

Guidelines on aspects of materials certification standards EN 10204 and ISO 10474



Acknowledgements

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Scope

This report provides high level guidance in respect of commonly related aspects or questions to the inspection/materials certification standards EN 10204 and ISO 10474.

It concentrates mainly on some of the more detailed aspects of Type 3.2 certification.

Introduction

There is perceived to be a general lack of understanding within industry of exactly what materials or inspection documentation/certification actually comprises. Some people might reference standards such as EN 10204:2004, *Metallic products – Types of inspection documents* or ISO 10474:2013, *Steel and steel products – Inspection documents* without a full understanding as to their proper use or application and/or that often additional requirements need to be specified. These key standards are also coming to the end of their useful life without ongoing review and update.

There are also perceived increasing difficulties with certification given today's sometimes more complex supply chain routing.

A specific and tailored approach might need to be generated by the purchaser for parts other than steels.

There are small differences between EN 10204 and ISO 10474 which are possibly due to the date of document publication and greater attempts at clarification in later issues. The correct terminology used within these standards is not specifically just that for **materials certification** but is perhaps more properly entitled **inspection documentation**. Throughout this document the terms Inspection Documentation (as per standards) and Materials Certification are used interchangeably.

It is also key to note that the EN 10204 document is also referenced with regards certification requirements under the European Union Pressure Equipment Directive (PED) 97/23/EC which is law within the European Community.

It is important to consider that inspection documentation is simply a guarantee in respect of traceability and materials defined properties. In many cases, material has no value unless it is also accompanied by its relevant inspection documentation.

Background

The materials certification standard EN 10204:1991, *Metallic products – Types of inspection documents* a document that was derived originally from DIN 50049, *Metallic Products: Types of Inspection Documents* which was then revised and published again in 2004.

It has been generally accepted that ISO 10474:2013, *Steel and steel products – Inspection documents* is directly related to EN 10204 even though its scope of application as per the title is not exactly the same as this later document more specifically only references steel products. This bias is almost certainly due to the fact that, historically, its greatest usage was in relation to the steel industry and it was more targeted towards manufacturers of steel products: plates, profiles, seamless pipes, forgings and castings.

The defined usage of these standards (within the body of the documents) does state that these standards and inspection principles can be applied to other products including non-metallic materials.

Inspection is commonly related to be one of two types: **non-specific** or **specific**. Often, the principal basis required is the level of assurance and legal connotations when required by law within the European Union.

Definitions from EN 10204:

- a) **Non-specific inspection.** Defined as an inspection carried out by the manufacturer in accordance with their own procedures to assess whether products defined by the same product specification and made by the same manufacturing process, are in compliance with the requirements of the order or not.

Under the basis of non-specific inspection, there are two differing inspection document options:

- **Type 2.1.** Declaration of compliance with the order without test results
- **Type 2.2.** Statement of compliance with the order, e.g. Type 2.1 and indication of test results of non-specific inspection.

Note that under non-specific inspection, the products inspected are not necessarily the products actually being supplied. This is not batch specific and only gives average values for that material produced from the mill over a manufacturing period.

- b) **Specific inspection.** Defined as an inspection carried out, before delivery, according to the product specification, on the products to be supplied or on test units of which the products supplied are part, in order to verify that these products are in compliance with the requirements of the order.

When considering specific product inspection (on a batch specific basis), there are also commonly now two inspection document options:

- **Type 3.1.** Statement of compliance with the order with indication of results of specific inspection including test results. Validated by a manufacturer's authorized inspection representative, independent of manufacturing and based on inspections before delivery.
- **Type 3.2.** Statement of compliance with the order with indication of results of specific inspection including test results. Validated by a manufacturers authorized inspection representative independent of manufacturing and a third party such as the purchaser's authorized inspection representative or an inspector designated by official regulations.

Further clarification as to the make-up of certification is provided – it is permissible for the manufacturer to transfer either Type 3.1 or 3.2 relevant test results obtained by specific inspection on primary or incoming products onto the inspection certificate if the manufacturer operates traceability procedures and can provide the required corresponding inspection documents.

The definitions contained within the documents are a key part in assuring a consistent and functionally safe product is delivered.

Some key definitions in respect of roles and parameters are:

- **Manufacturer:** Organization that manufactures the respective products according to the requirements of the order and to the properties specified in the referenced product specification.
- **Intermediary:** Organization that is supplied with products by the manufacturers and which then in turn supplies them without further processing or after processing without changing the properties specified in the purchase order and referenced specifications.
- **Product Specification:** Complete detailed technical requirements relevant for the order, stated in written form, e.g. referenced regulations, standards and other specifications. Typical examples commonly include ISO or ASTM standards.

A good understanding of these definitions is considered key to the application basis of the inspection documentation standards. Some of the main issues can arise simply due to misinterpretation or poor definition of order requirements and understanding by either the purchaser or vendor.

The form of documentation/certification has also changed to a degree, moving away in areas from paper documents to an electronic basis. While this can potentially help in terms of verifying certificate validity, it is currently an unfamiliar process to some purchasers.

Pressure Equipment Directive (PED) 97/23/EC

Pressure Equipment Directive (PED) 97/23/EU (shortly to be superseded by 2014/68/EU), is law within the European Union. It defines a set of essential safety requirements as per Annex I of which materials certification is considered a key aspect. It introduces the term **materials manufacturer**.

This is different in comparison with the US or many other countries worldwide, where standards like the ASME Boiler and pressure vessel (BPV) code are commonly used.

Note: In many US states, compliance with the ASME BPV code is a regulatory requirement. Inspection by the registered ASME inspector is required to demonstrate that the materials conform to the appropriate product specification using certificates of compliance or material test reports and that these documents represent the products actually being used.

Annex I section 4.3 of PED requires that the material manufacturer must prepare documentation affirming compliance with the specification required by the equipment manufacturer. This requires a detailed knowledge of the material being manufactured and the impact of processing parameters. (A validation test might also be required.) The material properties to be ultimately used in the design basis of the equipment must also be affirmed by the material manufacturer.

Any subsequent manufacturing process or indeed fabrication which could affect the properties of the base material shall be taken into account when specifying properties, e.g. tempering temperature and Post Weld Heat Treatment used in manufacture, to ensure properties are not degraded below that specified in the design.

It further states that values are not required in the certificate itself, but it is necessary, as a minimum, to refer to the specification where these values are included or defined. The volume of gaseous substances present, especially for steels that are not fully killed, should also be documented in the Manufacturer's Test Certificate.

Where a material manufacturer has an appropriate quality-assurance system, certified by a competent body established within the Community and having undergone a specific periodic assessment for materials, certificates issued by the manufacturer are presumed to certify conformity with the relevant requirements of the PED.

Pressure equipment materials and certification requirements are defined in relation to the pressure rating by PED categories and are applied using the inspection Type basis using e.g. EN 10204.

A certificate of specific product control is required for the main pressure bearing parts of pressure equipment in Categories II, III and IV, i.e. Type 3.1 or 3.2. Main pressure bearing parts in Category I applications or other pressure parts may however only require documentation to Type 2.2 whereas other parts might only require Type 2.1 documentation. Permanent attachments to main pressure parts are required to have the same minimum category as the main part.

Further clarification is given in the sections highlighted below:

- Main pressure bearing parts are as specified under PED 97/23/EC guideline 7/6 and are stated to be comprising the envelope under pressure. Typical examples are shells, ends, main body flanges, tubesheets of exchangers and tube bundles.
- Bolting is defined in Guideline 7/8 which states a bolt is not considered to be a main pressure bearing part unless its failure would result in a sudden discharge of pressure energy. This is an important consideration and is usually related to the number of bolts and whether or not the bolting is of the main body in respect of service and criticality. Notified bodies tend to have differences in opinion on this aspect and in particular the exact definition of what 'main' implies.
- Welding is another key materials area. Manufacturers are required to provide inspection documents affirming compliance with specification. Based on PED 97/23/EC Section 4 of Annex I and guidelines 7/5 and 7/10, manufacturers are required to provide test report Type 2.2 in accordance with EN 10204. Traceability is also considered a very important aspect and which can typically be maintained by procedural methods that cover receipt, identification, storage, transfer, use and the availability of inspection documents at final inspection. In practical terms, simple aspects expected to be included under welding are chemical composition of filler metals (or type of filler metal in respect of hydrogen content) or all-weld metal, tensile properties of all-weld metal and impact properties of all-weld metal at the designation temperature.

Type 3.2 certification aspects

Type 3.2 certification is increasingly being required in important applications due to some issues having been found where components nominally meet requirements on paper but, when tested subsequently, fail to meet the material specification.

There might be a number of underlying reasons for these discrepancies including certifications which were changed, certification documents that were unclear, or certification markings that were used without permission.

The end user may also specify additional requirements in the order specification and the third party may be required to witness all transfer of markings additional to the scope of Type 3.2 documentation.

The scope of inspection pertaining to the 'Third Party Inspection Agency' is required to be in line with a mutually-agreed 'Inspection Test Plan' between the third party inspector, manufacturer and purchaser.

Traceability can be considered a key aspect. Traceability depends very much on the quality systems that should already be in place and which can be audited by the third party contracted for inspection.

It is also essential to confirm the basis of testing is 'true' certification because there is a tendency within industry for stock materials to complement existing Type 3.1 certification with additional testing. This practice is often termed 'intent' of Type 3.2 documentation.

Simply, a paperwork review of certification at the stockist by third party inspection companies does not permit re-certification of inspection documents Type 3.1 to Type 3.2. Neither does test house update based on any additional testing as the test house is not classed as a manufacturer.

Type 3.2 certification

Type 3.2 certification is produced by the manufacturer, with test sampling and mechanical testing witnessed by a third party or purchaser designated inspector with verified identification and traceability aspects being applied back to the original steelmaker. Therefore, Type 3.2 certification can only be produced by the manufacturer at the time of manufacture.

From EN 10204, an Inspection Document 3.2 is defined as:

“Document prepared by both the manufacturers authorized inspection representative, independent of the manufacturing department and either the purchasers authorized inspection representative or the inspector designated by the official regulations and in which they declare that the products supplied are in compliance with the requirements of the order and in which test results are supplied.”

One key aspect is that it specifies the requirements of the order rather than just stating simply a product standard.

Type 3.2 ‘Intent’

One fairly common practice within the oil and gas industry is the position where Type 3.2 certification is required but, to meet short project timescales or for small quantities, it is only possible to obtain materials from stockholders with a Type 3.1 certification. With safety and reliability being a key concern for certain applications, there is a requirement to further validate the properties and traceability of the materials being utilized.

To provide this additional surety and ‘intent of’ Type 3.2 certification, there is a practice to repeat all specified mechanical testing of the material by taking a new test sample from cut-off or from a sacrificial part of the actual lot of material, utilizing a third party organization to witness the test sampling and the new/ additional testing, confirm markings, and afterwards to countersign and issue a report stating the basis of the ‘intent of’ certification and clearly label it as such. This typically includes a review of the steelmaker’s certificate of origin and verification of marking including a review of traceability back to ladle chemical analysis. This will also typically include sample dimensional checks.

It is the responsibility of the vendor to confirm with the purchaser the acceptability of this approach in terms of the order specification.

Some guidance on common issues

Inspection type/specifications

The type of inspection document is required to be specified in detail by the purchaser if it is not already specified in the product standard, e.g. ISO 10474 Type 3.1 or 3.2 for specific product control.

Any organization that changes the metallurgical state or material properties of a product is required to be considered a material manufacturer being a steel plate or seamless pipe mill, a foundry, a forge or casting shop permitted to issue inspection documents in compliance with ISO 10474 and EN 10204. Only manufacturers of the material product or who change the metallurgical state are permitted to generate inspection documents in compliance with ISO 10474 and EN 10204.

Where an intermediary has simply changed the product dimensions by, e.g. machining, sawing, turning, an additional document, e.g. a product certificate, is required to be supplied for these new dimensions and relate specifically to the original inspection documents and order specification and demonstrate traceability aspects. Also, in any product certificate, a copy of the original steel manufacturer's certificate should be attached.

Manufacturers involved in the issue of inspection documentation are required to have a written procedure documenting the certification process in detail and this is typically approved by the accredited body issuing an ISO 9001 certificate including the specific material assessment. This is required to additionally detail the standard form of the inspection certificate type and include details of the authorized manufacturers' representatives, independent of manufacturing who may validate/sign inspection documents.

When the purchaser requires a test report under a non-specific basis, they should further define the specific product characteristics required to be included on the certificate.

Further specific guidance on the base requirements is given in document ISO 404:2013, *Steel and steel products – General technical delivery requirements*, Clause 8.

It is not possible to change or update the inspection document Type from one Type to another subsequent to materials manufacturing.

Welded products (e.g. tubes, pipes, fittings) which are manufactured using a manual or mechanized welding process shall be considered to be a product in its own right when these are manufactured from coil/plate and fully heat treated post welding to develop specific materials properties. QA/QC aspects then cover not only the base material but the process of manufacture and, in particular, welding and subsequent heat treatment to confirm the quality and properties of the item as a whole. See also PED Guidelines 7/19 and 7/25.

Test results for weld consumables are usually based on non-specific inspection and testing is based on assumptions of quality control aspects and shall be provided as a minimum to inspection Type 2.2 documentation. Specific control may be warranted in some cases and is usually accomplished by batch testing of weld consumables.

The frequency of testing and certification shall be as specified in the product standard or the order specification.

The inspection documentation shall only relate to materials in their final processed form and therefore shall be wholly representative with regards to properties which may be used for design purposes.

Inspection documentation

Guidance on the information required for inspection/materials certification documentation is given in EN 10168, *Steel products – Inspection documents – List of information and description*. This can be a useful reference particularly when making an assessment as to the likely validity of inspection documentation.

Inspection documentation is required to include specific additional documentation to the product standard when determined in the purchase order specification or company standards.

Inspection documentation/certification shall be comprehensive in nature and should, as a guide, include all essential elements in Table 1 of EN 10168.

Traceability

Traceability is a key aspect to be maintained through all stages of materials manufacture to the final product testing and marking, and issue of inspection documentation.

All materials are required to be marked with a specific traceable number identifying each piece of material at any stage of the manufacturing operations to secure the final traceability against a manufacturer's inspection documentation.

Traceability aspects may also specifically apply to assurance in manufacture rather than as individual parts and may involve Positive Materials Identification additionally of weld consumables or completed welds.

Additional testing

The principal basis of what is to be included on materials certification/documentation is outlined in EN 10168, *Steel products – Inspection documents – List of information and description*.

There may be a requirement for additional aspects to be included in the scope of the third party witnessing, which if deemed relevant, must be further defined by order specification or company specifications.

Some examples of this, for detailed consideration, are:

- heat treatment (unless otherwise called for by specification)
- manufacture of a first item of type or pattern in major forgings or castings
- Non-Destructive Examination e.g. surface crack detection, ultrasonic/eddy current or magnetic testing
- hardness testing (usually included through ASTM specifications)
- fracture toughness properties and control
- specific dimensional properties and control
- surface condition and roughness
- chemical analysis of clad layers
- corrosion testing including for sour service
- Positive Materials Identification (PMI)
- ferrite-scope measurement.

Recommendations

The understanding within all purchasing organizations of what inspection documentation actually entails and the additional information required to be specified in company specifications and purchase orders should be improved by education particularly when Type 3.2 documentation is specified.

The basis and understanding of likely longer lead/delivery times for the application of Type 3.2 documentation should be better appreciated and planned during project conception.

It is expected that regular review and update should take place of inspection documentation standards utilized within industry, i.e. EN 10204 and ISO 10474, on the stated renewal frequency. Relevant industry bodies should assist and participate. IOGP suggests the items discussed in this guideline be reviewed and incorporated.

The future aim and use of the standards should be reviewed. Better synergies should be developed between the EN, ISO and other worldwide committees. The update of these standards should also include a better guide as to scope of application and should add further definitions and clarification as to the correct usage of inspection documentation types.

The terminology used within these key standards should be confirmed and defined, in particular the existing terms **inspection documentation** and perhaps the more commonly used industry term of **materials certification**.

The updated inspection/certification standards should aim to give further guidance on possible additional elements to be included in any order specification in addition to those within materials standards.

When reviewing inspection documentation for validity, reference the essential elements defined in EN 10168 and confirm the stated documentation basis and material manufacturer.

References

EN 10168:2004, *Steel products – Inspection documents – List of information and description*.

EN 10204:2004, *Metallic products – Types of inspection documents*.

ISO 404:2013, *Steel and steel products – General technical delivery conditions*.

ISO 10474:2013, *Steel and steel products – Inspection documents*.

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