

## Economic Commission for Europe

### Inland Transport Committee

#### Working Party on the Transport of Dangerous Goods

5 September 2022

#### Joint Meeting of the RID Committee of Experts and the Working Party on the Transport of Dangerous Goods

Geneva, 12–16 September 2022

Item 3 of the provisional agenda

#### Standards

### Information on the difficulties in applying a standard cited in Chapter 6

#### Transmitted by the European Committee for Standardisation (CEN)

#### Introduction

1. The Government of France submitted document ECE/TRANS/WP.15/AC.1/2021/41 to the Joint Meeting in September 2021. This document highlighted some apparent difficulties in applying standard EN ISO 11118:2015, *Gas cylinders — Non-refillable metallic gas cylinders — Specification and test methods* as referenced in 6.2.4 of RID/ADR. The representative of CEN announced that the concerns raised were forwarded to the relevant ISO Technical Committee, ISO/TC58/SC3, Cylinder design, and were expected to be discussed at the plenary meeting of this committee due to be held on 20-21 October 2021, (see informal document INF.25 of the September 2021 session). He offered to report back to the Joint Meeting on the findings from ISO/TC/58/SC3.

#### Discussion

2. ISO/TC58/SC3 met in October 2021 and agreed to establish a Task Force of experts, (ISO/TC58/SC3/TF3), that would be requested to review the points raised in document ECE/TRANS/WP.15/AC.1/2021/41. The Task Force was requested to produce a report by the end of January 2022.

3. The task force met in December 2021 and reviewed document ECE/TRANS/WP.15/AC.1/2021/41.

4. In accordance with the procedures of ISO the report from the task force meeting was submitted in January 2022 to ISO/TC58/SC3 for ballot. There were comments received from two standards bodies and these were passed back to the task force chair to arrange a meeting to discuss these. The comments were discussed, and minor amendments were incorporated into the report in accordance with ISO procedures. It was agreed that a second ballot was not required.

5. The report from ISO/TC58/SC3 was circulated to CEN/TC23 in July 2022 and no comments were received by the comment deadline.

6. ISO/TC58/SC3/TF3 emphasized that standard ISO 11118 is a non-refillable pressure receptacle standard and should not be confused or compared to refillable pressure receptacle standards.

#### Summary of report of ISO/TC58/SC3/TF3

7. The report from the experts who examined ISO 11118 is attached as Annex 1 of this document.

8. The experts noted that there are many millions of cylinders have been satisfactorily designed, manufactured and tested in accordance with ISO 11118.

9. ISO/TC58/SC3/TF3 noted that ISO 11118 is fit for purpose but in response to comments from France there are some improvements and clarifications which could be considered to make the document more user friendly without affecting the scope or technical content.

### **Further action**

10. A request will be made by CEN/TC23 to ISO/TC58/SC3 to include the items identified by ISO/TC58/SC3/TF3 at the next review of ISO 11118. This matter will be discussed at the forth coming meeting of ISO/TC58/SC3 in October 2022.

11. During the next revision of ISO 11118 participation from experts who prepared ECE/TRANS/WP.15/AC.1/2021/41 would be welcomed by ISO/TC58/SC3.

## Annex 1

### ISO TC58 SC3 TF3 - Meeting Date 06-23-22 - Experts Position Paper

#### Introduction

The directive of ISO TC58 SC3 TF3 was to review the comments dated July 7, 2021, from the Economic and Social Council pertaining to ISO 11118 and form Expert opinions on the comments. Items used to research, understand, and form opinion were (but not limited to) the following:

- Letter dated July 7, 2021 from the Economic and Social Council (ECE)
- ISO 11118, 2015
- Amendment ISO 11118, 2019
- Power Point presentation submitted by France at a TPED meeting
- 20 comments received on the TF-3 position paper
- Various ISO, EN and North American Standards
- Expert experiences in manufacturing and inspection of non-refillable pressure receptacles

It was determined by the Experts that Items numbered 1, 2 and 3 of the Economic and Social Council (ECE) letter required no actions by the Task Force.

The Experts emphasize that ISO 11118 is a nonrefillable pressure receptacle Standard and should not be confused or compared to refillable pressure receptacle Standards or ASME pressure vessel Standards.

#### Item 4

This item concerned the potential for brittleness within the carbon steel. The concern expressed in the letter was that the submitter felt ISO 11118 lacked verbiage to indicate the carbon steel shall be resistant to brittle fractures. It was noted that no carbon steel brittleness was found in the surveillance audit but was still a concern by the surveillance group.

The Experts reviewed and discussed the requirements of ISO 11118 and felt that no change to the Standard is required.

The Experts concurred that the entire section on “materials of construction” must be reviewed by the surveillance group for proper material evaluation. Adding an additional statement on material brittleness does not add value. The Experts concluded that experience has shown that the materials of construction requirements for carbon steels in Clause 5 and burst test requirements in Clause 9.2.4 adequately addresses the potential for embrittlement in carbon steels. The specific requirement for the material of construction not being brittle at the minimum operating temperature or at -20° C whichever is lower is a requirement that the pressure receptacle manufacturer and inspector need to confirm.

#### Substantiation

- When reviewing Clause 5 it was noted that 5.1.6 clearly states that the materials of construction shall be suitable for use at the minimum operating temperature or at - 20°C whichever is lower. The Experts noted that how this requirement is achieved could be confidential between the pressure receptacle manufacturer and the steel mill, but it is the responsibility of the inspector to confirm compliance.
- Burst testing of the completed pressure receptacles in the prototype testing as well as the batch testing requires that the pressure receptacles exhibit a

ductile fracture and that the pressure receptacles shall remain in one piece after bursting.

- Pressure receptacles designed and constructed to ISO 11118 can be as thin as 0.6 mm. Charpy impact testing of carbon steel this thin is not recommended and would result in inaccurate and potential meaningless values.
- The Experts reviewed the dimensional requirements for Charpy impact testing and noted the pressure receptacles manufactured in accordance with ISO 11118 would be too thin according to the size of the sample noted in the Standards. ASTM E2248 defines that minimum thickness for sample test is 4.83 mm.

## Item 5

This item concerned the weld quality on carbon steel pressure receptacles. It was noted by the surveillance group that weld irregularities (e.g., visual inspection) were found during the surveillance audit.

The Experts concluded the quality and repeatability of welds relates to the process controls and quality control at the manufacturing facility. ISO 11118, nor other ISO pressure receptacle design Standards, addresses manufacturing facility process controls and quality control systems. Additionally, the Experts concluded that automated and semi-automated welding as required in the standard is very beneficial for repeatability of welds by taking out the numerous variables that are present in manual welding.

The Experts agree that conformity assessment during manufacturing is a vital factor for all manufacturing processes.

- A recommendation will be made by ISO TC58 SC3 TF3 to ISO TC58 SC3 WG29 to consider modifying ISO 11118 to be more precise on visual acceptance criteria.
- A recommendation will be made by ISO TC58 SC3 TF3 to ISO TC58 SC3 WG29 to consider evaluating ISO 5817 for applicability in ISO 11118.

## Substantiation

- These designs are for nonrefillable pressure receptacles. Once the pressure receptacle is filled and the contents are exhausted, the pressure receptacle may not be refilled.
- ISO 11118 designs are unlike refillable pressure receptacles manufactured in accordance with ISO 4706. ISO 11118 pressure receptacles do have a finite life expectancy whereas refillable pressure receptacles can remain in service for decades with appropriate periodic inspection and testing.
- ISO 11118 does state the welding must be conducted by semi-automatic or an automatic process in Clause 8.1.1.2.1.
- The workmanship of a semi-automated or automated weld will be of higher quality than that of a manual weld. This leads to enhanced process controls and quality control for welding. Again, appropriate inspection must be carried out in parallel.
- ISO 11118 states and the workmanship Cause 8.2 (c) that the workmanship of the completed welds shall not have concavity, the undercutting or abrupt weld irregularity cracks or any other defects.
- One weld irregularity noted in the PowerPoint presentation was an overlap of the circumferential seam weld and was not considered by the Experts to be a defect. Another weld irregularity noted in the presentation was on a braze fillet of a flange located in the head of the pressure receptacle. In brazing, it is not necessary to visually observe a fillet to have a sound weld since the braze alloy may be fusing a vertical seam versus a horizontal seam in a braze joint.

- X-rays of welds and braze joints on nonrefillable pressure receptacles is not required nor is there pass/fail criteria for pressure receptacles manufactured to ISO 11118.

## Item 6

This item concerned the requirements for welding qualification. The surveillance group indicated that they felt clarification was needed between the actual welding machinery process and the operator performing the function.

The Experts reviewed the requirements of ISO 11118 and agreed that the requirements in Clause 8 are intended to validate the welding process and the operator performing the function. This would include but not be limited to the weld joint design, positioning of the weld, the welding consumables, and the operator. These requirements were noted in an Amendment to ISO 11118 issued in 2019.

The Experts discussed the possibility of referring to ISO 15614-12 in the subclause 8.1.1.2.2.1 of ISO 11118 for spot, projection, and membrane welds. There was no consensus on adding a reference to ISO 15614-12. Therefore, this possibility will be sent to the ISO 11118 group for their study and consideration.

- A recommendation will be made by ISO TC58 SC3 TF3 to ISO TC58 SC3 WG29 to consider evaluating ISO 15614-12 for qualification of spot, projection, and membrane welds.
- A recommendation will be made by ISO TC58 SC3 TF3 to ISO TC58 SC3 WG29 to consider evaluating Clause 9.2.3.2 concerning only tensile strength determination of weld test coupons in ISO 11118.

## Substantiation

- Clause 8.1.1.2.2.1 states requirements for qualification of the welding process as well as the operator.

### 8.1.1.2.2.1 General

- a) All welders, welding operators and welding procedures shall be approved by meeting the requirements of 8.1.1.2.2 through 8.1.1.2.2.9 or those given in ISO 9606 - 1, ISO 14732, ISO 15613, and ISO 15614-1 as appropriate.
- b) Records of welders and welding operator qualifications and welding procedure qualifications shall be kept on file by the manufacturer.
- c) Welding procedure specification approval tests shall be carried out such that the welds shall be representative of those made in production.
- d) Welders, welding operators and welding procedures shall pass the approval tests for the specific type of work and procedure specification concerned.

## Item 7

The surveillance group indicated that upon assessment of product they found pressure receptacles designs with the minimum wall thickness less than that noted on the manufacturer's product drawing. The surveillance group indicated that an addition was needed to ISO 11118 for verification of the minimum wall thickness during manufacturing.

The Experts concluded the repeatability of minimum wall thickness relates to the process controls and quality control at the manufacturing facility. ISO 11118 nor other ISO pressure receptacle design Standards addresses manufacturing facility process controls and quality system/assurance. Adding a requirement in ISO 11118 does not correct a process control or quality control issue.

The Experts reviewed and discussed the requirements of ISO 11118 and concluded that Clause 9.2.3.2 of ISO 11118 does need modified to clarify that only tensile strength determination is required on weld tensile tests.

- A recommendation will be made by ISO TC58 SC3 TF3 to ISO TC58 SC3 WG29 to consider evaluating Clause 9.2.3.2 concerning only tensile strength determination of weld test coupons in ISO 11118.
- A recommendation will be made by ISO TC58 SC3 TF3 to ISO TC58 SC3 WG29 to consider adding information to Clause 10.1 or elsewhere in ISO 11118 indicating periodic validation of the pressure receptacle minimum wall thickness is required.

## Substantiation

- The minimum wall thickness of the pressure receptacle is calculated by the equation noted in Clause 7 and the additional requirements listed after the equation.
- The minimum design wall thickness of the pressure receptacle is the side wall of the pressure receptacle not the domed heads (see Clause 3.2).
- It was noted that the surveillance group used the yield strength from a weld tensile coupon to determine the minimum wall thickness. Yield strength from the sidewall tensile test is the value to be used for yield strength determination since the weld tensile coupon may contain a heat affected zone from the joining by welding of the pressure receptacle top and bottom. When using the yield strength from the weld tensile coupon it is expected a lower yield strength will be present than the sidewall thus, the lower yield strength would increase the minimum wall thickness.
- It is also noted that the minimum wall thickness of the pressure receptacle design must be validated by the burst test during prototype testing and batch testing.
- ISO 11118 is clear on minimum design wall thickness.

## Item 8

This item addressed the requirements in Annex A concerning pressure relief devices. The surveillance group is requesting that the requirements of A.4.3 (a) be removed from Annex A.

The Experts reviewed A.4.3 (a) and 8.1.3 and concluded that a membrane could be a non-refillable device and a pressure relief device simultaneously.

Additionally, the Experts concluded that A 4.3 is discussing the membrane used as a non-refillable device not a pressure relief device. The requirement for the membrane being used as a pressure relief device is located in Clause 8.1.3. Therefore, notified bodies should be testing in accordance with the Standard.

- A recommendation will be made by ISO TC58 SC3 TF3 to ISO TC58 SC3 WG29 to consider evaluating Clause 8.1.3 ISO 11118 and add a parenthetical (see A 4.3.1 for membrane non-refillable devices).

## Substantiation

Clause 8.1.3 assures that the pressure receptacles will not fail catastrophically.

The intent of clause A.4.3 (a) was to assure that if a combination task was being conducted by a membrane that adequate testing was in place.

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## Action Item Summary

The following action items will be forwarded to the TC 58 SC 3 WG 29 (ISO 11118) group for their consideration.

- A recommendation will be made by ISO TC58 SC3 TF3 to ISO TC58 SC3 WG29 to consider modifying ISO 11118 to be more precise on visual acceptance criteria.
- A recommendation will be made by ISO TC58 SC3 TF3 to ISO TC58 SC3 WG29 to consider evaluating ISO 5817 for applicability in ISO 11118.
- A recommendation will be made by ISO TC58 SC3 TF3 to ISO TC58 SC3 WG29 to consider evaluating ISO 15614-12 for qualification of spot, projection, and membrane welds.
- A recommendation will be made by ISO TC58 SC3 TF3 to ISO TC58 SC3 WG29 to consider evaluating Clause 9.2.3.2 concerning only tensile strength determination of weld test coupons in ISO 11118.
- A recommendation will be made by ISO TC58 SC3 TF3 to ISO TC58 SC3 WG29 to consider adding information to Clause 10.1 or elsewhere in ISO 11118 indicating periodic validation of the pressure receptacle minimum wall thickness is required.

A recommendation will be made by ISO TC58 SC3 TF3 to ISO TC58 SC3 WG29 to consider evaluating Clause 8.1.3 ISO 11118 and add a parenthetical (see A 4.3.1 for membrane non-refillable devices).

Respectfully Submitted:

*Steve*

Steven T. Gentry Convenor,

TF-3 07-20-22