In initiatives to enhance corporate value, it is important to strive to improve productivity in all business activities, and to continuously increase management efficiency. Tokyo Electron (TEL) is reviewing and optimizing its business processes across the company as a whole, in development and manufacturing divisions as well as in sales and administration divisions, and the company is promoting quality management throughout the value chain. In addition, the company is developing various educational programs in an effort to enhance the awareness and capabilities of each employee regarding productivity, as well as implementing continuous quality improvement activities throughout the supply chain in collaboration with suppliers. By implementing quality-focus operations, TEL is further improving productivity, in its efforts to build strong relationships of trust with all stakeholders.

**Medium-term goals (3)**

## Constantly pursue higher management efficiency

**Priority themes, Main activities**

**Quality management** | **Improvement of quality in the value chain**

- Quality management
  Quality policy, management system, enhancement of quality-related awareness and capabilities
- Improvement of quality in the value chain
  Initiatives at the development and design stages, improved productivity in software development, support optimization, response when issues arise

**SDGs initiatives**

- Promote improvement of productivity, continuously increasing management efficiency, contributing to the development of the industry and society, and contributing to continuous economic growth
- Promote quality management throughout the value chain, ensuring sustainable forms of production and consumption

**Decent work and economic growth** | **Responsible consumption and production**

SUSTAINABLE DEVELOPMENT GOALS



# Quality management

## Quality policy

Tokyo Electron (TEL) has a quality policy shared by all group companies which it has developed and is rolling out.

1. Quality Focus
   Focusing on quality to satisfy customers, meet production schedules, and reduce required maintenance even with temporary cost increases.
2. Quality Design and Assurance
   Building quality into products and assure in-process quality control, from the design and development phase throughout every process.
3. Quality and Trust
   When a quality-related problem occurs, working as a team to perform thorough root cause analysis and resolve problems as quickly as possible.
4. Continual Improvement
   Ensuring customer satisfaction and trust by establishing quality goals and performance indicators and by implementing continual improvement using the PDCA cycle.
5. Stakeholder Communication
   Listening to stakeholder expectations, providing timely product quality information, and making adjustments as needed.

## Management system

TEL is building quality assurance systems under the leadership of the Representative Director, President & CEO. To provide consistent, high-quality products, TEL has been acquiring ISO 9001 quality management system certification at various sites since 1994, and now, all of the group's manufacturing companies have successfully obtained certification.

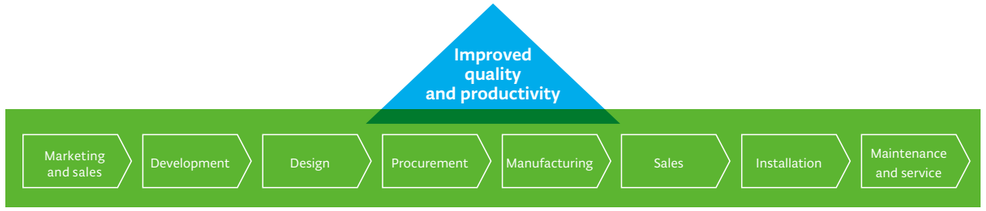
**ISO 9001 certified factories and offices**

| Company name | Factory/Office name | Certification date |
|---|---|---|
| Tokyo Electron Technology Solutions | Yamanashi Office (Fujii/Hosaka) | September 1994 |
| | Tohoku Office | December 1994 |
| Tokyo Electron Kyushu | Koshi Office | March 1997 |
| TEL Magnetic Solutions | — | November 2009 |
| Tokyo Electron Korea | Balan Factory | September 2011 |
| Tokyo Electron Miyagi | Taiwa Office | September 2012 |
| TEL FSI | — | March 2013 |
| TEL Epion | — | May 2014 |
| Tokyo Electron (Kunshan) | — | May 2018 |

# Improvement of quality in the value chain

## Quality management throughout the value chain

Tokyo Electron (TEL) believes that implementing continuous improvement, not only of products and services but also of all work processes, contributes to improved quality and productivity. The company strives to improve operations throughout the value chain, while strengthening collaboration within the company and externally, reflecting the needs of customers.



## Raising awareness and skills

TEL believes in the importance of every employee having a high awareness and understanding of quality, and conducts various educational programs to this end. In addition to the fundamental quality education that all new employees receive, we focus on PDCA education for all employees, including those overseas. Through e-learning courses, employees learn the need for continuous improvement using the iterative four steps of the PDCA cycle. As of May 2019, 93.7% of our employees had completed the courses.

In addition, the company implements its own education program called TEL 6-Step for employees closely involved in quality control, such as developers, designers, quality managers, and service personnel, through which they acquire a problem-solving model to handle important issues. It is a partially altered version of the eight discipline (8D) problem-solving method,[1] widely used in quality control, customized to replace TEL's problem-solving process. The program enables thorough investigation of the true nature of problems to determine the technical factors and root causes, cultivating skills that lead to quick resolution and prevention of similar problems arising. TEL currently uses e-learning training for delivery, and as of May 2019, approximately 5,500 employees had completed the program. In addition, the company conducts group training, focused on quality control leaders at its bases, for practical, exercise-based learning about resolution of quality issues, in an effort to enhance work improvement skills at production and development sites.

Moreover, TEL encourages employees to obtain external QC certification[2] through the Quality Management (QM) and Quality Control (QC) examinations and recommends their acquisition of fundamental skills, so that they can autonomously tackle quality improvement. Since fiscal year 2012, the number of certified employees has increased each year to approximately 2,200 as of March 2019.

1
8D problem-solving method: A method for solving problems in quality improvement through eight disciplines or processes

2
QC certification: Quality management certification operated by the Japanese Standards Association and the Union of Japanese Scientists and Engineers. The total number of people qualified nationwide exceeds 520,000 (as of September 2018).

New employee training conducted in April 2019

QC certification holders

**2,200 employees**

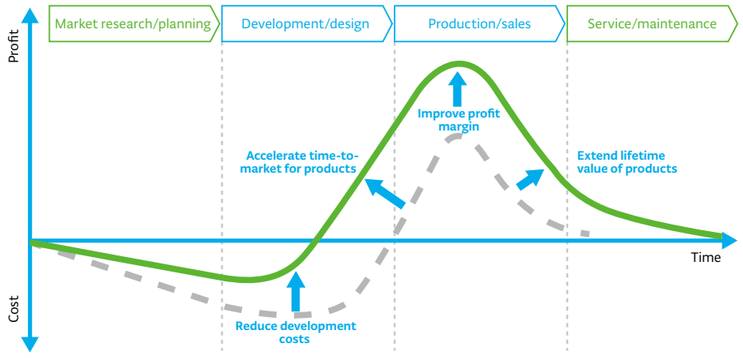
(as of March 2019)

## Initiatives at the development and design stages

### Promotion of front-loading and self-process assurance systems

In order to improve the quality of products, it is important to avoid contamination by defects in upstream processes, and to ensure quality in each process so that defective products are not allowed to flow into later processes. From this perspective, TEL is promoting front-loading and self-process assurance systems. In order to raise the degree of product quality at an early stage, TEL implements thorough risk detection and mitigation measures (FMEA)[3] from the initial stages of product design in an effort to suppress the occurrence or outflow of defects. The company also conducts thorough inspections in each process and verification using simulation in the self-process assurance system. Together with this promotion of front-loading and self-process assurance systems, TEL is also focusing on the deployment of Product Life-cycle Management (PLM). By deploying and promoting this concept of PLM, TEL comprehensively manages and analyzes all processes from product planning, development, design, and production through to service, in an effort to achieve early release of products on the market, work efficiency enhancement, quality improvement, and cost reduction.

3
FMEA (failure mode and effects analysis): Method to grasp risks in advance, prevent and mitigate




■Example initiative

Through the Quality Management Committee, Tokyo Electron Technology Solutions Yamanashi Plant implements consistent quality control, from the development and design stage through to mass production, managing the progress of development, sharing quality issues, and so on.

With new development projects, the Yamanashi Plant checks thoroughly to ensure quality and reliability requirements are sufficiently fulfilled, by establishing "gates" at each stage of conceptual design, transition to release of plans, shipment of evaluation units to customers, and transition to mass production.

To ensure this initiative, session-based DRs[1] are held by persons in charge of design development, quality control, production, purchasing, sales and other related divisions, together with experts who possess technical knowledge.

When transitioning to mass production of equipment, a "mass production package," comprised of a BOM,[2] a QC process chart,[3] a manufacturing quality instruction manual,[4] a startup manual[5] and so on, is prepared to ensure mass production operations are also carried out in full, and self-process assurance systems are established. Providing education to workers and managing their skills is also conducive to activities aimed at the release of high-quality equipment.

Going forward, to further develop quality improvements, ongoing improvement activities will be promoted so that, based on an original evaluation model, essential evaluation points are applied without fail in order to maximize quality at each stage of the manufacturing process, from planning (concept level) through to the parts and materials level.

1
DR: Design Review

2
BOM (bill of materials): A chart of parts showing how many of each are used for each finished product

3
QC process chart: A chart recording the process flow for one product from procurement of raw materials and parts to shipment of the finished product, including management characteristics and methods

4
Manufacturing quality instruction manual: Technical information transmitted from the design team to the manufacturing team

5
Startup manual: Summary of procedures and warnings when starting up equipment

### Response to safety laws and regulations

TEL regularly checks the safety regulations and guidelines concerning equipment, and has established systems for responding to them. Equipment is checked by a third party inspection company before shipment to ensure that the equipment complies with international safety standard and the guidelines like SEMI S2.[6] Also, regarding the Machinery Directive and EMC Directive,[7] we obtain certificates of conformity from the Notified Bodies in Europe.

6
SEMI S2: This is a set of environmental, health, and safety guidelines for semiconductor manufacturing equipment

7
EMC Directive: This is one of the New Approach Directives that apply to the EU member states

## Software development initiatives

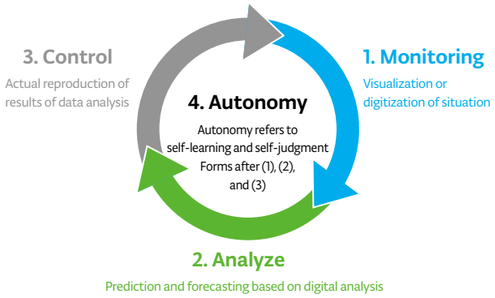
### Streamlining product development

Since 1995, Tokyo Electron (TEL) has used platform software developed in-house in its semiconductor production equipment, leading to streamlined operations and improved product quality. By introducing common platform software the company is able to reduce the hours spent on developing duplicate functions for each type of equipment, to guarantee real-time[1] control, and endeavors to connect this to enhancement of its response capability to new demands and technologies.

In addition, TEL is also adopting concepts such as object-oriented[2] for the more efficient software development, while also promoting development and introduction of new platform software for development of next-generation equipment.

### Realization of smart equipment

With the rapid progress of innovation in manufacturing utilizing IoT and AI, TEL is working on designing the form of future semiconductor production equipment required in the smart fabs[3] which customers aim to realize, and to develop the various software and systems that will be required there. The specialized development units responsible for advanced data utilization and system development cooperate with each business unit and production site in the pursuit of smart equipment that offers simple operation, presentation of the causes and resolutions of troubles, and autonomous operation through prediction of results.




## Initiatives with suppliers

Developing strong partnerships with suppliers is essential to improve product quality. In efforts to maintain and improve quality, since 2000, TEL has conducted its unique Supplier Total Quality Assessments (STQA) to enable its suppliers to properly understand the level of quality that the company expects from suppliers. Before starting business with new suppliers, an STQA is conducted via self-assessment to evaluate their product quality, costs, and information security. The assessment also includes CSR issues, including human rights, ethics, safety, and the environment. If any risks to quality are found, TEL representatives visit the supplier on-site to explain the problems, TEL's expectations for the level of quality required. After the supplier understands the issues, TEL asks that they plan and make improvement measures, and provides continuous support until all of the improvements have been completed. The company conducts on-site audits once every three years at suppliers who manufacture important components and at suppliers where quality issues have been found.

In recent years, TEL has been particularly focused on process improvement activities using statistical process control (SPC).[4] Equipment that TEL provides to its customers must always be controlled to avoid variations, to ensure accurate process repeatability, and to realize high productivity. To achieve this, TEL works to ensure understanding of the importance of, and agreement to, these activities by suppliers which handle specific important parts, and works on SPC together with suppliers, in order to reduce variations in the quality of parts, in an effort to maintain and improve processes to produce good products.

### ■Example initiative

At all of its production sites, TEL collaborates with suppliers to implement initiatives to reduce the occurrence of defective goods. Company employees visit the production sites of suppliers to learn about their production environment in order to discuss and implement effective improvement proposals. In addition, Tokyo Electron Technology Solutions Yamanashi Plant works closely with business partners to share data on parts and unit manufacturing, and to promote quality management through SPC, and is thereby delivering results in defect rate reduction.

1 Real-time: The property of time limitation until the completion of work

2 Object-oriented: A software engineering theory

3 Smart fab: A fab which realizes production innovation through analysis and utilization of data from all of the equipment, facilities, and human work within the fab

4 SPC (statistical process control): Refers to using statistical methods to analyze manufacturing processes, take measures for establishing and maintaining stable processes, and improve process capability. In many cases, statistical methods indicate techniques with a focus on control charts.

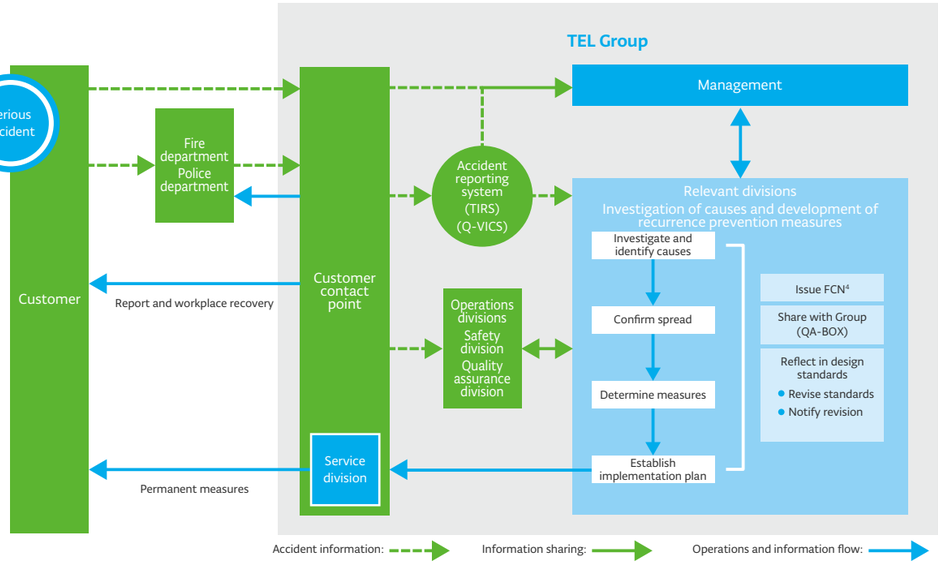
## Response to quality problems

In addition to compliance with ISO and EN[1] safety standards, TEL establishes design rules applicable to its own equipment to achieve the highest level of safety possible. In addition to developing systems to manufacture safe products, the company fulfill its mission as an equipment manufacturer by establishing systems for responding to design- or manufacturing-related issues or accidents arising from operation-related problems.

If an accident occurs, TEL uses its TIRS[2] accident reporting system to report and share information with all levels of management, from safety and quality personnel in each division to senior management. We immediately conduct an accident investigation to identify the cause and plan preventive measures.

In addition, TEL uses a proprietary system called QA-BOX[3] to share accident information within TEL Group. The results of accident investigations are quickly implemented on the problem equipment, as well as on equipment operated by other customers, and, for example, reflected in design standards in operation. As well as sharing problems and countermeasures through QA-BOX, it is also used to prevent recurrence of accidents. Accident-related data accumulated in QA-BOX is used for the cumulative analysis of trends to visualize the types of equipment which frequently experience problems and the types of problems that they experience, whereby we can implement countermeasures that have an immediate impact, leading to a reduction in the number of accidents attributable to equipment.

### Response to serious accidents




1 EN (European Norm): Uniform standard for the European Union complimenting parts of technical standards not stated in European Commission directives ("New Approach" directives)

2 TIRS: TEL Incident Report System

3 QA-BOX: TEL Group internal information sharing and horizontal deployment tool

4 FCN (Field Change Notice): Refers to general recall notice