# COMMERCIAL PRODUCTION OF TEMPEST EQUIPMENT

Historically, in the years before the inception of the Industrial TEMPEST Program (ITP), manufacturers of computer and communications equipment were not overly concerned with the various disciplines of TEMPEST. Some companies manufactured "ruggedized" TEMPEST equipment for military applications in those days. Commercially available telecommunications, word processing and data processing equipment was TEMPEST-certified, for the most part, on an individual basis.

With the establishment of ITP, it became possible for commercial manufacturers to produce a TEMPEST equipment offering. These equipments now may be listed on the U.S. Government's Preferred Products List (PPL), once they are approved by the appropriate federal authorities, who require TEMPEST certification tests on the final version of the equipment to be listed on the PPL. It is the commercial manufacturer's responsibility to produce every PPL-listed unit thereafter so that it meets the criteria of the originally qualified unit. This is no light undertaking. It entails relentless attention to detail, excellent communication, extensive controls, and a commitment to quality.

Within a company structure, the key areas of TEMPEST product development are:

1. Design
2. Manufacturing
3. Quality
4. Field Service

The following paragraphs point out some major concerns in each of these areas for any company committed to providing high quality, TEMPEST-certified equipment on the Preferred Products List.

**Design**

The design phase presents a multitude of challenges. Most companies involved in the ITP offer commercial and TEMPEST versions of the same basic equipment; it is this situation which will be dealt with herein. Before any effort is expended on the TEMPEST model development, it is very important that this project be considered a new product throughout the company. The dangers in not treating the TEMPEST version as a unique new product are that it will not receive the proper focus and that integration between commercial and TEMPEST models could occur.

With this groundwork laid, the design definition begins. After the baseline TEMPEST testing has been performed, the areas of non-compliance are identified and the task of incorporating mechanical and/or electrical corrective measures is initiated. Some companies may have their own TEMPEST engineering organization while others employ the services of an independent test agency. In both cases, a close working relationship must exist between the TEMPEST re-design group and the following elements:

1. Electrical Engineering
2. Mechanical Engineering
3. Manufacturing Engineering
4. Component Engineering
5. Quality Engineering
6. Field Service Engineering
7. Documentation

The results of this multifunction interaction will be beneficial in the overall TEMPEST product life.

Several issues must be examined in parallel while working with these groups. Any electrical or mechanical modifications should be carefully thought out to result in easily manufactured units; it is not wise to generate unnecessarily complicated processes that are difficult to manufacture. When manufacturing in large quantities, the possibility of error increases; a simplified design decreases this possibility.

Another major outcome of the design phase should be a quality control (QC) checklist to be used by QC to ensure adherence to the manufacturing process. The QC inspection procedures can thus be generated by a joint effort between the design group and QC. This teamwork concept is of major importance; the "win-win," or mutually beneficial approach, is to understand each other's concerns and work together toward a common goal—a high quality product.

This same concept is true with respect to the continued upkeep of the TEMPEST equipment in the field. The design group must first be aware that various features of a TEMPEST design may fail, and while this may occur without causing operational failure, it could defeat the objective of the TEMPEST design. The design effort should address means of avoiding this potential problem by keeping the design simple, i.e., with a minimum number of "band-aids." Where special materials are required, serious consideration should be given to: resistance to corrosion, excessive wear, over-compression, or inadvertent abuse; continued proper fit; and consistent mating surface alignment. A multitude of band-aids yields a multitude of potential problems.

The underlying themes during the design phase are these: keep it simple, communicate, be aware, and work together.

**Manufacturing**

The many facets of building electronics equipment present a tremendous management challenge, a challenge that is compounded when manufacturing TEMPEST-certified equipment in large quantities. The primary concern is good communication, which comes in many forms.

Documentation is certainly the first line of communication. Anyone who has attempted to put together toys on Christmas Eve can appreciate the value of a well documented set of instructions.

We all learn from our mistakes, but sometimes the mistakes cannot be repaired without replacement at a high price. To avoid this dilemma, it is beneficial for the manufacturing engineer to establish good documentation of the building process in a systematic fashion. This again calls for a team effort with the design group, constituting the first step to building in the quality.

A second form of communication in the manufacturing process is training. Because the manufacturing organization has the expertise in efficient building processes, the best results are derived from effective use of this experience. Thus, the training begins when the redesign process starts. With manufacturing engineers involved in the beginning of a TEMPEST project, the final result includes their input and critique. This team effort at the onset paves the way for a mutually owned product. Design helps manufacturing; manufacturing helps design. Another "win-win" situation, in which the big winner is the company itself, comes out of this approach.

An additional aspect of this training is the awareness of the need for high quality in a TEMPEST product. Not many people committed to achieving perfection make the effort without some understanding of their objective. It is important to convey to those building the product that failure to produce a consistently high quality product could result in its removal from the PPL. The product line depends on each individual's commitment to high quality and this standard of excellence is an example to be followed by others. Some refer to this as pride of ownership.

Another concern in manufacturing a TEMPEST product is instituting a segregated facility or building area. There are major advantages in this approach. When resources are dedicated to the fabrication of TEMPEST units, the danger of integrating commercial and TEMPEST components disappears. Additionally, when personnel who are trained in the TEMPEST manufacturing process are dedicated to that exclusively, there is consistency in results. On the other hand, if there are shared resources between TEMPEST and commercial assembly lines the risk of error increases. Anyone familiar with a particular process on a commercial assembly line may, while working on a TEMPEST assembly line, inadvertently install an incorrect component. With a mulititude of assemblies being built, the risk becomes high. Even when mistakes are detected by quality control, the rework costs and time lost become an undesirable setback.

One final note on the TEMPEST manufacturing process cannot be overemphasized. In every case, there should not be any question that quality **must** come before quantity.

**Quality**

Although all aspects of TEMPEST development are paramount to a high quality product, the conscience of all phases belongs to the quality control and quality assurance (QA) groups. QC personnel must have a very high commitment level and must be willing to be unbending to the defined procedures. On many occasions, they will be challenged on seemingly unreasonable details. Success in TEMPEST production depends entirely on the highest quality; it is vital, therefore, for QC personnel to receive full support in their function from the TEMPEST engineering/design personnel. The challenged QC decisions may have merit and should be reviewed by an authoritative TEMPEST representative for TEMPEST design impact. Should a change be justifiable, then formal amendment procedures may be instituted. The intent is to be flexible and to ensure accurate documentation for the QC function to follow. It is this awareness and level of commitment that must be shared by the QC and TEMPEST engineering/design functions. The by-product of this interaction is a regularly updated

"quality plan." This plan, which must be approved initially by federal authorities, is the reference source for all QC and QA activities.

The watchdog of the QC group is quality assurance. The QA organization should "check the checkers" on an audit sampling basis; a rate of sampling that yields a high confidence level regarding the quality of the TEMPEST product should be established. In addition to the physical inspection audit activities, TEMPEST verification testing should be performed as a subset of QA. These tests may be performed in-house or subcontracted. The advantage of merging these two operations is the common communication channel through QC to the manufacturing lines. This provides the most rapid distribution of information regarding corrective action to key personnel, which also avoids confusion and duplication of effort.

**Field Service**

From the date of installation throughout the product life, maintaining TEMPEST integrity is the responsibility of the field service organization. The TEMPEST product must be designed with field service considerations in mind. This can only occur through teamwork between the field service and design groups.

Primary concerns for the efficient operation of field service are training and awareness, customer contact, preventive maintenance, and communication. One of the most important objectives of any commercial TEMPEST field service group must be a training and awareness program. Logistically, this is best handled from a central training facility so that sample equipment may be scrutinized under the direction of experienced trainers. Included in this program should be a checklist of those components peculiar to the TEMPEST device—specifically, those items that could need repair but would not cause operational failure of the unit. Training materials must be authorized by the U.S. Government.

Customer contact and preventive maintenance go hand in hand. Preventive maintenance (PM) should be scheduled on a regular basis; PM includes using the checklist. One way to lighten the PM load is to work with the customer in this area. By making customers aware of how to recognize potential problems, a service call relating to a checklist item can be requested. Communications channels for the field service engineer must be well defined and as direct as possible. It is relatively easy for communication back to the home office to get out of hand and/or delayed unless direct lines are established. When confusion exists, the details being reported can be easily distorted.

Commercial TEMPEST production is serious business. It requires a commitment level of the highest degree and an understanding of the risks involved. It demands a high quality product that can be accomplished only through collective attention to detail. The successful company in the Industrial TEMPEST Program needs to follow a few very basic guidelines: keep it simple, communicate, be aware, and work together.

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personnel. Weekly and monthly rates may be available at some savings. These rates generally are quoted on an actual cost or a per-diem basis.

It is generally good to obtain an estimate of the length of time it will take to do the job. However, be aware that many factors can be influential which are beyond the control of the consultant. Examples would be: changes in design, lack of sufficient data available, change in requirements, and general logistical problems. One approach to avoid these problems would be to get a package deal, such as one price to produce a product (such as a document, etc.)

Generally the consultant will need office space in your facility. This could include a desk, storage facility, supplies and typing services. In some cases, especially with a package contract, the consultant can make considerable use of his home office. These things should be discussed prior to agreeing on a contract price.

It is difficult for a consultant to make guarantees. Sometimes, he will guarantee the preparation of an acceptable document, especially where he has had considerable experience with the accepting agency. But, there are always contingencies. Your best guarantee is to know your consultant or his parent organization, and place your judgement on his past performance and reputation.

Beware of consulting firms that sub-contract your work. If the subcontract engineer is moon-lighting, he usually is competent and is offering the expertise he has gained through the years of service with his employer. If the sub-contract engineer is independent or unemployed, it may mean that he cannot sell his services based upon his own reputation. This advice is only a word of caution, not an indictment of such consulting arrangements.

**Contracting Procedures**

The simplest and most common method of obtaining consulting services is by the issuance of a purchase order and a statement of work. An alternative, though more complicated method, is through a consulting agreement. Companies will find the following suggestions helpful when faced with the necessity of retaining a consultant:

1. Be wary of individuals selling their services at bargain prices. Such individuals lack confidence in their own value and, obviously, are not in high demand.
2. Review the resume of the individual who will be performing the service, either from a company or the individual. Check his references from other jobs.
3. Check availability of the individual and identify your needs. Determine if he has back-up support or is spread thin on too many jobs.
4. Be certain that objectives are clearly set forth in the contract or purchase order for services. Make firm plans for maintaining adequately close liaison with the consultant or consulting firm. Since objectives probably will require re-orientation on larger jobs as the program progresses, it is essential that communications in both directions be prompt, emphatic and to the point.
5. Don't hesitate to include a proprietary information agreement in your contract or purchase order. The consultant will be completely willing to sign and abide by it.
6. If you are not pleased with the performance or availability of the consultant, seek another. There are plenty available. It is, therefore, prudent to have an appropriate cancellation clause in you contract or purchase order.
7. Do not insist that all work be performed at your facilities. The consultant may work more efficiently in his office where files, reference material or even a computer may be available.
8. Do not frequently call the consultant for free advice after the contract is completed. You may be surprised by an additional invoice if you become a free loader and nuisance. The consultant will be willing to answer questions about his work after it is completed, as long as you are reasonable.