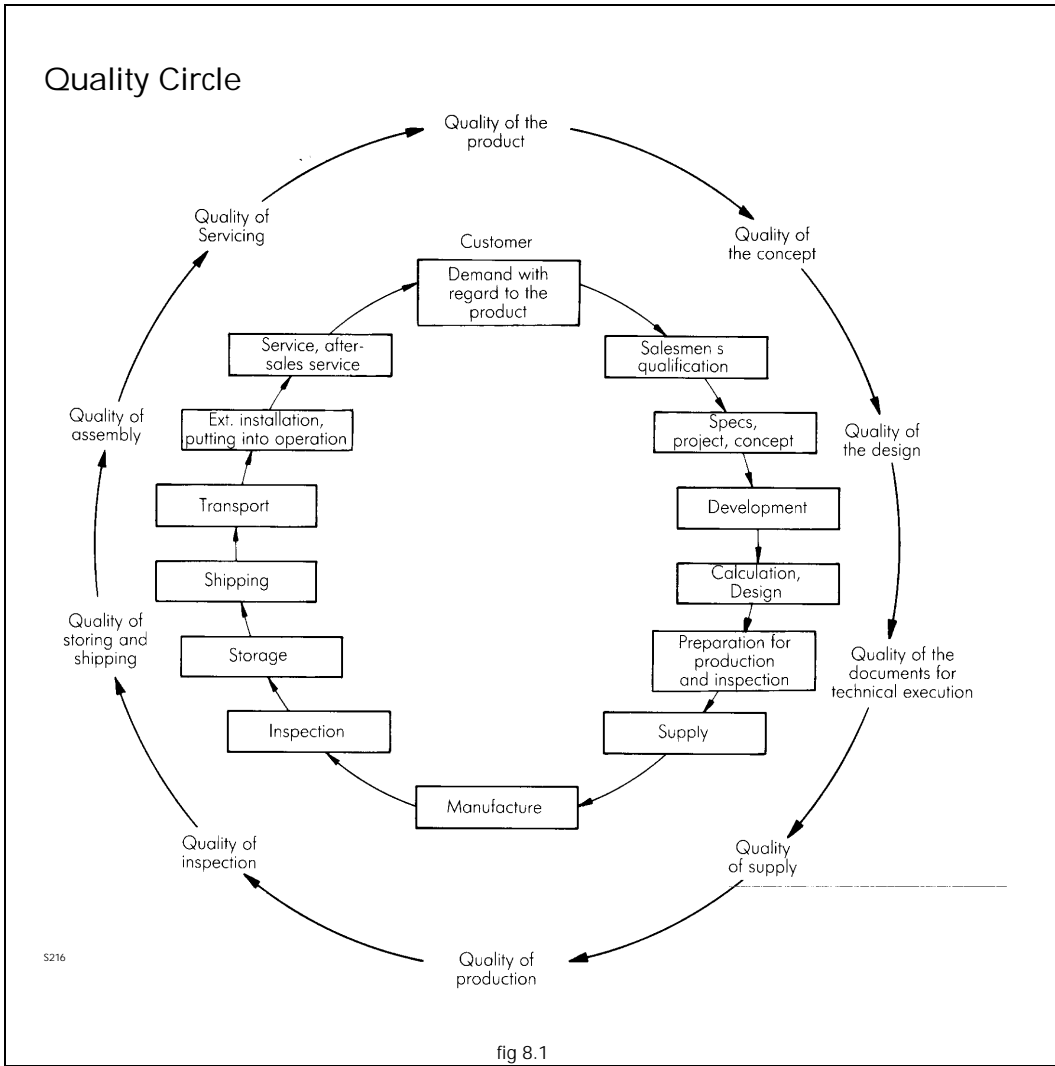


# 8 QUALITY ASPECTS

## 8.1 Quality



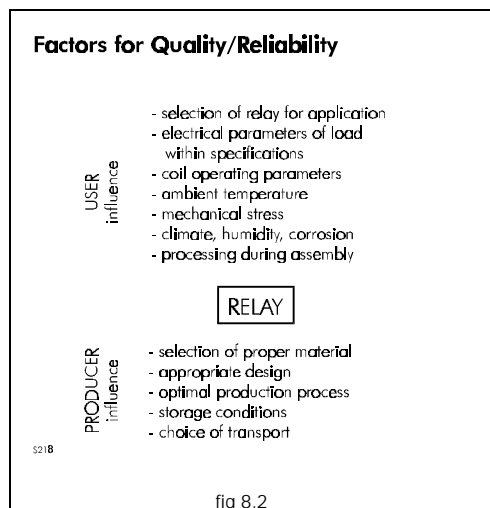
## POWER RELAYS

Product quality is judged according to criteria such as reliability, design, life expectancy etc. Certain quality parameters such as AQL, failure rate, and failure probability are applied to obtain an objective assessment of quality. Interpreted broadly, however, quality encompasses everything from product design to applications advice. In short, a quality product is one which operates without problems.

Relay quality is governed by many parameters. Both the manufacturer and customer have an important influence on the quality and reliability of the component in use.

The manufacturer is responsible for providing a high quality product by: product concept, optimal design, manufacture, storage and transport.

The customer is responsible for selecting a suitable product and using it within its specification.



## ISO 9000

ISO 9000-9004 are quality monitoring and management standards recognised in most industrialized countries.

To achieve certification to these standards, a supplier has to fulfil a range of criteria involving almost all departments, such as R&D, design, purchase, production, sales, marketing and service, implementing defined policies and procedures.

These standards give many advantages to customers including the elimination of time consuming and costly quality audits leading to quicker product introduction. The supplier is also able to provide any necessary quality documentation.

Quality Assurance policies and procedures are documented in a quality manual. The effectiveness of the system is checked continuously by internal audits.

### ISO 9000 Quality System Elements

Clause (or sub-clause) No. in ISO 9004	Title	Corresponding clause (or sub-clause) Nos. in		
		ISO 9001	ISO 9002	ISO 9003
4	Management responsibility	4.1 ●	4.1 ○	4.1 ○
5	Quality system principles	4.2 ●	4.2 ●	4.2 ○
5.4	Auditing the quality system (internal)	4.17 ●	4.16 ○	—
6	Economics — Quality-related cost considerations	—	—	—
7	Quality in marketing (Contract review)	4.3 ●	4.3 ●	—
8	Quality in specification and design (Design control)	4.4 ●	—	—
9	Quality in procurement (Purchasing)	4.6 ●	4.5 ●	—
10	Quality in production (Process control)	4.9 ●	4.8 ●	—
11	Control of production	4.9 ●	4.8 ●	—
11.2	Material control and traceability (Product identification and traceability)	4.8 ●	4.7 ●	4.4 ○
11.7	Control of verification status (Inspection and test status)	4.12 ●	4.11 ●	4.7 ○
12	Product verification (Inspection and testing)	4.10 ●	4.9 ●	4.5 ○
13	Control of measuring and test equipment (Inspection, measuring and test equipment)	4.11 ●	4.10 ●	4.6 ○
14	Nonconformity (Control of nonconforming product)	4.13 ●	4.12 ●	4.8 ○
15	Corrective action	4.14 ●	4.13 ●	—
16	Handling and post-production functions (Handling, storage packaging and delivery)	4.15 ●	4.14 ●	4.9 ○
16.2	After-sales servicing	4.19 ●	—	—
17	Quality documentation and records (Document control)	4.5 ●	4.4 ●	4.3 ○
17.3	Quality records	4.16 ●	4.15 ●	4.10 ○
18	Personnel (Training)	4.18 ●	4.17 ○	4.11 ○
19	Product safety and liability	—	—	—
20	Use of statistical methods (Statistical techniques)	4.20 ●	4.18 ●	4.12 ○
—	Purchaser supplied product	4.7 ●	4.6 ●	—

**Key**

- Full requirement
- Less stringent than ISO 9001
- Less stringent than ISO 9002
- Element not present

S220

fig 8.3

## 8.2 Quality assurance in the design phase

Quality assurance begins at the design stage of a product and is implemented on the basis of a structured plan with periodic design reviews and continuous qualification of products and processes.

Project plans guarantee that all procedures from the product concept to manufacture of the final product are followed and documented.

Techniques such as FMEA are used to achieve high product quality.

## POWER RELAYS

### FMEA (Failure mode and effect analysis)

FMEA is the analysis of potential faults and their ramifications. By doing this, quality and reliability become controllable. With the FMEA method, potential sources of failure such as contact springs, coil, etc. can be investigated with regard to fault type, fault sequence, fault causes, fault prevention and risk factors assigned.

The cause and probability of the fault determine the definition for the quality assurance and manufacturing tolerances which are integrated into the production process. FMEA dictates that all imaginable errors are assessed and taken into account.

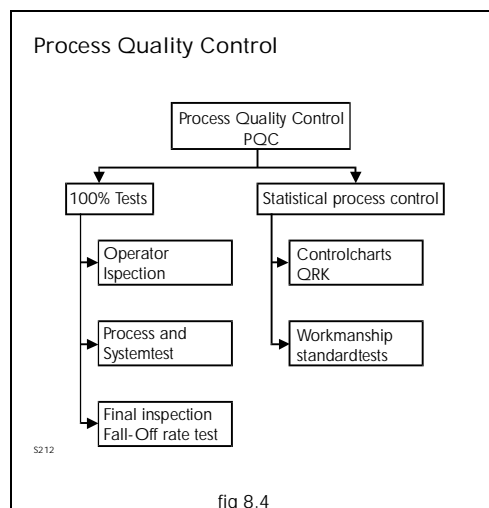
### 8.3 Quality assurance in production

Test results from incoming inspection through the different production stages to final inspection are documented.

Different techniques are used for quality control during production.

#### SPC (statistical process control)

SPC is the statistical regulation of processes. The basic concept is the continual monitoring of important manufacturing parameters including measurements relating to tools, material values and adjustment values. By recording and evaluating these values, trends can be detected and, if necessary, the process adjusted to maintain specified mean parameters.



**FOM (fall off rate management)**

FOM is the management of a quality control system using feedback control loops. It is a comparison between targets set and targets achieved. The difference between them is the fall off rate or FOR.

As a feedback control loop, FOM covers:

- purchasing
- development
- quality assurance
- production
- material defects solved by suppliers
- design errors
- inspection errors
- production errors

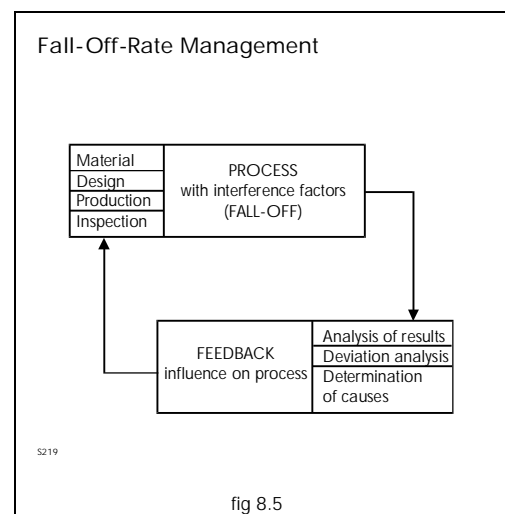


fig 8.5

Two methods of measurement are typical:

- the number of interventions or repairs undertaken per cause of failure per location in the manufacturing sequence, measured in %
- the cost arising from the interventions undertaken per cause of failure and failure location in a given monetary unit. These costs increase the further along the manufacturing process the failure occurs.

**100% testing**

All relays are subjected to a specification based, 100% final inspection and test by regularly calibrated equipment.

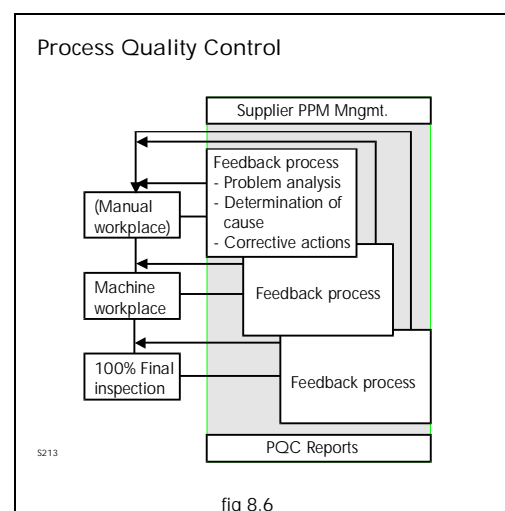


fig 8.6

**Burn in and screening**

In some special cases burn in tests are performed at the end of the production process to eliminate early failures (see bathtub curve) and to provide a low initial failure rate.

**Sample tests**

In addition to the standard production tests, sample tests of electrical life and reliability are performed. These tests comprise an additional check of specification parameters as well as

## POWER RELAYS

those which cannot be tested during the production process, such as time consuming reliability tests or destructive tests.

### 8.4 Delivery agreements

#### AQL agreements

AQL is defined as the acceptable proportion of faulty units in spot checks. The agreed on, or established AQL value in percent is the acceptable proportion of faulty units per lot or batch. AQL is always related to a quality level or a particular test procedure. Sampling plans are established by which the acceptance or rejection of a total quantity (N) is decided on the basis of the sampling and assessment of a single spot check.

AQL agreements are the basis for production release and acceptance of relays by the customer. They define the sampling methods applicable to supply contracts. On the basis of these agreements the quality of delivery lots is checked. The AQL value agreed upon is the measure for acceptance or rejection of the individual delivery lots.

#### PPM agreements

PPM management is a quality system which incorporates the production process of the customer in the control loop for quality assurance system of the supplier. This is, in fact, another 100% test under parameters set by the production requirements of the customer. The customer is now part of the control loop, so close cooperation with the supplier is absolutely necessary to find and eliminate defects with the aim of improving overall product quality.

