

FACTORY ACCEPTANCE TESTS

A Winning Combination for the Buyer and Seller

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Project Managers of the Food and Pharmaceutical industry have been through the same scenario time and time again: A Factory Acceptance Test (better known as a FAT) is scheduled at the fabrication plant in which all purchased equipment will be demonstrated as per specified line speeds. A contingent of the appropriate personnel is planned to witness the test complete with airline tickets, hotels, rental cars, and low expectations based on prior FAT trip experiences. Upon arriving at the fabrication plant, and after the smoke and mirrors are cleared out, the customer figures out that the equipment is far from ready to ship. Since the ship dates are at hand, a compromise is negotiated, the equipment is released, and the start-up is plagued with in plant modifications, massive delays, and a discontented customer that is far behind on production before the start button is pressed for the first time to release commercial product.

The main reason the above performance is continuously repeated relates to the set goal of most fabrication plants to get a release on shipment by spending minimal time and effort on the FAT. Setting up a proper FAT is expensive and costs production capacity. Utilities have to be run, the equipment has to be set accurately, the software has to be modified to operate in a simulated state while handshaking with its equipment partners, and the system has to be exercised several days in advance of the customer visit to insure line speeds. In short, a mini plant has to be set up and running in a format which proves that the equipment is performing as per the standards called out in the purchase order.

Why would Retort equipment manufacturers go through all this trouble when they can gain shipping acceptance by the skin of their teeth at about 10% of the effort and cost? The answer to this question is quite simple. A thorough FAT is the **least** expensive “big picture” investment that an equipment manufacturer can make. It all starts with owning up to your Quality Policy.

MEETING THE CUSTOMER’S QUALIFICATION:

When the buyer arrives on site to witness an FAT, the intent of the trip is to qualify the equipment against what was agreed to in the purchase order specifications. From the seller’s perspective, the FAT should be viewed as the perfect tool to insure that the products are operational and delivered on time. By setting the bar relatively high for a successful FAT, the products need to be completed well in advance to allow enough time for setting up the equipment to simulate line speeds. When production schedules are put on paper by the Seller’s project manager for job tracking, the completion date to begin testing is often 4-6 weeks in advance of the ship date. This early target for equipment completion insures on time delivery, and a flawless track record can then be proven to future perspective customers. A very positive industry reputation regarding on-time delivery is a strong marketing tool. A major mistake most sellers make is the strategy that an FAT’s only value is to get the buyer to release the equipment in the least expensive format possible.



FAT Customer Training:

The FAT is an ideal forum in which managers, operators, plant engineers, and maintenance personnel can touch and feel the equipment in an operational mode before it ships. By making it an inclusive “team” oriented trip, the customer is able to interface with the same individuals who show up at the plant during start-up. Besides witnessing the equipment trials, there are several secondary benefits that result. FAT training formats could include:

- ❑ Initial informal hands-on training presented to the Buyer’s production team by the Manufacturer’s technicians during the FAT is part of a valuable team building effort, and an opportunity to attain confidence by seeing the equipment perform at the fabrication facility.
- ❑ Actual hands on training with developed software allow real-world machine operation.
- ❑ Time allotted for design reviews on installation and start-up give both parties valuable input that makes for a fast track start-up.
- ❑ The FAT also becomes an ideal forum to review the bill of materials and discuss spare parts required for start-up and first year of operation.
- ❑ A complete documentation review gives the plant crew confidence in maintenance procedures.
- ❑ An installation scope meeting to review the critical parameters and tolerances regarding equipment set-up.

Exercising the Machinery:

Machinery that is powered up for the first time never works properly. Both mechanical and electrical failures are very common. If the FAT is handled properly, the initial set of out of the box failures have been eliminated prior to the customer's arrival. The second wave of problems that get resolved in the 90% range during FAT is component infant mortality failures, and software bugs. Listed below are several other major technical areas that are also addressed on A.B.R.S. systems prior to and during FAT that dramatically reduce start-up time:

- ❑ Container staging at the Loader Infeed is validated for pattern forming and backpressure control.
- ❑ Sweep speed is validated at the Loader and Unloader per specs.
- ❑ Position encoders calibrated on Loader/Unloader hydraulic lifts
- ❑ Discrete and analog sensors validated on all equipment
- ❑ Safety circuits are tested on all equipment
- ❑ Basket Transfer at the Shuttle/Conveyor and Shuttle/Interface points are validated
- ❑ Weight load tests are performed at the Shuttle
- ❑ All Conveyors are run under load, motor amperage draw checked, and chains re-tightened
- ❑ Shuttle laser positioning system tested at multiple set points
- ❑ Retort hydro test performed to resolve leaks at flanges
- ❑ Retort circulation checked for proper flow
- ❑ Retort valves/instruments calibrated
- ❑ Retort full capacity load test run to validate drive train
- ❑ Retort doors exercised and checked for seal integrity
- ❑ Instrumentation is checked for correct readings and calibration
- ❑ All Human Machine Interface Touchscreen Panels are checked for functionality.
- ❑ Full Line speed circle tests are performed to insure proper line speeds.
- ❑ PLC module to module communication and handshaking functions are tested.

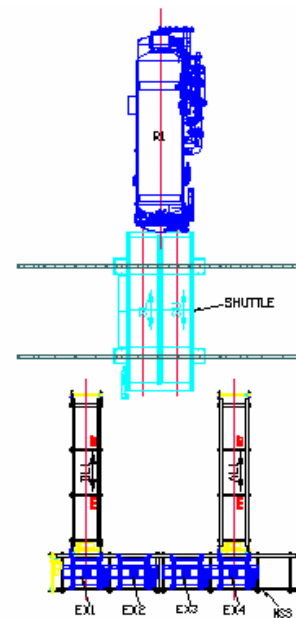


Figure 1: Typical FAT “Circle Test”

As an output of the FAT, the customer and vendor develop a punch list or additional items requested prior to shipment. Since multiple design reviews have taken place leading up to the FAT, this small list typically consists of items related sanitary issues, sharp edges, or tagging. When the equipment arrives at the plant, it is weeks ahead of a competitor that minimized their FAT to push the equipment out of the door to quickly. The sins of a poorly performed FAT are paid for at start-up by having to modify, adjust, and replace faulty components without fabrication shop support.

FACTORY ACCEPTANCE TEST CHECKLIST -

Below is a basic list of parameters used to validate equipment prior to shipment.

Note that representatives from several disciplines are required to insure that the proper eyes are placed in all areas. At minimum, the lead project engineer, project manager, and maintenance manager should attend.

Engineering:

- Utility requirements lines identified on equipment per general arrangement dwg.
- Start-up requirements for utilities mapped
- Start-up calendar and milestones identified
- Start-up resources and responsibilities committed.
- Critical equipment placement procedures and tolerances reviewed
- Coordination of sub-contractor support defined
- Electrical and mechanical tagging of the equipment is per specifications
- Measure critical tolerances on equipment

Operations:

- Equipment operates at line speeds specified for all containers
- Human Machine Interface is functional
- Container Changeover is demonstrated
- Operator procedures reviewed as per manuals
- Override screens reviewed
- Machine safety parameters tested
- In Plant training schedule review
- Weight load capacity tests on all equipment witnessed

Maintenance:

- Lubrication points are easily accessible
- Preventative maintenance points reviewed as per documentation
- Special tools required for maintenance identified
- Bill of materials reviewed for spare parts
- Major wear items identified and change procedures reviewed
- Any special maintenance procedures are demonstrated
- Critical installation tolerances reviewed on documentation
- Instrument calibration procedures reviewed

Construction:

- General arrangement drawings and dimensions reviewed per layout
- Proper materials used on frames, drive train and controls
- All sharp edges removed from equipment
- Proper finish or coating is provided as per specifications
- Sanitary construction specifications followed
- Start-up review for in plant equipment placement
- Rigging and shipping procedures reviewed

Due diligence spent in assuring that the FAT checklist is complete will result in significant reductions in time and money once the equipment arrives for start-up. A collaborative effort by the buyer and seller builds trust in the relationship prior to shipment as opposed to fear and animosity. With a thorough FAT, the equipment arrives on site with a confidence that will carry through the transfer of ownership. The result is a dramatic reduction in start-up costs related to contractors and operator training, and an immediate gain in line efficiency when production begins.

Cost Savings of an Efficient FAT:

The cost savings (both short term and long term) associated with a successful turn key FAT positively affect the bottom line for both the buyer and the seller. These savings can make or break a project manager's capital expenditure budget.

The Buyer:

- ❑ In A.B.R.S. installations not built by a turn key supplier, the various modules of the system (Loaders, Shuttles, Retorts, conveyors) are introduced to each other for the first time when they are delivered to the plant. The handshaking between the modules has to be worked through on site, and problems that arise as a result of mechanical or software interfacing tends to turn into a finger pointing scenario between the various start-up crews. With a single source FAT, the modules are interfacing prior to shipment, days and sometimes weeks can be saved on site. This is critical in a plant's ability to schedule production for commercial sale of product. This delay also increases the amount of billable hours by all vendors involved. If the seller's scope is not turn key, this task can still be accomplished, but the expense and coordination of several vendors in 1 facility for a comprehensive FAT is significant (especially if there is a combination of North American and European suppliers).
- ❑ Equipment that has not been exercised prior to shipment will suffer in the plant due to infant mortality failures, improper wiring, major software bugs, and multiple adjustments/modifications in order to bring the equipment to an operating efficiency. The FAT dramatically reduces in plant modifications or equipment start-up failures due to the dress rehearsal performed. Again, this factor weighs heavily on start-up efficiency and commercial product availability. Increased billable hours and expenses by all vendors involved will cost the buyer on the back end of the job.
- ❑ If a start-up is on a tight schedule, and the Vendors are behind on bringing equipment on-line, the first area that typically suffers in making up time is operator/maintenance training. With condensed training, the operators and maintenance personnel are more hesitant to take ownership, and therefore efficiencies suffer and downtimes are significantly longer until the plant attains a comfort level.



The Seller:

- ❑ By running a thorough FAT resulting in a quick start-up, customer management takes notice of the start-up team that is waiting for everyone else in the plant to finish. These accolades are passed up the ladder, and helps land future jobs. Everyone remembers who performed a great start-up, and who failed miserably. The best salesman in the plant is an effective start-up team.
- ❑ In plant modifications take approximately 3-4 times the amount of time to correct in a plant. Without the support of shop personnel and an array of tools, pressure is placed on the field technicians to perform modifications or repairs in-plant with parts and tools air freighted by the home shop in a frenzy. Since the repairs are under warranty, significant costs deduct directly from the bottom line for the seller.
- ❑ A successful FAT aids in facilitating a much faster "hand off" of the keys to the equipment since the field technicians have more available time to teach and work with the same technicians that visited and received preliminary training at FAT. The relationships and confidence built during the FAT promote ownership of the equipment as opposed to months of extra phone support, and additional trips to the plant due to uncertainty and poor training. Shop time spent supporting a plant on warranty issues, or answering operation questions can get very time consuming and costly to the seller.

When Purchasing Agents, Production Engineers, and Project Managers meet to select a Vendor, the value added in a comprehensive FAT should be heavily factored in order to protect the back-end of the installation. Using several references before purchase to gauge a Supplier's performance at Start-Up is a very good indicator of how thorough and successful the FAT was provided. Most job cost overruns occur after the equipment arrives at the plant, and are due to time and materials spent in order to modify problems that could have been resolved prior to shipment. For both the Seller and Buyer, the definition of a successful job is weighed on how quickly the equipment was turned over to production at line speed. The Factory Acceptance Test plays a key role to insure that both parties walk away from the job with a story of success.

Allpax Products provides a complete line of integrated turn-key retort room equipment including:

- Retorts – water spray, water shower, water immersion, steam-air, saturated steam, multi-process mode
- Basket Delivery Systems – shuttles, drones, moles, ribbi's
- Loading & Unloading Stations – for cans, jars, pouches, trays, sensitive thin wall plastic containers
- Basket Conveying Systems – for hands-free retort room operation
- Controls – retorts, automation, basket tracking systems
- Technical Services – process authority, project management, system startup, contractor supervision, training

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