INTERNATIONAL STANDARD

ISO 11678

First edition
1996-03-15

Agricultural irrigation equipment — Aluminium irrigation tubes

Matériel agricole d'irrigation — Tubes d'irrigation en aluminium

Reference number
ISO 11678:1996(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 11678 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 18, *Irrigation and drainage equipment and systems*.

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

Agricultural irrigation equipment — Aluminium irrigation tubes

1 Scope

This International Standard specifies minimum required properties and test methods for aluminium tubes intended for use in agricultural irrigation systems for the transport of water, at temperatures not exceeding 50 °C, for irrigation purposes.

It applies to hand-moved and towed tubes, and to tubes intended for stationary or temporary installation.

It does not apply to tubes with integrated couplings, which will be the subject of a future International Standard.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 209-1:1989, *Wrought aluminium and aluminium alloys — Chemical composition and forms of products — Part 1: Chemical composition.*

ISO 2859-1:1989, *Sampling procedures for inspection by attributes — Part 1: Sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 alclad tube; cladded tube: Tube having on both inside and outside surfaces a metallurgically bonded aluminium or aluminium alloy coating which is anodic to the core material and which, therefore, protects the core from corrosion.

3.2 average outside diameter of aluminium tube: Arithmetic mean of two mutually perpendicular outside diameters, measured at one cross-section.

3.3 average wall thickness of tube: Arithmetic mean of eight measurements of wall thickness, equally spaced around the circumference of one cross-section, but not on the weld line in the case of welded tubes.

3.4 denting factor: Parameter calculated as the product of the minimum tensile yield strength, in megapascals, and the square of the wall thickness of the tube, in millimetres, divided by the nominal diameter, in millimetres, in evaluating the ability of an aluminium tube to withstand external mechanical loading without permanent local deformation.

3.5 nominal diameter of tube, D_{nom}: Conventional numerical designation approximately equal to the outside diameter of an aluminium tube.

3.6 nominal pressure, PN: Maximum working pressure at which a piping component is stated to operate under normal service conditions.

4 Classification

The tubes are classified as follows.

4.1 According to nominal pressure

4.1.1 Tubes of a nominal pressure of up to 400 kPa (4 bar).

4.1.2 Tubes of a nominal pressure of up to 1 000 kPa (10 bar).

4.1.3 Tubes of a nominal pressure of up to 1 600 kPa (16 bar).

4.2 According to method of manufacture

4.2.1 Welded tubes, designated by letter code "W".

4.2.2 Extruded tubes, designated by letter code "E".

4.3 According to the type (see table 6)

4.3.1 Type A tubes.

4.3.2 Type B tubes.

5 Marking

All tubes shall bear a readily visible, clear and durable impressed marking, including the following details:

a) manufacturer's name and/or trademark;

b) year of manufacture;

c) nominal pressure, as specified in 4.1;

d) a marking to identify chemical composition, as specified in the manufacturer's catalogue;

e) marking to indicate method of manufacture;

f) marking to indicate whether the tube is type A or type B.

The marking shall be impressed near the end of the tubes at a distance of at least 0,2 m from the end and not more than 0,5 m from the end. The depth of the impression shall be at least 0,05 mm and shall not exceed 0,15 mm.

6 Technical characteristics

6.1 General

The walls of the tube at its ends shall be parallel to its axis, and the ends of the tube shall be perpendicular to its axis. For tubes reinforced with a sleeve, the tube lip shall overlap the sleeve lip. Insertion of the reinforced sleeve shall not increase the outside diameter of the tube. For a distance of 200 mm from the ends of the tube, weld seams (if these exist) shall not protrude from the inner and outer surfaces of the tube by more than 0,3 mm.

6.2 Material

6.2.1 Welded tubes

Welded tubes shall be of aluminium alloy, the chemical composition of which is specified in table 1, or of any other material which has been verified as suitable for the purpose.

6.2.2 Extruded tubes

Extruded tubes shall be of aluminium alloy, the chemical composition of which is specified in table 2, or of any other material which has been verified as suitable for this purpose.

6.3 Dimensions

6.3.1 Tube diameter

The outside diameter of the tube and its allowable deviations shall be as specified in table 3. To determine the average outside diameter of an aluminium tube, two measurements shall be made of two mutually perpendicular outside diameters measured at one cross-section.

6.3.2 Tube length

The length of the tube shall not be shorter than the manufacturer's declared length by more than 20 mm, measured with an instrument having an accuracy of 5 mm.

Table 1 — Required chemical composition of alloys for welded tubes

Alloy		Wall section	Chemical composition[1] %							
ISO Designation[2]	International registration record[3]		Cr	Ti	Zn	Mg	Mn	Si	Fe	Cu
Al Mn1Cu	3003		—	—	0,10 max.	—	1,0 to 1,5	0,6 max.	0,7 max.	0,05 to 0,20
Al Mn1Mg1	3004	Core	—	—	0,25 max.	0,8 to 1,3	1,0 to 1,5	0,30 max.	0,7 max.	0,25 max.
		Cladding[4]	—	—	0,8 to 1,3	0,1 max.	0,1 max.	—	0,7 max.	0,1 max.
Al Mg1,5(C)	5050		0,10 max.	—	0,25 max.	1,1 to 1,8	0,10 max.	0,40 max.	0,7 max.	0,20 max.
Al Mg2,5	5052	Core	0,15 to 0,35	—	0,10 max.	2,2 to 2,8	0,10 max.	0,25 max.	0,40 max.	0,10 max.
		Cladding[4]	—	—	0,8 to 1,3	0,1 max.	0,1 max.	0,7 max.	—	0,1 max.
Al Mg1SiCu	6061		0,04 to 0,35	0,15 max.	0,25 max.	0,8 to 1,2	0,15 max.	0,40 to 0,8	0,7 max.	0,15 to 0,40

1) The percentage of any other alloy component shall not exceed 0,05 % and the total of all other alloy components shall not exceed 0,15 %. Aluminium shall make up the remainder of the alloy.

2) Conforming to ISO 209-1.

3) The four-digit designation listed is taken from the *Registration Record of International Alloy Designations and Chemical Composition Limits for Wrought Aluminum and Wrought Aluminum Alloys*, published by the Aluminum Association, Washington, DC, USA.

4) The thickness of the cladding shall be at least 10 % of the total wall thickness of the tube.

Table 2 — Required chemical composition of alloys for extruded tubes

Alloy		Chemical composition[1] %							
ISO Designation	International registration record	Cr	Ti	Zn	Mg	Mn	Si	Fe	Cu
Al Mg1SiCu	6061	0,04 to 0,35	0,15 max.	0,25 max.	0,8 to 1,2	0,15 max.	0,40 to 0,8	0,7 max.	0,15 to 0,40
Al Mg0,7Si	6063	0,10 max.	0,10 max.	0,10 max.	0,45 to 0,9	0,10 max.	0,20 to 0,6	0,35 max.	0,10 max.

1) The percentage of any other alloy component shall not exceed 0,05 % and the total of all other alloy components shall not exceed 0,15 %. Aluminium shall make up the remainder of the alloy.

6.3.3 Wall thickness of tube

The wall thickness shall be measured at eight points, equally spaced around the circumference of one cross-section, but not on the weld in the case of welded tubes.

At any point, the wall thickness shall not exceed the value declared by the manufacturer by more than the values specified in table 4.

In addition, for extruded tubes, the average wall thickness shall not exceed the value declared by the manufacturer by more than the values specified in table 4.