

## Introduction

The chief executive officer of any company always sets the quality standards for the company. His standards always set the upper limits on quality in the company. His standards are, in fact, what he demands and accepts in quality from the company. Written procedures that, for whatever reasons, are not followed, are not his standards even if he signs them. He cannot escape this responsibility by appointing a Q.C. Manager and hiring a large Q.C. Department.

This implies and demands that for a company to sell quality products, the chief executive officer must know what a quality product is. It also implies that the chief executive officer has the training, experience, knowledge, and ability to work with his people to establish the total manufacturing system required to manufacture quality parts. He understands that the system must be continuously changed and improved to always produce better quality products and to keep up with the always-changing world definition of a quality product.

The ability of the chief executive officer to set quality goals and to reach them is the key that a customer must have to know that a supplier will sell the customer quality parts. The following five pages list my quality goals and broadly outline the system we have to produce quality parts to meet these goals. The quality production manual, which follows these six pages, is a detailed look at this system, including our ongoing efforts to improve our manufacturing system.

Contract manufacturing shops work in an environment that is different from a company that sells a product. We have only a very indirect and small influence on the design of the product we make. Lean manufacturers, especially in Japan, are bringing suppliers into the early design stages of a new product. In fact, most lean manufacturers are turning the complete design of large portions of their products over to their suppliers.

A diversified contract shop that has many customers that make many different products has a unique opportunity to see what is happening in a wide cross section of world class manufacturing. The diversified contract shop can bring the latest world class manufacturing ideas and methods in their field to the relationship with the customer. "Incestuous" policies and procedures that are so obvious to the outsider can be pointed out to customer and supplier if a close relationship exists.

Among others, the L.H. Thomson Company works for the Boeing Company, which is the world's largest premier manufacturer of commercial jetliners. We work for the Ford Motor Company, which was the first large company to bring lean manufacturing to America. We work for the Trane Company, which is a major worldwide manufacturer of air conditioning and heating equipment. We work for Cascade Corporation which supplies OEM components to most fork lift manufacturers. We work for Coors and other beverage can manufacturers. Two of our latest major customers are Reliance Electric - the first company to guarantee their electric motors for 40 years, and Pitney-

Bowes, the major manufacturer of postage meters and mailing machines. The L.H. Thomson Company is diversified. The commercial work is really competitive and keeps us lean and mean.

My first goal for the L.H. Thomson Company is for us to be good enough and be able to communicate well enough with our customers so they will bring us into the design process early and let us work as part of their company in manufacturing components for their products. It is essential for our customers to let us find out what they want and need so we can provide it for them. This type of communication with our customers is the one most important thing we can do to improve our quality.

My second goal for the L.H. Thomson Company is to have every employee totally involved in running the company. Everything in the company should be dispersed as much as possible. For example, do not have a big central tool crib that requires major computers and material handling equipment to run. One that even a genius cannot keep operating efficiently without having lost items or items out of stock. Do let each machine group or cell have their own tool cabinet and have each individual machine operator responsible for storing, conserving, and re-ordering the tools he uses. Management of the manufacturing process is the most important thing to disperse throughout the company. Let the people who run the process be the owners of the process and live or die with it. This is the essence of my second goal. (Note: I have had no teams die with the process. Always our people have produced beyond my wildest imagination.)

My third goal is to be the best, most efficient, and have the highest quality of any contract shop in the world. To be totally world class. To even set the standards for world class contract shops. This goal is not stated frivolously. My people and I understand the hard work and performance required to meet this goal. This is "The Goal" of our company. I have listed it third because it is totally dependent on how well we do on reaching our first two goals.

Profits will surely flow from meeting our goals. Profits will allow us to grow, to hire more people, and to buy and develop new manufacturing technologies that will be mainly embodied in manufacturing equipment. This growth and progress toward our goals is the predominant reason for, and will be the predominant use of our profits. Personal consumption of wealth takes too much time and distracts us from our goals.

Quality is giving the customer more than he expects at a price he can afford. The word quality has two general meanings today. One meaning is that a more expensive item has a higher quality than a less expensive item. Leather seats in a car have a higher quality than vinyl seats for instance. The quality we mean in contract manufacturing is giving the customer the best of what he wants. If he wants, needs, and can pay for vinyl seats, we will produce the best vinyl seats available. We will continue to make the vinyl better and better until maybe it becomes more desirable than leather in feel, texture, smell, etc. In contract manufacturing, it is imperative that the supplier find out what the consumer wants and needs and supplies it to him with the best quality available.

To accomplish high quality in manufacturing, specific procedures have to be developed and put in place. Our procedures have been developed over 36 years of being in one of the most competitive businesses in existence. Competition is a hard and thorough teacher.

To begin with, there is no dichotomy between quality and production. A company that requires a "Quality Control Department" to force manufacturing to produce quality products is already in deep trouble. There is no quality control department at Toyota Motor Company. Toyota is generally regarded as the highest quality producer in a volume of a complex product in the world. The procedures at the L.H. Thomson Company are completely diffused through every facet of the company. Most of the detail procedures were developed by the people on the floor or by the people who are actually doing the work.

Every person here understands the responsibility we have in making flight critical parts for airplanes that many lives depend on. Everyone knows we can only buy material that is listed on the drawing, that the material must be certified, that the material must be verified when it is received, the certification must be checked and matched with the material, the material must be marked the minute it is received, material can only be issued according to the production plan, no material may be switched between shop orders, and all parts must be made exactly according to the drawing.

All processes must be done only by customer approved sources and checked by us. All records of above have to be kept. I know everyone here knows these things because I have told them personally. They know because they helped work out the procedures originally and also help update the procedures when any weak points are discovered. There is no doubting this commitment comes from the top. It is also written in our quality production manual. We will keep any quality manual the customer requires.

We develop a job book for each operation for each part or assembly we make. The job book has detailed instructions for manufacturing the part. We have a customer print, a sketch for the operation, all dimensions on the sketch are numbered, key characteristics are noted on the sketch, an inspection sheet is included with each numbered print dimension listed. Each dimension is listed with instructions and gages required to check it. An AQS Control Plan is included when required. All special gages are listed, all tools and fixtures are listed, all chuck jaws, etc. are listed, the CNC programs are included, material type and size are listed, all tool length settings are listed, a sample efficiency sheet is included, SPC data collection and chart sheets are included for real time charting and operator feed back to process, and tie-in sheets are included for multiple shifts. These tie-in sheets give a record of any past problems for future runs. These job books are the key instrument that allows us to control the parts. These job books are the most comprehensive I have observed anywhere. I can show you a job book for every job we run.

The manufacturing plan, shop order, and shop traveler are one. They list all the material, processes and operations required by the part drawing. They also include inspection points. The job books are actually part of the overall manufacturing plan. The plan lists the operations and

departments in sequence. The plan at each operation states to perform this operation per the job book.

There is a revision sheet kept inside the job book that lists the latest revision and date of the customer print, sketch, CNC programs, inspection sheet, etc. These revisions and dates are checked against the customer purchase order and the shop order plan. No one wants to get caught making parts to the wrong revisions.

We have a continuous review of all these procedures. Any flaws or problems with the procedures are corrected immediately, on the spot, by all the team members involved.

We have a strict company policy that all dimensions on every part are checked 100% by the operator at the time the part is run. We give the operator the equipment and training required to do this.

Key characteristics are always checked with variable gages. Other dimensions may be checked with functional or go/no-go gages. This gives the operator immediate feedback if something happens to the process or if some external event is affecting the process. Having the whole universe of the parts on SPC charts gives more accurate predictions. We have found that totally relying on SPC from sampling parts cannot catch the few parts that go off target because of tool wear, tool breakage, unexplained glitches, etc. We seemed to have been stuck on 50 to 60 parts per million reject rate until we started 100% inspection by the operator. We are now progressing toward our goal of zero parts per million.

We have always run dimensions on the mean or target value. We are starting with all key characteristics that have a CPK of less than two and working continuously with the process to get the CPK above two. About 80% of the dimensions already have a CPK of six or above. We will continue to improve the capability of all processes even the ones above CPK two, over time.

Almost always when we find the root cause of a problem it is not a person or machine problem, but an organizational problem. SPC and Q.C. have never and will never produce a part. They are only tools to be used by production people to make good parts.

Individual responsibility is still required even though people are working in a team. No magic will ever change this.

We assign a generalist project manager to the production of each part. He usually writes the plan, the CNC program, parts of the job book and supervises the production team in finishing the job book and starting production. He also does tool and fixture design, requisitions and orders material for tooling and for the job, reports progress to all teams, and sometimes makes the tooling for the part in the tool room. He will not let his job go bad. The Japanese word for this man is Shusa, which translates as "large product manager".

CNC programs are designed to finish as many key characteristics as possible with one finish tool so that these dimensions are held in proportion by a proven CNC program. This allows one dimensional check to, in effect, check several others at the same time. Checking and charting one key characteristic dimension would also prove the several others.

All machines/processes will have their capabilities determined for different operations such as boring, turning, hole location, etc. Charts will be published for each machine showing the CPK for a range of drawing, specification limits. These capabilities will be re-checked almost continuously by checking various runs of parts. We will move to the more basic and sophisticated approach of controlling the process statistically instead of controlling individual parts statistically.

We have in place a production bonus that definitely encourages people to work in teams and to produce quality parts. Each work group or team puts all the bonus money into a pot and each team member shares equally. If any out of spec parts leave the work group area, no bonus at all is paid for that order. The team is paid three-fourths of the machine hourly rate for each hour saved. This can be substantial amounts of money because three fourths of the hourly rate on some machines reaches \$31.00 per hour.

The requirements that Q.C. has to be forced to answer to top management implies a sick company. If top management's main concern is not already quality, you may as well give it up.

I have purposely left one of the most important topics until last for emphasis. I firmly believe that machine tools and accessories should improve with use. That if properly used, maintained, and upgraded over time the machine will hold closer tolerances over time instead of looser tolerances. This requires real discipline in the areas of machine use and maintenance. There are no compressed air blow guns anywhere in the shop. Chips blown in to the works of a machine are a major cause of breakdowns and degradation of accuracy and performance. Manufacturers' recommendations, plus our own preventative maintenance procedures, are always followed. If a problem occurs in a machine, we find the root cause and fix it. These fixes become a part of our regular procedures. We continuously add upgrades to machines as they become available. We have regular daily, weekly, monthly, quarterly, annual, two year, five year, and eight year maintenance performed on all machines.

The proper use of the machine includes using the machine to capacity but never over capacity so as to overload the machine. All tool holders for machining centers and lathes are always protected and never allowed to be bumped or bruised. All accessories, fixtures, gages, etc. are always protected and used as they should be. The one cardinal rule for caring for a machine and accessories is cleanliness. A new machining center can bore hole diameters and hole locations to tenths of a thousandth of an inch. If the tool holders and spindle bore are beat up by rough handling, over a few months time the accuracy of bore diameters made by the machine will increase to one thousandth of an inch and then two thousandths and then five. If a process capability study is done on a new machine, it will be meaningless in two or three months. Proper

care and maintenance of machine tools and accessories are probably the most important things that enable an operator to hold a target dimension with little variation.

We have procedures and a social atmosphere in place in our company that allows regular people to do a superb job. In fact, when regular people are allowed to use their mind and control what they do, they invariably turn out to be extraordinary people that produce extraordinary, high quality parts at low cost. I never cease to be amazed.

We will also put in place any formal quality control procedures required by customers.

Loranzo H. Thomson  
President