

# SVENSK STANDARD

## SS-ISO 10998:2008

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### Lantbrukstraktorer – Krav för styrning (ISO 10998:2008, IDT)

### Agricultural tractors – Requirements for steering (ISO 10998:2008, IDT)

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## 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 10998 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 4, *Tractors*.

This second edition cancels and replaces the first edition (ISO 10998:1995), which has been technically revised.



# Agricultural tractors — Requirements for steering

## 1 Scope

This International Standard specifies performance and safety requirements for both normal and emergency steering modes of agricultural tractors. It is applicable to those tractors having a maximum design speed, measured in accordance with ISO 3965, not exceeding  $(60 \pm 3)$  km/h.

It is not applicable to track-laying tractors equipped with steel tracks having a maximum design speed, measured in accordance with ISO 3965, not exceeding  $(15 \pm 3)$  km/h.

## 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.

ISO 789-11:1996, *Agricultural tractors — Test procedures — Part 11: Steering capability of wheeled tractors*

ISO 3965:1990, *Agricultural wheeled tractors — Maximum speeds — Method of determination*

ISO 7000:2004, *Graphical symbols for use on equipment — Index and synopsis*

ISO 14982:1998, *Agricultural and forestry machinery — Electromagnetic compatibility — Test methods and acceptance criteria*

ISO 19879:2005, *Metallic tube connections for fluid power and general use — Test methods for hydraulic fluid power connections*

## 3 Terms and definitions

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

### 3.1 General terms

#### 3.1.1

##### **agricultural tractor**

power-driven vehicle, either wheeled and having at least two-axles or tracklaying, whose function depends essentially on its tractive power, and which is specially designed to pull, push, carry or actuate certain implements, machines or trailers intended for use in agriculture or forestry

NOTE Such a tractor can be arranged to carry a load and/or attendants as specified in ISO 23205.

#### 3.1.2

##### **steering equipment**

all components whose purpose is to determine the direction of movement of the tractor, comprising **steering control** (3.1.3), **steering transmission** (3.1.4), **steered wheels** (3.1.7) or tracks, and **energy supply** (3.1.8) if any

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### 3.1.3

#### **steering control**

part of the steering equipment which controls steering operation

NOTE It may be operated with or without the direct intervention of the driver. For steering equipment in which the steering forces are provided solely or partly by the muscular effort of the driver, the steering control includes all parts from the driver interface up to the point where the steering effort is transformed by mechanical, hydraulic or electrical means.

### 3.1.4

#### **steering transmission transmission**

all parts of the steering equipment providing the means of transmitting the steering forces between the steering control and the steered wheels or tracks

NOTE 1 It includes all parts from the point where the steering control effort is transformed by mechanical, hydraulic or electrical means.

NOTE 2 The steering transmission is divided into two independent functions: The **control transmission** (3.1.4.1) and the **energy transmission** (3.1.4.2). Where the term "steering transmission" or "transmission" is used alone in this International Standard, it encompasses both control transmission and energy transmission. A distinction is drawn between mechanical, electrical and hydraulic transmission systems or combinations thereof, according to the means by which the signals and/or energy is transmitted.

#### 3.1.4.1

##### **control transmission**

all components by means of which signals are transmitted for control of the steering equipment

#### 3.1.4.2

##### **energy transmission**

all components by means of which the energy required for control/regulation of the steering function of the wheels is transmitted

### 3.1.5

#### **autonomous steering system**

system that incorporates a function within a complex electronic control system that causes the tractor to follow a defined path or to alter its path in response to signals initiated and transmitted from off-board the tractor

NOTE The driver will not necessarily be in primary control of the tractor.

### 3.1.6

#### **advanced driver assistance steering system**

system, additional to the main steering system, that provides assistance to the driver in steering the tractor, but where the driver remains at all times in primary control of the tractor

NOTE The advanced driver assistance steering system comprises the **automatically commanded steering function** (3.1.6.1) and/or **corrective steering function** (3.1.6.2).

#### 3.1.6.1

##### **automatically commanded steering function**

function within a complex electronic control system where actuation of the steering system can result from automatic evaluation of signals initiated on-board the tractor, possibly in conjunction with passive infrastructure features, to generate continuous control action in order to assist the driver in following a particular path, in low speed manoeuvring or parking operations

#### 3.1.6.2

##### **corrective steering function**

discontinuous control function within a complex electronic control system whereby, for a limited duration, changes to the steering angle of one or more wheels or tracks can result from the automatic evaluation of signals initiated on-board the tractor, in order to maintain the basic desired path of the tractor or to influence the tractor's dynamic behaviour

**NOTE** Systems that do not themselves positively actuate the steering system but that — possibly in conjunction with passive infrastructure features — simply warn the driver of a deviation from the ideal path of the tractor or of an unseen hazard by means of a tactile warning transmitted through the steering control, are also considered to be corrective steering.

### 3.1.7

#### **steered wheels**

wheels, the alignment of which may be altered directly or indirectly in relation to the longitudinal axis of the tractor in order to determine the direction of movement of the tractor

**NOTE 1** The steered wheels include the axis around which they are rotated in order to determine the direction of movement of the tractor. Endless tracks of tracklaying tractors and all wheels of skid steered tractors are considered to be steered wheels for the purposes of this International Standard.

**NOTE 2** In the case of tractors with **articulated steering equipment** (3.3.6.2), all wheels of the tractor are considered to be steered wheels for the purposes of this International Standard.

### 3.1.8

#### **energy supply**

parts of the steering equipment which provide energy, control energy, and where appropriate, process and store energy

**NOTE** The energy supply also includes any storage reservoirs for the operating medium and the return lines, but does not include the tractor engine (except for the purposes of 5.4.1.3), nor the drive between it and the energy source

#### 3.1.8.1

##### **energy source**

part of the energy supply which provides the energy in the required from

**EXAMPLE** Hydraulic pump, air compressor, manual exertion.

#### 3.1.8.2

##### **energy reservoir**

part of the energy supply in which the energy provided by the energy source is stored

**EXAMPLE** Pressurized fluid reservoir, tractor battery.

#### 3.1.8.3

##### **storage reservoir**

part of the energy supply in which the operating medium is stored

**EXAMPLE** Fluid reservoir at or near atmospheric pressure.

### 3.1.9

#### **maximum mass**

maximum allowable tractor mass as stated by the manufacturer

### 3.1.10

#### **continuous**

without step changes in response to changing input

## 3.2 Steering parameters

### 3.2.1

#### **steering control effort**

force applied to the steering control in order to steer the tractor

### 3.2.2

#### **steering time**

period of time from the beginning of the movement of the steering control to the moment at which the steered wheels have reached a specific steering angle

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### 3.2.3

#### **steering angle**

angle between the projection of a longitudinal axis of the tractor and the line of intersection of the wheel plane (being the central plane of the tyre, normal to the spin axis of the wheel) and the road surface

NOTE 1 It is not applicable to tracklaying and skid steered (wheeled) tractors.

NOTE 2 For tractors with articulated steering equipment, it is the total displacement angle between the front wheels and the rear wheels as they move about one or more vertical steering axes from their normal straight-ahead condition to a turned condition.

### 3.2.4

#### **steering forces**

all forces operating in the steering transmission

### 3.2.5

#### **mean steering ratio**

(tractors on which the steering control is a steering wheel) ratio of the angular displacement of the steering control of wheeled tractors to the mean of the swept steering angle of the steered wheels for a full lock-to-lock turn

### 3.2.6

#### **turning circle**

circle within which are located the projections onto the ground plane of all the points of the tractor, excluding devices which can be folded (e.g. mirrors), when the tractor is driven in a circle

### 3.2.7

#### **nominal radius of steering wheel**

length which, in the case of a steering wheel, is the shortest dimension from its centre of rotation to the outer edge of the rim

### 3.2.8

#### **reaction forces**

forces emerging at the wheels and transmitted directly or indirectly to the steering control

NOTE The reaction forces are in balance with the forces applied to the steering control in order to maintain the achieved and intended direction of movement of the tractor.

## 3.3 Types of steering equipment

### 3.3.1

#### **main steering system**

steering equipment of a tractor which is mainly responsible for determining the direction of travel

NOTE It can consist of either **manual steering equipment** (3.3.1.1), **power-assisted steering equipment** (3.3.1.2) or **full-power steering equipment** (3.3.1.3).

#### 3.3.1.1

##### **manual steering equipment**

steering equipment in which the steering forces result solely from the muscular effort of the driver

#### 3.3.1.2

##### **power-assisted steering equipment**

steering equipment in which the steering forces result from both the muscular effort of the driver and the energy supply (supplies)

NOTE Steering equipment in which steering forces result solely from one or more energy supplies when the equipment is intact, but in which steering forces can be provided by the muscular effort of the driver alone if there is a fault in the steering (integrated power system), is also considered to be power-assisted steering equipment.

### 3.3.1.3

#### **full-power steering equipment**

steering equipment in which the steering forces are provided solely by one or more energy supplies and not by the muscular effort of the driver

### 3.3.2

#### **self-tracking equipment**

(tractors having more than two axles) steering system designed to create a change of steering angle on one or more wheels only when acted upon by forces and/or moments applied through the tyre to road contact

### 3.3.3

#### **auxiliary steering equipment**

steering equipment in which the rear wheels are steered in addition to the front wheels

NOTE The rear wheels can be steered in the same direction or in the opposite direction to the front wheels, and/or the steering angle of the front wheels and/or the rear wheels can be adjusted relative to the tractor's behaviour.

### 3.3.4

#### **front-wheel steering equipment**

steering equipment in which only the wheels of the front axle(s) are steered

### 3.3.5

#### **rear-wheel steering equipment**

steering equipment in which only the wheels of the rear axle(s) are steered

### 3.3.6

#### **multi-wheel steering equipment**

steering equipment in which the wheels of one or more of each of the front and the rear axle(s) are steered

#### 3.3.6.1

##### **all-wheel steering equipment**

steering equipment in which all the wheels are steered

#### 3.3.6.2

##### **articulated steering equipment**

steering equipment in which the movement of chassis parts relative to each other is directly produced by the steering forces

#### 3.3.6.3

##### **compound steering equipment**

steering equipment that is a combination of front-axle steering and articulated steering

#### 3.3.6.4

##### **skid steering equipment**

steering equipment where the change of direction of the tractor is achieved by different rotational speeds of the wheels or endless tracks left and right of the longitudinal plane of the tractor

## 3.4 Types of steering transmission

### 3.4.1

#### **purely mechanical steering transmission**

steering transmission in which the steering forces are transmitted entirely by mechanical means

### 3.4.2

#### **purely hydraulic steering transmission**

steering mechanism in which the steering forces, somewhere in the transmission, are transmitted only by hydraulic means