

ENGINEERING AND MANAGEMENT ON GLOBAL SOURCING OF ELECTRONIC COMPONENTS TO IMPROVE PRODUCT RELIABILITY

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Abstract

As business looks towards the 21st century, a long-term strategy that focuses on global sourcing will be the vital factor in whether companies win or lose. At the same time, with electronic components, it is important to ensure stable quality and reliability, together with other important parameters. In order to achieve this, creating an effective mechanism of failure analysis and database management for electronic components is essential. The authors introduce the actual mechanism employed by NEC and explain the ideas and insight they have obtained from their experience.

Key Words: global sourcing, electronic components, failure analysis, X-ray CT scanning analysis, quality assurance system

1. PREFACE

The Japanese equipment assembly industry has also had a beneficial environment in terms of component procurement.

However, starting from the 1990's, with the long term economic stagnation that resulted from the bursting of the bubble economy, out-sourcing has become increasingly desirable, a trend given future impetus by the high value of the yen. In 1997, many Asian countries entered a period of economic downturn.

Nevertheless, the trend toward out-sourcing remained unchanged and a portion of the multiple vendors is represented by overseas component manufactures. Based on the strategic idea of procuring the best components in the world, 'global sourcing' is becoming more popular.

This paper introduces the methods of assuring quality and reliability of electronic components that support the global procurement strategy for electronic components of NEC. It also discusses notes on global sourcing obtained from the authors' own experiences.

2. NEC's Overseas Material Procurement Structure⁽¹⁾

As of June, 1998, the NEC group comprised 52 companies and 51 factories in over

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18 countries outside Japan and is engaged in the production of many products. The overseas material procurement strategy is also one of the most important issues of management. Currently, overseas procurement activities are carried out by eight international procurement offices (IPO: International Purchasing Office) covering four regions.

IPOs are located in various regions of North America, Europe, and Asia and are engaged in procurement of high quality components and materials worldwide. To supply Japanese components and materials to overseas production corporations efficiently, the Tokyo IPO was established. Procurement information is connected to each region through a dedicated information network system, achieving horizontal integration and information sharing.

3. Procuring Components and Materials from the Asian Region⁽¹⁾

NEC has established a procurement route for low-cost, high quality components and materials in the Asian region and has expanded and enhanced this route. Because this route is close to the production bases of the Asian region, NEC can expect price merits and material distribution merits. Recent trends indicate a rapid increase in procurement from the Asian region of NEC.

The Asian IPO is engaged in component and material procurement from South East Asia and consists of four bases: Hong Kong, which serves as the regional head office; Taiwan; Singapore; and Shanghai.

4. Quality Assurance Activities of Materials Procured from Overseas

4.1 Quality Levels of Electronic Component Procured from Overseas

During the 1980's, many manufacturers in the world progressively transferred production bases to the Asian region, thereby increasing production. Currently, the technologies and management know-how transferred have taken root, quality has improved, and some electronic components are comparable to the level of Japanese products. However, overall, many components have not reached the quality level of Japanese products.

4.2 Role of IPO in Quality Assurance

IPO is engaged in the following quality assurance support activities, although its main role is procurement.

- (1) Support by the IPO Engineering Department
Factory investigation, factory approval, quality management guidance, and on-site inspection, etc.
- (2) Transaction management by the IPO Procurement Department
Order Management based on quality results, etc.

4.3 Structuring Overseas Component and Material Procurement⁽¹⁾

The CS&QM Promotion Division of the Head Office handles preparation of the manuals required for standardization within the NEC group, such as the manual for implementing quality assurance. Figure 1 shows the quality assurance step in overseas component and material procurement.

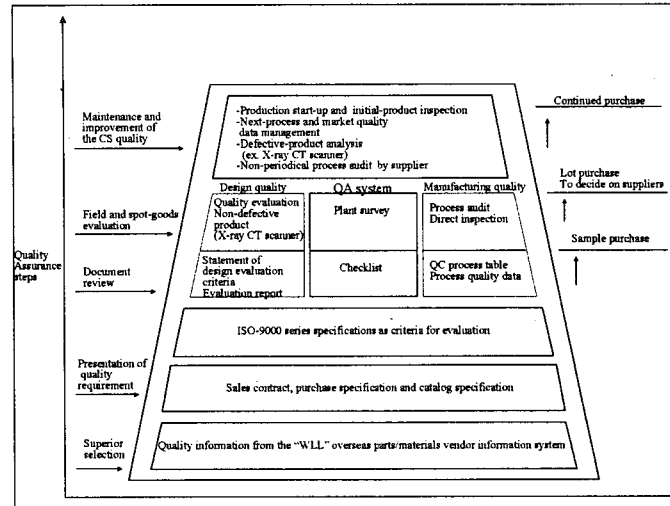


Fig. 1 Supplier Management System in NEC's Parts/Materials Procurement

4.4 Selecting Vendors⁽³⁾

The minimum requirement is that basic performance and initial quality reach the required standard. A more important factor is to ascertain that the vendor can provide stable supply for a long period of time. As one of the criteria, acquisition of ISO 9000 Series approval is set as the precondition. The CS&QM Promotion Division in the Head Office is implementing capability investigations regarding 68 vendors in conjunction with related operation divisions up to now.

4.5 Implementing Reliability Evaluation^{(2) (3)}

The recent trend toward downsizing, low power consumption, and increasing complexity may cause new reliability and safety problems. In addition, reliability evaluation in a mounted state of electronic components on printed circuit boards has become necessary as a result of the popularization of SMT (surface mounting technology). This trend is recognized for overseas procurement components as well, necessitating the implementation of basic evaluation items are at the very least. This is done by evaluating the components through comparisons with Japanese components of the same types. In the example shown in Figure 2, although the performance of aluminum electrolytic capacitors indicates satisfactory results, the drift of characteristics ($\Delta C/C$) started to show differences as time progresses.

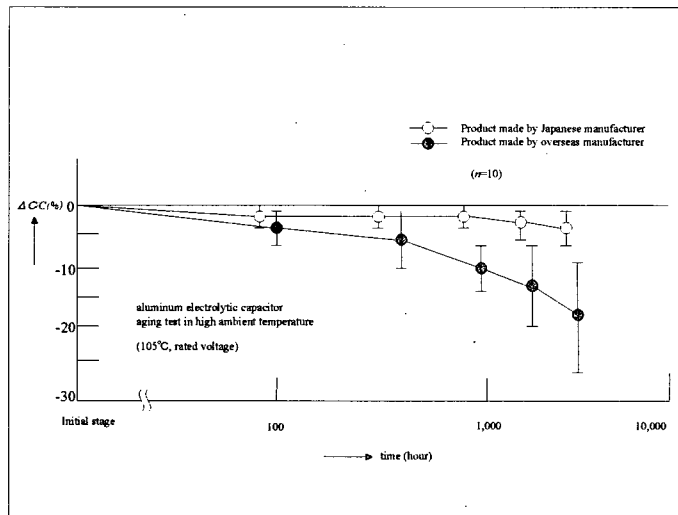


Fig.2 Data Obtained by Reliability Test for Products Procured from Overseas

4.6 Implementing Failure Analysis^{(2) (3)}

Failure analysis is implemented at the investigation stage and mass production stage. Simple failure analysis is implemented in each local production base. However, more substantial failure analysis and operable component analysis are implemented in the failure analysis base in Japan. As an example, nondestructive analysis by an X-ray CT scanner is introduced. This analysis provides useful quality and reliability information such as detection of internal faults and checking assembly irregularities. Figure 3 shows the analysis results up to the present time by X-ray CT and Figure 4 shows an example of aluminum electrolytic condenser analysis results.

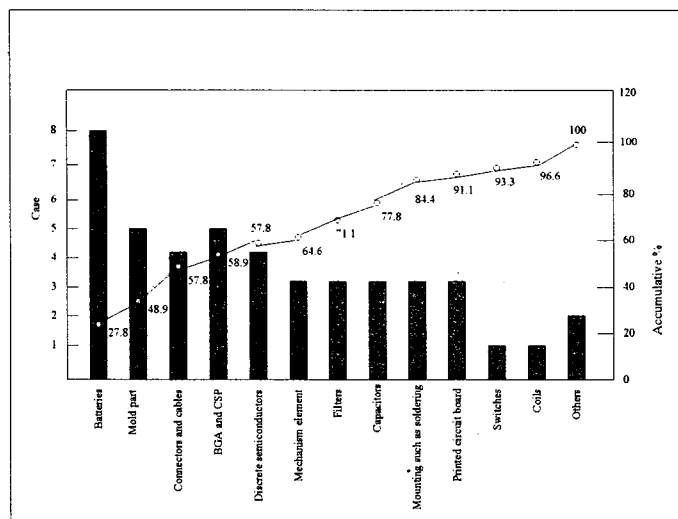


Fig. 3 Classification of Analysis

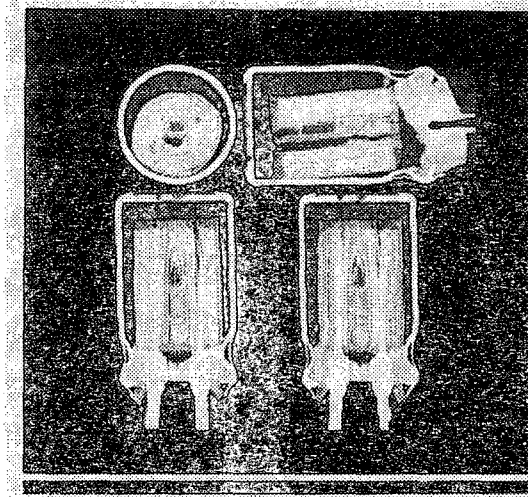


Fig.4 Examples of X-ray CT Observation on Aluminum Electrolytic Capacitor

4.7 Sharing Material Procurement Information

A series of procurement information steps is developed horizontally and shared among the bases that are connected through a dedicated network system WILL (Worldwide Information Library for Low Cost Materials). The quality information includes the quality assurance structure, past quality problem status, and a quality ranking that is continuously updated. A communication meeting is held periodically by parties involved in quality assurance and is used as a consultation opportunity for reviewing horizontal development of the information and procurement strategy.

5. Seven Precepts in Overseas Component and Material Procurement⁽³⁾

The following notes were obtained from direct experience in overseas component and material procurement.

(1) Handle new manufacturers carefully since they cannot handle quality problems effectively.

Before procurement, check the record of manufacturers with respect to the deficiencies and failures that have been experienced in the past.

(2) The quality of a sample and the actual product may be different.

This was due to insufficient quality control at mass production.

(3) Do not accept the vendor simply because of its high initial performance.

Often, sufficient reliability evaluation has not been implemented. See Fig. 2.

(4) Even if the vendor continuously supplies good quality products, do not feel assured.

Quality of products may be good in the present lot, but their quality will vary unexpectedly in the following lots.

(5) Appearance criteria vary according to the manufacturer.

Exchange limited samples in advance and eliminate any disagreements of views between both parties.

(6) Analysis capability for deficient products is an important condition in selecting vendors.

Early problem solving requires the user to cooperate with the manufacturer in deficiency analysis.

(7) Indicate requirements in the specification and drawings clearly.

Ambiguous expressions and unclear requirements often cause quality problems.

6. Conclusion

Enterprise globalization is expected to progress further towards the 21st Century. The global economy demands global sourcing and decisions on status and quick action based on a global view are becoming more important.

Future subjects can be summarized as follows:

- (1) Building a global quality assurance structure: Establishment of an internationally common procurement technology and maintenance and improvement of the ISO 9000 level quality system
- (2) Utilization and promotion of information networks: Increasing development speed by sharing component and material procurement information
- (3) Acceleration of local design and production: Products will be designed and produced locally to suite local component materials.

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