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Equipment for crop protection — Closed transfer systems (CTS) — Performance specification

Matériel de protection des cultures — Systèmes de transfert fermés (STF) — Spécification des performances

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 6, *Equipment for crop protection*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Equipment for crop protection — Closed transfer systems (CTS) — Performance specification

1 Scope

This document specifies operator and environment-related safety requirements and the means of their verification for the design and construction of closed transfer systems (CTS) for liquid formulations of plant protection products (PPP) in 1 l to 20 l containers.

In addition, it specifies the type of information on safe working practices including information about residual risks to be provided by the CTS manufacturer and specifies the maximum potential contamination during any single transfer operation.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3600, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Operator's manuals — Content and format*

ISO 3767-1, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays — Part 1: Common symbols*

ISO 3767-2, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays — Part 2: Symbols for agricultural tractors and machinery*

ISO 5681, *Equipment for crop protection — Vocabulary*

ISO 21278-1:2008, *Equipment for crop protection — Induction hoppers — Part 1: Test methods*

ISO 21278-2, *Equipment for crop protection — Induction hoppers — Part 2: General requirements and performance limits*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5681 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
application equipment
device or assembly of components to mix and apply plant protection products and other compatible chemicals to the target

[SOURCE: ISO 5681:2020, 3.1.16]

3.2
closed transfer system
CTS
device or assembly of components, including the container to *application equipment* (3.1) interface, intended to wholly and partially transfer plant protection products or other compatible liquids from their original containers into application or mixing equipment by direct coupling or other engineering means of enclosure that reduces the exposure of the operator and environment

[SOURCE: ISO 5681:2020, 3.2.9.6]

3.3
single transfer operation
actions required to be completed starting from connection of the container to the CTS, completion of the product transfer procedure, measurement of partial transfers where applicable, rinsing of the container and the transfer device, and removal of the container ready for storage or disposal

4 General requirements

4.1 CTS shall include:

a) a means of interfacing with containers (see Annex A as an example) and application equipment;

b) a means of controlling or measuring part or all of the product from the container;

c) a means to rinse the container in to the application equipment, if appropriate (for example if CTS is designed for containers as shown in Annex A);

d) a means of flushing the CTS as well as the interface.

Compliance shall be checked by inspection and the function tests specified in this document.

4.2 A manual shall be provided by the CTS manufacturer that meets the requirements in Clause 6.

4.3 All operations of a CTS shall be possible while using appropriate personal protective equipment, including gloves as recommended in the operator's manual and on the container label.

Compliance shall be checked by a function test.

4.4 CTS's shall be designed so that no part of the equipment is subjected to pressures greater than the manufacturer's stated maximum for the system. To minimize potential contamination in the event of a failure, no part of the CTS shall operate with the concentrated product formulation at a pressure greater than 100 kPa unless:

a) the component parts of the CTS have been pressure tested with a pressure of two times the maximum for the system, or

b) a secondary containment system is used.

The CTS shall not modify the pressure in the container by more than negative 4 kPa from the ambient atmospheric pressure.

Compliance shall be checked by measurement a) and inspection b).

4.5 The CTS shall empty the content of the container while:

a) maintaining the shape, dimensions and leak tightness of the container; no leakage shall occur in accordance with 5.1;

b) allowing drainage of the contents, in accordance with 5.2;

c) allowing effective rinsing of the container and any interfaces when required (after partial transfer, product measurement or no rinsing if the container is refillable), in accordance with 5.2.

4.6 The CTS when operated according to the operator's manual and attached to the application equipment shall not:

a) cause leakage at the device it is connected to;

b) influence the circulation system of the application equipment it is connected to;

c) allow the introduction of air that promotes foaming or reduces pump performance.

Compliance shall be checked by a function test.

4.7 All controls on CTS's shall be clearly labelled using symbols conforming to ISO 3767-1 and ISO 3767-2 where appropriate.

Compliance shall be checked by a function test.

4.8 CTS shall be designed to prevent any return of liquid to clean water supply.

Compliance shall be checked by a function test.

4.9 In case the container opening is covered by a foil, the foil shall be kept attached to the container and be rinsed.

Compliance shall be checked by a function test.

5 Performance requirements

5.1 Leakage

5.1.1 General

When operating CTS equipment, in accordance with the manufacturers operating instructions, there shall be no observable leaks from the container, CTS, the interface between them including any associated connections, measuring or control devices when tested according to 5.1.4. One sample of each adaptor/interface available from the CTS manufacturer shall be supplied with the CTS tested.

5.1.2 Principle

This test is conducted while the CTS is being used to connect, open, empty, measure (where measurement devices are present) and rinse the container and CTS. The test uses a 0,1 % solution of a surfactant in water with the addition of a fluorescent dye to disclose any leaks at the relevant stages of operation.

5.1.3 Apparatus

5.1.3.1 System leakage test formulation, specified in Annex C. A similar dye that fluoresces under the ultraviolet light specified in 5.1.3.6 can be substituted.

5.1.3.2 Test container, the maximum size container with which the system is designed to operate and specified in the CTS manufacturer's manual.

5.1.3.3 The **CTS** to be tested shall be prepared to operate as determined by the manufacturers' operator instructions for installation and use.

5.1.3.4 The **pipe/hose supplying** the rinsing water to the CTS shall be fitted with a pressure indicator and any pump or other means of assisted dispense shall be fitted with a crop sprayer pressure gauge.

Sprayers shall be fitted with a pressure indicator, the accuracy of which shall be

— ±0,2 bar for working pressures between 1 bar (included) and 8 bar (included),

— ±0,5 bar for working pressures between 8 bar and 20 bar (included), and

— ±1 bar for working pressures more than 20 bar.

The pressure indicator shall be clearly readable. The pressure indication shall be stable. The scale of the pressure indicator shall be marked as follows:

— every 0,2 bar for working pressures less than 5 bar;

— every 1,0 bar for working pressures between 5 bar (included) and 20 bar (included);

— every 2,0 bar for working pressures more than 20 bar.

5.1.3.5 **Ultraviolet disclosing goggles or filter with yellow lenses**, to protect the eyes of the test operator and to enhance visibility of UV fluorescence.

5.1.3.6 An **ultraviolet light source**: **High output LED flashlight**, with a wavelength of 385 nm to 400 nm and a minimum UV-A intensity of 10 000 µW/cm^2.

5.1.3.7 **Potable water** and **disposable wipes** for dye removal.

5.1.3.8 An **absorbent sheet** able to collect all splashes and leakages placed on ground under the CTS to be tested. The dimension should be able to collect splashes and leakage from the CTS and connection to the application equipment.

5.1.4 Procedure

5.1.4.1 Load the test formulation to the nominal volume of the container (5.1.3.2). Thoroughly clean all external surfaces of the product container and CTS using the ultraviolet dye removal materials specified in 5.1.3.7. Scan all surfaces of the product container and CTS with the UV light source and remove any disclosed areas using the dye removal materials to ensure no dye is visible.

5.1.4.2 The operator shall ensure to use a coverall and gloves that are not contaminated with the test formulation. These can be tested using the UV light source in a dark room before and after the test. Connect the filled container prepared as specified in 5.1.4.1 to the CTS. Transfer the test formulation into the CTS to be tested in accordance with the CTS manufacturer's instructions including the measuring device if fitted.

5.1.4.3 Immediately upon completion of the actions in 5.1.4.2 and with the connections to the container and CTS fully engaged and connected, blackout all windows and turn off all other light sources to the point that no visible light enters the room then use the UV light source to inspect all external surfaces of the container, CTS and associated connections. Using the appropriate yellow tinted spectacles/filter, observe the surfaces for evidence of leakage. Record any leakage in a test report (see example in Annex D).

5.1.4.4 Operate the container rinsing device of the CTS as detailed in the manufacturers' operator manual to achieve the internal rinsing of the container and internal rinsing of the CTS as specified in 5.2. Use the UV light source to inspect all external surfaces of the product container, CTS and associated connections.

5.1.4.5 Use the same procedure to identify any fluorescence of residues on the operator's coverall and gloves as this also indicates system leakage.

5.1.4.6 Use the same procedure to identify any fluorescence of residues on the absorbent sheet on the ground as it indicates leakages to the environment.

5.1.4.7 Complete this procedure a minimum of 5 times. Record results in a test report (see example in D.2).

5.2 Container and system interface rinsing

5.2.1 General

After rinsing the container, the maximum residue remaining in the test container and on systems interfaces shall not exceed 0,01 % of the test containers (5.1.3.2) nominal volume at each point.

5.2.2 Principle

This test uses a test liquid formulation containing a blue dye, of which small quantities can be traced and quantified using direct chemical analysis or spectrophotometric (colorimetric/fluorimetric) analysis techniques after extraction. The CTS equipment and each interface shall be cleaned and dry before each test.

5.2.3 Apparatus

5.2.3.1 The CTS to be tested shall be installed and operated according to the manufacturer's instructions. If the CTS is designed to function with a foil seal on the container closure, the test shall be completed with a foil seal on the test container.

5.2.3.2 The **pipe/hose supplying** the rinsing water to the CTS shall be fitted with a pressure indicator and any pump or other means of assisted dispense shall be fitted with a crop sprayer pressure gauge.

Pressure indicator performance is as defined in 5.1.4.3.

5.2.3.3 A **sticky reference product** test liquid as defined in Table B.1.

5.2.3.4 Clean **containers** with which the system is designed to operate as specified in the CTS manufacturers' manual (5.1.3.2).

5.2.3.5 An **open top circular mixing container** with a nominal capacity suitable to prepare the total volume of test liquid required in one or more batches.

5.2.3.6 A **two speed** (0 r/min to 1 100 r/min and 0 r/min to 3 000 r/min) **electric drill** fitted with a paint/plaster mixing attachment.

5.2.3.7 **Clean absorbent swabs** (soft tissue paper) that can be moulded to the shape of a finger end to be used to collect any residues that are visible and accessible on the surfaces of the CTS, container and any of the CTS interfaces.

5.2.4 Procedures

The following procedures can be combined to reduce the complexity and time required.

5.2.4.1 Container rinsing procedure

This test is detailed below and is similar to ISO 21278-1:2008, 6.8.1.

The CTS manufacturers' operating instructions shall be followed, and the tests conducted with an ambient temperature between 15 °C and 30 °C.

5.2.4.1.1 The tests shall be carried out with a clean and dry container as specified in 5.1.3.2 and the test liquid in Annex B.

5.2.4.1.2 If the CTS being tested requires a sealing foil to be part of the container and packaging, this should be specified and the conditions for opening and rinsing the container shall be followed.

5.2.4.1.3 Connect the container to the device to be tested. Empty the container, filled with the test liquid specified in Annex B, until no evident dripping is present for at least 20 s and conduct the test directly.

5.2.4.1.4 Clean the container and CTS using the procedure detailed in the manufacturer's instruction manual.

5.2.4.1.5 Fill the container with a volume of water equivalent to 10 % of its nominal volume. Close the container with a lid, rinse the container by intense shaking and take a sample of that liquid. Determine the concentration of original test liquid formulation by using an appropriate spectrophotometric (colorimetric/fluorimetric) analysis technique to an accuracy of ±5,0µl/l. Calculate the residue collected from the CTS using Formula (1):

$$R = c\,V \tag{1}$$

where

R is the residue collected from the CTS;

V is the volume of water;

c is the concentration of original test liquid.

Calculate the percentage of the residue of the container nominal volume, Vn, using Formula (2):

$$p = \frac{R}{Vn} 100\% \tag{2}$$

where

p is the percentage of the residue of the container;

Vn is the nominal volume.

5.2.4.2 Interface residue procedure

On disconnection from the rinsed PPP container, the aggregate maximum residue on the interface of the CTS and the PPP container and any other interfaces, used to connect the system that are accessible to the operator, shall not exceed an amount equivalent to 0,25 ml of the Annex B test liquid.

5.2.4.2.1 Before each test, the interfaces shall be cleaned and dried.

5.2.4.2.2 Prepare the swabs by forming them into a shape similar in size and area to the end of a forefinger and label each swab (the top of an 'S' class gloved finger or a 12 mm dowel with a hemispherical head or test probe from ISO 5395-3 can be used to achieve this).

5.2.4.2.3 Collect all accessible residues after having completed the transfer of a test liquid formulation (as specified in Annex B) and rinsing procedure when using the container specified by the manufacturer's instruction manual (5.1.3.2).

5.2.4.2.4 Separate the interface and/or any other connections that should be disconnected according to the manufacturer's instruction manual.

5.2.4.2.5 Use the swabs as prepared in 5.2.4.2.2 to recover any visible residues on the interface surfaces, that an operator could access, and touch during system operation. Use a separate swab for each part of each interface and record where they are used. Place the used swabs in a sealable container to prevent drying.

5.2.4.2.6 Determine the concentration c of original test liquid formulation by immersing the swabs in a known volume, V, of water and then use an appropriate spectrophotometric (colorimetric/fluorimetric) analysis technique to an accuracy of ±5,0 µl/l. Calculate the residue collected from the CTS using Formula (1).

5.2.4.3 Simultaneous tests

Follow the CTS manufacturer's instruction manual procedures to complete a minimum of 5 container rinse and interface residue tests.

Record the details of the CTS being tested, the container used, pressure and volume of the rinse water used and any differential pressure generated in the model of table in D.3, for the removal of the container residues, and in the model of table in D.4 for the interface residues.

5.3 Transfer system residues

5.3.1 General

After dispensing the container, rinse test liquid as detailed in Annex B and rinsing/flushing the CTS according to the manufacturer's specified procedure the total maximum residue inside the CTS, including any associated measuring or control devices, shall be less than 1 ml of the container rinsing test liquid formulation. The manufacturer of the CTS shall determine the position where the flow path of liquid from CTS equipment ends and the application equipment it is connected to begin.

5.3.2 Principle

This test uses the container rinsing test liquid formulation detailed in Annex B of which small quantities can be traced and quantified using direct chemical analysis or spectrophotometric (colorimetric/fluorimetric) analysis techniques after extraction. This formulation is thick and sticky to represent the behaviour of a sticky product likely to resist rinsing.

5.3.3 Apparatus

5.3.3.1 The **CTS** to be tested shall be, installed and operated according to the manufacturer's instructions.

5.3.3.2 **Container rinsing test liquid formulation**, as specified in Annex B.

5.3.3.3 The **pipe/hose supplying** the rinsing water to the CTS shall be fitted with a pressure indicator and any pump or other means of assisted dispense shall be fitted with a crop sprayer pressure gauge.

Pressure indicator performance is as defined in 5.1.4.3.

5.3.3.4 **Clean containers** that the system is designed to operate with and specified in the CTS manufacturer's manual.

5.3.4 Procedure

5.3.4.1 Carry out the assessment of residues after having completed the transfer of the test liquid formulation (as specified in Annex B) into the CTS using the product container specified in 5.1.3.2 filled to the nominal volume with Annex B test liquid and procedure that the CTS manufacturer operator instructions recommends to be used with their equipment. When the container is empty, flush the CTS in accordance with the manufacturer's instructions.

5.3.4.2 When the transfer and rinsing is completed, use a clean container to flush the CTS with a volume, *V*, of 10 l of fresh water and collect the water from the outlet of the CTS as defined in 6.3.4. This shall include all parts of the CTS and associated attachments up to the connection of the CTS to the sprayer's circulation pipework. Use the same flushing water and procedure a further 9 times.

5.3.4.3 When the flushing process is completed retain a sample in a clean and sealable container for analysis.

5.3.4.4 Determine the quantity of test liquid formulation recovered into the water by an appropriate spectrophotometric (colorimetric/fluorimetric) analysis technique to an accuracy of ±5,0 µl. The equivalent volume of residue shall be a maximum of 1 ml of Annex B test liquid.

5.3.4.5 Calculate the residue *R* collected from the CTS using Formula (1).

5.3.4.6 Complete this procedure a minimum of 5 times. Record results in the format provided in D.5.

5.4 Speed of operation test

5.4.1 General

The results of this CTS speed of operation test shall be reported and included in the manufacturer's operator manual.

5.4.2 Principle

This document requires manufacturers of CTS equipment to test equipment to ensure the efficiency of operation can be quantified.

5.4.3 Apparatus

5.4.3.1 The **CTS to be tested** shall be installed and operated to the manufacturer's instructions. This shall include any associated **pump, venturi or other ancillary devices** that are required by the CTS manufacturer to operate with a sprayer.

5.4.3.2 **Test liquid formulation** to be used is specified in Annex B.

5.4.3.3 The **pipe/hose supplying** the rinsing water to the CTS shall be fitted with a pressure indicator and any pump or other means of assisted dispense shall be fitted with a crop sprayer pressure gauge.

Pressure indicator performance is as defined in 5.1.4.3.

5.4.3.4 The largest **container** with which the system is designed to operate and specified in the CTS manufacturer's manual.

5.4.3.5 A **stop watch** to measure the time of the transfer and rinsing process.

5.4.4 Procedure

5.4.4.1 Prepare the CTS and have the test formulation packed in the selected container and available close to the CTS.

5.4.4.2 Start the stop watch. The container should be connected to the CTS following the manufacturer's instructions. The operating instructions should be followed to transfer the complete contents of the container until the flow of the test liquid from the container ceases. Once the container is empty of test liquid, the container and CTS shall be rinsed following the manufacturer's instructions, to the performance required in 5.2.

5.4.4.3 When the container and CTS has been rinsed and drained, disconnect the CTS from the container, stop timing and record the result.

5.4.4.4 Repeat the test 5 times. Record the details of the packaging used, the rinsing water pressure and volume, any motive force from a pump or venturi used to empty the container and record these test results in a format similar to the one provided in D.6.

5.5 Measurement device accuracy

5.5.1 General

This shall be ±2,5 % of the smallest container volume listed in the operator manual.

5.5.2 Principle

This test uses clean potable water to determine the accuracy of any measuring device included as part of a CTS by comparing the volume transferred, as measured by the device to be tested, to the actual volume transferred from the container.

5.5.3 Apparatus

5.5.3.1 The **CTS and measuring device to be tested** installed and operated to the manufacturer's instructions. This shall include a scale that allows a measuring interval of 50 ml and a control to permit accurate start and stop of the measuring process.

5.5.3.2 The **pipe/hose supplying** the rinsing water to the CTS shall be fitted with a pressure indicator and any pump or other means of assisted dispense shall be fitted with a crop sprayer pressure gauge.

Pressure indicator performance is as defined in 5.1.4.3.

5.5.3.3 A clean and dry empty **container** that is the smallest container that can be used with the CTS as specified by the CTS manufacturer.

5.5.3.4 Clean potable **water**.

5.5.4 Procedure

5.5.4.1 Weigh the empty container and record the result.

5.5.4.2 Fill the container to the recommended nominal volume (as with real product) to be used in the test and record the weight. To determine the mass of the liquid in the container, subtract the mass of the empty container from the total mass (container and liquid).

5.5.4.3 Connect the container to the CTS following the manufacturer's instructions and use the measuring device to dispense three volumes, 75 %, 50 % and 25 % of the maximum measuring capacity.

5.5.4.4 Disconnect the container from the measuring device after each measurement and reweigh it to determine the actual mass dispensed and determine the equivalent volume.

5.5.4.5 Rinse the CTS and measuring device according to the manufacturer's manual.

5.5.4.6 Complete this procedure a minimum of 5 times.

5.5.5 Test report

The results of the tests shall be stated in a test report. The minimum information to be recorded is given in D.7.

6 Operator manual

6.1 CTS's shall be supplied with comprehensive instructions for installation, operation and maintenance in accordance with ISO 3600.

6.2 Manufacturers of CTS's shall specify the range of requirements for the application equipment on which the system is to be installed to give effective operation of the CTS in terms of mounting position, liquid flows, pressures and any other specific requirements in accordance with ISO 21278-2.

6.3 Manufacturers of CTS shall specify the following.

6.3.1 The maximum and minimum size of container with which the system is designed to operate.

6.3.2 The method of connection of the CTS to the container and the specifications of the container closures with which the system safely operates.

6.3.3 The recommended position and connection of the CTS when mounted on application equipment or if used as a connectable device that remains at the filling site.

6.3.4 The point at which the CTS ends, and the crop sprayer pipework/application equipment begins.

6.3.5 The necessity for, or procedures to accommodate, an induction foil seal on a container.

6.3.6 The recommended personal protective equipment and an instruction to follow the chemical product label requirements for personal protective equipment.

6.3.7 The products or substances known to the CTS manufacturer that are incompatible with the construction materials of the CTS and therefore shall not be dispensed using this particular equipment.

6.3.8 The results achieved in the speed of operation test.

6.3.9 The volume, pressure of water and procedure required to achieve the rinsing requirement of a 0,01 % residue and the time in which this can be completed with the Annex B test liquid and until the container is visually clean.

6.3.10 The positive or negative pressures required to achieve the transfer and rinsing performance specified in the manufacturer's instruction manual.

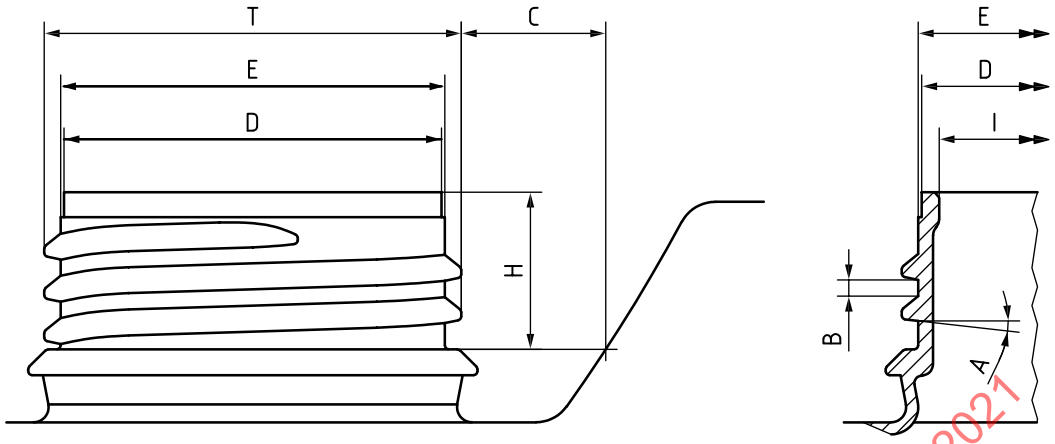
6.3.11 A statement that an adaptor fitted to a container shall remain on the container until the container is emptied and rinsed.

Annex A
(informative)

Container closure to CTS interface — Dimensions for a CTS interface to accommodate a 63 mm container neck

The dimensions and tolerances identified for this interface have been proposed by the PPP and application equipment manufacturers as the dimensions that are acceptable to define a 63 mm container closure to CTS interface and that need to be controlled. These dimensions are provided to give guidance to CTS manufacturers who intend to use the 63 mm container neck as the interface for their equipment. These dimensions shall also provide guidance to any packaging manufacturers who would like to ensure an appropriate connection between their products and a CTS meeting the requirements of this document.

The interface connection for CTS equipment shall be constructed to make a leak tight and secure connection and the principal points to be controlled are identified in Figure A.1.



Key

Label	Dimension description	Dimension or tolerance
	Number of thread turns	2,5 turns
	Pitch	4,23 mm
T	Thread diameter External diameter of the neck thread determined as the mean of two perpendicular diameters avoiding the parting line	63,5 mm + 0,25mm −0,0 mm
E	External neck diameter External diameter of the neck, excluding thread, determined as the mean of two perpendicular diameters avoiding the part line	59,7 mm +0,25 mm −0,0 mm
C	Clear space around the threaded portion of the neck Free of interference from features on the container such as handle, shoulder or reinforced mould part line	7 mm min.
I	Internal neck diameter Minimum internal diameter of the neck, through the total length of the neck bore, preferably with smooth parallel walls.	53 mm min.
H	Height between top of the neck and top of the tamper evident ring	18 mm min.
A	Angle underneath the thread	10° ± 1°30′
B	Vertical distance between 2 threads (at the root)	1,05 mm min.
D	Upper sealing ring - diameter at top of neck Diameter at top of neck	57,7 mm +1,00 mm - 0,0 mm
	Neck ovality Difference between the maximum and the minimum neck diameters	0,3 mm maximum
	Sealing surface flatness Sealing platform should be regular, smooth and free from defects which could prevent the formation of a liquid tight seal	0,2 mm maximum

Figure A.1 — Container neck

Annex B
(normative)

Test liquid

B.1 Formulation

Table B.1 — Formulation

Ingredient	CAS Number (Chemical Abstracts Service) (CAS = x)	% weight of mix (weight for weight) (% weight = y)
Polysaccharide (based on Xanthan Gum)	CAS 11138-66-2	0,7
Methyl cellulose	CAS 09004-67-5	0,3
Sodium carbonate	CAS 93673-48-4	0,2
Anti-bacterial preservative	CAS 02634-33-5	0,1
Blue dye	CAS 99149-43-6	0,1
Potable water		98,6
TOTAL		100

B.2 Mixing procedure

Use the following method to mix the test liquid formulation.

B.2.1 Weigh out the chemical constituents in the proportions specified in Table B.1.

B.2.2 Add potable quality water to an open-topped circular container with sufficient capacity to contain the volume of formulation to be made and allow mixing without spillage. Position the electrically powered electric drill and stirrer to agitate the liquid while preventing a vortex being generated and the inclusion of air.

B.2.3 Hold the mixing element so that it is approximately 15 mm from the base of the container and set the speed to low.

B.2.4 Add the tracer dye followed by the sodium carbonate.

B.2.5 Slowly introduce the polysaccharide (Xanthan gum) occasionally removing any build-up of deposit at the centre of the stirrer and stir for a further 10 min. Do not allow a vortex to form as this will entrain air into the mixture. Regulate the speed of the mixer and the position of the mix head to achieve this.

B.2.6 Slowly add the methyl cellulose. As the mixture thickens select the higher mixing speed but do not allow a vortex to form, any air bubbles observed should be allowed to rise and break, mix for 20 min.

B.2.7 Allow the mixture to rest overnight at 10 °C, this allows the mixture to fully hydrate the polysaccharide and methyl cellulose thickening agents and to release any air entrained during the mixing process.

B.2.8 Place the test liquid into containers that the CTS manufacturer's instructions specify are compatible to the CTS design.

Any other similar dye that is capable of being traced using the test methods specified may be used if it is ensured that the same results are achievable, any substitution shall be recorded in the test report.

NOTE If the test liquid is intended to be used within 48 hours, the preservative is not necessary. If the antibacterial preservative is not used, it is exchanged to 0,1 % of water.

This liquid can be used and reused if it is not diluted or contaminated during the test procedures.

Annex C
(Normative)

System leakage test formulation

C.1 Formulation

Table C.1 — Formulation

Ingredient	CAS Number	% weight of mix
Water soluble fluorescein disodium salt	CAS 518-47-8	0,01
Surfactant fatty alcohol polyglycol ether	CAS 78330-21-9	0,1
Potable water		99,8
TOTAL		100

C.2 Mixing procedure

C.2.1 Fill a suitable container with the water and add the Surfactant followed by the Fluorescein disodium salt.

C.2.2 Stir the mixture to ensure an even distribution of the ingredients.

Any other similar dye that is capable of being traced using the test methods specified may be used if it is ensured that the same results are achievable any substitution shall be recorded in the test report.

This liquid can be used and reused if it is not diluted or contaminated during the test procedures.