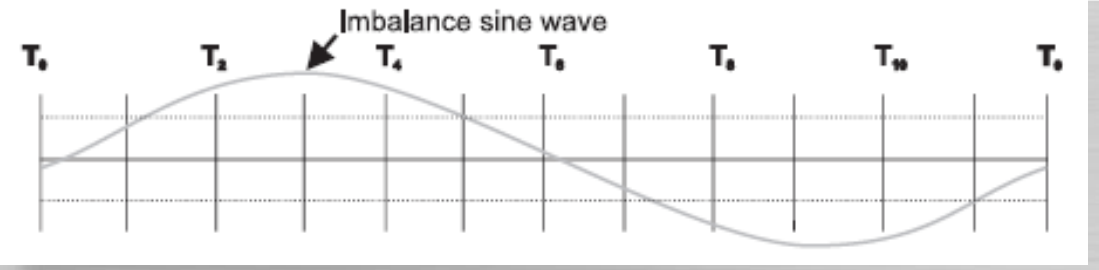
If the high peak occurs between:

T_0 and T_2	**T_2 and T_4**	T_4 and T_6	T_6 and T_8	T_8 and T_{10}	T_{10} and T_0
Then the imbalance is located between ribs:					
2 ↔ 3	**3 ↔ 1**	3 ↔ 1	1 ↔ 2	1 ↔ 2	2 ↔ 3
And the imbalance is closest to rib:					
3	**3**	1	1	2	2

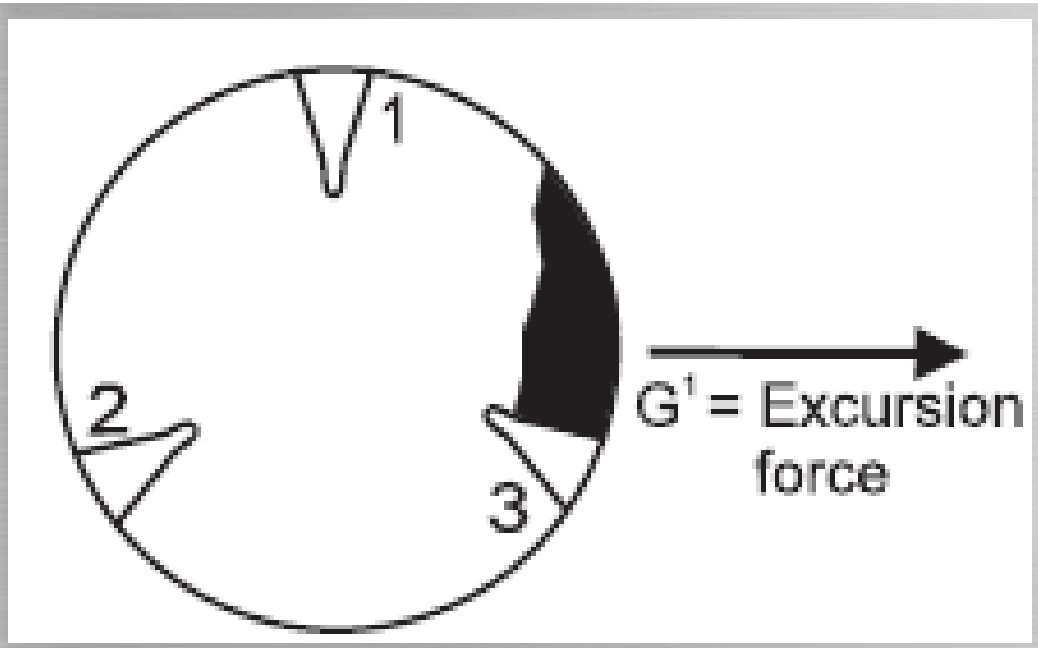
Cylinder position at:



Step Two—Cancel the Imbalance



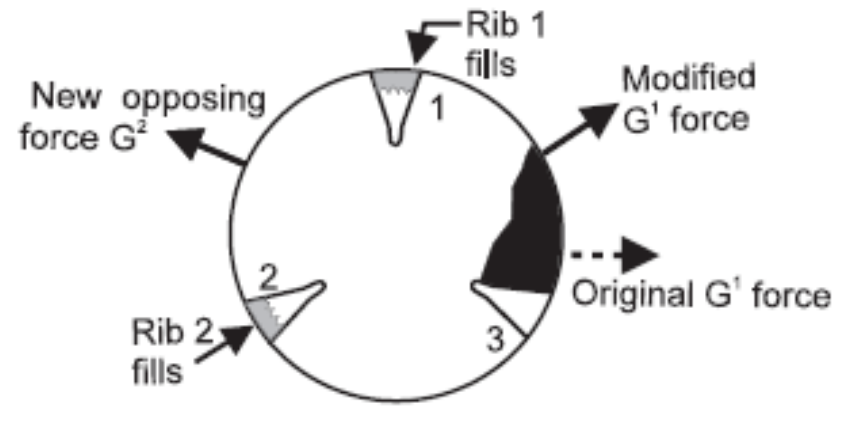
Imbalance exists between ribs 3 and 1, but closest to rib 3



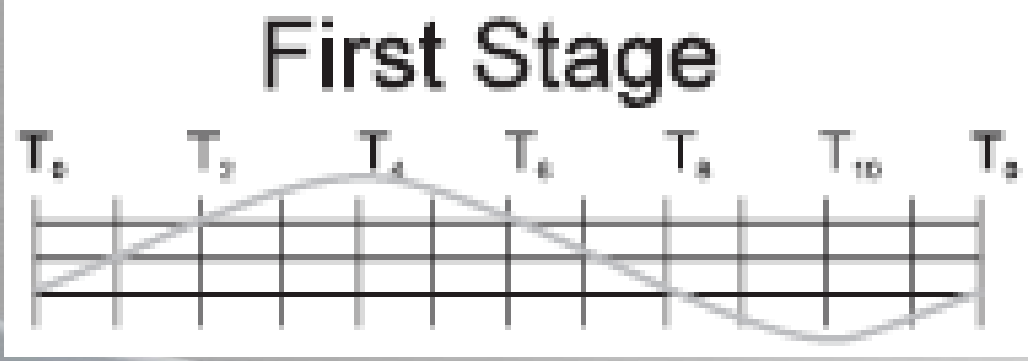
The maximum excursion force G^1 Occurs next to rib 3. Since no Counterbalancing rib is exactly Opposite the imbalance, an equal But opposite force must be moved to a point opposite G^1.

Step 2—Cancel the Imbalance

- Stage 1



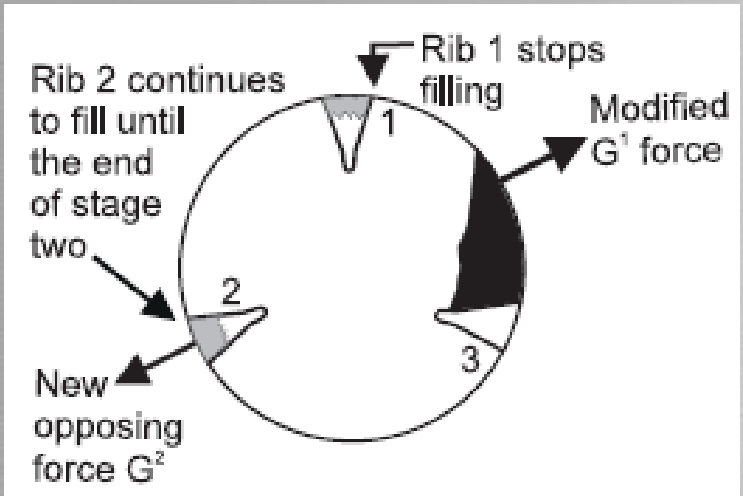
Initially water is added to ribs 1 and 2, creating a new opposing excursion force G^2. This new force modifies the vector of the original excursion force G^1. This new modified excursion force shifts opposite rib 2.



The new voltage sine wave shows that the imbalance excursion force vector has shifted to opposite rib 2.

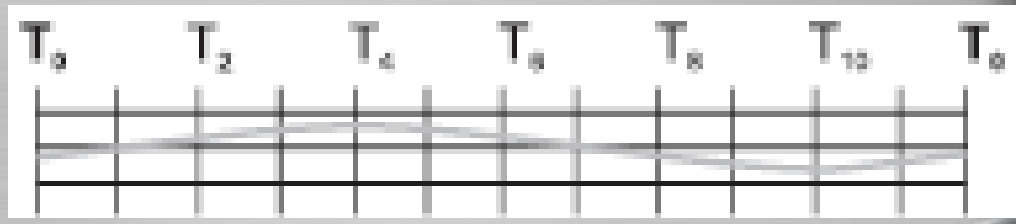
Step 2—Cancel the Imbalance

- Stage 2



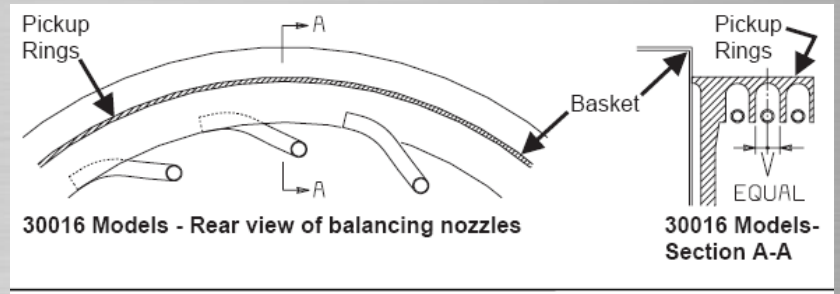
Rib 1 stops filling while rib 2 continues to fill. This results in moving the opposing G^2 force opposite the modified G^1 force. When the two forces equalize, it will reduce the cylinder shell front excursion, and the amplitude of the resulting accelerometer sine waves.

Water Valves shut off and the system monitors for any renewal of an out of balance condition.



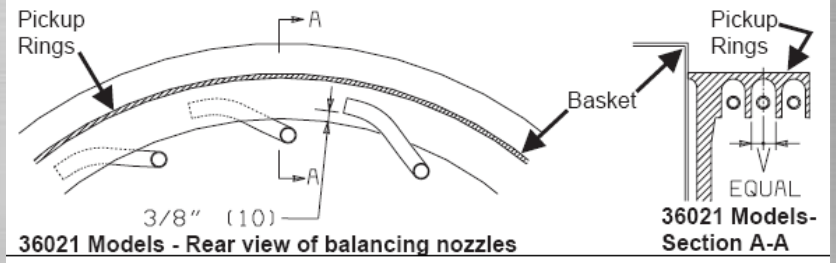
System Maintenance

- Cam Switches must be lubricated
- Belts must be tight but not banjo string tight
- Balance nozzles must be aimed
  - If not:
    - Could rub on the rings and sharpen the nozzle's edges
    - Water no longer flows into the rings evenly and splashes into a wrong ring.
- Water Pressure to the Valves
  - 28 psi
    - Set by Pressure Regulator on Electronic Balancing Models
- Proximity Switch
  - .187-.25" from Target Plate



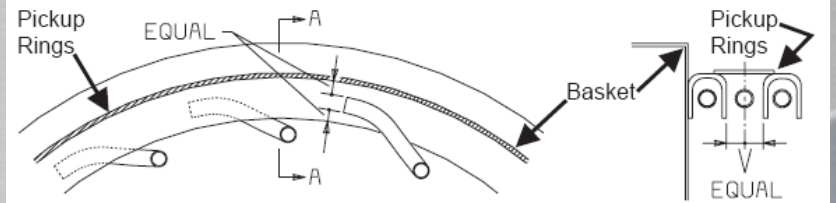
30016 Models - Rear view of balancing nozzles

30016 Models- Section A-A



36021 Models - Rear view of balancing nozzles

36021 Models- Section A-A

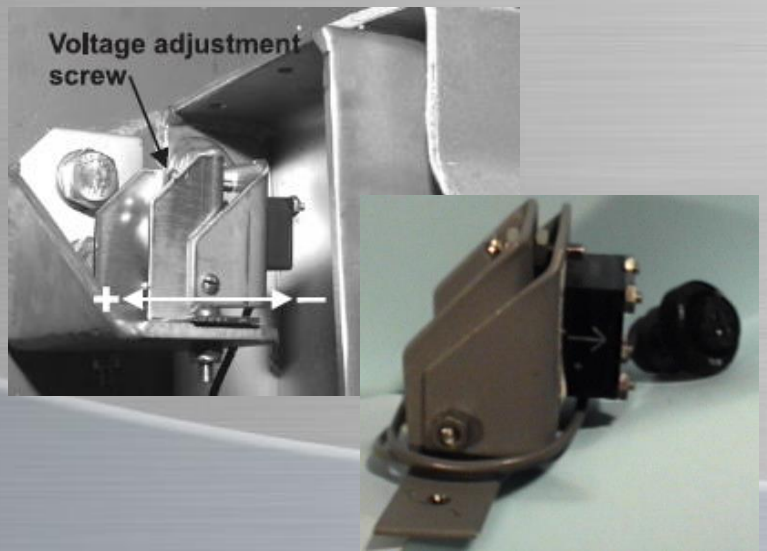


All Hydro-Cushion Models - Rear view of balancing nozzles (48032 shown)

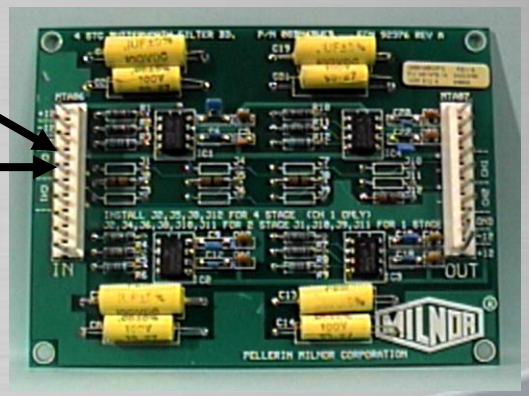
All Hydro-cushion Models - Section A-A (48032 shown)

System Maintenance

- Setting the Accelerometer
  - Done with shell front in the drain/extract position
  - Measure the accelerometer voltage at the Balance Filter Board 1MTA 86-4 to 1MTA 86-5
    - Nominal should be 2.3 - 2.5 vdc. The higher the voltage the more sensitive the circuit.
    - Outputs higher than 5 vdc indicate a defective unit.



2.3 – 2.5 vdc



Balancing System Status Panel

- Balance Excursion Lamp
  - Illuminates when 3-wire is energized
- Balancing Valve Lights
  - 3 lights will go On and Off with their respective balancing valves.
  - Should be Off once balancing is complete
  - Should not see all three lights lit at the same time.