



## **DRAFT EAST AFRICAN STANDARD**

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### **Stainless steel storage tanks — Specification**

### **EAST AFRICAN COMMUNITY**

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## Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in the East African Community. It is envisaged that through harmonized standardization, trade barriers that are encountered when goods and services are exchanged within the Community will be removed.

In order to achieve this objective, the Community established an East African Standards Committee mandated to develop and issue East African Standards.

The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the private sectors and consumer organizations. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the procedures of the Community.

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

EAS 783 was prepared by Technical Committee EASC/TC 035, *Steel and steel products*.

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## Stainless steel storage tanks — Specification

### 1 Scope

This Draft East African Standard specifies constructional requirements, sampling and test methods for non - pressurized stainless steel storage tanks for food related items.

### 2 Normative references

The following referenced documents are indispensable for the application 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.

ASTM A 240/A 240M-07, *Standard specification for chromium and chromium-nickel stainless steel plate, sheet, and strip for pressure vessels and for general applications*

ISO 6892 -1, *Metallic materials — Tensile strength test*

ISO 3651-1:1998 Determination of resistance to intergranular corrosion of stainless steels — Part 1: Austenitic and ferritic-austenitic (duplex) stainless steels — Corrosion test in nitric acid medium by measurement of loss in mass (Huey test)

ISO 3651-2, Determination of resistance to intergranular corrosion of stainless steels — Part 2: Ferritic, austenitic and ferritic-austenitic (duplex) stainless steels — Corrosion test in media containing sulfuric acid

ISO 9328-7, Steel flat products for pressure purposes — Technical delivery conditions — Part 7: Stainless steels

ISO 16143-1, Stainless steels for general purposes — Part 1: Corrosion-resistant flat products

### 3 Terms and definitions

For the purposes of this standard, the following terms and definitions shall apply.

#### 3.1

##### **bright polished finish**

shining reflective finish obtained by polishing the surface without complete obliteration of previously existing grinding marks or other surface texture

#### 3.2

##### **defective**

tank that fails in one or more aspects to comply with the appropriate requirements of this standard

### 3.3

#### directional satin finish

finish obtained by so grinding the surface with fine abrasives (without subsequent polishing) as to leave a silky appearance, with the abrasive marks running in the same general direction

## 4 Constructional requirements

### 4.1 General requirements

#### 4.1.1 Material

The stainless steel used under the specified chloride level of the foodstuff, shall be ISO type 304L, type 316L, type 304, or type 316, as specified by the purchaser, and of the relevant composition given in Table 1. Grade 304 and 316 are more preferable for food and surgical use.

**Table 1 — Typical chemical composition of stainless steel**

Mass fraction, %													
Steel grade	C	Si	Mn	P	S	N	Cr	Cu	Mo	Nb	Ni	Ti	Others
			max.	max.	max.								
Austenitic corrosion-resisting grades													
X2CrNi 18-9	≤0,030	≤1,00	2,00	0,045	0,015	≤0,10	17,5 to 19,5	—	—	—	8.0 to 10,5	—	—
X5CrNi 18-10	≤0,07	≤1,00	2,00	0,045	0,015	≤0,10	17,5 to 19,5	—	—	—	8.0 to 10,5	—	—
X2CrNi Mo17-12-2	≤0,030	≤1,00	2,00	0,045	0,015	≤0,10	16,5 to 18,5	—	2,00 to 2,50	—	10.0 to 13.0	—	—
X5CrNi Mo17-12-2	≤0,07	≤1,00	2,00	0,045	0,015	≤0,10	16,5 to 18,5	—	2,00 to 2,50	—	10,0 to 13,0	—	—
<sup>a</sup> Elements not listed in this table may not be intentionally added to the steel without the agreement of the purchaser, except for finishing of the cast. All appropriate precautions are to be taken to avoid the addition of such elements from scrap and other materials used in production, which would impair mechanical properties and the suitability of the steel  Determination of chemical composition of the listed stainless steel grades can be done by either of the following standards; ISO 14284, ISO 4937, ISO 4938, ISO 4939, ISO 4940, ISO 10138, ISO 13898-1, ISO 13898-2, ISO 15355 and ISO 19272.													

**Table 2— Permissible deviations between the product analysis and the limiting values given in Table 2 for the cast analysis**

<b>Element</b>	<b>Specified limits, cast analysis</b>		<b>Permissible deviation<sup>a</sup></b>
	% (mass fraction)		% (mass fraction)
Carbon		≤0,030	+0,005
	>0,030	≤0,20	±0,01
	>0,20	≤0,60	±0,02
	>0,60	≤1,20	±0,03
Silicon		≤1,00	+0,05
Manganese		≤1,00	+0,03
	>1,00	≤2,00	±0,04
	>2,00	≤15,0	±0,10
Phosphorus		≤0,045	+0,005
	>0,045	0,070	±0,010
Sulfur		≤0,015	+0,003
	>0,015	≤0,030	±0,005
	≥0,10	≤0,50	±0,02
Chromium			
	>15,0	≤20,0	±0,20
Molybdenum			
	>1,75	≤8,0	±0,10
Nickel			
	>5,0	≤10,0	±0,10
	>10,0	≤20,0	±0,15
Nitrogen		≤0,10	+0,01
	≥0,10	≤0,60	±0,02
Aluminium	≥0,05	≤0,30	±0,05
	>0,30	≤1,50	±0,10
Boron		≤0,010	+0,000 5
		≤1,00	+0,04



Copper	>1,00	≤5,0	±0,10
Niobium		≤1,00	+0,05
Tungsten		≤3,00	+0,05
Vanadium		≤0,50	+0,03
		≤1,00	+0,05
Titanium	>1,00	≤3,0	±0,07
a ± means that in one cast, the deviation can occur over the upper value or under the lower value of the specified range in Table 1, but not both at the same time.			

#### 4.1.2 Construction

Tanks shall be made by stamping, pressing, or fabricating, or by a combination of two or more of these methods.

#### 4.1.3 Joints

All joints shall fit closely, and the whole length of each joint shall be welded. The welded joints shall be ground flush with the working face. No solder shall be used on joints.

#### 4.1.4 Welds

Welds shall be fusion welds done by the seaming process or by any other welding process that produces a weld having mechanical properties and corrosion resistance of at least the same order as those of the parent metal. When tested in accordance with ISO 6892-1, the strength of the welded point, shall be similar to the strength of parent material, as shown in Table 3.

**Table 3 — Mechanical properties of Stainless Steel**

Steel designation		Product	Proof strength		Tensile strength	Elongation after fracture	Resistance to intergranular corrosion	
Name	ISO number	(Class)	Rp0,2	Rp1,0	Rm	A80d	in the delivery condition	in the sensitized condition
			MPa min.		MPa	% min.		
X2CrNi18-9	4307-304-03-I	C 2R	220	250	520 to 720	45	yes	yes
X5CrNi18-10	4301-304-00-I	C 2R	230	260	540 to 750	45	yes	no
X2CrNiMo17-12-2	4404-316-03-I	C 2R	240	270	530 to 730	40	yes	yes
X5CrNiMo17-12-2	4401-316-00-I	C 2R	240	270	530 to 730	40	yes	no

#### 4.1.5 Finish

All exposed surfaces shall be free from buckles, dents, pits, deep scratches, and other defects, and shall have a medium directional satin or a bright polished finish, as specified by the purchaser. The tanks shall be free from dirt, grease, graphite, and other foreign matter.

## **4.2 Specific requirements**

### **4.2.1 Design and dimensions**

The design of the tank shall either be square, round, rectangle or cylindrical or as may be agreed between the purchaser and the manufacturer. The dimensions shall be in accordance with the purchaser and manufacturer agreement with respect to design requirements. The minimum thickness of the material used for manufacturing the tank shall be 0.3 mm. Normal tolerances of 0.015 mm shall apply to the thickness of the material.

### **4.2.2 Construction**

The tank shall be grooved around the circumference with minimum number of five grooves. The tank shall consist of two holes at the top, one for the inlet and other for tank breathing, and two holes at the bottom, one for the outlet and the other for draining during cleaning.

Note: Other construction requirements not covered under this standard can be in accordance with the agreement between manufacturer and purchaser. The preferred tank capacities and dimensions can be as per annex A.

### **4.2.3 Leakage**

The tank shall not show any leakage when tested in accordance with 7.3.

### **4.2.4 Hydrostatic pressure**

The tank shall withstand hydrostatic force when tested in accordance with 7.4.

## **5 Marking**

Each tank shall be legibly and indelibly marked with the following information on the surface of the tank:

- a) manufacturer's name and address;
- b) capacity of the tank in litres;
- c) Stainless steel grade,
- d) batch number of the tank; and
- e) thickness of the material.

## **6 Sampling and compliance**

### **6.1 Sampling**

#### **6.1.1 General**

The sampling procedures in 6.1.2 and 6.1.3 shall be applied in determining whether a lot complies with the appropriate requirements of this standard. The samples so taken shall be deemed to represent the lot for the respective properties.

NOTE This clause applies to the sampling for inspection and testing before acceptance or rejection of single lots (consignments) in cases where no information about the implementation of quality control or testing during manufacture is available to help in assessing the quality of the lot. It is also used as the procedure for adjudications in cases of dispute.

### 6.1.2 Sample for inspection

From the lot, random sampling shall be done in accordance with Table 3.

**Table 3 — Sample for testing and inspection**

Lot size	Sample size		
	Sample for inspection	Sample for testing	Defective acceptance number
Less than 20	All	1	0
20 – 100	20	2	1

### 6.1.3 Sample for testing

From each sample taken in accordance with 6.1.2, random sampling of the number of tanks relative to the appropriate lot size shall be done in accordance with Table 3.

## 6.2 Compliance

The lot shall be deemed to comply with the requirements of this standard, if after inspection and testing

- the number of defectives found in the sample taken in accordance with 6.1.2 does not exceed the appropriate acceptance number given in Table 3; and
- no defective is found in the sample taken in accordance with 6.1.3.

## 7 Inspection and methods of test

### 7.1 Inspection

Inspection of samples shall be done in accordance with 6.1.2 for compliance with the appropriate requirements of clauses 4, 5, and 6 other than those given in 4.1.1.

### 7.2 Chemical analysis of stainless steel

Use the method described in ASTM A 751, or any other approved method, to determine the chemical composition of the steel used in the manufacture of each tank in the sample taken in accordance with 6.1.3.

### 7.3 Leakage test

Fill water to the full capacity of the tank under room temperature and atmospheric pressure and leave it for 15 min. Observe if there is any leakage.

### 7.4 Pressure test

Fill water to the full capacity of the tank under room temperature and atmospheric pressure and leave it for 15 min.

The tank shall withstand the hydrostatic pressure calculated by the following formula:

$$P = \rho hg$$

where:

$P$  is the hydrostatic pressure;

$\rho$  is the density of food stuff;

$h$  is the height of the tank; and

$g$  is the acceleration due to gravity.

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## Bibliography

SANS 906:2006, *Stainless steel wash-hand basins* Published by South Africa Bureau of Standards

Henkel and Pense, 2002, *Structure and properties of engineering materials*, fifth edition, published by McGraw – Hill, New York

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**Annex A**  
**(Informative)**

**Table A.1 The preferred tank capacity and dimensions for circular stainless steel tanks**

Tank Capacity (Litres, L)	Diameter of Tank (mm) ± 10 mm	Tank Height (mm) ± 10 mm	Thickness (mm) ± 0.015 mm
60	430	450	0.4
120	480	700	0.4
250	760	550	0.4
350	760	775	0.4
450	760	995	0.4
650	760	1435	0.4
750	760	1655	0.4
1000	960	1435	0.4
1250	960	1740	0.5
1500	960	2075	0.5
1700	1180	1560	0.5
2000	1180	1830	0.6
2500	1420	1600	0.7
3000	1420	1925	0.7
4000	1610	2030	0.7
4500	1610	2230	0.7
5000	1610	2820	0.7
7050	1610	3500	0.7
10000	2200	2910	0.7

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