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## Comparison of Quality Management Systems in Japan and Germany in the Field of Welded Parts †

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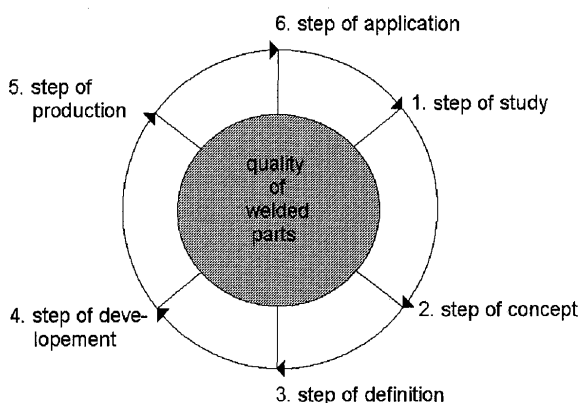
All over the world where quality management systems are used, the ISO 9000 and the following are known, in Japan as well as in Germany. These quality management systems give the general foundation how such a system can be implanted in different firms of different branches.

The beginning of the year 2000 has been a change with German companies: today, numerous companies are certified in accordance with DIN EN ISO 9000 - 9003 and have organised their operations accordingly functional. In this year, DIN EN ISO 9000:2000 calls for the introduction of process-orientated organisation structures and documentation.

The new regulations in the soon revised standards necessitate the adaptation of systems.

In Japan the quality management systems are already process-orientated organised.

A general view of the different points which are important for the result: "good welded part" for a quality management system can be presented in **Figure 1**: quality circle of welding.



**Fig. 1** Six steps from a project which influence the quality of welded parts (quality circle of welding).

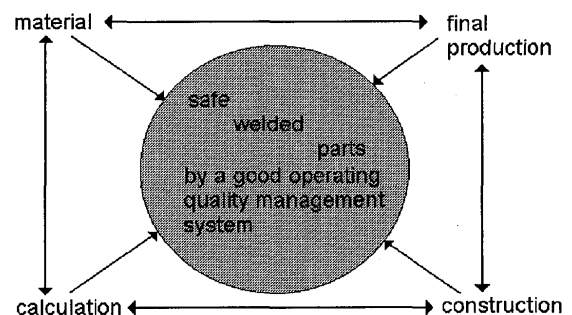
But this picture gives only a survey about the general sequence of manufacturing to get a good quality from beginning (idea) until end (welded part).

For the industrial engineering, especially the working plane, the declaration has to be more concretely. It is not the work of one section or one worker to produce a part of good/high quality, since there are different influences which have to be well cooperated (**Figure 2**: cooperation between different fields to get safety welded parts).

This comparison of quality management systems in Japan and Germany in the field of welded parts wants to introduce into the special of practising the quality management systems.

Therefore it is useful to know that the qualities of a part will be influenced by workers in a process (welding, material, parameter of the process) by using a machine (welding procedure) in the field of a firm.

The working together of all the influences like calculation, construction, material, production as well the welder, the management and the inspection of welding will have as result a good welded part (**Figure 3**: triangle of a good quality management system "welding").



**Fig. 2** Cooperation between different fields to get safe welded parts by a good quality management system.

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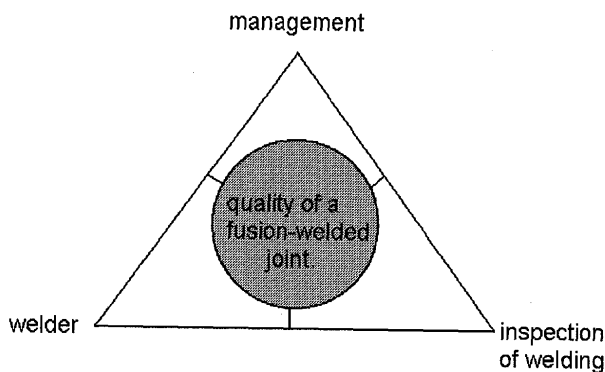


Fig. 3 Triangle of a good quality management system "welding".

For a comparison in the field of welded parts it is specially of interests to show

- \* some differences
- \* some specialities or/and
- \* established instructions

depending on the size of the firm which is using such a quality management system.

In this context I want to say that I picked up some points which I compare between the normal working-live in Japan and Germany in using the quality management systems. It only can be a short summary not a complete comparison.

Differences, specialities and established instructions in the quality management systems by firms of different sizes of the firms about 500 employees:

### The Quality Consciousness of Each Worker

In Japan, the staff including the management is always conscious of quality. The high quality demonstrates the real power of their ability and of the company. The management refers to the quality of products by using all opportunities.

The top managers are responsible for making each employee aware of the importance of quality and improving employees' quality consciousness by education. The superiors also have to give instructions concerning quality to every worker before operation.

Every person in the field of production is member of a quality circle. Because of the discussion in these groups everybody knows exactly which problem should be solved at the moment.

Difference to Germany: Not a single person is responsible to solve a problem, it is the work of the group.

In Germany the manager implants also quality circles in all sections of the company and the worker gets the information that the subject "QUALITY" is very important. The quality circles is guided by a leader,

who is responsible for periodical meetings and for regular results. The crew has to make suggestions which problems are to solve. They have to report about work and possible solutions. Responsible for the special result is only one member of the group.

Difference to Japan: Not the group is responsible, only one member of the quality circle is responsible for doing something special.

### To Avoid Defects or Flaws (Prevention)

In Japan, firms practise on the one hand the common power, that means that they check the following items before welding. These are groove conditions (dimension, surface condition), shielding gas flow, welding conditions (electrical current, voltage, welding speed), preheating temperature etc..

On the other hand the welding operation is conducted by those workers who have been certified according to the JIS (Japanese Industrial Standard). In addition, the welding procedure, shape of groove, welding consumables (materials) and their control, the inspections, the types of defects which have to be repaired, welding repairing methods and so on are documented in the Quality System Document. The welding operation should to be conducted according to the document.

In Germany the welding operation is described in national standards (DIN: German industrial standard) and in European standards (EN). The welder will be educated as in Japan. The same items, which are already described will be checked before beginning.

Every company has a Quality-Hand-Book where the specialities are described, including instruction for avoiding mistakes or to repair defects.

I do not see any big differences between Japan and Germany.

### Reaching Quality of the Produced Part/ Quality-Valuation of the Produced Welding Part

In Japan as well in Germany at first the welder inspects his work himself. The company inspects internal and external defects due to customer's regulation.

#### 1) Non destructive inspection

- Radiographic Test (crack, blow hole, lack of fusion, incomplete penetration)
- Ultrasonic Test (crack, blow hole, lack of fusion, incomplete penetration)
- Magnetic Particle Test (crack, blow hole, lack of fusion, incomplete penetration)

#### 2) External defects inspection

- appearance (pit, over rap, under cut, weld reinforcement etc.)
- liquid penetrate test (surface crack, pit, under cut)

Another possibility is that the welding process and

the welding part are checked and recorded with a checklist, which is stored for further reference.

I cannot see any differences between Japan and Germany in this point.

### How to Classify Welding Defects

In Japan, the welding process and the welding part are checked and recorded with a checklist. It will be distinguished between internal and external defects. Internal defects are: blow hole, slag inclusion, lack of fusion, incomplete penetration, hot crack, cold crack etc.. External defects are: under cut, over lap etc.

In Germany it is quite similar with the classification of welding defects.

In this point there are no differences between Japan and Germany.

### Removal of Defects

For the removal of welding defects I cannot see any differences between Japan and Germany. It is the same method: the welding operation procedure, shape of groove, welding materials and their control, inspection, the types of defects which have to be repaired, welding repairing methods and so on are documented in the Quality System Document. The welding operation has to be conducted according to the this document.

The repair of a welding defect follows the steps:

- \* Removal of the welding defect  
(using air-arc gouging, etc.)
- \* Confirmation of removal weld defect  
(appearance test, liquid penetrate test)
- \* Repair welding

### Quality Improvement

In Japan the most firms have a Quality-Circle-Action system. The working course is continually improved with the help of the quality system. It is ensured by setting and improving the wanted quality of a product and by reducing the rate of defects of the key process.

The employees gather in small groups. In these groups they discuss about the quality, the improvement and what is the best process to make products. This is the well known Japanese system.

Also in Germany most of the firms have also a Quality-Circles-Action system for improvements.

### Period of Liability for the Welded Parts

In Japan, the period of liability is generally 2 years but it depends on the contract between customer and company. Often the period of liability is not specially fixed.

The opinion of the firms is that the quality of welded parts should be ensured, provided that the steel is proper. In case of deterioration including material

fatigue caused by long-term service or the failure induced by the factors that can not be predicted and/or are not specified in the specification, the repair is sometimes to the debit of the contractor. In other times it is necessary to find an agreement about the costs (for example cost-sharing).

In Germany questions of liability will be written down in the contract between customer and company. The basis of a contract is given by law (what has to and what can be written down in the contract). The period of liability depends on the contract between customer and the company.

### Occupational Safety

In Japanese companies a daily morning meeting is carried out, concerning the occupational safety before operation for every body to realize the necessity of safety. Besides, OH&S (Occupational Health & Safety) system is introduced to many companies. The members of the quality circles discuss about safety every month in meetings. If a small accident occurs in a factory, the companies will exchange the information as soon as possible to prevent a similar accident.

In Germany the superiors of the sections will have a monthly meeting for a discussion of occupational safety in the firm. The contents of this meeting are to avoid accidents and make suggestions to improve the occupational safety.

An annual check of each worker about the occupational safety will be done.

### Exchange of Information

All Japanese firms support the exchange of information between the factories. So they have meetings and committees regularly. For example the quality meetings are carried out once a month.

In Germany the manager gives also an information to the employees about the present situation of the firm, during a meeting or in a brochure every month (or quarterly).

### Training of the Employees, Developing One's Knowledge

The firms will give a beginner a special training term and also let him take part in the education program (nearly the same in Germany). Afterwards the employees have to improve their skill on their own in addition to the job.

- \* Developing the knowledge of the employees

The ISO regulations which are related to quality control, repair of welded defects, a new machine for welding and so on (in Germany only once a year) will be taught twice a year.

- \* Checking the employees concerning the production of quality welded parts.

To ensure the quality (or level) of welding, technical tests specified by JIS (Japanese Industrial Standard) are realized for welding operators. The employees have to be tested by JIS. If they fail the test, they cannot continue their job. So they have to improve their skill. Besides, the education and training are planned and led on every year. The results of education and training are recorded. The management always checks this result and tries not to fail this test for welders. This is one of the most important job for managers. The result of the annual education and training will be written down in Germany. When a defect appears during the year it will be looked for the responsible person. If this person has passed the last test, the person will repeat the unit and will get a reference. If the person has not taken part in the last unit, the manager will get the reference.

### Relationship Men - Process - Quality

The relationship between men-process-quality is documented by the introduction of the process controlling according to ISO 9001 in Japan as in Germany.

Every company tries to make the best process for producing high quality. Besides, the question of the cost is very important. If a firm can spend much money, it is easy to raise the quality of a product. In any case - all over the world - the firms have to educate the worker and to build the process to keep the quality as good as possible while the money is limited.

The most important factors are except a effective process quality check system are the persons, who carry out the process, the costs and price of the parts, the quality of the part, etc. (see the pictures at the beginning).

When the firms have completed the system, the members of these company have to be educated and convinced continuously about the consciousness of quality.

### Specialities: Earthquake-Factor

In Japan exists an earthquake factor for welding buildings. The factor is divided in a factor for a small earthquake, a factor of a middle earthquake which is calculated for coming every 20 to 30 years and a factor of a big earthquake which is calculates to come once a century.

In Germany does not exist an earthquake-factor for welded parts or buildings in general.

### Summary

The technical description of quality management systems which is written down in the ISO 9000 and following, does not differ very much if you are in Japan or in Germany. In other words: the basis for the

construction of a quality management system is the same in both countries.

The national standards (in Germany also the European standards) differ in some parts (for example the earthquake factor).

Because of the harmonizing of the standards in Europe, the using and the application of national standards is easier in Japan than in Germany.

The main difference in the application of the quality management systems between Japan and Germany are the following points:

#### (1) The responsibility

In Japan a section or a quality circle is responsible for a good result, in Germany it is only one person who has to guide the group and who is responsible.

Advantage: In Japan everybody in the group understands which problems are to be solved and what is to do next. In Germany the manager has to know only the person, who is responsible for the group for interviewing the results of the quality circles, meetings etc. Disadvantage: In the practical use in Japan, it is possible, that the members of a quality circle rely on the next to solve a problem, and the solution has to wait. On the other hand in Germany the only responsible person of a group is keen on finding a solution and has to motivate the group members that they will help to solve the problem.

#### (2) The presentation

Every section of a working group has a notice board to show the current problems, the results and the work of the group. Because of the composition and the education of the group-members in Japan, everyone can give explanations about the progress. The technical equipment is quite similar in Germany. Only the ability to inform a visitor what is to do shortly has to be improved in Germany. At some Japanese Universities the students learn to lecture their works to an audience. This point can be improved in the German education of students.

#### (3) The employee

In my opinion it is very important to practise a good quality management system. It does not concern only the service or the technical section because welding, a method of production, is important for all parts of the company. If everybody has understood what is the result of producing a good part, if everyone has a good basic education for his work and will continue the firm regularly, it is not necessary to speak about the importance of the quality management system always.

When the employee is convinced of the company it is very easy to practise such a quality management system and the firm can save a lot of money and time.

Whether a quality management system works well

you can see, when problems arise which are to be solved between customer and company. When the customer knows that the company is working seriously and is endeavour to solve the problems he will continue to work with this firm.

With the factor "employee" you can manage many things concerning the application of quality management systems now and in the near future.

Finally I have to say that it is important to speak about the problems and to solve them; the combination of word and action should be realized.

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