

5.7 FACTORY ACCEPTANCE TEST

A factory acceptance test (FAT) is conducted to determine and document the equipment hardware and software operates according to its specification, covering functional, fault management, communications, support systems, and interface requirements. The FAT demonstrates that the hardware and/or software work according to specification. It is particularly important for highly integrated systems due to the complexity of the potential problems that could occur. For programmable systems, the FAT demonstrates that the application program satisfies the requirements of the software specification and works within the specified hardware.

Schedule, cost, personnel resources, and equipment readiness should be considered when determining when an FAT is appropriate for a particular project. The FAT may be conducted at the manufacturer's facility, owner/operator workshop, or a third-party location. When possible, the FAT should involve integrated hardware, software, and communication tests.

Extensive hardware and/or software validation can take significant time, depending upon the size of the IPS. Cost is therefore an issue to consider, both monetary and required resource investment. An FAT often ties up the manufacturer's resources and testing facilities, as well as dedicated owner/operator representatives. To some, this additional cost may seem unnecessary, since each IPF still requires validation by an SAT. To others, early testing is considered an excellent investment of both time and money.

For projects on a tight time schedule, the physical installation of the hardware may be a critical path item. In these cases, the decision may be made to combine the FAT and site validation. This can pose significant risk to the project schedule and budget. Identifying equipment problems during site validation shifts focus away from the field installation and commissioning to troubleshooting the equipment. This can cause significant commissioning and validation delays with numerous personnel waiting around and doing very little until the equipment is ready.

A comprehensive FAT is the most cost effective means to ensure that the equipment operates correctly and is of high quality and integrity. The SAT is almost invariably a chaotic and tense time, so it is not the optimum time to be searching for IPF equipment 'bugs,' whether hardware or software-related. The best approach from a project management standpoint is for the hardware and software to come to the field fully tested, so field performance troubleshooting can focus on installation issues.

The FAT should be witnessed by someone familiar with the design basis intent, but who was not responsible for assembling the hardware or programming the software under review. In general, independent review is provided by an owner/operator representative, who will take responsibility for the system when

completed, and by a technical specialist who is familiar with the hardware and software expectations.

5.7.1 FAT Procedure

An FAT procedure should outline the equipment and functionality to be tested. The FAT should evaluate the hardware and software organization, understandability, and annotation, because this affects the ability of the owner/operator to safely modify the equipment in the future. It should also include peripheral equipment, such as sequence of events recorders, communication modules, and remote I/O communication.

The hardware manufacturer generally conducts a functional test of the equipment in accordance with their quality control plan. The equipment components are connected and powered up and the basic functionality, fault management, and communication ability is validated. This quality control test is not a substitute for validation.

PE logic solver manufacturers sometimes refer to the hardware test as a “rack and stack” test. It is typically used to verify the operation of the PE logic solver hardware and diagnostics, including the processors, power supplies, communications modules, and I/O modules. The application program and its compatibility with the hardware is validated separately.

A test plan and procedure should be developed to ensure comprehensiveness of the test execution. The procedure should, at a minimum, describe the following:

- Define test method(s),
- Functionality to be tested,
- Pass/Fail criteria, and
- Test Documentation

The FAT should fully demonstrate that the hardware and software achieves its specification and the design basis. As with all testing, the intent is to demonstrate and document that the equipment operates as intended. The test outcome should give the test team confidence that the equipment behaves as expected under the full range of foreseeable conditions, including misuse and error. The FAT procedure should cover:

- Measures to prevent unauthorized access to or alteration of equipment,
- Compatibility of any application software with the embedded software,
- Required equipment response time (e.g., scan rate for PLC),
- Fault management by simulating errors (e.g., disconnecting power cables or communication cables),