#### Operation of the Float Tank and Dewatering System

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| Equipment Description | The Float Tank is a covered vessel used to store polymer for the transition from the batch coagulation process upstream to the continuous drying process downstream. Cuts (batches) from the coagulator are a mixture of polymer and water.  As the PTFE agglomerates are formed in the coagulator, they trap significant amounts of air inside the particles. This entrapped air allows the polymer (which is about twice as dense as water) to float.  “Sinkers” are polymer pieces that are no longer floating in the tank. They can be formed when large chunks of polymer are loosely stuck to the float tank, and to each other, and don’t have enough buoyancy to float. This type of “sinker” can usually be refloated, a process which consists of using a medium pressure cold demineralized water hose to break up the chunks into ones small enough to float. Sinkers are also formed when the floating agglomerates are agitated enough that the entrapped air escapes, this type of sinker material is unlikely to be refloated.  Air is bubbled into the bottom of the float tank to aid in floating the polymer, and bubbled from the sides to guide the polymer toward the middle. A skimmer (screw conveyor for line 1 and paddle conveyor for lines 2 & 3) moves the powder from the surface of the water to the narrowed, exit end of the float tank.  The wet powder drops into a dewatering screener, also known as a SWECO screener. The oversized powder is screened off (Line 1 and 3). The rest of the powder is screened for dewatering, and moves to a chute leading onto the oscillating feeder. The oscillating feeder also acts as a dewaterer, while distributing the powder evenly into the dryer. The dry finishing system starts at the discharge of the oscillating feeder.  A large valve empties a large volume of water from the float tank when a new cut is dropped to it. The water passes through a screen to prevent powder from entering the flotation tank separation tank (FTST).  The FTST separates any coagulated material, which may have bypassed the screen in the float tank, from water that contains surfactant and ammonium carbonate. This wastewater drains to the central sump and is pumped to the W9 wastewater treatment facility.  For the remainder of this operating direction, the use of # indicates a 1, 2 or 3 for the three float tank/FTST systems. |

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**Operation of the Float Tank and Dewatering System, Continued**

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| Manual Operation of Float Tank Air | A header supplies air to manual valves for sidestream flow. An automatic valve as listed below must be open before the sidestream manual valves will work.   |  |  | | --- | --- | | Unit | Valve | | 1 | 10218HV | | 2 | 99SV | | 3 | 449SV |   The manual valves should be adjusted so that as little air as possible is used to direct powder to the throat. See Figures 1 for the layout of the six air zones on lines 2 & 3 and Figure 2 for the Line 1 layout. |

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Operation of the Float Tank and Dewatering System, Continued

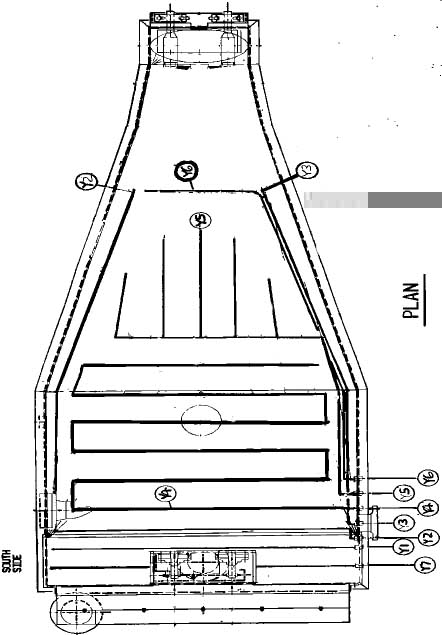
##### Figure 1: Lines 2 and 3 Float Tank Sparging Lines



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Operation of the Float Tank and Dewatering System, Continued

##### Figure 2: Lines 1 Float Tank Sparging Lines



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Operation of the Float Tank and Dewatering System, Continued

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| Coagulator Drop Timer Control | The DCS coagulator drop timer regulates how often cuts are dropped from the coagulator to the float tank.  The float tank provides important clues to how well the timer is set.   * If the setpoint is set too low,   + Then the float tank receives more powder than the dryer can take.   + As a result, polymer drops to the bottom of the float tank and cannot be easily recovered. These “sinkers” are sold as second quality product or scrapped.   + In extreme cases, the float tank will pack with polymer, leading to significant product loss because drums produced while the tank is packing have significant shear potential, and are generally not suitable for first quality customers. * If the setpoint is set too high,   + Bare spots develop in the dryer since the belt is moving faster than the powder is being delivered to it. Bare spots cause an uneven drying profile, which contributes to poor product quality and wet product. |

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| Float Tank Exhaust | To reduce the prevalence of pungent ammonium carbonate in the float tank area, each float tank has a vent stack line that ties into a common exhaust blower  This blower should always be on to help reduce personnel exposure to process chemicals.  Blower equipment number = 1540-1818-1760  Main Electrical Lockout = ECR 2 MCC 3  Unit Location = High Roof West of #1 Exhaust |

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| Float Tank Throat Sprays | In #3 Float Tank, the throat sprays are used to prevent sinkers at the throat as well as guide powder toward the dewatering screener. |

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Operation of the Float Tank and Dewatering System, Continued

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| Line 1 Float Tank Water Sprays | The line 1 float tank has three types of demineralized water sprays inside the vessel for contamination control.   1. At the four places where screw conveyor shafts pass through the tank wall via “lip seals”, small water sprays keep powder from accumulating around the shaft. These first sets of sprays are controlled with a manual valve located just above the oscillating feeder housing.    1. Once set, they should not require adjustment.    2. Dryer operator should check for operation of these sprays during normal field patrol. 2. There are ten water sprays located above and along the length of the screw conveyors. This set of sprays has a fixed spray angle that allows water spray to cover the entire exposed screw surface and prevent powder buildup. They remain on when the float tank is in operation. 3. A set of four sprays is intended for clean in place (abbreviated as C.I.P.). During transition cleanups, the C.I.P. sprays are valved in. They have the unique feature of a rotating head driven by water pressure with multiple spray nozzles such that water is sprayed around the float tank’s entire interior surface. |

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| **Automatic Operations Float Tank Level Control** | The float tank has two types of level control. In either type, level control is needed to prevent the water level from getting too high (which results in float tank overflow which in turn tends to plug the dewatering screener, and cause wet material) or too low (which results in inadequate skimming of the powder thus starving the dryer). Most of the time there is a normal level control algorithm which reacts to small changes in level and adjusts the drain valve or makeup valve accordingly. For a few seconds in each coagulator cycle, however, a much more drastic action is taken to maintain the desired control. This is required due to the large, but predictable, change in float tank contents when a drop is made from the coagulator. The effluent water passes through a screen to prevent coagulated material from entering the Flotation Tank Separation Tank (FTST).  A large discharge valve and piping are required to quickly empty a large volume of water from the float tank when a new cut is dropped to it. The Float Tank uses a 4” ball valve as a dump valve to remove water quickly (#1FT-10219HV, #2FT – 71HV, #3FT – 455HV).  A 4” control valve is used in tandem with the dump valve to control the level as closely as possible to the setpoint (#1FT – 10200LV1, #2FT – 71LV1, #3FT- 446LV1).  The float tank level control is a split range design. As the level controller output increases from 0% to 50%, the control drain valve changes from wide open to completely closed. As the controller output increases from 50% to 100%, the makeup water valve changes from completely closed to wide open. Therefore, both valves are shut with a controller output of 50%. |

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Operation of the Float Tank and Dewatering System, Continued

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| **Dryer Operator**  **Response to Packed Float Tank** | When a float tank becomes packed or the float tank throat is restricted causing powder to back up into the float tank chain, there is a high potential for product contamination (CQSI 38125 in year 2016) :   * Notify pack out operators that a float tank issue has been found and there is potential contamination in the product. * Notify pack out operators that they will be getting SECOND QUALITY material from that point forward so the powder involved in the cleaning of the float tank is made 2nd quality. * Estimate time float tank problem may have started and communicate to pack out operators so impacted material can be put on quality HOLD. (The pack out operator can put material ON HOLD by setting the LIMS flag “Finishing Process Standard” to “FAIL” for the impacted lots.) * Clean out float tank per procedure. * Have IVS clean the Float Tank chain if it cannot effectively be cleaned with water hose.   Once the float tank system is ready for good material,  Notify pack out operators that FIRST QUALITY material is about to resume following a bare spot.   1. Please note the time of the float tank issue, and when first quality material was resumed in the dryer log to aid in investigation. 2. Initiate a QVR. |

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| **Automatic Operations Float Tank Separation Tank (FTST)** | **Normal Operation**  The effluent water from the Float Tank drains to the Separation tank (FTST), this water then gravity drains to the GenX sump between #2 and #3 Dryers, and is screened for excess powder before being pumped by (2) 3” Wilden pumps to the W9 Line 2 facility.  For products with high surfactant or solids  If the effluent is unsuitable for W9 Line 2, the water may be diverted to the inside Supernate sump in the SE corner of the Dryer room. This takes the effluent to W9 Line 1, which can handle higher surfactant and solids load. This path requires the use of 2” Wilden pumps, controlled by the DCS by selecting W9 Line 1 from the dropdown menu on the #1, 2, or 3 Float Tank DCS screen, which kick on and off based on the tunable separation tank levels. Tubing can be attached to the pump outlet and hung overhead with zip ties to feed into the sump while keeping walkways clear of obstacles. With this setup, it is important to regularly check the tubing for wear near the zip ties and plugging. |

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Operation of the Float Tank and Dewatering System, Continued

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| **Automatic Operations Float Tank Separation Tank (FTST)**  **(Continued)** | **Normal Operation, Continued**  Further, dispersion operators should be notified to monitor sump levels and perform a hot water flush as needed to prevent and dislodge obstructions in the sump from solids buildup.  Please note that while feeding to W9 Line 1 can offer short term relief to W9 Line 2 upsets, it should be treated as a last resort as it leads to reduction in carbon bed life and in surfactant recovered. Contact Technical or the FLS for further guidance when feeding to W9 Line 1.  In either mode, a high level in the separation tank will close the Float Tank drop valves to prevent a separation tank overflow. Persistent high levels will even prevent subsequent coagulator drops to prevent surfactant containing water from overflowing onto the floor.  **Divert #1 Float Tank**  Normal process configuration can divert all three float tanks to W9 Line 1 sump. It may be necessary during the production of RMS516s to drain the effluent water from only Float Tank #1, to the Line 1 basin.   1. Water flow from Float Tank #1 will need to be closed to W9 Line 2. 2. Attach a hose to the drain valve from tank. Valve should only be opened after hose has been routed to the Line 1 basin sump. 3. Change SEP TANK DESTINATION from W9 LINE 2 to W9 LINE 1 on No. 1 Float Tank DCS screen. 4. Once 516 campaign has been finished or it is determined W9 can operate efficiently, valve positions should be returned to normal and drain hose removed. SEP TANK DESTINATION needs to be returned to W9 LINE 2 on DCS. |

*End of topic*

**Operation of the Sweco Dewatering Screener**

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| Operation of Sweco Dewatering Screener | Maintain the Sweco screener (aka dynascreener) in a plug free and shearing free state. This is key to prevent polymer shearing and scrap material.  **Startup:** Prior to starting a campaign, inspect the screener. It should be clean and assembled correctly.  **Field Check:** Field check the SWECO every 2 hours for blinding or fouling during operation.   * Use the two ports on the screener to inspect for buildup. * Check the oversize boot and oversize flow. No powder flow to the oversize drum suggests it is plugged. Check the boot, pipe and screener nozzle. High powder flow to the oversize drum suggests the screen is fouled. * Check the float tank throat to the Sweco is not plugged * Check flow to the oscillating feeder and coagulator conditions. * Check the SWECO vibration settings. * Check for large, chunky material in front of the bed leveler. This is an indication the screener may have a problem.   If needed, clean the SWECO during operation with cold water. Do not clean with hot water while operating, this causes powder to stick, and can accelerate screener plugs.  **Camera Monitoring**: Monitor the camera – this is not a substitute for field checks   * Regularly watch for large, chunky material in front of the bed leveler. This is an indication the screener may have a problem. |

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| Dryer Operator Response to Plug or Restriction | When Sweco screener (dynascreener) plug/restriction is found:   * Notify packout operators a plug was just found. * Notify packout operators that they will be getting SECOND QUALITY material from that point so the powder involved in the cleaning is made 2nd quality. * Clean the Sweco screener of any sheared material. At this same time, refloat sinkers, clean the oscillating feeder screen and bed leveler so the system starts up clean.   Once the dewatering system is ready for good material,  Notify packout operators that FIRST QUALITY material is about to resume.   1. Please note the time of the screen plug, and when first quality material was resumed in the electronic lots to aid in investigation. 2. Initiate material disposition 3. Contact Packout Operators 4. Request the LIMS flag “Finishing Process Standard” be set to “FAIL” for the prior 100 drums. Prior quality events have involved up to 100 drums. This does not mean 100 drums will be made second quality, but it places it on hold for disposition by a quality resource. |

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Operation of the **Sweco Dewatering Screener**, **Continued**

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| Clean the SWECO Screener | Prepare the clean by:   * Lock out the SWECO screener – isolate energy * Put on the required PPE per the PPE matrix |
|  | |  |  | | --- | --- | | **Step** | **Description** | | 1 | Loosen the quick-release clamp rings and remove spacing frames. | | 2 | Remove screens | | 3 | Clean screens with hot water – until the inner surface of the SWECO and screens have no visible residue | | 4 | Clean the inlet boot and chute from the Float Tank | | 5 | Clean the SWECO discharges – boot and the chute | | 6 | Replace screens, right side up (top hat up) | | 7 | Align the product spout, the water drain and oversize spout (Line 1 and 3) | | 8 | Reclamp quick-release clamp ring holders | |

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|  | Unlock the SWECO – the equipment will cool down while performing lockout.  Restart the system and observe operation upon startup and initial operation.  *Continued on next page* |

Operation of the **Sweco Dewatering Screener**, **Continued**

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| Assemble the SWECO Screener | Prepare to assemble the Sweco Screener by:   * Verifying the lock out of the SWECO screener – isolate energy * Put on the required PPE per the PPE matrix  |  |  | | --- | --- | | **Step** | **Description** | | 1 | Install the bottom Spacer Ring and position the water discharge spout. | | 2 | Install the bottom dewatering screen with the small 80 mesh screen with the screen oriented “top hat up”.  20181108_133128  Figure : Dewatering Screen - small mesh  20181108_133136001002003  Figure : Dewatering Screen - top hat up | | 3 | Install the middle spacer ring with the product discharge spout positioned into the dryer inlet. |   *Continued on next page* |

Operation of the **Sweco Dewatering Screener**, **Continued**

**Assemble the SWECO Screener, Continued**

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|  | |  |  | | --- | --- | | 4 | Install the oversize larger mesh screen (Dryer 1 & 3 only).  20181108_133102  Figure 3: Oversize Screen -larger mesh  20181108_133108  Figure 4: Oversize Screen – top hat up | | 5 | Install the top spacer ring with the oversized discharge spout positioned over the oversize drum. | | 6 | Install the lid with inlet spout. | | 7 | Reclamp quick-release clamp ring holders |   *Continued on next page* |

Operation of the **Sweco Dewatering Screener**, **Continued**

**Assemble the SWECO Screener, Continued**

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|  | |  |  | | --- | --- | | 8  **Product Discharge to Dryer** | The completed assembly should resemble the graphic below. Except for dryer 2 which does not contain an oversize screen or oversize spout.    **Lid**  **Dewatering Screen**  **Oversize Screen**  **Dewatering Spout**  **Oversize Spout** | | 9 | Unlock the SWECO and restart the system and observe operation upon startup and initial operation. | |

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Operation of the Sweco Dewatering Screener, Continued

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| Dewatering Screener Diagram | Polymer feeds the SWECO dewatering screener from the float tank.  A large mesh screen removes any oversize material on line 1 and 3. Oversize on line 2 travels through the Dryer and is screened in the Packout chute.  The powder vibrates on top of an 80-mesh screen before being transferred to the oscillating feeder. The SWECO removes about 50 pph (lbs/hr) of water during normal operation.  The Sweco screener is a screening device that vibrates about its center of mass. Vibration is accomplished by eccentric weights on the upper and lower ends of the motion-generator shaft. A diagram of an example unit is shown below: (all 3 Sweco screeners are slightly different from line to line because of the units’ age)    Rotation of the top weight creates vibration in the horizontal plane, which causes material to move across the screen to the periphery. The lower weight acts to tilt the machine, causing vibration in the vertical and tangential planes. |

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Operation of the **Sweco Dewatering Screener**, **Continued**

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| Dewatering Screener Line 1 Weight Settings | The speed and spiral pattern of material travel over the screen can be set by for maximum throughput and screening efficiency.  A larger view of the pair of weights is shown below. The position of the pair of weights has been optimized for Line 1 to minimize the amount of standard powder that travels out the oversize chute.  http://prodimages.vertmarkets.com/image/9003df42/9003df42-6561-42f3-9bfd-24d3578f04bf/original/i_300_fw.gif  Figure 3. Example of Lead angle adjustment (gold wheel) and top force wheel (gray wheel)  Lead angles on the gold lead angle adjustment wheel range from 0 to 350°. Note how the slots range the full circle. Settings for this screener are:   |  |  |  | | --- | --- | --- | | Setting | Description | When Used | | 6-70-6 | One weight is placed 6 spaces to the left and the other 6 spaces to the right of the lead angle of 60°. This was the as found condition during the 9/1/13 vendor visit and results in heavy oversize production. | Setting used prior to 9/1/13. | | 2-60-2 | One weight is placed 2 spaces to the left and the other 2 spaces to the right of the lead angle of 60°. This is an alternative setting offered by the vendor. | Alternative setting suggested by vendor on 9/1/13. | | 4-70-4 | One weight is placed 4 spaces to the left and the other 4 spaces to the right of the lead angle of 70°. This gave good vertical and horizontal amplitude for the desired separation. | Optimized setting on RMS137S from 9/1/13. | | 6-40-4 | One weight was placed 6 spaces to the left and the other 3 spaces to the right of the lead angle of 40°. This may explain too much small material discharged as oversize. | As found setting on 9/29/14 | | 3-60-3 | One weight is placed 3 spaces to the left and the other 3 spaces to the right of the lead angle of 60°. This is expected to provide more vertical amplitude to break clumps and reduce horizontal motion so small material is not thrown out the oversize. | Optimized setting on RMS137S from 9/29/14. | |

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Operation of the **Sweco Dewatering Screener**, **Continued**

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| Dewatering Screener Line 1 Weight Settings (Continued) | Maintaining optimized settings is important to prevent overloading the oversize. Excess oversize can plug the oversize discharge line, and backup into the screener leading to sheared, unusable polymer.  The higher the lead angle the longer the material will stay on the screen surface. The lower the lead angle (say 30 degrees) the quicker the oversize will move towards the outer frame wall (think centrifugal force).  The higher the lead angle (say 100 degrees) the more spiral the material will travel before it reaches the outside frame wall. The optimal lead angle for dewatering material is 60º. |

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| Screener Amplitude Stickers (Checking Vibration) | Vibration decals are located on the external frames of the two machines.  These can be found on many of our vibrating pieces of equipment.  Each decal (sticker) has two triangles on each sticker.  One is for the vertical amplitude one is for the horizontal amplitude.  There is number labeled 1 2 3 & 4 above the triangle and this is in increments in 1/16”.  Locate your eyes completely level with the sticker and obtain readings for the vertical and horizontal amplitudes on the unit measured in 1/16”.  If you see the two lines cross on the “Vertical Amplitude” portion of the sticker at the number 2, you would know that there is 1/8” vertical amplitude.  These stickers are good indicators of vibration without having to access the plates.  The amplitude is how high and far particles are thrown, which transfers to how fast the material moves on the screen surface.  The higher material is thrown (vertical amplitude) and the longer it is thrown (horizontal amplitude) then the quicker it will reach the discharge spout.  The closer the two weights are moved together then the higher the central mass and therefore the higher the throw/amplitude/conveyance. |

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Operation of the **Sweco Dewatering Screener**, **Continued**

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| Dynascreener PowerIndicators | The dynascreener occasionally plugs and restrictions have been the cause of multiple customer complaints. These events cause shearing of polymer that is often not detected by coconut count. The dynascreener power indicators have proven effective at flagging at least some of these plugs/restrictions. The power drawn by the dynascreeners can be monitored via IP.21 tags. An alarm will sound indicating a possible plug or restriction in the dynascreener when the 5-minute moving average of the power drawn is greater than setpoint and the screener motor has been on for 20 minutes or more.  See below:     |  |  |  | | --- | --- | --- | | Dynascreener | IP.21 Tag | Alarm Set Point | | #1 | 10211XG.PV | 0.18 | | #2 | 53XG.PV | 0.20 | | #3 | 416XG.PV | 0.25 |   When this alarm sounds, the operator should inspect and clean the dynascreener. |

End of topic

#### Operation of the Oscillating Feeder and Bed Leveler

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| Equipment Description | The oscillating feeder is a vibrating screen that oscillates back and forth distributing polymer across the width of the dryer conveyor belt. The PEEK belt covers the perforated metal belt to keep the polymer from passing through, yet allowing adequate airflow to dry the powder. The PEEK belt provides a clean surface on which the polymer is conveyed slowly through the drying and cooling sections. The oscillating feeder screen also acts as a dewaterer. The resin is leveled to a uniform height by the bed leveler (paddle wheel assembly) in each dryer. The height of the bed is adjustable by a ratchet system holding the bed leveler on either side of the dryer.  **On Dryer 1:**  The size of the pile presented to the bed leveler is controlled by a feed control loop.  This loop consists of capacitance probes, a laser, and DCS logic.  The laser detects the powder height, and drives to maintain a level between the (tunable) low and high setpoints by speeding or slowing the float tank screw speed. When the laser shows the powder pile dropping, it increases the float tank skimmer speed (up to a tunable upper speed limit) to bring more powder to the belt.  To prevent an overload of powder to the belt, if the capacitance probes read a high level for 30 seconds, this shuts off the oscillating feeder vibration and the Sweco screener vibration, halting powder flow to the belt. These capacitance probes have an adjustable sensitivity setting in the field, which can vary the maximum shutoff powder height if it is changed. The probe sensitivity can also be altered when powder sticks to the probe, or with increased water content in the powder.  **On Dryers 2 and 3:**  The size of the pile presented to the bed leveler is controlled by an on/off signal from the capacitance probes.  To prevent an overload of powder to the belt, if the capacitance probes read a high level for 30 seconds, this shuts off the oscillating feeder vibration and the Sweco screener vibration, halting powder flow to the belt. When the level drops below the capacitance probe sensitivity level, the feed system resumes, bringing powder to the belt.  These capacitance probes have an adjustable sensitivity setting in the field, which can vary the maximum shutoff powder height if it is changed. The probe sensitivity can also be altered when powder sticks to the probe, or with increased water content in the powder. |

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**Operation of the Oscillating Feeder and Bed Leveler, Continued**

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| Adjusting the Oscillating Feeder | The width of the powder on the belt is controlled by the width of the feeder swing.  Adjustments to the East-West swing of the oscillating feeder can be made on the South side of the feeder (by opening the South doghouse feeder doors). To adjust the width of the feeder swing on the East side, one should change the West side adjustor.  The hydraulic pump controls the speed of the arm swing. The SOC’s in Sect. 4.E give guidelines as to settings. Wet resin can occur if feeder is not adjusted properly.  Adjust oscillator speed with flow control valve on hydraulic unit. Speed adjustment can be made while running. (This adjustment should only be required after replacement of hydraulic parts.)  Move the air clamp to ON. Air clamps holding the screen to the vibrator are interlocked with the vibrator motor through a pressure switch. Motor will not run unless feeder is clamped  **Additional information regarding these pieces of equipment and how to troubleshoot them can be found in Section 8.B, Troubleshooting Guide.** |

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| Interlocks and Safety | Feeder compartment door switches are software interlocked to stop the Oscillating Feeder when the door is opened. This stops the feeder oscillation by closing an automatic block valve in the hydraulic supply to the feeder. This interlock also stops the Oscillating Feeder Vibrating Conveyor, the SWECO Dewatering Screener and the FT Skimmer.  The hydraulic supply manual block valve for the Oscillating Feeder must be Lock, Tag and Tried when removing the feeder screen for cleaning. NOTE: WHEN THE HYDRAULIC SUPPLY PUMP THAT PROVIDES POWER TO THE OSCILLATING FEEDER AND THE BELT TENSIONER IS TURNED OFF, THE DRYER BELT WILL INTERLOCK DOWN BECAUSE TENSION TO THE PEEK BELT IS LOST.  Lock and Tag close the Oscillating Feeder manual block valve when running the dryer metal belt with the hydraulic supply pump running when it is necessary to positively prevent movement of the Oscillating Feeder (for example, when personnel are in the feeder compartment high pressure cleaning the metal belt). |

End of topic