

Engineering. If the contract is turnkey, define the contractor's engineering responsibilities and provide all necessary engineering design objectives and system performance requirements. Depending on the scope of the engineering entrusted to the contractor, the following items may be included:

- end-to-end transmission performance objectives in terms of noise and/or bit error rate,
- grade-of-service objectives, and
- reference equivalents for circuit attenuation.

Installation. To avoid misunderstandings about methods and quality expected, general installation instructions should be provided for such items as:

- planning and coordination;
- general methods concerning cable practice, earthing practice, equipment stenciling and cable tag practice, etc.;
- installation tests;
- supply of tools and test equipment;
- changes and additions to the approved specifications and drawings; and
- supervision or on-the-job training of personnel, if applicable.

Acceptance. Factory acceptance testing or field acceptance testing, or both, may be required of the contractor, depending on the type of contract.

Notification requirements for factory and field acceptance as well as provision of procedures, equipment, forms, and reports should be stipulated.

Factory test certificates are usually requested and the right to witness factory tests should be reserved. Minimum factory tests may be specified.

Field acceptance tests may be conducted independently or jointly. They should ensure that the contract requirements have been fully satisfied. Minimum functional and performance tests may be specified. Basically, acceptance should ensure that

- the correct types and quantities of equipment have been provided;
- the installation is complete and of acceptable quality;

- the system is demonstrated to be fully functional; and
- the system meets performance specifications (proof of performance).

Training. Since staff must be prepared to operate and maintain the systems after commissioning, training is almost always needed. When new equipment and technologies are involved, training is absolutely essential. Courses should be requested for the following types of training and implemented as appropriate:

- engineering course: to enable expansion planning;
- field maintenance course: for on-site fault finding and repair;
- repair centre course: if repair at component level is anticipated;
- installation course: if installation will be undertaken; and
- instructor courses.

All staff to be involved in the installation or acceptance phase of the project must receive suitable training before participating in these phases.

The number of candidates for each course as well as their education and experience should be stated.

Documentation. At a minimum, the contractor should be required to submit manuals for all equipment provided. Depending on the type of contract, shop drawings, test procedures, site documentation, recommended spares and test equipment lists, and other submissions may be required from the contractor. The submittal of some of these may be requested in preliminary form with the bid.

The contractor should be asked to submit installation procedures and site drawings for review and approval before installing any equipment. Likewise, the contractor should submit acceptance test procedures before beginning acceptance tests.

General site drawing requirements should be stipulated to ensure that essential information is provided and that standard or preferred formats are observed. Full-size reproducible masters of all as-built drawings should be requested for submission at contract completion.