

Method of test for

**Static loading of
protective cabs and
frames for agricultural
wheeled tractors,
including acceptance
conditions**

ICS 65.060.10

Committees responsible for this British Standard

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AFRC Institute of Engineering Research
Agricultural and Allied Workers' National Trade Group
Agricultural Engineers' Association
British Agricultural and Garden Machinery Association Ltd.
County Surveyors' Society
Department of Trade and Industry (Vehicle Division)
Forestry Commission
Health and Safety Executive
Home Timber Merchants' Association of Scotland
Local Authority Organizations
Ministry of Agriculture, Fisheries and Food
National Farmers' Union
Society of Motor Manufacturers and Traders Limited

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Contents

	Page
Committees responsible	Inside front cover
National foreword	ii
Method	
Introduction	iii
1 Scope	1
2 Normative references	1
3 Definitions	1
4 Symbols	2
5 Apparatus	2
6 Preparation of tractor and protective structure	2
7 Procedure	3
8 Seat index point	4
9 Clearance zone	4
10 Tolerances	5
11 Acceptance conditions	5
12 Extension to other tractor models	6
13 Labelling	6
14 Test report	6
Appendices	
A Requirements for providing resistance to brittle fracture or protective structure at reduced operating temperature	14
B Test report for protective structure	15
C Data sheet for protective structure	17
Table	
A.1 Minimum Charpy V-notch impact energy requirements for protective structure material at a specimen temperature of $-30\text{ }^{\circ}\text{C}$	14
Figures	
1a Static load force — deflection diagram — Overload test not necessary	7
1b Static load force — deflection diagram — Overload test	8
1c Static load force — deflection diagram — Continuing overload test	9
2 Front and rear load application	10
3 Side load application	10
4 Example of arrangement for crushing test	11
5 Clearance zone	12
6a Clearance zone from side	13
6b Clearance zone from front or rear 65 mm behind the seat index point	13

National foreword

The revision of this British Standard has been prepared under the direction of the Agricultural Machinery and Implements Standards Policy Committee and is identical with ISO 5700 : 1989 'Wheeled tractors for agriculture and forestry — Protective structures — Static test method and acceptance conditions', prepared by Technical Committee ISO/TC 23, Tractors and machinery for agriculture and forestry, of the International Organization for Standardization (ISO).

This third edition supersedes BS 5947 : 1985, which is withdrawn. The technical differences in this edition are summarized in the introduction.

Cross-references

International standard	Corresponding British Standard
ISO 5353 : 1978	BS 5631 : 1978 Specification for earth moving machinery and tractors and machinery for agriculture and forestry — seat index point (Identical)

Technical Committee AGE/6 has reviewed the provisions of ISO 612 : 1978 and ISO 4253 : 1977, to which reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Introduction

0.1 In the revision of this International Standard to adopt "Seat Index Point" (SIP) in place of "Seat Reference Point" (SRP), the mean seat position is used in accordance with ISO 5353. The seating position is therefore moved to the mean horizontal from the rearmost position used in previous editions. Half the minimum horizontal adjustment as stated in ISO 4253 is the adjustment figure used.

To adopt the seat index point (SIP) in place of seat reference point (SRP), the relationship of SIP 90 mm above and 140 mm in front of the SRP has been used. This relationship should be used when converting from SRP to SIP or vice versa.

The 1980 edition of ISO 3462, *Tractors and machinery for agriculture and forestry — Seat reference point — Method of determination* used a relationship of SIP 97 mm above and 130 mm in front of the seat reference point. In a practical comparison, however, it was found that the 90 mm vertical and the 140 mm horizontal relationship gave the most accurate conversion.

Variation from the 1980 edition of ISO 3462 is due to

- a) seat cushions not being horizontal in practice;
- b) seat cushion angle to backrest not being 90°;
- c) curvature of the backrest placing the SIP device slightly forward of the SRP device.

0.2 Testing of protective structures for wheeled tractors for agriculture and forestry aims at minimizing the likelihood of driver injury resulting from accidental overturning during normal operation of the tractor.

The strength of the protective structure is tested by applying static loads to simulate actual loads which may be imposed on the cab or frame when the tractor overturns either to the rear or to the side without free fall. The tests allow observations to be made on the strength of the structure and the attachment brackets to the tractor and also of the tractor parts that may be affected by the load imposed on the structure.

Annex A gives requirements for providing resistance to brittle fracture at reduced operating temperature.

Wheeled tractors for agriculture and forestry — Protective structures — Static test method and acceptance conditions

1 Scope

This International Standard specifies a static loading test method and the acceptance conditions for protective structures (cab or frame) of wheeled tractors for agriculture and forestry.

It applies to tractors having at least two axles for pneumatic-tyred wheels, with or without track attachments, and with a tractor mass not less than 800 kg and not more than 15 000 kg.

NOTE — The limit of 15 000 kg on the tractor mass is based on the extent of research to date. Further studies are required to obtain the basic data to be used for a new edition of this International Standard, which will include tractors with a mass of more than 15 000 kg. However, this International Standard may be considered for use for tractors with a tractor mass greater than 15 000 kg until the new edition of this International Standard has been agreed.

Provision is made to cover both tractors with the conventional forward facing driver's position only and those with a reversible driver's position that is in agreement with OECD test code practice. For tractors with a reversible driver's position, a clearance zone is defined to be the combined clearance zones for the two driving positions. The point of application of the side loading is determined as the mid-point between the seat index points measured in the two positions.

The minimum track width of rear wheels should generally be greater than 1 150 mm. It is recognized that there may be designs of tractors, for example, lawn-mowers, narrow vineyard tractors, low profile tractors used in low buildings with limited overhead clearance, orchards, etc., stilt tractors and certain forestry machines such as forwarders, for which this International Standard is not appropriate.

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 612 : 1978, *Road vehicles — Dimensions of motor vehicles and towed vehicles — Terms and definitions*.

ISO 4253 : 1977, *Agricultural tractors — Operator's seating accommodation — Dimensions*.

ISO 5353 : 1978, *Earth-moving machinery, and tractors and machinery for agriculture and forestry — Seat index point*.

3 Definitions

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

3.1 protective structure : Cab or frame for the protection of drivers of wheeled tractors for agriculture or forestry by minimizing the likelihood of driver injury resulting from accidental overturning during normal operation.

NOTE — The protective structure is characterized by providing space for the clearance zone either inside the envelope of the structure or within a space bounded by a series of straight lines from the outer edge of the structure to any part of the tractor that might come into contact with flat ground and that is capable of supporting the tractor in that position if the tractor overturns.

3.2 tractor mass : Mass of the unladen tractor in working order with tanks and radiators full, protective structure with cladding, and any track equipment or additional front-wheel drive components required for normal use. The operator, optional ballast weights, additional wheel equipment, special equipment and loads are not included.

3.3 reference mass : Mass, not less than the tractor mass (see 3.2), selected by the manufacturer for calculation of the energy inputs to be used in the tests.

3.4 horizontal loading test : Application of a horizontal load to the rear, front and side of the structure.

NOTE — As loading continues, the cab/frame deformation may cause the direction of loading to change. This is permissible.

3.5 crushing test : Application of a vertical load through a beam placed laterally across the uppermost members of the protective structure.

3.6 longitudinal median plane (of a vehicle) : See ISO 612.

3.7 vertical reference plane (of a vehicle) : Vertical plane generally longitudinal to the tractor and passing through the seat index point and the steering-wheel centre.

NOTE — Normally this reference plane coincides with the longitudinal median plane of the tractor.

4 Symbols

The following symbols are used in this International Standard:

m_t	= reference mass, as defined in 3.3, in kilograms
D	= deflection of the protective structure for the calculated basic energy required at the point of, and in line with, the load application, in millimetres
F	= static load force for the calculated basic energy required, in newtons
$F_{\max}$	= maximum static load force occurring during loading (excluding overload), in newtons
E_{is}	= energy input to be absorbed during side loading, in joules
E_{il1}	= energy input to be absorbed during first longitudinal loading, in joules
E_{il2}	= energy input to be absorbed during a second longitudinal loading, in joules
F_r	= applied force at rear in the crushing test, in newtons
F_f	= applied force at front in the crushing test, in newtons

5 Apparatus

5.1 Horizontal loading tests

5.1.1 Material, equipment and attachment means to ensure that the tractor chassis is firmly fixed to the ground (and supported) independently of the tyres.

5.1.2 Means to apply a horizontal force to the protective structure, such as shown in figures 2 and 3, complying with the requirements of 5.1.2.1 to 5.1.2.4.

5.1.2.1 It shall be ensured that the load can be uniformly distributed normal to the direction of loading and along a beam of length between 250 and 700 mm, in an exact multiple of 50 mm.

5.1.2.2 The edges of the beam in contact with the protective structure shall be curved with a maximum radius of 50 mm.

5.1.2.3 Universal joints, or the equivalent, shall be incorporated to ensure that the loading device does not constrain the structure in rotation or translation in any direction other than the loading direction.

5.1.2.4 Where the protective structure length, covered by the appropriate load-applying beam, does not constitute a straight line normal to the load application direction, the space shall be packed so as to distribute the load over this length.

5.1.3 Equipment to measure force and deflection along the direction of application of the force and relative to the tractor chassis. To ensure accuracy, measurements shall be taken as continuous recordings. The measuring devices shall be located so as to record the force and deflection at the point of, and along the line of, loading.

5.1.4 Means to prove that the clearance zone has not been entered during the test. A measuring rig based on the clearance zone as shown in figure 5 can be used.

5.2 Crushing tests

5.2.1 Material, equipment and attachment means to ensure that the tractor chassis is firmly fixed to the ground (and supported) independently of the tyres.

5.2.2 Means to apply a downward force on the protective structure, such as shown in figure 4, including a stiff beam with a width of 250 mm.

5.2.3 Equipment to measure total vertical force applied.

5.2.4 Means for proving that the clearance zone has not been entered during the test. A measuring rig based on the clearance zone as shown in figure 5 can be used.

6 Preparation of tractor and protective structure

6.1 The protective structure shall be to production specifications and shall be fitted to the appropriate tractor model chassis in accordance with the manufacturer's declared attachment method.

6.2 The assembly shall be secured to the bedplate so that the members connecting the assembly and the bedplate do not deflect significantly in relation to the protective structure under loading. The assembly shall not receive any support under loading other than that due to the initial attachment.

6.3 A track width setting for the rear wheels if present shall be chosen such that no interference exists with the protective structure during the tests.

The assembly shall be supported and secured or modified so that all the test energy is absorbed by the protective structure and its attachment to the tractor rigid components.

6.4 All detachable windows, panels and removable non-structural fittings shall be removed so that they do not contribute to the strength of the protective structure.

In cases where it is possible to fix doors and windows open or remove them during work, they shall be either removed or fixed open for the test, so that they do not add to the strength of the protective structure. It shall be noted whether, in this position, they would create a hazard for the driver in the event of overturning.