FAT/SAT Requirements Document – Dispensing Machines

1. **Objective**

Define the acceptance test procedures and success criteria for:

* FAT (Factory Acceptance Test) – performed at the supplier's site
* SAT (Site Acceptance Test) – performed after installation within the production line at the customer site

1. **Scope**

The system includes 8 standalone dispensing machines, each containing:

* Nordson Robotic system (PROX5/G4V)
* Vision System for navigation and inspection (OptiSure)
* Custom mechanical plate for two dispensing heads (30cc tubes) with pneumatic pistons
* Tip height detection mechanism
* 2 time-pressure dispensers (Ultimus)
* PC + SW + Keyboard + Mouse
* Manual barcode reader
* Operator-facing GUI
* Connectivity to FITS MES system

1. **FAT – Factory Acceptance Test**
2. **Location:** Supplier site
3. **Goals:** Ensure that each station is functionally and mechanically ready for installation.
4. **Test Categories (applied per station):**

* Basic Functionality Checks:
  + Mechanical mounting of the tools (camera/laser B/Dispensing tubes)
  + SW + Optisure installation and key
  + Vision camera performs and lighting is working
  + Pistons can move up and down and respond to I/O signals
  + Both dispensing heads responding to I/O signals
  + Laser B is responding to on/off signal
  + Barcode responding to scanning
  + Mechanical motion of all 3 axes within the range and moving smoothly
  + All cables (power, Ethernet, pneumatic tubes) are properly connected and routed
  + GUI launches without error and default state is stable
  + EMO button functionality
  + Launch calibration test for Tip height, camera calibration, fiducial recognition, scale position, etc.
* Green Path Flow:
  + Operator login → program selection → barcode scan → machine run → Inspection → result OK
* Red Path Scenarios:
  + No barcode scanned
  + Invalid barcode
  + Product not placed in tray (empty run/no fiducial)
  + Fiducials are not recognized
  + Inspection failed (due to technical issues)
  + Barcode valid (no FITS validation during FAT) - barcode validation.
* GUI:
  + Go through I/O statuses and toggle each I/O manually
  + Go through the program screen
  + Go through the camera and inspection screen, toggle each function manually
  + Switch between different modes (teach/run)
  + Switch between different operating accesses (operator/service)
* Data Logging:
  + Result data stored in correct format (.csv or .json, depending on station configuration)
  + Fields: timestamp, barcode, program number, result
  + Offline buffering supported: if network or storage destination is temporarily unavailable, results and images will be stored locally and forwarded once the connection is restored in correct format (.csv or .json, depending on station configuration)
  + Run at least 5 different units per station, with each unit tested in at least 5 different scenarios (PASS, FAIL, retries, misplacement, barcode errors, etc.)
  + For repeatability:
    - Place a part and allow the camera to run continuously, testing the fiducials recognition 1000 times. Verify that at least 99.9% (1 miss-judgment per 1000 runs) of the results are consistent. This test should be conducted for each defined fiducial/part.
    - Place a part and allow the camera to run continuously, testing the same inspection 1000 times per pass scenario and 1000 per fail scenario. Verify that at least 99.9% (1 miss-judgment per 1000 runs) of the results are consistent. This test should be conducted for each defined inspection scenario.

1. **SAT – Site Acceptance Test**
2. **Location:** Customer production site - after integration into the line
3. **Goals:** Ensure full integration, operator flow, and communication with FITS in the production environment.
4. **Tests Per Station:**

* Re-run all FAT green and red path scenarios and physical tests
* Barcode routing through production FITS system
* GUI behavior under normal and faulty conditions (reset/run/etc)
* Operators retry and override behavior
* Confirm run and inspection accuracy with at least 30 real parts
* 25-unit consecutive production run per station with 100% tracking and valid results

1. **Infrastructure Checks:**

* Network and power integration
* Station ID tagging
* Image/data storage destination configuration

1. **Training:**

* At least 3 operators (FBN employees) run at least 5 parts each on station
* Observation of user flow, alerts, and troubleshooting steps

1. **Sign-Off Criteria**

* All FAT/SAT steps successfully completed or documented with approved deviations
* Logs saved
* Operator sign-off
* Mechanical schemes and 3D models
* Electrical schemes and BOM
* Customer QA and engineering approval

## Appendix A – FAT Execution Checklist Table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Station ID | Test Category | Sub-Test | Completed (Yes/No) | Comments |
| 1 | Basic Functionality | EMO functionality |  |  |
| 2 | Basic Functionality | Mechanical motion ranges |  |  |
| 3 | Basic Functionality | Piston’s functionality |  |  |
| 4 | Basic Functionality | Barcode reader connected |  |  |
| 5 | Basic Functionality | Camera communication |  |  |
| 6 | Basic Functionality | Mount stability |  |  |
| 7 | Green Path | Pass scenario |  |  |
| 8 | Red Path | No barcode |  |  |
| 9 | Red Path | Invalid barcode |  |  |
| 10 | Red Path | Wrong product type |  |  |
| 11 | Red Path | Empty tray/no fiducials |  |  |
| 13 | Red Path | Retry after fail |  |  |
| 15 | Logging | Result file saved |  |  |
| 17 | Repeatability | 1000 run test |  |  |

## Appendix B – SAT Execution Checklist Table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Station ID | Test Category | Sub-Test | Completed (Yes/No) | Comments |
| 1 | Basic Functionality | EMO functionality |  |  |
| 2 | Basic Functionality | Mechanical motion ranges |  |  |
| 3 | Basic Functionality | Piston’s functionality |  |  |
| 4 | Basic Functionality | Barcode reader connected |  |  |
| 5 | Basic Functionality | Camera communication |  |  |
| 6 | Basic Functionality | Mount stability |  |  |
| 7 | Green Path | Pass scenario |  |  |
| 8 | Red Path | No barcode |  |  |
| 9 | Red Path | Invalid barcode |  |  |
| 10 | Red Path | Wrong product type |  |  |
| 11 | Red Path | Empty tray/no fiducials |  |  |
| 13 | Red Path | Retry after fail |  |  |
| 15 | Logging | FITS integration confirmed |  |  |
| 16 | Production | 30 real parts run |  |  |
| 17 | Production | 25 consecutive parts |  |  |
| 18 | Training | 3 operators ran 5 parts each |  |  |