



Education and Culture

Leonardo da Vinci

Course: 141 - TIG WELDING OF STAINLESS STEEL

Module 9

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MODULE 9

Delivery of the product.

Manufacturing processes such as fusion welding are widely used to produce many products, and for some companies, these are the key production features. Products may range from simple to complex; examples include pressure vessels, domestic and agricultural equipment, cranes, bridges, transport vehicles and other items.

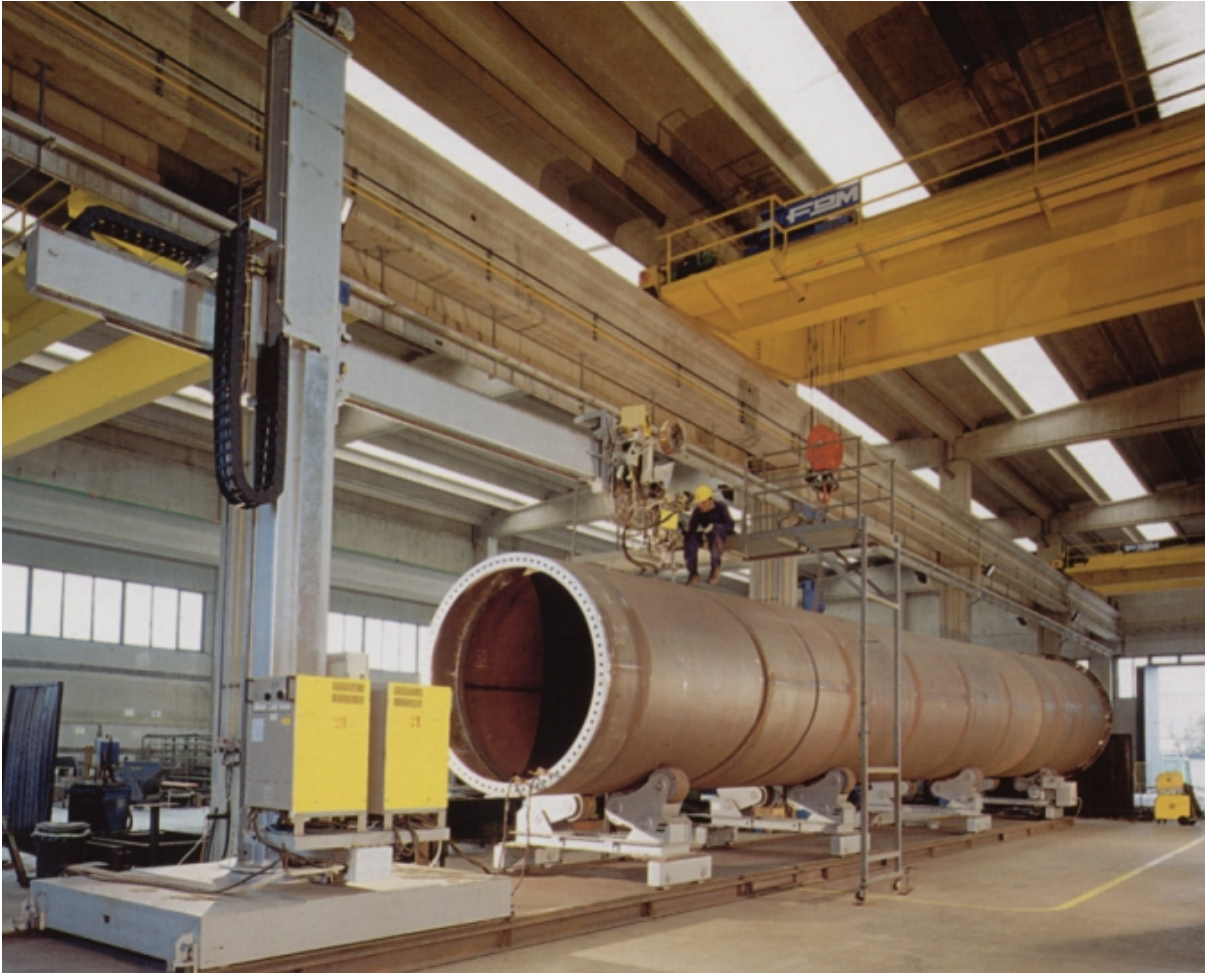
These processes exert a profound influence on the cost of manufacture and on the quality of the product. It is therefore important to ensure that these processes are carried out in the most effective way and that appropriate control is exercised over all aspects of the operation. In general, ISO 9001 standard has been developed in order to apply a consistent Quality Management System.

However, surface coating, painting, composite manufacture, welding and brazing are considered as “special processes” because the quality of the manufactured product cannot be readily verified by final inspection. In the case of welded products, quality cannot be inspected directly in the product, but has to be built in during fabrication, as even the most extensive and sophisticated non-destructive testing does not improve the quality of the product.

For this reason quality management systems alone may be insufficient to provide adequate assurance that these processes have been carried out correctly. Special controls and requirements are usually needed, which require adequate competence control before, during and after operation. For products to be free from serious problems during production and in service, it is necessary to provide controls from the design phase through material selection, into manufacture and subsequent inspection. For example, poor design may create serious and costly difficulties in the workshop, on site, or in service; incorrect material selection may result in problems, such as cracking in welded joints.

To ensure sound and effective manufacturing, the management needs to understand and appreciate the sources of potential problems and to implement appropriate procedures for their control.

All these considerations lead to the development of specific standards, EN ISO 3834.



For long a number of people have thought that a defined level of quality, could have primarily been reached, through the implementation of "a manual and several documented procedures", considering the specific technical knowledge, over the fabrication process applied, a matter of secondary interest.

Getting the "substantial quality" is quite easy: to recognise a first priority to the specific technical competence on the fabrication process. According to that, the European trend in quality management is clearly moving from a system approach to a process/product approach, claiming for Manufactures to show an evidenced competence.

The European Product Directives and their referring European standards, claiming for the fulfilment of specific technical requirements, are exhaustive examples of that.

The European Welded Product Directives.

The European Directives, have the dual purpose of:

- ensuring the free movement of goods through a technical harmonization and
- guaranteeing a high level of public interest protection.

Innovative features of this legislation, addressed to the introduction of CE marking, include:

- the definition of mandatory essential requirements and
- the setting up of appropriate conformity assessment procedures.

The Manufacturer assumes the responsibility of designing and performing a product, bound to be placed on the Community market, retaining the overall control along the whole fabrication course.

For that the Manufacturer must give clear evidence of having the necessary competence.

Consistently with this responsibility, the Manufacturer is due to ensure that the conformity of his product is assessed to the essential requirements of the applicable Directives.

Where a Directive requires products and/or systems to be independently assessed, this must be done by a "Notified Body". However, even if the Notified Body is involved, the responsibility of the product conformity, is primarily on the Manufacturer.

The most important European Directives, concerning welded products, are shown in the table:

87/404/EEC	Simple Pressure Vessel Directive	SPVD
97/23/EC	Pressure Equipment Directive	PED
99/36/EC	Transportable Pressure Equipment Directive	TPED
89/106/EEC	Construction Product Directive	CPD
01/16/EC	Conventional Rail System Directive	CRSD
96/48/EC	High Speed Rail Directive	HSRD

The European Welded Product Standards

It is up to the Manufacturer to decide which way to go through to fulfil the Directives' essential requirements, giving evidence of such a fulfilment. The simplest way, often from contractual point of view, is that of the European standards, either harmonised or not.

The European harmonised standards, provide a direct presumption of conformity to the corresponding Directives' essential requirements.

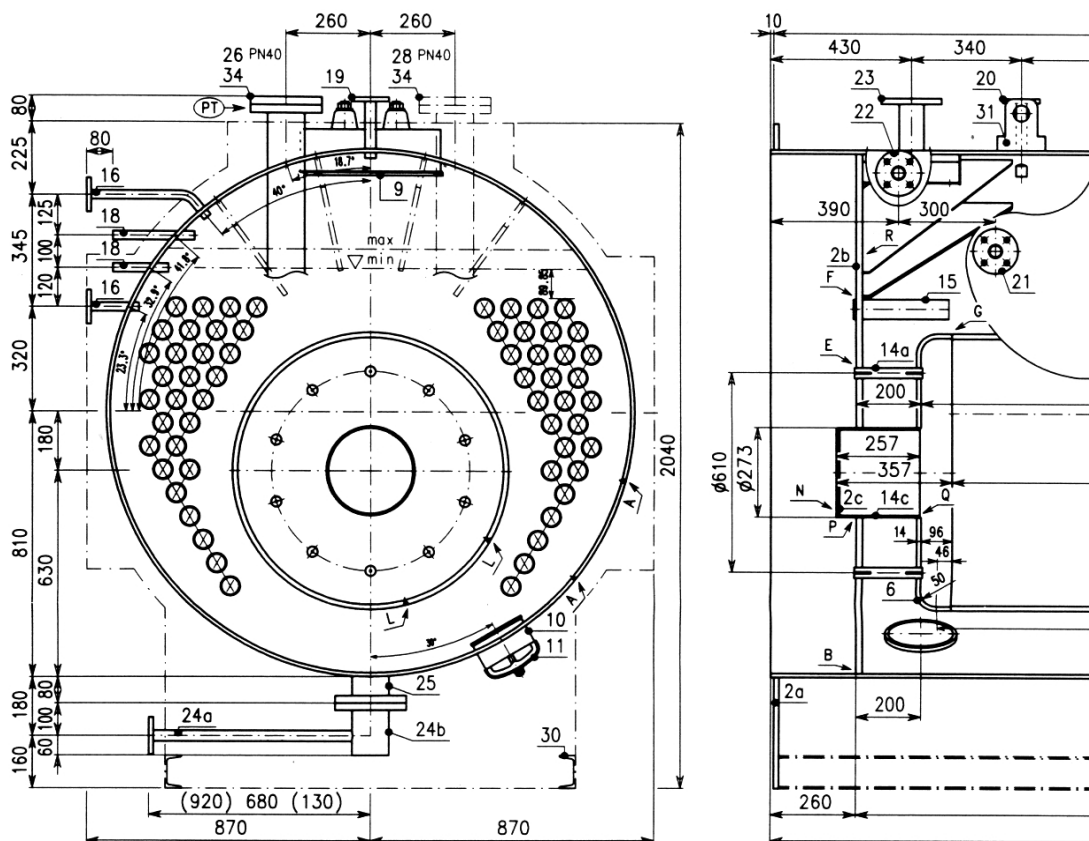
The European non harmonised standards, are however an agreed tool that can assure transparency and common understanding; consequently they are becoming a more and more applied reference in manufacturing contracts.

The most important applicable European standards, dealing with welding fabrication, are shown in the table:

Directive	Product Standard	Standard Title
87/404/EEC (SPVD)	EN 286	Simple unfired pressure vessels designed to contain air or nitrogen

97/23/EC (PED)	EN 13445 EN 13480 EN 12952 EN 12953	Unfired Pressure Vessels Metallic Industrial Piping Water-Tube Boilers and Auxiliary Installations Shell Boilers
99/36/EC (TPED)	EN 13530 EN 14025	Cryogenic Vessels – Large transportable vacuum insulated vessels Tanks for transport of dangerous goods
89/106/EEC (CPD)	pr EN 1090	Execution of steel and aluminium structures
01/16/EC (CRSD) 96/48/EC (HSRD)	pr EN 15085	Welding of railway vehicles and components

All these standards, when facing the welding fabrication process control, mention directly or indirectly the EN ISO 3834.



Example of a pressure vessel.

The EN ISO 3834

Stated that the Manufacturer, is fully responsible for his product conformity, an effective control of the whole fabrication course is a non ignorable matter, particularly when a “special process” like welding, with its ancillary activities (e.g.: PWHT, NDT, etc), is involved.

This control over the whole fabrication course is:

- not only the correct way to face the responsibility duties,
- but also the best route to fulfil the contractual and regulatory requirements of the marketed product without any waste or extra costs.

On the other hand, it is well known that any new technological innovation or any new regulatory reference applied impacts on the organisational system, which is at the basis of the industrial profit making process.

The EN ISO 3834 is made of five parts, whose headlines are self-explaining;

- Part 1: Criteria for the selection of the appropriate levels of quality requirements;
- Part 2: Comprehensive quality requirements;
- Part 3: Standard quality requirements;
- Part 4: Elementary quality requirements;
- Part 5: Applicable documents.

The main criteria, by means of which, the Manufacturer can select the Part of EN ISO 3834 convenient to his fabrication process, are:

- the critical state of the product from safety point of view;
- the manufacturing complexity of the product;
- the range of materials used;
- the possible metallurgical problems that can arise;
- the welding processes adopted and their level of automation;
- the significance, with respect to the expected service, of possible manufacturing defects.

All reported above means that the correct Part of EN ISO 3834 to be chosen is not necessarily depending on the demanded quality of the product, but rather on the real need for the specific fabrication process to be controlled in order to systematically guarantee the fulfilment of the contractual and regulatory requirements.

In other words it is the typology of the specific fabrication process the driving parameter for the selection of the correct EN ISO 3834 Part to be consistent with.

As already said, all phases of the welding fabrication process are taken into consideration by the EN ISO 3834, that is:

- Contractual and regulatory requirement review;
- Technical requirement review;
- Sub-contracting;
- Welding personnel;
- Inspection and testing personnel;
- Equipment;
- NDT personnel;
- Welding and ancillary activities;
- Welding consumables;
- Storage of parent metals;
- Post weld heat treatments;
- Inspection and testing;
- Non-conformance and corrective actions;
- Calibration and validation;
- Identification and traceability;
- Quality records.

Being a management standard, the EN ISO 3834 refers to other specific standards, dealing with particular topics or operations concerning the welding fabrication process (e.g.: personnel or procedure qualification, NDT, PWHT, etc.).

The EN ISO 3834, is more process oriented and attentive to the technical aspects; in fact:

- not only the quality manual is unneeded as before,
- but even the unwritten praxis, rooted on a specific technical competence, tend often to replace, with an equal value, the documented procedures.

Even the non-conformances appear to be primarily evaluated depending on whether they affect or not (and if yes, in what extent) the product real quality (instead of to be only a breach to the quality system), leading therefore to a process oriented assessment.

Identification and traceability

Identification of pieces and parts, and the possibility to retrace their position during the manufacturing stages and when delivered to the customer is one of the most effective way to achieve quality of the product and to have feedback about its functionality.

However, it shall be noted that identification and traceability can imply expensive procedures and are therefore not required by the ISO 3834 standard. However, they can be required by standards, fabrication codes or by the customer himself.

Whenever required, it shall be maintained during the manufacturing process, which means that for every piece or component it shall be possible to retrieve its history by marking the parts and controlling the relevant documentation. Documented systems to ensure identification and traceability of the welding operations shall include:

- identification of production plans;
- identification of routing cards;
- identification of weld locations in construction;
- identification of non-destructive testing procedures and personnel;
- identification of welding consumable (e.g. designation, trade name, Manufacturer of consumables and batch or cast numbers);
- identification and/or traceability of parent material (e.g. type, cast number);
- identification of location of repairs;
- identification of location of temporary attachments;
- traceability for fully mechanised and automatic weld-equipment for specific welds;
- traceability of welder and welding operators of specific welds;
- traceability of welding procedure specification of specific welds.

Quality records

Quality records shall be retained for a minimum period of five years in the absence of any other specified requirements.

Quality records shall include, when applicable:

- record of requirement/technical review;
- material certificates;
- welding consumable certificates;
- welding procedure specifications;
- equipment maintenance records;
- welding procedure approval records (WPAR);

- welder or welding operator qualification certificates;
- production plan;
- non-destructive testing personnel certificates;
- heat treatment procedure specification and records;
- non-destructive testing and destructive testing procedures and reports;
- dimensional reports;
- records of repairs and non-conformance reports.