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An experimental cost model for the analysis of quality cost in a manufacturing enterprise

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AN EXPERIMENTAL COST MODEL FOR

THE ANALYSIS OF QUALITY COST IN

A MANUFACTURING ENTERPRISE

A Dissertation

Submitted

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Industrial Technology

Approved:

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Table of Contents

CHAPTER PAGE

List of Tables

List of Figures

AN EXPERIMENTAL COST MODEL FOR

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An Abstract of a Dissertation

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ABSTRACT

The intent of the study was to construct a quality cost model for manufacturing enterprises. A quality cost model provides a manufacturing enterprise with a cost structure which enables it to gauge and measure the efficiency and effectiveness of its management and processes. The quality cost model was specifically constructed to aid a manufacturing enterprise in establishing a quality cost system for its operations and activities and contains three distinct initial implementation or decision areas; the quality cost management decisions area, the quality cost system applications area, and the quality cost system utilization area.

The quality cost model was evaluated by a panel composed of quality practitioners from a wide variety of manufacturing enterprises after the panel had received an explanation of the quality cost model's functions and operation and the panel had utilized the quality cost model during demonstration exercises.

Study results indicated that the quality cost model is very adoptable and adaptable across a wide variety of industries and is potentially effective in enabling a manufacturing enterprise to structure and develop a preliminary quality cost system.

CHAPTER I

INTRODUCTION

A quality cost model is a cost structure which provides an enterprise with the ability to gauge and measure the efficiency and effectiveness of its management and processes. A fundamental management concern within any enterprise is the efficiency and effectiveness of the processes by which the enterprise develops, produces, delivers, and provides both pre- and post-delivery customer service. Peter F. Drucker (1973) defined efficiency and effectiveness within a management perspective:

> Effectiveness is the foundation of success--efficiency is a minimum condition for survival _after_ success has been achieved. Efficiency is concerned with doing things right. Effectiveness is doing the right things. (p. 45)

Patrick L. Townsend (1986) applied a quality perspective to these terms when he reported on the definitions being established by a corporate Quality Steering Committee he was observing:

> . . . the Quality Steering Committee echoes Peter F. Drucker's observation, "Efficiency is doing something very well. Effectiveness is doing the right thing exceedingly well. . . . What is the point of doing something very efficiently that should not be done at all?" (p. 33)

The goal of the quality cost model is to identify, analyze, and assist in correcting the causes of inefficiency and ineffectiveness. Development of a quality cost model requires establishment of a quality cost policy, development of a quality cost vocabulary, creation of a quality cost framework, and selection and assembly of a documentation system. Once a quality cost model is accepted and established, varying definitions and divergent views of quality within the enterprise will be replaced by a common vocabulary and perspective.

Statement of the Problem

The problem of this study was to develop and validate an experimental quality cost model for establishing a quality cost system within a manufacturing enterprise. Currently, there is no quality cost model generally available to the individual manufacturing enterprise or quality practitioner. The developed quality cost model provided the theoretical and descriptive components necessary to establish a preliminary quality cost policy and program and the framework for quality cost identification, comparison, and analysis. This model enables a manufacturing enterprise to identify areas requiring improved effectiveness and efficiency in resource use in manufacturing management and processes.

Statement of Need

The need for this study is based upon the writer's research in the field of quality, the results of an informal investigation into the topic of quality costs, and the lack of a generally available quality cost model.

The writer initiated a proposal for a Quality Technology Concentration within the Industrial Technology Bachelor of Science Program at the University of Wisconsin-Stout in 1982. The concentration received Regents' approval in 1984. The writer participated in a funded research project at the University of Northern Iowa in 1985 during which he developed a proposal for curriculum and an interdisciplinary program in the area of quality. The research stemming from these activities enabled the writer to explore and consider the many varied areas within the quality discipline. The topic of quality costs appeared to be an area of significant importance in the writings of many authors in the quality field; continued reading in the area, however, revealed only scant references to or suggestions for the development or structuring of an implementable cost model. The writer identified the development of a Quality Cost Model as a possible dissertation topic.

To substantiate the significance of quality costs as a possible dissertation topic, the researcher conducted an informal investigation. Ten corporate level quality professionals employed by major corporations were asked to evaluate the significance and appropriateness of quality costs as a possible dissertation topic within a doctoral program in Industrial Technology. Nine of the 10 responded; the nonrespondent had recently retired and requested that mail not be forwarded. Several excerpts reflect these respondents' consistently positive comments. Dr. John Hromi, Director of the Center for Quality and Applied Statistics at the Rochester Institute of Technology, offered the following view:

> Quality Costs is a timely topic for investigation. It has been claimed that 15 to 25 percent of the sales dollar goes down the drain because of poor quality. . . . Because some companies have no quality-cost tracking systems, it would be

> of great value to such companies to have a relatively simple, readily-understood model(s) of a quality-associated costing system. The model(s) should give meaning to the quality, productivity and competitiveness relationship. (Dr. J. D. Hromi, personal communication, February 23, 1987)

Mr. Michael L. Sandahl, the Director of Reliability and Quality for Cray Research, Inc., presented his view:

> Cost of Quality information is a fundamental tool to help to manage the overall quality program in a company. Although a generous amount of literature exists about quality costs, . . . I believe there still exists theoretical and practical application areas left unexplored. (M. L. Sandahl, personal communication, January 13, 1987)

Mr. William W. Eggleston, Vice President for Quality of IBM, stated that:

> The focus on quality costs is essential not only to the quality profession but throughout any organization or company. The emphasis that this country is placing on competitiveness and productivity requires a total commitment and the management, style, and tone to aggressively pursue effectiveness and efficiency with significant impact to bottom-line profitability. (W. W. Eggleston, personal communication, January 28, 1987)

A review of the literature disclosed only philosophical and conceptual treatments of quality costs. No generally available model exists for the development of a quality cost system; hence, the need for this study. Although the literature consistently encouraged development and use of quality cost information, the literature was generally silent on the development of models necessary for implementation of a quality cost system. No quality cost standard exists to provide models of appropriate quality cost treatments; few quality cost references provide even partial insight into practical quality cost model development.

Quality cost models <u>are</u> in place in a number of large American enterprises (e.g., ITT, Westinghouse, IBM, 3M); however, these models are typically designed and implemented to agree with existing internal management and cost accounting systems within particular enterprises and, due to this, possess unique and peculiar characteristics that do not allow them to be generalized readily. These models are held on a proprietary basis and are not generally available to other enterprises or practitioners. Small and medium size manufacturing enterprises often have the disadvantages of a smaller resource base of quality professionals and an inability to commit time and operational specialists necessary to develop a quality cost model. This is the need this study addresses.

Clearly, there is a need for a generally available quality cost model with a supporting system, a logical framework, and a documentation scheme. Individual manufacturing enterprises could readily adapt such a general quality cost model to their particular needs and use it as the basis for their quality cost systems.

Research Questions

This study determined whether the proposed experimental quality cost model (Appendix D) was adequate for a manufacturing enterprise to structure and develop a quality cost system. Specifically, did the proposed quality cost model enable a manufacturing enterprise to make the necessary management, system application, and system utilization decisions necessary for a quality cost system implementation?

Management Decisions

For a manufacturing enterprise, did the developed and presented experimental quality cost model provide an explanation of quality cost theory and applications sufficient to enable management to:

1. make a preliminary determination as to whether a quality cost system is an appropriate management tool for their enterprise or operations?

2. reach a preliminary determination of the goal or purpose of a quality cost system within the context of their processes and operations?

3. formulate and establish a preliminary quality cost policy?

System Application

For a manufacturing enterprise, did the developed and presented experimental quality cost model provide an explanation of quality cost systems applications sufficient to enable management to:

4. formulate and establish a preliminary quality cost vocabulary?

5. make a preliminary decision of the appropriate level for the initial installation of a quality cost system within the enterprise?

6. make a preliminary determination of the most relevant and appropriate focus for quality cost information?

7. make preliminary estimates of appropriate quality cost standards?

8. develop a generally adoptable quality cost model that is generally applicable as a tool by enterprises within manufacturing?

9. develop a generally adaptable quality cost model that is able to be modified or made suitable to the requirements of an enterprise within manufacturing?

System Utilization

For a manufacturing enterprise, did the developed and presented experimental quality cost model provide an explanation of quality cost system utilization sufficient to enable management to:

10. develop a preliminary quality cost diagnosis procedure?

11. develop and establish preliminary quality cost elements descriptive of its individual operations and processes?

12. prepare preliminary quality cost reports?

13. prepare preliminary quality cost evaluation and analysis reports?

Limitations

This study was conducted in view of three limitation areas: the evaluation panel, the researcher, and the scientific validity of the study.

The evaluation panel limitations were:

1. the scope of the study was confined to the panel of quality professionals.

2. the panel was composed of quality professionals employed by manufacturing enterprises only from the states of Wisconsin and Minnesota.

3. the quality professionals constituting the panel lacked a common understanding and background in the topical area of quality costs.

4. panel members required an explanation of the quality cost model before they could effectively evaluate the model.

5. panel members received only a brief exposure to the model.

6. panel members studied the model but were not actually able to test the model.

The researcher limitations were:

1. that an extensive evaluation of the experimental quality cost model would have required extensive and expensive experimentation over a long period of time (2 to 3 years); the researcher's limited resources restricted the extent of the experiment.

2. that an extensive evaluation of the experimental quality cost model would have required almost complete access to the financial and management records of a cooperating manufacturing enterprise.

3. that the researcher was limited to development of the model but did not actually test the model.

The scientific validity limitations were:

1. that the model was tested for adoptability, adaptability, and potential effectiveness. While empirical validity

evidence was desirable, the gathering of such related evidence fell outside the scope of this study.

2. that the model was not validated as an experimental tool.

3. that the research instrument was not validated prior to the workshop session. Validation, however, would have required an additional workshop prior to the actual workshop; the time and expense associated with an additional workshop would have been prohibitive.

Delimitations

The scope of this study was delimited to development of an experimental quality cost model for manufacturing enterprises. It was assumed that with changes in descriptors and terminology, the model would have applicability in services and service industries.

Assumptions

Three major assumptions were made. First, it was assumed that quality cost theory is generally applicable across different types and sizes of manufacturing industries. Second, it was assumed that a group of quality practitioners could serve as a panel concerning the effectiveness of the experimental quality cost model. Third, it was assumed that the panel would provide a forthright evaluation of the model and that their responses would be representative.

Definition of Terms

The following general terms are defined to clarify their use in the context of this study. Terms specific to the model itself are defined in Appendix D.

QUALITY. "The totality of features and characteristics of a product or service that bear on its ability to satisfy given needs" (ANSI/ASQC Standard A3-1978, 1978, p. 1).

QUALITY COST. The cost of making and identifying quality errors, establishing improvement opportunities, and measuring improvement.

MODEL. A depiction or representation of the relationships between and among concepts.

The following definitions are extracted from ANSI Z1.7-1971, ASQC A3-1979: Quality Systems Terminology but have been modified to represent a quality cost characteristic. For example, the definition for a quality program has been modified to reflect a quality cost program.

QUALITY COST PROGRAM. The documented plans for implementing the quality cost system.

QUALITY COST SYSTEM. The collective plans, activities, and events that are provided to ensure that the resources applied to product, process, or service will satisfy given needs.

QUALITY COST MODEL. A general conceptual depiction of a quality cost system.

The remaining chapters of the dissertation will:

1. review the current literature on the topic of quality costs and qualitative research.

2. provide an explanation of the research methodology.

3. report the research findings.

4. offer conclusions and recommendations.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

Manufacturers must concentrate on the quality of their products and services if they are to compete and thrive. A significant component of this concentration is that the manufacturer understand and control the costs associated with creating and delivering quality. As a strategic concept and tactical tool, quality costs can be instrumental in a manufacturer's efforts to provide and sustain a quality focus and to effect significant reductions in the costs of poor or inadequate quality.

The development and current status of the concept of quality costs and its significance as a management tool can be understood only within the context of the recent emergence of quality as critical to the continued competitiveness of manufacturing and service enterprises. Historically, manufacturing and service management focused on production costs. Production costs were considered the primary factor for management and operational attention and overshadowed concerns related to quality. In the emergence of quality as a critical competitive factor, quality is now redefining or often displacing production costs as the pre-eminent factor in competitive marketing. It is this development which makes quality costs not only a timely concept but a powerful tool in the effort to improve continually the quality of manufactured products and services.

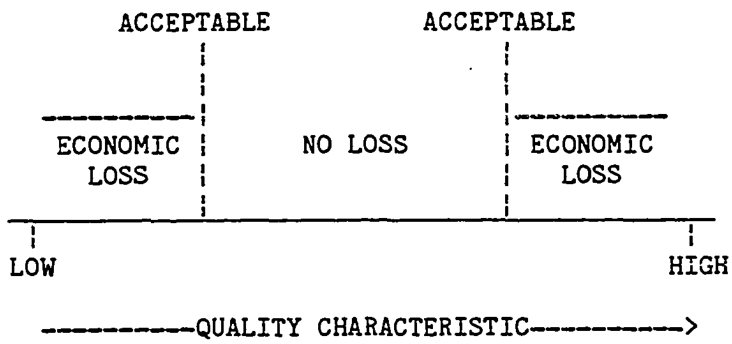
Emergence of Quality as a Critical Factor

From the beginning of mass manufacturing in the late nineteenth century, production cost control and production cost containment have been considered the most significant management factors in most successful manufacturing enterprises (Halberstam, 1986; Reich, 1983). An enterprise's competitive position in a market or industry was viewed primarily as a reflection of management's ability to predict and control costs associated with developing, manufacturing, and selling its product or service. The level of quality within a product or service was typically regarded strictly as an economic (cost) consideration or factor; the prevailing attitude in most enterprises was that one couldn't afford to make things (products or services) too good (Brown, 1951; Crosby, 1979; Harrington, 1987).

Because traditional manufacturing enterprises treated the quality of a product or service primarily as an economic (cost) factor, quality was considered secondary to cost. Enterprises delivered to the market and to their customers that quality level the enterprise considered economically feasible and suitable. Very little external consultation was conducted on the market or customer quality needs or requirements (Drucker, 1973, 1980; Halberstam, 1986).

Predetermined enterprise decisions based on an economic fact-of-life view served as the enterprise's single reference. This traditional economic view can be diagrammed (Figure 1).

Figure 1. Traditional costs view of quality



This diagram (Figure 1) indicates that the enterprise stands to lose money if the enterprise's products are of too low a quality. This is not difficult to understand; low quality means customer dissatisfaction, warranty costs, and so forth. The other side of the equation, a too-high level of quality, was believed to result in a product that exceeded customer expectations and resulted in additional production costs that would price the product out of the market.

This economic view of quality would seemingly dictate that the enterprise maintain a self-determined middle position which would avoid the economic losses encountered either side of center. This economic production mind-set proved sufficient for those product or service markets which had limited offerings, choices, or competition. Customers having few choices or options must take what is available; their decision-to-purchase is usually based on economic considerations.

Product and service marketplaces, however, are not static arenas. Competition among enterprises for customers and market share insures that competing enterprises will attempt to differentiate and promote those unique and special characteristics of their product or service offerings. It is this competition which has forced many enterprises to change their perspective on quality. To remain competitive, they must treat quality not as subordinate to cost but as equal to it (Crosby, 1984; Deming, 1986; Ishikawa & Lu, 1985). In fact, current research indicates that quality supercedes price in the decision-to-purchase. J. M. Martin (1987) quoted Feigenbaum:

> There is a basic change in the way people buy today. Eight out of 10 people today make quality equal to or greater than price as their main consideration, whereas only three or four out of 10 felt that way a decade ago. This is as major a shift in US marketplace trends as any that has occurred since World War II. (p. 44)

The myth that high quality requires exorbitant cost of production has also been dispelled. Observed Harrington (1987):

> Poor quality costs your company money. Good quality saves your company money. It's as simple as that. James E. Olson, President of AT&T, said, "A lot of people say quality costs you too much. It does not. It will cost you less." But many companies today do not measure the cost of poor quality, and if you do not measure it, you cannot control it. Why is it, then, that those in corporate management do not insist on the same good financial control over poor-quality cost (PQC) that they exercise over the purchase of materials, when often PQC exceeds the total materials budget? (p. 3)

The early 1960's saw the development of a trend toward differentiating products and services by stressing the quality of a product or service and the productivity of the enterprise's efforts. The myth that too high a level of quality cannot be afforded was exploded. As Tribus and Tsuda (1984) explained, this change in economic perspective required that management radically reorient its thinking about the relationship between costs associated with quality and long-term productivity:

> Managers need to learn that when they increase the quality of whatever they do, productivity goes up and costs go down. Many managers do not believe this. They think it goes the other way around. The "cost of quality" calculation, which tries to find the "optimal quality investment," is a snare and a delusion. In every cost of quality calculation, the terms left out are often bigger than the ones included. The decrease in the variability of any process serves . . . to "remove the Fog" surrounding the process and permit creative "imagineering" which produces dividends not thought of and therefore not included in the calculus. (p. 2)

Quality and productivity were no longer considered strictly economic (cost) factors in many highly competitive enterprises and markets. In the new competition, enterprises identified and marketed themselves as the deliverers of quality products and services created within a high productivity manufacturing and delivery environment. Both the consumer and the marketplace responded quickly and favorably to these new enterprises and their broader, more innovative product and service offerings, especially to those obvious quality differences among offered products and services. Quality began to be perceived as very important to the customer as he or she differentiated among products and services and as a very effective marketing strategy. Quality could no longer be treated as a mere adjunct or as a secondary economic (cost) consideration; it was no longer simply a subordinate factor.

Quality became a factor equal in importance to economics (Kume, 1985; Peters & Austin, 1985; Taguchi, 1981).

An early writing addressing quality and cost as separate but interdependent issues appeared in November of 1951, in the Harvard Business Review. Theodore Brown understood product quality as essential to effective marketing and competitive advantage in a free market. Brown warned manufacturers that they could no longer afford to treat quality on the level of cost factor but had to see it as a customer requirement and as essential to continued existence in a competitive system:

> The subject of specific cost and dollar savings is one which quality control engineers at times carefully avoid. The reason seems to be that a consistently good final product made under a system of quality control may cost more than a product of less dependable quality made by haphazard methods. It is unfair, however, to look at the problem solely from this point of view. Surely, the ultimate consumer has some interest in the quality of what he purchases. Reliability and freedom from repairs even under hard-usage are the qualities which he seeks. Merchandise of low quality in the long term is likely to be unsatisfactory. From the manufacturer's point of view, the competitive system of free enterprise tends to force him into the acceptance of quality control if he is to satisfy his customers and so maintain his standing in the market. (p. 78)

Brown concluded that the free enterprise system itself would force enterprises to set aside the strictly economic view of quality and to place at least equal emphasis on the customer's view of quality.

Emergence of Quality Costs as Concept and Tool

This early shift in attitude toward quality (away from quality as a cost factor and toward quality as a marketing strategy) was accompanied by a related development. In the early 1950's Armand Feigenbaum and J. M. Juran began asking provocative questions about the economics of shoddy quality: How much does the production of poor quality actually cost the manufacturer? How significant are the costs associated with scrap, rework, field failures, warranty, and other costs associated with poor quality? What difference would it make to control and eliminate such avoidable costs?

Feigenbaum's Contributions

In his work at General Electric in the early 1950's, Armand Feigenbaum (1956) observed that quality costs were having an adverse impact on the enterprise, and he developed a cost system for communicating the magnitude and importance of these quality related costs to management. He developed a dollar-based reporting system which he referred to as quality costs. Feigenbaum's method enabled him to collect costs associated with developing the quality system and inspecting products and costs associated with product failure.

Feigenbaum (1983) divided quality costs into "the costs of control and the costs of failure of control" (p. 111). (See Figure 2.)

Figure 2. Feigenbaum's concept of quality costs

QUALITY COSTS		SEGMENTS
COSTS OF CONTROL	---------->	PREVENTION COSTS
	---------->	APPRAISAL COSTS
COSTS OF FAILURE OF CONTROL	---------->	INTERNAL FAILURE COSTS
	---------->	EXTERNAL FAILURE COSTS

He separated costs of control into prevention costs which "keep defects and nonconformities from occurring and include the quality expenditures to keep unsatisfactory products from coming about in the first place" and appraisal costs which "include the costs for maintaining company quality levels by means of formal evaluations of product quality" (p. 111).

Among prevention costs, Feigenbaum (1956) listed quality planning, product-design verification, process control, quality work force training, and others. Appraisal costs included test and inspection of purchased materials, laboratory-acceptance testing, inspection, field testing, and others.

Feigenbaum (1956) further divided quality costs into internal and external failure costs. Both of these cost categories are caused by materials and products that fail to meet quality requirements according to Feigenbaum. Internal failure costs represent costs of unsatisfactory quality within the factory; scrap, rework, and reworked materials belong in this category. Feigenbaum identified external failure costs as expense associated with poor quality goods reaching the customer and generating performance failure, warranty costs, and customer complaints.

Feigenbaum (1956) wrote about what he considered exceedingly high quality costs. Although he could not find documented research on the subject, he believed the evidence indicated that in many cases quality cost expenses accounted for 7% to 10% of the cost of sales. "In fact," he stated, "quality costs (inspection, testing, laboratory checks, scrap, rework, customer complaints, and similar expenses) have crept up to become a multimillion-dollar item" (p. 93). Feigenbaum believed that for many companies, quality costs were much too high and would over the long term cost these companies their market and competitive position.

Feigenbaum's dollar-based system for extracting and recording the magnitude and possible effects of quality costs was developed primarily to gain the attention of top managers. At the time Feigenbaum first wrote on quality costs, he felt that the only way to gain upper management's attention relative to quality was to express the costs of quality in dollar figures. Unfortunately, this was often the only way to impress upper management with the importance of quality. Since Feigenbaum's early efforts, many authors and practitioners have attempted to engage the attention of management by estimating the cost of quality to the enterprise.

The attempt to determime the actual cost of quality within an enterprise is still very actively pursued. Sinha and Willborn (1985) estimated that "from 15% to 40% of the manufacturer's cost of an average product is for hidden waste that the company tries to recover through higher prices passed on to the consumer" (p. 503). Townsend (1986) stated "IBM estimates that 30 percent of its products' manufacturing costs--the total Cost of Quality, prevention, detection, and appraisal--arises directly from not doing it right the first time" (p. 127). The Cost Effectiveness Committee of the American Society for Quality Control (ASQC) reported that "quality losses, i.e., restoration or failure costs, have been known to approximate 5 to 15 percent of sales billed—much of it centered around warranty adjustments costs" (American National Standards Institute/American Society for Quality Control, 1971, p. 38). Crosby (1984) described the concept of the price of nonconformance (all the expenses involved in doing things wrong) as "an enormous amount of money, representing 20 percent or more of sales in manufacturing and 35 percent of operating costs in service companies" (p. 85).

The continuing research into determining the actual dollar value associated with quality costs has accompanied further refinement of Feigenbaum's concept of quality costs. Many large enterprises have applied the quality cost concept to measure and improve their quality systems, among them Honeywell, IBM, IT&T, 'bbott Laboratories. Digital Equipment, General Electric, General Motors, Bendix, and many others (Harrington, 1987).

Feigenbaum's contribution to the development of quality costs as a concept and a tool is considerable. His identification and categorization of quality costs enabled him to derive rudimentary estimates of their influence on the overall costs of production. His dollar estimates of the magnitude of quality costs caught the attention of management and contributed to early efforts to identify and reduce these wasteful expenditures.

Feigenbaum's approach to quality costs, however, is largely one of tabulation. His figures told management how well it (management) was doing what it thought should be done. Feigenbaum's approach did not consider customer and market expectations.

Feigenbaum structured General Electric's proprietary quality cost model. His writings allude to this model but only in nonspecific philosophical and conceptual terms (Feigenbaum, 1983).

Juran's Contributions

In 1951, J. M. Juran observed that enterprises should realize it is profitable to identify and reduce those costs associated with poor quality. Juran's focus was on productivity or how the efficiency and effectiveness (productivity) of the enterprise could be increased by eliminating unnecessary cost stemming from poor quality. In the first edition of his Quality Control Handbook, Juran (1951) explained the concept of quality costs and presented his now classic gold in the mine analogy:

> Experience has shown that it is very useful to compute what costs would disappear if there were no defects whatever. . . . The total of the(se) avoidable costs is the "gold in the mine." This "gold in the mine" is evaluated by asking "What present costs would disappear if all defects disappeared?" (p. 1-34)

Juran's rationale is that often a greater return-on-investment can be realized from reducing costs of poor quality than from attempting to increase sales. If the expense and influence of poor quality is reduced, the image of the enterprise is enhanced, and the market for its products or services will grow. If the enterprise has quality problems and attempts only to increase sales, the influence and adverse effects of its poor quality will only lead to greater difficulties with the expenses associated with poor quality and dissatisfied customers. Because this opportunity to increase return-on-investment is already available and focused within the enterprise and its operations, it is an internal opportunity or the gold in the mine available if the enterprise only digs a little. In the third edition of the Quality Control Handbook (1979), Lundvall and Juran comment on the concept of the gold in the mine:

> Behind the concept was the implication that costs resulting from defects were a gold mine in which profitable digging could be done. This concept became widely used to demonstrate that programs for defect reduction could be carried out at a return on investment. (p. 5-2)

Juran used an inward-looking perspective (i.e., internal to the organization) similar to the focus Feigenbaum adopted. Juran's approach provided greater detail in organizing a quality cost system but offered no general quality cost model.

Quality Costs as a Requirement

While Brown, Feigenbaum, Juran, and others strongly recommended and championed the recognition and assessment of costs associated with quality, there was no requirement that any enterprise establish a cost of quality program. In December of 1963, the Department of Defense issued MIL-Q-9858A, Quality Program Requirements which signaled the beginning of a trend toward the mandating of quality costs assessment and reporting (Department of Defense, 1985).

The requirements stipulated in MIL-Q-9858A were quite nonspecific. The standard directed specified government contractors and their subcontractors to maintain and employ quality cost data as a management element within their quality program:

> 3.6 Costs Related to Quality. The contractor shall maintain and use quality cost data as a management element of the quality program. . . . The specific quality cost data to be maintained and used will be determined by the contractor. These data shall, on request, be identified and made available for "on site" review by the Government Representative. (Department of Defense, 1985, p. 3)

Under this specification, the contractor was required to maintain and report quality costs but was allowed great latitude in determining which costs to report and how to construct the quality cost system. As a result, contractors commonly met this specification by simply directing their accounting departments to total the salaries of all employees in overt quality control (i.e., inspection and testing) functions. This undifferentiated and largely useless figure was acceptable as a report of quality costs under these initial (1963) Department of Defense regulations.

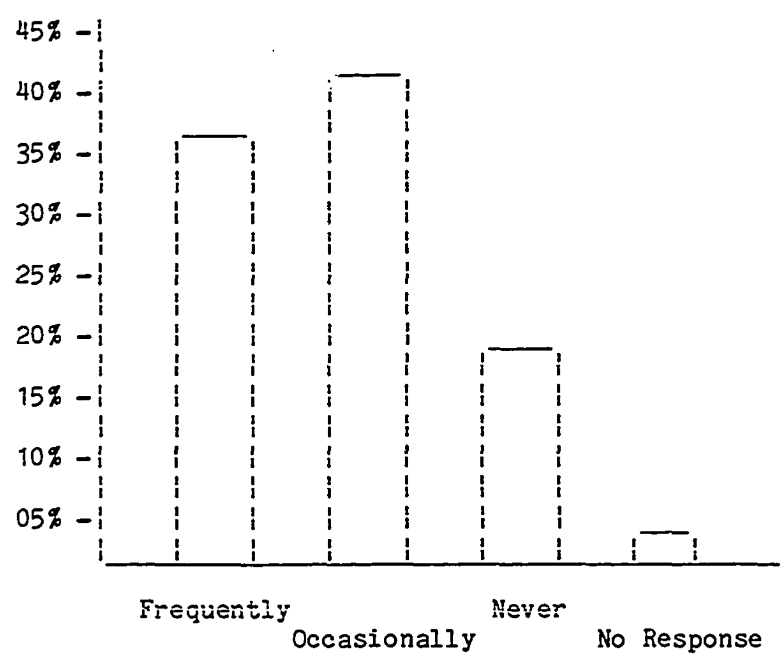
In 1975 a less permissive standard was issued. MIL-STD-1520A, Corrective Action and Disposition System for Nonconforming Material, identified which costs must be gathered and reported rather than allowing this decision to individual contractors (Department of Defense, 1980). It required that quality cost data be used to provide current and trend information for internal review and action.

Increasing Use of Quality Costs

In recent years, increasing numbers of government and commercial contracts have required the reporting of quality costs, from the costs of scrap and rework to documentation of full-scale quality cost programs (Campanella & Corcoran, 1983).

Attendees of the 1985 Annual Quality Congress, the largest national gathering of practitioners in quality and quality related fields, were surveyed by Duhan and West (1985) to ascertain which quality control techniques were most frequently used by their organizations. The responses indicated that over 35% of the organizations reported using quality costs frequently and over 40% reported using quality costs occasionally (Figure 3).

Figure 3. Percent of organizations using quality costs
From "AQC Survey Reports on Tools of the Trade" by D. Duhan and A. West, 1985, Quality Progress, 18, p. 84.



The increasing use of quality costs as a concept and a tool can be attributed to four developments (Juran & Gryna, 1980). First, quality costs themselves have grown due to the increased volume of complex products. Technologically advanced and innovative products require a greater precision and reliability than previously experienced.

Second, more long-life products are on the market. These products bring with them the possibility of high costs associated with field failures, field service, spare parts, and maintenance labor. It is, in fact, sometimes more costly to keep these products in operation than it was to purchase them in the first place.

Third is the pressure resulting from a "life behind the quality dikes". Observed Juran (1979a), "In the twentieth century, for the first time in human history, the great masses of human beings placed their safety, health, and even their daily well-being behind numerous protective dikes of quality control" (p. 4-2). The whole social structure is now premised and dependent on the quality of manufactured products, on the reliability of medicines, bridges, tunnels, cars, waste removal, aircraft, complex defense systems. Not surprisingly, the national economy, too, depends more and more on quality control. Marketability of products determines national income, and marketability depends increasingly upon quality. In such a context, the concept of quality costs becomes highly significant.

A fourth reason for the growing acceptance and use of quality costs is the need for quality professionals to communicate their findings and recommendations to upper management in the language of upper management, the language of money. Juran (1979b) describes the common languages in companies diagrammatically (Figure 4).

Figure 4. The languages in companies

From "Quality Policies and Objectives" by J. M. Juran, 1979b, in Quality Control Handbook edited by J. M. Juran, F. M. Gryna, and R. S. Bingham. New York: McGraw-Hill Book Company, pp. 3-11.

```
                  /\
                 /  \
                /    \
               /      \
              / UPPER  \   --> LANGUAGE OF
             /MANAGEMENT\        MONEY
            /____________\
           /              \
          /     MIDDLE     \
         /   MANAGEMENT:    \
        /  MUST BE BILINGUAL \
       /______________________\
      /                        \
     /    LOWER MANAGEMENT      \
    /    AND NONSUPERVISORS:     \
   /     LANGUAGE OF THINGS       \
  /________________________________\
```

Juran contends that the language spoken by top executives (upper management) is the language of money, of sales, investment, profits, return-on-investment. Top executives reach decisions about possible courses of action only through explanations made in and understandings developed through the use of this common language. The language at the bottom of the enterprise, on the other hand, is the language of things. Supervisors, foremen, and nonsupervisory personnel communicate in the language of meters, hours, tons, kilowatts, and so forth. Effective mid-level technical/professional managers, therefore, must be bilingual. Technical/professionals in middle management positions must be able to take the observations and data from individuals using the language of things (defects, scrap, etc.) and develop a system and structure to convert these findings into the language of upper management, the language of money (Juran, 1979b). The quality costs concept permits the translation of the quality professional's findings into the dollars and cents language of upper management. As a management tool, quality costs permits the definition of opportunity and the measurement of success. As Juran and Gryna (1980) explained:

> What has emerged is a concept of defining and measuring "quality cost" and then using the resulting figures for two different but interrelated purposes:
> 1. To provide a "new scoreboard" as an added form of cost control.
> 2. To "identify opportunities" for reducing costs. Here the emphasis is not on meeting some historical standard but on challenging the validity of that standard. (p. 12)

Lack of Quality Cost Standards

Although the concept of and systems of quality costs have existed since the 1950's, no quality cost standards exist. Quality cost terminology and definitions related to quality costs are available but standard terminology or generally agreed upon definitions are not. Several factors contribute to this. First, early adopters of quality cost systems usually modified an existing cost accounting system to create and provide definitions for their particular system of quality costs. In these cases, quality costs were defined within the context of internal and often proprietary accounting systems. These internally created quality cost systems established their own peculiar sets of quality cost terminology and definitions which were not easily transportable or suitable to broad generalization.

Second, many established authors who began writing on the concept of quality costs already supported a basic quality philosophy. They often chose to emphasize quality costs from a view which conformed to their already existing philosophy of quality thus creating a diffusion of quality cost thought rather than a focus.

Third, accounting professionals often chose to treat the quality cost concept as a trendy and possibly short-lived phenomenon which used a less than rigorous application of accounting. Finally, perhaps the most significant factor was the continuing evolution of quality thought and the growing focus on customer satisfaction and market competition.

Further explanation will clarify the evolutionary nature of the quality costs concept. Initially, writers such as Feigenbaum and Juran addressed quality costs primarily from an internal (within the enterprise) economic view; Juran's gold in the mine analogy exemplifies this focus on the economic advantage the company might reap by eliminating the wastefulness inherent in the production of shoddy goods. The view of quality and quality programs evolved from this preoccupation with internal economics to a broader customer/user perspective. Here the attention of the enterprise is focused upon meeting the customer's quality expectations and requirements. Concepts and applications of quality costs changed to conform to this new concept of quality. Quality costs expanded to account for and measure the effectiveness of the new external customer/user emphasis (Crosby, 1984; Harrington, 1987; Townsend, 1986).

In light of these developments, some argue that general standards for quality cost terminology and definitions cannot be established. Their arguments rest on the broad differences in stated quality goals and objectives, differing quality cost philosophies, systems, and applications among the many quality professionals and individual enterprises.

No quality cost standard currently exists. The 1963 Quality Program Requirements (1963), MIL-Q-9858A (Department of Defense, 1985) required no specified structure or form for reporting of quality costs. The 1975 standard MIL-STD-1520A, Corrective Action and Disposition System for Nonconforming Material, identified costs that must be gathered and reported but within a very specific context. Neither document was intended to be nor could it serve as a quality cost standard.

Quality costs are addressed in ANSI/ASQC Standard Z-1.15-1979, Generic Guidelines for Quality Systems, but only in an informational appendix (American National Standards Committee Z-1 on Quality Assurance, 1980). Appendix C is entitled "Management of Quality Costs" but is separated from the standards contained within the document by this statement:

> This Appendix is not part of the American National Standard ANSI/ASQC Z-1.15-1979 Generic Guidelines for Quality Systems but is included for informational purposes only. (p. 15)

The standard provides broad though very limited recommendations for managing quality costs and quality cost systems. It suggests that quality cost reporting be as comprehensive and useful as possible and recommends that quality cost reports be classified into meaningful (cost) elements.

The American Society for Quality Control has supported the development of a number of technical publications addressing quality costs. The ASQC Quality Cost Technical Committee was formed in 1961, and in 1971 published Quality Costs--What & How to provide a conceptual framework for quality cost programs and definitions for the categories and elements of quality costs (American Society for Quality Control, 1971). This early work reflects the orientation to the economics of quality and consequently results in a very strong internal focus:

> The basic concept of quality costs is recognition and organization of certain quality-related costs to gain knowledge of their major contributing segments and of the direction of their trends. . . . Quality costs help to measure overall quality activities within a business, supplying cross-checks for measuring inputs against outputs. (pp. 5-6)

This concept of quality costs closely parallels the earlier approaches of Feigenbaum and Juran and agrees with the direction established by MIL-Q-9858A and MIL-STD-1520A.

The Quality Cost Technical Committee used a quality cost element division similar to that contained in ANSI/ASQC Z-1.15 (American Society for Quality Control, 1971):

> Prevention--Costs incurred for planning, implementing and maintaining a quality system that will assure conformance to quality requirements at economic levels. (p. 8)

Appraisal—Costs incurred to determine the degree of conformance to quality requirements. (p. 13)

Internal Failure—Costs arising when products, components, and materials fail to meet quality requirements prior to transfer of ownership to customer. (p. 16)

External Failure—Costs incurred when products fail to meet quality requirements after transfer of ownership to the customer. (p. 19)

The Quality Cost Technical Committee sponsored numerous publications on quality costs including Guide for Reducing Quality Costs (American Society for Quality Control, 1977, 1987), Guide for Managing Vendor Quality Costs (American Society for Quality Control, 1980), Quality Costs: Ideas and Applications (Grimm, 1984), Principles of Quality Costs (Hagan, 1986), and Guide for Managing Supplier Quality Costs (Winchell, 1987). The Committee also sponsored professional training programs and annual presentations on quality costs.

In 1986, the Committee published Principles of Quality Costs (Hagan, 1986) as a replacement for Quality Costs—What & How (1971). The new publication exhibited a very obvious shift from the earlier economic view to a customer/user view. Management concepts of quality costs are very similar in both documents, but Principles of Quality Costs (1986) expands upon and addresses changes (e.g., audits, service, and vendors) not specified in earlier quality cost elements. Elements of quality cost which have been brought into line with contemporary quality theory and management practices are defined:

Prevention Costs—The costs of all activities specifically designed to prevent defects in deliverable products or service. Includes activities prior to and during product or service development, purchasing, operations planning and execution, operations support, and post-delivery service.

> Appraisal Costs—The costs associated with measuring, evaluating or auditing products or services to assure conformance with quality standards and performance requirements. These include the inspection, test or audit of purchased materials, manufacturing or process operations, operations support documentation and materials, and installation or field trials. Include labor and fringe benefit costs, as well as expenses and depreciation.
>
> Failure Costs—The costs required to evaluate and either correct or replace products or services not conforming to requirements or customer/user needs. This includes purchased materials and associated product or service design and support materials because they failed to meet requirements or customer/user needs. Includes both material and labor costs, with fringe benefits.
>
> Internal Failure Costs—The costs occurring prior to completion or shipment of the product or furnishing of a service.
>
> External Failure Costs—The costs occurring after shipment of the product and during or after furnishing of a service. (Hagan, p. 4)

These expanded definitions of the quality cost elements mark a clear departure from the previously held economic (production cost) view of quality. The new focus rests solidly on balancing economic and customer/user considerations; however, the new focus and written works in quality cost have not provided a substantive quality cost model that a quality practitioner can use to establish a quality cost program. This lack of a quality cost model keeps many practitioners from bridging the gap between theory and practice.

Qualitative Research

This study employed qualitative research processes to determine the adoptability and adaptability of the experimental quality cost model. Qualitative research is a broad term used to refer to a number of research strategies which share certain methodological and epistemological characteristics. Qualitative research is, for example, inductive and process-oriented; it aims not to produce scientific law-like generalities but perspective, understanding, and holistic assessment of whatever is being investigated. Qualitative research is not dependent upon statistical analysis. The qualitative researcher is himself the key instrument for data analysis (Bogdan & Biklen, 1982; Lincoln & Guba, 1985; Patton, 1980; Smith & Heshusius, 1983).

Respected researchers such as Denzin (1970), Glaser and Strauss (1967), and Patton (1980) agree that the qualitative research process is particularly well suited for certain areas of inquiry: for examining previously unstudied situations, for developing or expanding upon a theory, and for exposing interactions in complex forms. These areas do not lend themselves to the more rigid deductive methodology which characterizes quantitative research. The qualitative approach, for example, is likelier to present a previously unstudied situation more completely as this approach avoids prematurely reducing an unexamined situation to a set of preconceived variables. In her examination of factors related to the success of quality circles, for instance, Heelan (1983) adopted a qualitative approach because the area was as yet unexamined. Heelan presented her rationale for the qualitative methodology:

> This was an area not yet subjected to empirical analysis; consequently, a complete set of variables related to their success had not yet been isolated. (p. 41)

Likewise, qualitative research lends itself to the development of theory, an inductive rather than deductive process. Glaser and Strauss (1967) caution against creating theory in a vacuum. They emphasize the importance of grounding theory by conducting thorough inductive studies.

The more inductive open-ended qualitative approach is also recognized as better able to reveal interactions in complex forms (Denzin, 1970; Glaser & Strauss, 1967). A many-sided reality such as an intricate model is sometimes more effectively studied using a qualitative rather than a quantitative model. To evaluate a complex financial model, Meier (1986) utilized a qualitative approach. He assembled a jury of seven members determined to have the background necessary to assess his Service Cost Index (SCI). Meier concluded that the jury's "overall high acceptance of the SCI model suggested the model possessed content validity" (p. 43). Such use of the qualitative approach illustrates its value in validating complex newly developed models which have not yet been broadly applied.

Summary

A review of the literature revealed that although quality cost is considered an important concept and management tool by many leading quality professionals and authorities, no readily adoptable/adaptable quality cost model exists. Likewise, consistent terminology and standards for model development are not in general use. Where quality cost systems are in operation, they are generally of a proprietary nature, having been created to serve the particular enterprise which invested in their development and establishment. The development of a readily available, workable model for the analysis of quality cost could be of significant benefit to manufacturing enterprises lacking the resources necessary to initiate and develop an individual proprietary system. A generally available model may also contribute to an increased understanding of quality costs, greater consistency in quality cost terminology, and the development of quality cost standards. Qualitative research strategies were employed to assess the experimental quality cost model.

CHAPTER III

METHODOLOGY

A quality cost model provides a manufacturing enterprise with a cost structure which enables it to gauge and measure the efficiency and effectiveness of its management and processes. Although the value of a quality cost system has received widespread endorsement, no quality cost model or quality cost standard for manufacturing enterprises is generally available. Many large enterprises have developed internal and proprietary quality cost systems but these quality cost models are not generally available to other enterprises or quality practitioners. This study addressed the issue of and provided a generally adoptable and adaptable quality cost model for manufacturing enterprises.

Development of the Quality Cost Model

The writer's development of the quality cost model was initiated after research into the subject of quality costs revealed only industry specific or theoretical and conceptual treatments. A dissertation abstract search covering the last 15 years revealed no study in the topical area of quality costs. A review of the professional literature in the quality field revealed no generally available quality cost model. Only references to the proprietary quality cost models and systems of large enterprises were located. Comments received from nationally known quality professionals during an informal investigation confirmed this lack of a generally available quality cost model.

A preliminary form of the quality cost model was developed to support educational presentations given by the researcher in courses in the quality sciences. This preliminary form was refined over a two year period to represent and depict the quality cost considerations encountered in a manufacturing enterprise. Refinement of the model involved incorporating additional information and components from quality and accounting literature, information sciences, and the recommendations of quality and manufacturing practitioners. The preliminary quality cost model was expanded into an experimental quality cost model.

A preliminary field test of the developed experimental quality cost model was conducted to assess the model's applicability and adaptability within the needs of a manufacturing enterprise. This field test took the form of an industrial internship (July 7, 1986, to July 9, 1987) with a medium size precision equipment manufacturer. The corporate manager of quality assurance supervised the internship and provided a final evaluation of the quality cost model.

As stated in the internship proposal, the internship was to provide an opportunity to develop a model of quality costs within a manufacturing environment:

> The proposed internship will develop a system for determining quality costs within a manufacturing environment. It will be supported by the development of procedures for practical and effective cost analysis and identification.

This preliminary application of the quality cost model was used specifically to:

1. provide a perspective regarding how and for what purposes the concept of quality cost would be applied within an actual manufacturing enterprise.

2. demonstrate the necessary working relationships and information exchanges a quality cost program would require between different functional areas within an actual manufacturing enterprise.

3. identify the structure and composition of quality cost considerations within an actual manufacturing enterprise.

4. insure that the preliminary quality cost model could be considered complete and appropriate for evaluation by a panel of experts.

In the final evaluation of the quality cost model's preliminary test within a manufacturing enterprise, Mr. David Windmuller, the corporate quality assurance manager stated:

> The concept of a comprehensive Quality Cost System for use not only as a measuring and reporting tool but also as a means to direct resources is very attractive to someone in my position. This document (the quality cost model) provides a very good starting point from which to mold a system for a particular manufacturing entity. (D. T. Windmuller, personal communication, July 9, 1987)

The quality cost model received a preliminary evaluation as adaptable and beneficial within a manufacturing environment.

Panel Method of Evaluation

For the purposes of this study, a panel of quality professionals (i.e., practitioners experienced in quality or quality related positions) from manufacturing enterprises evaluated the experimental quality cost model developed by the researcher. This method of evaluation was selected for several reasons. Time and financial constraints prohibited extensive field testing of the model. The proprietary nature of the management and financial records to which the researcher would need access for such testing also represented a constraint. While in-depth field testing was desirable, it was beyond the intended scope of this research project. In this study the evaluation by a panel of quality professionals was considered sufficient to determine the adoptability, adaptability, and potential effectiveness of the experimental quality cost model.

The researcher explained the proposed quality cost research project to the Northwest Wisconsin Subsection of the American Society for Quality Control, a society of quality professionals, and the Industrial Management Department of the University of Wisconsin-Stout. Both organizations agreed to lend their support and sponsorship to the quality cost model research project. The support was in the form of co-sponsorship of the two-day quality cost workshop, a news release to practicing quality professionals reporting the availability of the quality cost model workshop, and the use of seminar space at the University of Wisconsin-Stout.

Members of the American Society for Quality Control, a society of quality professionals, were invited to participate in a two-day quality cost model workshop which detailed and explained the theory and use of the quality cost model. The participants in the workshop formed the evaluation panel. It was assumed that the quality practitioners who constituted the evaluation panel applied their knowledge of quality practices and knowledge and experience from the manufacturing environment to provide an adequate evaluation of the experimental quality cost model.

Members of the quality cost model evaluation panel were selected from workshop participants who met the following criteria:

1. current employment in a quality position or a position with a quality responsibility for at least one year; or

2. previous employment in a quality position or a position with a quality responsibility for at least one year within the past five years.

The evaluation panel was arbitrarily determined to be optimal at a size of 15 or more; in no case was the panel to have fewer than 10 qualified members.

Participant Demographics

In this section, a brief review of participants' basic demographics background—the industries they represented, their years of experience, age range, and geographical locations—is presented.

All panel members were from manufacturing enterprises. Six panel members were from the plastics industry, two from the computer industry, two from the food processing industry, and one from the machine tool industry. Ten of the workshop participants qualified as panel members under criterion one (current employment in a quality position or position with a quality responsibility for at least one year), and one workshop participant qualified as a panel member under criterion two (employment in a quality position for at least one year within the past five years). A profile of the 11 workshop attendees who qualified to serve as quality cost model evaluation members can be found in Appendix A.

Seven evaluation panel members currently held quality positions, two in a production position, one in a cost accounting position, and one from a materials testing position. The seven panel members in quality positions had experience ranging from two to over 10 years. This represents a total of over 56 years of quality position experience. The two members in a production position with a quality responsibility had from two to more than 10 years of experience representing a total of over 13 years of production position experience. The member from a cost accounting position had worked for two years in a cost accounting position with a quality responsibility and a total of 12 years in cost accounting. The member from the materials testing position with a quality responsibility had one year of experience. This represented a cumulative total of evaluation panel experience in all categories of over 90 years and a panel average of over eight years of experience per member.

A review of the age range of the quality cost model evaluation panel revealed two panel members in the 40 to 50 age range and four panel members in the 31 to 40 age range. Five panel members fell in the 20 to 30 age group.

The geographical distribution of panel member industries is displayed in Figure 5.

Figure 5. Geographical location of panel member industries

```
          Webster, WI          Phillips, WI
             (1)                  (1)
           77 miles   Turtle    120 miles
              \       Lake, WI     /          Medford, WI
               \        (1)       /               (1)
                \     42 miles   /             103 miles
                 \       ¦      /  _____________¦
                  \____   \    / /
                       \   \  / /   ---28 miles---Chippewa Falls,
                        \   \/ / /                    WI (2)
 St. Paul,---56 miles---University---24 miles--- Eau Claire, WI (4)
  MN (1)                     of
                      Wisconsin-Stout
                       Menomonie, WI
```

Note. The parenthesis displays the number of panel members from industries within the same geographical location.

Each panel member received the complete workbook edition of the experimental quality cost model (Appendix D). The quality cost workshop agenda is presented in Appendix B.

It was recognized that the workshop session could provide an inherent bias to the study. Workshop instruction and responses to panel questions could provide information beyond that contained within the published model. Both the presenter and panel could gain insights on model installation and operation not contained in the original model.

Following the workshop session, panel members completed a 13-item Likert-style instrument (Appendix C).

The Research Instrument

The 13-item Likert-scale segment of the research instrument corresponded to the research questions posed in Chapter I. To insure that the evaluation instrument was properly constructed, it was reviewed by professionals familiar with instrument development and construction.

The Likert Scale is commonly used in qualitative research; the scale utilized for the items in this study was modeled after the one developed by Meier (1986, p. 43). The responses are ranked as shown below (Figure 6).

Figure 6. Likert scale

1	2	3	4	5
quite adequately		adequately		quite inadequately

Responses 1, 2, and 3 were treated as a positive evaluation and responses 4 and 5 as negative. That is, a response of 1 (quite adequate), 2 and 3 (adequate) were considered indicative of a positive evaluation. A response of 4, or 5 (quite inadequate), on the other hand, was treated as a negative evaluation. The responses to each of the thirteen items were reported in a separate table. Each table contained the item in question and the number and percentage of responses received by that item in each of the five categories.

A summary of the responses to the Management Decision research questions (items one through three), System Application Research questions (items four through nine), and System Utilization questions (items ten through thirteen) follow the last question in each identified group. A comparison of responses to the Management, System Application, and System Utilization research question groups are presented in table form.

A comparison of positive and negative responses, mean responses to the research questions, and mean response from individual panel members is provided in an appropriate table or figure. A summary table of the items was also constructed to provide an overall view of the ratings for all 13 items. Additionally, results for each question (and the implications these results have for the model) are discussed in narrative form. Finally, an overall summary analysis of the panel's evaluation and the implications this evaluation has for the quality cost model as a viable tool for manufacturing enterprises are discussed.

CHAPTER IV

RESULTS

This study was conducted to determine the adoptability, adaptability, and potential effectiveness of the experimental quality cost model. The experimental quality cost model was constructed to provide a manufacturing enterprise's management with a cost structure which would enable them to gauge and measure the efficiency and effectiveness of its policies and processes.

A panel of quality professionals from manufacturing enterprises was selected from the participants who attended a workshop on the quality cost model. The evaluation panel evaluated the experimental quality cost model after a complete explanation of the model and model operation. The data resulting from the panel evaluation of the quality cost model are presented in this chapter.

Presentation of Results

In this chapter, the results of the evaluation panel members' responses to the research questions are presented. First, the Management Decision, System Application, and System Utilization quality cost model responses are presented. This is followed by a comparison of the positive and negative responses to the quality cost model research questions, a comparison of the mean responses for research questions, and a comparison of mean responses for individual panel members. Finally, an overall summary by research question and panel member response concludes the results chapter.

Only three negative responses occurred among the 142 total responses (one in item five, one in item eight, and one in item 12). If no negative responses appeared for an item, only the table of positive responses is shown. Chapter III provided an explanation for the Likert-type scale and definition of positive and negative responses.

Management Decision Questions

The management decision questions (items one through three) were those which required panel members to evaluate the quality cost model's sufficiency in terms of organizational policy, goals, and objectives. Specifically, would the model enable management to make a preliminary determination as to whether a quality cost system is an appropriate management tool for their enterprise or operation? Would it enable management to reach a preliminary determination of the goal or purpose of a quality cost system within the context of their processes and operations? Would it enable management to formulate and establish a preliminary quality cost model?

Research Question One: Management Tool

The purpose of research question one was to evaluate the quality cost model's sufficiency in enabling management to reach a preliminary determination as to whether a quality cost system is an appropriate management tool for their enterprise or operations.

One evaluation panel member selected the No Response block for question one resulting in only 10 responses for this question. Individual responses ranged from 2 to 3 with a mean response of 24/10 or 2.4. The evaluation results were 100% positive as shown in Table 1.

Table 1

Responses to Research Question One

Responses	Evaluation Results	
	Number	Percent
Positive		
1. Quite Adequately	-	----
2.	6	60.0
3. Adequately	4	40.0
Total Positive Responses	10	100.0

Research Question Two: Goal or Purpose

The purpose of research question two was to evaluate the quality cost model's sufficiency in enabling management to reach a preliminary determination of the goal or purpose of a quality cost system within the context of their processes and operations.

The range of individual responses was from 2 to 3 with a mean response of 25/11 or 2.3. Evaluation results were 100% positive. (See Table 2.)

Research Question Three: Quality Cost Policy

Research question three was intended to evaluate the quality cost model's sufficiency in enabling management to formulate and establish a preliminary quality cost policy.

Table 2

Responses to Research Question Two

Responses	Evaluation Results	
	Number	Percent
Positive		
1. Quite Adequately	-	----
2.	8	72.7
3. Adequately	3	27.3
Total Positive Responses	11	100.0

Table 3

Responses to Research Question Three

Responses	Evaluation Results	
	Number	Percent
Positive		
1. Quite Adequately	-	----
2.	8	72.7
3. Adequately	3	27.3
Total Positive Responses	11	100.0

Individual responses ranged from 2 to 3 with a mean response of 25/11 or 2.3. Once again, evaluation results were 100% positive as shown in Table 3.

A summary of the panel's responses to those questions (items one through three) pertaining to the management aspects of the quality cost model is provided in Table 4.

Table 4

Comparison of Management Decision Responses

	Responses to Items 1 to 3							
	quite adequately		adequately		quite inadequately			
Item	1	2	3	4	5	M	NR	n
1	-	6	4	-	-	2.4	1	10
2	-	8	3	-	-	2.3	-	11
3	-	8	3	-	-	2.3	-	11
TOTALS	-	22	10	-	-		1	32
PER		68.7	31.3					

The mean for this group of items was 74/32 or 2.3, and the panel members' responses were 100% positive. In Table 4, M is the mean response for the research question; NR indicates no response to the items for each research question; n is the number of responses for each question; TOTALS show the column totals for the responses; and PER is the column percentage for each response.

System Application Questions

The system application questions (items four through nine) required panel members to evaluate the quality cost model's sufficiency in applying quality cost system elements within the enterprise. Specifically, would the model address system application factors such as the formulation and establishment of a vocabulary; decisions on initial installation; the focus for quality cost information; standards for quality costs; and generally be adoptable and adaptable?

Research Question Four: Quality Cost Vocabulary

The purpose of research question four was to evaluate the quality cost model's sufficiency in enabling management to formulate and establish a preliminary quality cost vocabulary. Panel members' 100% positive evaluations are shown in Table 5.

Table 5

Responses to Research Question Four

	Evaluation Results	
Responses	Number	Percent
Positive		
1. Quite Adequately	3	27.3
2.	6	54.5
3. Adequately	2	18.2
Total Positive Responses	11	100.0

Individual responses to question four ranged from 1 to 3 with a mean response of 21/11 or 1.9.

Research Question Five: Initial Installation

Research question five was designed to evaluate the quality cost model's sufficiency in enabling management to make a preliminary decision of the appropriate level for the initial installation of a quality cost system within the enterprise.

Table 6

Responses to Research Question Five

Responses	Evaluation Results Number	Evaluation Results Percent
Positive		
1. Quite Adequately	-	----
2.	7	63.6
3. Adequately	3	27.3
Total Positive Responses	10	90.9
Negative		
4.	1	9.1
5. Quite Inadequately	-	---
Total Negative Responses	1	9.1

As evident in Table 6, positive responses to research question five slightly exceeded 90%. Individual responses ranged from 2 to 4 with a mean of 27/11 or 2.5. This is the first of the items which had a negative response.

Research Question Six: Relevant and Appropriate Focus

The purpose of research question six was to evaluate the quality cost model's sufficiency in enabling management to make a preliminary determination of the most relevant and appropriate focus for quality cost information. As shown in Table 7, panel members were unanimous in their positive evaluation of this research item.

Table 7

Responses to Research Question Six

	Evaluation Results	
Responses	Number	Percent
Positive		
1. Quite Adequately	1	9.1
2.	7	63.6
3. Adequately	3	27.3
Total Positive Responses	11	100.0

The range of individual responses was from 1 to 3 with a mean response of 24/11 or 2.2.

Research Question Seven: Quality Cost Standards

Research question seven was designed to evaluate the quality cost model's sufficiency in enabling management to make preliminary estimates of appropriate quality cost standards. As indicated in Table 8, the evaluation results were 100% positive.

Table 8

Responses to Research Question Seven

	Evaluation Results	
Responses	Number	Percent
Positive		
1. Quite Adequately	-	----
2.	5	45.5
3. Adequately	6	54.5
Total Positive Responses	11	100.0

The range of individual responses was from 2 to 3 with a mean response of 28/11 or 2.5.

Research Question Eight: Quality Cost Model Adoptability

This question was designed to evaluate the model's sufficiency in enabling management to adopt it as a tool for use by manufacturing enterprises. In Table 9 an evaluation rate of over 90% positive is displayed.

Table 9

Responses to Research Question Eight

Responses	Evaluation Results	
	Number	Percent
Positive		
1. Quite Adequately	1	9.1
2.	8	72.7
3. Adequately	1	9.1
Total Positive Responses	10	90.9
Negative		
4.	1	9.1
5. Quite Inadequately	-	---
Total Negative Responses	1	9.1

Individual responses ranged from 1 to 4 with a mean response of 24/11 or 2.2. Question eight was the second item with a negative response.

Research Question Nine: Quality Cost Model Adaptability

Research question nine was designed to evaluate the model's sufficiency in enabling management to modify or make the model suitable to the requirements of a manufacturing enterprises.

The evaluation results are displayed in Table 10. Individual responses ranged from 1 to 3 with a mean response of 21/11 or 1.9.

Table 10

Responses to Research Question Nine

Responses	Evaluation Results	
	Number	Percent
Positive		
1. Quite Adequately	3	27.3
2.	6	54.5
3. Adequately	2	18.2
Total Positive Responses	11	100.0

In Table 11, responses of the panel to questions four through nine (identified as pertaining to system application aspects of the model) were compared. Over 96% of the responses in the system application category were positive. The overall mean response was 145/60 or 2.2.

In Table 11, M is the mean response for the research question; NR indicates no response to the items for each research question; n is the number of responses for each question; TOTALS show the column totals for the responses; and PER is the column percentage for each response.

Table 11

Comparison of System Application Responses

	Responses to Items 4 to 9							
	quite adequately		adequately		quite inadequately			
Item	1	2	3	4	5	M	NR	n
4	3	6	2	-	-	1.9	-	11
5	-	7	3	1	-	2.5	-	11
6	1	7	3	-	-	2.2	-	11
7	-	5	6	-	-	2.6	-	11
8	1	8	1	1	-	2.2	-	11
9	3	6	2	-	-	1.9	-	11
TOTALS	8	39	17	2	-		-	66
PER	12.1	59.1	25.8	3.0				

System Utilization Questions

The system utilization questions, which were items 10 through 13, required panel members to evaluate the quality cost model's sufficiency in terms of the utility of information it provided. Specifically, would the model address system utilization factors such as a quality cost diagnosis procedure; quality cost elements; quality cost reports; and cost evaluation and analysis?

Research Question Ten: Quality Cost Diagnosis Procedure

Research question 10 was included to evaluate the quality cost model's sufficiency in enabling management to develop a preliminary quality cost diagnosis procedure. The range of individual responses to question 10 were from 2 to 3 with a mean response of 24/11 or 2.2. All panel members rated the model positively in this area as evident in Table 12.

Table 12

Responses to Research Question Ten

	Evaluation Results	
Responses	Number	Percent
Positive		
1. Quite Adequately	-	----
2.	9	81.8
3. Adequately	2	18.2
Total Positive Responses	11	100.0

Research Question Eleven: Quality Cost Elements

Research question 11 was intended to evaluate the quality cost model's sufficiency in enabling management to develop and establish preliminary quality cost elements descriptive of its individual operations and processes.

For question 11, panel members once again produced all positive responses as shown in Table 13. Responses ranged from 1 to 3 with a mean of 23/11 or 2.1.

Table 13

Responses to Research Question Eleven

	Evaluation Results	
Responses	Number	Percent
Positive		
1. Quite Adequately	1	9.1
2.	8	72.7
3. Adequately	2	18.2
Total Positive Responses	11	100.0

Research Question Twelve: Quality Cost Reports

Research question 12 was included to evaluate the quality cost model's sufficiency in enabling management to prepare preliminary quality cost reports. Once again, evaluators rated the model highly. Over 90% of panel members' evaluations were positive. In Table 14 responses to question 12 are presented.

Individual responses to question 12 ranged from 1 to 4 with a mean response of 24/11 or 2.2. This item is the third and last to receive a negative response.

Table 14

Responses to Research Question Twelve

Responses	Evaluation Results	
	Number	Percent
Positive		
1. Quite Adequately	1	9.1
2.	8	72.7
3. Adequately	1	9.1
Total Positive Responses	10	90.9
Negative		
4.	1	9.1
5. Quite Inadequately	-	---
Total Negative Responses	1	9.1

Research Question Thirteen: Evaluation and Analysis Reports

Research question 13 was designed to evaluate the quality cost model's sufficiency in enabling management to prepare preliminary quality cost evaluation and analysis reports. One hundred percent of panel members produced positive evaluations as is clear from Table 15.

The range of individual responses was from 1 to 3 with a mean response of 22/11 or 2.0.

Table 15

Responses to Research Question Thirteen

Responses	Evaluation Results: Number	Percent
Positive		
1. Quite Adequately	2	18.2
2.	7	63.6
3. Adequately	2	18.2
Total Positive Responses	11	100.0

Responses of the evaluation panel members to research items 10 through 13 (those questions pertaining to system utilization aspects of the quality cost model) are summarized in Table 16. Over 97% of panel members' responses were positive in the system utilization set of research questions with an overall mean response of 90/44 or 2.2.

In Table 16, M is the mean response for the research question; NR indicates no response to the items for each research question; n is the number of responses for each question; TOTALS show the column totals for the responses; and PER is the column percentage for each response.

Table 16

Comparison of System Utilization Responses

	Responses to Items 10 to 13							
	quite adequately		adequately		quite inadequately			
Item	1	2	3	4	5	M	NR	n
10	-	9	2	-	-	2.2	-	11
11	1	8	2	-	-	2.1	-	11
12	1	8	1	1	-	2.2	-	11
13	2	7	2	-	-	2.0	-	11
TOTALS	4	32	7	1	-		-	44
PER	9.1	72.7	15.9	2.3				

Table 17

Comparison of Management Decision, System Application, and System Utilization Groups by Response Percentage

	Responses				
	quite adequately		adequately		quite inadequately
Group	1	2	3	4	5
Management	---	68.7	31.3	---	---
System Application	12.1	59.1	25.8	3.0	---
System Utilization	9.1	72.7	15.9	2.3	---

A comparison of the evaluation panel's percentage response values for the management, system application, and system utilization research question groups is presented in Table 17. As is clear from this table, the experimental quality cost model was rated highly positive across all three question groups with the heaviest percentages of ratings falling in the 2 category (between 1—quite adequately and 3—adequately).

Comparison of Positive and Negative Responses

Table 18 provides a comparison of the negative and positive responses to the quality cost model. For the 13 quality cost model research questions, the evaluation panel's positive response rate was 139/142 or exceeded 97%, while the negative response rate stood at 3/142 or less than 3%. Research questions 5, 8, and 12 each received one negative response.

Mean Response to the Individual Research Questions

In Figure 7, the mean response for each of the 13 research questions is displayed. Item seven received the lowest mean evaluation panel response at 2.6. This item addresses how sufficiently the quality cost model enables management to make preliminary estimates of appropriate quality cost standards. At 1.9, items four and nine received the highest average evaluation panel response. Item four addresses how sufficiently the quality cost model enables management to formulate and establish a quality cost vocabulary, and item nine addresses how sufficiently the model enables management to develop a generally adaptable quality cost system (able to be modified or made suitable to requirements).

Table 18

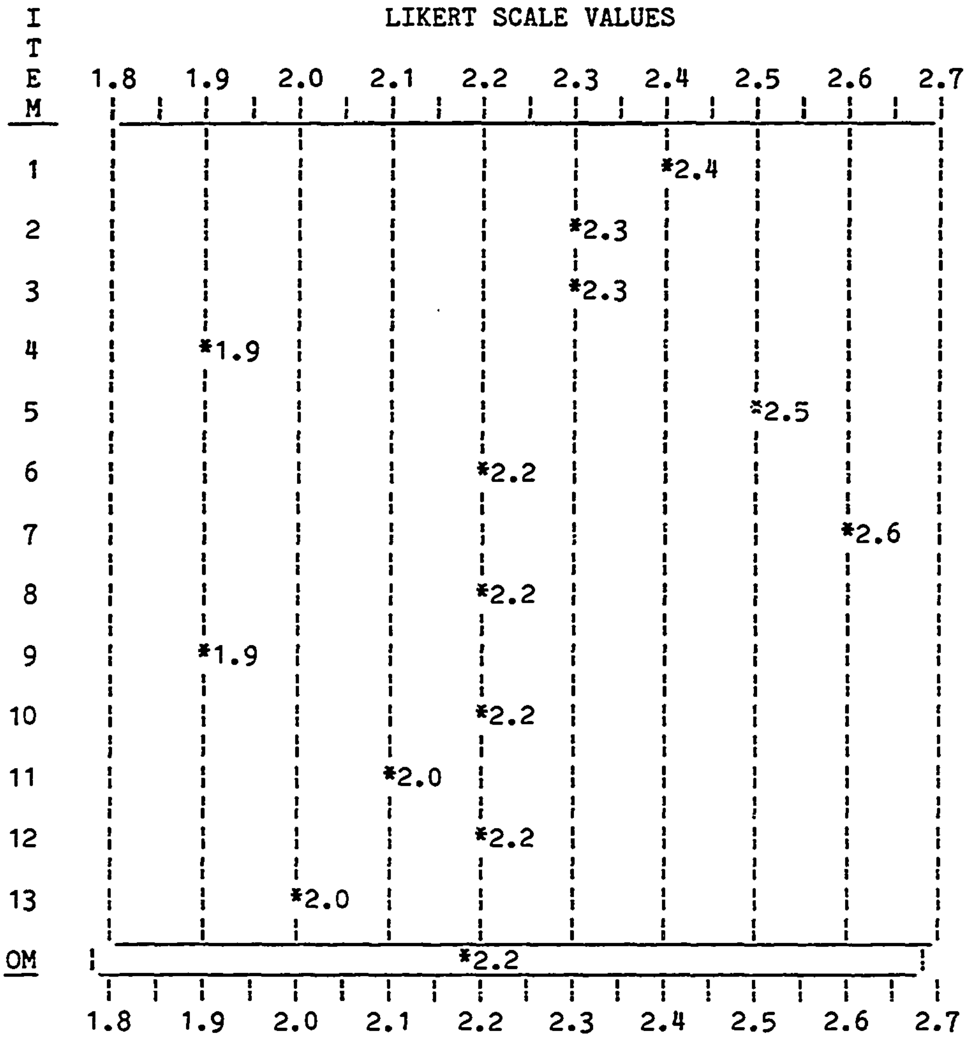
Comparison of the Evaluation Panel's Positive and Negative Responses to the Quality Cost Model

	Positive Responses		Negative Responses	
Item	Number	Percent	Number	Percent
1	10	100.0	-	---
2	11	100.0	-	---
3	11	100.0	-	---
4	11	100.0	-	---
5	10	90.9	1	9.1
6	11	100.0	-	---
7	11	100.0	-	---
8	10	90.9	1	9.1
9	11	100.0	-	---
10	11	100.0	-	---
11	11	100.0	-	---
12	10	90.9	1	9.1
13	11	100.0	-	---
Response Percentage	139/142	97.9	3/142	2.1

Mean Response of Individual Panel Member

The mean response of each individual panel member is displayed in Figure 8. Means were determined by summing the

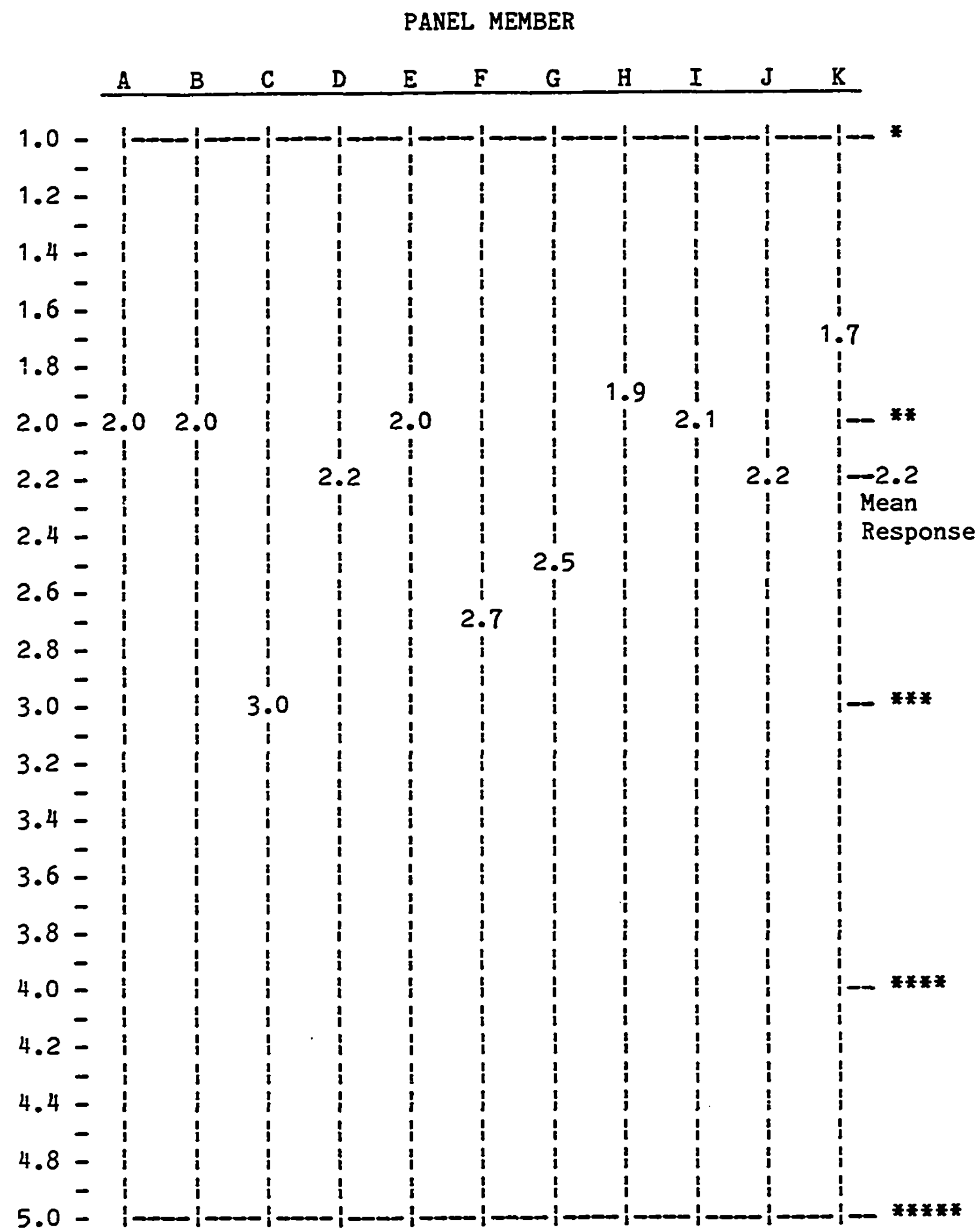
Figure 7. Mean response to thirteen individual research questions



Note. OM is the overall mean response for the 13 research questions.

panel member's individual research question responses and dividing by the number of responses. As revealed in Figure 8, evaluation panel member C provided the lowest mean response for the quality cost model at 3.0 while evaluation panel member K provided the

Figure 8. Mean response to research questions by individual panel member



Note. Stars (* to *****) correspond to Likert scale ratings of 1 (quite adequately) to 5 (quite inadequately).

highest mean response at 1.7. Evaluation panel member C held a production position in the dairy processing industry; panel member K held a quality position in the machine tool industry. Taken as a group, evaluation panel members produced a mean rating of 2.2 for the 13 research questions addressing the quality cost model.

Overall Summary of Responses

Results of the evaluation panel's response to the quality cost model study are summarized by individual research question and panel member in Table 19. The individual research questions are labeled Item and numbered from 1 to 13. The 11 evaluation panel members are referenced alphabetically from A through K and occupy the column positions. The evaluation panel members' positions, years in position, and industries are provided in Appendix A.

In Table 19, the range of responses is given as RN; the ratio of total response value to number of responses is given as RT; and the mean value of the response is given as M.

As can be seen in Table 19, the mean response was provided for each research question. The rating of 5 (quite inadequately) was never selected. The rating of 2 was selected most frequently; it was chosen 93 out of 142 times (65.0%). The No Response (NR) category was elected only once and was not counted in the determination of percentages. The overall mean response to the quality cost model by the evaluation panel stands at 312/142 or 2.2.

The experimental quality cost model was rated positively in 139 of 142 individual selections or at a positive rating of 97.88%.

Table 19

Research Question and Panel Member Response Summary

ITEM	A	B	C	D	E	F	G	H	I	J	K	RN	RT	M
						PARTICIPANT								
1	2	*	3	2	2	3	3	2	2	3	2	2-3	24/10	2.4
2	3	3	3	2	2	2	2	2	2	2	2	2-3	25/11	2.3
3	2	2	3	2	2	2	3	2	2	3	2	2-3	25/11	2.3
4	2	2	3	3	2	2	1	1	2	2	1	1-3	21/11	1.9
5	2	2	4	2	2	3	3	2	2	2	3	2-4	27/11	2.5
6	2	2	3	2	2	3	2	2	3	2	1	1-3	24/11	2.2
7	2	3	3	3	2	3	3	3	2	2	2	2-3	28/11	2.7
8	2	2	3	2	2	2	4	2	2	2	1	1-4	24/11	2.5
9	1	2	3	2	2	2	3	1	2	2	1	1-3	21/11	1.9
10	2	2	2	2	2	3	3	2	2	2	2	2-3	24/11	2.2
11	2	2	3	2	2	3	2	1	2	2	2	1-3	23/11	2.1
12	2	1	3	2	2	4	2	2	2	2	2	1-4	24/11	2.2
13	2	1	3	2	2	3	2	2	2	2	1	1-3	22/11	2.00
RN	1-3	1-3	2-4	2-3	2	2-4	1-4	1-3	2-3	2-3	1-3			
RT	26/13	24/12	39/13	28/13	26/13	35/13	33/13	24/13	27/13	28/13	22/13		312/142	
M	2.0	2.0	3.0	2.2	2.0	2.7	2.5	1.9	2.1	2.2	1.7	OVERALL MEAN = 2.2		

Note. The * indicates a No Response selection.

Responses Categorized by Position

As is often the case in qualitative research, unforeseen questions emerge as the researcher analyzes the data (Bogdan & Biklen, 1982; Glaser & Strauss, 1967; Lincoln & Guba, 1985). Although the criteria for evaluation panel members had been established prior to the actual evaluation of the experimental quality cost model, it was not possible to determine who the actual panel members would be, what their positions in the manufacturing enterprise would be, nor how long they would have worked in these positions.

During analysis of the research results and evaluation of the panel members' employment, it became obvious that a question could arise concerning whether the experimental quality cost model had been viewed differently by those panel members currently employed in a quality position and by those panel members having a collateral quality responsibility in their current position or previous employment. Would these two distinct groups differ in their views on the adoptability, adaptability, and potential effectiveness of the experimental quality cost model? How different would these views be, and would the differences be localized to one or two specific questions or represent a more general difference?

To compare the evaluation responses of the quality and collateral quality position panel members, the researcher analyzed the responses to the research questions by the nature of the position the panel members held. This information was obtained from the registration form presented in Appendix C.

To have qualified as a member of the quality cost model evaluation panel, the individual must have been:

1. currently employed in a quality position or a position with a quality responsibility for at least one year; or

2. previously employed in a quality position or a position with a quality responsibility for at least one year within the past five years.

The evaluation panel was comprised of 11 individuals from manufacturing enterprises. All 11 met the above criterion, 10 qualifying under the first criterion and one under the second criterion. Seven panel members were identified as currently employed in a quality position and four members as from a position with a collateral quality responsibility.

Panel Members in Quality Positions

The purpose of this section is to display the research question responses from panel members in a quality position. Seven panel members met this criterion; all were currently employed in a quality position for at least one year. Their responses are presented in Table 20.

In Tables 20 and 21, M is the mean response for the research question or from the evaluation panel member; RN is the range of responses for the individual item or from the individual evaluation panel member; and RT is the ratio of the sum of responses over either the number of items, research questions, or the sum of responses selected relative to the number of evaluation panel members.

Table 20

Responses by Evaluation Panel Members in Quality Positions

ITEM	A	D	E	F	G	H	K	RN	RT	M
	QUALITY POSITION PANEL MEMBERS									
1	2	2	2	3	3	2	2	2-3	16/7	2.3
2	3	2	2	2	2	2	2	2-3	15/7	2.1
3	2	2	2	2	3	2	2	2-3	15/7	2.1
4	2	3	2	2	1	1	1	1-3	12/7	1.7
5	2	2	2	3	3	2	3	2-3	17/7	2.4
6	2	2	2	3	2	2	1	1-3	14/7	2.0
7	2	3	2	3	3	3	2	2-3	18/7	2.6
8	2	2	2	2	4	2	1	1-4	15/7	2.1
9	1	2	2	2	3	1	1	1-3	12/7	1.7
10	2	2	2	3	3	2	2	2-3	16/7	2.3
11	2	2	2	3	2	1	2	1-3	14/7	2.0
12	2	2	2	4	2	2	2	2-4	16/7	2.3
13	2	2	2	3	2	2	1	1-3	14/7	2.0
RN	1-3	2-3	2	2-4	1-4	1-3	1-3			
RT	26/13	28/13	26/13	35/13	33/13	24/13	22/13		194/91	
M	2.0	2.2	2.0	2.7	2.5	1.9	1.7	OVERALL MEAN =		2.1

Panel Members with Collateral Quality Responsibilities

Table 21 provides a summary of the responses of panel members from a position with a collateral quality responsibility. This analysis was conducted to determine how panel members identified as having collateral quality responsibilities responded to the research questions. Four workshop participants qualified; three were currently employed in a position with a quality responsibility, and the other had had a position with a quality responsibility for at least one year within the past five years.

Panel members with a collateral quality responsibility were identified from the registration material as panel members:

B, from materials testing position,

C, currently in a production position,

I, currently in a cost accounting position,

J, currently in a production position.

Comparison of Panel Members by Position

A comparison of the differences in mean responses from panel members in a quality position and those in a collateral quality position can be found in Table 22. This comparison is presented according to the three basic research question groupings: management decision, system application, and system utilization.

Responses from panel members with collateral quality responsibilities range from 2.0 to 2.7 or 0.8 while the responses from panel members in a quality position have a

Table 21

Responses by Panel Members with Collateral Quality Responsibilities

ITEM	PANEL MEMBERS WITH A COLLATERAL QUALITY RESPONSIBILITY B	C	I	J	RN	RT	M
1	*	3	2	3	2-3	8/3	2.7
2	3	3	2	2	2-3	10/4	2.5
3	2	3	2	3	2-3	10/4	2.5
4	2	3	2	2	2-3	9/4	2.3
5	2	4	2	2	2-4	10/4	2.5
6	2	3	3	2	2-3	10/4	2.5
7	3	3	2	2	2-3	10/4	2.5
8	2	3	2	2	2-3	9/4	2.3
9	2	3	2	2	2-3	9/4	2.3
10	2	2	2	2	2	8/4	2.0
11	2	3	2	2	2-3	9/4	2.3
12	1	3	2	2	1-3	8/4	2.0
13	1	3	2	2	1-3	8/4	2.0
RN	1-3	2-4	2-3	2-3			
RT	24/12	39/13	27/13	28/13		118/51	
M	2.0	3.0	2.1	2.2	OVERALL MEAN =		2.3

Table 22

Comparison Between Responses from Quality Position Panel Members and Collateral Quality Responsibility Panel Members

RESEARCH QUESTIONS PERTAINING TO	ITEM	QUALITY POSITION MEAN RESPONSE	COLLATERAL POSITION MEAN RESPONSE	DIFFERENCE
MANAGEMENT ITEMS	1	2.3	2.7	+0.4
	2	2.1	2.5	+0.4
	3	2.1	2.5	+0.4
SYSTEM APPLICATION ITEMS	4	1.7	2.3	+0.5
	5	2.4	2.5	+0.1
	6	2.0	2.5	+0.5
	7	2.6	2.5	-0.1
	8	2.1	2.3	+0.2
	9	1.7	2.3	+0.5
SYSTEM UTILIZATION ITEMS	10	2.3	2.0	-0.3
	11	2.0	2.3	+0.3
	12	2.3	2.0	-0.3
	13	2.0	2.0	-0.0
TOTAL ITEM RATIO		27.6/13	30.4/13	+2.6/13
OVERALL ITEM MEAN		2.1	2.3	+0.2

range from 1.7 to 2.6 or 1.0. The overall mean from the collateral quality group is 2.3 while the mean of panel members in quality positions is 2.1.

As the comparative data in Table 22 reveal, panel members from a quality position rated the experimental quality cost model higher in management item questions (1-3) and system application questions (4-9) than did the other panel members. The system utilization questions were ranked higher by those panel members with a collateral quality responsibility.

Overall, the panel members from quality positions rated the model higher by 0.2 than panel members with collateral quality responsibilities. Given that only the integer values from 1 to 5 were available for any research question response and that the differences between the two groups were consistently less than one, no sizable differences in the evaluations provided by the two groups are apparent.

Summary

This chapter began with an analysis of the evaluation panel members' responses to the quality cost model. Responses were reported by the management decision, system application, and system utilization question groups and followed by a comparison of the responses for each group. A comparison of the positive and negative responses displayed a consistently high positive response level. A presentation of the average response value for each research question showed that positive responses were very evenly distributed across all of the research questions. Even the lowest rated items did not fall below a 90% positive rating. An average response value for each evaluation panel member was shown as well as an overall response summary by research question and panel member.

To determine whether panel members who qualified under the criterion of current employment in a quality position responded differently to the research questions than those members who had a collateral quality responsibility, an item by item analysis was conducted for each group and between the groups. A comparison of the variation in responses for the two groups displayed only a minimal difference.

The overall positive rating of the quality cost model stood at 97.9%. The model's management decision questions (1-3) received a positive rating of 100%; the system application questions (4-9) received a positive rating of 97%, and the system utilization questions (10-13) were positively rated at 98%. Evaluation panel members from a quality position rated the quality cost model positively 94 out of 97 times or with a 96.9% positive rating. Panel members from a position with a collateral quality responsibility rated the quality cost model positively 50 out of 51 times or with a 98% positive rating.

Chapter V will provide the conclusions and recommendations which follow from this study.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

This study tested the adoptability, adaptability, and potential effectiveness of the experimental quality cost model. Within the limitations of the study, the model appears to have significant merit.

The quality cost model was developed to provide the management of a manufacturing enterprise with a cost structure. This structure would enable managers to identify the cost categories they need to measure the efficiency and effectiveness of their policies and processes. A panel of 11 quality professionals from manufacturing enterprises evaluated the experimental quality cost model after an explanation of the model and its operation. The evaluation panel members represented a wide variety of manufacturing enterprises: computer manufacturing, dairy processing, machine tools, and plastics. In technology, processes, products, and size, the panel members' organizations were widely divergent.

According to the evaluation panel response, the quality cost model would enable a manufacturing enterprise to make the necessary management decision, system application, and system utilization decisions. The management decision area of the quality cost model received a 100% positive evaluation; the system application area received a 96.97% positive evaluation, and the system utilization area received a 97.73% positive evaluation.

The evaluation panel members' consistently positive response to the quality cost model indicated that it is very adoptable (generally applicable as a tool) and adaptable (able to be modified or made suitable to the requirements of the manufacturing enterprise). The consistently positive evaluation (97.88%) the quality cost model received indicates that it will be effective in structuring and developing a preliminary quality cost system for a manufacturing enterprise. The researcher concluded that the model has adoptability, adaptability, and potential effectiveness across a wide range of manufacturing enterprises.

It was recognized that the workshop session provided an inherent bias to the study. Workshop instruction and responses to panel member questions provided information beyond that contained within the published model. Both presenter and panel gained insights on model installation and operation not contained in the original model. While this may have influenced the panel's evaluation of the basic model, it did emphasize the preliminary nature of the model and the need to adapt the model to the specific requirements of the adopting enterprise. The workshop session provided the researcher with additional insights and information that will be incorporated into the continuing development of the model.

Further Development and Variations of the Model

Item seven received the lowest mean evaluation panel response. This item addressed how sufficiently the quality cost model enables management to make preliminary estimates of appropriate quality cost standards. After reviewing this section of the quality cost model, the researcher believes that the preliminary quality cost standards currently contained in the model are not clearly stated from a practitioner's point of view nor are they defined on an operational or implementable basis. The researcher believes that this section of the model requires a more specific applications orientation and perhaps the inclusion of recommendations for cost standards aligned with quality cost system objectives and requirements.

Item five received the second lowest mean evaluation panel response. This item addresses how sufficiently the quality cost model enables management to make a preliminary decision on the appropriate level for the initial installation of a quality cost system within the enterprise. After reviewing the model, the researcher believes that comments regarding item seven are applicable to item five. The model provides an adequate explanation of the concept of appropriate level for initial installation of a quality cost system and provides several alternative installation schemes, but from the practitioner's view does not appear to set system installation recommendations in alignment with the quality cost system objectives and requirements of the enterprise. A more specific applications orientation for the installation section would be of benefit.

The evaluation panel's strong positive endorsement of the quality cost model encourages its further development and refinement. The researcher has identified three areas for continued improvement of the model: extending it to meet the requirements of the service sector enterprises; elaborating upon the training component; and developing a computerized version.

Having determined that the model is adoptable and adaptable within manufacturing enterprises, the researcher is investigating its application in service sector industries. Here, as in the manufacturing enterprises, costs of quality are critical to maintaining and increasing market share and stability. The researcher believes that the quality cost model can be focused and adjusted to meet the service enterprise's needs and requirements.

As anticipated, the researcher noted that the evaluation panel members represented many levels of understanding and knowledge regarding quality costs. After the two-day workshop, however, they were all able to discuss and structure quality cost concepts and applications. This was especially evident during the handling of two case studies used in the workshop and in the completion of sample quality cost worksheets. The researcher concluded that while the workshop sessions appeared to address the panel members' needs for background knowledge, greater development and refinement of presentation and application materials would significantly improve the delivery of key conceptual background and applications information. The instruction of quality professionals (and others) in the use of the quality cost model could be augmented by the development of a series of case studies which would allow participants to develop facility in application of the model. A series of on-site implementation and application strategies and materials could also be developed for enterprises desiring to contract for assistance with installation and initial monitoring within the quality cost system.

The development of a computer support program, such as a spreadsheet or overlay program, for the quality cost model would increase its usefulness. The quality cost model currently uses paper worksheets for data collection, evaluation, and analysis. This requires the assembly of individual worksheets and data entries made by hand. The advantages of computer assistance would include ease and speed of data entry, readiness of information at the work site, and the possibility of networking information into central files and locations. This would increase the flexibility of the model and its effectiveness and efficiency within the enterprise.

Recommendations for Future Research

This study did not exhaust the opportunity for quality costs as a research topic. As directly addressed in the limitations, this study did not carry the quality cost model into the actual operating environment of a manufacturing enterprise. The true test of the quality cost model's value would be within the operating environment. This would appear to offer an excellent base for future research.

A second area of opportunity would be exploration of quality costs within the service sector. The costs of quality encountered in the service industries often exceed those referenced for the manufacturing industries. The sensitivity and vulnerability of services to inefficiency and ineffectiveness of operations create a significant and ever present possibility of threat to the enterprise.

The third area of opportunity is development of a research proposal which allows the researcher to develop insights and understanding of the American industrial and technological system in real-time terms and conditions. There is great personal satisfaction in knowing that the research undertaken so far may assist in building just one part of that necessary bridge between knowledge, understanding, and application.

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APPENDICES

APPENDIX A

Participant Profile

Participant	Position	Years in Position	Industry
A	Quality	10+	Plastics
B	Materials Testing	1	Plastics
C	Production	7	Dairy Processing
D	Quality	7	Plastics
E	Quality	8	Dairy Processing
F	Quality	2	Computer
G	Quality	10+	Computer
H	Quality	4	Plastics
I	Cost Accounting	2	Plastics
J	Production	2	Plastics
K	Quality	2	Machine Tool

APPENDIX B

Workshop Agenda

First Day

Morning Session

Introduction to the Study

Description of Quality Cost Systems

Installation of Quality Cost Systems

Afternoon Session

Quality Cost System Operation

Diagnosis of Quality Cost Information

Quality Cost Analysis and Evaluation

Case Study One

Second Day

Morning Session

Case Study One Review

Case Study Two

Afternoon Session

Case Study Two Review

Quality Cost Model Review

Completion of the Panel Evaluation

APPENDIX C

Quality Cost Model Evaluation Instrument

This registration information form was provided to workshop participants during the workshop registration process. The registration information form was returned by the participant to obtain the workshop materials.

REGISTRATION INFORMATION

Name: ________________________________

Employed in: ___ manufacturing ___ services ___ government,
___ self-employed ___ other

Current : ___ design ___ engineering ___ production
Position ___ quality ___ purchasing ___ materials
___ testing ___ accounting ___ marketing
___ services ___ inspection ___ other

Years in position: __1 __2 __3 __4 __5 __6 __7 __8 __9 __10 or more.

Is there a quality or quality related responsibility in your current position? ___ yes ___ no

Have you held a quality or quality related position in the last five years ___ yes ___ no

Prior ___ design ___ engineering ___ production
Position: ___ quality ___ purchasing ___ materials
___ testing ___ accounting ___ marketing
___ services ___ inspection ___ other

Years in position: __1 __2 __3 __4 __5 __6 __7 __8 __9 __10 or more.

Age: ___ 20-30 ___ 31-40 ___ 41-50 ___ 51-60

QUALITY COST WORKSHOP EVALUATION

As participants in the quality cost workshop, you are requested to respond to the following questions regarding the Quality Cost Model. Each question requests that you rate a given concept or feature of the model by placing a check (x) on a 5-point scale below the question. If you believe that the model is quite adequate to adequate in enabling you to plan for and implement the quality cost system feature being addressed in the question, place a check from 1 to 3. Adequate indicates that you believe that the model is sufficiently adoptable and adaptable and quite adequate indicates that you believe that the model is more than sufficiently adoptable and adaptable.

```
     <------------------------>
    ___________________________________________________
         1    |   2   |    3    |    4    |    5          |__|
      quite                                    quite        no
    adequately          adequately       inadequately response
```

If you believe that the model is less than adequate in enabling you to plan for and implement the quality cost feature being addressed in the question, place a check from 4 to 5. Quite inadequate indicates that you believe that the model is less than sufficiently adoptable and adaptable.

```
                                   <------------------>
    ___________________________________________________
         1    |   2   |    3    |    4    |    5          |__|
      quite                                    quite        no
    adequately          adequately       inadequately response
```

There is space for comments below each question if you wish to amplify or qualify your response. The no response block may be used for items that you feel are not applicable to your specific position or area.

NAME:________________________

QUALITY COST WORKSHOP QUESTIONNAIRE

1. The quality cost model is intended to explain quality cost sufficiently to enable management to:

   make a preliminary determination as to whether a quality cost system is an appropriate management tool for their enterprise or operations.

   In your opinion, how adequately does the quality cost model accomplish this?

1	2	3	4	5	[ ]
quite adequately		adequately		quite inadequately	no response

Comments:

____

____

____

____

2. The quality cost model is intended to provide an explanation of quality costs sufficient to enable management to:

   reach a preliminary determination of the goal or purpose of a quality cost system within the context of their processes and operations.

   In your opinion, how adequately does the quality cost model accomplish this?

1	2	3	4	5	[ ]
quite adequately		adequately		quite inadequately	no response

Comments:

____

____

____

____

3. The quality cost model is intended to provide an explanation of quality cost theory sufficient to:

   enable a manufacturing enterprise to formulate and establish a preliminary quality cost policy.

   In your opinion, how adequately does the quality cost model accomplish this?

1	2	3	4	5	☐
quite adequately		adequately		quite inadequately	no response

   Comments:

   ____
   ____
   ____
   ____
   ____

4. The quality cost model is intended to provide an explanation of quality cost system operations and applications sufficient to:

   enable a manufacturing enterprise to formulate and establish a preliminary quality cost vocabulary.

   In your opinion, how adequately does the quality cost model accomplish this?

1	2	3	4	5	☐
quite adequately		adequately		quite inadequately	no response

   Comments:

   ____
   ____
   ____
   ____
   ____

5. The quality cost model is intended to provide an explanation of quality cost system operations sufficient to:

> enable a preliminary decision of the appropriate level for the initial installation of a quality cost system within the enterprise.

In your opinion, how adequately does the quality cost model accomplish this?

1	2	3	4	5	[ ]
quite adequately		adequately		quite inadequately	no response

Comments:

6. The quality cost model is intended to:

> enable a manufacturing enterprise to make a preliminary determination of the most relevant and appropriate focus for quality cost information.

In your opinion, how adequately does the quality cost model accomplish this?

1	2	3	4	5	[ ]
quite adequately		adequately		quite inadequately	no response

Comments:

7. The quality cost model is intended to provide an explanation of quality cost system application sufficient to:

enable a manufacturing enterprise to make preliminary estimates of appropriate quality cost standards.

In your opinion, how adequately does the quality cost model accomplish this?

1	2	3	4	5	
quite adequately		adequately		quite inadequately	no response

Comments:

8. The quality cost model is intended to be:

generally adoptable, that is generally applicable as a tool by enterprises within manufacturing.

In your opinion, how adequately does the quality cost model accomplish this?

1	2	3	4	5	
quite adequately		adequately		quite inadequately	no response

Comments:

9. The quality cost model is intended to be:

   generally adaptable, that is able to be modified or made suitable to the requirements of an enterprise within manufacturing.

   In your opinion, how adequately does the quality cost model accomplish this?

1	2	3	4	5	[ ]
quite adequately		adequately		quite inadequately	no response

   Comments:

10. The quality cost model is intended to provide an explanation of quality cost system application sufficient to:

    enable a manufacturing enterprise to develop a preliminary quality cost diagnosis procedure.

    In your opinion, how adequately does the quality cost model accomplish this?

1	2	3	4	5	[ ]
quite adequately		adequately		quite inadequately	no response

    Comments:

11. The quality cost model is intended to provide an explanation and examples of quality cost categories sufficient to:

    enable a manufacturing enterprise to develop and establish preliminary quality cost elements descriptive of its individual operations and processes.

    In your opinion, how adequately does the quality cost model accomplish this?

1	2	3	4	5	
quite adequately		adequately		quite inadequately	no response

Comments:

12. The quality cost model is intended to provide an explanation and examples of the procedures and documentation necessary to:

    prepare preliminary quality cost reports.

    In your opinion, how adequately does the quality cost model accomplish this?

1	2	3	4	5	
quite adequately		adequately		quite inadequately	no response

Comments:

13. The quality cost model is intended to provide an explanation and examples of the procedures and documentation necessary to:

prepare preliminary quality cost evaluation and analysis reports.

In your opinion, how adequately does the quality cost model accomplish this?

1	2	3	4	5	
quite adequately		adequately		quite inadequately	no response

Comments:

APPENDIX D

Quality Cost Model

THE QUALITY COST INFORMATION SYSTEM:

A RESOURCE MANUAL

by

Wallace Charles Carlson Jr.

SECTIONS

INTRODUCTION

The objective of this resource manual is to provide an enterprise with a system for evaluating and managing the product/service quality cost dimension of its operations. The real test of any quality policy, goal, or program is determined by its contribution to customer satisfaction and profit.

The quality cost program is an information system used to evaluate and analyze the effectiveness and efficiency of the enterprise's quality policies and management toward the goals of quality improvement and profit contribution. Cost accounting and cost of quality systems both identify and quantify those costs directly affected by management and provide credence to and justification for business decisions. Cost accounting systems have traditionally provided information and guidance for the general management of an enterprise while quality cost systems have identified factors associated with quality management.

The resource manual is designed to enable an enterprise to develop a common quality cost vocabulary, construct the framework required for a quality cost information system, and then to select and assemble the components necessary to support the selected framework. The quality cost information system may be initiated at and developed for any level within the enterprise.

The resource manual begins with a description of quality cost theory and origins, placing quality costs within the context of historical and contemporary standards and authors. There follows an installation section with recommendations for developing an initial enterprise quality cost information system concept, quality cost definitions, quality cost determination, and quality cost modeling. An operational section provides an example of quality cost information system utilization. The remaining sections provide examples and explanations of supporting components within the quality cost information system and provide the enterprise with the opportunity to define and construct supporting materials for a quality cost information system according to the enterprise's specific requirements.

In concept, a quality cost program is a simple management tool. Just develop a quality cost structure, record the costs related to quality, and use these costs to assist the enterprise in analyzing and controlling its quality efforts. However, although quality cost is simple in concept, the development and installation of a quality cost information system is often complex and faces major hurdles. Quality and quality cost are influenced and defined by numerous and diverse factors. These factors include process, product, service, corporate policy and strategy, competition level, market conditions, and cost accounting methods. The enterprise's culture and value system also contribute significantly to its cost of quality.

The success of an enterprise in any industry is eventually decided by its competitive position in respect to other enterprises in that industry. Competitive focus has expanded from a limited domestic view to a view of competition within the global market. A fundamental component of competition common to all enterprises, in all markets, is the efficiency and effectiveness of the process which develops, produces, delivers, and provides both pre- and post-delivery service to the customer. In management terminology, efficiency is usually defined as, "an ability to do something very well" and effectiveness is defined as "doing the right thing exceedingly well". A quality cost information system provides a structure by which the efficiency and effectiveness of the enterprise's quality program and processes can be gauged and measured. A quality cost system will also decrease the occurrence of varying definitions and divergent views of quality.

DESCRIPTION SECTION INDEX

DESCRIPTION 2

INTRODUCTION

This section will trace the evolution and development of the concept of quality costs. Historically, the economics (costs) of manufacturing and service production have been and continue to be major factors in management and operations. Indeed, from the beginning of mass manufacturing in the late nineteenth century, cost control and containment were considered the most significant management factors in many successful enterprises.

Quality as Secondary to Cost

An enterprise's competitive position in a market or industry was primarily a reflection of management's ability to predict and control costs associated with developing, manufacturing, and selling its product or service. The level of quality within a product or service was often regarded as strictly an economic (cost) consideration or factor; the prevailing attitude in most enterprises was that one couldn't afford to make things (products or services) too good.

Because traditional enterprises viewed the quality of a product or service primarily as an economic (cost) factor, quality was secondary to cost. Enterprises delivered to market and customer that quality level the enterprise considered economically competitive, feasible and suitable. Very little market or customer consultation was conducted on quality needs or requirements.

DESCRIPTION 3

Predetermined enterprise decisions based on an economic fact-of-life view served as the enterprise's single reference. This traditional <u>economic</u> view can be diagrammed as shown below.

```
         ACCEPTABLE           ACCEPTABLE
                  |                    |
                  |                    |
      ----------|                    |----------
       ECONOMIC |       NO LOSS       | ECONOMIC
         LOSS   |                     |   LOSS
   _____________|_____________________|_____________
     |                                          |
   POOR                                    VERY GOOD

      ----------QUALITY CHARACTERISTIC---------->
```

The <u>economic</u> view of quality seemingly dictated that the enterprise maintain a self-determined middle position which would avoid the economic losses encountered either side of center. This economic production mind-set proved sufficient for those product or service markets which had limited offerings, choices, or competition. Customers having few choices or options must take what is available; their decision-to-purchase will usually be based on economic considerations.

Product and service marketplaces, however, are not static arenas. Competition among enterprises for customers and market share insures that competing enterprises will attempt to differentiate and promote those unique and special characteristics of their product or service offerings.

DESCRIPTION 4

Quality as a Marketing Strategy

The early 1960's saw the development of a trend toward differentiating products and services by stressing the quality of a product or service and the enterprise's productivity. Quality and productivity were no longer considered strictly economic (cost) factors in many highly competitive enterprises and markets. New competitive enterprises identified and marketed themselves as the deliverers of quality products and services created within a high productivity manufacturing and delivery environment. Both the consumer and the marketplace responded quickly and favorably to these new enterprises and their broader, more innovative product and service offerings, especially to those obvious quality differences among offered products and services.

Quality was no longer an adjunct to or a secondary economic (cost) consideration; it was no longer simply a factor of economics. Quality was a factor equal in importance to economics. Quality began to be perceived as very important to the customer as he or she differentiated between products and services, and as a very effective marketing strategy.

An early writing addressing quality and cost as separate but interdependent issues appeared in the November, 1951, Harvard Business Review.

DESCRIPTION 5

Theodore Brown wrote in his article Quality Control:

> The subject of specific cost and dollar savings is one which quality control engineers at times carefully avoid. The reason seems to be that a consistently good final product made under a system of quality control may cost more than a product of less dependable quality made by haphazard methods. It is unfair, however, to look at the problem solely from this point of view. Surely, the ultimate consumer has some interest in the quality of what he purchases. Reliability and freedom from repairs even under hard-usage are the qualities which he seeks. Merchandise of low quality in the long term is likely to be unsatisfactory. From the manufacturer's point of view, the competitive system of free enterprise tends to force him into the acceptance of quality control if he is to satisfy his customers and so maintain his standing in the market.
> (p. 78)

Brown concluded that the free enterprise system itself would force enterprises to set aside the strictly economic view of quality and to place at least equal emphasis on the customer's view of quality.

Quality Costs

In the early 1950's, Armand Feigenbaum, working at General Electric, developed a system for communicating to management the magnitude and importance of costs related to quality. He developed a dollar-based reporting system which he referred to as quality costs. Feigenbaum's method enabled him to collect costs associated with developing the quality system and inspecting products and costs associated with product failure. Feigenbaum (1956) wrote about what he considered exceedingly high quality costs. Although he could not find documented research on the subject, he believed the evidence indicated that in many cases quality cost expenses accounted for 7% to 10% of the cost of sales. "In fact," he stated, "quality costs (inspection, testing, laboratory checks, scrap, rework, customer complaints, and similar expenses) have crept up to become a multimillion-dollar item." (p. 93)

Feigenbaum believed that for many companies quality costs were much too high and would over the long term cost these companies their market and competitive position. His dollar-based system of extracting and recording the magnitude and possible effects of quality costs caught the attention of many top managers. Since that time, Feigenbaum's concept of quality costs has been refined and applied to measure and improve the quality systems of many large enterprises, among them Honeywell, IBM, IT&T, Abbott Laboratories, Digital Equipment, General Electric, General Motors, Bendix, and many others (Harrington, 1987).

In 1951, J. M. Juran presented his argument: the enterprise should realize that it is profitable to identify and reduce those costs associated with poor quality. Juran's focus was on productivity or how the efficiency and effectiveness (productivity) of the enterprise could be increased by eliminating unnecessary cost stemming from poor quality. In the first edition of his <u>Quality</u>

Control Handbook, Juran (1951) explained the concept of quality costs and presented his now classic "gold in the mine" analogy:

> Experience has shown that it is very useful to compute what costs would disappear if there were no defects whatever. . . . The total of the(se) avoidable costs is the "gold in the mine." . . . This "gold in the mine" is evaluated by asking "What present costs would disappear if all defects disappeared?" (p. 1-34)

Juran's rationale is that often a greater return-on-investment can be realized from reducing costs of poor quality than from attempting to increase sales. If the expense and influence of poor quality is reduced, the image of the enterprise is enhanced, and the market for its products or services will grow. If the enterprise has quality problems and attempts only to increase sales, the influence and adverse effects of its poor quality will only lead to greater difficulties with the expenses associated with poor quality and dissatisfied customers. Because this opportunity to increase return-on-investment is already available and focused within the enterprise and its operations, it is an internal opportunity or the "gold-in-mine" available if the enterprise only "digs" a little.

In his third edition of the Quality Control Handbook (1974), Juran comments on the concept of the "gold in the mine":

> Behind the concept was the implication that costs resulting from defects were a gold mine in which profitable digging could be done. This concept became widely used to demonstrate that programs for defect reduction could be carried out at a good return on investment . . .
> (p. 5-11)

Quality Cost as a Requirement

While Brown, Feigenbaum, Juran, and others strongly recommended and championed the recognition and assessment of costs associated with quality, there was no requirement that any enterprise establish a cost of quality program. In December of 1963, the Department of Defense issued MIL-Q-9858A, Quality Program Requirements which required many government contractors and subcontractors to maintain and employ quality cost data as a management element within their quality program, stating:

> 3.6 Costs Related to Quality. The contractor shall maintain and use quality cost data as a management element of the quality program. . . . The specific quality cost data to be maintained and used will be determined by the contractor. These data shall, on request, be identified and made available for "on site" review by the Government Representative. (p. 3)

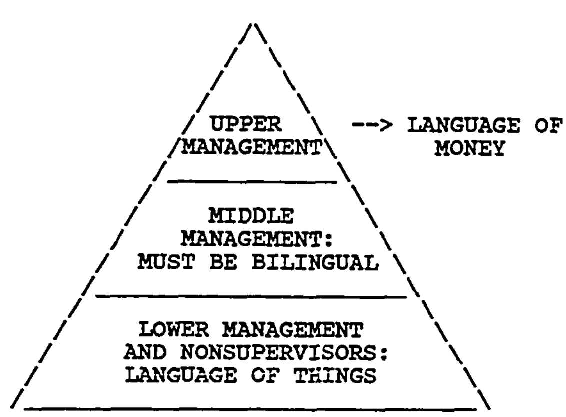
Under this specification, the contractor is required to maintain and report quality costs, but the contractor is allowed much latitude in determining which costs to report and how the quality cost system is constructed. MIL-STD-1520A, Corrective Action and Disposition System for Nonconforming Material, issued in 1975, is less permissive and identifies which costs must be gathered and reported rather than allowing this decision to individual contractors. It required that quality cost data be used to provide current and trend information for internal review and action.

In recent years, increasing numbers of government and commercial contracts require the reporting of quality costs, from the costs of scrap and rework to documentation of full-scale quality cost programs (Campanella, 1983). This increasing use of the concept of quality costs can be attributed to four developments (Juran & Gryna, 1980). First, quality costs themselves have grown due to the increased volume of complex products. Technologically advanced and innovative products require a greater precision and reliability than previously experienced.

Second, more long-life products are on the market. These products bring with them the possibility of high costs associated with field failures, field service, spare parts, and maintenance labor. It is, in fact, sometimes more costly to keep these products in operation than it was to purchase them in the first place.

Third is the pressure resulting from a "life behind the quality dikes". Juran coined this phrase. "In the twentieth century, for the first time in human history," he comments, "the great masses of human beings placed their safety, health, and even their daily well-being behind numerous protective dikes of quality control." (p. 4-2) The whole social structure is now premised and dependent on the quality of manufactured products, on the reliability of medicines, bridges, tunnels, cars, waste removal, aircraft, complex defense systems. Not surprisingly, the national economy, too, depends more and more on quality control. Marketability of products determines national income, and marketability depends increasingly upon quality. In such a context, the concept of quality costs becomes highly significant.

A fourth reason for the growing acceptance and use of quality costs is the need for quality professionals to communicate their findings and recommendations to upper management in the language of upper management, the language of money. Juran (1979) describes the common languages in companies by using the diagram below.



DESCRIPTION 11

Juran contends that the language spoken by top executives (upper management) is the language of money, of sales, investment, profits, return-on-investment. Top executives reach decisions about possible courses of action only through explanations made in and understandings developed through the use of this common language. The language at the bottom of the company, on the other hand, is the language of things. Supervisors, foremen, and nonsupervisory personnel communicate in the language of meters, hours, tons, kilowatts, and so forth. The effective mid-level technical/professional manager, therefore, must be bilingual. The technical/professional in middle management positions must be able to take the observations and data from individuals using the language of things (defects, scrap, etc.) and develop a system and structure to convert these findings into the language of upper management, the language of money (Juran, 1979). Juran's diagram contains a footnote that indicates that communications between technical/professional positions may also require a more common language. He observes:

> There are numerous local dialects peculiar to various functions, e.g., accounting, market research, quality control. These dialects are understood by the local professionals and by few others. (p. 3-11)

The quality costs concept permits the translation of the quality professional's findings into the dollars and cents language of upper management. As a management tool, quality costs permit the definition of opportunity and the measurement of success. As Juran and Gryna (1980) stated:

> What has emerged is a concept of defining and measuring "quality cost" and then using the resulting figures for two different but interrelated purposes:
>
> 1. To provide a "new scoreboard" as an added form of cost control.
>
> 2. To "identify opportunities" for reducing costs. Here the emphasis is not on meeting some historical standard but on challenging the validity of that standard. (p. 12)

<u>Quality Cost Estimates</u>

Many authors have estimated the cost of quality to the enterprise. Sinha and Willborn (1985) state that "from 15% to 40% of the manufacturer's cost of an average product is for hidden waste that the company tries to recover through higher prices passed on to the consumer." (p. 503) Townsend (1986) states that "IBM estimates that 30 percent of its products' manufacturing costs - the total Cost of Quality, prevention, detection, and appraisal - arises directly from not doing it right the first time." (p. 126)

The Cost Effectiveness Committee of ASQC (1971) offers the following: "Quality losses, i.e., restoration or failure costs, have been known to approximate 5 to 15 percent of sales billed--much of it centered around warranty adjustments costs." (p. 38) Crosby (1984) addresses the concept of "the price of nonconformance" which is all the expenses involved in doing things wrong and states that this "is an enormous amount of money, representing 20 percent or more of sales in manufacturing companies and 35 percent of operating costs in service companies." (p. 85)

Quality Cost Definitions

Although the concept of and systems of quality costs have existed since the 1950's, there is no quality cost standard. Quality cost terminology and definitions related to quality costs exist but there are no standard terminology or generally agreed upon definitions. There are many reasons for this. Many of the early adopters of quality costs systems modified an existing cost accounting system to create and provide the definitions for their quality cost systems. In these cases, quality costs were defined within the context of an internal and often proprietary accounting system. These internally created quality cost systems established their own peculiar sets of quality cost terminology and definitions which were not easily transportable or suitable to broad generalization.

A second factor was that many established authors who began writing on the concept of quality costs already had a basic quality philosophy. They often chose to emphasize quality costs from a view which conformed to their already existing views of quality. This created a diffusion of quality cost thought rather than a focus. Accounting professionals often chose to treat the quality cost concept as a trendy and possibly short-lived phenomenon which used a very soft application of cost data.

Perhaps the most significant factor, however, was the continuing evolution of quality cost thought and a growing breadth of applications. Initially, quality costs were addressed by writers such as Feigenbaum and Juran primarily from an internal (within the enterprise) economic view; this was evidenced by Juran's analogy of "the gold in the mine". As the view of quality and quality programs expanded from an internal economic view to a broader customer/user view, the concepts and application of quality costs also expanded to account for and measure the effectiveness of this new external customer/user emphasis. Indeed, an excellent argument could be made that general standards for quality cost terminology and definitions cannot be established. This would be due to the broad differences in stated quality goals and objectives and differing quality cost philosophies, systems, and applications among the many quality professionals and individual enterprises.

The definition of quality as used throughout this writing does come from a standard; the definition is provided by the joint Standards Committee of the American

DESCRIPTION 15

National Standards Institute and American Society for Quality Control (ANSI/ASQC) in ANSI/ASQC A3-1978, Quality Systems Terminology:

> Quality: The totality of features and characteristics of a product or service that bear on its ability to satisfy given needs. (p. 1)

Although there is no quality cost standard, quality costs are addressed in ANSI/ASQC Standard Z-1.15-1979, Generic Guidelines for Quality Systems. Appendix C is entitled the "Management of Quality Costs" but is separated from the standards contained within the document by this statement:

> This Appendix is not part of the American National Standard ANSI/ASQC Z-1.15-1979 Generic Guidelines for Quality Systems, but is included for informational purposes only. (p. 15)

MIL-Q-9858A, Quality Program Requirements requires many government contractors and subcontractors to maintain and employ quality cost data as a management element although there is no specified form or structure for this data, and MIL-STD-1520A, Corrective Action and Disposition System for Nonconforming Material, identifies costs that must be gathered and reported but within a very specific context. Neither document was intended to be nor could it be constituted as a quality cost standard.

ANSI/ASQC Z-1.15 provides broad though very limited recommendations for managing quality costs and quality cost systems. It suggests that quality cost reporting be as comprehensive and useful as possible and recommends that quality cost reports be classified into meaningful (cost) elements and that these cost elements be listed and defined:

> . . . A standard and effective classification is:
>
> 3.3.1 PREVENTION. Efforts intended to prevent failure and to provide the economically optimum amount of appraisal.
>
> 3.3.2 APPRAISAL. Costs associated with testing and inspecting the product to assure that prescribed quality levels are met.
>
> 3.3.3 INTERNAL FAILURE. Costs resulting from product failing to meet requirements prior to delivery to the initial customer (e.g., scrap, rework, retest).
>
> 3.3.4 EXTERNAL FAILURE. Costs resulting from product failing to meet requirements after delivery to the initial customer (e.g., product service, warranty and returns, direct costs and allowances, product recall cost, and insurance). In industries where user liability costs are dramatically increasing, care should be taken to provide for realistic future costs, not limited to past actual cost experience. (p. 16)

The American Society for Quality Control has supported the development of a number of technical publications addressing quality costs. In 1961, the ASQC Quality Cost Technical Committee was formed, and in 1967 the committee published Quality Costs - What & How to provide a conceptual framework for a quality cost program and definitions for the categories and elements of quality costs. This early work in quality costs conveys a strong sense of the economics of quality and a very strong internal focus.

DESCRIPTION 17

The concept of quality cost contained in Quality Costs - What & How, (1967) is described:

> The basic concept of quality costs is recognition and organization of certain quality-related costs to gain knowledge of their major contributing segments and of the direction of their trends. . . . Quality costs help to measure overall quality activities within a business, supplying cross-checks for measuring inputs against outputs.

This concept of quality costs closely parallels the earlier concepts of Feigenbaum and Juran and agrees in general with the direction established by MIL-Q-9858A and MIL-STD-1520A. The Quality Cost Technical Committee used a quality cost element division similar to that contained in ANSI/ASQC Z-1.15, suggesting these cost identifications and definitions:

> Prevention -- Costs incurred for planning, implementing and maintaining a quality system that will assure conformance to quality requirements at economic levels. (p. 8)
>
> Appraisal -- Costs incurred to determine the degree of conformance to quality requirements. (p. 13)
>
> Internal Failure -- Costs arising when products, components and materials fail to meet quality requirements prior to transfer of ownership to customer. (p. 16)
>
> External Failure -- Costs incurred when products fail to meet quality requirements after transfer of ownership to the customer. (p. 19)

The Quality Cost Technical Committee sponsored professional training programs and annual presentations on quality costs and published, Guide to Reducing Quality Costs (1977, 1987), Guide for Managing Vendor Quality Costs (1980), Quality Costs: Ideas and Applications (1984), Management of Quality: Preparing for a Competitive

Future (1984), Principles of Quality Costs (1986), and Guide for Managing Supplier Quality Costs (1987).

Principles of Quality Costs (1986) was published as a replacement for Quality Costs - What & How (1967) and displays a very obvious shift from an earlier economic view of quality to a customer/user view. The management concepts of quality costs are very similar in both documents, but Principles of Quality Costs expands upon and addresses changes (e.g., audits, service, and vendors) that were not specified in earlier quality cost elements. The elements of quality cost have been brought into line with contemporary quality theory and management practices. The elements are defined as:

> Prevention Costs - The costs of all activities specifically designed to prevent defects in deliverable products or service. Includes activities prior to and during product or service development, purchasing, operations planning and execution, operations support, and post delivery service.
>
> Appraisal Costs - The costs associated with measuring, evaluating or auditing products or services to assure conformance with quality standards and performance requirements. These include the inspection, test or audit of purchased materials, manufacturing or process operations, operations support documentation and materials, and installation or field trials.
>
> Include labor and fringe benefit costs, as well as expenses and depreciation.
>
> Failure Cost - The costs required to evaluate and either correct or replace products or services not conforming to requirements or customer/user needs. This includes purchased materials and associated product or service design and support materials because they failed to meet requirements or

> customer/user needs. Includes both material and labor costs, with fringe benefits.
>
> Internal Failure Cost - The costs occurring prior to completion or shipment of the product or furnishing of a service.
>
> External Failure Cost - The costs occurring after shipment of the product and during or after furnishing of a service. (p. 4)

These expanded definitions of the quality cost elements mark a clear departure from the previous <u>economic</u> view of quality and create focus on the <u>customer/user</u>.

The following is a <u>customer/user</u> modification of Juran's diagram of common languages:

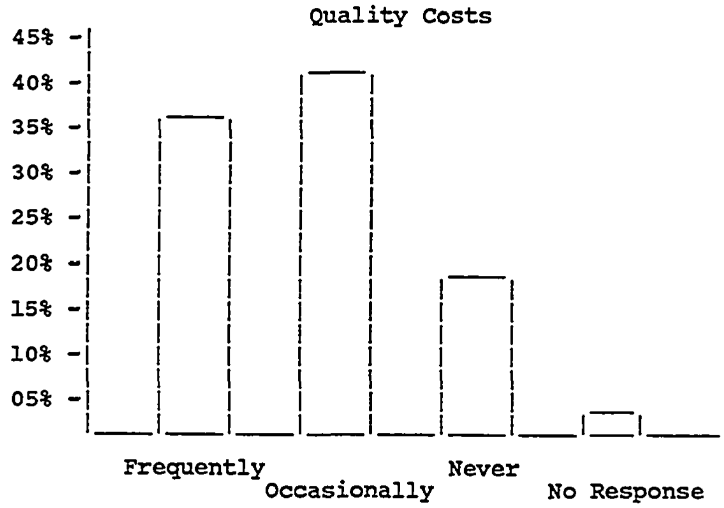
```
              /\
             /  \
            /    \        LANGUAGE OF MARKETS,
           /      \       CUSTOMERS, USERS, SERVICE,
          / UPPER  \  --> GOALS, MONEY, QUALITY
         /MANAGEMENT\     AND QUALITY COST
        /____________\
       /              \       LANGUAGE OF DEPARTMENT,
      /     MIDDLE     \  --> SECTION, PROCESS, AND
     /   MANAGEMENT;    \     PRODUCT GOALS, QUALITY
    /  MUST BE BILINGUAL \    AND QUALITY COSTS
   /______________________\
  /                        \      LANGUAGE OF WORK,
 /  LOWER MANAGEMENT,       \ --> PEOPLE, MATERIALS
/     FOREMEN, AND           \    OPERATIONS, TOOLS,
/     NONSUPERVISORS          \   SCHEDULES, QUALITY,
/______________________________\  AND QUALITY COST
```

<u>Users of Quality Costs</u>

Attendees of the 1985 Annual Quality Congress, the largest national gathering of practitioners in quality and quality related fields, were surveyed by Duhan and West

(1985) to ascertain which quality control techniques were most frequently used by their organizations. The responses indicated that statistical quality control and quality audits were the most commonly used techniques. The survey response indicating the use of quality costs were shown in figure 18 (p. 86) which is provided below:

Quality Costs



The response indicated that over 35% of the organizations use quality costs frequently, and over 40% use quality costs occasionally.

INSTALLATION SECTION INDEX

INTRODUCTION

The initial installation of a quality cost system requires the consideration of a number of important factors. A decision must be reached as to the purpose or goal of the quality cost information system, what cost information will be developed and defined, at what levels within the enterprise the implementation will take place and which quality cost standards will be used. The enterprise's current and potential capacity to obtain and structure quality cost information must also be ascertained. Cost information produced by existing cost accounting systems and procedures should be carefully evaluated to determine their relevance to quality cost information. Many cost accounting systems focus on the most quantifiable and traditional aspects of production processes (usually quantity, time, and budget) and are not structured to address quality costs directly. Each of these considerations is very significant to the successful installation of a quality cost information system and will be discussed.

An outline of the recommended installation steps and sequence is provided on the following page, Figure I-1. It is recommended that the installation outline and topics form an initial focus for preliminary discussions and planning for the installation of the quality cost information system.

Figure I-1. Quality cost information system installation diagram

Section One

Purpose or Goal of the System

Section Two

Structure of the Quality Cost Information System

Section Three

Focus and Definitions in Quality Cost Information

Section Four

Initial Level of Installation

Entire Enterprise

Identified Operations and Activities

Individual Elements within Operations and Activities

Figure I-2. Section One

Purpose or Goal of the System

Purpose or Goal

The purpose or goal of a quality cost information system is usually stated in terms of gain or benefit to the enterprise. Commonly, the goal of a quality cost information system is to enhance the enterprise's ability to manage quality and to facilitate those quality improvement efforts leading to reduction of operating costs. Pressure for higher operating efficiency and effectiveness at lower costs is a critical concern for all enterprises.

Every identifiable quality problem carries with it a quantifiable real cost and offers an opportunity for cost reduction. No improvement in cost or quality can occur without positive corrective action. Such corrective action is paid for only once, whereas the failure to take corrective action on a problem is paid for over and over again.

The purpose or goal of the quality cost information system must agree with and complement the enterprise's current or target quality philosophy, policy, and objectives. The enterprise must have a quality policy and a distinctive, usable, agreed upon definition of quality which focuses its quality system and efforts or quality will mean something different to everyone taking the time to consider the term. The enterprise will not be able to focus its resources toward or achieve its quality needs.

A quality cost information system is <u>not</u> a stand-alone program. It stands in support of the quality management system and is used to highlight real opportunities for quality improvement and to measure actual progress toward quality goals. Without an active and visible enterprise commitment to quality and a quality management system to support, there is no justification for a quality cost information system. Attempting a stand-alone quality cost program (one that is not based on an enterprise-wide quality commitment, effort, and focus on problem resolution) will usually result in a program that appears to be only a finger-pointing and money-saving device. This will weaken the existing quality efforts and reduce most willing participation.

If the enterprise states or implies that its goal is an <u>immediate</u> reduction of <u>total</u> quality costs, it risks a drive toward short-term quick fixes (i.e., reduction of the number of inspectors, doubling-up on individual responsibilities, and reductions in prevention costs such as training and equipment upgrading). This will produce apparent and quantifiable short-term cost reduction but will result in detrimental effects over the long term (i.e., inadequate staffing, training, and equipment) and will provide no indication of what the real generators and drivers of adverse quality costs are.

Eliminating the sources and causes of problems while meeting the on-going demands of schedule, budget, and quantity requires hard work. The process is time-dependent and evolutionary in nature, not a rapid overnight phenomenon. The quality cost information system can only identify those costs stemming from errors; it is up to the enterprise's management team to prepare and equip the personnel of the enterprise to eliminate the causes of the errors.

Using the premise that any cost that can be identified and avoided will have a direct and positive effect on profit is one benefit of a quality cost information system. The quality cost information system can also gauge the effectiveness of quality management system activities and their ability to assist in and establish corrective action in dollars and cents, the language that management is most familiar with and usually acts on.

Figure I-3. Section Two

Structure of the Quality Cost Information System

Structure

Structuring the quality cost information system begins with an understanding that quality improvement and cost improvement are synonymous.

The quality cost information system does not compete with existing accounting systems. The quality cost information system is not an adjunct to the existing accounting system. The quality cost information system is designed to operate in conjunction with the existing accounting system. The accounting system is the primary management information system for the enterprise, and a quality cost information system expands the vision of the management information system into the area of quality performance.

INSTALLATION 7

To validate the dollars and cents language of the quality cost information system, it is necessary that the senior accounting/financial officer of the enterprise or their designated representative be held responsible for quality cost collection, compilation and reporting as a function of the enterprise's management information system and as a service to the quality management function.

The structure of the quality cost information system should result from the collaborative efforts of a management team comprised of quality, finance/accounting, and at least one or more additional interested managers. This team should be formally designated the Quality Cost Information Management Team. The composition of the team should be diverse enough to develop a quality cost information structure that will blend all of the best thought within the enterprise and be senior enough to make decisions or, at least, to make recommendations directly to the enterprise's top management.

It is important that the establishment of the committee and its membership be widely announced and that every segment of the enterprise have an opportunity to present their views and information to the committee. No segment of the enterprise should be given the option to disassociate itself from the system, and no segment should be excluded from the opportunity to present information. This is done to forestall the growth of a <u>We</u> and <u>Them</u> attitude toward the quality cost information system. Providing full disclosure to the union is a necessity, and the union's views and support should be actively solicited.

In designing the structure of the quality cost information system, there are four important factors for the committee to consider:

1. The quality cost information system must be a formal and legitimatized component of the enterprise's management system.

2. The quality cost information system must be able to identify opportunities.

3. The quality cost information system must be able to justify management improvement actions.

4. The quality cost information system must be able to measure the effectiveness of improvement actions.

The structure and operation of the quality cost information system should not be cumbersome. A complicated set of rules and procedures with many variables and alternatives may create an impressive document, but it will also create confusion and invite disuse. This is especially true of any promotional and training materials used for the system. Any materials used to guide the day-to-day operation of the system should be streamlined and facilitate ease of use.

INSTALLATION 9

The Quality Cost Information Committee responsibilities will include:

1. Ensuring that the quality cost information system is in compliance with the enterprise's quality policy and goals.

2. Developing the formal quality cost information system policy.

3. Developing procedures by which a generally acceptable degree of quality cost validity, reliability, and creditability can be established.

4. Establishing the initial definitions and goals for the program.

5. Developing and promoting the necessary educational and training program.

6. Monitoring the effectiveness and operation of the program.

7. Determining the recognition and reward functions of the program.

The quality cost information system should never be considered a finished, immutable, locked-in-stone product. The quality cost information system is a continuing process which will always be developing in order to meet the challenge of newly disclosed opportunities.

Figure I-4 Section Three

Focus and Definitions in Quality Cost Information

Focus

The arguments for quality improvement and statements of rewards to be gained from increasing quality are usually weak when stated in broad generalities and popular slogans, but will become unmistakably clear when stated in the dollars and cents language of management.

Early quality cost writings often focused on manufacturing errors and inefficiency. This is exemplified by Juran's initial concept of the "gold in the mine". This focus sends a clear message: if you, the manager or supervisor in a manufacturing unit for which we have large amounts of existing quantitative data, will only clean up your act, we, the less scrutinized rest of the enterprise, will be in better competitive and economic shape.

The responsibility for quality does not rest solely in manufacturing, and quite often even those quality costs identified within manufacturing result from decisions made outside of manufacturing. Design, engineering, materials, purchasing, marketing, advertising, sales, and the enterprise's quality philosophy need to be integrated as cost factors in determining quality costs. Quality costs are phenomena of organization-wide scope and cannot and should not be attributed to or focused on a single segment of the enterprise. An admonishment to cut quality costs is meaningless, especially when the admonishment can be read as currently being addressed almost exclusively to one or two enterprise areas.

Without an enterprise-wide quality cost program and focus, the goal and long-term value from a quality cost information system will be defeated.

Definitions

This section, the preceding section, and the two glossaries at the end of the resource manual contain many of the common definitions used in a quality cost system. Using these common definitions as a base, the enterprise can select definitions, modify them, or even create new definitions to meet the specific operational and activity requirements of the enterprise. The prevention, appraisal, internal, and external sections of this resource manual contain worksheets for common quality costs classifications and spaces for cost elements to be individually defined by the enterprise.

The development of an extensive base of quality cost terms and definitions should not be considered of immediate importance to the system. This is an activity that can be gradually undertaken throughout the quality cost information system's maturation. The general quality cost groupings of prevention, appraisal, and failure should provide an adequate initial framework for the installation of a quality cost information system. In the initial stages of the quality cost information system's development, it is usually more practical to allow the individual activities and operations to <u>discover</u> specific costs within the general quality cost groupings during the process of error identification and correction than to attempt a total pre-indoctrination.

The incremental and measurable reduction of quality costs is the real goal of the quality cost system, not an extensive education in the number of possible quality costs.

Figure I-5. <u>Section Four</u>

Initial Level of Installation

- Entire Enterprise
- Identified Operations and Activities
- Individual Elements within Operations and Activities

<u>Initial Installation</u>

The goal of the initial installation plan should be to insure those initial successes which will promote and create interest in program involvement. For an initial installation, it is recommended that three trial cost reduction and problem-solving targets (opportunities) be selected from within the enterprise. Three cost teams should then be selected and each assigned one of the cost targets. These targets should not be the enterprise's largest and most difficult problems -- those problems which have already tested and stumped the most creative and knowledgeable managers in the enterprise. The first cost reduction teams will have a challenging enough agenda without taking on the ultimate in quality cost difficulties.

One method of selecting initial cost targets is to ask managers and supervisors for their recommendations on cost reduction or problem areas. The targets should offer an obvious opportunity for improvement, contain identifiable cost categories, and be representative of the enterprise's normal operations. Team members should represent those operations and activities having a primary association with the target cost area. The three initial groups will require education and training in quality costs, problem solving techniques, nominal group techniques, and the enterprise's quality cost information system.

The three initial groups will actually have two separate and distinct agendas. The first agenda will be to prove the effectiveness of the quality cost information system as a tool, to improve and build upon the capabilities of the system, and to identify, recommend, and install any additional requirements not provided for.

The second agenda will be to prove the ability of the quality cost system to create cost-savings. The three groups should be encouraged to interact jointly and share their experiences with the system and their views on the system's operation. The group leaders should meet with and provide verbal status reports to the quality information system management team. The quality information management team should view the three initial groups and the groups' operations as the management team's first report on the effectiveness of quality cost information structure.

The enterprise-wide quality cost program and quality cost information system installation and training effort should not begin until both have been piloted by the initial three groups, and the effectiveness of both has been established.

The decision to move from the trial program into the enterprise-wide program should be the decision of the quality information management information team.

The enterprise-wide installation of a quality cost information system is theoretically possible at several different levels:

1. Quality cost information system capable of reporting the aggregate total of all quality costs for all operations and activities within the enterprise.

2. Quality cost information systems for identified operations and activities within the enterprise.

3. Quality cost information systems for individual elements within identified operations and activities.

Figure I-6.

TOTAL QUALITY COST INFORMATION SYSTEM								
OPERATION 1			OPERATION 2			OPERATION 3		
EL1	EL2	EL3	EL1	EL2	EL3	EL1	EL2	EL3

Enterprise-wide Installation

The first option's focus, a total quality cost information system, would appear to have greater capacity to assimilate and consider quality costs being reported from outside the enterprise. These would be the quality costs associated with warranty, field failure, field service, field repair, sales adjustments. These external cost could then be decomposed to provide quality cost information related to specific products and processes and then further reduced to provide quality cost information specific to individual operations and activities.

If the third option is selected, for example, (positioning the installation of the quality cost information system at elements within operations and activities), the sum of elemental or activity quality costs could be used to determine quality costs associated with the parent operation or activity.

Similarly, an initial positioning of quality costs at level two (parent operations and activities) allows each individual parent operation or activity to be summed into an aggregate total family of costs. This aggregate total would represent the total cost of quality for the enterprise. The initial installation at level two also allows the decomposition of parent quality costs into quality costs associated with identified elements within the operation or activity.

The purpose of the quality cost information system is to organize the quality costs in a way that supports analysis. The value of the quality cost information system is its ability to identify opportunities for improvement and then monitor that improvement over time. The system installation should facilitate analysis, opportunity identification, and improvement monitoring.

OPERATION 1

OPERATION SECTION INDEX

OPERATION 2

INTRODUCTION

This manual is designed to enable an individual enterprise to develop and construct a quality cost information system framework and then to assemble the necessary components to support that framework. Quality cost information systems can be developed for any level of operation or activity within the enterprise. Not all aspects, forms, or pages within this manual are mandatory, and in specific instances, many are not required.

The enterprise may choose a bottom-up development for its quality cost information system. The quality costs associated with activities and operations elements are to be aggregated, building upward through product and process quality costs, toward the enterprise's total cost of quality. The enterprise may also choose to begin with actual or estimated total quality costs, decompose these total quality costs figures to the quality costs at product/process level, and continue through to quality costs at the element level within activities and events. The manual contents can also be used to provide a framework for systematic quality cost problem identification and analysis.

The enterprise's purpose for the quality cost information system and its use of quality cost information will determine which aspects of the manual are employed at any specific point in time. The manual materials were developed to support any expansion or change of focus the enterprise may choose for the quality cost information system.

It is recommended that for each quality cost opportunity, the quality cost team evaluate the opportunity, select the applicable working pages from this manual, photocopy those pages, and assemble a separate opportunity quality cost information manual.

> The structures and definitions provided in this manual are for example only and should not be considered as complete or fully suitable for the individual enterprise without considered evaluation.
>
> The criteria for any structure or definition is an ability to meet the commonly agreed upon requirements and interests of the enterprise. The success of a quality cost information system will depend to a large degree upon the development of a common quality cost language, a working set of definitions, and a consistent use of terminology.

The goal or purpose of our Quality Cost Information System is to:

____

____

____

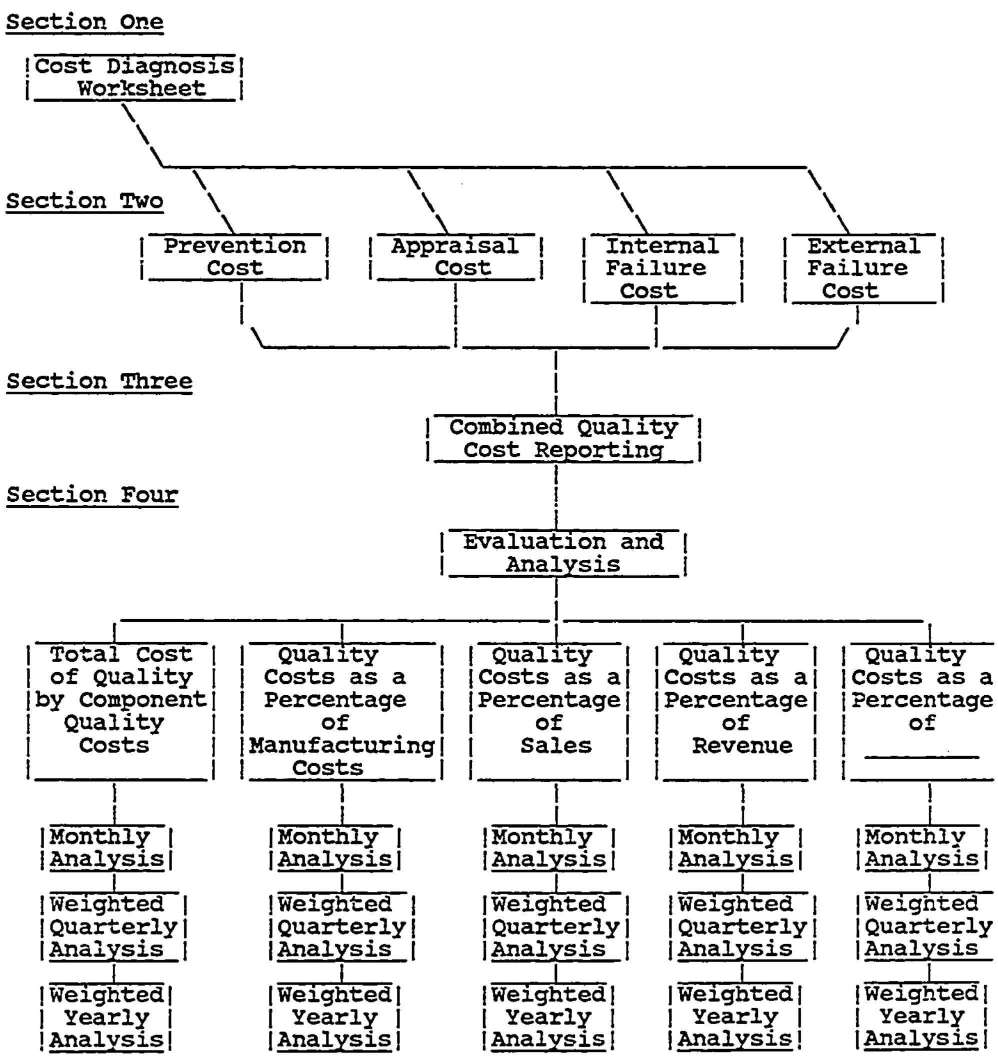
____

Does this agree with the formal or informal quality policy of the enterprise? |_| Yes |_| No

The working sections of the quality cost information manual are designed to enable the enterprise to identify and define any additional cost elements that may be required.

The manual's working structure is shown in Figure OP-1. This figure does not include the introduction, description, installation, and operation sections. These sections are preparatory to the actual working section of the manual.

Figure OP-1. Resource manual diagram



The individual sections of Figure OP-1 will be explained in detail throughout the Operation section.

OPERATION 6

Figure OP-2. Section One

Cost Diagnosis Worksheet

Examples of Cost Diagnosis worksheets are presented on pages 7 to 9.

Diagnostic Worksheet

Cost Diagnosis Worksheets are used to rank products or processes on the basis of actual or estimated quality costs. The worksheets may also be used to rank total quality cost figures for an enterprise. Cost Diagnosis worksheets do not allow for the entry of actual dollar values but are structured to identify the magnitude of quality costs in seven weighted classifications ranging from very high (9) to very low (0).

V	H	A	A	B	L	V
E	I	B	V	E	O	E
R	G	O	E	L	W	R
Y	H	V	R	O		Y
		E	A	W		
H			G			L
I		A	E	A		O
G		V		V		W
H		E		E		
9	7	5	3	2	1	0

The function of the ranking system is to establish weighted differences between individual cost components within the quality cost information system.

There are seven basic forms of the Cost Diagnosis worksheet:

1. Total quality cost - coded.
2. Product quality cost - coded.
3. Process quality cost - coded
4. Total quality cost - uncoded.
5. Product quality cost - uncoded.
6. Process quality cost - uncoded.
7. Unassigned quality costs.

Total quality cost worksheets are for total quality cost evaluations. Product and process worksheets are for product and process evaluations. Coded worksheets contain the five-character letter codes for individual component quality costs; uncoded worksheets do not contain the character codes. The five-character letter groups are used for the supporting applications computer program.

The unassigned quality cost worksheets can be employed for any assigned quality cost evaluation and ranking required by the enterprise.

The Cost Diagnosis worksheets contain four major quality cost categories:

1. External failure quality costs.
2. Internal failure quality costs.
3. Appraisal quality costs.
4. Prevention quality costs.

All major quality cost categories are identified by the first character of the five character code. External failure quality cost codes have an E as the first character of the five-character code; Internal failure quality cost codes have an I as the first character, with an A for appraisal costs and P for prevention costs.

Each major quality cost category is divided into elemental quality costs. The last four letters of the five-character code are used to identify elemental quality costs within the major categories. For example, in the five-character code, EADRE, the first letter, E, indicates that this is an external failure cost, and the following four-character group, ADRE, identifies the element cost, additional related expenses.

The structured and alphabetical glossaries at the end of the manual provide the definitions of all terms and five-character codes. These terms and the coding structure are referred to throughout the manual.

Each category has four optional unassigned quality cost codes for use as required. Space is provided in both the structured and alphabetical glossaries for entering their assigned use and meaning.

The following three pages are from the Cost Diagnosis section of the manual. They include the section index and Product - Coded worksheets. Each quality cost information system installation will have an individualized initial focus. This initial focus may be with total quality cost, a product or product group quality cost, or a process or process group quality cost. It is assumed that from these initial focus points, an individual product or process will be selected for analysis and evaluation.

The following worksheets describe an initial focus on a single product (a generator) from the electrical products division of the enterprise. The generator has caused serious customer and supplier complaints, and the enterprise has established a cost group to investigate the problem.

COST DIAGNOSIS WORKSHEETS

OPERATION 10

COST DIAGNOSIS 4

Product: GENERATOR

Unit/Dept: ELECTRICAL PRODUCTS

Date: MARCH, 1987

By: COST GROUP

		VERY HIGH	HIGH	ABOVE AVE	AVERAGE	BELOW AVE	LOW	VERY LOW
		9	7	5	3	2	1	0
External Failure								
Warranty Administration	EWAAD	X						
In-Warranty Repair/Parts	EIWRP	X						
Out-of-Warranty Repair/Parts	EOWRP				X			
Field Service	EFISE	X						
Applications	EAPPL				X			
Returns	ERETU	X						
Reclassification	ERECL			X				
Recalls	ERECA			X				
Additional Related Expense	EADRE	X						
Liability Reserve	ELIAB				?			
	EXONE							
	EXTWO							
	EXTHR							
	EXFOU							
Internal Failure								
Design Failure Costs	IDEFC				X			
Investigation	IINVE	X						
ECR/ECN Cost	IEECO	X						
Supplier Reviews	ISURE				X			
Material Reviews and Action	IMRAA	X						
Rework	IREWO	X						
Repair	IREPA				X			
Reinspection	IREIN		X					
Product Awaiting Disposition	IPADI	X						
Reclassification	IRECL				X			
Excess Manufacturing Cost	IEXMC		X					
Excess Manufacturing Burden	IEXMB		X					
Additional Related Expenses	IADRE			X				
Scrap	ISCRA			X				
	INONE							
	INTWO							
	INTHR							
	INFOU							

OPERATION 11

COST DIAGNOSIS 5

Product: GENERATOR

Unit/Dept: ELECTRICAL PRODUCTS

Date: MARCH, 1987

By: COST GROUP

		VERY HIGH	HIGH	ABOVE AVE	AVERAGE	BELOW AVE	LOW	VERY LOW
		9	7	5	3	2	1	0
Appraisal								
Incoming Inspection	AININ				X			
Product Qualification Tests	APQTE				X			
Material/Parts In-process Inspection and Test	AMPIP				X			
Material/Parts Final Inspection and Test	AMPFI			X				
Assembly/End-Item In-process Inspection and Test	AAEIP	X						
Assembly/End-Item Final Inspection and Test	AAEFI	X						
Repair Test and Inspection	ARTIN	X						
Metrology	AMETR				X			
Metrology Maintenance	AMETM				X			
____________	APONE							
____________	APTWO							
____________	APTHR							
	APFOU							
Prevention					X			
Product Design	PPRDE				X			
R&D Quality	PRDQU				X			
R&D Support	PRDSU				X			
Engineering Quality	PENQU			X				
Engineering Support	PENSU	X						
Field Quality	PFIQU				X			
Field Support	PFISU		X					
External Quality	PEXQU				X			
External Support	PEXSU				X			
Purchasing	PPURC			X				
Quality Planning	PQPLA				X			
Quality Administration	PQADM				X			
Quality Training	PQTRA				X			
Quality Audits Internal	PQAIN				X			
Quality Audits External	PQAEX				X			
Quality Related Maintenance	PQRMA				X			
Vendor Certification	PVCER				X			
____________	PRONE							
____________	PRTWO							
____________	PRTHR							
	PRFOU							

OPERATION 12

Using the Cost Diagnosis worksheets, the cost group has ranked the significance of quality costs for the generator by category and component. The cost group decided to pursue the investigation of those components having a very high cost estimate. The very high cost estimates are associated with:

External Failure:

1. Warranty Administration.
2. In-Warranty Repair/Parts.
3. Field Service.
4. Returns.
5. Additional Related Expense.
6. Although Liability Reserve is not indicated in the very high category, a possible impact (?) is established for continuing consideration.

Internal Failure

1. Investigation.
2. ECR/ECN Cost.
3. Material Reviews and Action.
4. Rework.
5. Product Awaiting Disposition.

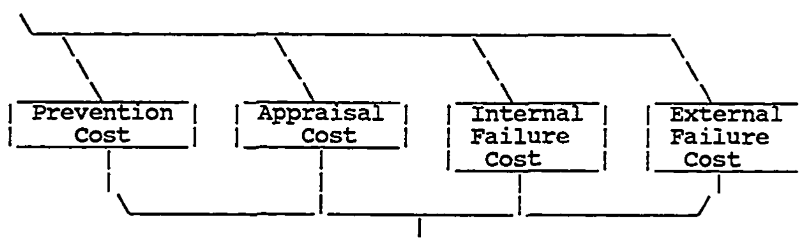
Appraisal

1. Assembly/End-Item In-process Inspection and Test.
2. Assembly/End-Item Final Inspection and Test.
3. Repair Test and Inspection.

Prevention

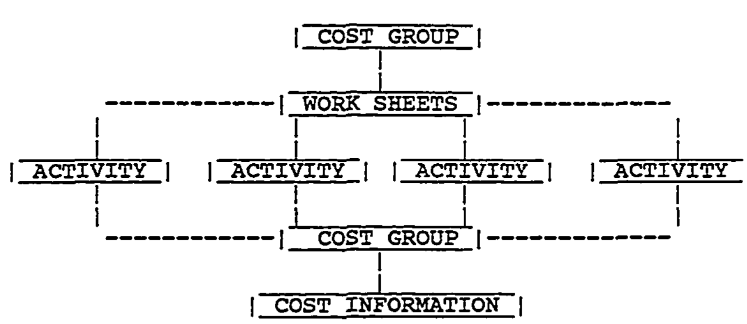
1. Engineering Support.

Figure OP-3. Section Two



The cost group completed the Cost Diagnosis worksheets and identified the major factors. The cost group will probably require assistance in determining the actual or estimated cost level. The second section of the quality cost system expands upon and provides detail for the significant factors identified in the completed Cost Diagnosis worksheets. This is facilitated by the structure of the quality cost system manual. The appropriate worksheets from any section of the manual can be photocopied and sent to individual operations or activities for data entry and completion.

Figure OP-4. Distribution of worksheets



Worksheets from the quality cost information system manual should be available in each activity or operation. The premise is that distribution of the worksheets will emphasize the quality cost system's development and will provide each activity or operation with the capability for appropriate documentation.

The computerized quality cost information system and an electronic mail system would significantly speed development of and access to the required data. It is recommended that individual activities and operations have access to the quality cost worksheets through their specific code identification. The individual activity or operation can use and assign the worksheets as their individual cost of quality information system. When compiled or combined cost of quality cost figures are requested, the individual activity or operation would only have to reassign and access the master system to provide their data to the external system.

EXTERNAL FAILURE COSTS

External failure costs result from product failing to meet requirements after delivery to the initial customer (e.g., product service, warranty and returns, direct costs and allowances, product recall costs, and insurance).

> This definition and component elements are provided for example only and should not be considered as complete or fully suitable for the individual enterprise without considered evaluation.
>
> The criteria for any definition and its component elements is an ability to meet the commonly agreed upon requirements and interests of the enterprise. The success of a quality cost information system will depend to a large degree upon the development of a common quality cost language, a working set of definitions, and a consistent use of terminology.

Our definition of External Failure Quality Cost is:

In industries where liability costs are dramatically increasing, care should be taken to provide realistic future costs not limited to past actual experience. The External Failure Cost Group currently contains ten defined categories. The External Failure Cost Index is shown on page 18. Four undefined/coded and four undefined/uncoded categories are provided to allow for category expansion or special purpose.

The cost group has identified the following external failure costs as being very high or as requiring continued monitoring. The cost group has developed a quality cost information project workbook for the generator and has included the appropriate external failure cost worksheets.

Each worksheet provides space for entering the individual cost elements for a cost category within the major cost grouping. In this example, special off-site visits to customers is the second cost element identified in the Additional Related Expense (EADRE) category within the External Failure Cost group. This is shown on page 20.

OPERATION 17

Each page provides for the entering of eight elements.

The AEC column of the worksheet allows elemental costs to be identified as:

- A Actual - Costs that exist and have been determined with certainty.
- E Estimated - Costs that have uncertainty associated with their actual value but are known to exist with certainty and therefore have been estimated.
- C Combined - Costs that have components of both actual (A) and estimated (E) Costs. These may also be indicated as percentages, e.g., 40/60.

The reference blank provides space to enter supporting documentation numbers (work orders, purchase orders, etc.) or other cost references.

Do we require additional categories within the External Failure Cost Group? Yes - No Circle one.

Element	AEC	Description

EXTERNAL FAILURE COST INDEX

OPERATION 19

EXTERNAL FAILURE COST 2

QUALITY COST COMPUTATION WORKSHEET

Date: MARCH 1987 | Page: 1 of 1

Quality Cost: Warranty Administration (EWAAD) | Period: 1ST QTR

Unit/Dept: ELECTRICAL PRODUCTS | By: COST GROUP

Element	AEC	Description
1	A	AN ESTIMATED 40% INCREASE IN WARRANTY ADMIN COSTS HAS BEEN IDENTIFIED WITH GENERATOR PRODUCT
		Reference: WAC Q1 Cost: $87,000
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:

Page Total: $87,000

Running Total: $87,000

OPERATION 20

EXTERNAL FAILURE COST 3

QUALITY COST COMPUTATION WORKSHEET

Date: MARCH 1987 Page: 1 of 1

Quality Cost: In-Warranty Repair/Parts (EIWRP) Period: 1ST QRT

Unit/Dept: ELECTRICAL PRODUCTS By: COST GROUP

Element	AEC	Description	
1	A	SPECIAL PRODUCTION RUNS FOR REPAIR PARTS	
		Reference: WO-372A	Cost: $6,437
2	A	SHELF PULL REPAIR PARTS	
		Reference: WO-372B	Cost: $4,576
3	A	ADDITIONAL REPAIR SUPPORT	
		Reference: WO-372	Cost: $11,764
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:

Page Total: $22,777
Running Total: $22,777

OPERATION 21

EXTERNAL FAILURE COST 5

QUALITY COST COMPUTATION WORKSHEET

Date: MARCH 1987 | Page: 1 of 1

Quality Cost: Field Service (EFISE) | Period: 1ST QTR

Unit/Dept: ELECTRICAL PRODUCTS | By: COST GROUP

Element	AEC	Description
1	A	FIELD SERVICE REQUIREMENTS HAVE INCREASED 42% DUE TO GENERATOR FAILURES
		Reference: FS RPT Cost: $121,274
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:

Page Total: $121,274
Running Total: $121,274

OPERATION 22

EXTERNAL FAILURE COST 7

QUALITY COST COMPUTATION WORKSHEET

Date: MARCH 1987 Page: 1 of 1

Quality Cost: Returns (ERETU) Period: 1ST QTR

Unit/Dept: ELECTRICAL PRODUCTS By: COST GROUP

Element	AEC	Description
1	A	31% OF 1ST QTR GENERATOR SALES HAVE BEEN RETURNED FOR CREDIT
		Reference: SALES Cost: $120,000
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:

Page Total: $120,000
Running Total: $120,000

OPERATION 23

EXTERNAL FAILURE COST 10

QUALITY COST COMPUTATION WORKSHEET

Date: MARCH 1987 Page: 1 of 1

Quality Cost: Additional Related Expense (EADRE) Period: 1ST QTR

Unit/Dept: ELECTRICAL PRODUCTS By: COST GROUP

Element	AEC	Description	
1	A	AIRFREIGHT ASSOCIATED WITH PRODUCT SUPPORT	
		Reference: PO-175/79/81	Cost: $1,875
2	A	OFF-SITE VISITS TO FOUR CUSTOMER LOCATIONS	
		Reference: SF	Cost: $6,547
3	A	EXTERNAL QUALITY SUPPORT	
		Reference: PO-177	Cost: $3,450
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:

Page Total: $11,872
Running Total: $11,872

OPERATION 24

EXTERNAL FAILURE COST 20

QUALITY COST COMPUTATION WORKSHEET

Date: MARCH 1987 Page: 1 of 1

Quality Cost: TOTAL EXTERNAL FAILURE COST Period: 1ST QTR

Unit/Dept: ELECTRICAL PRODUCTS By: COST GROUP

Element	AEC	Description		
EWADD	A	WARRANTY ADMINISTRATION		
		Reference: 1 OF 1	Cost:	$87,000
EIWRP	A	IN-WARRANTY REPAIR/PARTS		
		Reference: 1 OF 1	Cost:	$22,777
EFISE	A	FIELD SERVICE		
		Reference: 1 OF 1	Cost:	$121,274
ERETU	A	RETURNS		
		Reference: 1 OF 1	Cost:	$120,000
EADRE	A	ADDITIONAL RELATED EXPENSE		
		Reference: 1 OF 1	Cost:	$11,872
		Reference:	Cost:	
		Reference:	Cost:	
		Reference:	Cost:	

Page Total: $362,923
Running Total: $362,923

INTERNAL FAILURE COSTS

Internal failure costs resulting from product failing requirements prior to delivery to the initial customer (e.g., scrap, rework, additional manufacturing burden, rework, repair, retest).

> This definition and component elements are provided for example only and should not be considered as complete or fully suitable for the individual enterprise without considered evaluation.
>
> The criteria for any definition and its component elements is an ability to meet the commonly agreed upon requirements and interests of the enterprise. The success of a quality cost information system will depend to a large degree upon the development of a common quality cost language, a working set of definitions, and a consistent use of terminology.

Our definition of Internal Failure Quality Cost is:

____

____

____

____

The Internal Failure Cost Group currently contains 14 defined categories. The Internal Failure Cost Index is shown on page 27. Four undefined/coded and four undefined/uncoded categories are provided to allow for category expansion or special purpose.

OPERATION 26

The cost group has identified the following internal failure costs as being very high. The cost group has included the appropriate internal failure cost worksheets in the generator quality cost workbook.

Do we require additional categories within the Internal Failure Cost Group? Yes - No Circle one.

Element	AEC	Description

OPERATION 27

INTERNAL FAILURE COST 1

INTERNAL FAILURE COST INDEX

OPERATION 28

INTERNAL FAILURE COST 3

QUALITY COST COMPUTATION WORKSHEET

Date: MARCH 1987 Page: 1 of 1

Quality Cost: Investigation (IINVE) Period: 1ST QTR

Unit/Dept: ELECTRICAL PRODUCTS By: COST GROUP

Element	AEC	Description
1	A	320 HOURS OF DOCUMENTED INVESTIGATION TIME AT SUPERVISORY LEVEL
		Reference: AC-23 Cost: $8,000
2	C	COMBINED (ACTUAL=170 & ESTIMATED=40) 210 HOURS OF ENGINEERING INVESTIGATION TIME
		Reference: WO-537 Cost: $21,000
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:

Page Total: $29,000
Running Total: $29,000

OPERATION 29

INTERNAL FAILURE COST 4

QUALITY COST COMPUTATION WORKSHEET

Date: MARCH 1987 — Page: 1 of 1

Quality Cost: ECR/ECN Cost (IEECO) — Period: 1ST QTR

Unit/Dept: ELECTRICAL PRODUCTS — By: COST GROUP

Element	AEC	Description	Reference	Cost
1	A	GENERATOR CHANGE 37 BEARING P/N 578574-2	WO-143	$1,200
2	A	GENERATOR CHANGE 37A BEARINGS P/N 578574-2	WO-145	$1,200
3	A	GENERATOR CHANGE 38 END BELLS P/N 578232-4	WO-146	$1,200
4	A	GENERATOR CHANGE 39 HOUSING P/N 578114-3A	WO-148	$1,200
5	A	GENERATOR CHANGE 39A HOUSING P/N 578114-B	WO-151	$1,200

Page Total: $6,000
Running Total: $6,000

OPERATION 30

INTERNAL FAILURE COST 6

QUALITY COST COMPUTATION WORKSHEET

Date: MARCH 1987 Page: 1 of 1

Quality Cost: Material Reviews and Action (IMRAA) Period: 1ST QTR

Unit/Dept: ELECTRICAL PRODUCTS By: COST GROUP

Element	AEC	Description	
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:

Page Total:
Running Total:

OPERATION 31

INTERNAL FAILURE COST 7

QUALITY COST COMPUTATION WORKSHEET

Date: MARCH 1987 Page: 1 of 1

Quality Cost: Rework (IREWO) Period: 1ST QTR

Unit/Dept: ELECTRICAL PRODUCTS By: COST GROUP

Element	AEC	Description
		Reference: ______ Cost: ______
		Reference: ______ Cost: ______
		Reference: ______ Cost: ______
		Reference: ______ Cost: ______
		Reference: ______ Cost: ______
		Reference: ______ Cost: ______
		Reference: ______ Cost: ______
		Reference: ______ Cost: ______

Page Total: ______
Running Total: ______

OPERATION 32

INTERNAL FAILURE COST 10

QUALITY COST COMPUTATION WORKSHEET

Date: MARCH 1987 Page: 1 of 1

Quality Cost: Product Awaiting Disposition (IPADI) Period: 1ST QTR

Unit/Dept: ELECTRICAL PRODUCTS By: COST GROUP

Element AEC Description

Reference: Cost:

Reference: Cost:

Reference: Cost:

Reference: Cost:

Reference: Cost:

Reference: Cost:

Reference: Cost:

Reference: Cost:

Page Total:
Running Total:

OPERATION 33

INTERNAL FAILURE COST 24

QUALITY COST COMPUTATION WORKSHEET

Date: MARCH 1987 Page: 1 of 1

Quality Cost: TOTAL INTERNAL FAILURE COST Period: 1ST QTR

Unit/Dept: ELECTRICAL PRODUCTS By: COST GROUP

Element	AEC	Description	
IINVE	C	INVESTIGATION	
		Reference: 1 OF 1	Cost: $29,000
IEECO	A	CHANGES	
		Reference: 1 OF 1	Cost: $6,000
IMRAA			
		Reference:	Cost:
IREWO			
		Reference:	Cost:
IPADI			
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:

Page Total:
Running Total:

APPRAISAL COSTS

Appraisal costs are associated with the testing and inspecting of product or process to assure that prescribed quality levels are met.

> This definition and component elements are provided for example only and should not be considered as complete or fully suitable for the individual enterprise without considered evaluation.
>
> The criteria for any definition and its component elements is an ability to meet the commonly agreed upon requirements and interests of the enterprise. The success of a quality cost information system will depend to a large degree upon the development of a common quality cost language, a working set of definitions, and a consistent use of terminology.

Our definition of Appraisal Quality Cost is:

____

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____

____

The Appraisal Failure Cost Group currently contains nine defined categories. The Appraisal Failure Cost Index is shown on page 36. Four undefined/coded and four undefined/uncoded categories are provided to allow for category expansion or special purpose.

The cost group has identified the following appraisal costs as being very high. The cost group has included the appropriate appraisal cost worksheets in the generator quality cost workbook.

Do we require additional categories within the Appraisal Quality Cost Group? Yes - No Circle one.

Element	AEC	Description
______	___	______________________________
		______________________________
		______________________________
______	___	______________________________
		______________________________
		______________________________
______	___	______________________________
		______________________________
		______________________________
______	___	______________________________
		______________________________
		______________________________

APPRAISAL COST INDEX

OPERATION 37

APPRAISAL COST 6

QUALITY COST COMPUTATION WORKSHEET

Date: MARCH 1987 Page: 1 of 1

Quality Cost: Assembly/End-Item In-Process Inspection and Test (AAEIP) Period: 1ST QTR

Unit/Dept: ELECTRICAL PRODUCTS By: COST GROUP

Element	AEC	Description
1		
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:

Page Total:
Running Total:

OPERATION 38

APPRAISAL COST 7

QUALITY COST COMPUTATION WORKSHEET

Date: MARCH 1987 Page: 1 of 1

Quality Cost: Assembly/End-Item Final Inspection and Test (AAEFI) Period: 1ST QTR

Unit/Dept: ELECTRICAL PRODUCTS By: COST GROUP

Element	AEC	Description	
1			
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:

Page Total:

Running Total:

OPERATION 39

APPRAISAL COST 8

QUALITY COST COMPUTATION WORKSHEET

Date: MARCH 1987 Page: 1 of 1

Quality Cost: Repair Test and Inspection (ARTIN) Period: 1ST QTR

Unit/Dept: ELECTRICAL PRODUCTS By: COST GROUP

Element	AEC	Description	
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:

Page Total:
Running Total:

OPERATION 40

APPRAISAL COST 20

QUALITY COST COMPUTATION WORKSHEET

Date: MARCH 1987 Page: 1 of 1

Quality Cost: TOTAL APPRAISAL COST Period: 1ST QTR

Unit/Dept: ELECTRICAL PRODUCTS By: COST GROUP

Element	AEC	Description	
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:

Page Total:
Running Total:

PREVENTION COSTS

Prevention costs are associated with all efforts intended to prevent failures and to provide the economically optimum amount of appraisal.

> This definition and component elements are provided for example only and should not be considered as complete or fully suitable for the individual enterprise without considered evaluation.
>
> The criteria for any definition and its component elements is an ability to meet the commonly agreed upon requirements and interests of the enterprise. The success of a quality cost information system will depend to a large degree upon the development of a common quality cost language, a working set of definitions, and a consistent use of terminology.

Our definition of Prevention Quality Cost is:

____

____

____

____

The Prevention Failure Cost Group currently contains nine defined categories. The Prevention Failure Cost Index is shown on page 45. Four undefined/coded and four undefined/uncoded categories are provided to allow for category expansion or special purpose.

The cost group has identified the following prevention costs as being very high. The cost group has included the appropriate prevention cost worksheets in the generator quality cost workbook.

Prevention quality costs are an area of special concern. Traditional cost accounting theory and processes usually treat cost and expense as equivalent terms and concepts. They both measure the using up of an asset or reduction of an asset's book value during a current period. The current period focus of costs and expenses usually creates a short term and myopic view of prevention costs. According to traditional accounting theory, once the asset goes through the expensing or costing-out process, and one goes to the shelf or bin where the asset is kept, there should be less there. The original amount is reduced by the amount expensed or costed out during the period. There remains a significant question that traditional accounting theory does not address. The enterprise trains employees in quality theory and practices, a prevention quality cost. Does the enterprise expect the employee's acquired knowledge and skill to disappear at the end of the accounting period? Should there be less in the bin? Many companies made a strong management and financial commitment (time and monetary expenditures) to quality systems and quality training over two decades ago. These companies are still realizing a return on the original investment. The "bin" has not emptied and will not empty in the foreseeable future.

Any prevention cost (expenditure) which results in a return of benefit to the enterprise for a period of time greater than the one accounting period should not be expensed or costed out in that period. The prevention costs should be recognized so that the true benefit and actual cost over time to the enterprise is realized. Many prevention costs (expenditures) are in reality long-term investments in increasing quality level and performance. The prevention cost (expenditure) for quality training programs demonstrates this point. It may be some months before the material and techniques taught in many quality training programs start returning significant benefit to the enterprise, but once the skills and experience are developed, the return to the enterprise will, in theory, last as long as the trained employee stays with the enterprise.

A methodology to recognize and accommodate prevention costs (expenditures) with a long term benefit stream is required.

OPERATION 44

Do we require additional categories within the Prevention Quality Cost Group? Yes - No Circle one.

Element	AEC	Description
________	___	________________________________
		________________________________
		________________________________
________	___	________________________________
		________________________________
		________________________________
________	___	________________________________
		________________________________
		________________________________
________	___	________________________________
		________________________________
		________________________________

OPERATION 45

PREVENTION COST 1

PREVENTION COST INDEX

OPERATION 46

PREVENTION COST 8

QUALITY COST COMPUTATION WORKSHEET

Date: MARCH 1987 | Page: 1 of 1

Quality Cost: Engineering Support (PENSU) | Period: 1ST QTR

Unit/Dept: ELECTRICAL PRODUCTS | By: COST GROUP

Element	AEC	Description
1	E	GENERATOR INVESTIGATION FINDINGS WHICH WILL PREVENT SIMILAR PROBLEMS ON OTHER PRODUCTS
		Reference: WO-148 Cost: $800
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:

Page Total: $800
Running Total: $800

OPERATION 47

PREVENTION COST 27

QUALITY COST COMPUTATION WORKSHEET

Date: MARCH 1987 Page: 1 of 1

Quality Cost: TOTAL PREVENTION COST Period: 1ST QTR

Unit/Dept: ELECTRICAL PRODUCTS By: COST GROUP

Element	AEC	Description	
PENSU	E	ENGINEERING SUPPORT	
		Reference: 1 OF 1	Cost: $800
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:
		Reference:	Cost:

Page Total: $800
Running Total: $800

Figure OP-5. Section Three

| Combined Quality Cost Reporting |

The section two worksheets are summed up on the Combined Quality Cost Reporting worksheets. The Combined Quality Cost Reporting worksheets profile component and total quality cost information. The selected worksheet pages are shown on pages 47 through 60.

Four forms of reporting worksheets are provided. The enterprise may wish to incorporate worksheets of this type or modify the worksheets to conform to their specific requirements. The computer applications program provides the four worksheet groups in the form shown.

The first set, pages 1 and 2, allows for the entry of component and elemental quality costs. Titles are provided; a space for indicating whether the entered cost is an actual, estimated, or combined value; a space for dollar cost value; and a space to allow reference back to the original documentation from which the displayed values were obtained.

The second set, pages 3 and 4, allows for a burden rate factor to be included for each component and elemental quality cost value.

The third set, pages 9 through 12, allows for presentation of total, component, and elemental quality costs as a figure for the current month, as a three-month moving average figure, and as a year-to-date moving average figure. Due to the uneven number of days in some monthly reporting periods, the three-month and year-to-date moving average figures will usually provide a more realistic average or trend value.

The fourth set of reporting worksheets, pages 17 and 18, represent a key section. On these worksheets, the dollar value of quality costs are stated as a percentage of manufacturing costs, sales, or revenue. Space is provided for the enterprise to develop and assign additional percentages as required.

Other percentages that could be of interest to the enterprise include:

1. a process-to-process percentage for a single product.
2. an individual process percentage within the total costs of a series of processes manufacturing a single product.
3. a product-within-a-product-family-group percentage.
4. an element percentage within the total process elemental cost.

The distribution of quality cost information system worksheets to individual activities and operations would facilitate individual activity and operation self-monitoring along a broader scope. A caution is needed. An ability to collect and monitor data should not be seen as sufficient justification to mandate that all quality costs of all processes, components, and elements should be continually collected and monitored without exception. A periodic process of evaluation, problem identification, problem resolution and reevaluation will usually provide the most satisfactory results and long-term utilization of the quality cost process. Data collected to determine quality costs, as with any form of data, should provide some basis for action. Any data which appears to be collected solely for the purpose of collecting data and which does not result in a form of action, may trivialize the program with which the data is associated.

Continuing the generator example, the cost group has received the section two worksheets from the activities, and operations has aggregated the data.

COST OF QUALITY WORKSHEET

	Actual Est. Comb.	Cost	Documentation
PREVENTION COST			
Product Design			
R&D Quality			
R&D Support			
Engineering Quality			
Engineering Support			
Field Quality			
Field Support			
External Quality			
External Support			
Purchasing			
Quality Planning			
Quality Administration			
Quality Training			
Quality Audits Internal			
Quality Audits External			
Quality Related Maintenance			
Vendor Certification			
TOTAL PREVENTION COST			
TARGET PREVENTION COST			
APPRAISAL COST			
Incoming Inspection			
Product Qualification Tests			
MATERIAL/PARTS			
In-Process Inspection and Test			
Final Inspection and Test			
ASSEMBLY/END-ITEM			
In-Process Inspection and Test			
Final Inspection and Test			
Repair Test and Inspection			
Metrology			
Metrology Maintenance			
TOTAL APPRAISAL COST			
TARGET APPRAISAL COST			

OPERATIONS 52

COMBINED QUALITY COST REPORTING 2

COST OF QUALITY WORKSHEET

	Actual Est. Comb.	Cost	Documentation
INTERNAL FAILURE COSTS			
Design Failure Costs			
Investigation			
ECR/ECN Cost			
Supplier Reviews			
Material Review and Action			
Rework			
Repair			
Reinspection			
Product Awaiting Disposition			
Reclassification			
Excess Manufacturing Cost			
Excess Manufacturing Burden			
Additional Related Expense			
Scrap			
TOTAL INTERNAL FAILURE COST			
TARGET INTERNAL FAILURE COST			
EXTERNAL FAILURE COSTS			
Warranty Administration			
In-Warranty Repair/Parts			
Out-of-Warranty Repair/Parts			
Field Service			
Applications			
Returns			
Reclassification			

Reference:______ Cost:______

Reference:______ Cost:______

Reference:______ Cost:______

Page Total: $22,777

Running Total: $22,777

COST OF QUALITY WORKSHEET

	Expense	Burden Rate	Total Expense
PREVENTION COST			
Product Design			
R&D Quality			
R&D Support			
Engineering Quality			
Engineering Support			
External Quality			
External Support			
Purchasing			
Quality Planning			
Quality Administration			
Quality Training			
Quality Audits Internal			
Quality Audits External			
Quality Related Maintenance			
Vendor Certification			
TOTAL PREVENTION COST			
TARGET PREVENTION COST			
APPRAISAL COST			
Incoming Inspection			
Product Qualification Tests			
MATERIALS/PARTS			
In-Process Inspection and Test			
Final Inspection and Test			
ASSEMBLY			
In-Process Inspection and Test			
Final Inspection and Test			
Repair Test and Inspection			
Metrology			
Metrology Maintenance			
TOTAL APPRAISAL COST			
TARGET APPRAISAL COST			

COST OF QUALITY WORKSHEET

	Expense	Burden Rate	Total Expense
INTERNAL FAILURE COSTS			
Design Failure Costs			
Investigation			
ECR/ECN Cost			
Supplier Product Reviews			
Material Review and Action			
Repair			
Rework			
Reinspection			
Reclassification			
Product Awaiting Disposition			
Excess Manufacturing Cost			
Excess Manufacturing Burden			
Additional Related Expense			
Scrap			
TOTAL INTERNAL FAILURE COST			
TARGET INTERNAL FAILURE COST			
EXTERNAL FAILURE COSTS			
Warranty			
In-Warranty Repair/Parts			
Out-of-Warranty Repair/Parts			
Field Service			
Applications			
Returns			
Reclassification			
Recalls			
Additional Related Expense			
Liability Reserve			
TOTAL EXTERNAL FAILURE COSTS			
TARGET EXTERNAL FAILURE COSTS			
TOTAL QUALITY COST			
TARGET QUALITY COST			

COMBINED QUALITY COST REPORTING
FOR THE QUARTER ENDING ________

	CURRENT MONTH			THREE MONTH MOVING AVERAGE		
	QUALITY COSTS	% OF SALES	OTHER	QUALITY COSTS	% OF SALES	OTHER
PREVENTION COST						
Product Design						
R&D Quality						
R&D Support						
Engineering Quality						
Engineering Support						
Field Quality						
Field Support						
External Quality						
External Support						
Purchasing						
Quality Planning						
Quality Administration						
Quality Training						
Quality Audits Internal						
Quality Audits External						
Quality Related Maintenance						
Vendor Certification						
TOTAL PREVENTION COST						
TARGET PREVENTION COST						

COMBINED QUALITY COST REPORTING
FOR THE QUARTER ENDING ________

	CURRENT MONTH QUALITY COSTS	CURRENT MONTH % OF SALES	CURRENT MONTH OTHER	THREE MONTH MOVING AVERAGE QUALITY COSTS	THREE MONTH MOVING AVERAGE % OF SALES	THREE MONTH MOVING AVERAGE OTHER
APPRAISAL COST						
Incoming Inspection	____	____	____	____	____	____
Product Qualification Tests	____	____	____	____	____	____
MATERIALS/PARTS IN-PROCESS						
In-Process Inspection and Test	____	____	____	____	____	____
Final Inspection and Test	____	____	____	____	____	____
ASSEMBLY/END-ITEM						
In-Process Inspection and Test	____	____	____	____	____	____
Final Inspection and Test	____	____	____	____	____	____
Repair Test and Inspection	____	____	____	____	____	____
Metrology	____	____	____	____	____	____
Metrology Maintenance	____	____	____	____	____	____
________________	____	____	____	____	____	____
________________	____	____	____	____	____	____
________________	____	____	____	____	____	____
________________	____	____	____	____	____	____
TOTAL APPRAISAL COST	____	____	____	____	____	____
TARGET APPRAISAL COST	____	____	____	____	____	____

COMBINED QUALITY COST REPORTING
FOR THE QUARTER ENDING ________

	CURRENT MONTH QUALITY COSTS	CURRENT MONTH % OF SALES	CURRENT MONTH OTHER	THREE MONTH MOVING AVERAGE QUALITY COSTS	THREE MONTH MOVING AVERAGE % OF SALES	THREE MONTH MOVING AVERAGE OTHER
INTERNAL FAILURE COSTS						
Design Failure Costs	____	____	____	____	____	____
Investigation	____	____	____	____	____	____
ECR/ECN Cost	____	____	____	____	____	____
Supplier Reviews	____	____	____	____	____	____
Material Review and Action	____	____	____	____	____	____
Rework	____	____	____	____	____	____
Repair	____	____	____	____	____	____
Reinspection	____	____	____	____	____	____
Product Awaiting Disposition	____	____	____	____	____	____
Reclassification	____	____	____	____	____	____
Excess Manufacturing Cost	____	____	____	____	____	____
Excess Manufacturing Burden	____	____	____	____	____	____
Additional Related Expenses	____	____	____	____	____	____
Scrap	____	____	____	____	____	____
____________	____	____	____	____	____	____
____________	____	____	____	____	____	____
____________	____	____	____	____	____	____
____________	____	____	____	____	____	____
TOTAL INTERNAL FAILURE COST	____	____	____	____	____	____
TARGET INTERNAL FAILURE COST	____	____	____	____	____	____

COMBINED QUALITY COST REPORTING
FOR THE QUARTER ENDING ________

	CURRENT MONTH QUALITY COSTS	CURRENT MONTH % OF SALES	CURRENT MONTH OTHER	THREE MONTH MOVING AVERAGE QUALITY COSTS	THREE MONTH MOVING AVERAGE % OF SALES	THREE MONTH MOVING AVERAGE OTHER
EXTERNAL FAILURE COSTS						
Warranty Administration	____	____	____	____	____	____
In-Warranty Repair/Parts	____	____	____	____	____	____
Out-of-Warranty Repair/Parts	____	____	____	____	____	____
Field Service	____	____	____	____	____	____
Applications	____	____	____	____	____	____
Returns	____	____	____	____	____	____
Reclassification	____	____	____	____	____	____
Recalls	____	____	____	____	____	____
Additional Related Expenses	____	____	____	____	____	____
Liability Reserve	____	____	____	____	____	____
____________	____	____	____	____	____	____
____________	____	____	____	____	____	____
____________	____	____	____	____	____	____
____________	____	____	____	____	____	____
TOTAL EXTERNAL FAILURE COSTS	____	____	____	____	____	____
TARGET EXTERNAL FAILURE COSTS	____	____	____	____	____	____
TOTAL QUALITY COST	____	____	____	____	____	____
TARGET QUALITY COST	____	____	____	____	____	____

QUALITY COSTS AS PERCENTAGES

	CURRENT MONTH	3 MONTH MOVING AVERAGE	YEAR TO DATE
PREVENTION COST AS A PERCENTAGE OF:			
Manufacturing Costs			
Sales			
Revenue			
APPRAISAL COST AS A PERCENTAGE OF:			
Manufacturing Costs			
Sales			
Revenue			
PREVENTION AND APPRAISAL COST AS A PERCENTAGE OF:			
Manufacturing Costs			
Sales			
Revenue			
INTERNAL FAILURE COST AS A PERCENTAGE OF:			
Manufacturing Costs			
Sales			
Revenue			
EXTERNAL FAILURE COST AS A PERCENTAGE OF:			
Manufacturing Costs			
Sales			
Revenue			
INTERNAL AND EXTERNAL FAILURE COST AS A PERCENTAGE OF:			
Manufacturing Costs			
Sales			
Revenue			

QUALITY COSTS AS PERCENTAGES

	CURRENT MONTH	3 MONTH MOVING AVERAGE	YEAR TO DATE
QUALITY COST AS A PERCENTAGE OF:			
Manufacturing Costs	______	______	______
Sales	______	______	______
Revenue	______	______	______
________________	______	______	______

ANALYSIS

Figure OP-6. Section Four

- Evaluation and Analysis
  - Total Cost of Quality by Component Quality Costs
    - Monthly Analysis
    - Weighted Quarterly Analysis
    - Weighted Yearly Analysis
  - Quality Costs as a Percentage of Manufacturing Costs
    - Monthly Analysis
    - Weighted Quarterly Analysis
    - Weighted Yearly Analysis
  - Quality Costs as a Percentage of Sales
    - Monthly Analysis
    - Weighted Quarterly Analysis
    - Weighted Yearly Analysis
  - Quality Costs as a Percentage of Revenue
    - Monthly Analysis
    - Weighted Quarterly Analysis
    - Weighted Yearly Analysis
  - Quality Costs as a Percentage of ________
    - Monthly Analysis
    - Weighted Quarterly Analysis
    - Weighted Yearly Analysis

The Evaluation and Analysis Section contains graphical worksheets. The Evaluation and Analysis Section Index is shown on pages 64 and 65. The worksheets are for monthly, moving-quarter, and moving-year time periods. The monthly analysis worksheet is indexed on a January to December, 12 month period. The moving-quarter worksheet is indexed to a 12 quarter (3 year) period. The moving-year analysis worksheet is indexed for a 12 year period.

The worksheets can be used to analyze quality costs on an enterprise-wide, identified operation or activity, individual element within operations and activities, product, or process basis.

The total cost of quality by component quality costs worksheet is used to divide a total quality cost figure into individual percentage values for each of the four major cost groupings; external failure, internal failure, appraisal, and prevention costs. The completed analysis worksheet will display the comparative percentage of total quality costs resulting from each major cost group category.

There are worksheets for analyzing quality costs as a percentage of manufacturing cost, sales, and revenue. The remaining analysis worksheets are unassigned and can to be employed as required by the enterprise's quality cost system.

OPERATION 63

EVALUATION AND ANALYSIS 1

QUALITY COST RATIOS AND ANALYSIS

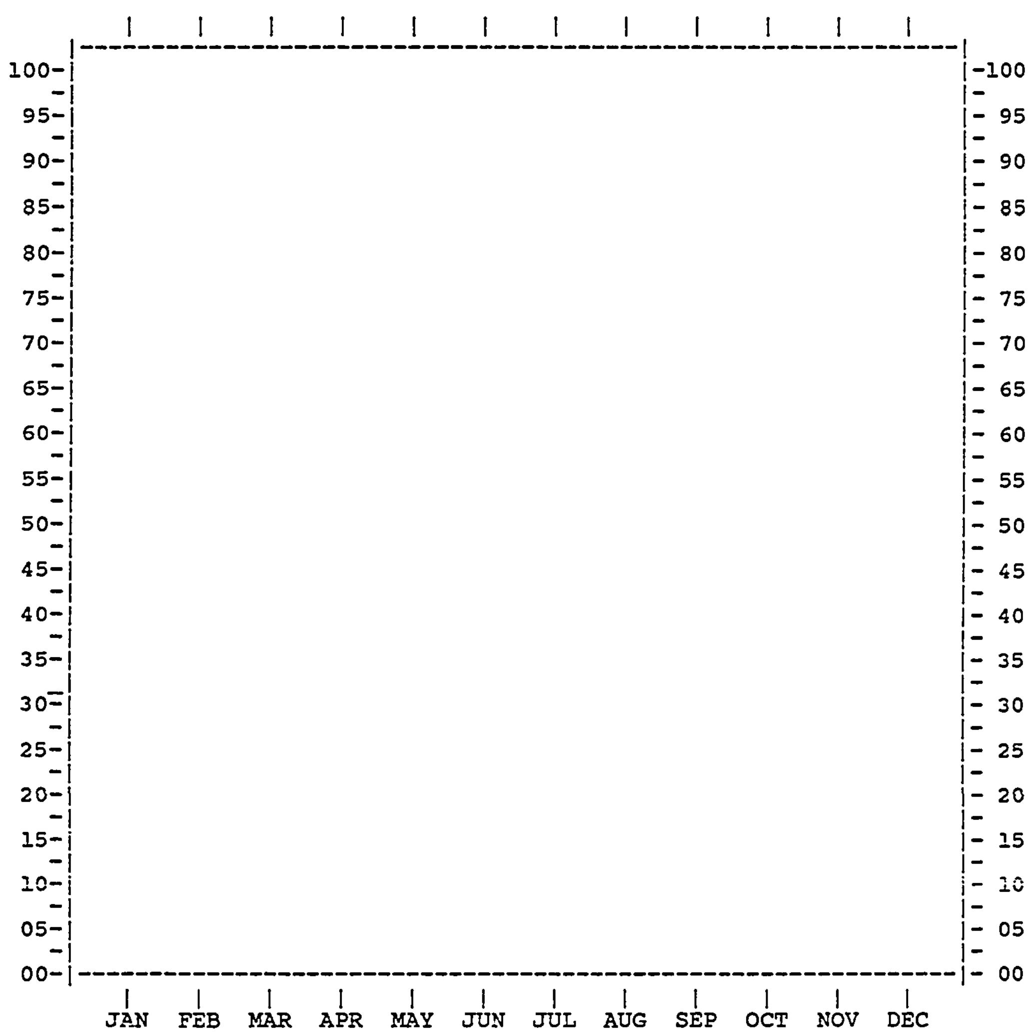
OPERATION 64

EVALUATION AND ANALYSIS 2

Quality costs for ______________________________ as a percentage of sales	
Monthly analysis	24
Quarterly analysis	25
Yearly analysis	26
Quality costs for ______________________________ as a percentage of revenue	
Monthly analysis	27
Quarterly analysis	28
Yearly analysis	29
Quality costs for ______________________________ as a percentage of ______________________________	
Monthly analysis	30
Quarterly analysis	31
Yearly analysis	32
Unassigned analysis sheets	
______________________________	33
______________________________	34
______________________________	35
Unassigned analysis sheets	
______________________________	36
______________________________	37
______________________________	38

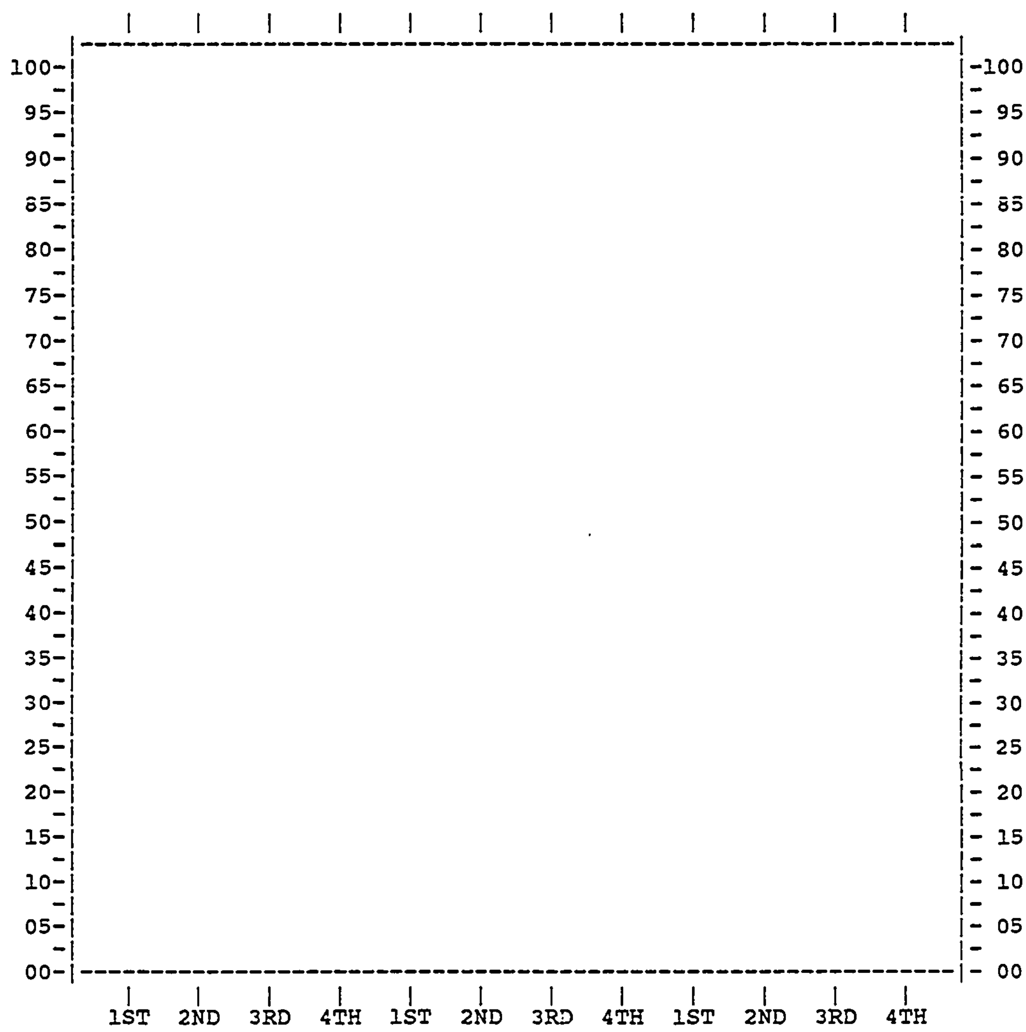
OPERATION 65

MONTHLY ANALYSIS OF TOTAL COST OF QUALITY BY COMPONENT QUALITY COSTS



OPERATION 66

QUARTERLY ANALYSIS OF TOTAL COST OF QUALITY BY COMPONENT QUALITY COSTS



COST DIAGNOSIS WORKSHEETS

Total: ______________________________

Unit/Dept: ______________________________

Date: ______________________________

By: ______________________________

		VERY HIGH	HIGH	ABOVE AVE	AVERAGE	BELOW AVE	LOW	VERY LOW
		9	7	5	3	2	1	0
External Failure								
Warranty Administration	EWAAD							
In-Warranty Repair/Parts	EIWRP							
Out-of-Warranty Repair/Parts	EOWRP							
Field Service	EFISE							
Applications	EAPPL							
Returns	ERETU							
Reclassification	ERECL							
Recalls	ERECA							
Additional Related Expense	EADRE							
Liability Reserve	ELIAB							
______________	EXONE							
______________	EXTWO							
______________	EXTHR							
______________	EXFOU							
Internal Failure								
Design Failure Costs	IDEFC							
Investigation	IINVE							
ECR/ECN Cost	IEECO							
Supplier Reviews	ISURE							
Material Reviews and Action	IMRAA							
Rework	IREWO							
Repair	IREPA							
Reinspection	IREIN							
Product Awaiting Disposition	IPADI							
Reclassification	IRECL							
Excess Manufacturing Cost	IEXMC							
Excess Manufacturing Burden	IEXMB							
Additional Related Expenses	IADRE							
Scrap	ISCRA							
______________	INONE							
______________	INTWO							
______________	INTHR							
______________	INFOU							

COST DIAGNOSIS 3

Total: ______________________________

Unit/Dept: ______________________________

Date: ______________________________

By: ______________________________

		VERY HIGH	HIGH	ABOVE AVE	AVERAGE	BELOW AVE	LOW	VERY LOW
		9	7	5	3	2	1	0
Appraisal								
Incoming Inspection	AININ							
Product Qualification Tests	APQTE							
Material/Parts In-process Inspection and Test	AMPIP							
Material/Parts Final Inspection and Test	AMPFI							
Assembly/End-Item In-process Inspection and Test	AAEIP							
Assembly/End-Item Final Inspection and Test	AAEFI							
Repair Test and Inspection	ARTIN							
Metrology	AMETR							
Metrology Maintenance	AMETM							
______________________	APONE							
______________________	APTWO							
______________________	APTHR							
	APFOU							
Prevention								
Product Design	PPRDE							
R&D Quality	PRDQU							
R&D Support	PRDSU							
Engineering Quality	PENQU							
Engineering Support	PENSU							
Field Quality	PFIQU							
Field Support	PFISU							
External Quality	PEXQU							
External Support	PEXSU							
Purchasing	PPURC							
Quality Planning	PQPLA							
Quality Administration	PQADM							
Quality Training	PQTRA							
Quality Audits Internal	PQAIN							
Quality Audits External	PQAEX							
Quality Related Maintenance	PQRMA							
Vendor Certification	PVCER							
______________________	PRONE							
______________________	PRTWO							
______________________	PRTHR							
	PRFOU							

COST DIAGNOSIS 4

Product: ____________________

Unit/Dept: ____________________

Date: ____________________

By: ____________________

		VERY HIGH	HIGH	ABOVE AVE	AVERAGE	BELOW AVE	LOW	VERY LOW
		9	7	5	3	2	1	0
External Failure								
Warranty Administration	EWAAD							
In-Warranty Repair/Parts	EIWRP							
Out-of-Warranty Repair/Parts	EOWRP							
Field Service	EFISE							
Applications	EAPPL							
Returns	ERETU							
Reclassification	ERECL							
Recalls	ERECA							
Additional Related Expense	EADRE							
Liability Reserve	ELIAB							
____________________	EXONE							
____________________	EXTWO							
____________________	EXTHR							
____________________	EXFOU							
Internal Failure								
Design Failure Costs	IDEFC							
Investigation	IINVE							
ECR/ECN Cost	IEECO							
Supplier Reviews	ISURE							
Material Reviews and Action	IMRAA							
Rework	IREWO							
Repair	IREPA							
Reinspection	IREIN							
Product Awaiting Disposition	IPADI							
Reclassification	IRECL							
Excess Manufacturing Cost	IEXMC							
Excess Manufacturing Burden	IEXMB							
Additional Related Expenses	IADRE							
Scrap	ISCRA							
____________________	INONE							
____________________	INTWO							
____________________	INTHR							
____________________	INFOU							

Product: ______________________________

Unit/Dept: ______________________________

Date: ______________________________

By: ______________________________

		VERY HIGH 9	HIGH 7	ABOVE AVE 5	AVERAGE 3	BELOW AVE 2	LOW 1	VERY LOW 0
Appraisal								
Incoming Inspection	AININ							
Product Qualification Tests	APQTE							
Material/Parts In-process Inspection and Test	AMPIP							
Material/Parts Final Inspection and Test	AMPFI							
Assembly/End-Item In-process Inspection and Test	AAEIP							
Assembly/End-Item Final Inspection and Test	AAEFI							
Repair Test and Inspection	ARTIN							
Metrology	AMETR							
Metrology Maintenance	AMETM							
______________________	APONE							
______________________	APTWO							
______________________	APTHR							
	APFOU							
Prevention								
Product Design	PPRDE							
R&D Quality	PRDQU							
R&D Support	PRDSU							
Engineering Quality	PENQU							
Engineering Support	PENSU							
Field Quality	PFIQU							
Field Support	PFISU							
External Quality	PEXQU							
External Support	PEXSU							
Purchasing	PPURC							
Quality Planning	PQPLA							
Quality Administration	PQADM							
Quality Training	PQTRA							
Quality Audits Internal	PQAIN							
Quality Audits External	PQAEX							
Quality Related Maintenance	PQRMA							
Vendor Certification	PVCER							
______________________	PRONE							
______________________	PRTWO							
______________________	PRTHR							
	PRFOU							

COST DIAGNOSIS 6

Process: ______________________________

Unit/Dept: ______________________________

Date: ______________________________

By: ______________________________

		VERY HIGH	HIGH	ABOVE AVE	AVERAGE	BELOW AVE	LOW	VERY LOW
		9	7	5	3	2	1	0
External Failure								
Warranty Administration	EWAAD							
In-Warranty Repair/Parts	EIWRP							
Out-of-Warranty Repair/Parts	EOWRP							
Field Service	EFISE							
Applications	EAPPL							
Returns	ERETU							
Reclassification	ERECL							
Recalls	ERECA							
Additional Related Expense	EADRE							
Liability Reserve	ELIAB							
______	EXONE							
______	EXTWO							
______	EXTHR							
______	EXFOU							
Internal Failure								
Design Failure Costs	IDEFC							
Investigation	IINVE							
ECR/ECN Cost	IEECO							
Supplier Reviews	ISURE							
Material Reviews and Action	IMRAA							
Rework	IREWO							
Repair	IREPA							
Reinspection	IREIN							
Product Awaiting Disposition	IPADI							
Reclassification	IRECL							
Excess Manufacturing Cost	IEXMC							
Excess Manufacturing Burden	IEXMB							
Additional Related Expenses	IADRE							
Scrap	ISCRA							
______	INONE							
______	INTWO							
______	INTHR							
______	INFOU							

Process: ______________________________

Unit/Dept: ______________________________

Date: ______________________________

By: ______________________________

		VERY HIGH	HIGH	ABOVE AVE	AVERAGE	BELOW AVE	LOW	VERY LOW
		9	7	5	3	2	1	0
Appraisal								
Incoming Inspection	AININ							
Product Qualification Tests	APQTE							
Material/Parts In-process Inspection and Test	AMPIP							
Material/Parts Final Inspection and Test	AMPFI							
Assembly/End-Item In-process Inspection and Test	AAEIP							
Assembly/End-Item Final Inspection and Test	AAEFI							
Repair Test and Inspection	ARTIN							
Metrology	AMETR							
Metrology Maintenance	AMETM							
____________	APONE							
____________	APTWO							
____________	APTHR							
	APFOU							
Prevention								
Product Design	PPRDE							
R&D Quality	PRDQU							
R&D Support	PRDSU							
Engineering Quality	PENQU							
Engineering Support	PENSU							
Field Quality	PFIQU							
Field Support	PFISU							
External Quality	PEXQU							
External Support	PEXSU							
Purchasing	PPURC							
Quality Planning	PQPLA							
Quality Administration	PQADM							
Quality Training	PQTRA							
Quality Audits Internal	PQAIN							
Quality Audits External	PQAEX							
Quality Related Maintenance	PQRMA							
Vendor Certification	PVCER							
____________	PRONE							
____________	PRTWO							
____________	PRTHR							
	PRFOU							

Total: ______________________________

Unit/Dept: ______________________________

Date: ______________________________

By: ______________________________

	VERY HIGH	HIGH	ABOVE AVE	AVERAGE	BELOW AVE	LOW	VERY LOW
	9	7	5	3	2	1	0
External Failure							
Warranty Administration							
In-Warranty Repair/Parts							
Out-of-Warranty Repair/Parts							
Field Service							
Applications							
Returns							
Reclassification							
Recalls							
Additional Related Expense							
Liability Reserve							
______________________							
______________________							
______________________							
______________________							
Internal Failure							
Design Failure Costs							
Investigation							
ECR/ECN Cost							
Supplier Reviews							
Material Reviews and Action							
Rework							
Repair							
Reinspection							
Product Awaiting Disposition							
Reclassification							
Excess Manufacturing Cost							
Excess Manufacturing Burden							
Additional Related Expenses							
Scrap							
______________________							
______________________							
______________________							
______________________							

Total: ______________________________

Unit/Dept: ______________________________

Date: ______________________________

By: ______________________________

	VERY HIGH	HIGH	ABOVE AVE	AVERAGE	BELOW AVE	LOW	VERY LOW
	9	7	5	3	2	1	0
Appraisal							
Incoming Inspection							
Product Qualification Tests							
Material/Parts In-process							
Inspection and Test							
Material/Parts Final							
Inspection and Test							
Assembly/End-Item In-process							
Inspection and Test							
Assembly/End-Item Final							
Inspection and Test							
Repair Test and Inspection							
Metrology							
Metrology Maintenance							
______________________							
______________________							
______________________							
Prevention							
Product Design							
R&D Quality							
R&D Support							
Engineering Quality							
Engineering Support							
Field Quality							
Field Support							
External Quality							
External Support							
Purchasing							
Quality Planning							
Quality Administration							
Quality Training							
Quality Audits Internal							
Quality Audits External							
Quality Related Maintenance							
Vendor Certification							
______________________							
______________________							
______________________							

Product: ______________________

Unit/Dept: ______________________

Date: ______________________

By: ______________________

	VERY HIGH	HIGH	ABOVE AVE	AVERAGE	BELOW AVE	LOW	VERY LOW
	9	7	5	3	2	1	0
External Failure							
Warranty Administration							
In-Warranty Repair/Parts							
Out-of-Warranty Repair/Parts							
Field Service							
Applications							
Returns							
Reclassification							
Recalls							
Additional Related Expense							
Liability Reserve							
______________________							
______________________							
______________________							
______________________							
Internal Failure							
Design Failure Costs							
Investigation							
ECR/ECN Cost							
Supplier Reviews							
Material Reviews and Action							
Rework							
Repair							
Reinspection							
Product Awaiting Disposition							
Reclassification							
Excess Manufacturing Cost							
Excess Manufacturing Burden							
Additional Related Expenses							
Scrap							
______________________							
______________________							
______________________							
______________________							

COST DIAGNOSIS 11

Product: ______________________________

Unit/Dept: ______________________________

Date: ______________________________

By: ______________________________

	VERY HIGH	HIGH	ABOVE AVE	AVERAGE	BELOW AVE	LOW	VERY LOW
	9	7	5	3	2	1	0
Appraisal							
Incoming Inspection							
Product Qualification Tests							
Material/Parts In-process Inspection and Test							
Material/Parts Final Inspection and Test							
Assembly/End-Item In-process Inspection and Test							
Assembly/End-Item Final Inspection and Test							
Repair Test and Inspection							
Metrology							
Metrology Maintenance							
______________________							
______________________							
______________________							
Prevention							
Product Design							
R&D Quality							
R&D Support							
Engineering Quality							
Engineering Support							
Field Quality							
Field Support							
External Quality							
External Support							
Purchasing							
Quality Planning							
Quality Administration							
Quality Training							
Quality Audits Internal							
Quality Audits External							
Quality Related Maintenance							
Vendor Certification							
______________________							
______________________							
______________________							

Process: ______________________________

Unit/Dept: ______________________________

Date: ______________________________

By: ______________________________

	VERY HIGH	HIGH	ABOVE AVE	AVERAGE	BELOW AVE	LOW	VERY LOW
	9	7	5	3	2	1	0
External Failure							
Warranty Administration							
In-Warranty Repair/Parts							
Out-of-Warranty Repair/Parts							
Field Service							
Applications							
Returns							
Reclassification							
Recalls							
Additional Related Expense							
Liability Reserve							
____________							
____________							
____________							
____________							
Internal Failure							
Design Failure Costs							
Investigation							
ECR/ECN Cost							
Supplier Reviews							
Material Reviews and Action							
Rework							
Repair							
Reinspection							
Product Awaiting Disposition							
Reclassification							
Excess Manufacturing Cost							
Excess Manufacturing Burden							
Additional Related Expenses							
Scrap							
____________							
____________							
____________							
____________							

Process: ______________________________

Unit/Dept: ______________________________

Date: ______________________________

By: ______________________________

	VERY HIGH	HIGH	ABOVE AVE	AVERAGE	BELOW AVE	LOW	VERY LOW
	9	7	5	3	2	1	0
Appraisal							
Incoming Inspection							
Product Qualification Tests							
Material/Parts In-process Inspection and Test							
Material/Parts Final Inspection and Test							
Assembly/End-Item In-process Inspection and Test							
Assembly/End-Item Final Inspection and Test							
Repair Test and Inspection							
Metrology							
Metrology Maintenance							
______________________							
______________________							
______________________							
Prevention							
Product Design							
R&D Quality							
R&D Support							
Engineering Quality							
Engineering Support							
Field Quality							
Field Support							
External Quality							
External Support							
Purchasing							
Quality Planning							
Quality Administration							
Quality Training							
Quality Audits Internal							
Quality Audits External							
Quality Related Maintenance							
Vendor Certification							
______________________							
______________________							
______________________							

COST DIAGNOSIS 14

Unit/Dept: ____________________

Date: ____________________

By: ____________________

	VERY HIGH	HIGH	ABOVE AVE	AVERAGE	BELOW AVE	LOW	VERY LOW
	9	7	5	3	2	1	0

Unit/Dept:______________________________

Date:______________________________

By:______________________________

	VERY HIGH	HIGH	ABOVE AVE	AVERAGE	BELOW AVE	LOW	VERY LOW
	9	7	5	3	2	1	0

PREVENTION COST INDEX

PREVENTION COST INDEX

PREVENTION COST 2

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Product Design (PPRDE) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	___	____
		____
		Reference:_____________ Cost:_________________
_______	___	____
		____
		Reference:_____________ Cost:_________________
_______	___	____
		____
		Reference:_____________ Cost:_________________
_______	___	____
		____
		Reference:_____________ Cost:_________________
_______	___	____
		____
		Reference:_____________ Cost:_________________
_______	___	____
		____
		Reference:_____________ Cost:_________________
_______	___	____
		____
		Reference:_____________ Cost:_________________
_______	___	____
		____
		Reference:_____________ Cost:_________________

Page Total:____________________
Running Total:____________________

PREVENTION COST 3

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: R&D Quality (PRDQU) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	___	______________________________
		Reference:____________ Cost:______________
_______	___	______________________________
		Reference:____________ Cost:______________
_______	___	______________________________
		Reference:____________ Cost:______________
_______	___	______________________________
		Reference:____________ Cost:______________
_______	___	______________________________
		Reference:____________ Cost:______________
_______	___	______________________________
		Reference:____________ Cost:______________
_______	___	______________________________
		Reference:____________ Cost:______________
_______	___	______________________________
		Reference:____________ Cost:______________

Page Total:__________________

Running Total:__________________

PREVENTION COST 4

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: R&D Support (PRDSU) Period:____________

Unit/Dept:________________________ By:________________

Element	AEC	Description
______	___	________________________________
		________________________________
		Reference:____________ Cost:____________
______	___	________________________________
		________________________________
		Reference:____________ Cost:____________
______	___	________________________________
		________________________________
		Reference:____________ Cost:____________
______	___	________________________________
		________________________________
		Reference:____________ Cost:____________
______	___	________________________________
		________________________________
		Reference:____________ Cost:____________
______	___	________________________________
		________________________________
		Reference:____________ Cost:____________
______	___	________________________________
		________________________________
		Reference:____________ Cost:____________
______	___	________________________________
		________________________________
		Reference:____________ Cost:____________

Page Total:____________________
Running Total:____________________

PREVENTION COST 5

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Engineering Quality (PENQU) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
______	___	____
		____
		Reference:_____________ Cost:_________________
______	___	____
		____
		Reference:_____________ Cost:_________________
______	___	____
		____
		Reference:_____________ Cost:_________________
______	___	____
		____
		Reference:_____________ Cost:_________________
______	___	____
		____
		Reference:_____________ Cost:_________________
______	___	____
		____
		Reference:_____________ Cost:_________________
______	___	____
		____
		Reference:_____________ Cost:_________________
______	___	____
		____
		Reference:_____________ Cost:_________________

Page Total:_____________________

Running Total:_____________________

PREVENTION COST 6

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Engineering Support (PENSU) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
________	___	______________________________
		Reference:__________ Cost:__________
________	___	______________________________
		Reference:__________ Cost:__________
________	___	______________________________
		Reference:__________ Cost:__________
________	___	______________________________
		Reference:__________ Cost:__________
________	___	______________________________
		Reference:__________ Cost:__________
________	___	______________________________
		Reference:__________ Cost:__________
________	___	______________________________
		Reference:__________ Cost:__________
________	___	______________________________
		Reference:__________ Cost:__________

Page Total:____________________

Running Total:____________________

PREVENTION COST 7

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Field Quality (PFIQU) Period:_____________

Unit/Dept:_________________________ By:_________________

Element AEC Description

_______ ___ ____

____

Reference:_____________ Cost:_________________

_______ ___ ____

____

Reference:_____________ Cost:_________________

_______ ___ ____

____

Reference:_____________ Cost:_________________

_______ ___ ____

____

Reference:_____________ Cost:_________________

_______ ___ ____

____

Reference:_____________ Cost:_________________

_______ ___ ____

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Reference:_____________ Cost:_________________

Page Total:____________________

Running Total:____________________

PREVENTION COST 8

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Field Support (PFISU) Period:____________

Unit/Dept:________________________ By:________________

Element	AEC	Description
_______	___	Reference:__________ Cost:__________
_______	___	Reference:__________ Cost:__________
_______	___	Reference:__________ Cost:__________
_______	___	Reference:__________ Cost:__________
_______	___	Reference:__________ Cost:__________
_______	___	Reference:__________ Cost:__________
_______	___	Reference:__________ Cost:__________
_______	___	Reference:__________ Cost:__________

Page Total:________________

Running Total:________________

PREVENTION COST 9

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: External Quality (PEXQU) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	___	______________________________________
		______________________________________
		Reference:_____________ Cost:_________________
_______	___	______________________________________
		______________________________________
		Reference:_____________ Cost:_________________
_______	___	______________________________________
		______________________________________
		Reference:_____________ Cost:_________________
_______	___	______________________________________
		______________________________________
		Reference:_____________ Cost:_________________
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		______________________________________
		Reference:_____________ Cost:_________________
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		Reference:_____________ Cost:_________________
_______	___	______________________________________
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		Reference:_____________ Cost:_________________
_______	___	______________________________________
		______________________________________
		Reference:_____________ Cost:_________________

Page Total:_____________________
Running Total:_____________________

PREVENTION COST 10

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: External Support (PEXSU) Period:_____________

Unit/Dept:________________________ By:________________

Element	AEC	Description
_______	___	______________________________
		______________________________
		Reference:_____________ Cost:_______________
_______	___	______________________________
		______________________________
		Reference:_____________ Cost:_______________
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		Reference:_____________ Cost:_______________
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		Reference:_____________ Cost:_______________
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		Reference:_____________ Cost:_______________
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		Reference:_____________ Cost:_______________

Page Total:____________________

Running Total:____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Purchasing (PPURC) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
______	___	______________________________
		______________________________
		Reference:_____________ Cost:_____________
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		Reference:_____________ Cost:_____________
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		Reference:_____________ Cost:_____________
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		Reference:_____________ Cost:_____________

Page Total:_____________________
Running Total:_____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Quality Planning (PQPLA) Period:____________

Unit/Dept:_________________________ By:________________

Element	AEC	Description
_______	___	________________________________
		________________________________
		Reference:____________ Cost:________________
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		Reference:____________ Cost:________________
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		Reference:____________ Cost:________________
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		Reference:____________ Cost:________________
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		Reference:____________ Cost:________________
_______	___	________________________________
		________________________________
		Reference:____________ Cost:________________

Page Total:____________________
Running Total:____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Quality Administration (PQADM) Period:____________

Unit/Dept:_________________________ By:________________

Element	AEC	Description
______	___	________________________________
		Reference:____________ Cost:______________
______	___	________________________________
		Reference:____________ Cost:______________
______	___	________________________________
		Reference:____________ Cost:______________
______	___	________________________________
		Reference:____________ Cost:______________
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		Reference:____________ Cost:______________
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		Reference:____________ Cost:______________
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		Reference:____________ Cost:______________
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		Reference:____________ Cost:______________

Page Total:__________________

Running Total:__________________

PREVENTION COST 14

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Quality Training (PQTRA) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	___	____________________________________
		____________________________________
		Reference:_____________ Cost:_________________
_______	___	____________________________________
		____________________________________
		Reference:_____________ Cost:_________________
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		____________________________________
		Reference:_____________ Cost:_________________
_______	___	____________________________________
		____________________________________
		Reference:_____________ Cost:_________________
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		Reference:_____________ Cost:_________________
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		____________________________________
		Reference:_____________ Cost:_________________
_______	___	____________________________________
		____________________________________
		Reference:_____________ Cost:_________________
_______	___	____________________________________
		____________________________________
		Reference:_____________ Cost:_________________

Page Total:_____________________

Running Total:_____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:_____of______

Quality Cost: Quality Audits Internal (PQAIN) Period:_____________

Unit/Dept:_________________________ By:________________

Element	AEC	Description
_______	___	____________________________________
		Reference:_____________ Cost:_______________
_______	___	____________________________________
		Reference:_____________ Cost:_______________
_______	___	____________________________________
		Reference:_____________ Cost:_______________
_______	___	____________________________________
		Reference:_____________ Cost:_______________
_______	___	____________________________________
		Reference:_____________ Cost:_______________
_______	___	____________________________________
		Reference:_____________ Cost:_______________
_______	___	____________________________________
		Reference:_____________ Cost:_______________
_______	___	____________________________________
		Reference:_____________ Cost:_______________

Page Total:_____________________
Running Total:_____________________

PREVENTION COST 16

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Quality Audits External (PQAEX) Period:_____________

Unit/Dept:_________________________ By:_________________

Element AEC Description

_______ ___ ____
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Reference:_____________ Cost:________________

_______ ___ ____
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Reference:_____________ Cost:________________

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Reference:_____________ Cost:________________

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Reference:_____________ Cost:________________

Page Total:____________________
Running Total:____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Quality Related Maintenance (PQRMA) Period:____________

Unit/Dept:______________________ By:________________

Element AEC Description

_______ ___ ________________________________

Reference:____________ Cost:______________

_______ ___ ________________________________

Reference:____________ Cost:______________

_______ ___ ________________________________

Reference:____________ Cost:______________

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Reference:____________ Cost:______________

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Reference:____________ Cost:______________

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Reference:____________ Cost:______________

Page Total:________________

Running Total:________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Vendor Certification (PVCER) Period:_____________

Unit/Dept:_________________________ By:________________

Element	AEC	Description
_______	___	____
		____
		Reference:_____________ Cost:________________
_______	___	____
		____
		Reference:_____________ Cost:________________
_______	___	____
		____
		Reference:_____________ Cost:________________
_______	___	____
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		Reference:_____________ Cost:________________
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		Reference:_____________ Cost:________________
_______	___	____
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		Reference:_____________ Cost:________________
_______	___	____
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		Reference:_____________ Cost:________________
_______	___	____
		____
		Reference:_____________ Cost:________________

Page Total:____________________

Running Total:____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:_____of_____

Quality Cost:______________________ Period:____________
(PRONE)

Unit/Dept:_________________________ By:________________

Element	AEC	Description
_______	___	______________________________
		Reference:__________ Cost:__________
_______	___	______________________________
		Reference:__________ Cost:__________
_______	___	______________________________
		Reference:__________ Cost:__________
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		Reference:__________ Cost:__________
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_______	___	______________________________
		Reference:__________ Cost:__________
_______	___	______________________________
		Reference:__________ Cost:__________
_______	___	______________________________
		Reference:__________ Cost:__________

Page Total:______________

Running Total:______________

PREVENTION COST 20

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:______________________ Period:_____________
(PRTWO)

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	___	______________________________________
		Reference:_____________ Cost:_______________
_______	___	______________________________________
		Reference:_____________ Cost:_______________
_______	___	______________________________________
		Reference:_____________ Cost:_______________
_______	___	______________________________________
		Reference:_____________ Cost:_______________
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_______	___	______________________________________
		Reference:_____________ Cost:_______________
_______	___	______________________________________
		Reference:_____________ Cost:_______________
_______	___	______________________________________
		Reference:_____________ Cost:_______________

Page Total:____________________
Running Total:____________________

PREVENTION COST 22

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:______________________ (PRFOU) Period:______________

Unit/Dept:________________________ By:_________________

Element	AEC	Description	
______	___	____________________	
		Reference:__________	Cost:__________
______	___	____________________	
		Reference:__________	Cost:__________
______	___	____________________	
		Reference:__________	Cost:__________
______	___	____________________	
		Reference:__________	Cost:__________
______	___	____________________	
		Reference:__________	Cost:__________
______	___	____________________	
		Reference:__________	Cost:__________
______	___	____________________	
		Reference:__________	Cost:__________
______	___	____________________	
		Reference:__________	Cost:__________

Page Total:__________________

Running Total:__________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:______________________ (_____) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
______	___	Reference:_____________ Cost:_________________
______	___	Reference:_____________ Cost:_________________
______	___	Reference:_____________ Cost:_________________
______	___	Reference:_____________ Cost:_________________
______	___	Reference:_____________ Cost:_________________
______	___	Reference:_____________ Cost:_________________
______	___	Reference:_____________ Cost:_________________
______	___	Reference:_____________ Cost:_________________

Page Total:____________________
Running Total:____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:______________________ Period:____________
(_____)

Unit/Dept:_________________________ By:________________

Element AEC Description

_______ ___ ____

Reference:____________ Cost:______________

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Reference:____________ Cost:______________

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Reference:____________ Cost:______________

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Reference:____________ Cost:______________

Page Total:__________________
Running Total:__________________

PREVENTION COST 25

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:______________________ Period:_____________

(_____)

Unit/Dept:_________________________ By:_________________

Element AEC Description

_______ ___ ____

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Reference:_____________ Cost:_________________

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Reference:_____________ Cost:_________________

Page Total:_____________________

Running Total:_____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:____________________ Period:____________

(_____)

Unit/Dept:____________________ By:______________

Element	AEC	Description
______	___	______________________________
		______________________________
		Reference:__________ Cost:__________
______	___	______________________________
		______________________________
		Reference:__________ Cost:__________
______	___	______________________________
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		Reference:__________ Cost:__________
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		Reference:__________ Cost:__________
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		Reference:__________ Cost:__________
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		Reference:__________ Cost:__________
______	___	______________________________
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		Reference:__________ Cost:__________
______	___	______________________________
		______________________________
		Reference:__________ Cost:__________

Page Total:______________

Running Total:______________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: TOTAL PREVENTION COST Period:____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	__	______________________________
		______________________________
		Reference:____________ Cost:____________
_______	__	______________________________
		______________________________
		Reference:____________ Cost:____________
_______	__	______________________________
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		Reference:____________ Cost:____________
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		Reference:____________ Cost:____________
_______	__	______________________________
		______________________________
		Reference:____________ Cost:____________

Page Total:____________________
Running Total:____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: TARGET PREVENTION COST Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	___	____________________
		____________________
		Reference:_____________ Cost:_____________
_______	___	____________________
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		Reference:_____________ Cost:_____________
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		Reference:_____________ Cost:_____________
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		Reference:_____________ Cost:_____________
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		Reference:_____________ Cost:_____________
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		Reference:_____________ Cost:_____________
_______	___	____________________
		____________________
		Reference:_____________ Cost:_____________

Page Total:_____________________

Running Total:_____________________

APPRAISAL COST INDEX

APPRAISAL COST 2

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Incoming Inspection (AININ) Period:____________

Unit/Dept:_________________________ By:________________

Element	AEC	Description
______	__	________________________________
		________________________________
		Reference:____________ Cost:____________
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		Reference:____________ Cost:____________
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		Reference:____________ Cost:____________
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		Reference:____________ Cost:____________
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		Reference:____________ Cost:____________

Page Total:________________

Running Total:________________

APPRAISAL COST 3

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Product Qualification tests (APQTE) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	___	________________________________
		________________________________
		Reference:_____________ Cost:_______________
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		Reference:_____________ Cost:_______________
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		Reference:_____________ Cost:_______________
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		Reference:_____________ Cost:_______________
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		Reference:_____________ Cost:_______________
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		________________________________
		Reference:_____________ Cost:_______________

Page Total:____________________

Running Total:____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Material/Parts In-Process Inspection and Test (AMPIP) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	___	____
		____
		Reference:_____________ Cost:_________________
_______	___	____
		____
		Reference:_____________ Cost:_________________
_______	___	____
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		Reference:_____________ Cost:_________________
_______	___	____
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		Reference:_____________ Cost:_________________
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		Reference:_____________ Cost:_________________
_______	___	____
		____
		Reference:_____________ Cost:_________________
_______	___	____
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		Reference:_____________ Cost:_________________
_______	___	____
		____
		Reference:_____________ Cost:_________________

Page Total:_____________________

Running Total:_____________________

QUALITY COST COMPUTATION WORKSHEET

Date:________________ Page:_____of_____

Quality Cost: Material/Parts Final Inspection and Test (AMPFI) Period:____________

Unit/Dept:____________________ By:______________

Element	AEC	Description
______	__	____________________________
		Reference:__________ Cost:__________
______	__	____________________________
		Reference:__________ Cost:__________
______	__	____________________________
		Reference:__________ Cost:__________
______	__	____________________________
		Reference:__________ Cost:__________
______	__	____________________________
		Reference:__________ Cost:__________
______	__	____________________________
		Reference:__________ Cost:__________
______	__	____________________________
		Reference:__________ Cost:__________
______	__	____________________________
		Reference:__________ Cost:__________

Page Total:______________

Running Total:______________

APPRAISAL COST 6

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Assembly/End-Item In-Process Inspection and Test (AAEIP) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	___	____
		____
		Reference:____________ Cost:______________
_______	___	____
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		Reference:____________ Cost:______________
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		Reference:____________ Cost:______________
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		Reference:____________ Cost:______________
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		Reference:____________ Cost:______________
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		Reference:____________ Cost:______________

Page Total:__________________

Running Total:__________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Assembly/End-Item Final Inspection and Test (AAEFI) Period:_____________

Unit/Dept:_________________________ By:__________________

Element	AEC	Description	
______	___	____________________	
		Reference:__________	Cost:__________
______	___	____________________	
		Reference:__________	Cost:__________
______	___	____________________	
		Reference:__________	Cost:__________
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		Reference:__________	Cost:__________
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		Reference:__________	Cost:__________
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		Reference:__________	Cost:__________
______	___	____________________	
		Reference:__________	Cost:__________

Page Total:__________________

Running Total:__________________

APPRAISAL COST 8

QUALITY COST COMPUTATION WORKSHEET

Date:__________________ Page:______of______

Quality Cost: Repair Test and Inspection (ARTIN) Period:____________

Unit/Dept:______________________ By:_______________

Element	AEC	Description	
______	__	____________________	
		Reference:__________	Cost:__________
______	__	____________________	
		Reference:__________	Cost:__________
______	__	____________________	
		Reference:__________	Cost:__________
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		Reference:__________	Cost:__________
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		Reference:__________	Cost:__________
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		Reference:__________	Cost:__________
______	__	____________________	
		Reference:__________	Cost:__________

Page Total:_______________

Running Total:_______________

APPRAISAL COST 9

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Metrology (AMETR) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	___	Reference:_____________ Cost:_________________
_______	___	Reference:_____________ Cost:_________________
_______	___	Reference:_____________ Cost:_________________
_______	___	Reference:_____________ Cost:_________________
_______	___	Reference:_____________ Cost:_________________
_______	___	Reference:_____________ Cost:_________________
_______	___	Reference:_____________ Cost:_________________
_______	___	Reference:_____________ Cost:_________________

Page Total:____________________

Running Total:____________________

APPRAISAL COST 10

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Metrology Maintenance (AMETM) Period:_____________

Unit/Dept:__________________________ By:_______________

Element	AEC	Description	
______	__		
		Reference:__________	Cost:__________
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		Reference:__________	Cost:__________
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		Reference:__________	Cost:__________
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		Reference:__________	Cost:__________
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		Reference:__________	Cost:__________
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		Reference:__________	Cost:__________
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		Reference:__________	Cost:__________
______	__		
		Reference:__________	Cost:__________

Page Total:_______________

Running Total:_______________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:______________________ Period:____________
(APONE)

Unit/Dept:________________________ By:________________

Element	AEC	Description
______	__	______________________________
		Reference:__________ Cost:__________
______	__	______________________________
		Reference:__________ Cost:__________
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		Reference:__________ Cost:__________
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______	__	______________________________
		Reference:__________ Cost:__________
______	__	______________________________
		Reference:__________ Cost:__________
______	__	______________________________
		Reference:__________ Cost:__________

Page Total:______________

Running Total:______________

APPRAISAL COST 12

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:______________________ Period:_____________
(APTWO)

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	___	______________________________
		Reference:____________ Cost:______________
_______	___	______________________________
		Reference:____________ Cost:______________
_______	___	______________________________
		Reference:____________ Cost:______________
_______	___	______________________________
		Reference:____________ Cost:______________
_______	___	______________________________
		Reference:____________ Cost:______________
_______	___	______________________________
		Reference:____________ Cost:______________
_______	___	______________________________
		Reference:____________ Cost:______________
_______	___	______________________________
		Reference:____________ Cost:______________

Page Total:____________________
Running Total:____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________ Page:____of____

Quality Cost:____________ (APTHR) Period:____________

Unit/Dept:____________ By:____________

Element	AEC	Description
____	__	____________
		____________
		Reference:________ Cost:________
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		Reference:________ Cost:________
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Page Total:____________
Running Total:____________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:_____ of_____

Quality Cost:______________________ Period:____________
(APFOU)

Unit/Dept:_________________________ By:________________

Element AEC Description

Element	AEC	Description
______	__	______________________________
		Reference:____________ Cost:____________
______	__	______________________________
		Reference:____________ Cost:____________
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		Reference:____________ Cost:____________
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		Reference:____________ Cost:____________

Page Total:________________
Running Total:________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________ Page:____of____

Quality Cost:______________ Period:__________

(____)

Unit/Dept:______________ By:__________

Element	AEC	Description
______	__	______________________ Reference:________ Cost:________
______	__	______________________ Reference:________ Cost:________
______	__	______________________ Reference:________ Cost:________
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______	__	______________________ Reference:________ Cost:________

Page Total:____________
Running Total:____________

APPRAISAL COST 16

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:______________________ Period:_____________

(_____)

Unit/Dept:_________________________ By:_________________

Element AEC Description

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Reference:____________ Cost:________________

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Page Total:__________________

Running Total:__________________

APPRAISAL COST 17

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:_________________________ Period:_____________

(_____)

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	___	____
		Reference:_____________ Cost:_________________
_______	___	____
		Reference:_____________ Cost:_________________
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		Reference:_____________ Cost:_________________

Page Total:_____________________

Running Total:_____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:______________________ Period:_____________

(_____)

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	___	______________________________________
		Reference:_____________ Cost:_________________
_______	___	______________________________________
		Reference:_____________ Cost:_________________
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		Reference:_____________ Cost:_________________
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		Reference:_____________ Cost:_________________
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		Reference:_____________ Cost:_________________
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		Reference:_____________ Cost:_________________

Page Total:_____________________

Running Total:_____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: TOTAL APPRAISAL COST Period:_____________

Unit/Dept:_________________________ By:_________________

Element AEC Description

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Reference:_____________ Cost:_________________

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Reference:_____________ Cost:_________________

Page Total:_____________________
Running Total:_____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: TARGET APPRAISAL COST Period:_____________

Unit/Dept:_________________________ By:_______________

Element AEC Description

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Reference:_____________ Cost:________________

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Reference:_____________ Cost:________________

Page Total:_____________________
Running Total:_____________________

INTERNAL FAILURE COST INDEX

INTERNAL FAILURE COST 2

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Design Failure Costs (IDEFC) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
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		________________________________
		Reference:____________ Cost:____________
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		Reference:____________ Cost:____________

Page Total:____________________

Running Total:____________________

INTERNAL FAILURE COST 3

QUALITY COST COMPUTATION WORKSHEET

Date:__________ Page:____of____

Quality Cost: Investigation (IINVE) Period:________

Unit/Dept:__________ By:________

Element	AEC	Description
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:
		Reference: Cost:

Page Total:

Running Total:

INTERNAL FAILURE COST 4

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: ECR/ECN Cost (IEECO) Period:_____________

Unit/Dept:_________________________ By:________________

Element	AEC	Description
_______	___	____________________
		Reference:__________ Cost:__________
_______	___	____________________
		Reference:__________ Cost:__________
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		Reference:__________ Cost:__________
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		Reference:__________ Cost:__________
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		Reference:__________ Cost:__________
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		Reference:__________ Cost:__________
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		Reference:__________ Cost:__________

Page Total:____________________
Running Total:____________________

INTERNAL FAILURE COST 5

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:_____of_____

Quality Cost: Supplier Reviews (ISURE) Period:_____________

Unit/Dept:_________________________ By:________________

Element	AEC	Description
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		Reference:__________ Cost:__________
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		Reference:__________ Cost:__________

Page Total:________________

Running Total:________________

INTERNAL FAILURE COST 6

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Material Reviews and Action (IMRAA) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
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		Reference:__________ Cost:__________
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		Reference:__________ Cost:__________
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		Reference:__________ Cost:__________

Page Total:____________________
Running Total:____________________

INTERNAL FAILURE COST 7

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Rework (IREWO) Period:_____________

Unit/Dept:_________________________ By:________________

Element	AEC	Description
_______	___	______________________________
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		Reference:____________ Cost:______________
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Running Total:____________________

INTERNAL FAILURE COST 8

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Repair (IREPA) Period:____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
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		Reference:__________ Cost:__________
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		Reference:__________ Cost:__________

Page Total:____________________
Running Total:____________________

INTERNAL FAILURE COST 9

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Reinspection (IREIN) Period:____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	___	Reference:_____________ Cost:_________________
_______	___	Reference:_____________ Cost:_________________
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_______	___	Reference:_____________ Cost:_________________

Page Total:_____________________

Running Total:_____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Product Awaiting Disposition (IPADI) Period:____________

Unit/Dept:______________________________ By:________________

Element	AEC	Description
______	___	______________________________
		Reference:____________ Cost:________________
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		Reference:____________ Cost:________________
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		Reference:____________ Cost:________________

Page Total:____________________
Running Total:____________________

INTERNAL FAILURE COST 11

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Reclassification (IRECL) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
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		Reference:__________ Cost:__________
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Page Total:____________________
Running Total:____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Excess Manufacturing Cost (IEXMC) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
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		Reference:_____________ Cost:_____________

Page Total:__________________
Running Total:__________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:_____of_____

Quality Cost: Excess Manufacturing Burden (IEXMB) Period:____________

Unit/Dept:________________________ By:______________

Element	AEC	Description
______	___	______________________________
		Reference:__________ Cost:__________
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Page Total:______________

Running Total:______________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Additional Related Expenses (IADRE) Period:____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	___	______________________________
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		Reference:__________ Cost:__________
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		Reference:__________ Cost:__________

Page Total:________________

Running Total:________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Scrap (ISCRA) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description	
______	___	______________________	
		Reference:__________	Cost:__________
______	___	______________________	
		Reference:__________	Cost:__________
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		Reference:__________	Cost:__________
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		Reference:__________	Cost:__________

Page Total:__________________
Running Total:__________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:_____of_____

Quality Cost:____________________ Period:____________
(INONE)

Unit/Dept:____________________ By:______________

Element AEC Description

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Reference:____________ Cost:______________

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Page Total:________________
Running Total:________________

QUALITY COST COMPUTATION WORKSHEET

Date: ____________________ Page: _____ of _____

Quality Cost: ____________________ Period: ____________
(INTWO)

Unit/Dept: ____________________ By: ____________

Element	AEC	Description
		Reference: ____________ Cost: ____________
		Reference: ____________ Cost: ____________
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Page Total: ____________
Running Total: ____________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:______________________ Period:____________
(INTHR)

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
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Page Total:________________

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QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:______________________ (INFOU) Period:_____________

Unit/Dept:________________________ By:________________

Element	AEC	Description
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		______________________________
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Page Total:________________

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QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:_______________________ Period:_____________

(_____)

Unit/Dept:_________________________ By:_________________

Element AEC Description

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Reference:_____________ Cost:_________________

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Reference:_____________ Cost:_________________

Page Total:_____________________

Running Total:_____________________

QUALITY COST COMPUTATION WORKSHEET

Date:__________________ Page:_____of_____

Quality Cost:____________________ Period:____________

(_____)

Unit/Dept:_______________________ By:_______________

Element	AEC	Description
______	___	Reference:__________ Cost:___________
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Page Total:_______________

Running Total:_______________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:______________________ Period:_____________
(_____)

Unit/Dept:_______________________ By:_________________

Element	AEC	Description
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Page Total:________________
Running Total:________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:______________________ Period:_____________
(_____)

Unit/Dept:_________________________ By:_________________

Element AEC Description

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Reference:_____________ Cost:_______________

Page Total:____________________
Running Total:____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: TOTAL INTERNAL FAILURE COST Period:____________

Unit/Dept:________________________ By:________________

Element	AEC	Description
______	___	______________________________
		Reference:__________ Cost:__________
______	___	______________________________
		Reference:__________ Cost:__________
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		Reference:__________ Cost:__________

Page Total:________________

Running Total:________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: TARGET INTERNAL FAILURE COST Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	___	________________________________ Reference:_____________ Cost:_________________
_______	___	________________________________ Reference:_____________ Cost:_________________
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_______	___	________________________________ Reference:_____________ Cost:_________________
_______	___	________________________________ Reference:_____________ Cost:_________________

Page Total:_____________________
Running Total:_____________________

EXTERNAL FAILURE COST INDEX

EXTERNAL FAILURE COST 2

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Warranty Administration (EWAAD) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	___	Reference:_____________ Cost:_________________
_______	___	Reference:_____________ Cost:_________________
_______	___	Reference:_____________ Cost:_________________
_______	___	Reference:_____________ Cost:_________________
_______	___	Reference:_____________ Cost:_________________
_______	___	Reference:_____________ Cost:_________________
_______	___	Reference:_____________ Cost:_________________
_______	___	Reference:_____________ Cost:_________________

Page Total:____________________

Running Total:____________________

EXTERNAL FAILURE COST 3

QUALITY COST COMPUTATION WORKSHEET

Date:________________ Page:_____of_____

Quality Cost: In-Warranty Repair/Parts (EIWRP) Period:____________

Unit/Dept:____________________ By:______________

Element	AEC	Description
_______	___	Reference:__________ Cost:__________
_______	___	Reference:__________ Cost:__________
_______	___	Reference:__________ Cost:__________
_______	___	Reference:__________ Cost:__________
_______	___	Reference:__________ Cost:__________
_______	___	Reference:__________ Cost:__________
_______	___	Reference:__________ Cost:__________
_______	___	Reference:__________ Cost:__________

Page Total:______________
Running Total:______________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Out-of-Warranty Repair/Parts (EOWRP) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	___	______________________________________
		______________________________________
		Reference:_____________ Cost:_______________
_______	___	______________________________________
		______________________________________
		Reference:_____________ Cost:_______________
_______	___	______________________________________
		______________________________________
		Reference:_____________ Cost:_______________
_______	___	______________________________________
		______________________________________
		Reference:_____________ Cost:_______________
_______	___	______________________________________
		______________________________________
		Reference:_____________ Cost:_______________
_______	___	______________________________________
		______________________________________
		Reference:_____________ Cost:_______________
_______	___	______________________________________
		______________________________________
		Reference:_____________ Cost:_______________
_______	___	______________________________________
		______________________________________
		Reference:_____________ Cost:_______________

Page Total:_____________________

Running Total:_____________________

EXTERNAL FAILURE COST 5

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Field Service (EFISE) Period:____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
______	___	______________________________
		Reference:____________ Cost:____________
______	___	______________________________
		Reference:____________ Cost:____________
______	___	______________________________
		Reference:____________ Cost:____________
______	___	______________________________
		Reference:____________ Cost:____________
______	___	______________________________
		Reference:____________ Cost:____________
______	___	______________________________
		Reference:____________ Cost:____________
______	___	______________________________
		Reference:____________ Cost:____________
______	___	______________________________
		Reference:____________ Cost:____________

Page Total:________________
Running Total:________________

EXTERNAL FAILURE COST 6

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Application (EAPPL) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
________	___	______________________________
		Reference:____________ Cost:____________
________	___	______________________________
		Reference:____________ Cost:____________
________	___	______________________________
		Reference:____________ Cost:____________
________	___	______________________________
		Reference:____________ Cost:____________
________	___	______________________________
		Reference:____________ Cost:____________
________	___	______________________________
		Reference:____________ Cost:____________
________	___	______________________________
		Reference:____________ Cost:____________
________	___	______________________________
		Reference:____________ Cost:____________

Page Total:________________
Running Total:________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Returns (ERETU) Period:_____________

Unit/Dept:_________________________ By:_______________

Element	AEC	Description
_______	___	______________________________
		______________________________
		Reference:__________ Cost:__________
_______	___	______________________________
		______________________________
		Reference:__________ Cost:__________
_______	___	______________________________
		______________________________
		Reference:__________ Cost:__________
_______	___	______________________________
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		Reference:__________ Cost:__________
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		Reference:__________ Cost:__________
_______	___	______________________________
		______________________________
		Reference:__________ Cost:__________
_______	___	______________________________
		______________________________
		Reference:__________ Cost:__________
_______	___	______________________________
		______________________________
		Reference:__________ Cost:__________

Page Total:______________
Running Total:______________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Reclassification (ERECL) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
______	___	________________________________
		________________________________
		Reference:____________ Cost:______________
______	___	________________________________
		________________________________
		Reference:____________ Cost:______________
______	___	________________________________
		________________________________
		Reference:____________ Cost:______________
______	___	________________________________
		________________________________
		Reference:____________ Cost:______________
______	___	________________________________
		________________________________
		Reference:____________ Cost:______________
______	___	________________________________
		________________________________
		Reference:____________ Cost:______________
______	___	________________________________
		________________________________
		Reference:____________ Cost:______________
______	___	________________________________
		________________________________
		Reference:____________ Cost:______________

Page Total:____________________

Running Total:____________________

EXTERNAL FAILURE COST 9

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Recalls (ERECA) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	___	______________________________
		______________________________
		Reference:__________ Cost:__________
_______	___	______________________________
		______________________________
		Reference:__________ Cost:__________
_______	___	______________________________
		______________________________
		Reference:__________ Cost:__________
_______	___	______________________________
		______________________________
		Reference:__________ Cost:__________
_______	___	______________________________
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		Reference:__________ Cost:__________
_______	___	______________________________
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		Reference:__________ Cost:__________
_______	___	______________________________
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		Reference:__________ Cost:__________
_______	___	______________________________
		______________________________
		Reference:__________ Cost:__________

Page Total:____________________
Running Total:____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Additional Related Expense (EADRE) Period:_____________

Unit/Dept:________________________ By:________________

Element	AEC	Description
________	___	______________________________________
		Reference:____________ Cost:____________
________	___	______________________________________
		Reference:____________ Cost:____________
________	___	______________________________________
		Reference:____________ Cost:____________
________	___	______________________________________
		Reference:____________ Cost:____________
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		Reference:____________ Cost:____________
________	___	______________________________________
		Reference:____________ Cost:____________
________	___	______________________________________
		Reference:____________ Cost:____________
________	___	______________________________________
		Reference:____________ Cost:____________

Page Total:________________

Running Total:________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: Liability Reserve (ELIAB) Period:_____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	___	________________________________
		Reference:____________ Cost:______________
_______	___	________________________________
		Reference:____________ Cost:______________
_______	___	________________________________
		Reference:____________ Cost:______________
_______	___	________________________________
		Reference:____________ Cost:______________
_______	___	________________________________
		Reference:____________ Cost:______________
_______	___	________________________________
		Reference:____________ Cost:______________
_______	___	________________________________
		Reference:____________ Cost:______________
_______	___	________________________________
		Reference:____________ Cost:______________

Page Total:____________________
Running Total:____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:______________________ Period:_____________
(EXONE)

Unit/Dept:_________________________ By:_________________

Element AEC Description

_______ ___ ____
____
Reference:_____________ Cost:_________________

_______ ___ ____
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Reference:_____________ Cost:_________________

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Reference:_____________ Cost:_________________

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Reference:_____________ Cost:_________________

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Reference:_____________ Cost:_________________

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Reference:_____________ Cost:_________________

Page Total:_____________________
Running Total:_____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:________________________ Period:_____________
(EXTWO)

Unit/Dept:_________________________ By:_________________

Element	AEC	Description	
_______	__	________________________________	
		Reference:_____________	Cost:_______________
_______	__	________________________________	
		Reference:_____________	Cost:_______________
_______	__	________________________________	
		Reference:_____________	Cost:_______________
_______	__	________________________________	
		Reference:_____________	Cost:_______________
_______	__	________________________________	
		Reference:_____________	Cost:_______________
_______	__	________________________________	
		Reference:_____________	Cost:_______________
_______	__	________________________________	
		Reference:_____________	Cost:_______________
_______	__	________________________________	
		Reference:_____________	Cost:_______________

Page Total:_____________________
Running Total:_____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:______________________ Period:_____________
(EXTHR)

Unit/Dept:______________________ By:________________

Element	AEC	Description	
_______	___	________________________________	
		Reference:__________	Cost:__________
_______	___	________________________________	
		Reference:__________	Cost:__________
_______	___	________________________________	
		Reference:__________	Cost:__________
_______	___	________________________________	
		Reference:__________	Cost:__________
_______	___	________________________________	
		Reference:__________	Cost:__________
_______	___	________________________________	
		Reference:__________	Cost:__________
_______	___	________________________________	
		Reference:__________	Cost:__________
_______	___	________________________________	
		Reference:__________	Cost:__________

Page Total:________________
Running Total:________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:______________________ Period:____________
(EXFOU)

Unit/Dept:________________________ By:________________

Element	AEC	Description
_______	___	____
		Reference:____________ Cost:______________
_______	___	____
		Reference:____________ Cost:______________
_______	___	____
		Reference:____________ Cost:______________
_______	___	____
		Reference:____________ Cost:______________
_______	___	____
		Reference:____________ Cost:______________
_______	___	____
		Reference:____________ Cost:______________
_______	___	____
		Reference:____________ Cost:______________
_______	___	____
		Reference:____________ Cost:______________

Page Total:____________________
Running Total:____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:________________________ Period:______________

(_____)

Unit/Dept:_________________________ By:________________

Element AEC Description

_______ __ ____

____

Reference:_____________ Cost:_______________

_______ __ ____

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Reference:_____________ Cost:_______________

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Reference:_____________ Cost:_______________

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Reference:_____________ Cost:_______________

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Reference:_____________ Cost:_______________

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Reference:_____________ Cost:_______________

Page Total:____________________
Running Total:____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:______________________ Period:______________
(_____)

Unit/Dept:__________________________ By:________________

Element AEC Description

_______ ___ ____

Reference:_____________ Cost:________________

_______ ___ ____

Reference:_____________ Cost:________________

_______ ___ ____

Reference:_____________ Cost:________________

_______ ___ ____

Reference:_____________ Cost:________________

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Reference:_____________ Cost:________________

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Reference:_____________ Cost:________________

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Reference:_____________ Cost:________________

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Reference:_____________ Cost:________________

Page Total:____________________
Running Total:____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost:______________________ Period:_____________
(_____)

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	___	____
		Reference:_____________ Cost:_________________
_______	___	____
		Reference:_____________ Cost:_________________
_______	___	____
		Reference:_____________ Cost:_________________
_______	___	____
		Reference:_____________ Cost:_________________
_______	___	____
		Reference:_____________ Cost:_________________
_______	___	____
		Reference:_____________ Cost:_________________
_______	___	____
		Reference:_____________ Cost:_________________
_______	___	____
		Reference:_____________ Cost:_________________

Page Total:_____________________
Running Total:_____________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________ Page:____of____

Quality Cost:____________ (____) Period:________

Unit/Dept:____________ By:________

Element	AEC	Description
____	__	________
		Reference:______ Cost:______
____	__	________
		Reference:______ Cost:______
____	__	________
		Reference:______ Cost:______
____	__	________
		Reference:______ Cost:______
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		Reference:______ Cost:______
____	__	________
		Reference:______ Cost:______
____	__	________
		Reference:______ Cost:______
____	__	________
		Reference:______ Cost:______

Page Total:________

Running Total:________

EXTERNAL FAILURE COST 20

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: TOTAL EXTERNAL FAILURE COST Period:____________

Unit/Dept:_________________________ By:_________________

Element	AEC	Description
_______	___	________________________
		Reference:__________ Cost:____________
_______	___	________________________
		Reference:__________ Cost:____________
_______	___	________________________
		Reference:__________ Cost:____________
_______	___	________________________
		Reference:__________ Cost:____________
_______	___	________________________
		Reference:__________ Cost:____________
_______	___	________________________
		Reference:__________ Cost:____________
_______	___	________________________
		Reference:__________ Cost:____________
_______	___	________________________
		Reference:__________ Cost:____________

Page Total:________________

Running Total:________________

QUALITY COST COMPUTATION WORKSHEET

Date:____________________ Page:______of______

Quality Cost: TARGET EXTERNAL FAILURE COST Period:_____________

Unit/Dept:_________________________ By:________________

Element	AEC	Description
_______	___	________________________________
		________________________________
		Reference:__________ Cost:__________
_______	___	________________________________
		________________________________
		Reference:__________ Cost:__________
_______	___	________________________________
		________________________________
		Reference:__________ Cost:__________
_______	___	________________________________
		________________________________
		Reference:__________ Cost:__________
_______	___	________________________________
		________________________________
		Reference:__________ Cost:__________
_______	___	________________________________
		________________________________
		Reference:__________ Cost:__________
_______	___	________________________________
		________________________________
		Reference:__________ Cost:__________
_______	___	________________________________
		________________________________
		Reference:__________ Cost:__________

Page Total:____________________
Running Total:____________________

COST OF QUALITY WORKSHEET

	Actual Est. Comb.	Cost	Documentation
PREVENTION COST			
Product Design			
R&D Quality			
R&D Support			
Engineering Quality			
Engineering Support			
Field Quality			
Field Support			
External Quality			
External Support			
Purchasing			
Quality Planning			
Quality Administration			
Quality Training			
Quality Audits Internal			
Quality Audits External			
Quality Related Maintenance			
Vendor Certification			
TOTAL PREVENTION COST			
TARGET PREVENTION COST			
APPRAISAL COST			
Incoming Inspection			
Product Qualification Tests			
MATERIAL/PARTS			
In-Process Inspection and Test			
Final Inspection and Test			
ASSEMBLY/END-ITEM			
In-Process Inspection and Test			
Final Inspection and Test			
Repair Test and Inspection			
Metrology			
Metrology Maintenance			
TOTAL APPRAISAL COST			
TARGET APPRAISAL COST			

COST OF QUALITY WORKSHEET

	Actual Est. Comb.	Cost	Documentation
INTERNAL FAILURE COSTS			
Design Failure Costs			
Investigation			
ECR/ECN Cost			
Supplier Reviews			
Material Review and Action			
Rework			
Repair			
Reinspection			
Product Awaiting Disposition			
Reclassification			
Excess Manufacturing Cost			
Excess Manufacturing Burden			
Additional Related Expense			
Scrap			
TOTAL INTERNAL FAILURE COST			
TARGET INTERNAL FAILURE COST			
EXTERNAL FAILURE COSTS			
Warranty Administration			
In-Warranty Repair/Parts			
Out-of-Warranty Repair/Parts			
Field Service			
Applications			
Returns			
Reclassification			
Recalls			
Additional Related Expense			
Liability Reserve			
TOTAL EXTERNAL FAILURE COSTS			
TARGET EXTERNAL FAILURE COSTS			
TOTAL QUALITY COST			
TARGET QUALITY COST			

COST OF QUALITY WORKSHEET

PREVENTION COST	Expense	Burden Rate	Total Expense
Product Design	______	______	______
R&D Quality	______	______	______
R&D Support	______	______	______
Engineering Quality	______	______	______
Engineering Support	______	______	______
External Quality	______	______	______
External Support	______	______	______
Purchasing	______	______	______
Quality Planning	______	______	______
Quality Administration	______	______	______
Quality Training	______	______	______
Quality Audits Internal	______	______	______
Quality Audits External	______	______	______
Quality Related Maintenance	______	______	______
Vendor Certification	______	______	______
______	______	______	______
______	______	______	______
______	______	______	______
______	______	______	______
TOTAL PREVENTION COST			______
TARGET PREVENTION COST			______

APPRAISAL COST	Expense	Burden Rate	Total Expense
Incoming Inspection	______	______	______
Product Qualification Tests	______	______	______
MATERIALS/PARTS			
In-Process Inspection and Test	______	______	______
Final Inspection and Test	______	______	______
ASSEMBLY			
In-Process Inspection and Test	______	______	______
Final Inspection and Test	______	______	______
Repair Test and Inspection	______	______	______
Metrology	______	______	______
Metrology Maintenance	______	______	______
______	______	______	______
______	______	______	______
______	______	______	______
______	______	______	______
TOTAL APPRAISAL COST			______
TARGET APPRAISAL COST			______

COST OF QUALITY WORKSHEET

	Expense	Burden Rate	Total Expense
INTERNAL FAILURE COSTS			
Design Failure Costs	____	____	____
Investigation	____	____	____
ECR/ECN Cost	____	____	____
Supplier Product Reviews	____	____	____
Material Review and Action	____	____	____
Repair	____	____	____
Rework	____	____	____
Reinspection	____	____	____
Reclassification	____	____	____
Product Awaiting Disposition	____	____	____
Excess Manufacturing Cost	____	____	____
Excess Manufacturing Burden	____	____	____
Additional Related Expense	____	____	____
Scrap	____	____	____
____	____	____	____
____	____	____	____
____	____	____	____
____	____	____	____
TOTAL INTERNAL FAILURE COST			____
TARGET INTERNAL FAILURE COST			____
EXTERNAL FAILURE COSTS			
Warranty	____	____	____
In-Warranty Repair/Parts	____	____	____
Out-of-Warranty Repair/Parts	____	____	____
Field Service	____	____	____
Applications	____	____	____
Returns	____	____	____
Reclassification	____	____	____
Recalls	____	____	____
Additional Related Expense	____	____	____
Liability Reserve	____	____	____
____	____	____	____
____	____	____	____
____	____	____	____
____	____	____	____
TOTAL EXTERNAL FAILURE COSTS			____
TARGET EXTERNAL FAILURE COSTS			____
TOTAL QUALITY COST			____
TARGET QUALITY COST			____

COMBINED QUALITY COST REPORTING
FOR THE MONTH ENDING ______

	CURRENT MONTH QUALITY COSTS	CURRENT MONTH % OF SALES	CURRENT MONTH OTHER	THREE MONTH MOVING AVERAGE QUALITY COSTS	THREE MONTH MOVING AVERAGE % OF SALES	THREE MONTH MOVING AVERAGE OTHER
PREVENTION COST						
Product Design						
R&D Quality						
R&D Support						
Engineering Quality						
Engineering Support						
Field Quality						
Field Support						
External Quality						
External Support						
Purchasing						
Quality Planning						
Quality Administration						
Quality Training						
Quality Audits Internal						
Quality Audits External						
Quality Related Maintenance						
Vendor Certification						
TOTAL PREVENTION COST						
TARGET PREVENTION COST						

COMBINED QUALITY COST REPORTING
FOR THE MONTH ENDING ________

	CURRENT MONTH			THREE MONTH MOVING AVERAGE		
	QUALITY COSTS	% OF SALES	OTHER	QUALITY COSTS	% OF SALES	OTHER
APPRAISAL COST						
Incoming Inspection						
Product Qualification Tests						
MATERIALS/PARTS IN-PROCESS						
In-Process Inspection and Test						
Final Inspection and Test						
ASSEMBLY/END-ITEM						
In-Process Inspection and Test						
Final Inspection and Test						
Repair Test and Inspection						
Metrology						
Metrology Maintenance						
TOTAL APPRAISAL COST						
TARGET APPRAISAL COST						

COMBINED QUALITY COST REPORTING
FOR THE MONTH ENDING ________

	CURRENT MONTH QUALITY COSTS	CURRENT MONTH % OF SALES	CURRENT MONTH OTHER	THREE MONTH MOVING AVERAGE QUALITY COSTS	THREE MONTH MOVING AVERAGE % OF SALES	THREE MONTH MOVING AVERAGE OTHER
INTERNAL FAILURE COSTS						
Design Failure Costs						
Investigation						
ECR/ECN Cost						
Supplier Reviews						
Material Review and Action						
Rework						
Repair						
Reinspection						
Product Awaiting Disposition						
Reclassification						
Excess Manufacturing Cost						
Excess Manufacturing Burden						
Additional Related Expenses						
Scrap						
TOTAL INTERNAL FAILURE COST						
TARGET INTERNAL FAILURE COST						

COMBINED QUALITY COST REPORTING
FOR THE MONTH ENDING ________

	CURRENT MONTH			THREE MONTH MOVING AVERAGE		
	QUALITY COSTS	% OF SALES	OTHER	QUALITY COSTS	% OF SALES	OTHER
EXTERNAL FAILURE COSTS						
Warranty Administration						
In-Warranty Repair/Parts						
Out-of-Warranty Repair/Parts						
Field Service						
Applications						
Returns						
Reclassification						
Recalls						
Additional Related Expenses						
Liability Reserve						
TOTAL EXTERNAL FAILURE COSTS						
TARGET EXTERNAL FAILURE COSTS						
TOTAL QUALITY COST						
TARGET QUALITY COST						

COMBINED QUALITY COST REPORTING
FOR THE QUARTER ENDING ________

	CURRENT MONTH QUALITY COSTS	% OF SALES	OTHER	THREE MONTH MOVING AVERAGE QUALITY COSTS	% OF SALES	OTHER
PREVENTION COST						
Product Design						
R&D Quality						
R&D Support						
Engineering Quality						
Engineering Support						
Field Quality						
Field Support						
External Quality						
External Support						
Purchasing						
Quality Planning						
Quality Administration						
Quality Training						
Quality Audits Internal						
Quality Audits External						
Quality Related Maintenance						
Vendor Certification						
TOTAL PREVENTION COST						
TARGET PREVENTION COST						

COMBINED QUALITY COST REPORTING
FOR THE QUARTER ENDING ________

	CURRENT MONTH QUALITY COSTS	% OF SALES	OTHER	THREE MONTH MOVING AVERAGE QUALITY COSTS	% OF SALES	OTHER
APPRAISAL COST						
Incoming Inspection	____	____	____	____	____	____
Product Qualification Tests	____	____	____	____	____	____
MATERIALS/PARTS IN-PROCESS						
In-Process Inspection and Test	____	____	____	____	____	____
Final Inspection and Test	____	____	____	____	____	____
ASSEMBLY/END-ITEM						
In-Process Inspection and Test	____	____	____	____	____	____
Final Inspection and Test	____	____	____	____	____	____
Repair Test and Inspection	____	____	____	____	____	____
Metrology	____	____	____	____	____	____
Metrology Maintenance	____	____	____	____	____	____
________	____	____	____	____	____	____
________	____	____	____	____	____	____
________	____	____	____	____	____	____
________	____	____	____	____	____	____
TOTAL APPRAISAL COST	____	____	____	____	____	____
TARGET APPRAISAL COST	____	____	____	____	____	____

COMBINED QUALITY COST REPORTING
FOR THE QUARTER ENDING ________

	CURRENT MONTH QUALITY COSTS	% OF SALES	OTHER	THREE MONTH MOVING AVERAGE QUALITY COSTS	% OF SALES	OTHER
INTERNAL FAILURE COSTS						
Design Failure Costs						
Investigation						
ECR/ECN Cost						
Supplier Reviews						
Material Review and Action						
Rework						
Repair						
Reinspection						
Product Awaiting Disposition						
Reclassification						
Excess Manufacturing Cost						
Excess Manufacturing Burden						
Additional Related Expenses						
Scrap						
TOTAL INTERNAL FAILURE COST						
TARGET INTERNAL FAILURE COST						

COMBINED QUALITY COST REPORTING
FOR THE QUARTER ENDING ______

	CURRENT MONTH			THREE MONTH MOVING AVERAGE		
	QUALITY COSTS	% OF SALES	OTHER	QUALITY COSTS	% OF SALES	OTHER
EXTERNAL FAILURE COSTS						
Warranty Administration	____	____	____	____	____	____
In-Warranty Repair/Parts	____	____	____	____	____	____
Out-of-Warranty Repair/Parts	____	____	____	____	____	____
Field Service	____	____	____	____	____	____
Applications	____	____	____	____	____	____
Returns	____	____	____	____	____	____
Reclassification	____	____	____	____	____	____
Recalls	____	____	____	____	____	____
Additional Related Expenses	____	____	____	____	____	____
Liability Reserve	____	____	____	____	____	____
____________	____	____	____	____	____	____
____________	____	____	____	____	____	____
____________	____	____	____	____	____	____
____________	____	____	____	____	____	____
TOTAL EXTERNAL FAILURE COSTS	____	____	____	____	____	____
TARGET EXTERNAL FAILURE COSTS	____	____	____	____	____	____
TOTAL QUALITY COST	____	____	____	____	____	____
TARGET QUALITY COST	____	____	____	____	____	____

COMBINED QUALITY COST REPORTING
FOR THE YEAR ENDING ________

	CURRENT MONTH QUALITY COSTS	CURRENT MONTH % OF SALES	CURRENT MONTH OTHER	THREE MONTH MOVING AVERAGE QUALITY COSTS	THREE MONTH MOVING AVERAGE % OF SALES	THREE MONTH MOVING AVERAGE OTHER
PREVENTION COST						
Product Design	____	____	____	____	____	____
R&D Quality	____	____	____	____	____	____
R&D Support	____	____	____	____	____	____
Engineering Quality	____	____	____	____	____	____
Engineering Support	____	____	____	____	____	____
Field Quality	____	____	____	____	____	____
Field Support	____	____	____	____	____	____
External Quality	____	____	____	____	____	____
External Support	____	____	____	____	____	____
Purchasing	____	____	____	____	____	____
Quality Planning	____	____	____	____	____	____
Quality Administration	____	____	____	____	____	____
Quality Training	____	____	____	____	____	____
Quality Audits Internal	____	____	____	____	____	____
Quality Audits External	____	____	____	____	____	____
Quality Related Maintenance	____	____	____	____	____	____
Vendor Certification	____	____	____	____	____	____
________	____	____	____	____	____	____
________	____	____	____	____	____	____
________	____	____	____	____	____	____
________	____	____	____	____	____	____
TOTAL PREVENTION COST	____	____	____	____	____	____
TARGET PREVENTION COST	____	____	____	____	____	____

COMBINED QUALITY COST REPORTING
FOR THE YEAR ENDING ________

	CURRENT MONTH QUALITY COSTS	% OF SALES	OTHER	THREE MONTH MOVING AVERAGE QUALITY COSTS	% OF SALES	OTHER
APPRAISAL COST						
Incoming Inspection						
Product Qualification Tests						
MATERIALS/PARTS IN-PROCESS						
In-Process Inspection and Test						
Final Inspection and Test						
ASSEMBLY/END-ITEM						
In-Process Inspection and Test						
Final Inspection and Test						
Repair Test and Inspection						
Metrology						
Metrology Maintenance						
TOTAL APPRAISAL COST						
TARGET APPRAISAL COST						

COMBINED QUALITY COST REPORTING
FOR THE YEAR ENDING ________

	CURRENT MONTH QUALITY COSTS	CURRENT MONTH % OF SALES	CURRENT MONTH OTHER	THREE MONTH MOVING AVERAGE QUALITY COSTS	THREE MONTH MOVING AVERAGE % OF SALES	THREE MONTH MOVING AVERAGE OTHER
INTERNAL FAILURE COSTS						
Design Failure Costs	____	____	____	____	____	____
Investigation	____	____	____	____	____	____
ECR/ECN Cost	____	____	____	____	____	____
Supplier Reviews	____	____	____	____	____	____
Material Review and Action	____	____	____	____	____	____
Rework	____	____	____	____	____	____
Repair	____	____	____	____	____	____
Reinspection	____	____	____	____	____	____
Product Awaiting Disposition	____	____	____	____	____	____
Reclassification	____	____	____	____	____	____
Excess Manufacturing Cost	____	____	____	____	____	____
Excess Manufacturing Burden	____	____	____	____	____	____
Additional Related Expenses	____	____	____	____	____	____
Scrap	____	____	____	____	____	____
____________	____	____	____	____	____	____
____________	____	____	____	____	____	____
____________	____	____	____	____	____	____
____________	____	____	____	____	____	____
TOTAL INTERNAL FAILURE COST	____	____	____	____	____	____
TARGET INTERNAL FAILURE COST	____	____	____	____	____	____

COMBINED QUALITY COST REPORTING
FOR THE YEAR ENDING ________

	CURRENT MONTH QUALITY COSTS	CURRENT MONTH % OF SALES	CURRENT MONTH OTHER	THREE MONTH MOVING AVERAGE QUALITY COSTS	THREE MONTH MOVING AVERAGE % OF SALES	THREE MONTH MOVING AVERAGE OTHER
EXTERNAL FAILURE COSTS						
Warranty Administration	____	____	____	____	____	____
In-Warranty Repair/Parts	____	____	____	____	____	____
Out-of-Warranty Repair/Parts	____	____	____	____	____	____
Field Service	____	____	____	____	____	____
Applications	____	____	____	____	____	____
Returns	____	____	____	____	____	____
Reclassification	____	____	____	____	____	____
Recalls	____	____	____	____	____	____
Additional Related Expenses	____	____	____	____	____	____
Liability Reserve	____	____	____	____	____	____
____________	____	____	____	____	____	____
____________	____	____	____	____	____	____
____________	____	____	____	____	____	____
____________	____	____	____	____	____	____
TOTAL EXTERNAL FAILURE COSTS	____	____	____	____	____	____
TARGET EXTERNAL FAILURE COSTS	____	____	____	____	____	____
TOTAL QUALITY COST	____	____	____	____	____	____
TARGET QUALITY COST	____	____	____	____	____	____

QUALITY COSTS AS PERCENTAGES

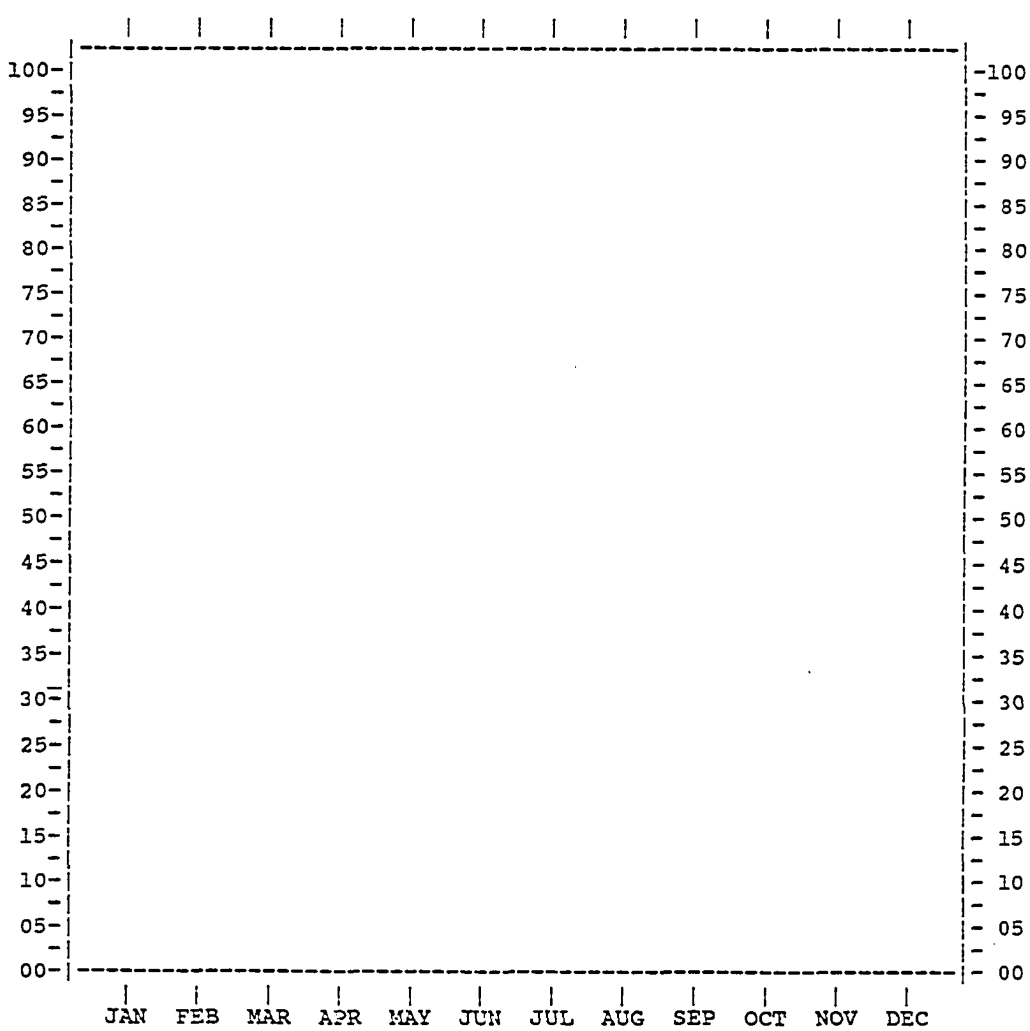
	CURRENT MONTH	3 MONTH MOVING AVERAGE	YEAR TO DATE
PREVENTION COST AS A PERCENTAGE OF:			
Manufacturing Costs	____	____	____
Sales	____	____	____
Revenue	____	____	____
________	____	____	____
APPRAISAL COST AS A PERCENTAGE OF:			
Manufacturing Costs	____	____	____
Sales	____	____	____
Revenue	____	____	____
________	____	____	____
PREVENTION AND APPRAISAL COST AS A PERCENTAGE OF:			
Manufacturing Costs	____	____	____
Sales	____	____	____
Revenue	____	____	____
________	____	____	____
INTERNAL FAILURE COST AS A PERCENTAGE OF:			
Manufacturing Costs	____	____	____
Sales	____	____	____
Revenue	____	____	____
________	____	____	____
EXTERNAL FAILURE COST AS A PERCENTAGE OF:			
Manufacturing Costs	____	____	____
Sales	____	____	____
Revenue	____	____	____
________	____	____	____
INTERNAL AND EXTERNAL FAILURE COST AS A PERCENTAGE OF:			
Manufacturing Costs	____	____	____
Sales	____	____	____
Revenue	____	____	____
________	____	____	____

QUALITY COSTS AS PERCENTAGES

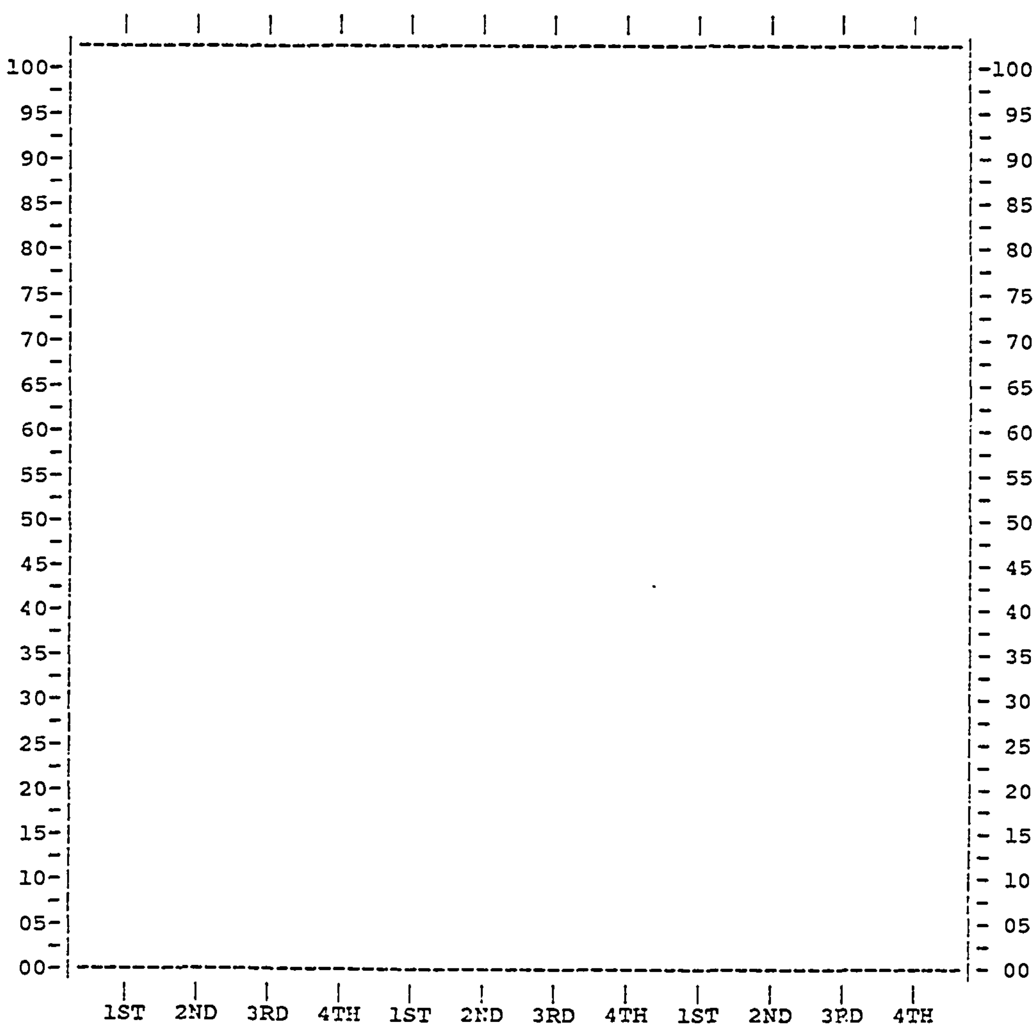
	CURRENT MONTH	3 MONTH MOVING AVERAGE	YEAR TO DATE
QUALITY COST AS A PERCENTAGE OF:			
Manufacturing Costs	______	______	______
Sales	______	______	______
Revenue	______	______	______
______________	______	______	______

QUALITY COST RATIOS AND ANALYSIS

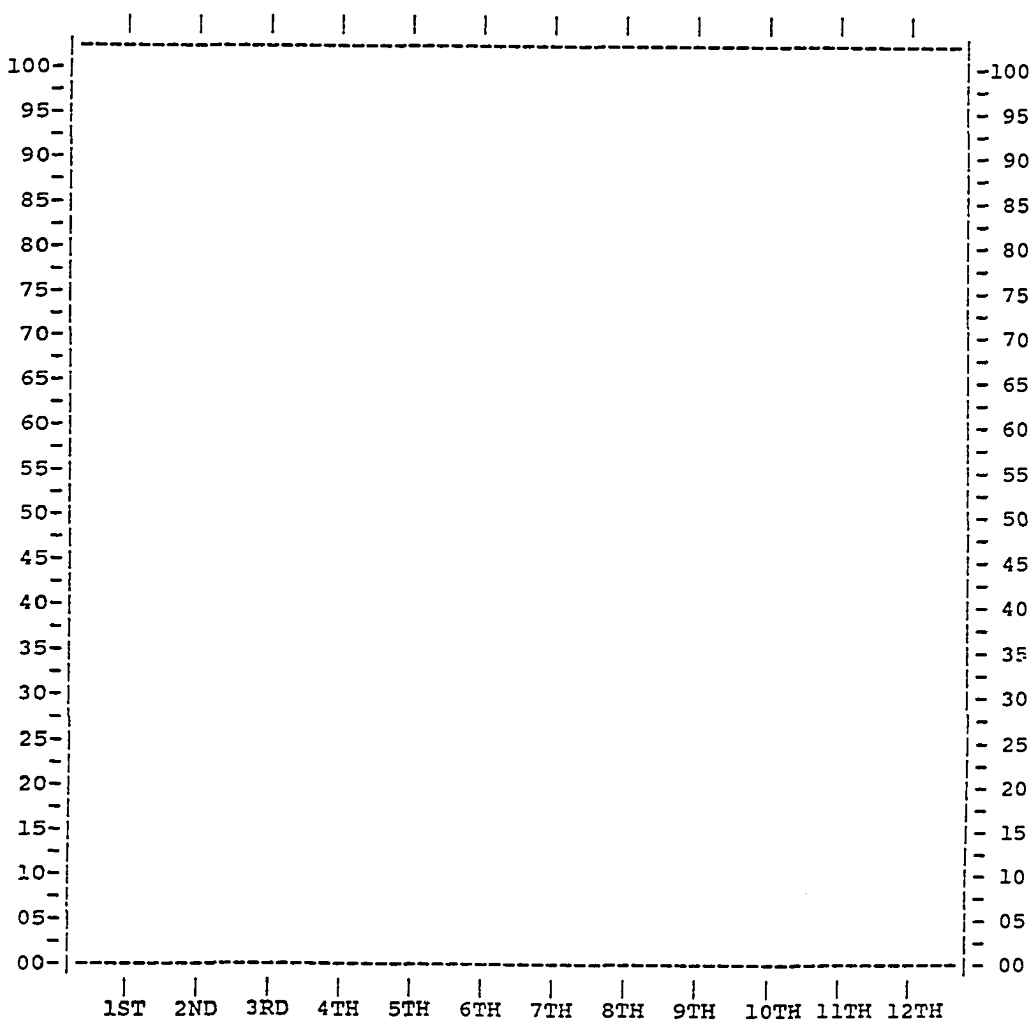
MONTHLY ANALYSIS OF TOTAL COST OF QUALITY BY COMPONENT QUALITY COSTS



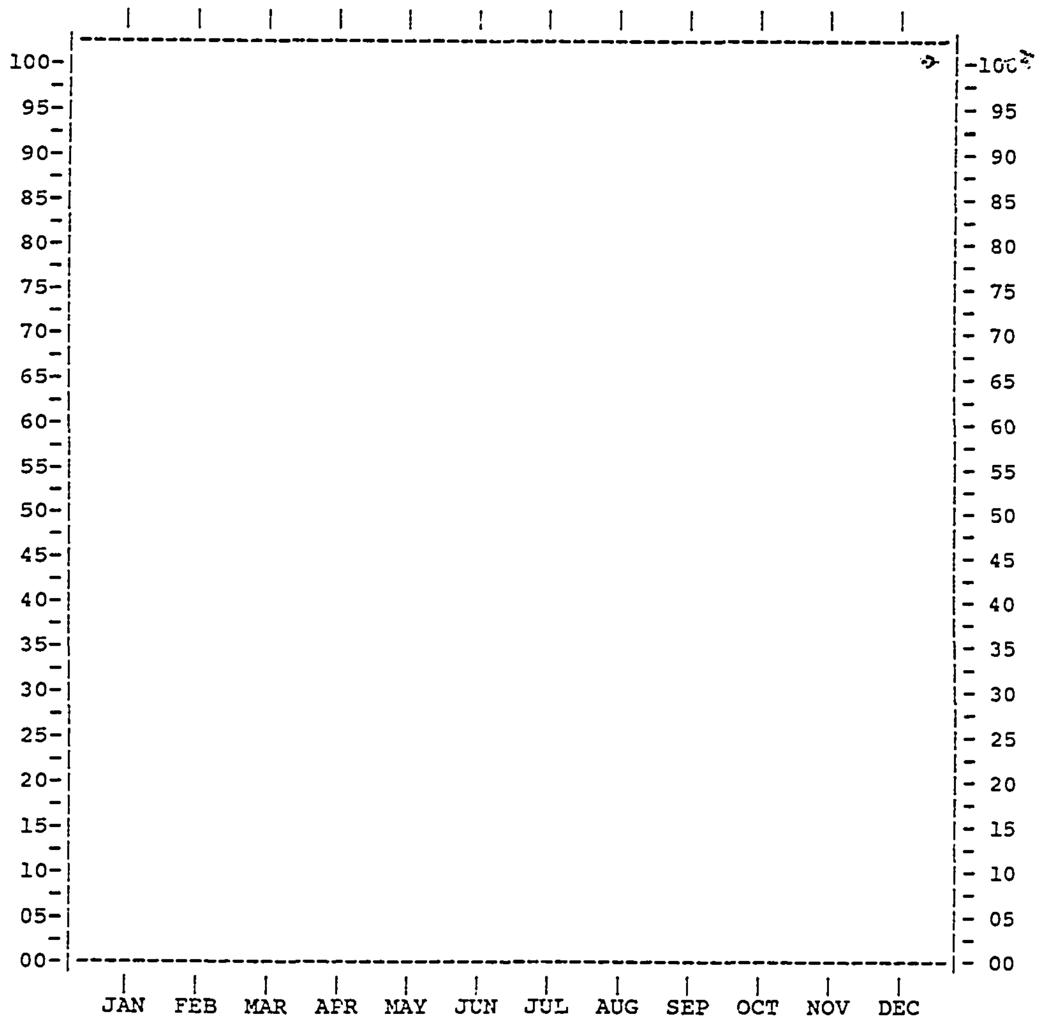
QUARTERLY ANALYSIS OF TOTAL COST OF QUALITY BY COMPONENT QUALITY COSTS



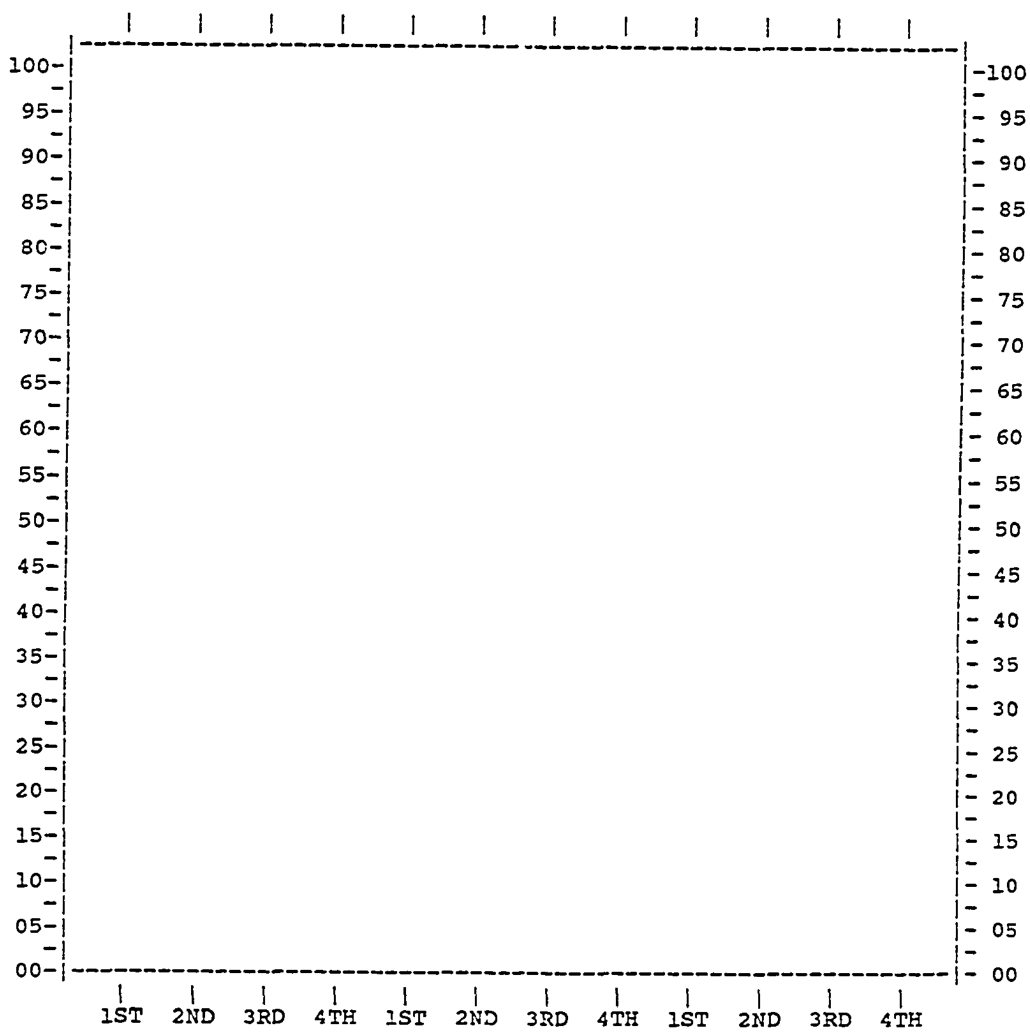
YEARLY ANALYSIS OF TOTAL COST OF QUALITY BY COMPONENT QUALITY COSTS



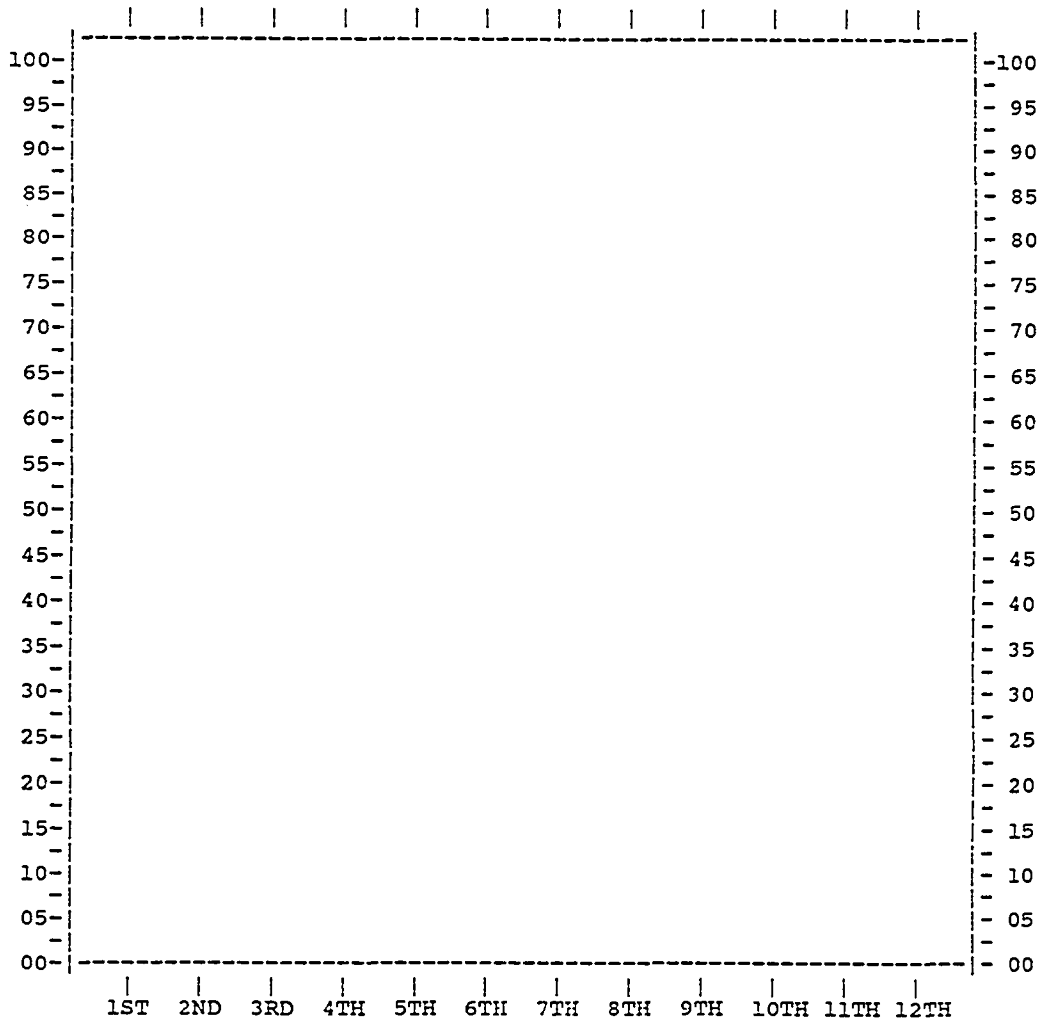
MONTHLY ANALYSIS OF QUALITY COSTS AS A PERCENTAGE OF MANUFACTURING COST



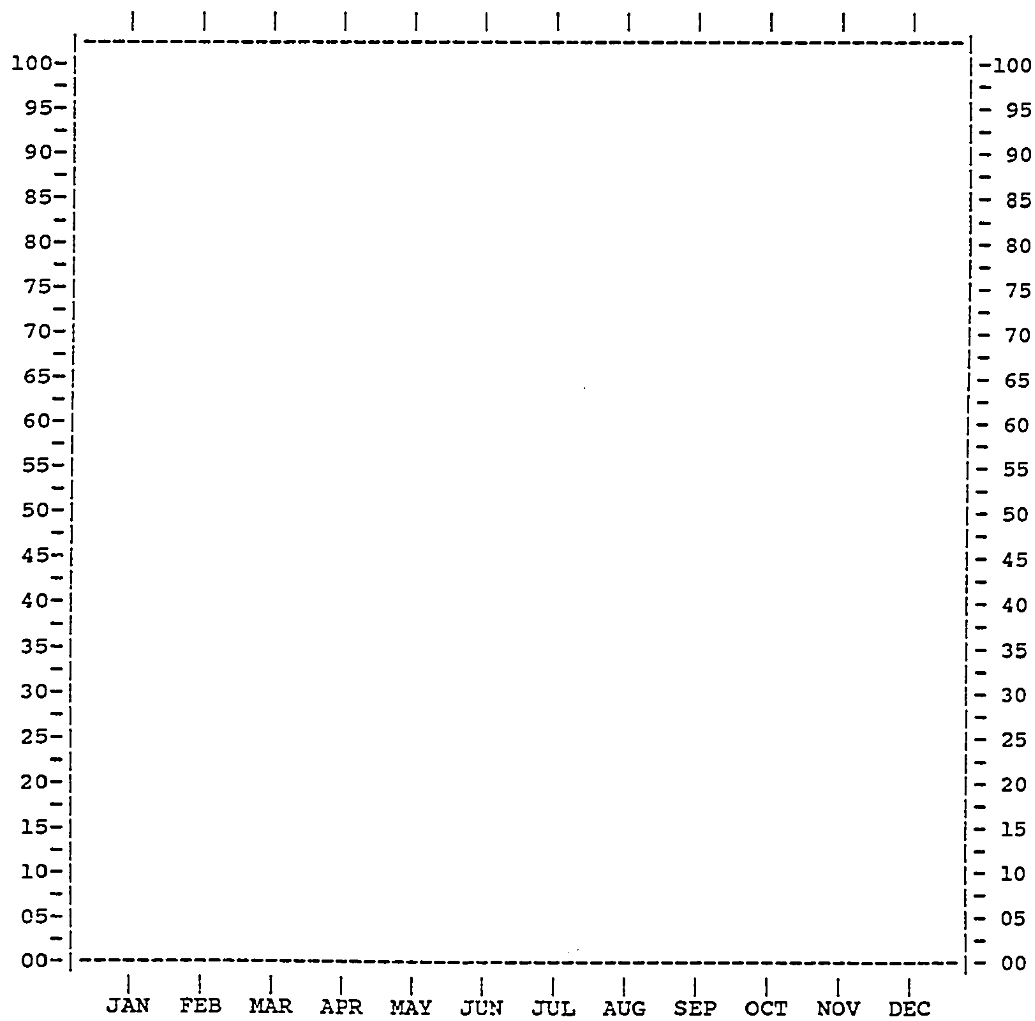
QUARTERLY ANALYSIS OF QUALITY COSTS AS A PERCENTAGE OF MANUFACTURING COSTS



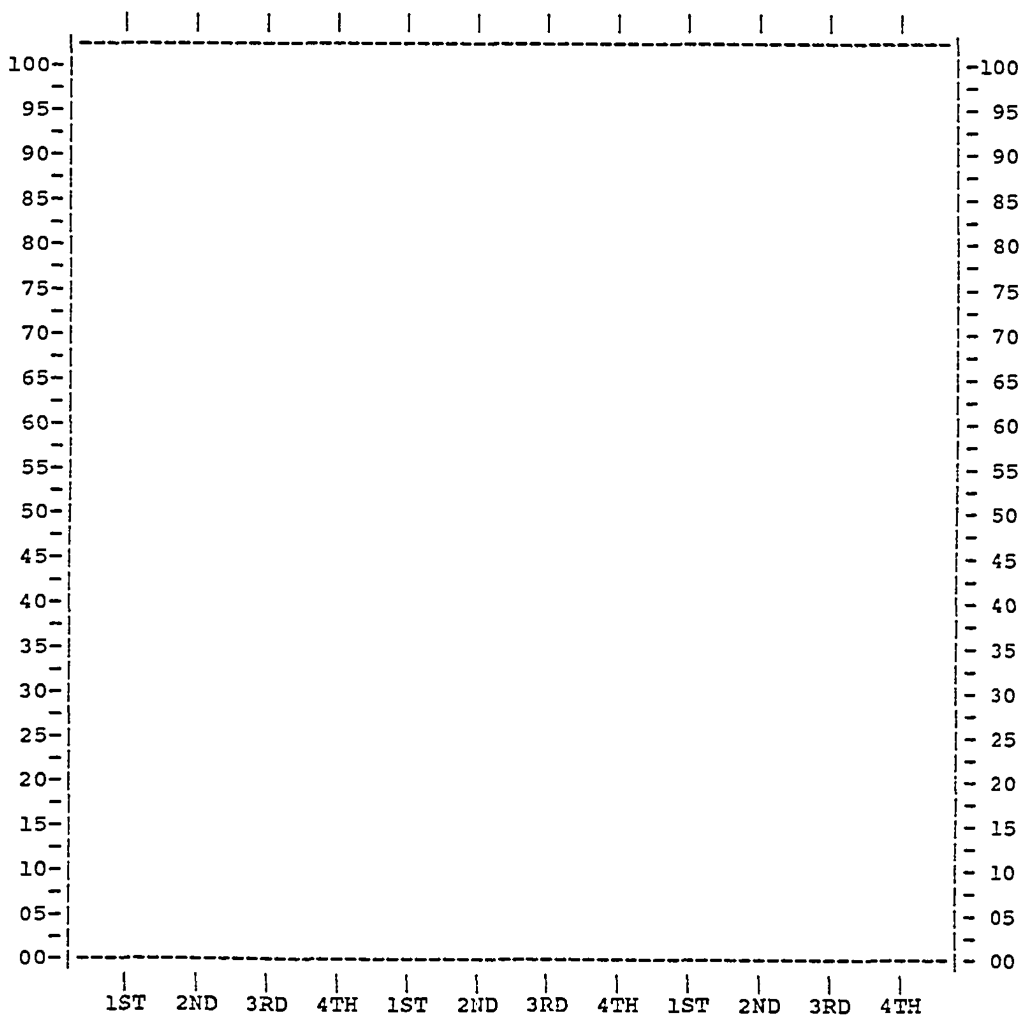
YEARLY ANALYSIS OF QUALITY COSTS AS A PERCENTAGE OF MANUFACTURING COSTS



MONTHLY ANALYSIS OF QUALITY COSTS AS A PERCENTAGE OF SALES



QUARTERLY ANALYSIS OF QUALITY COSTS AS A PERCENTAGE OF SALES



YEARLY ANALYSIS OF QUALITY COSTS AS A PERCENTAGE OF SALES

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        |    |    |    |    |    |    |    |    |    |    |    |
     |------------------------------------------------------------|
100-|                                                              |-100
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 95-|                                                              |- 95
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 90-|                                                              |- 90
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 85-|                                                              |- 85
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 80-|                                                              |- 80
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 75-|                                                              |- 75
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 70-|                                                              |- 70
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        |    |    |    |    |    |    |    |    |    |    |    |
       1ST  2ND  3RD  4TH  5TH  6TH  7TH  8TH  9TH 10TH 11TH 12TH
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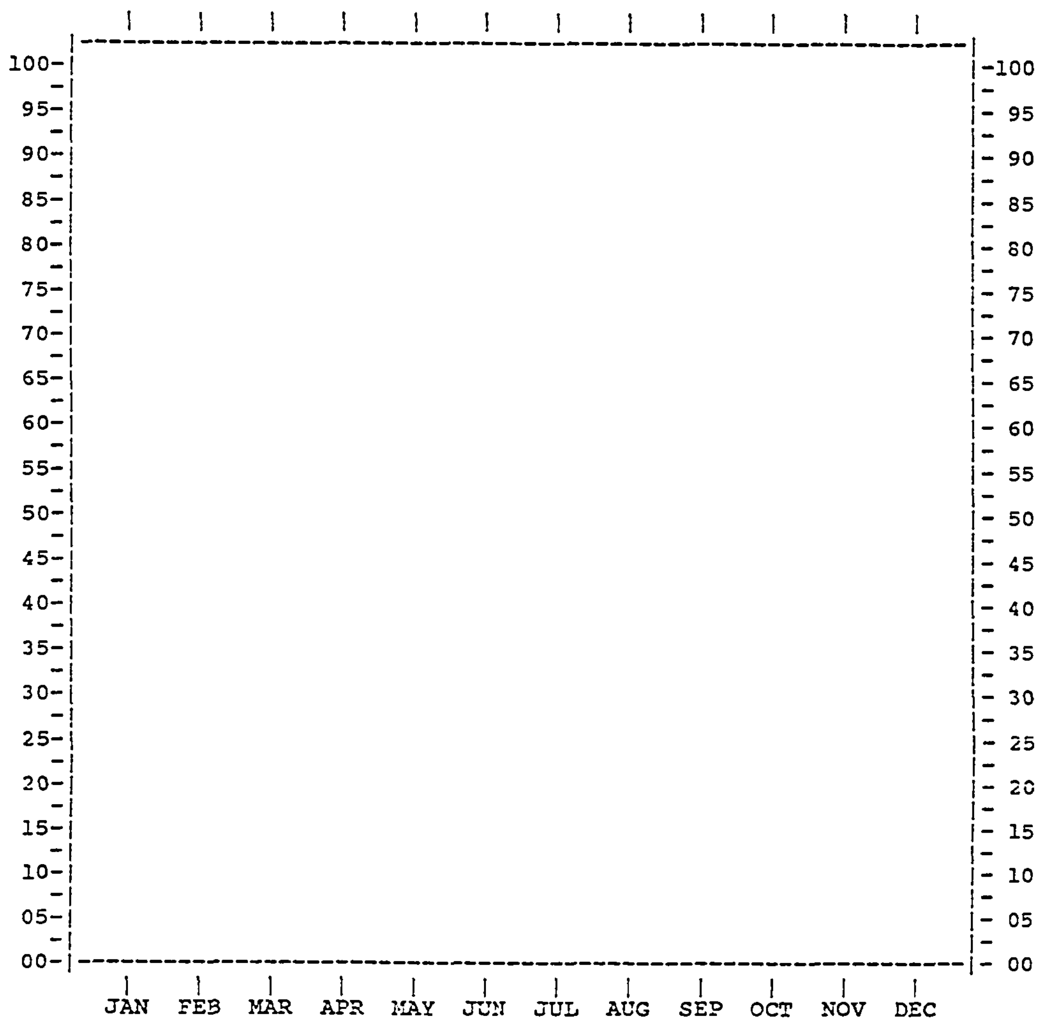
MONTHLY ANALYSIS OF QUALITY COSTS AS A PERCENTAGE OF REVENUE



QUARTERLY ANALYSIS OF QUALITY COSTS AS A PERCENTAGE OF
REVENUE

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         |     |     |     |     |     |     |     |     |     |     |     |
     |------------------------------------------------------------------------|
 100-|                                                                        |-100
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  95-|                                                                        |- 95
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  90-|                                                                        |- 90
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  85-|                                                                        |- 85
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  80-|                                                                        |- 80
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  75-|                                                                        |- 75
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  70-|                                                                        |- 70
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  60-|                                                                        |- 60
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  55-|                                                                        |- 55
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  40-|                                                                        |- 40
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  00-|------------------------------------------------------------------------|- 00
         |     |     |     |     |     |     |     |     |     |     |     |
        1ST   2ND   3RD   4TH   1ST   2ND   3RD   4TH   1ST   2ND   3RD   4TH
```

YEARLY ANALYSIS OF QUALITY COSTS AS A PERCENTAGE OF REVENUE

```
        |    |    |    |    |    |    |    |    |    |    |    |
    |------------------------------------------------------------|
100-|                                                            |-100
   -|                                                            |-
 95-|                                                            |- 95
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 90-|                                                            |- 90
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 85-|                                                            |- 85
   -|                                                            |-
 80-|                                                            |- 80
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 75-|                                                            |- 75
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 70-|                                                            |- 70
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 60-|                                                            |- 60
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 25-|                                                            |- 25
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 20-|                                                            |- 20
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 15-|                                                            |- 15
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 00-|------------------------------------------------------------|- 00
        |    |    |    |    |    |    |    |    |    |    |    |
       1ST  2ND  3RD  4TH  5TH  6TH  7TH  8TH  9TH 10TH 11TH 12TH
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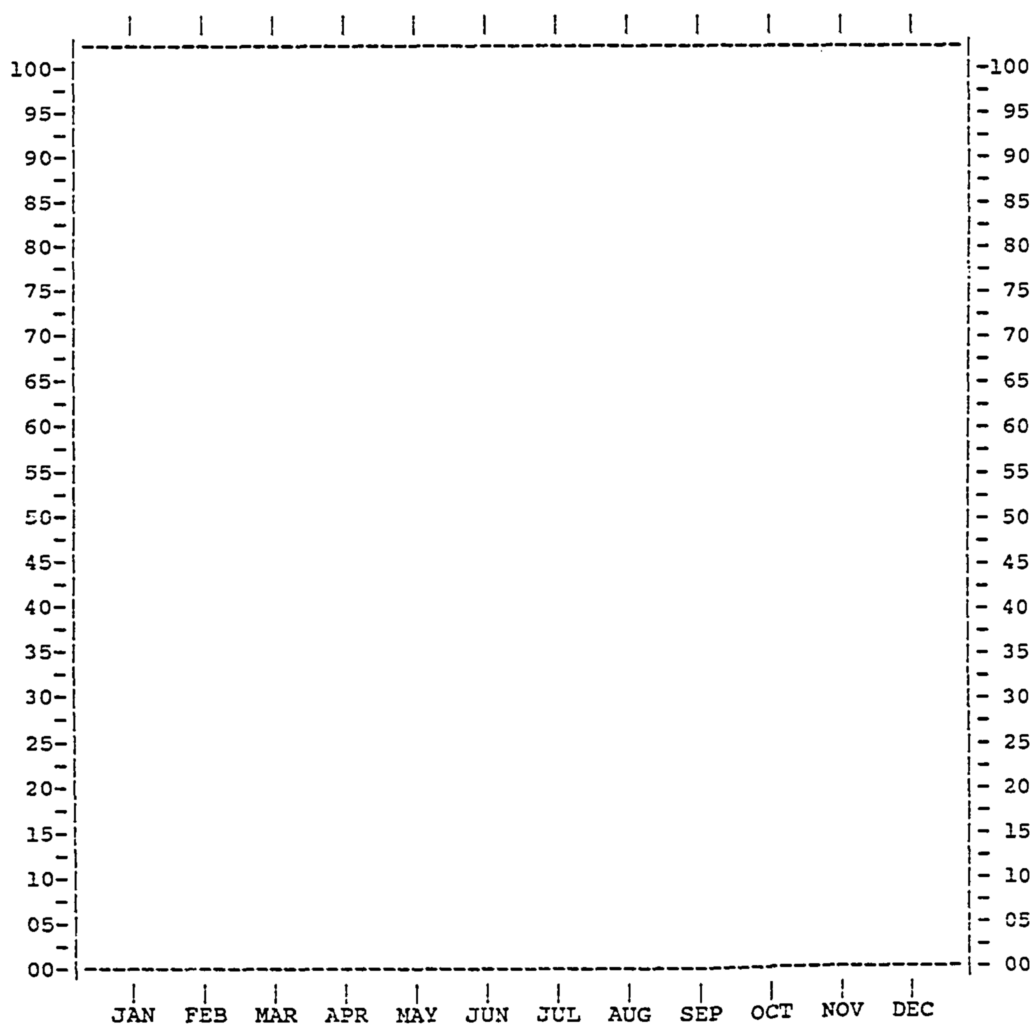
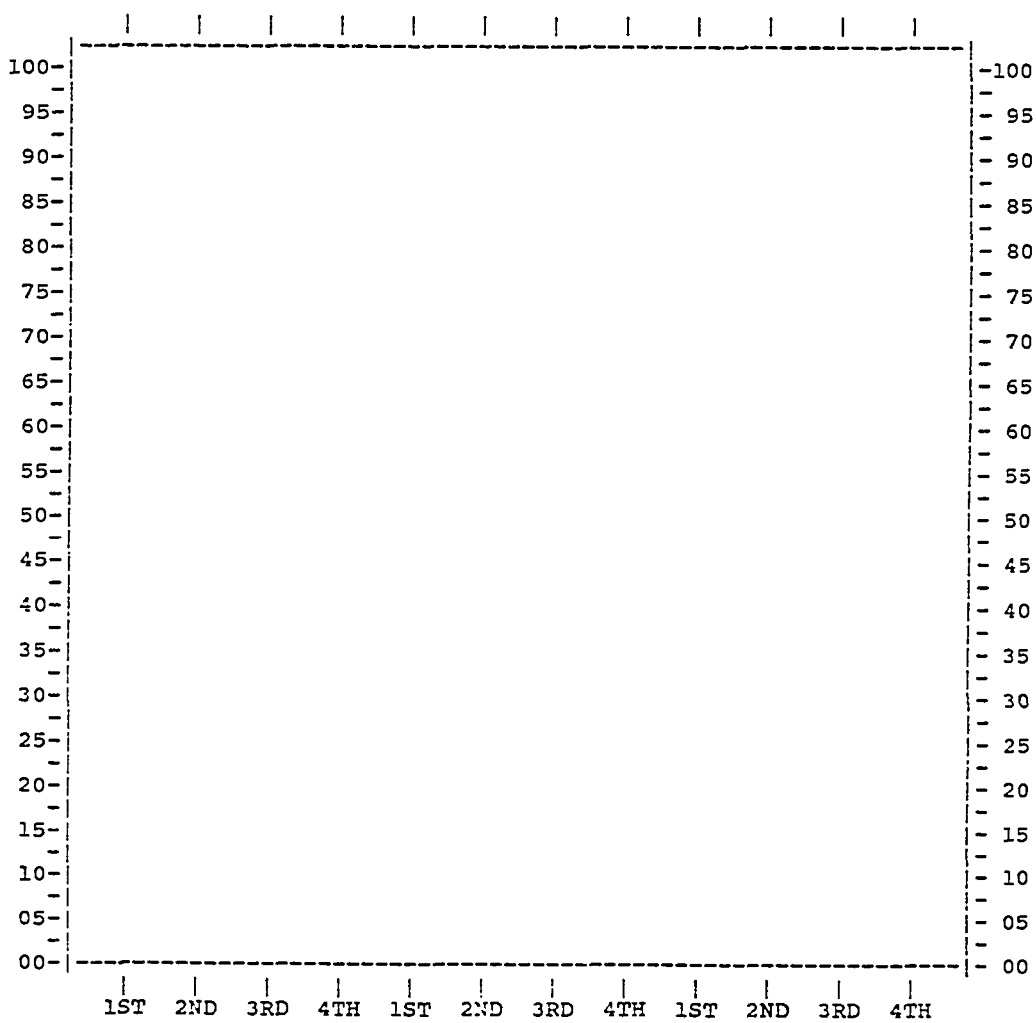
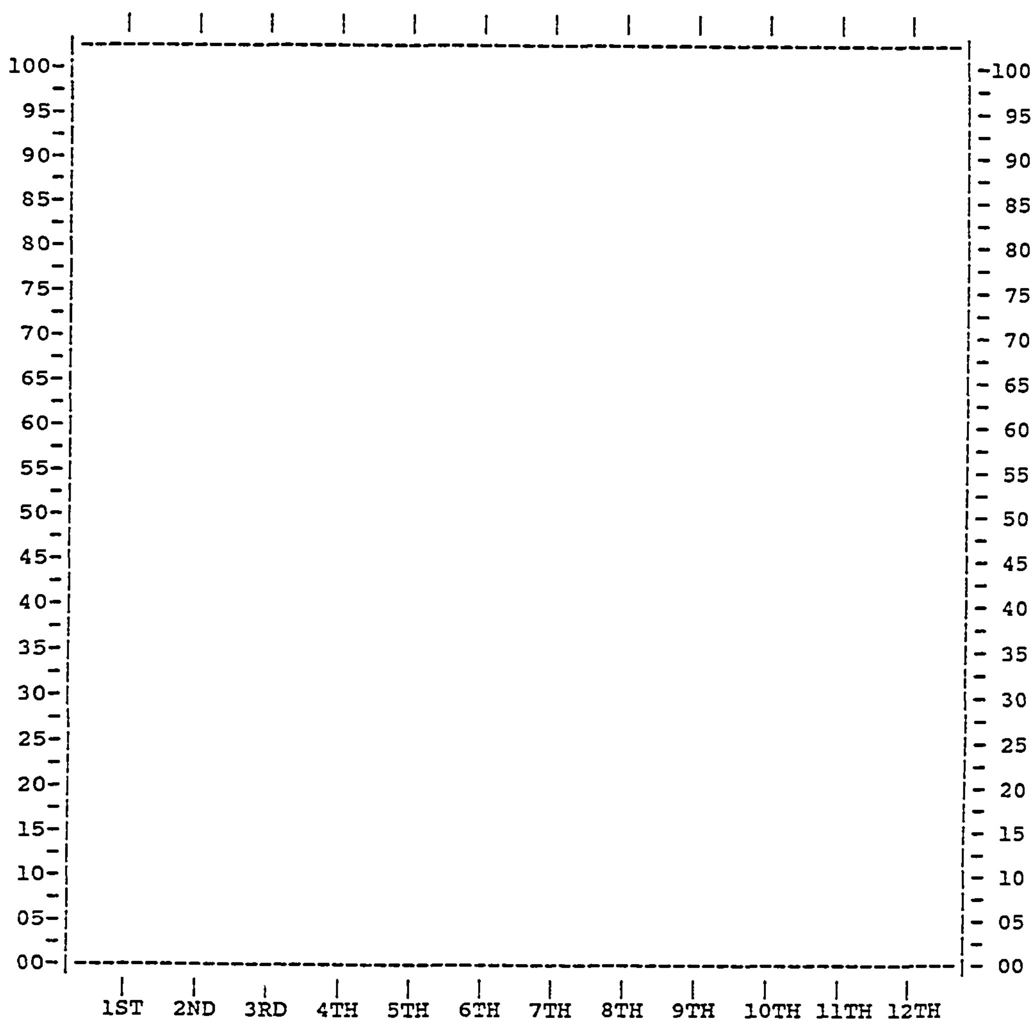
MONTHLY ANALYSIS OF QUALITY COSTS AS A PERCENTAGE OF ____________



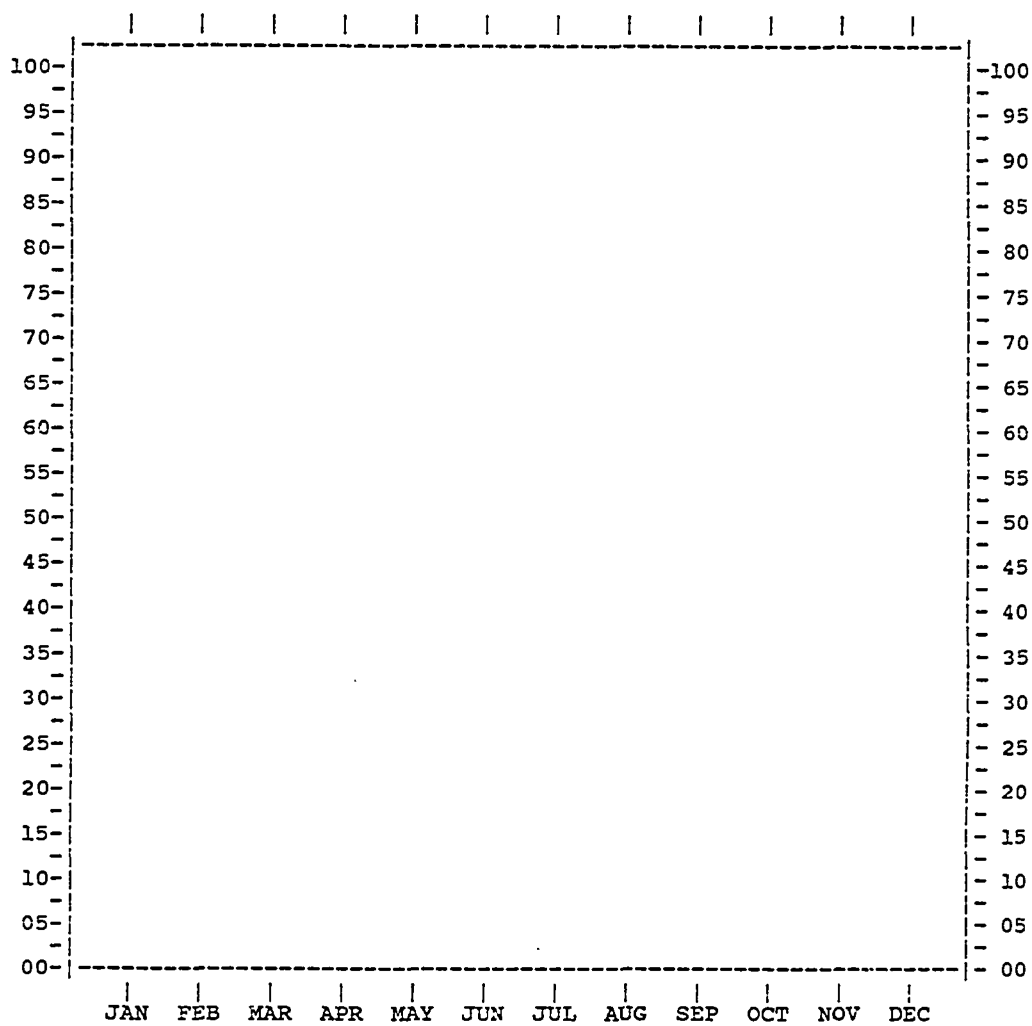
QUARTERLY ANALYSIS OF QUALITY COSTS AS A PERCENTAGE OF



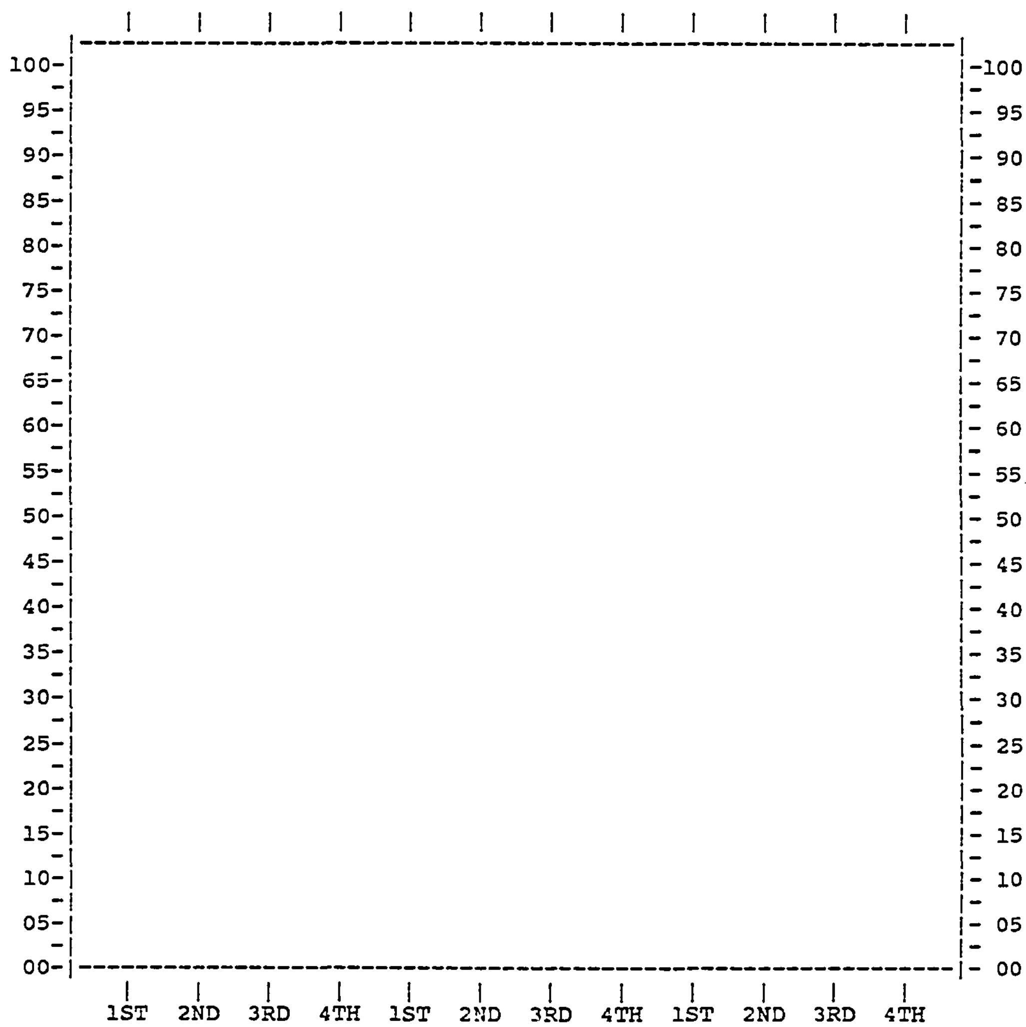
YEARLY ANALYSIS OF QUALITY COSTS AS A PERCENTAGE OF ____________________



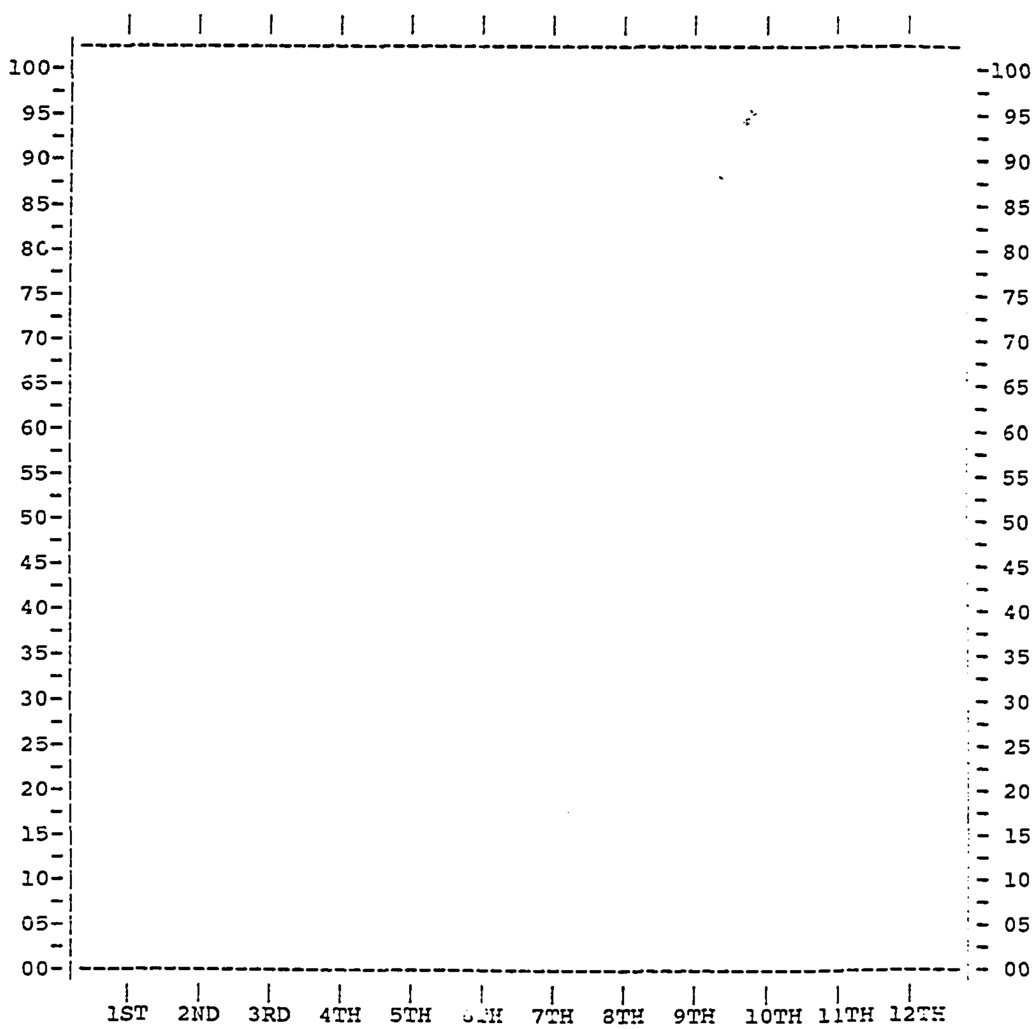
MONTHLY ANALYSIS OF TOTAL COST OF QUALITY FOR ______________________
BY COMPONENT QUALITY COSTS



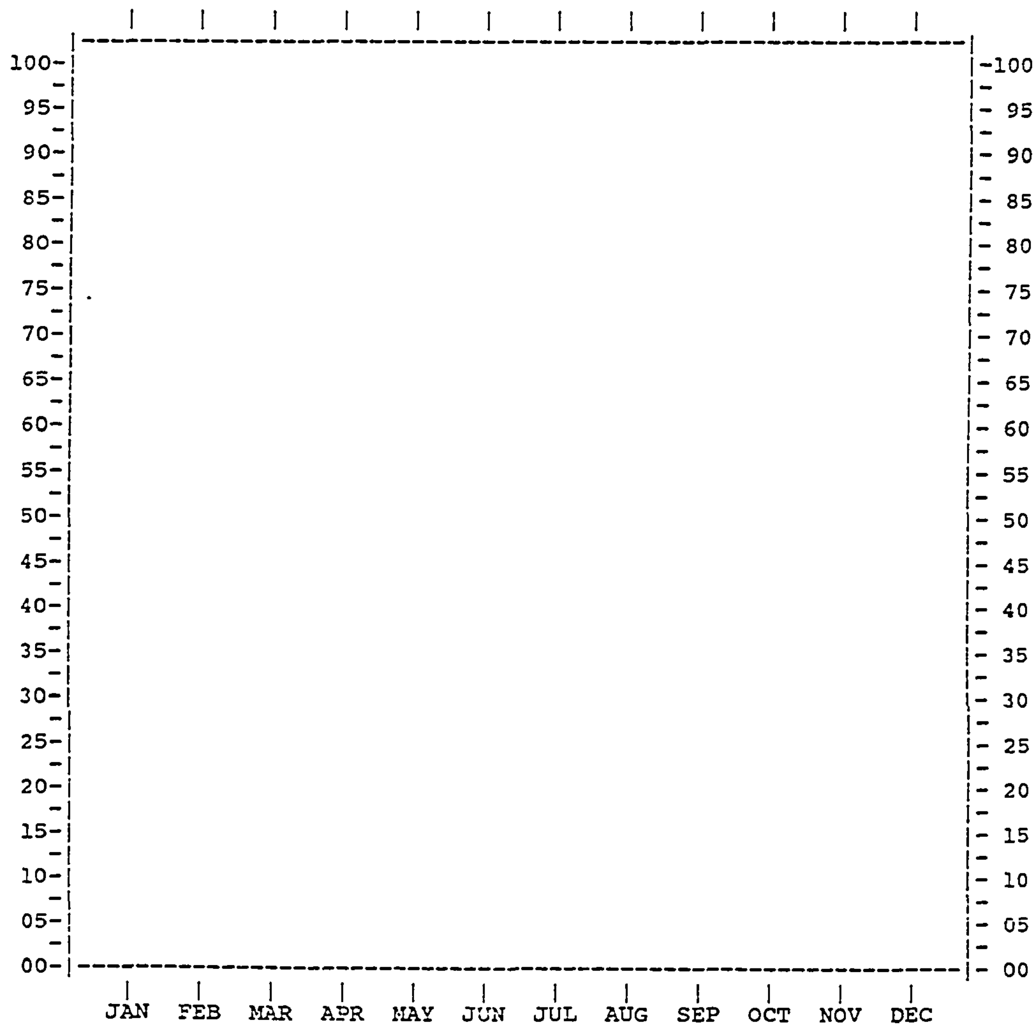
QUARTERLY ANALYSIS OF TOTAL COST OF QUALITY FOR ____________________
BY COMPONENT QUALITY COSTS



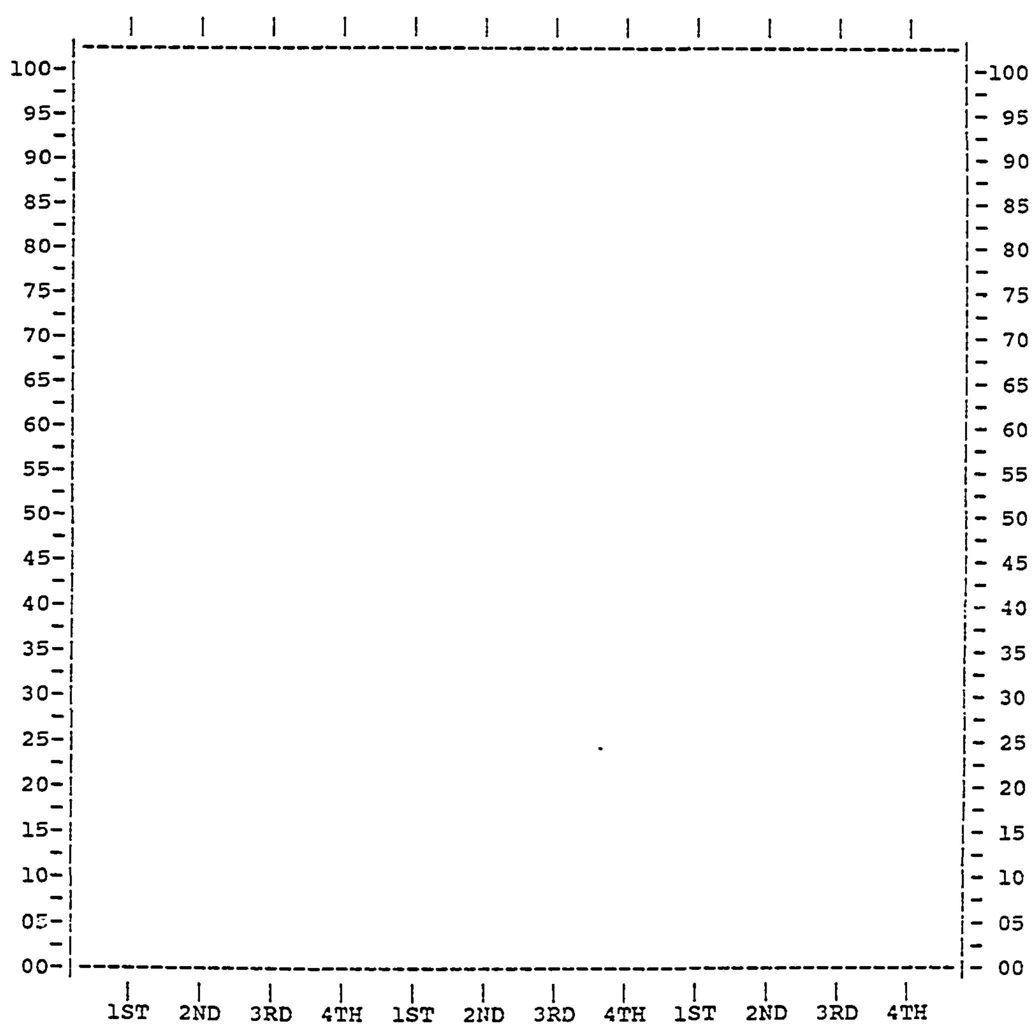
YEARLY ANALYSIS OF TOTAL COST OF QUALITY FOR ______________________
BY COMPONENT QUALITY COSTS



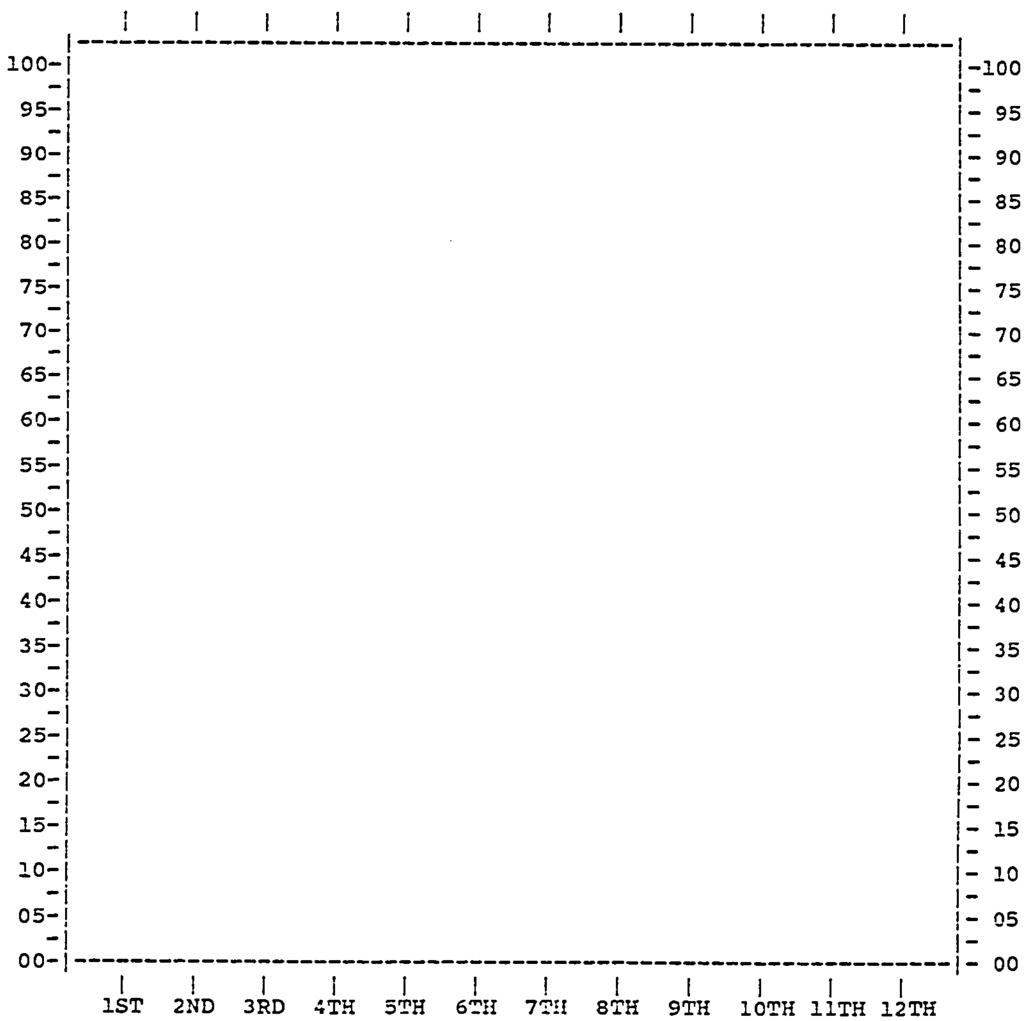
MONTHLY ANALYSIS OF QUALITY COSTS FOR ______________________
AS A PERCENTAGE OF MANUFACTURING COST



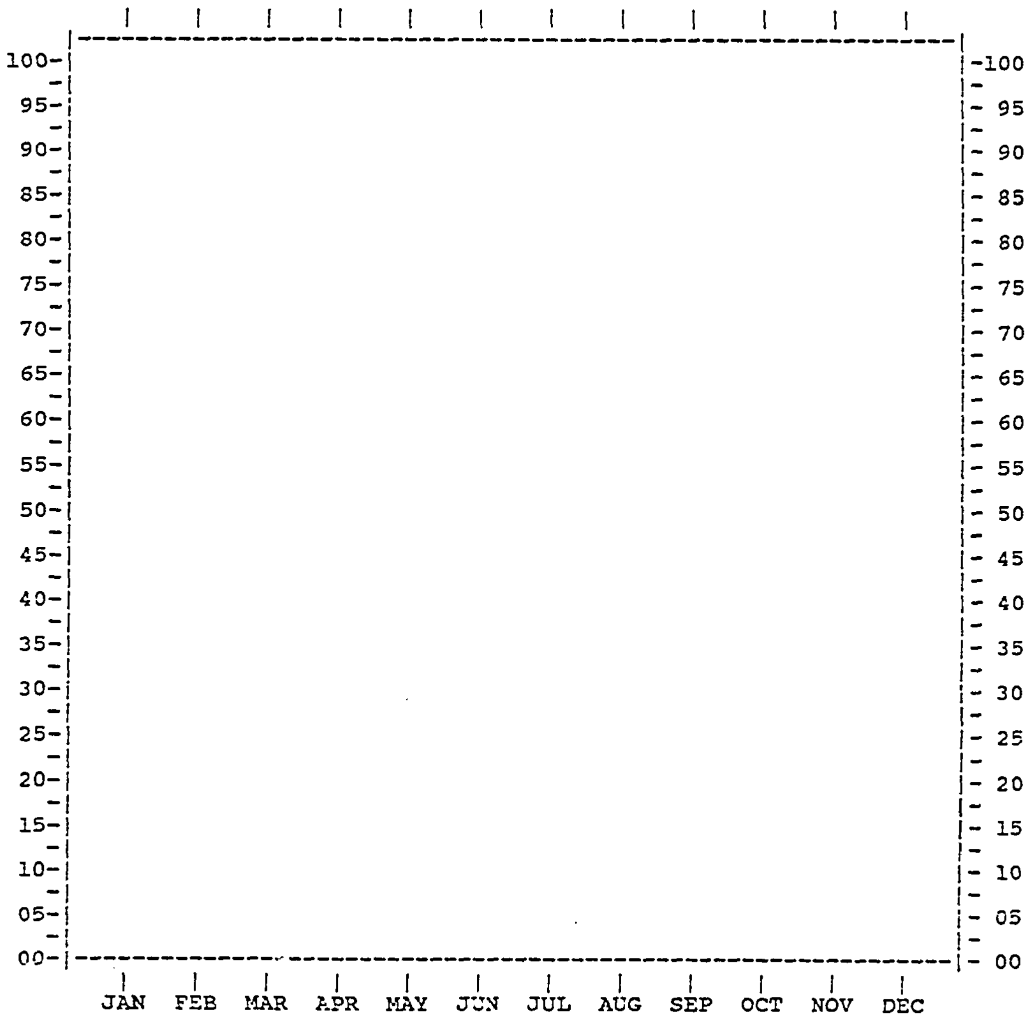
QUARTERLY ANALYSIS OF QUALITY COSTS FOR ______________________
AS A PERCENTAGE OF MANUFACTURING COSTS



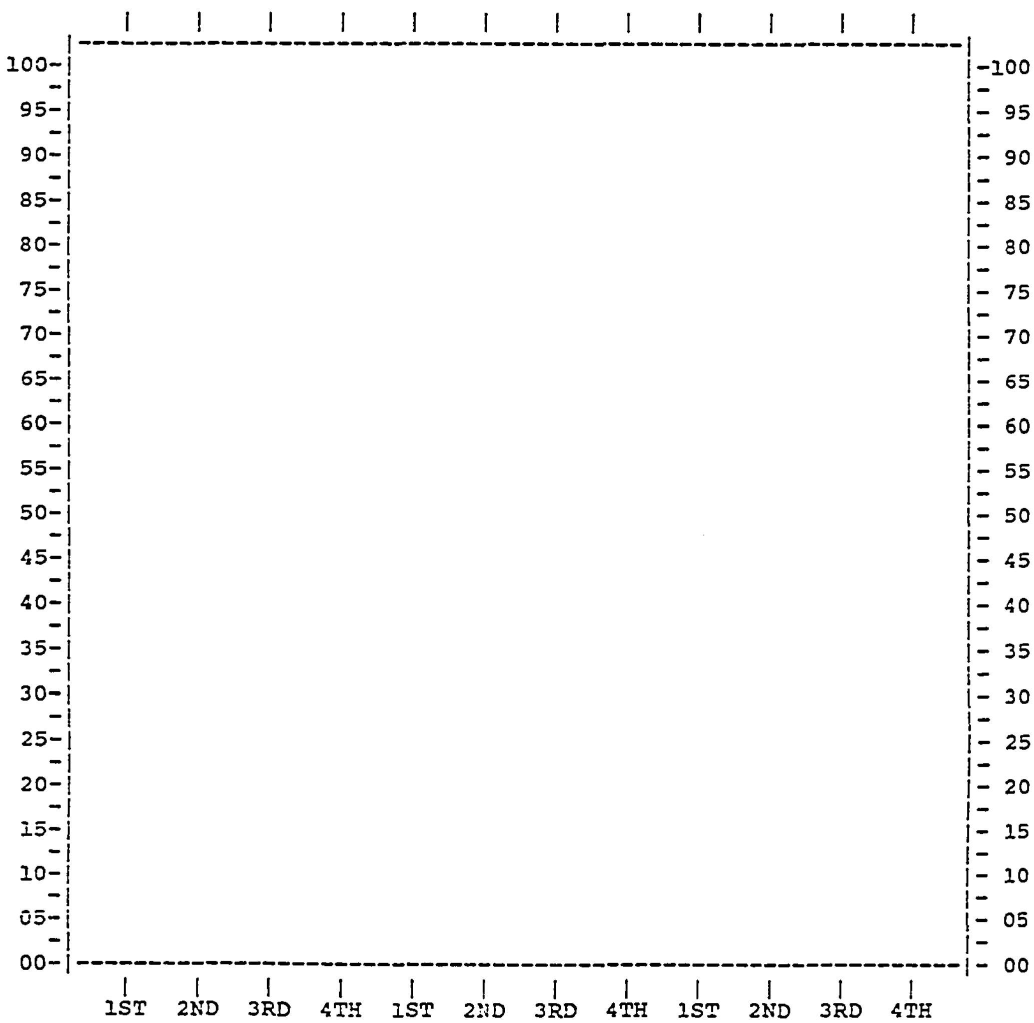
YEARLY ANALYSIS OF QUALITY COSTS FOR ____________________
AS A PERCENTAGE OF MANUFACTURING COSTS



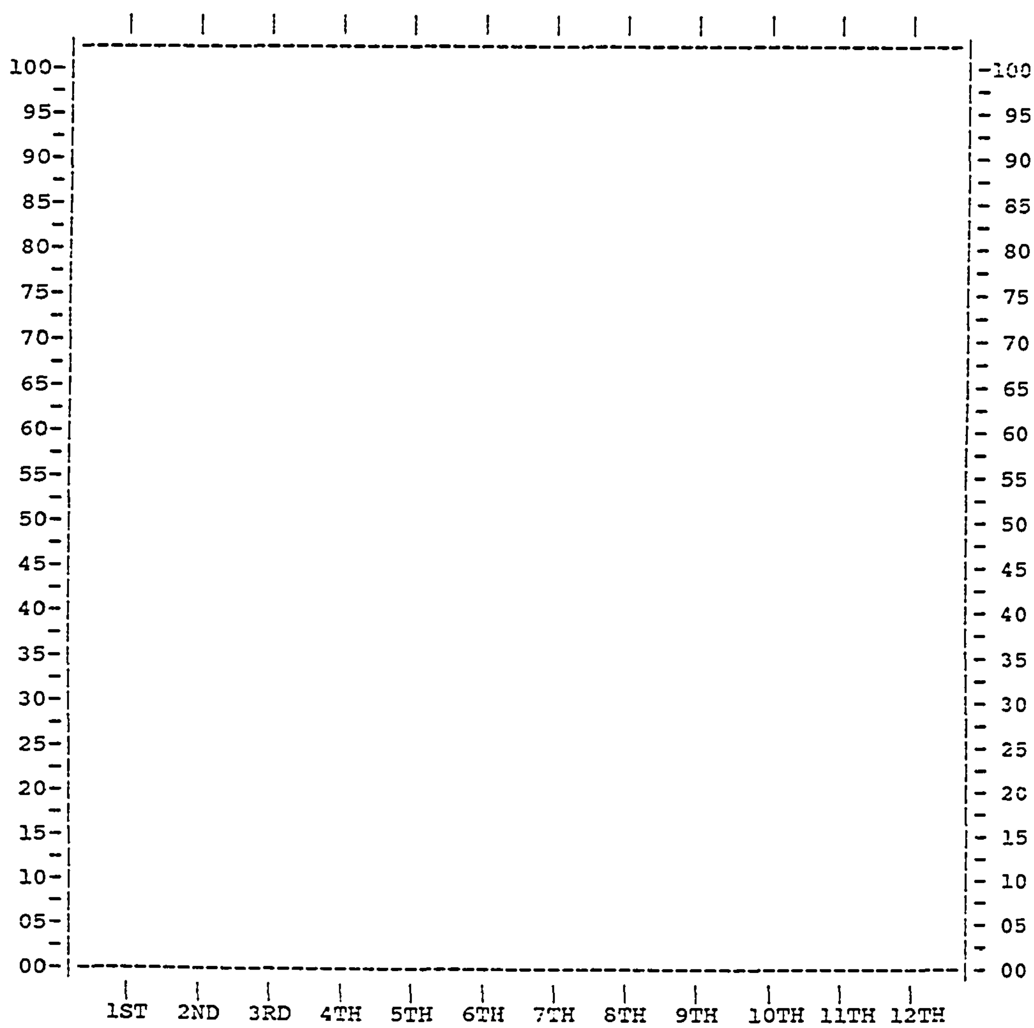
MONTHLY ANALYSIS OF QUALITY COSTS FOR ______________________
AS A PERCENTAGE OF SALES



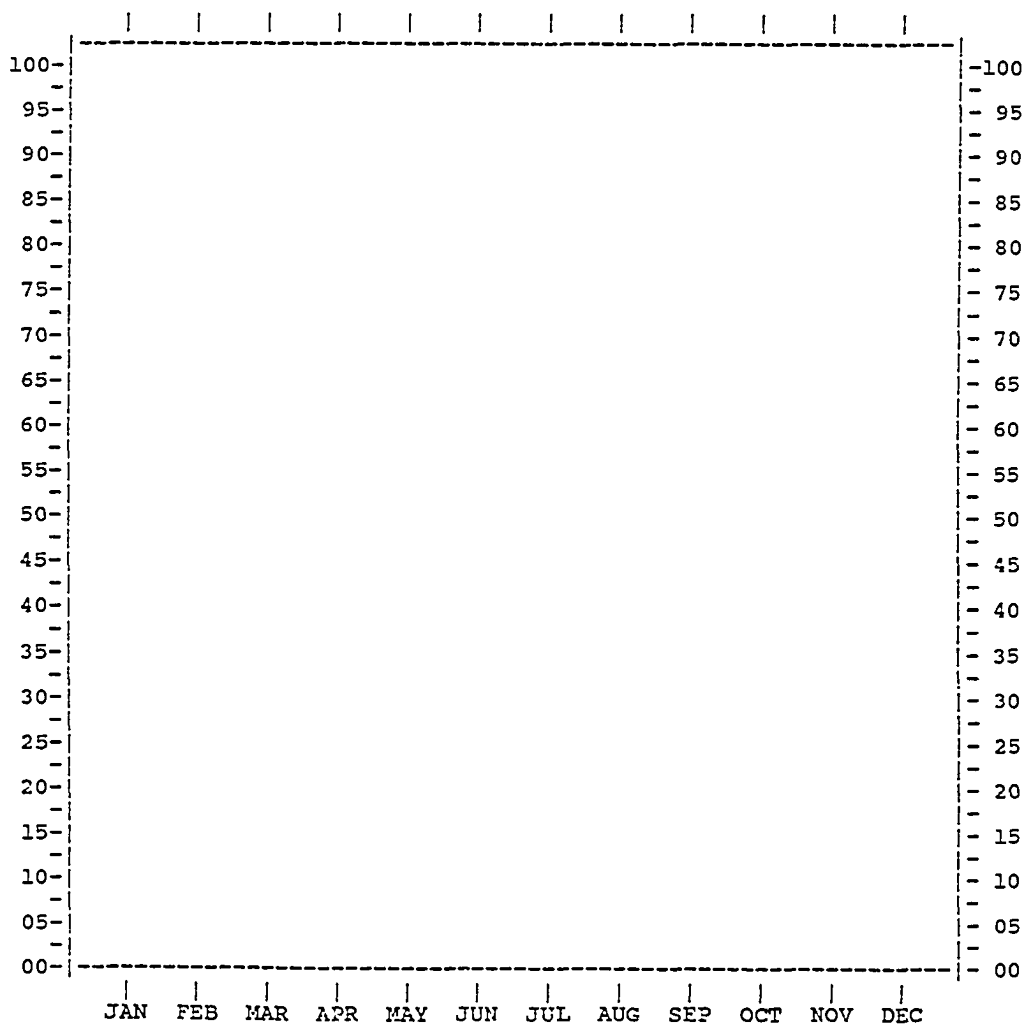
QUARTERLY ANALYSIS OF QUALITY COSTS FOR ____________________
AS A PERCENTAGE OF SALES



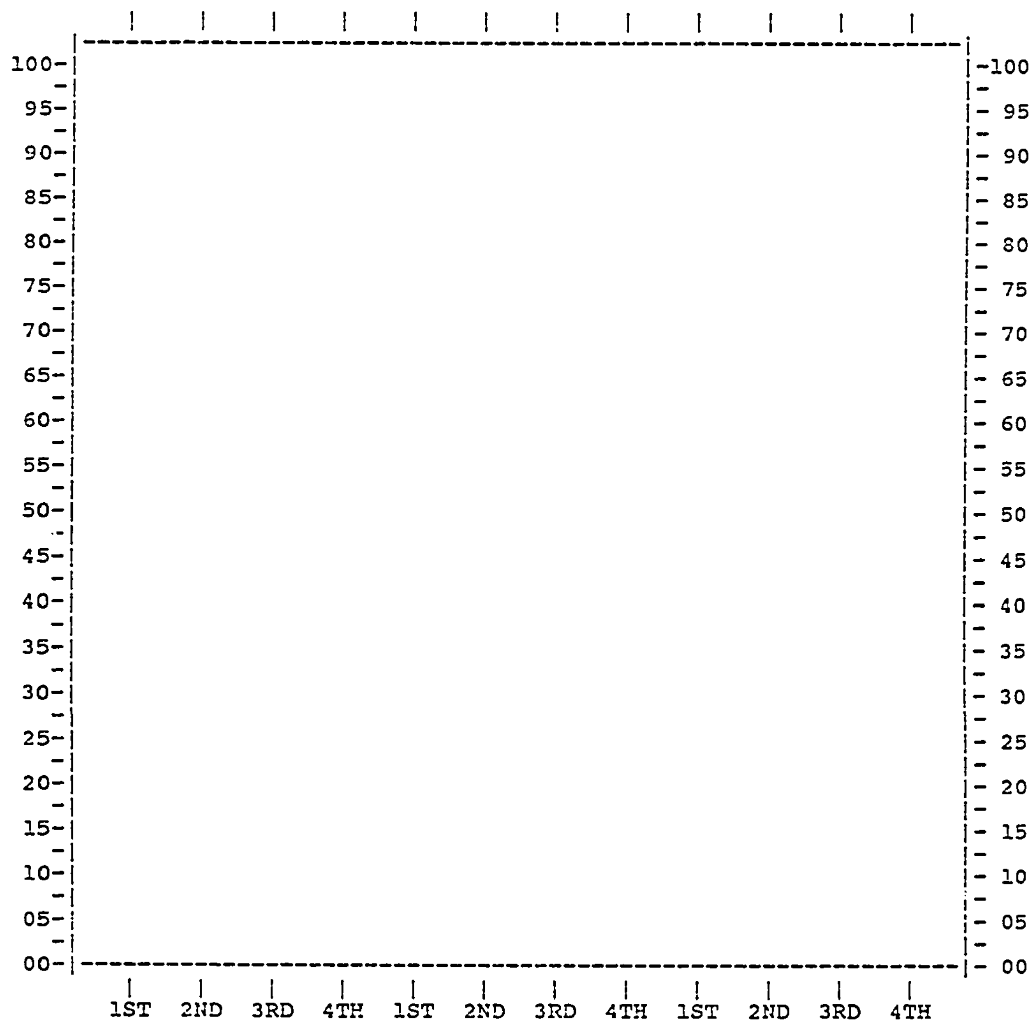
YEARLY ANALYSIS OF QUALITY COSTS AS A PERCENTAGE OF SALES



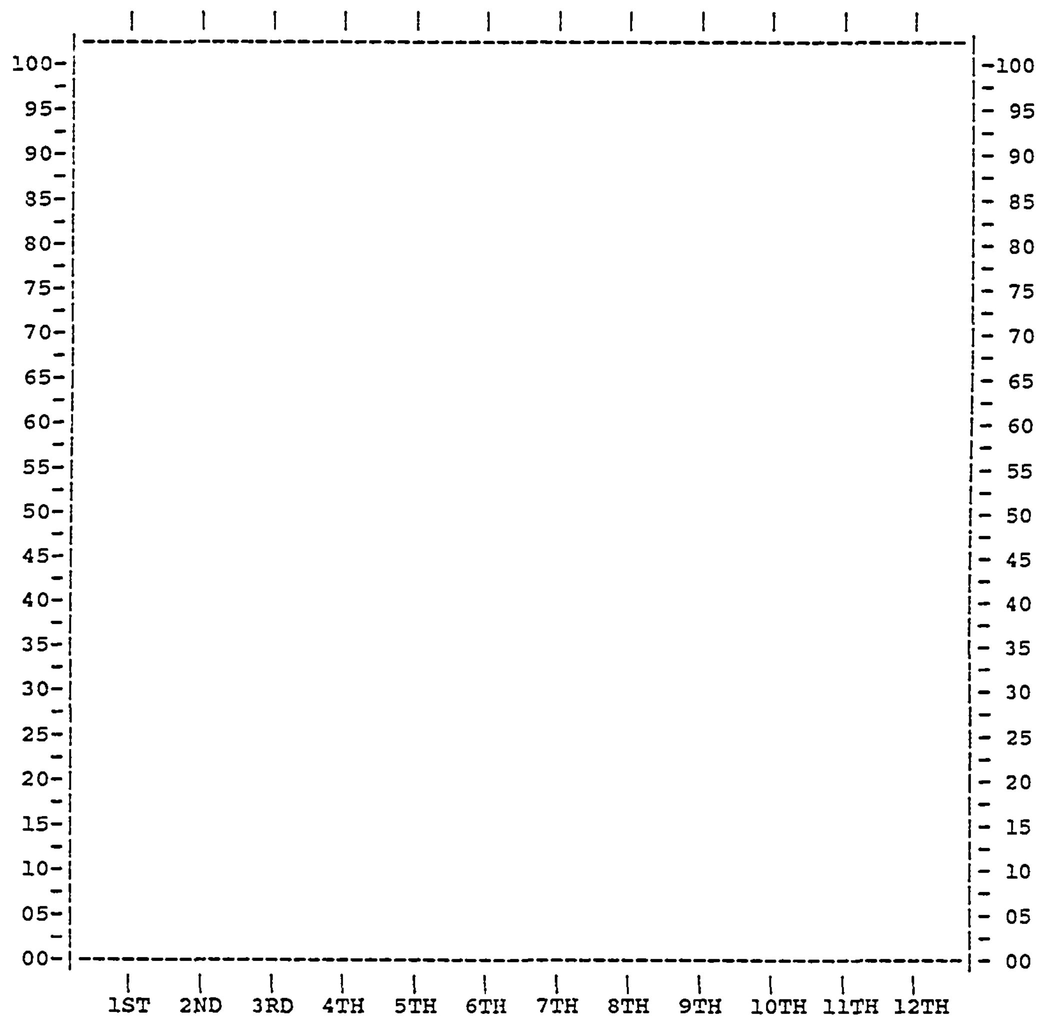
MONTHLY ANALYSIS OF QUALITY COSTS FOR ______________________________
AS A PERCENTAGE OF REVENUE



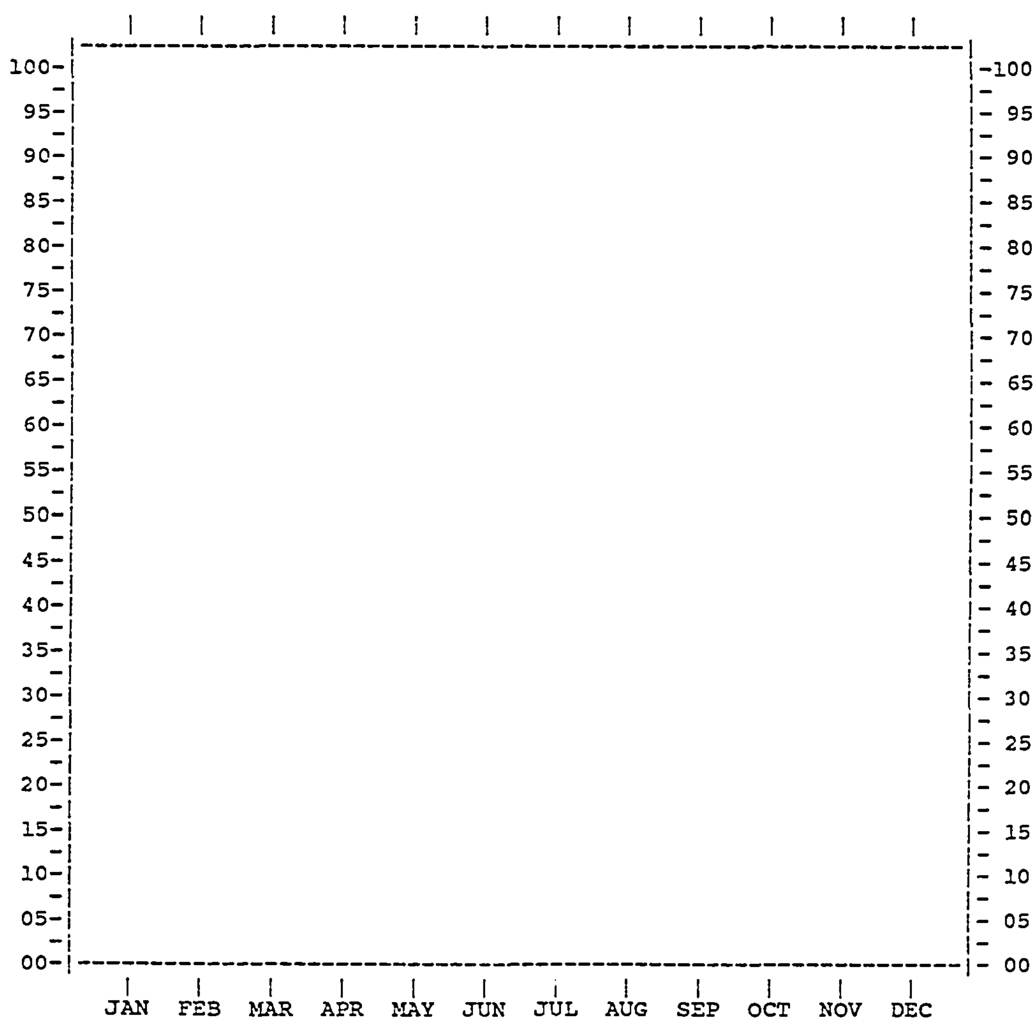
QUARTERLY ANALYSIS OF QUALITY COSTS FOR ______________________
AS A PERCENTAGE OF REVENUE



YEARLY ANALYSIS OF QUALITY COSTS FOR ______________________
AS A PERCENTAGE OF REVENUE



MONTHLY ANALYSIS OF QUALITY COSTS FOR ______________________
AS A PERCENTAGE OF ______________________



QUARTERLY ANALYSIS OF QUALITY COSTS FOR ______________________________
AS A PERCENTAGE OF ____

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        |    |    |    |    |    |    |    |    |    |    |    |
    |-------------------------------------------------------------|
100-|                                                             |-100
   -|                                                             |-
 95-|                                                             |- 95
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 75-|                                                             |- 75
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 70-|                                                             |- 70
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       1ST  2ND  3RD  4TH  1ST  2ND  3RD  4TH  1ST  2ND  3RD  4TH
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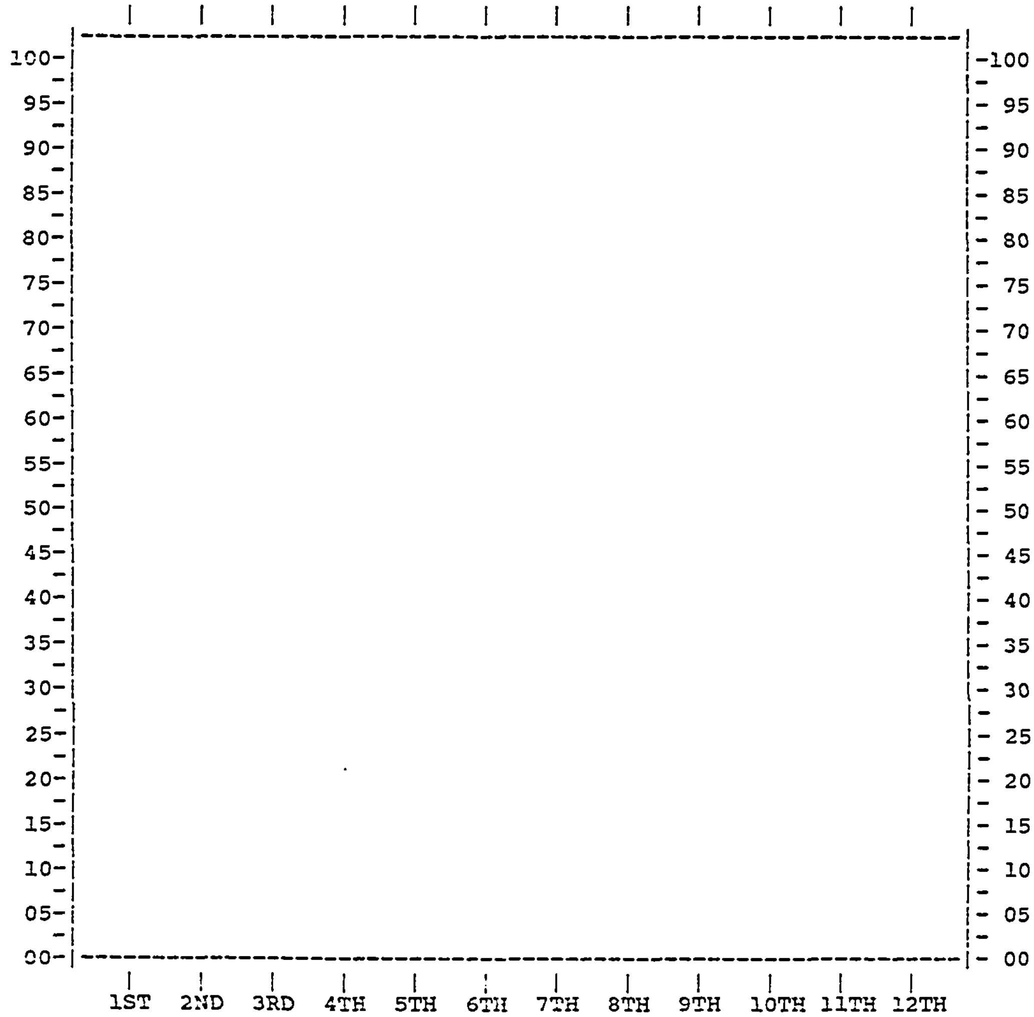
YEARLY ANALYSIS OF QUALITY COSTS FOR ______________________
AS A PERCENTAGE OF ______________________



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       |     |     |     |     |     |     |     |     |     |     |     |
      |------------------------------------------------------------------------|
100-|                                                                        |-100
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 95-|                                                                        |- 95
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 90-|                                                                        |- 90
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 85-|                                                                        |- 85
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 80-|                                                                        |- 80
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 40-|                                                                        |- 40
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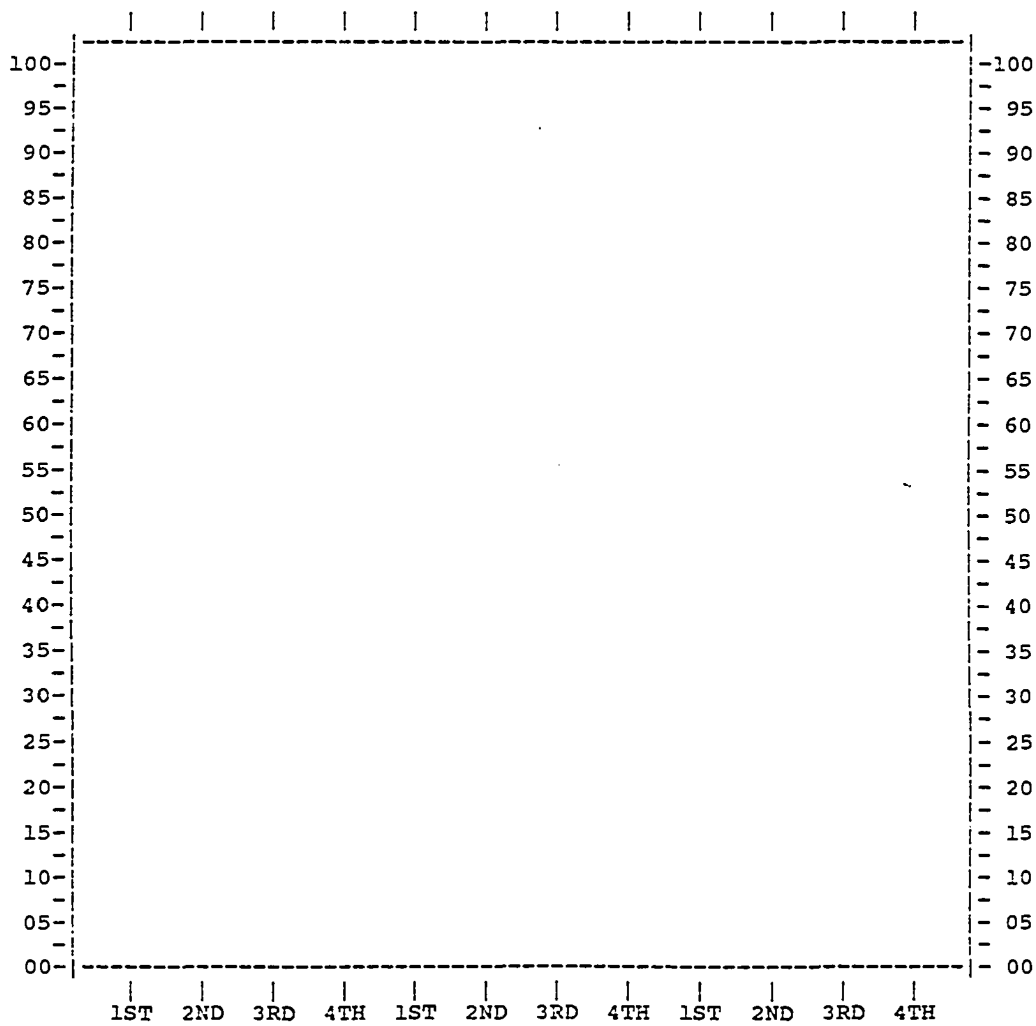
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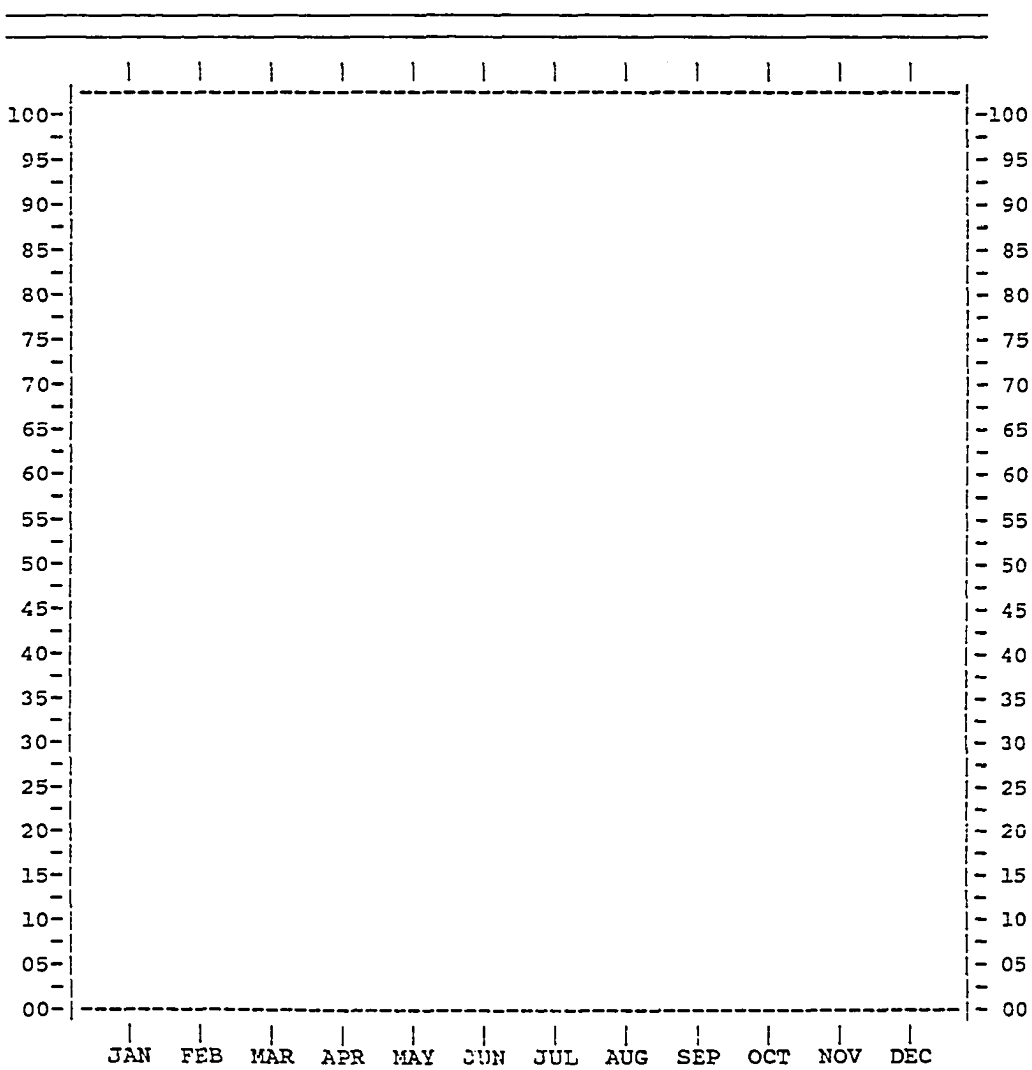
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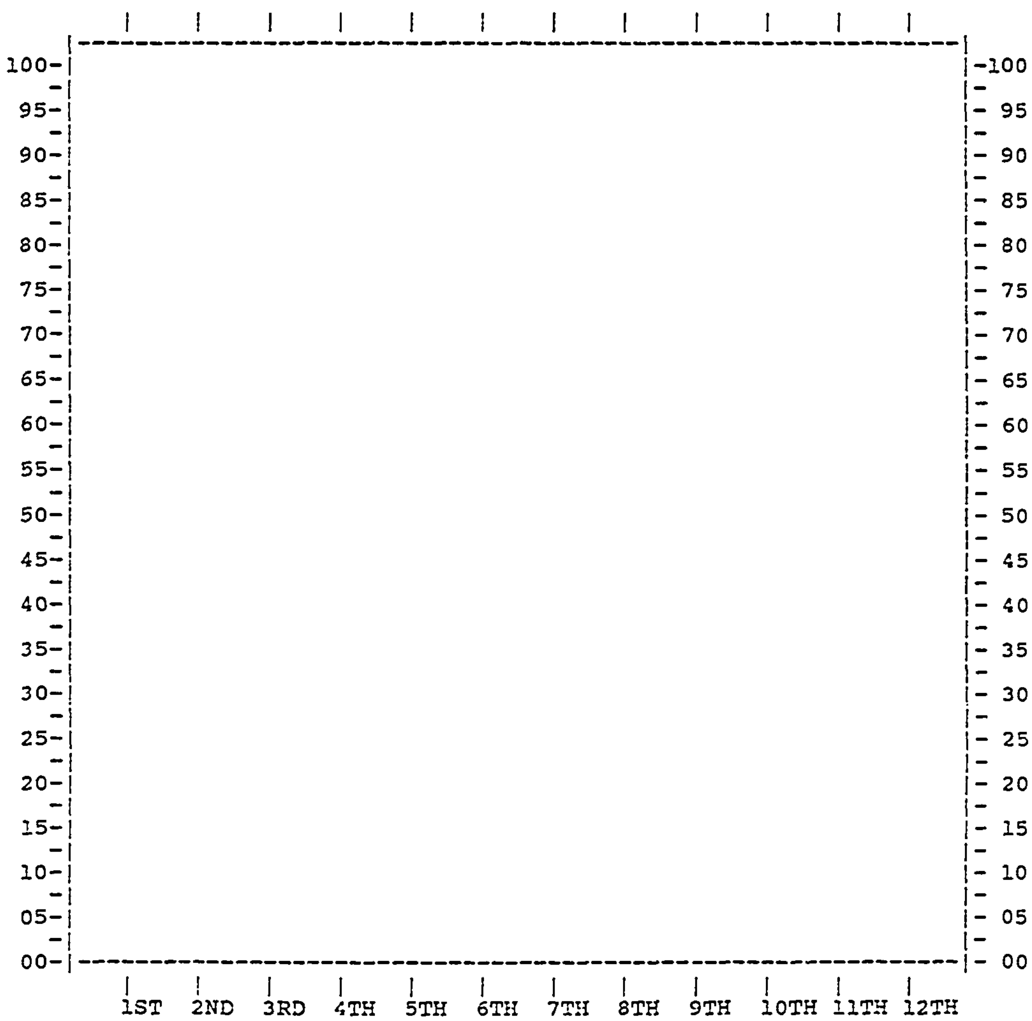
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STRUCTURED GLOSSARY

<u>Prevention Costs</u>	Efforts intended to prevent failures and to provide the economically optimum amount of appraisal.
Product Design (PPRDE)	Design efforts prior to production specifically related to increasing the quality of the product, process, or service and/or reducing quality costs.
R&D Quality (PRDQU)	R&D efforts prior to production specifically related to increasing the quality of the product, process, or service and/or reducing quality costs.
R&D Support (PRDSU)	R&D efforts during production specifically related to maintaining or increasing the quality of the product, process, or service and/or reducing quality costs.
Engineering Quality (PENQU)	Engineering efforts prior to production specifically related to increasing the quality of the product, process, or service and/or reducing quality costs.
Engineering Support (PENSU)	Engineering efforts during production specifically related to maintaining or increasing the quality of the product, process, or service and/or reducing quality costs.
Field Quality (PFIQU)	Field activity or field representive efforts prior to production specifically related to increasing the quality of the product, process, or service and/or reducing quality costs.
Field Support (PFISU)	Field activity or field representive efforts during production specifically related to maintaining or increasing the quality of the product, process, or service and/or reducing quality costs.
External Quality (PEXQU)	Externally obtained preproduction efforts specifically related to increasing the quality of the product, process, service and/or reducing quality costs.

STRUCTURED QUALITY COST GLOSSARY 2

External Support (PEXSU)	Externally obtained efforts during production specifically related to maintaining or increasing the quality of the product, process, or service and/or reducing quality costs.
Purchasing (PPURC)	Differential costs associated with obtaining identified vendor/supplier/product/material/ service to increase the quality of the product/ service and/or reduce quality costs.
Quality Planning (PQPLA)	The collective planning efforts of an identified quality unit to ensure that a product, process, or service will satisfy given needs.
Quality Administration (PQADM)	The collective administrative activities of an identified quality unit.
Quality Training (PQTRA)	Training directed toward increasing the quality of the product, process, or service and/or reducing quality costs.
Quality Audits Internal (PQAIN)	A systematic internal examination of organizational acts and decisions in respect to the quality of the product, process, or service.
Quality Audits External (PQAEX)	A systematic examination of the acts and decisions of another organization in respect to the quality of the product, process, or service.
Quality Related Maintenance (PQRMA)	Maintenance costs which are specifically dedicated toward or the portion of a maintenance cost which can be specifically identified as incurred to improve the quality of the product, process, or service and/or reducing quality costs.
Vendor Certification (PVCER)	The procedure and action by a duly authorized body of determining, verifying, and attesting in writing to vendor qualifications of personnel, processes, procedures, or items in accordance with applicable requirements.

STRUCTURED QUALITY COST GLOSSARY 3

____________ (PRONE)	____________
____________ (PRTWO)	____________
____________ (PRTHR)	____________
____________ (PRFOU)	____________
Appraisal Costs	Costs associated with testing and inspecting the product to assure that prescribed quality levels are met.
Incoming Inspection (AININ)	Examination of received items to determine the degree and extent of acceptability.
Product Qualification Tests (APQTE)	A quantitative assessment of conformance to required product characteristics.
Material/Parts (AMP--)	Manufactured or purchased items intended for inclusion in identified end-items or for repair spares.
Assembly/End-Item (AAE--)	Identified units or end-items which are sold in the normal course of business.
In-Process Inspection and Test (---IP)	Certification and verification which takes place during manufacturing.
Final Inspection and Test (---FI)	Certification and verification which takes place upon or after completion of manufacturing.

STRUCTURED QUALITY COST GLOSSARY 4

Repair Test and Inspection (ARTIN)	Certification and verification which takes place after a repair action.
Metrology (AMETR)	Analysis of quality characteristics for both control and improvement or the reduction of quality costs.
Metrology Maintenance (AMETM)	Maintenance and repair associated with the metrology program.
______ (APONE)	______
______ (APTWO)	______
______ (APTHR)	______
______ (APFOU)	______
<u>Internal Failure Costs</u>	Costs resulting from product failing to meet requirements prior to delivery to the initial customer(e.g., scrap, rework, retest).
Design Failure Costs (IDEFC)	Efforts associated with processing, reviewing, and making determinations related to discrepant parts or assemblies stemming from design related cause.
Investigation (IINVE)	Efforts of reviewing, checking, and establishing causal nature of quality related problems.
ECR/ECN Cost (IEECO)	Portion of the engineering change system efforts directly attributable to quality.

Supplier Reviews (ISURE)	Efforts associated with processing and making determinations related to supplier/vendor provided discrepant materials, parts, or assemblies.
Material Review and Action (IMRAA)	Efforts associated with processing and making determinations related to discrepant materials, parts or assemblies.
Rework (IREWO)	Efforts associated with bringing material, part or assembly into blueprint specification or configuration.
Repair (IREPA)	Efforts associated with a material, part or assembly which meets blueprint specifications or configuration but does not function.
Reinspection (IREIN)	Efforts associated with reinspection due to rework, repair, design change, engineering change orders/notices or failures.
Product Awaiting Disposition (IPADI)	Cost of lost revenue/sales due to product being maintained in inventory for quality related reasons.
Reclassification (IRECL)	Non-conforming material, part or assembly which is remanufactured or reworked to conform to the specifications of another material, part or assembly.
Excess Manufacturing Cost (IEXMC)	Portion of manufacturing costs directly incurred as a result of quality deficiencies.
Excess Manufacturing Burden (IEXMB)	Portion of manufacturing burden directly incurred as a result of quality deficiencies.
Additional Related Expenses (IADRE)	Extraordinary expenses stemming from an internal failure and incurred to meet contractual obligations or customer requirements.
Scrap (ISCRA)	Efforts and costs associated with the disposition of materials, parts or assemblies which cannot be reclassified, reworked or repaired.

(INONE)	
(INTWO)	
(INTHR)	
(INFOU)	
<u>External Failure Costs</u>	Costs resulting from product failing to meet requirements after delivery to the initial customer (e.g., product service, warranty and returns, direct costs and allowances, product recall costs, and insurance). In industries where user liability costs are dramatically increasing, care should be taken to provide for realistic future costs, not limited to past actual cost experience.
Warranty Administration (EWAAD)	The collective administrative efforts of an identified warranty unit and field service warranty activities.
In-Warranty Repairs/Parts (EIWRP)	Attendant service, repair, replacement, and transportation activities associated with in-warranty material, parts or assemblies.
Out-of-Warranty Repair/Parts (EOWRP)	Attendant service, repair, replacement, and transportation activities associated with out-of-warranty material, parts, or assemblies.
Field Service (EFISE)	The collective efforts of field service activities in investigating and adjusting complaints stemming from product service.

STRUCTURED QUALITY COST GLOSSARY 7

Applications (EAPPL)	Customer initiated return of product for reason of unsuitability for intended purpose.
Returns (ERETU)	Customer or distribution network initiated returns of parts, assemblies, or product due to nonconformance with concurrent loss of sale.
Reclassification (ERECL)	Nonconforming material, part, or assembly which is remanufactured or reworked to the classification and specifications of another material, part, or assembly.
Recalls (ERECA)	Manufacturer initiated actions to withdraw parts, assembly or product from service and distribution network.
Additional Related Expenses (EADRE)	Extraordinary expenses stemming from an external failure and incurred to meet contractual obligations or customer requirements.
Liability Reserve (ELIAB)	Efforts and costs associated with the prevention and minimization of liability related to products and services.
______ (EXONE)	______
______ (EXTWO)	______
______ (EXTHR)	______
______ (EXFOU)	______

GLOSSARY

Additional Related Expenses (EADRE) (IADRE)	Extraordinary expenses stemming from an external failure and incurred to meet contractual obligations or customer requirements. Internal Failure - External Failure
Applications (EAPPL)	Customer initiated return of product for reason of unsuitability for intended purpose. External Failure
<u>Appraisal Costs</u> (A----)	Costs associated with testing and inspecting the product to assure that prescribed quality levels are met.
Appraisal Four (APFOU)	______________________________
Appraisal One (APONE)	______________________________
Appraisal Three (APTHR)	______________________________
Appraisal Two (APTWO)	______________________________
Assembly/End-Item (AAE--)	Identified units or end-items which are sold in the normal course of business. Appraisal
Design Failure Costs (IDEFC)	Efforts associated with processing, reviewing, and making determinations related to discrepant parts or assemblies stemming from design related cause. Internal Failure
ECR/ECN Cost (IEECO)	Portion of the engineering change system efforts directly attributable to quality. Internal Failure
Engineering Quality (PENQU)	Engineering efforts prior to production specifically related to increasing the quality of the product, process, or service and/or reducing quality costs. Prevention

ALPHABETICAL QUALITY COST GLOSSARY 2

Engineering Support (PENSU)	Engineering efforts during production specifically related to maintaining or increasing the quality of the product, process, or service and/or reducing quality costs. Prevention
Excess Manufacturing Burden (IEXMB)	Portion of manufacturing burden directly incurred as a result of quality deficiencies. Internal Failure
Excess Manufacturing Cost (IEXMC)	Portion of manufacturing costs directly incurred as a result of quality deficiencies. Internal Failure
<u>External Failure Costs</u> (E----)	Costs resulting from product failing to meet requirements after delivery to the initial customer (e.g., product service, warranty and returns, direct costs and allowances, product recall costs, and insurance). In industries where user liability costs are dramatically increasing, care should be taken to provide for realistic future costs, not limited to past actual cost experience.
External Four (EXFOU)	______
External One (EXONE)	______
External Quality (PEXQU)	Externally obtained preproduction efforts specifically related to increasing the quality of the product, process, service and/or reducing quality costs. Prevention
External Support (PEXSU)	Externally obtained efforts during production specifically related to maintaining or increasing the quality of the product, process, or service and/or reducing quality costs. Prevention
External Three (EXTHR)	______

External Two (EXTWO)	___
Field Quality (PFIQU)	Field activity or field representative efforts prior to production specifically related to increasing the quality of the product, process, or service and/or reducing quality costs. Prevention
Field Service (EFISE)	The collective efforts of field service activities in investigating and adjusting complaints stemming from product service. External Failure
Field Support (PFISU)	Field activity or field representative efforts during production specifically related to maintaining or increasing the quality of the product, process, or service and/or reducing quality costs. Prevention
Final Inspection and Test (AAEFI)(AMPFI)	Certification and verification which takes place upon or after completion of manufacturing. Appraisal
Incoming Inspection (AININ)	Examination of received items to determine the degree and extent of acceptability. Appraisal
In-Process Inspection and Test (AAEIP)(AMPIP)	Certification and verification which takes place during manufacturing. Appraisal
Internal Failure Costs (I----)	Costs resulting from product failing to meet requirements prior to delivery to the initial customer (e.g., scrap, rework, retest).
Internal Four (INFOU)	___
Internal One (INONE)	___
Internal Three (INTHR)	___

ALPHABETICAL QUALITY COST GLOSSARY 4

Internal Two (INTWO)	______________________
In-Warranty Repairs/Parts (EIWRP)	Attendant service, repair, replacement, and transportation activities associated with in-warranty material, parts or assemblies. External Failure
Investigation (IINVE)	Efforts of reviewing, checking, and establishing causal nature of quality related problems. Internal Failure
Liability Reserve (ELIAB)	Efforts and costs associated with the prevention and minimization of liability related to products and services. External Failure
Material/Parts (AMP--)	Manufactured or purchased items intended for inclusion in identified end-items or for repair spares. Appraisal
Material Review and Action (IMRAA)	Efforts associated with processing and making determinations related to discrepant materials parts or assemblies. Internal Failure
Metrology (AMETR)	Analysis of quality characteristics for both control and improvement or the reduction of quality costs. Appraisal
Metrology Maintenance (AMETM)	Maintenance and repair associated with the metrology program. Appraisal
Out-of-Warranty Repair/Parts (EOWRP)	Attendant service, repair, replacement, and transportation activities associated with out-of-warranty material, parts, or assemblies. External Failure
<u>Prevention Costs</u> (P----)	Efforts intended to prevent failures and to provide the economically optimum amount of appraisal.
Prevention Four (PRFOU)	______________________

ALPHABETICAL QUALITY COST GLOSSARY 5

Prevention One (PRONE)	______________________
Prevention Three (PRTHR)	______________________
Prevention Two (PRTWO)	______________________
Product Awaiting Disposition (IPADI)	Cost of lost revenue/sales due to product being maintained in inventory for quality related reasons. Internal Failure
Product Design (PPRDE)	Design efforts prior to production specifically related to increasing the quality of the product, process, or service and/or reducing quality costs. Prevention
Product Qualification Tests (APQTE)	A quantitative assessment of conformance to required product characteristics. Appraisal
Purchasing (PPURC)	Differential costs associated with obtaining identified vendor/supplier/product/material/ service to increase the quality of the product/ service and/or reduce quality costs. Prevention
Quality Administration (PQADM)	The collective administrative activities of an identified quality unit. Prevention
Quality Audits External (PQAEX)	A systematic examination of the acts and decisions of another organization in respect to the quality of the product, process, or service. Prevention
Quality Audits Internal (PQAIN)	A systematic internal examination of organizational acts and decisions in respect to the quality of the product, process, or service. Prevention
Quality Planning (PQPLA)	The collective planning efforts of an identified quality unit to ensure that a product, process, or service will satisfy given needs. Prevention

Quality Related Maintenance (PQRMA)	Maintenance costs which are specifically dedicated toward or the portion of a maintenance cost which can be specifically identified as incurred to improve the quality of the product, process, or service and/or reducing quality costs. Prevention
Quality Training (PQTRA)	Training directed toward increasing the quality of the product, process, or service and/or reducing quality costs. Prevention
R&D Quality (PRDQU)	R&D efforts prior to production specifically related to increasing the quality of the product, process, or service and/or reducing quality costs. Prevention
R&D Support (PRDSU)	R&D efforts during production specifically related to maintaining or increasing the quality of the product, process, or service and/or reducing quality costs. Prevention
Recalls (ERECA)	Manufacturer initiated action to withdraw part, assembly or product from service and distribution network. External Failure
Reclassification (ERECL) (IRECL)	Nonconforming material, part, or assembly which is remanufactured or reworked to the classification and specifications of another material, part, or assembly. Internal Failure - External Failure
Reinspection (IREIN)	Efforts associated with reinspection due to rework, repair, design change, engineering change orders/notices or failures. Internal Failure
Repair (IREPA)	Efforts associated with a material, part or assembly which meets blueprint specifications or configuration but does not function. Internal Failure
Repair Test and Inspection (ARTIN)	Certification and verification which takes place after a repair action. Appraisal
Returns (ERETU)	Customer or distribution network initiated return of parts, assemblies, or product due to nonconformance with concurrent loss of sale. External Failure

ALPHABETICAL QUALITY COST GLOSSARY 7

Rework (IREWO)	Efforts associated with bringing material, part or assembly into blueprint specification or configuration. Internal Failure
Scrap (ISCRA)	Efforts and costs associated with the disposition of materials, parts or assemblies which cannot be reclassified, reworked or repaired. Internal Failure
Supplier Reviews (ISURE)	Efforts associated with processing and making determinations related to supplier/vendor provided discrepant materials, parts, or assemblies. Internal Failure
Vendor Certification (PVCER)	The procedure and action by a duly authorized body of determining, verifying, and attesting in writing to vendor qualifications of personnel, processes, procedures, or items in accordance with applicable requirements. Prevention
Warranty Administration (EWAAD)	The collective administrative efforts of an identified warranty unit and field service warranty activities. External Failure

Code to Cost Breakdown

AAEFI	Appraisal-Assembly/End-Item Final Inspection and Test
AAEIP	Appraisal-Assembly/End-Item In-Process Inspection and Test
AININ	Appraisal-Incoming Inspection
AMETM	Appraisal-Metrology Maintenance
AMETR	Appraisal-Metrology
AMPFI	Appraisal-Material/Parts Final Inspection and Test
AMPIP	Appraisal-Material/Parts In-process Inspection and Test
APFOU	Appraisal-Four:__________
APONE	Appraisal-One:__________
APQTE	Appraisal-Product Qualification Tests
APTAR	Appraisal-Cost Target
APTHR	Appraisal-Three:__________
APTOT	Appraisal-Total Cost
APTWO	Appraisal-Two:__________
ARTIN	Appraisal-Repair Test and Inspection
_____	Appraisal-__________
_____	Appraisal-__________
_____	Appraisal-__________
_____	Appraisal-__________

EADRE	External-Additional Related Expense
EAPPL	External-Application
EFISE	External-Field Service
EIWRP	External-In-Warranty Repair/Parts
ELIAB	External-Liability Reserve
EOWRP	External-Out-of-Warranty Repair/Parts
ERECA	External-Recalls
ERECL	External-Reclassification
ERETU	External-Returns
EWAAD	External-Warranty Administration
EXFOU	External-Four:__________
EXONE	External-One:__________
EXTAR	External-Target Cost
EXTHR	External-Three:__________
EXTOT	External-Total Cost
EXTWO	External-Two:__________
_____	External-__________
_____	External-__________
_____	External-__________
_____	External-__________

CODE TO COST CLASSIFICATION 2

IADRE	Internal-Additional Related Expense
IDEFC	Internal-Design Failure Cost
IEECO	Internal-ECR/ECN Cost
IEXMB	Internal-Excess Manufacturing Burden
IEXMC	Internal-Excess Manufacturing Cost
IINVE	Internal-Investigation
IMRAA	Internal-Material Reviews and Action
INFOU	Internal-Four:__________
INONE	Internal-One:__________
INTAR	Internal-Target Cost
INTHR	Internal-Three:__________
INTOT	Internal-Total Cost
INTWO	Internal-Two:__________
IPADI	Internal-Product Awaiting Disposition
IRECL	Internal-Reclassification
IREIN	Internal-Reinspection
IREWO	Internal-Rework
ISCRA	Internal-Scrap
ISURE	Internal-Supplier Reviews
_____	Internal-__________
_____	Internal-__________
_____	Internal-__________
_____	Internal-__________
PENQU	Prevention-Engineering Quality
PENSU	Prevention-Engineering Support
PEXQU	Prevention-External Quality
PEXSU	Prevention-External Support
PFIQU	Prevention-Field Quality
PFISU	Prevention-Field Support
PPRDE	Prevention-Product Design
PPURC	Prevention-Purchasing
PQADM	Prevention-Quality Administration
PQAEX	Prevention-Quality Audits External
PQAIN	Prevention-Quality Audits Internal
PQPLA	Prevention-Quality Planning
PQRMA	Prevention-Quality Related Maintenance
PQTRA	Prevention-Quality Training
PRDQU	Prevention-R&D Quality
PRDSU	Prevention-R&D Support
PRFOU	Prevention-Four:__________
PRONE	Prevention-One:__________
PRTAR	Prevention-Target Cost
PRTHR	Prevention-Three:__________
PRTOT	Prevention-Total Cost
PRTWO	Prevention-Two:__________
PVCER	Prevention-Vendor Certification
_____	Prevention-__________
_____	Prevention-__________
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INDEX