Instructions for Use of ARS-1 Experimental Packing Line

The packing line consists of five independent functional units:
1. Dump tank
2. Brush bed
3. Dryer
4. Aweta sorter
5. Hot water heater

Each unit may be used alone or in concert with other units in line as needed. These instructions describe the use of the packing line in general and the operation of each independent unit in detail.

General Procedure

Safety First!
- You must have Lock out/Tag out training prior to using the packingline. Please call Dick Bishop (663-8181 ext 240) several days prior to arrange training.
- Because there is no phone in ARS-1, you must provide your own cell phone in case of emergency.
- Emergency numbers:
  - Fire or ambulance 911
  - WSU 663-8181 ext 0 (front desk), x247 (postharvest), or x239 (Gene Kupferman)
  - USDA 664-2280 ext 261 or 257 (front desk)
- Walk along the entire line checking for safety hazards. Make sure nothing is lying on the brush beds and that no equipment is stored under the line
- Water and electricity do not mix. Keep electrical cords for pumps or other external equipment off the floor.
- The floor around and near the line will get wet if the brush bed or dump tank is used. Use the squeegee to remove excess water to the floor drain to minimize slipping.
- Most moving parts (chains, sprockets, conveyors) are shielded but are accessible. Keep hands and loose clothing away.
- Turn the conveyor belt OFF before reaching over the guard to retrieve fruit
- Turn the main power OFF prior to performing maintenance, resolving equipment problems or looking for lost fruit.
- Become aware of the location of the emergency stop switches for the brush bed, dryer conveyor and sorter units.
- Do not operate any potentially hazardous machinery alone.
Power and Setup
The main power switch (press green START button) is located on the north wall near the dump tank. This switch supplies power to each of the units and the electrical outlets above the line.

Each unit (dump tank, brush bed, dryer, sorter and hot water heater) is also independently powered so units may be switched on as needed.

Be sure to switch off each unit when finished and prior to turning off the main power so the next user isn’t surprised by moving equipment.

Dump Tank

Drencher
There is a PVC drencher available to drench bins over the dump tank. If the drencher is attached to the tank and you do not want to use it, please call the Postharvest Lab (663-8181 ext247) to have it removed.

Filling
Before filling the dump tank, check that the drain valve and the metal gate (both on the south side of the tank are closed).

The dump tank is filled from a hose fitting located on the west side of the elevator. Timing for tank filling with normal water pressure should be about 45 minutes. The volume of water in the tank is approximately 15.6 gal/in., or 6.4 inches = 100 gallons.

Fill to the top of the main portion of the tank.
**Bin Hoist:**
The power switch for the bin hoist is on the north-east corner of the bin. Pull lever adjacent to power switch toward you to bring the bin loader to its highest position.

Load bin making sure it will clear the side of the tank.

Slowly lower the bin using the lever.
Too fast a dump and you will overfill the system.

Use the pump (switch located between tank and elevator on the east side of the tank) to move fruit to the elevator as needed. Water levels change the effectiveness of the pump for moving fruit. Do not overfill the elevator with fruit, as the brush line will then become overfilled.

**Emptying the Dump Tank:**
Using the blue 2” hose connected to the drain valve drain over the side of the North side concrete pad. The remaining few inches of water can be dumped by removing the gate from the base of the bank. The final inch of water needs to be removed manually using the floor squeegee.

Please contact Steve Raymond, USDA (664-2280 x237) or Robin Boal, WSU-TFREC Pathology (663-8181 x228) if you have questions about the dump tank.

**Brush Bed**

*Equipment needed:*
(1) 100-foot hose to drain the rinse water collection tank.
(2) 50-foot hoses if using the warm water rinse.
(1) 10-foot hose if using the cold water rinse.
(1) soap pump and bar if washing the fruit.
Your chemicals clearly labeled with name and date.
**Brush Bed Basics**

The brush bed consists of two unique brush segments, the washing/rinsing brush bed and the waxing brush bed.

- The poly washing brushes are available in three different grades of stiffness and will rotate alternately at variable speeds. The speed controller for the brush bed is located on the west side of the line.
- There are four sets of horsehair brushes that can be used in the wax bed. These are labeled and segregated by wax type.
- If there are horsehair brushes in the wax section, and you are NOT waxing the fruit, please put in poly brushes (buff) which are more robust and do not require a warm water rinse.
- If you need the brushes changed, please call the Postharvest Lab (663-8181 ext 247).

Fruit will not move through the line independently. Use the small squeegee to gently push fruit through the packing line.

**Power and Speed**

The power switch for the brush bed is located on the outside of the brush speed controller (west side of the line). Pull the green knob switch out to start the brushes rotating and push in to stop (circled in photo). The emergency stop for the brush bed must also be pulled out for line to operate.

Lift the controller cover to record the brush speed (Hz) for the fast brushes (left), slow brushes (middle) and the horsehair wax brushes (right).
The speed of the brushes can be adjusted using knobs on the south side of the controller case (see top right photo). Brush set 1 is the fast brushes and set 2 is the slow brushes.

Brush speeds and corresponding revolutions per minute are shown in the following table:

<table>
<thead>
<tr>
<th>Brush set</th>
<th>Hz</th>
<th>rpm</th>
<th>Brush set</th>
<th>Hz</th>
<th>rpm</th>
<th>Brush set</th>
<th>Hz</th>
<th>rpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1=Fast</td>
<td>60 (100%)</td>
<td>192</td>
<td>No. 2=Slow</td>
<td>45 (75%)</td>
<td>144</td>
<td>Wax</td>
<td>45</td>
<td>86.3</td>
</tr>
<tr>
<td>45 (75%)</td>
<td>192</td>
<td>144</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 (50%)</td>
<td>96</td>
<td>60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60 58 115</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

An EMERGENCY STOP switch for the brush bed is located on the control panel on the front of the packingline. Push the red button to stop the brushes and pull to restart (see photo).

Both the green brush bed switch on the back of the packingline and the red emergency stop switch must be pulled out for the line to operate.

**Washing**

The soap bar and pump are located near the dump tank and will deliver premixed soap concentrations at a variable rate. The pump and bar belong to the WSU-TFREC Postharvest lab and may be checked out for use by other groups.

Plug the soap pump into the covered GFCI outlet on the east side of the dump tank. When finished, pump clean water through the soap bar until it runs clear. Rinse the brush bed with cold water until water runs clear.

**Rinsing**

The rinse bar can be connected to either warm or cold water using hoses. The cold water spigot is located near the west wall adjacent to the bed. To use warm water, see the Hot Water Heater section or contact WSU TFREC postharvest to set up the water heater and trough. Allow 4 hours heating time (or overnight) to warm up water for a warm rinse.

The gray 50-ft hose has an in-line valve so that the rinse water flow can be controlled from the front side of the packingline.
Wash and rinse water flow to a catch basin under the brush bed. To pump out the water, string the 100-foot hose out the door and into the orchard, then plug in the submersible wastewater pump (see photo). The pump will cycle on as the water level rises in the tank. After the pump has pumped out most of the water and shut off, unplug the pump and drain the remaining water by opening the drain door on the side of basin.

**Waxing**

The resident wax pump and wig-wag disperser are controlled by switches on the east side of the bed near the dryer. Set the pump switch to “REV” to pump wax to the wigwag. The wax pump rate can be varied from 1 to 10 (low to high). A setting of 2 to 3 works well for most applications.

After packing, clear out remaining wax from the lines by setting pump switch to “FOR” and turning the speed up to 10. Then reverse the switch and run warm water through the pump line and wig-wag to remove residual wax. Rinse the horsehair wax brushes with warm water (90 to 105 °F) for at least 15 minutes until water runs clear. Leave brush bed power on and spin dry the brushes for at least 15 minutes.

There are four sets of wax brushes available for use, color coded as follows:

- Black—Water only, no wax
- White—Carnauba wax
- Blue—Shellac wax
- Red—Wax plus fungicide

You must contact the WSU-TFREC Postharvest Lab (663-8181 x247) to change wax brushes.

**Brush Bed Checklist**

1. Brushes in place and speed adjusted
2. Hoses in place (wastewater pump, rinse water, other water hoses as needed)
3. Water on
4. Soap pump primed and powered
5. Wax pump primed and powered
6. Wigwag switched on
7. All hands/objects clear of bed
8. Turn on brush bed

**Dryer**

Dryer switches are located on the control panel on the east side of the packingline. To use the dryer:

- Turn conveyor switch ON
- Press START to turn blower ON
- Turn heater control ON
- Adjust heater to desired temperature.

There are two removable doors on the outside of the dryer that can be removed for access to the conveyor.
Before reaching into dryer or over the guard at the end of the conveyor to retrieve fruit, you MUST TURN the conveyor OFF.

**Aweta Sorter**

The Aweta sorter is controlled by a PC, which can be used to sort fruit by size and color. To turn on the Aweta sorter:

- Turn the PC and monitor ON and press F1 at the DOS prompt to complete boot
- 1. Go around the west side of the sorter and turn the main power lever ON (lever up)
- 2. On the south side of the Aweta control box, turn the power switch up (12 o’clock)
- 3. Press the green button to turn the camera ON

Load your grader and sorter programs to the Aweta by using the AWESORT program on the PC.

- To set up a customized grader program, please contact Marc Dilley (663-8181 x227).
- To drop all fruit to table 2 (not sorting by size and color), load Nancy2 for the grader program and NancyB for the camera program.
- To do fruit counts and weight, see the detailed instructions below.

The camera must warm up for 2 minutes before the Aweta unit will work. Pull the black cord on the front of the Aweta unit to turn the line on and off.

The switch to rotate the sorter tables is on the front (east) side of the packingline to the right of the first drop and is labeled “tables.”
AWETA Computer Program: For Fruit Count and Weight

1. Turn on camera before starting program (see instructions and photos above). The camera needs to warm up for a few minutes before starting the program.
2. Start AWETA program (double-click on Awesort icon)
3. Set up programs: For Pathology Fruit Rot Runs: to have fruit number, fruit weight, and fruit returned to a bin located before the sorting tables use the following programs:
   a. Grade Program – 50 = Peter Pears
   b. Camera Program – 24 MAD Fuji
4. Use the following keystroke sequence between each bin to label each data set and re-set fruit count and fruit weight
   a. Escape
   b. Print – No
   c. F7
   d. Enter
   e. Change Treatment label (example Scholar 4-1)
   f. If needed change main label for experiment
   g. Enter
   h. Escape
   i. No (to set programs - except first time in morning to set the programs as listed above)
   j. Lot Exchange – Yes
   k. F9
   l. This should give you a refreshed screen with 0 for fruit count and 0 for fruit weight.
Hot Water Heater

The hot water is currently located on the east side of the building. Because there is no water piped to that side of the building, hoses must be used to get cold water to and warm water from the tank. The tank takes several hours to heat up, so the following may be set up the night before:

- Fill the trough with cold water using the green 50-ft hose
- Open the valve on the manifold to recirculate water back to the trough (no. 1 in photo)
- Turn the pump and heater switches ON (no. 2 in photo)
- If the water does not start recirculating back to the trough within 1 to 2 minutes, raise the recirculating pump (no. 3 in photo) and hose to work air bubble out of system
- Adjust the temperature of the water using the digital controls and instructions posted on the wall next to the heater. Temperature can be displayed in either °F or °C. You will lose up to 5 °F in cold weather through the hose, so adjust temperature accordingly.

On packing day, the goal is to keep the water in the trough warm so that the hot water heater can keep up with the demand. The trough is insulated and has an insulated cover, use these to keep the water warm. To connect warm water to the rinse bar:

- Connect the gray 50-ft hose to the hose manifold (no. 1 in photo) and open valve
- Leave the recirculating valve open approximately half way so that warm water continues to recirculate into the trough
- Connect the gray hose to the short green hose which is connected to the rinse bar
- Use the valve connector from the gray hose to green hose to control the flow of rinse water.
- Keep a constant slow supply of cold water running to the trough through the green hose to keep the water level in the trough near the top.