

Functional Description of the Equipment Modules comprising the VFFS machine example

The Vertical Form, Fill & Seal machine that is the basis of this example is made up of three primary equipment modules (EM). These include weigh scale, bag feed, and sealer/cutter. The unit operations associated with each of these are listed below. A detailed listing of operations for the sealer/cutter based on PackML Machine States is listed as well.

Weigh Scale

1. Verify initial weight (Tare) and gate conditions as compared to control set points.
2. Start material feed (conveyor?).
3. Open in-feed gate.
4. Compare weight to target set point.
5. Close in-feed gate.
6. Stop material feed.
7. Open dump gate.
8. Close dump gate.
9. Confirm ready state for step advance.

Bag Feed

1. Verify conditions as compared to control set points (temperature, interlocks, etc.)
2. Feed bagging material to former.
3. Index feed rollers (left and right servos).
4. Confirm ready state for step advance.

Sealer/Cutter

1. Verify conditions as compared to control set points
2. Apply seal platens via left and right servos.
3. Activate cutter (if separate operation from sealing).
4. Deactivate cutter (if separate operation from sealing).
5. Withdraw seal platens via left and right servos.
6. Repeat cycle pending state change.

Sealer/Cutter per PackML Machine State Model

“Stopped” State

1. Compare shutdown conditions to actual conditions.
2. Left and right servos are held in “safe” position.
3. Temperature controller output for heating seal platens is off.

“Starting” State

1. Compare shutdown conditions to actual conditions.
2. Interrogate all sealer/cutter machine safeguards confirming safe condition.
3. Temperature controller for heating seal platens is turned on.
4. Platens are heated to and held at temperature set point.
5. Left and right servos are initialized and held in “safe” position.
6. Material jam sensor is interrogated.
7. Compare shutdown conditions to actual conditions.
8. Provide ready condition signal to controller.

“Ready” State

1. Compare shutdown conditions to actual conditions.
2. Maintain temperature set point on seal platens.
3. Hold servos in “safe” position.
4. Await state change command.

“Standby” State

1. Compare shutdown conditions to actual conditions.
2. Maintain temperature set point on seal platens.
3. Hold servos in “safe” position.

“Producing” State

1. Compare shutdown conditions to actual conditions.
2. Maintain temperature set point on seal platens.
3. Interrogate sensor to confirm presence of filled bag.
4. Apply seal platens via left and right servo.
5. Activate cutter (if separate operation from sealing).
6. Deactivate cutter (if separate operation from sealing).
7. Withdraw seal platens by returning left and right servos to “safe” position.
8. Interrogate sensors to confirm completion of cut.
9. Signal step advance to Weigh Scale and Bag Feed modules.
10. Repeat cycle pending state change.

“Holding” State

1. Compare shutdown conditions to actual conditions.
2. Left and right servos are moved to “safe” position.
3. Provide Held condition signal to controller.

“Held” State

1. Compare shutdown conditions to actual conditions.
2. Left and right servos are held at “safe” position.
3. Maintain temperature set point on seal platens.
4. Await state change command.

“Stopping” State

1. Compare shutdown conditions to actual conditions.
2. Left and right servos are returned to “safe” position.
3. Temperature controller output for heating seal platens is turned off.
4. Provide Stopped condition signal to controller.

“Aborting” State

1. Left and right servos are returned to “safe” position.
2. Output is removed from temperature controller.
3. Advance to Aborted state

“Aborted” State

1. Left and right servos are held in “safe” position.
2. Output from temperature controller is maintained off.
3. Await Stop command to advance to Stopped state.