TELETYPE CORPORATION
Product Development and
Research Organization

Section 1.000
Design Handbook
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DESIGN AT TELETYPE

1.000 Teletype Design Principles

1.010 Introduction

SUMMARY - TELETYPE PRODUCTS MUST BE PROPERLY DESIGNED. THIS HANDBOOK IS A MEANS TOWARD ACCOMPLISHING THAT OBJECTIVE.

This handbook is for the use of designers and engineers of Teletype equipment. It provides a summary of design principles and other data formulated during many years of experience in the design and manufacture of printing telegraph equipment. In a readily available form, such information can be used to best advantage in reducing the likelihood of repeating previous mistakes and also by conserving time which might unnecessarily be spent rediscovering sound design practices.

Although the handbook should be used as the guide in design, it should not stifle creativity. It should be visualized not as a restriction but as a means for promoting sound design with economy of effort.

This handbook is divided into two parts. The first includes general information and explains the underlying philosophy of Teletype design practice. The second provides specific details concerning practical problems, such as dimensioning and data sheets.

It will be necessary to keep the handbook up to date. To assist in this, please notify the Design Standards Organization of any change or addition that seems desirable.

1.020 Teletype Design Philosophy

SUMMARY - TELETYPE'S DESIGN PHILOSOPHY EMBRACES PERFORMANCE AND ALSO SUCH THINGS AS SCHEDULES, COSTS, AND QUALITY. MANAGEMENT EVALUATES DESIGN ACCORDINGLY AND DOES NOT RESTRICT NEW IDEAS IN THEIR ACCOMPLISHMENT.

Design at Teletype is a creative art, although one in which the advantages of the new must be constantly weighed against the Company's experience. Experience, however, should not restrict new ideas and approaches. Progress requires fresh thinking. The limiting factor in the origin of new methods and ideas lies largely within the engineer or designer.

In evaluating designs, the primary concern is the degree to which the mechanisms perform their intended functions. Good designs are not only predicated upon this, but also on the quality necessary, cost, and ease of manufacture so that schedules can be met. In verifying these, management expects the facts to be available that bear out the superiority of a design.

1.021 Creativity

SUMMARY - THE IMPORTANCE OF CREATIVITY. HOW TO USE AND STIMULATE IT.

Creativity is a primary attribute required in product development and research. It is the ingredient that makes Company growth possible through improvement and the development of new products.

To be creative one must use imagination. Knowledge and good work habits are essential in the solution of problems, but some development and research problems are difficult to solve in a purely logical way because there is no one approach which will lead to the solution of all problems.

Effort is required in order to develop a productive imagination. Worthy ideas are more likely to follow if focal points are established as a guard against aimless drifting.

A permissive atmosphere is desirable rather than one of premature criticisms or abandonment. When freedom of thought is allowed in the solution of problems, there will be a much greater likelihood of setting off a chain reaction of useful ideas.

To stimulate creative thinking the following basic rules should be observed:

1. State the problem in a general way.
2. Maintain an open mind toward new ideas. Avoid "It won't work" and, "It's not practical" viewpoints.
3. Maintain a competitive atmosphere in the search for ideas.

One handicap to the solution of problems can be reluctance to use the thoughts and ideas of others. Time will be conserved for creative talent if fullest use is made of existing valid information. In using the oral or written thought of others, it is necessary to differentiate between facts and opinions, since unsubstantiated data should not be used as a basis for making decisions.

Group interchanges of ideas can be a productive means for directing and stimulating constructive action. Through such meetings, it is possible to accumulate quickly many good ideas concerning solutions to problems.

Reluctance to express ideas in the discussions can usually be overcome with questions of the following type:

a. What are other possibilities?

b. Why is it this way?

c. Why not do it this way?

d. Can it be made? Can it be made easily?

e. How can loss of power or motion be avoided?

f. Why does it have to be so big?

g. Can it be done with fewer parts?

h. What is the effect dynamically?

i. How fast will it go?

When this discussion is over, the ideas can be evaluated and the choices made as to which are the most feasible in the solution of the problem.

Solutions may involve two extremes. One is that which uses the first or easiest solution that comes to mind; the other is that in which a problem is approached from the standpoint that the search for a better way should be a never ending process. Successful product development is between the two extremes because the time must come when the searching ends and the building begins.

It should be remembered that freedom of thought and action are not without restrictions. New ideas are among the most important assets of a company and the benefits of those ideas should be reserved for the Company.

1.030 Function of Development and Research Personnel and Organization

SUMMARY - PRODUCT DESIGNERS AND ENGINEERS ARE RESPONSIBLE FOR DEVELOPING PRODUCTS FOR WHICH A DEMAND EITHER EXISTS OR CAN BE CREATED.

Product designers and engineers occupy key roles in industry because their work has a direct bearing on the future of a business. A company will either advance or fall behind, depending on its ability to develop products for which a demand exists or can be created. The success of a Company's Development and Research program depends on the skill and ability of its designers and engineers.

Individuals engaged in development work at Teletype are primarily concerned with the application of engineering principles to mechanical and electrical designs. To do this, good work techniques are essential for efficiency in the application of ability and experience. Also, supplemental facilities and skills are required. These include model making, apparatus testing, customer service, methods and all of the other aspects necessary for the operation of the business.

At Teletype, the engineering and design of equipment is the responsibility of the Product Development and Research Organization. The work of this Organization is divided into Research, Development and Service activities. P. D. Routine No. 1 establishes the functions, and P. D. Routine No. 1A, the structure of the Organization.

1.040 Design Objectives

SUMMARY - DESIGN FOR EFFICIENT PERFORMANCE AND ECONOMICAL MANUFACTURE.

Although design freedom exists in meeting project requirements, certain objectives must be achieved to produce a readily marketable product. These objectives must be analyzed in light of problems surrounding the production, sale, shipment, installation, and use. Following is a list of design objectives: *

1. Performance is a unit's ability to satisfy its end requirements. Evaluation should be in terms of the performance of production equipment; not only that of experimental models.

2. Reliability. Unless continuous and reliable performance is inherent, the design is not adequate. Each part and assembly must be carefully designed to assure the reliability required under the expected abuse and ambient operating conditions.

3. Maintenance of units in a degree consistent with the nature of their use is expected, but design should minimize maintenance and facilitate lubrication, adjustment and repair.

4. Safety must be considered in design to prevent possible injuries to personnel or damage to equipment.

5. Low Manufacturing Costs

   The use of suitable but economical materials and processes, and also a minimum of parts is important. This objective is discussed in detail in another section of this handbook. (See Index).

6. Size and weight is important since Teletype equipment is used extensively in mobile installations and is also a factor in packing and shipping.

7. Customer Appeal

   Pleasing appearance should be considered and its place in a particular design evaluated. Quiet operation, freedom from glare, good "feel" and location of controls, and easy cleaning are among other items which should have an important place in design consideration.

8. Additional items for consideration during design are covered in P. D. Routine 23.

In order to accomplish the design objectives, the general principles listed below should be followed:

1. Design to meet the end requirements for the job.

2. Design simply.

* The importance of the objectives with respect to each other may vary with the project.

3. Dimension simply, but so that design intent is clear and can be met.

4. Design for economical manufacture, interchangeable assembly, and facile maintenance.

5. Select material for parts on the basis of function and ease of fabrication.

6. Design to minimize the number of adjustments.

7. Design parts for common usage, if practicable.

1.050 Standards

SUMMARY - THE OBJECTIVE OF STANDARDIZATION IS PRIMARILY REDUCTION OF DEVELOPMENT AND MANUFACTURING COSTS.

The standards in the subsequent sections of this handbook are provided as a means for solving recurrent design problems. Their use will conserve talent and facilities and will promote sound designs by adherence to proven practices.

1.060 Manufacturing Costs and Design

SUMMARY - PRODUCT DESIGN IS A CONTROLLING FACTOR AS TO THE MANUFACTURING PROCESSES REQUIRED AND THE RESULTING COSTS.

Low costs are of extreme importance. Designs must be carefully considered and evaluated, since they have an important bearing on costs. However, the term " low price " in reference to a product is relative. The parts for products low in price are not necessarily inexpensive to manufacture because a good part must always be properly designed to provide the desired functions and life. Designers must continually be cognizant of the importance of low manufacturing costs in a design.

The design quite frequently restricts the choice of manufacturing methods, and in so doing sets the limits beyond which few improvements in cost can be made. Preferably, a design should be flexible enough to permit a significant difference in manufacturing methods in the event quantity requirements change markedly. The usual manufacturing pattern for new Teletype products is one of caution insofar as the initial expenditure for tooling is concerned. Customer demands are not always firmly established at the time of release to manufacture and operating requirements may change, thus obsoleting what has gone before. Until these things have firmed up therefore, expensive tooling, and manufacturing methods involving large outlays for machinery are held in abeyance.

Many of the problems associated with releasing equipment to manufacture and the myriad change orders usually resulting can be avoided through careful consideration in the design state. From the beginning of every project, the matter of rationalizing between the ideal and the practical is a problem which must be adequately solved prior to release. It requires the engineer and designer to consider carefully:

1. Does the design achieve the end requirements for the project?

2. Do the drawings properly convey design intent so that manufactured parts will meet the end requirements ?

3. Does the design permit flexibility in manufacturing processes and methods ?

1.070 Development and Research Procedures

SUMMARY - THE DEVELOPMENT OF A GOOD DESIGN REQUIRES BOTH CONCERTED ORGANIZED EFFORT AND CREATIVE THINKING.

The Product Development and Research Organization has the responsibility for developing equipment that will meet the needs of customers and also enable Teletype to maintain its position of leadership in the Printing Telegraph Industry. Ideas for projects come from a number of different sources :

1. Management initiates projects for the development of new equipment or the modification of existing equipment on the basis of its investigations of the market and technological advances.

2. Customer requests to the Product Development and Research Organizations or the Sales Organizations may result in development or research projects.

3. Manufacturing conditions may make a development program desirable.

4. Field data on equipment performance is continually evaluated by the Company and may lead to development work.

After management has approved a project, it is assigned to the appropriate Development or Research Department. In beginning an assignment, the engineers and designers should marshal all information. This is not only necessary in achieving good design but it also serves as a yardstick against which a design is evaluated. The necessary data includes:

1. Purpose of project

2. Performance requirements, including ambient operating conditions.

3. Price range

4. Size and weight

5. Appearance

6. Number of units required.

Aside from project requirement data, there are numerous sources of additional information that should be considered as a prelude, to an extent consistent with the need. Frequently this procedure results in a better insight to a problem by revealing how similar or related problems were solved in the past. Among these sources of information are:

1. Teletype engineering file folders
2. Teletype equipment bulletins
3. Technical publications - books, periodicals, etc.
4. Teletype data sheets
5. Teletype Standards
6. Teletype test reports
7. Conferences and discussions

When the background information relevant to a project is known, development work can commence. Although, it is difficult to foresee all the problems that may arise in a project, a development itinerary should be evolved so that scheduling can be planned. The itinerary in the development of a design involves a sequence of orderly steps to completion. Then a time schedule should be developed so that the project can be completed by the target date. The steps involved in scheduling include the following types of work:

1. Idea sketches are made, evaluated, and selected as a basis for further work.
2. The mathematics of the design are completed and a layout of the mechanism and its movements is made.
3. After and during steps 1 and 2, conferences are called for resolving difficulties and ascertaining job progress.
4. Shape is given to the elements of the design from detail drawings made of the layout. This phase of designing is of the utmost importance because of the effect it has on the ultimate production. While changes can and are made in later stages, the manufacturing techniques are established at this point.
5. Models are assembled largely from parts that have been custom made according to the detail drawing specifications. The completed models are then evaluated for all-round performance and conformance to the project's objectives and in light of customer acceptance.
6. Final clean-up of the design is completed, and when necessary or desirable, more models may be built to prove-in resulting modifications.
7. Manufacturing information is released.

It should be understood that in actual practice, progress may not be as straightforward as indicated above. It may be necessary or proper to telescope some of the efforts. For example testing may begin on certain design elements before the whole unit is completed, and final models may be under construction while some of its parts are being released for manufacture.

1.080 Summary

Two main considerations should constantly be in mind during the design of a project:

1. Objective

The major goal is to achieve in the final product the end results established for the project. In doing this, standards and tradition should be guiding, not restraining, influences.

2. Manufacture and Manufacturing Costs

A design must be tailored to suitable inexpensive manufacturing processes.