EWF Guide to deal with the transition from EN 287-1 to EN ISO 9606-1 as efficiently as possible

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INTRODUCTION TO THIS GUIDE

The successor of EN 287-1 has caused quite a lot of controversy in European industry. The current ISO 9606-1:2012, issued in mid-2012, is not used, or hardly used at all, in the Netherlands and Belgium. But the reality is that after many years of “faithful” service in Europe, the old EN 287-1 has been replaced by EN-ISO 9606-1. A replacement that brings with it quite a lot of things that are not clear, particularly in the transition phase.

The reason why this transition is so important lies in the fact that in its set-up, the authorities looked expressly at the requirements that other “competing” standards make, such as the ASME code and the AWS.

This document intends to provide a guide as to how to deal with this transition as efficiently as possible. It is not a “must”, but perhaps it provides the clarification that the reader is looking for.
Perhaps unnecessarily, it is pointed out that this document DOES NOT replace the standard, but merely explains it in more detail!

For the sake of convenience only those sections that have been changed significantly compared with the current EN 287-1 are discussed. Also – for your convenience – the original section and paragraph numbers and titles as they are in the standard, are used in this document.

This guidance is prepared and approved by EWF Technical Committee and endorsed by the EWF Board. The original text has been drafted by the Dutch Standards Committee on “Welding” (341008) in close cooperation with the Belgian Standards Committee on “Welding Techniques”, 2013.

1. Introduction

We come across something new straight away in the introduction. First of all it is clear that all new qualifications have to comply with the new standard! As far as prolongation is concerned, it is said that the (old) qualifications must meet requirements as set out in the new standard as far as the "technical intent"[2] of the standard is concerned. It is also said that the range of qualification must be interpreted as it is described in the new standard. We will come back to this later.

2. Normative references

Of course this list has been fully updated to the situation as it is now. However, one important thing must not be overlooked: they are almost all undated references! This means that always reference is made to the latest (!) version of a document. Sometimes this can mean that as a result a new interpretation of a certain situation becomes necessary. So be careful!

4.3 Symbols and abbreviated terms

4.3.1 For test pieces

In this list only the introduction of "s" is striking as the weld metal thickness or the fused metal thickness in a butt weld connection.

This parameter becomes important when we look at the ranges of qualification.

4.3.2 For filler metals

In order to enable application that is as wide as possible for different codes and standards, there are two categories for the electrode covering (flux of the core wire): one based on figures such as in the AWS and one based on letters as we are already familiar with from the "old" EN 287. As these are two parallel systems, it is advised to use both systems on certificates in order to prevent any possible confusion now and in the future and to keep the certificate recognisable for ASME, AWS and ISO.

Below there is an overview of the designations given in the standard, with some additional explanation.

Group	Filler material for welding of	Examples of applicable ISO standards [xx] refers to the bibliography in the standard)	Examples of applicable AWS standards
FM1	Non-alloy and fine grain steels	ISO 2560, ISO 14341,[8] ISO 636,[1] ISO 14171,[6] ISO 17632[14]	AWS A5.1, AWS A5.18, AWS A5.17, A5.20
FM2	High-strength steels	ISO 18275,[21] ISO 16834,[13] ISO 26304,[25] ISO 18276[22]	AWS A5.5, AWS A5.28, AWS A5.28, AWS A5.23, AWS A5.29
FM3	Creep-resisting steels Cr < 3.75 %	ISO 3580,[3] ISO 21952,[23] ISO 24598,[24] ISO 17634[16]	AWS A5.5, AWS A5.28, AWS A5.23, AWS 5.29
FM4	Creep-resisting steels 3.75 ≤ Cr ≤ 12%	ISO 3580,[3] ISO 21952,[23] ISO 24598,[24] ISO 17634[16]	AWS A5.5, AWS A5.28, AWS A5.23, AWS 5.29
FM5	Stainless and heat-resisting steels	ISO 3581,[4] ISO 14343,[9] ISO 17633[15]	AWS A5.4, AWS A5.9, AWS A5.22
FM6	Nickel and nickel alloys	ISO 14172,[7] ISO 18274[20]	AWS A5.11, AWS A5.14

Nr[1].	Type of coating	Detailed information
03	rutile basic covering	Titanium dioxide, calcium carbonate
10	cellulosic covering	Cellulose, sodium
11	cellulosic covering	High cellulose, potassium
12	rutile covering	High titania, sodium
13	rutile covering	High titania, potassium
14	rutile + iron powder covering	Iron powder, titania
15	basic covering	Low hydrogen, sodium
16	basic covering	Low hydrogen, potassium
18	basic + iron powder covering	Low hydrogen, potassium, iron powder
19	limenite covering	Iron oxide, titania, potassium
20	iron oxide covering	High iron oxide
24	rutile + iron powder covering	Iron powder, titania
27	iron oxide + iron powder covering	High iron oxide, iron powder
28	basic + iron powder covering	Low hydrogen, potassium, iron powder
45	basic covering	Electrodes for downhill welding of pipe lines
48	basic covering	Low hydrogen, potassium, iron powder

4.3.5 Types of arc welding

Here there is apparently superfluous information on three generally very well-known abbreviations MIG, MAG and TIG. The meaning of these abbreviations is given because they are used elsewhere in the standard.

5. Essential variables and range of qualification

5.1 General

This list contains the main differences compared with the previous standards for welder's qualification. Parent material is replaced by welding filler material! This is the main change compared with EN 287-1. Also a number of new parameters are given as a result of improvements in the standard concerning backing.

A comment on the parent material: this does indeed have to be stated (reported), but without attributing a range of qualification to it!

5.2 Welding processes

Here there a number of things are found that are the result of the redefinition of welding processes in EN-ISO 4063 and section 4.2 of EN-ISO 9606-1.

For submerged arc welding, a change of process 121 to 125 (solid wire to cored electrode) or the other way round, does not have any consequences for the qualification of the welder.

[1] The symbol for type of covering or core is based on those given in various International Standards on filler materials.

For MIG/MAG welding the problem is greater: A welder who is qualified in the area of short circuit arc welding (process 131, 135 or 138) is also permitted to weld with other material transfer modes (globular, pulsed, spray arc), but not the other way round.

How to determine whether you are welding in the short circuit arc area?

You can of course say: “but you can hear” or “just look at the many diagrams we all know”. But what to do for example with a modern power source, which varies sometimes in a very subtle way with the material transfer? Here common sense is urgently needed!

A clean short-circuit arc regime is reached if welding is carried out with a power source with an arc voltage and wire feed speed set low whereby during welding brief short circuits and extinction of the arc occur. This welding equipment is set with an arc voltage and wire feed speed and gives as an output a variable current: power sources have a CV (or CP) current-voltage characteristic. In brief, the conventional, semi-automated machines.

In many modern power sources there is no clean short-circuit arc, but what is known as a “modified short-circuit arc” as it is called by some manufacturers of welding equipment. For example CMT, Cold-Arc, Cold Weld, STT, Speedpulse, PCS, forceArc, Rapid Weld, SpeedArc, DeepARC, etc. This modified short-circuit arc is not eligible for qualifying a welder for short-circuit arc. So a welder can be qualified for short-circuit arc only if the source can be set as a conventional welding machine with CV current-voltage characteristics.

5.3 Product type

The first sentence of this section discretely says something important: “or other product form”. It is important that you also look at 5.4 d), as this says what is meant by it! Another product form can be specified by a client, customer specification, inspection body or product standard in specific cases.

5.4 Type of weld

An important piece of information that we know from the latest revision of EN 287-1 is the fact that a fillet weld can no longer be qualified by a butt weld test. However, a type of alternative is proposed here, a combined test piece (Annex C), in which one part can be welded as a fillet weld and one part as a butt joint and can be tested together. However, be careful, a welder who needs a qualification for a butt joint will in most cases also want to “include” a penetration of the weld straight away. If that is the case, the combined test piece is no good.

With such fillet weld qualifications, the range of qualification has to be adhered to of the butt joint!

In 5.4. e) there is an annoying mistake in the English-language version of the standard: the reference to Figure 3 should be Figure 4.

Note: the detailed description of how such a combined test has to be carried out is described in point 5.4.b; an additional fillet weld in 5.4.e. Also, the use of this option must be stated specially on the certificate (see section 10, final sentence).

5.5 Filler metal grouping

5.5.1 General

The classification of welding filler material groups is given in Table 2. A separate test must have been passed for welding filler materials that do not come under any of the groups that are specified.

Important addition: it is not necessary to use the same materials as those in which the weld connection has to be made. But bear in mind the weldability!

5.5.2 Range of qualification

Table 3 speaks for itself; the range of qualification is wide!

Note: for the time being the classification into FE numbers is entirely separate and therefore has nothing to do with other standards in which welding filler materials are classified!

5.6 Filler material type

The observation about the two welding processes that are covered by the standard that can work without welding filler materials (TIG and gas welding) can be important. On this subject the standard states that the parent material used is the limiting factor for the range of qualification, in other words the welder is qualified only for the group of materials in which he has passed his test.

Table 4 gives the range of qualification for covered electrode types and Table 5 for the other filler materials.

5.8 Welding positions

Here too a warning is needed; a number of welding positions have disappeared from the tables. For the first time a standard makes active use of the difference between testing positions and welding positions! This difference has already existed for a long time (you may know it from the ASME BPV Code of many years ago or even your own national code, but this has not, or hardly ever, been used in ISO or in CEN either.

In principle, our “PA”, PB”, etc. are only testing positions, which are used solely in carrying out a test. These testing positions have a tolerance within which the test must be carried out.

It is different with welding positions, the positions in which material parts that are to be joined are in in the production phase. These are designated with names such as “flat”, “horizontal”, “overhead”, etc. Here too there are tolerances that are described in EN-ISO 6947.

This is also the reason why for example the PH position (for pipe), has no more range of qualification than PH but only PA (flat), PE (overhead), PF (vertical upwards); the qualified welding positions are now given here; this is also in line with ASME IX and the AWS, there it works the same. This also applies for H-L045 which qualifies PA (flat), PC (horizontal), PE (overhead), PF (vertical upwards) and not “H-L045” any more. The same reasoning concerns J-L045. EN-ISO 9606-1 works expressly with both systems; the designation PA, PB etc. as they appear in the current European and international standards and the positions “described” in the ASME code and the AWS are used (see Table 9 and 10 of EN-ISO 9606-1).

The advice here is: use both systems on your certificates, as this will make it most likely that these will be accepted by a wide group of inspectors or supervisors.

6.3 Welding conditions

There is also something new to report concerning the “stop-start” requirement.

The “old” standard talks about making one stop-start in the root layer and one in the capping layer! In this new standard – if more than one welding process is being used – at least one stop-start must be carried out for each welding process used, so including that in the root layer and one in the capping layer. Note: changing from a solid or a metal cored electrode to a flux cored electrode is considered to be a change in process! In such cases it is recommended to put all stops-starts in one line so that the number of test bars or sections (if applicable) can be limited.

A frequently asked question is: “How long do I need to wait between stopping and re-starting?” The answer is very simple: the material must be able to solidify. So counting for a little while before re-starting is reasonable.
A practical tip: have the welder draw a chalk line where he has stopped. In this time the weld metal has been able to solidify. Then he can carry on welding.

7. Acceptance requirements for test pieces

There is a very important sentence here: The sum of the greatest discontinuities exceeding 1 mm but less than 3 mm in any one bend specimen shall not exceed 10 mm. Another new element can be found in the “incorrect weld toe” (ISO 6520: ref. 505). In the last version of EN 287 this imperfection had gone to level “C”, but in EN-ISO 9606-1 this imperfection goes back again to at most level “B”!

This information is important mainly with NDT (visual inspection)!

8. Re-tests

Any test that fails to comply with the requirements of this standard may only be carried out once without further training having been given. So after failing for a second time, training has to be given again (verifiably) before a new test can be taken!

9. Period of validity

9.1 Initial qualification

An important new requirement is that with the first qualification it must already be stated on the certificate how in the future the extension will be carried out.

A choice can be made from the options described in 9.3.

It should be realised that with this, the choice is fixed for each qualification!

9.2 Confirmation of the validity

Not too much has been changed in this section, only clarified.

Perhaps superfluously the comment that it is clearly not the intention that the welding coordinator of a company signs the interim confirmations “quickly” if the “big” extension will take place after two or three years. *Consider the responsibility that the manufacturer has for the product he supplies!*

9.3 Revalidation of welder qualification

As noted earlier in this document, there are a number of options, and already when the certificate is issued it has to be stated how the certificate will be extended.

The options are given below, in abbreviated form:

1. The welder carries out a new test every three years.
2. The old method is also an option; every two years, two welds that have been made during the last six months before the validity of the certificate has expired are assessed.
3. A welder’s qualification is *valid without limitation* provided that:
    a. The validity is confirmed every six months
    b. The welder is working for the same manufacturer, and
    c. The manufacturer’s quality system satisfies the requirements of EN-ISO 3834-2 or -3 and this must have been verified, carried out by an authorised organisation (e.g. notified body, “NoBo”, EWF/IIW).

d. The manufacturer has documented that the welder has produced welds of acceptable quality, based on criteria from application standards, such as EN 13445 “Unfired pressure vessels”, EN 1090 “Execution of steel structures and aluminium structures”, EN 12952 “Water-tube boilers and auxiliary installations”, EN 12953 “Shell boilers”, EN 13480 “Metallic industrial piping” and EN 14222 “Stainless steel shell boilers”.

The requirements described above are not the full text of the standard but just a shortened reproduction!

This section clearly shows the influence of the attributing of responsibility to the manufacturer. In particular option 3 gives scope to a welding coordinator to keep “his” welders with the help of a well thought out administrative system. This is a typical bit of philosophy that comes from the ASME Code.

Note: Don’t let the manufacturer think that it is an easy job! He should never forget that in the event of accidents this responsibility lies with HIM and no one else!

10. Welder’s qualification test certificate

The standard states clearly that the issuing of a certificate is strictly the sole responsibility of the examiner or examining body and in Annex A presents a “format”. It is striking in this that – as well as all the familiar things – also a number of what are called non-essential variables have to be recorded, such as:

- Type of current and electrode polarity;
- Parent material group/subgroup;
- Shielding gas.

If a supplementary fillet weld test is carried out (in accordance with 5.4.e), the result must also be recorded on the certificate.

11. Designation

After discussing all the changes, it will surprise no one that the recommended designation method has also been adapted to the new set-up. This means that considerable adjustments will have to be made to any computer systems that work with the “old” 287 system.

What is to be done next?

The introduction of this new standard for the qualification of welders provides several possibilities in the transition from the old to the new.

It is very important to read the foreword, the introduction and the first part of the standard very carefully.

1) All new certificates as from the date of issue of EN-ISO 9606-1 are carried out according to the new standard.
   This also appears to apply for all those other (application) standards that refer to an older version, e.g. EN-287-1, whether it has been given a year or not!
2) Existing certificates for which the welding information is available.
   a) With tests *within the technical intent*[2] of EN-ISO 9606-1.
      These will be able to be transferred by a certifying body to a new certificate. With this, any new ranges of qualification must be entered!

The question here of course is: "what is technical intent[2]?". This is difficult to answer and therefore remains a little suggestive. Realistically it is to be expected that this means for example the scope of the test as the intent, whereby a different test specimen position over the diameter of a test pipe (for example Figure 5 of the standard) does indeed still fall within the technical intent[2].

b) With tests *not within the technical intent*[2] of EN-ISO 9606-1.
If a welder's qualification has not been carried out or tested within the technical intent[2] of the new standard, in principle a transition cannot be made to the new standard and a new test will have to be taken!

3) Existing certificates on which no more welding information can be obtained.
Unfortunately it is not possible to convert an old certificate into a certificate according to the new EN-ISO 9606-1.

[2] At the moment of writing, there is a formal question send to ISO/TC 44 on the term "technical intent".