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INTERNATIONAL RECOMMENDATION

R 21- Taximeters

Metrological and Technical Requirements, Test Procedures and Test Report Format

Fifth Committee Draft Recommendation

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EXPLANATORY NOTE

This fifth committee draft Recommendation has been prepared by the TC7 / SC4 Secretariat and reflects consideration of the comments received on the fourth committee draft consultation exercise in March 2006.

OIML TC7/SC4 “Measuring instruments for road traffic”

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FOREWORD

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TERMINOLOGY

The terminology used in this Recommendation conforms to the *International Vocabulary of Basic and General Terms in Metrology* [1], the International *Vocabulary of Legal Metrology* [2], to the *OIML Certificate System for Measuring* Instruments [3], and to the *OIML International Document for General requirements for Electronic Measuring Instruments* [4]. In addition, for the purposes of this Recommendation, the following definitions apply.

T.1 GENERAL

T.1.1 Taximeter

An instrument intended to measure duration and to measure distance on the basis of a signal delivered by a distance measurement transducer and to calculate and indicate the fare to be paid on the basis of the measured distance and/or measured duration.

T.1.2 Taxi

A vehicle, typically a car controlled by a driver that takes passengers on a journey in exchange for a fare.

T.1.3 Taximeter unit

A taximeter complete with a distance measurement transducer, and all appropriate interfaces and peripheral devices (e.g. interfaces, printer, display) for normal operation in a taxi.

T.1.4 Metrological authority

An authorized representative of the national service of legal metrology (i.e. the verification, and/or issuing authority) with responsibility for ascertaining and confirming that the instrument satisfies all or parts of the requirements of this Recommendation.

T.1.5 Metrologically relevant

Any device, instrument, function or software of a taximeter that influences the measurement result or any other primary indication is considered as metrologically relevant.

T.2 CONSTRUCTION

T.2.1 Device

A “device” is the integral part of the taximeter providing the means by which a specific function is performed, irrespective of the physical realization, e.g. by a mechanism or a key initiating an operation; the device may be a small part or a major part of taximeter (e.g. calculator, totalizer, real time clock)..

T.2.2 Peripheral device

A peripheral device is an additional device which repeats or further processes the measurement result and other primary indications (e.g. printer)

T.2.3 Calculator

Supprimé : Vehicle

Supprimé : vehicle installed

Supprimé : approving

Supprimé : or some

A calculator that receives and converts the output signals from the distance measurement transducer and associated measuring instruments to display and record for subsequent use.

T.2.4 Real-time clock

A clock incorporated into the taximeter that tracks time.

T.2.5 Event-counter

A non-resettable counter that increments each time device-specific parameters (T.2.11.3) are changed. The reference number of the counter at the time of initial or subsequent verification is fixed and secured by appropriate hardware or software means of the modified instrument.

Note: The term "non-resettable" implies that if the counter has reached its maximum number it will not continue with zero without the intervention of the verification authority.

T.2.6 Distance measurement transducer

An instrument installed in a taxi that converts the distance to be measured into pulses or digital data which are passed to the calculator in the taximeter.

T.2.7 Communication interface

An electronic, optical, radio or other hardware and software interface that enables information to be automatically passed between measuring instruments or devices.

T.2.8 User interface

An interface that enables information to be passed between a human user and the measuring instrument or its hardware or software devices, as, e.g. switch, keyboard, mouse, display, monitor, printer, touchscreen.

T.2.9 Protective interface

Interface which allows the introduction of only such data into the data processing device of taximeter, which cannot

- display data, that are not clearly defined and could be taken for a measurement result,
- falsify displayed, processed or stored measurement results or primary indications,
- adjust the instrument or change any adjustment factor

T.2.10 Electronic instrument

An instrument employing electronic sub-assemblies and performing a specific function. An electronic instrument is usually manufactured as a separate unit and can be independently tested.

T.2.11 Software

T.2.11.1 Legally relevant software

Programs, data, type-specific and device-specific parameters that belong to the taximeter,

Supprimé : incorporated into the taximeter

Supprimé : , the real-time clock, and possibly from

Supprimé : , and converts them into the appropriate parameters (time, duration, distance, fare), and if appropriate totalizes and/or stores the results in memory until they are used. In addition, the calculator may be capable of communicating both ways with these devices.¶

Supprimé : and also functions in the event the voltage supply to the taximeter is interrupted

Supprimé : a protected operational and measurement mode of the taximeter is entered and one or more

Supprimé : s are made to device-specific parameters (T.2.10.3).

Supprimé : in-service

Supprimé : an authorized person

Supprimé : Note: The distance measurement transducer does not provide information about the duration.¶

Supprimé : components

Supprimé : T.2.10 . Intelligent dedicated equipment The equipment or device capable of performing secured data processing, transmitting, downloading and storage (e.g. intelligent transducer, calculator, personal computer)

Supprimé : ¶

Note: As defined above, it may be a main part of the taximeter (e.g. distance measurement transducer) or a peripheral device (e.g. printer)¶

T.2..2 . Electronic sub-assembly¶

¶

A part of an electronic instrument comprised of electronic components and having a recognisable function of its own (e.g. A/D converter, display).**T.2.11.3** . Electronic componentThe smallest physical entity that uses electron or hole conduction in semiconductors, gases, or in a vacuum.¶

and define or fulfil functions that are subject to metrological control.

T.2.11.2 Type-specific parameter

Legally relevant parameter with a value that depends on the type of taximeter only. They are fixed at type approval of the taximeter.

T.2.11.3 Device-specific parameter

Legally relevant parameter that depends on the individual taximeter. Such parameters comprise adjustment and configuration parameters. They are adjustable or selectable only in the in-service mode of the taximeter and may be classified as those that should be secured (unalterable) and those that may be accessed (settable parameters).

T.2.11.4 Software identification

A sequence of readable characters of software, and that is inextricably linked to the software (e.g. version number, checksum).

T.2.12 **Data storage device**

The internal memory storage of the instrument or external storage device used for keeping data ready after completion of the measurement.

T.2.13 Taxi identification number

Numbers and/or letters identifying the taxi or the national vehicle registration number.

T.3 **METROLOGICAL CHARACTERISTICS**

T.3.1 **Measurement data**

T.3.1.1 Fare

The monetary amount calculated, indicated and displayed as a fare by the taximeter, due for a taxi journey based on a fixed initial fee (excluding any supplementary charges) and/or the length and/or the duration of the journey.

T.3.1.1.1 Supplementary charges

Additional monetary amount for an extra service, entered on manual command, suitably identified, indicated and displayed separately from the fare in 'Hired' (occupied) and in 'Stopped' (to pay) positions, with the possibility to add to the fare and display temporarily the total value of the fare including the supplementary charge at the end of the journey.

T.3.1.1.2 Initial hire fee (or initial charge)

The initial hire fee is a fixed amount, charged to the passenger, regardless of the time or distance of the journey.

T.3.1.1.3 Fare increment step

The smallest amount of money by which the fare may be incremented in equal steps in 'Hired' (occupied) position in accordance with the national regulation.

Supprimé : Legally relevant parameter with a value that depends on the individual taximeter. Such parameters comprise calibration and configuration parameters, such as measurement data, i.e. tariff data, fare and totalled fares (including the decimal sign and the monetary unit), time and distance data, and software identification.

Supprimé : by authorised person

Supprimé : (T.3.1)

Supprimé : Storage may be integrated with the taximeter (e.g. non-removable data storage that is part of the taximeter, e.g. hard disk, or removable storage, e.g. diskettes, CD-RW). Storage may also be on a universal computer system (multitasking operating system where storage can be moved within the universal system), or a remote system, e.g. file server located anywhere, e.g. in the same building or even in a different country. Thus the communications link to storage devices may be direct, which permits handshaking, or indirect, whereby there might be an intermediate storage phase not under the control of the user, e.g. dial-up on Internet. ¶

T.3.1.2 Cross-over speed

The taxi speed (km/h) at which the time-counting and distance-counting methods operate the taximeter at the same rate. The speed value is determined by division of the time tariff value by the applicable distance tariff value.

Supprimé : vehicle

Supprimé : drive

The cross-over speed is worked out as:

$$\frac{\text{Time tariff [amount/h]}}{\text{Distance tariff [amount/km]}}$$

For example:

Time tariff: ∈ 60.00 / h

Supprimé : 20

Distance tariff: ∈ 3.00 / km

Supprimé : 50

Cross-over speed [km/h]: $\frac{\in 60.00/h}{\in 3.00/km}$ = 20 km/h.

Supprimé : 40

T.3.1.3 Fare calculation method

T.3.1.3.1 Normal calculation method S (single application of tariff)

Fare calculation based on application of the time tariff below the cross-over speed and application of the distance tariff above the cross-over speed.

T.3.1.3.2 Normal calculation method D (double application of tariff)

Fare calculation based on the combined application of time tariff and distance tariff over the whole journey.

T.3.1.4 Taximeter constant k

Supprimé : Instrument

The constant k of the taximeter is expressed as pulses per kilometre and represents the number of the pulses which the taximeter must receive in order to indicate correctly a distance travelled of 1 kilometre.

T.3.1.5 Vehicle coefficient w

Supprimé : constant

The coefficient w of the vehicle is expressed as pulses per kilometre and represents the number of pulses a vehicle produces per kilometre of travel in its current location. The coefficient w varies in relation to several factors, in particular tyre wear and tyre pressure, the load carried by the vehicle and the conditions in which the journey is made.

T.3.1.6 Initial distance

The distance which can be travelled according to the tariff for the initial hire fee, considering distance-counting only.

Supprimé : fare

T.3.1.7 Initial time

The period during which the taxi can be used for the initial hire fee, considering time-counting only.

Supprimé : vehicle

Supprimé : fare

T.3.1.8 Time-counting

Time-counting is the calculation method in which the fare increases in proportion to the duration of the journey.

T.3.1.9 Distance-counting

Distance-counting is the calculation method in which the fare increases in proportion to the distance travelled.

T.3.1.10 Time-distance counting

Time-distance counting is the calculation method in which two components of the fare increase concurrently, one in proportion to the duration of the journey and the other in proportion to the distance travelled.

T.3.1.11 Distance measuring signal

The signal supplied by the distance measurement transducer to the taximeter, in proportion to the distance travelled.

T.3.1.12 Time measuring signal

The signal supplied by a clock incorporated in the taximeter, in proportion to the duration of the journey.

T.3.1.13 Reference number of pulses

The theoretical number of pulses from a distance and/or time measuring signal, which can be calculated using the tariff data and the taximeter constant k, which should lead to a certain change in the fare indication.

T.3.1.14 Tariff

A set of tariff values (including initial time / initial distance) that represents a schedule of charges or rates which will be operative in the taximeter in a specified tariff position.

T.3.1.15 Tariff values

The values from which the taximeter calculates the fare.

T.3.1.16 Distance tariff value

The tariff value expressed as an amount of money for a given distance.

T.3.1.17 Time tariff value

The tariff value expressed as an amount of money for a given period of time.

T.3.1.18 Tariff position

A position to which the taximeter can be adjusted in the ‘Hired’ (occupied) position.

T.3.2 Tariff regulation

A regulation, establishing which tariffs and supplements are to be applied under specified conditions.

T.3.3 Operating position

The different operating positions in which a taximeter fulfils different parts of its functioning.

T.3.3.1 ‘For hire’ (free) position

In ‘For hire’ (free) position the taximeter is not calculating a fare and no paying customer is making a taxi journey.

T.3.3.2 ‘Hired’ (occupied) position

In ‘Hired’ (occupied) position the taximeter is indicating and calculating a fare which is based on a possible initial hire fee and a tariff for the time of the journey and/or distance travelled.

T.3.3.3 ‘Stopped’ (to pay) position

In ‘Stopped’ (to pay) position a journey has been completed and the fare is indicated.

Supprimé : has ceased to increase with time while distance-counting is active

T.3.3.4 ‘Measure’ position

Additional operating position in which the total distance and duration of the journey are measured.

T.3.4 Repeatability

Ability of taximeter to provide results that agree one with the other under the same operating conditions of measurement [based on VIM 3.6].

T.3.5 Durability

Ability of a taximeter to maintain its performance characteristics over a period of use.

T.3.6 Checking facility

Facility that is incorporated in the taximeter and which enables significant fault to be detected and acted upon.

Note: The term ‘acted upon’ refers to any adequate response by the taximeter (luminous or acoustic signals, prevention of measurement process, etc).

T.3.7 Automatic checking facility

A checking facility that operates without the intervention of an operator, and performs securing and monitoring activities.

T.3.8 Audit trail

A historical record of all taximeter data, adjustments and measurement operations. Checks can be made to ensure that adjuatments and measurements has been carried out in accordance with the appropriate parts of this Recommendation.

T.3.9 Operational mode

Mode in which the taximeter is fully operational and implements all functions, including security functions

T.3.10 Service mode

Mode for updating or confirming the taximeter parameters to be held in the memory storage

T.4 INDICATIONS AND ERRORS

T.4.1 Digital indication

An indication in which the output or display of the measurement results is digitized [VIM 4.11].

Note: The term 'digitized' relates to the form of presentation of the output or display, not to the principle of operation of the instrument.

T.4.2 Primary indications

Indications, signals and symbols that are subject to requirements of this Recommendation.

T.4.3 Totalization indicator

The part of the taximeter indicator for displaying the sum of totalized values in a separate display mode from other values.

T.4.4 Operating position indicator

The part of the taximeter that displays the operating position (T.3.3).

T.4.5 Errors

T.4.5.1 Error (of indication)

The indication of an instrument minus a true value of the corresponding input quantity [VIM 5.20].

T.4.5.2 Intrinsic error

The error of an instrument determined under reference conditions [VIM 5.24].

T.4.5.3 Initial intrinsic error

The intrinsic error of an instrument as determined prior to performance tests.

T.4.5.4 Maximum permissible errors (MPE)

Supprimé : vehicle identification and

Supprimé : vehicle characteristics such as w, k, tyre size current time and current odometer value number. ¶

Inséré : such as

Inséré : number

Supprimé : Taximeter service mode is conducted by the appropriate metrological authority (T.1.4)

Inséré : Taximeter service mode

Supprimé : **T.4.1 Taximeter indicator** ¶

Supprimé : A part of the taximeter that displays the measurement results either continuously or on demand.Note: "Indication", "indicate" or "indicating" includes both displaying and/or printing.

Supprimé : for the tariff (or other criteria) based measurement results allocated to individual registers

Supprimé : indicated measurement

Supprimé : actual measurement

Extreme values of an error permitted by specifications, regulations, etc, for a given instrument. [VIM 5.21]

T.4.5.5 Fault

The difference between the error of indication and the intrinsic error of a taximeter.

Note: Principally, a fault is the result of an undesired change of data contained in or flowing through an electronic instrument. In this Recommendation, a "fault" is a numerical value.

T.4.5.6 Significant fault

A fault the magnitude of which is greater than the maximum permissible error of the taximeter.

The following are not considered to be significant faults:

- faults that result from simultaneous and mutually independent causes in the instrument,
- faults that make it impossible to perform any measurement,
- transitory faults that are momentary variations in the indications which cannot be interpreted, memorised or transmitted as a measurement result,
- faults that are so serious that they will inevitably be noticed by those interested in the measurement.

T.5 TEST CONDITIONS

T.5.1 Equipment under test (EUT)

Taximeter or a device subjected to performance tests.

T.5.2 Influence quantity

A quantity that is not the measurand but affects the result of the measurement [VIM 2.7].

T.5.3 Influence factor

An influence quantity having a value within the specified rated operating conditions of the EUT.

T.5.4 Disturbance

An influence quantity having a value within the limits specified in this Recommendation, but outside the specified rated operating conditions of the EUT.

T.5.5 Rated operating conditions

Conditions of use (e.g. reference conditions applicable in the IEC Standard) giving the range of values of the influence factors, for which the errors (of indication) of the EUT are required to be within the maximum permissible errors [based on VIM 5.5].

T.5.6 Reference conditions

A set of reference values, or reference ranges of influence quantities prescribed for testing the performance of the EUT, or the inter-comparison of the results of measurements [based on VIM 5.7].

T.5.7 Preconditioning

Treatment of the EUT, with the object of removing, or partly counteracting, the effects of its previous history. Where called for, it is the first process in the test procedure.

T.5.8 Conditioning

Exposure of the EUT to an environmental condition (influence factor or disturbance) in order to determine the effect of such a condition on it.

T.5.9 Recovery

Treatment of the EUT, after conditioning, in order that the properties of the EUT may be stabilised before measurement.

T.5.10 Performance test

A test intended to verify whether the EUT is capable of accomplishing its intended functions.

T.5.11 Function test

A test conducted at reference conditions at the start of the type evaluation test to check the distance and time accuracy of the taximeter.

Supprimé : and at the end

Supprimé : pulse

T.5.12 Function control test

A test conducted during and/or after each influence factor and disturbance test to check the distance and time accuracy of the taximeter.

T.6 SYMBOLS, UNITS AND ABBREVIATIONS

MPE	Maximum permissible error
EUT	Equipment Under Test
ms^{-2}	Metres per second per second
ASD	Acceleration spectral density

TAXIMETERS

1 GENERAL

1.1 Scope

This International Recommendation specifies the metrological and technical requirements and test procedures for taximeters that are subject to national metrological control.

It is intended to provide standardized requirements and testing procedures to evaluate the metrological and technical characteristics in a uniform and traceable way.

1.2 Application

This Recommendation applies to taximeters that calculate fares charged for journeys according to defined tariffs.

This Recommendation does not apply to mechanical taximeters.

1.3 Principle of operation

A transducer installed and interfaced to a moving part of the taxi provides the taximeter with secured distance information representative of the distance travelled by the taxi. One or more devices, incorporated in the taximeter, receive the output signals from the distance measurement transducer and associated measuring instrument, analyse and converts the signals into appropriate parameters. The signals are then electronically processed to totalise, display and possibly record the results of a measurement as fares due for a taxi journey based on specified tariffs and/or the length and/or the duration of the journey.

1.3.2 The major taximeter devices are as follows:

– A distance measurement transducer interfaced to a moving part of the taxi to collect stable signal at every speed travelled.

– A calculator incorporated into the taximeter that receives the output signals from the distance measurement transducer and from associated measuring instruments, and converts them into the appropriate parameters (time, duration, distance, fare), and if appropriate totalizes and/or stores the results in memory until they are used. In addition, the calculator may be capable of communicating both ways with these devices.

– A real-time clock incorporated into the taximeter that tracks time and also functions in the event the voltage supply to the taximeter is interrupted.

– An indicator device to display the fare to be paid for a journey.

1.4 Terminology

The terminology given in the terminology section shall be considered part of this Recommendation.

2 METROLOGICAL REQUIREMENTS

2.1 Main function of the taximeter

The taximeter shall be designed to measure the duration, and calculate the distance of a fare-paying journey based on a signal delivered by a distance measurement transducer.

Additionally, it calculates and displays on the indicator, the fare to be paid on a journey based on the calculated distance and/or the measured duration of the journey.

2.2 Maximum permissible errors (MPE)

2.2.1 Initial verification

The maximum permissible errors on initial verification are:

2.2.1.1 For taximeter not installed in the vehicle:

a) For the time measured, the greatest value of 0.2 s or ± 0.1 %;
b) For the distance measured, the greatest value of 4 m or ± 0.2 % of the distance, or a lower accuracy as necessitated by the vehicle coefficient w, where the minimum value for w is specified by the manufacturer;
c) For the fare calculated, ± 0.1%. Allowance shall be made for the rounding of the least significant digit of the fare indication.

2.2.1.2 For taximeter installed in the vehicle:

a) For the time measured, ± 0.2 %;
b) For the distance measured, ± 2 %;
c) A difference of less than 0.2 % of the taximeter constant 'k' from the coefficient 'w' on the vehicle on which the taximeter is mounted.

2.2.2 In-service verification

The maximum permissible errors on in-service verification of a taximeter unit shall be as specified in 2.2.1.2 for vehicle-installed taximeters.

2.3 Taximeter accuracy conformance over time

Taximeters shall be designed to provide a level of confidence that the accuracy and operation of the taximeter is within the requirements of this Recommendation for a period of at least one year of normal use. Any malfunction of the taximeter arising from significant faults shall be automatically and clearly indicated (e.g. by a visible or audible fault indication or by automatic switch off). The documentation submitted by the manufacturer (5.2.1) shall include a description of how this requirement is met.

2.4 Units of measurement

The units of measurement to be used on a taximeter are:

- time, in seconds, minutes and hours;
- distance, in metres (m) or kilometres (km), or as specified in national regulation;
- the fare, as specified in national regulation.

Supprimé : 2.2 Accuracy class The taximeter shall be designated with one accuracy class, which shall be marked on the taximeter in accordance with the descriptive markings in 3.12.

Supprimé : constant

Supprimé : 2..2 In-service verification The maximum permissible errors in-service verification of a unit shall be as follows:

Supprimé : , or a lower accuracy as necessitated by the vehicle constant w, where the minimum value for w is specified by the manufacturer;

Supprimé : 0.5

Supprimé : constant

Supprimé : "near to certainty",

Supprimé : The level of confidence shall take account of uncertainties of measurement, significant faults and failure of the instrument. ¶ ¶

2.5 Influence quantities

Unless otherwise specified by the manufacturer, the climatic, mechanical and electromagnetic operating influences on the taximeter shall be determined in accordance with the performance tests in Annex A.

2.5.1 Temperature

If no particular working temperature is specified by the manufacturer, then the taximeter shall maintain its metrological properties within the following temperature limits:

– the lower temperature limit shall be -40 °C, -25 °C, or -10 °C
– the higher temperature shall be + 40 °C, +55 °C, or +70 °C

For special applications and/or depending on local environmental conditions, the limits of the temperature range may differ provided that this range shall not be less than 80 °C and shall be specified in the descriptive markings.

2.5.2 DC voltage supply

A taximeter shall comply with the appropriate metrological and technical requirements, if the voltage supply varies from the nominal voltage from the lower and upper limits of the voltage range marked on the taximeter at:

12 V road vehicle battery supply: lower limit is 9 V, upper limit is 16 V
24 V road vehicle battery supply: lower limit is 16 V, upper limit is 32 V

The taximeter shall either continue to function correctly if there is a temporary voltage drop below the lower operating limit or abort an existing measurement if the voltage drop is for a longer period.

Supprimé : not indicate any measurement values if the voltage supply is

Supprimé : below the lower operating limit specified by the manufacturer

2.6 Constant k of the taximeter

The taximeter constant k shall not be lower than 500 pulses per kilometre and it shall be possible to adjust it to the vehicle coefficient w with such accuracy that the maximum permissible error is not exceeded. It shall be possible to display the constant k on the taximeter as a readily accessible decimal number. Every change of the constant k shall be secured in accordance with 3.2.5. The use of the taximeter shall not be possible when the change registration capacity is exceeded. That capacity will be defined by the manufacturer.

Supprimé : constant

Supprimé : taximeter shall be equipped with a

Supprimé : by means of which

Supprimé : of 0.02 %

Supprimé : during in-service inspection mode as specified in 3.14.3

Supprimé : if the corrections occur when the taximeter is in service mode or conducted in accordance with national regulation

Inséré : if the corrections occur when the taximeter is in service mode

Inséré : conducted

Supprimé : and in compliance with the securing requirements in 3.2.5

Inséré : in compliance with

2.7 Real-time clock

The real time-clock shall keep track of the time of the day and the date. One or both values may be used for the automatic change of tariffs. The following requirements apply:

a) The timekeeping accuracy shall be ± 2 minutes per week.
b) Correction for summer and winter time shall be performed automatically in applicable countries and comply with the securing requirements in 3.2.5.
c) Other time corrections, automatic or manually, shall be prevented during a journey, unless conducted during a verification process.

In the event of an interruption of the power, the real time clock shall continue to function correctly, and retain the correct time and date in the taximeter for at least one year, unless otherwise specified in national regulation.

3 TECHNICAL REQUIREMENTS

3.1 Suitability for use

A taximeter shall be designed to suit the method of operation and vehicles for which it is intended. It shall be of adequately robust construction in order that it maintains its metrological characteristics.

3.2 Security of operation

3.2.1 Fraudulent use

A taximeter shall have no characteristics likely to facilitate its fraudulent use.

3.2.2 Accidental breakdown and maladjustment

A taximeter shall be so constructed that an accidental breakdown or maladjustment of devices likely to disturb its correct functioning cannot take place without its effect being evident (e.g. by a visible or audible fault indication or by automatic switch off).

3.2.3 Calculator

The taximeter shall be designed in such a way as to permit easy inspection and adjustments of the calculator in order to assess its functionality and to conform to changes in its functions imposed by national regulations. Any malfunction shall be clearly indicated (e.g. by a significant fault indication or by automatic switch off).

3.2.4 Controls

Controls on taximeters shall be so designed that they cannot normally come to rest in positions other than those intended by design, unless during the manoeuvre all indication is made impossible. Keys shall be marked unambiguously.

3.2.5 Securing of functions, hardware, software and pre-set controls

Means shall be provided for securing taximeter functions, measurement data, hardware, software and pre-set controls, to which access, adjustment or removal is prohibited. National regulation may specify the securing that is required. There shall be adequate securing to ensure that:

a) Access to legally relevant functions shall only be allowed to the metrological authority, e.g. by means of passwords, an event counter (T.2.5) or an automatic checking facility (T.3.7) providing an information record of the access;
b) Any access to the legally relevant functions becomes automatically evident, e.g. by means of an event counter or an automatic checking facility automatically updating a device-specific parameter the value of which at the time of the last verified set-up had been durably marked on the taximeter in accordance with the requirements of 3.12;
c) A minimum of ten of the most recent access or changes to the legally relevant and metrological functions shall be recorded and retained by the taximeter in its memory storage;
d) Protection of device-specific and software functions against intentional, unintentional and accidental changes shall be provided in accordance with the software requirements in 3.11;

Supprimé : ¶

2.9 Additional functions of a vehicle unit¶

¶

<#>In addition to the main functions of a taximeter described in 2.1, a taximeter complete with a vehicle installed distance measurement transducer shallensure the following functions:detection and notification of events and/or faults¶
<#>reading, recording and storing in data storage;¶
<#>printing;¶
<#>data transmission and downloading to and from external devices;¶
<#>in-service inspection functions;¶
<#>driver manual entry functions;¶
<#>time correction functions;¶
<#>security functions;¶
<#>other functions as described in 3.14.3.¶

Supprimé : devices

Supprimé : authorised person

e) Detection of physical tampering or removal of taximeter hardware shall be provided (e.g. seals);
f) Transmission of legally relevant data via interfaces shall be secured against intentional, unintentional and accidental changes in accordance with the interface requirements in 4.2.3;
g) The securing possibilities available in a taximeter shall be such that separate securing of the settings is possible;
h) Other means of securing specified by the manufacturer shall ensure the integrity and authenticity of measurement data and taximeter functions.

3.3 Fare calculation

The interval of fare to pay, and the monetary symbols shall comply with national regulation.

The calculation of fare can be carried out by one of the following methods:

a) Normal calculation method S (single application of tariff)

The fare is calculated from time-counting below the cross-over speed and from distance-counting above the cross-over speed in accordance with the selected tariff.

b) Normal calculation method D (double application of tariff)

The fare is calculated from combined time-counting and distance-counting in accordance with the selected tariff

If both method S and method D are possible in a taximeter, the option of switching between them shall be by a secured setting in accordance with 3.2.5.

The indications for fare calculation shall comply with 3.9.1

3.4 Tariff programming

3.4.1 Tariff data

The tariff data of each allocated tariff may include the following:

- initial hire fee;
- initial time;
- initial distance;
- time-tariff value;
- distance-tariff value;
- supplementary charge increment, if appropriate;
- signatures of the corresponding tariff parameters.

Supprimé : data;¶
software identification

3.4.2 Input of tariff data

It shall be possible to secure the access to the level where tariff data can be changed in accordance with the securing requirements 3.2.5.

The tariff data may be entered individually via appropriate protective user interface(s).

Unauthorised or unintentional tariff re-programming due to interfacing with other equipment shall conform to the securing requirements in 3.2.5.

If the taximeter is capable of having its tariffs re-programmed in advance of the effective date, those tariffs shall not become effective until that date.

3.5 Operating position indication

The operating positions for the tariff based measurement results allocated to individual registers in a taximeter are distinguished on the indicator as follows:

3.5.1 'For hire' (free) position

In 'For hire' (free) position the fare calculation is disabled (i.e. time-counting and distance-counting are inactive).

In 'For hire' (free) position it shall be possible to display, when relevant, the following parameters:

a) All elements of the indicator display;
b) The contents of totalizers (see 3.7);
c) The constant k expressed in pulses per kilometre;
d) The contents of the event counters;
e) The tariff data of each allocated tariff (see 3.4.1);
f) Signatures of the corresponding tariff parameters;
g) Date and time;
h) Software version number and/or checksum.

Supprimé : 4

The above parameters shall not be displayed for more than 10 seconds when the taxi is moving.

Other indications in 'For hire' (free) position are permitted provided that they are in accordance with national regulation, they shall not be interpreted as fare or supplement indication and their use is subject to the security of operation requirements in 3.2.

3.5.2 'Hired' (occupied) position

In 'Hired' (occupied) position the fare calculation takes place on the basis of a possible initial charge and a tariff for distance travelled and/or duration of the journey (i.e. time-counting and distance-counting are active).

The indications in 'Hired' (occupied) position at the beginning of the journey shall be in the following order:

a) The initial charge,
b) The first fare indication, followed by subsequent fare indication changes corresponding to the initial and then successive equal time intervals or distances specified in the applied tariff;

Indications in 'Hired' (occupied) position may also include the distance and time displays provided they comply with the quality of indication requirements in 3.9.1. In addition, all indications in 'Hired' (occupied) position shall be in accordance with national regulation.

3.5.3 'Stopped' (to pay) position

At the end of the journey and the taxi has stopped, in 'Stopped' (to pay) position the fare due for the journey is indicated and fare calculation based on time and distance is disabled (i.e. time-counting and distance-counting inactive.

The indications in 'Stopped' (to pay) position at the end of the journey shall be:

a) The fare to be paid for the journey, or
b) If there is a supplementary charge for an extra service, entered by manual command, this shall be displayed separately from the indicated fare. However, in this case a taximeter may indicate temporarily the value of the fare including the supplementary charge.

In the case of b) the indication of the supplement shall be made by figures with a height not more than that of the figures indicating the fare.

The indications in the 'Stopped' position shall comply with 3.9.1.

3.5.4 'Measure' position for the normal calculation method D (double application of tariff) system

If the fare calculation is according to the normal calculation method D, the taximeter shall be equipped with the 'Measure' position in which the distance and duration of the journey are measured and displayed in real time on a separate indicator as follows:

a) Time measured in hours with the smallest increment of 1 minute;
b) Distance measured shall have a resolution better than or equal to 0.1 km;
c) Readings for both time and duration may be given at the same time, or may be recalled one after the other by means of the operating position indicator;
d) The period of use shall be shown as hh:mm:ss and the indicated unit of measurement shall comply with the requirements in 3.9.1 so that there can be no confusion as to the quantity indicated.

Supprimé : 30 seconds

3.6 Additional requirements for the operating position indicator

The indication of the operating positions is subject to the following requirements:

a) In 'Stopped' (to pay) position and before the start of any new journey, the indication of the fare at the end of a previous journey shall be displayed for a sufficient period (at least 10 seconds, or for a period in accordance with national regulation);
b) The design and setting of the operating position indicator shall ensure that any change in operating positions and their indications comply with the appropriate securing requirements in 3.2.5;
c) It shall not be possible to switch to any other operating positions other than those mentioned above, unless otherwise specified in national regulation.

3.7 Totalizers

A taximeter shall be fitted with non-resettable totalizers which can clearly and unambiguously display all of the following values:

a) Total distance travelled by the taxi;
b) Total distance travelled when hired;
c) Total number of journeys;
d) Total amount of money charged as supplements;
e) Total amount of money charged as fare.

Other data may be totalled and indicated provided that they comply with national regulation and with the requirements in 3.9.1 for quality of indication to prevent the display of totalized values being used to deceive passengers.

Values saved under conditions of power loss shall be included in the total.

Totalized values shall be displayed for a maximum of 10 seconds, or for a time specified in accordance with national regulation.

Totalizers shall have a minimum number of digits (e.g. 8 digits).

Totalized values shall be stored for at least one year for subsequent use.

Supprimé : the purposes of transferring the values to another device

3.8 Automatic change of tariffs

The automatic change of tariffs may be triggered by the:

a) Distance of the journey;
b) Duration of the journey;
c) Time of day;
d) Date;
e) Day of the week; or
f) Other data specified in accordance with national regulation.

Any alteration of tariff values shall comply with the appropriate securing requirements in 3.2.5.

3.9 Indicating and printing

3.9.1 Quality of reading

The primary indications shall be by means of a display. Reading of the primary indications (T.4.2) shall be reliable, easy and unambiguous under conditions of normal use including in the daylight and night, and the figures forming the indications shall be of a size in height and of a shape and clarity that permits easy reading.

Supprimé : hard copymeasurement.

Inséré : measurement

Supprimé : of at least 10 mm

Primary indications shall contain names or symbols of the units of measurement and comply with the requirements of 2.4.

The indicator display shall be so designed that the indications of interest to the passenger are sufficient for a particular application, suitably identified and readable from a distance of at least 2 metres.

Supprimé : meters

A digital indication shall show at least one figure beginning at the extreme right to adequately differentiate subordinate digits.

A decimal fraction value shall be separated from its integer by a decimal sign (comma or dot), with the indication showing at least one figure to the left of the decimal sign and all figures to the right of the decimal sign.

Supprimé : Zero may be indicated by one zero to the extreme right, without a decimal sign.

3.9.2 Printing

A printer may be used to obtain a hard copy at the end of the measurement. Printing shall be clear and permanent for the intended use. Printed figures shall be of a size at least of at least 2 mm high in height, clear, legible and unambiguous.

If printing takes place, the name or the symbol of the unit of measurement shall be either to the right of the value or above a column of values, or placed in accordance with national regulation.

Multiple copies of the print-out containing the same data must be marked “copy” or “duplicate”.

The minimum printout resulting from each measurement operation shall be dependent upon the application of the taximeter and in accordance with national regulation. In general the printout information may include the following:

– tariff identification;
– fare;
– supplementary charge;
– distance and duration of the journey;
– date and the time of the journey

Supprimé : programmed

3.10 Data storage devices

Measurement data and legally relevant parameters may be stored in a memory of the taximeter, or on external storage for subsequent use (e.g. indication, printing, transfer, totalising, etc). In this case, the stored data shall be adequately protected against intentional and unintentional changes during the data transmission and/or storage process and shall contain all relevant information necessary to reconstruct an earlier measurement.

Supprimé : (hard drive), or on a universal computer storage, or on external storage

Data storage devices shall be secured to ensure that:

a) Data transfer complies with the appropriate requirements for software securing in 3.11;
b) external storage devices identification and security attributes shall be verified to ensure integrity and authenticity;
c) Exchangeable storage media is sealed against unauthorised removal in accordance with 3.2.5;
d) When storage capacity is exhausted, new data shall replace oldest data;
e) Other means of securing stored data specified by the manufacturer shall ensure the integrity and authenticity of measurement data.

3.11 Software

The legally relevant software of a taximeter shall be identified by the manufacturer, i.e., the software that is critical for measurement characteristics, measurement data and metrologically important parameters, stored or transmitted, and software programmed to detect system fault (software and hardware), is considered as an essential part of a taximeter and shall meet the requirements for securing software specified below. National regulation may specify other requirements for securing software.

3.11.1 The manufacturer shall provide documentation on software including the following:

a) A description of the legally relevant software;
b) A description of the accuracy of the measuring algorithms (e.g. programming modes);
c) A description of the user interface, menus and dialogues;
d) The unambiguous software identification;
e) An overview of the software system, e.g. topology block diagram, type of computer(s), description of software functions, etc, if not described in the operating manual;
f) Means of securing software;

g) The operating manual
h) Other information relevant to the software characteristics of the taximeter.

3.11.2 Software shall be secured to ensure that:

a) Legally relevant software shall be adequately protected against accidental or intentional changes by means of an audit trail (T.3.8) from a software event counter (T.2.5) and/or automatic checking facility (T.3.7) providing information record of the changes to legally relevant software or parameter. Evidence of an intervention such as changing, uploading or circumventing the software shall be non-erasable, automatically recorded and stored for at least one year, or for a period set in accordance with national regulation;
b) Legally relevant software shall be assigned with a software identification (see T.2.11.4) which shall be adapted in the case of every software change that may affect the functions and accuracy of the taximeter. In addition, downloading of legally relevant software shall be with appended software identification, target equipment identification and security attributes to ensure integrity and authenticity. In this case, the software identification is considered as device-specific parameters (see T.2.11.3). Software identification shall be easily provided by the taximeter;
c) Downloading of legally relevant software and data shall be through appropriate protective interfaces connected to the taximeter;
d) Functions that are performed or initiated via a software interface shall meet the relevant requirements and conditions of 4.2.3;
e) Other software securing means specified by the manufacturer shall ensure the integrity and authenticity of measurement data.

Supprimé : 3.6.1

3.12 Descriptive markings

Taximeters shall bear the following markings, variable according to national regulation, at each location having a fare indicating device:

Supprimé : or printing

- name or identification mark of manufacturer;
- name or identification mark of the importer (if applicable);
- serial number and type designation of the taximeter (if applicable);
- type approval sign and/or number of type examination certificate;
- year of manufacture;
- specified range of the constant 'k' (if applicable) in pulses per kilometre;
- software identification (if applicable).

Supprimé : <#>accuracy class;¶
<#>type approval sign;¶
<#>power supply V;¶
<#>relevant data in respect of the conditions of use;¶

Supprimé : date

Supprimé : km $^{-1}$

Supprimé : **<#>**emperature range . °C;¶

3.12.1 Supplementary markings

Depending upon the particular use of the taximeter, one or more supplementary markings may be required on the taximeter, e.g.:

- relevant data in respect of the conditions of use;
- where a particular taximeter is verified using a particular type of vehicle (i.e. mini-van, air suspension systems only);

Supprimé : ¶
Other markings may be specified in accordance with national regulation provided they are applied in accordance with the requirements in 3.2.¶

Supprimé : type approval by the metrological authority issuing the type approval certificate.

Supprimé : , then this should be marked on the taximeter.

3.12.2 Presentation of descriptive markings

Descriptive markings shall be indelible and of a size, shape and clarity that permit legibility under normal conditions of use of the instrument. Markings shall be grouped together in a clearly visible place on the instrument, either on a descriptive plate fixed near the indicating device or on the indicating device itself. It shall be possible to seal the plate bearing the markings, unless it cannot be removed without being destroyed.

These additional markings may be either in the national language or in form of adequate, internationally agreed and published pictograms or signs.

As an alternative all applicable markings in 3.12 may be simultaneously displayed by a software solution either permanently or on manual command. In this case the markings are considered as device-specific parameters (see T.2.111.3), and the following shall apply:

– k, w and real-time clock shall be displayed as long as the taximeter is switched on;
– the other markings may be accessed and displayed by a simple manual commend (e.g. a specific keystroke);
– it shall be described in the type approval certificate;

3.13 Verification Marks

According to national legislation, initial verification may be testified by verification marks, e.g.:

– verification authority identification;
– date of verification;
– other verification markings specified in accordance with national regulation (e.g. actual value of the taximeter constant 'k' in pulses per kilometre, vehicle registration).

After every subsequent verification new marks shall replace the old marks where necessary to reflect new information.

3.13.1 Position of verification marks

A place shall be provided for the application of verification marks. This place shall:

– be such that the part on which the marks are located cannot be removed from the taximeter without damaging the marks;
– permit the easy application of the marks without changing the metrological qualities of the taximeter;
– be clearly and visibly marked on, in or near the fare indicating device when the taximeter is in service.

3.14 Installation and test conditions

3.14.1 General

Taximeters shall be manufactured, tested and installed so as to minimise any adverse effects of the testing and installation environment. If the correct testing or operation of the taximeter is likely to be affected by the properties of other connected equipment and the vehicle in which it is installed, then the taximeter shall be provided with a means to secure the correct testing and operation of the taximeter (e.g. a test connector interface as specified in 4.2.3 for testing purposes). Where particular details of installation have an effect on the accuracy of the taximeter these details shall be recorded in the test report (e.g. influence of the vehicle).

3.14.2 Taximeter operation

After installation the taximeter shall comply with the appropriate requirements of this Recommendation.

All settings that can influence the compliance with this Recommendation shall be secured (see 3.2.5), with access possible only through e.g. a service mode (T.3.9). Other settings not

Supprimé : instrument

Supprimé : must

Supprimé : <#>the software elements of the display complies with the appropriate requirements for software securing in 3.11. ¶

Inséré : <#>the software elements of the display complies with the

Inséré : <#>appropriate

Inséré : <#>for software securing in

Supprimé : vehicle constant 'w'¶
specified range of the

Supprimé : km $^{-1}$

Supprimé : ¶

3.13.2 Mounting of verification marks¶
¶
<#>Taximeters shall have a verification mark support located as specified above, which shall ensure the conservation of the marks as follows:when the mark is made with a stamp, the support may consist of a strip of lead or any other material with similar qualities (for example plastic, brass etc. depending on national regulation) inserted into a plate fixed to the instrument or a cavity bored into the instrument;¶
<#>when the mark consists of an adhesive transfer, a space shall be provided for this purpose.¶

Supprimé : <#> Taximeter compatibility with distance measurement transducer¶
¶
A taximeter shall be installed in accordance with the manufacturer's installation instructions providing that it with the requirements of this Recommendation, especially the requirements in Clauses 3 for securing and security of operation and suitability for use. ' Taximeters shall be installed non-activated, with all metrological and technical parameters set to appropriate and valid default values. Before activation, taximeters shall neither store nor transmit measurement data. During installation, all known parameters shall be pre-set. Taximeters shall be connected to a distance measurement transducer to ensure the correct functioning of the unit to meet the requirements of this OIML Recommendation, espec … [1]

subject to legal control shall have appropriate protected access (see 3.2.5) through e.g. an operational mode (T.3.10).

Supprimé : <#>A taximeter connected to the above distance measurement transducer shall possess at least the following modes of operation:operational mode (T.3.)¶
in-service mode (T.3.)All functions listed in 2.9 shall work in any mode of operation after activation with the following exceptionthe in-service inspection function is accessible in the in-service mode only;¶
<#>time correction is possible only in the in-service mode;¶
<#>driver manual entries functions during the journey (entry of places where the daily work periods begin and/or end for a driver) are accessible in the operational mode;¶
downloading of legally relevant software is not accessible in the operational mode.The in-service inspection mode shall allow the taximeter to: ¶
<#>automatically pair the distance measurement transducer with the vehicle unit;¶
<#>digitally adapt the taximeter constant (k) to the vehicle constant (w);¶
<#>adjust (without limitation) the current time;¶
<#>adjust the current odometer value,¶
<#>record and update vehicle unit details (vehicle unit identification, distance measurement transducer identification);¶
record and store details of the metrological authority, vehicle identification and parameters updated or confirmed: w, k, tyre size, odometer (old and new values), date and time (old and new values), time adjustment data including (date and time, old value, date and time, new value), most recent in-service inspection.

4 ELECTRONIC REQUIREMENTS

4.1 General requirements

Taximeters shall comply with the following requirements in addition to the applicable requirements of all other clauses of this recommendation.

4.1.1 Rated operating conditions

Taximeters shall be so designed and manufactured that they do not exceed the maximum permissible errors under rated operating conditions.

4.1.2 Influence quantities

Taximeters shall comply with the requirements of 2.5 and shall also comply with appropriate metrological and technical requirements under conditions of high relative humidity above 93 % when combined with cyclic temperature changes and condensation.

4.1.3 Disturbances

Taximeters shall be so designed and manufactured that when exposed to disturbances, either

a) Significant faults do not occur (i.e. the difference between the indication due to the disturbance and the indication without the disturbance (intrinsic error), either shall not exceed the value given in T.4.5.6, or
b) Significant faults are detected and acted upon. The indication of significant faults in the display should not be confusing with other messages that appear in the display.

4.1.4 Durability

The requirements in 4.1.1, 4.1.2 and 4.1.3 shall be met durably in accordance with the intended use of the instrument.

4.1.5 Evaluation for compliance

A type of a taximeter is presumed to comply with the requirements of 4.1.1, 4.1.2, 4.1.3 if it passes the examination and tests specified in Annex A.

4.1.6 Application

The requirements in 4.1.3 may be applied separately to each:

a) Individual cause of significant fault, and/or
b) Part of the electronic instrument.

The choice of whether 4.1.3 (a) or (b) is applied is left to the manufacturer.

4.2 Functional requirements

4.2.1 Indicator display test

Upon switch-on (switch-on of indication), a display test procedure shall be performed that shows all relevant signs of the indicator in their active and non-active state sufficiently long to be checked by the operator. This is not applicable for non-segmented displays, on which failures become evident, for example screen-displays, matrix-displays, etc

4.2.2 Acting upon significant faults

When a significant fault has occurred, either the taximeter shall be made inoperative automatically, or a visual or audible indication shall be provided automatically and shall continue until the user takes action or the fault disappears.

Supprimé : been

4.2.3 Interface

A taximeter shall be equipped with communication interfaces (T.2.7) permitting the coupling of the taximeter to any other instruments or the vehicle for automatic transmission of information, and a user interface (T.2.8) permitting the exchange of information exchange between a human user and the taximeter.

A taximeter shall be able to transmit the following data through appropriate protective interfaces:

- operation position: ‘For Hire ’,‘Hired ’or ‘Stopped’;
- totalizer data according to 3.7;
- general information: constant of the distance measurement transducer, date of securing, vehicle identification, real time, tariff identification;
- fare information for a journey: total charged, fare, calculation of the fare, supplement charge, date, start time, finish time, distance travelled;
- appropriate tariff(s) information: parameters of tariff(s).

4.2.3.1 Interface documentation

The manufacturer shall provide documentation on all taximeter interfaces comprising of at least:

a) A list of all commands (e.g. menu items);
b) Description of the software interface;
c) A list of all commands together;
d) A brief description of their meaning and their effect on the functions and data of the measuring instrument;
e) Other relevant information regarding the interface characteristics of the taximeter.

4.2.3.2 Securing of taximeter interfaces

Communication and user interfaces shall not allow the metrological functions of the taximeter and its legally relevant software and measurement data to be inadmissibly influenced by other interconnected instruments, or by disturbances acting on the interface.

Securing of interfaces may be by hardware or software means provided that:

a) Data is protected (for example, with a protective interface as in T.2.9) against accidental or deliberate interference during the transfer;

b) All functions in the software interface shall be subject to the requirements for securing software in 3.11;
c) All functions in the hardware interface shall be subject to the requirements for securing hardware in 3.2.5;
d) Metrologically relevant parts of the target instrument shall be included in the initial or subsequent verification;
e) It shall be easily possible to verify the authenticity and integrity of data transmitted to and/or from the taximeter and the target instrument;
f) Functions performed or initiated by other connected instruments through the interfaces shall meet the appropriate requirements of this OIML Recommendation;
g) Secured settings shall automatically prevent the operation of the taximeter in the absence or improper functioning of other instruments required by national regulation to be connected to the interfaces;
h) Other securing means specified by the manufacturer shall ensure integrity and authenticity of taximeter functions and measurement data.

Supprimé : (or equivalent conformity assessment procedures)

Supprimé : of a taximeter to inhibit automatically the operation of the taximeter for reasons of the non-presence or improper functioning of the required device

4.2.4 Taximeter test connector

To facilitate functional testing (A.4.1) taximeters interfacing to a pulse sensor shall be equipped with a test connector which can process at least the signals in Table 1.

Table 1 – Taximeter test connection signals

Input:	Output:
Distance pulses at a rate equivalent to a speed of up to 200 km/h	Distance pulses
Time pulses at a rate equivalent of up to 10 times real time;	Time pulses
Signal to block time counting.	A signal to indicate fare increments.
The electrical data of the signals must be compatible with the following:	
Signal LOW (logic 0) -12 V< U_l < 0.8 V	Signal LOW (logic 0) 0 V< U_l < 1 V (1)
Signal HIGH (logic 1) 3 V< Uh < 12 V	Signal HIGH (logic 1) 3 V< Uh < 5 V (1)
Input resistance R, > 4, 7 k ohms	Source resistance Rs < 10 k ohms. (1)
Notes:	(1) No load at test pin. (2) Signals are referred to ground on the test connector, normally the negative line of the taximeter voltage supply. (3) All signals shall be of rectangular shape with a pulse width of at least 25 µs and a rise and fall time of a maximum of 20% of the pulse width.

The test connector of the taximeter shall be easily accessible after installation in a vehicle provided that it is secured against unauthorised access in accordance with 3.2.5.

If the taximeter is connected to a network in the car (e.g. CAN bus), there shall be the possibility for an input and output for the distance information. In that case the taximeter does not work with pulses but with digital distance information.

4.2.5 Voltage drop below the lower voltage limit (2.5.2)

In case of a voltage drop below the lower voltage limit, the taximeter shall automatically:

a) Continue to function correctly or resume its correct functioning without loss of data available before the voltage drop if the voltage drop is temporary (e.g. less than 20 seconds), i.e. due to restarting the vehicle engine;
b) Abort an existing measurement and return to the 'For hire' (free) position if the voltage drop is for a longer period (e.g. greater than 20 seconds). In this case, the taximeter shall resume its correct functioning and the stored measurement data concerning the aborted journey must be correct;
c) Show a significant fault or is automatically put out of service if the voltage drop is for a lengthy period.

If disconnected from the voltage supply, a taximeter shall store the totalized values for at least one year or for a period set in accordance with national regulation.

Supprimé : 60

Supprimé : (e.g. longer than 60 seconds)

Supprimé : In all cases, the period of the voltage drop may be set in accordance with national regulation;

4.2.6 Repeatability

The application of the same taximeter under the same conditions of measurement shall result in the close agreement of successive measurements. The difference between the successive measurement results shall be less than the appropriate maximum permissible error in 2.2.

4.3 Examination and tests

The examination and testing of a taximeter and any devices having metrological influence is intended to verify compliance with the applicable requirements of this Recommendation.

4.3.1 Examination

A taximeter having metrological influence shall be examined to obtain a general appraisal of the design and construction.

Devices may be examined and tested only once while being connected to a taximeter, and may be declared as suitable for connection to any verified taximeter having an appropriate and protective interface.

A description of the operation and type of devices fitted to the taximeter shall be included in the type approval certificate.

4.3.2 Performance tests

A taximeter shall be tested as specified in Clause 6 and Annex A to determine the correct functioning of the equipment.

As far as applicable, the same tests shall be performed as for complete instruments.

Susceptibility that would result from the use of electronic interfaces to other equipment shall be determined in the tests.

4.3.3 Metrological features to be considered

All metrologically relevant features and functions (see T.3 and T.4) have to be tested at least once in a taximeter as far as applicable and as many as possible in the same taximeter. Variations in metrologically relevant features and functions like different housings,

temperature and humidity ranges, instrument functions, indications, etc. may require additional partial testing of those factors which are influenced by that feature. These additional tests should preferably be carried out on the same taximeter, but if this is not possible, tests on one or more additional taximeter may be performed under the responsibility of the testing authority.

5 METROLOGICAL CONTROLS

5.1 General

The metrological controls of taximeters shall, in agreement with national regulation, consist of:

- type approval,
- initial verification,
- subsequent verification
- in-service inspection.

Tests should be applied uniformly by the legal metrology services and should form a uniform program. Guidance for the conduct of type approval and initial verification is provided in OIML International Documents D 19, [5] and D 20, [6] respectively.

5.2 Type approval

5.2.1 Documentation

The application for type approval shall include the submission to the metrological authority of the following information and documents, as far as applicable and in accordance with national legislation:

- the technical and electronic specifications;
- the metrological characteristics of the taximeter;
- a functional description of the taximeter and its devices;
- drawings, diagrams, and general software information, description of software functions and operation manual, explaining the construction and operation;
- list of tariffs provided on the taximeter;
- any document or other evidence that the design and construction of the taximeter and devices complies with the requirements of this Recommendation.

Note: Adherence to requirements for which no test is available, such as software-based operations, may be demonstrated by a specific declaration of the manufacturer (e.g. for interfaces as per 4.2.3, and for password protected access to set-up and adjustment operations as per 3.2.5.

5.2.2 Type Evaluation

Type evaluation shall be carried out on one or more taximeters submitted in a form suitable for laboratory tests. The submitted documents shall be examined and tests carried out to verify that the taximeter complies with the:

Supprimé : The application for type approval of the taximeter having metrological influence shall include documentation comprising:¶

Supprimé : source code

Supprimé : 5.2.2 General requirements¶
¶
Type evaluation shall be carried out on one or more taximeters submitted in a form suitable for laboratory tests. The type evaluation shall consist of tests specified in 5.2.3.¶
¶

Supprimé : 3

a) Metrological requirements in Clause 2, particularly with reference to the appropriate limits of error and the operating conditions specified by the manufacturer,
b) Technical requirements in Clause 3,
c) Electronic requirements in Clause 4.

The appropriate metrological authority shall conduct the tests in a manner that prevents an unnecessary commitment of resources, and permit the results of the tests to be assessed for initial verification

Note: The appropriate metrological authority is advised to accept, with the consent of the applicant, test data obtained from other metrological authorities without repeating tests.

5.2.2.1 Type evaluation tests

Supprimé : 5.2.3

Type evaluation tests shall be done:

- under the normal rated operating conditions for which the taximeter is intended;
- functioning of the taximeter shall be determined as specified in Clause 6 and Annex A;
- influence factors shall be applied to the taximeter as specified in 2.5 and Annex A;
- either on the premises of the metrological authority to which the application has been submitted, or in any other suitable place agreed between the metrological authority concerned and the applicant.

The metrological authority may require the applicant to supply equipment and personnel to perform the tests.

5.2.2.2 Type approval certificate

The following information shall appear on the type approval certificate:

- name and address of the recipient of the certificate;
- name and address of the manufacturer, if not the recipient ;
- type and/or certificate number;
- metrological and technical characteristics;
- type approval mark;
- information on the location of marks for type approval, initial verification and securing;
- list of documents accompanying the type approval certificate; and
- specific remarks.

Supprimé : commercial designation

If applicable, the version of the metrological part of the evaluated software shall be indicated in the type approval certificate or its annexes.

5.2.2.3 Determination of accuracy requirements

Accuracy requirements shall be determined in accordance with the appropriate parts of 2.2.1 by compliance with the metrological requirements at initial verification of the taximeter.

5.3 Initial verification

5.3.1 General requirements

Initial verification tests shall be carried out in accordance with national regulations by the appropriate metrological authority to establish conformity of the taximeter to the approved type and/or the requirements of this Recommendation.

The appropriate metrological authority shall conduct the tests in a manner that prevents an unnecessary commitment of resources. In appropriate situations and to avoid duplicating tests previously performed on the taximeter for type evaluation under 5.2.2, the authority may use the results of observed tests for type evaluation.

The metrological authority may require the applicant to supply equipment and personnel to perform the tests.

5.3.2 Initial verification tests

Initial verification tests shall be carried out to verify compliance with the following requirements:

- 2.2.1, maximum permissible errors on initial verification;
- 2.7, correction of real-time clock;
- 4.2.6, repeatability.

Tests shall be done on the taximeter including all devices which form the assembly as intended for normal operational use and the verification procedure may be carried out in two stages, where the first stage shall allow for easy examination of the tariff parameters and distance measurement without the influence of the vehicle, and the second stage shall comprise all examinations of which the outcome is dependent on tests of a vehicle-installed taximeter.

5.3.3 Conformity

A declaration of conformity to the approved type and/or this Recommendation shall cover:

- compliance with the appropriate maximum permissible errors in 2.2.1;
- correct functioning of all devices, e.g. distance transducer, calculator, real-time clock;
- construction material and design, as far as they are of metrological relevance;
- if appropriate a list of the tests performed.

5.3.4 Visual inspection

Before testing, the taximeter shall be visually inspected for:

- metrological characteristics, i.e. time and distance measurement;
- prescribed inscriptions and positions for verification and control marks.

5.3.5 Marking and securing

According to national legislation, initial verification may be testified by verification marks as specified in 3.13. National legislation may also require securing of devices whose dismantling or maladjustment might alter the metrological characteristics of the taximeter without the alterations being clearly visible. The provisions of 3.2.5 and 3.13 shall be observed.

Supprimé : in accordance with 5.3.2

Supprimé : During the initial verification tests, the taximeter shall include all devices which form the assembly as intended for normal operational use¶
¶

Supprimé : <#>underthe normal operating conditions for which the taximeter is intendedin two stagesin a laboratory environment or any other suitable place agreed between the metrological authority concerned and the applicant to examine the metrological characteristics of the taximeter without the influence of the vehicle, and¶
vehicle installed unit (see T.1.3) in order to determine the influences of the vehicle on the metrological properties of the taximeter (6.). The metrological authority may require the applicant to supply equipment and personnel to perform the tests.¶

5.4 Subsequent metrological control

Subsequent metrological control may be performed by the metrological authority according to national regulation.

5.4.1 Subsequent verification

Subsequent verification shall be carried out in accordance with the same provisions as in 5.3 for initial verification with the error limits being those on initial verification. Marking and securing may take place according to 5.3.5, the date being that of the subsequent verification.

5.4.2 In-service inspection

In-service inspection shall be carried out in accordance with the same provisions as in 5.3 for initial verification with the exception that the in-service maximum permissible errors in 2.2.2 shall be applied. Marking and securing may remain unchanged, or renewed as per 5.4.1.

6 TEST METHOD

6.1 General

Taximeters shall undergo type approval in accordance with the requirements in A.1. All the relevant test information, indications and functional performance shall be recorded for the tests.

Initial verification of a taximeter, including all devices which form the assembly as intended for normal operational use, shall include checks for conformity with the approved type and verification of the metrological and technical requirements in accordance with A.2. In appropriate situations and to avoid duplicating tests previously performed on the taximeter under type approval, the results of the observed type approval tests may be used.

6.2 Functional tests according to the featured calculation method (A.4)

The following tests shall be conducted to verify that taximeters can maintain the performance required during performance testing in A.5.4:

a) Function test in 6.2.1;
b) Function control test in 6.2.2;
c) Visual examination in 6.3; and
d) Test report format in 6.4.

These functional tests are performed according to the calculation method featured in the taximeter (i.e. normal calculation method S or method D), and conducted in accordance with the test program in Table 2.

6.2.1 Function test (A.4.3)

An initial check of the taximeter function at the beginning of the test program (Table 2) is performed at reference environmental conditions with the function test described in A.4.3 for the following criteria:

a) Test of initial distance and initial time;
b) Lowest, middle and highest values of:
   - the specified pulse frequency range (from 5 km / h up to a maximum speed of at least 200 km / h as specified by the manufacturer);
   - Pulse voltage levels;
   - two or more k values shall be tested (each with a minimum of 500 pulses per kilometre and a maximum specified by the manufacturer);
c) Voltage supply variations;
d) Time and date of the test (e.g. at the beginning and end of tests);
e) Criteria and selection of automatic changes, if applicable (see 3.8);
f) Checklist for taximeter operation and tasks (see Annex C).

6.2.2 Function control test during and after influences or disturbances (A.4.4)

The distance and time accuracy of the taximeter is checked for a suitable tariff during and/or after influence or disturbance conditions. The function control test is performed according to the calculation method featured in the taximeter and as described in A.4.4.

6.3 Visual examination (A.4.2)

The taximeter shall be carefully checked for any visible deterioration after each test. Details of observations shall be noted and recorded.

6.4 Test report format

The results of the tests shall be recorded in the test report format given in Annex C.

6.5 Program of functional tests

Table 2 –Test program

Test category	Test	Test reference	Notes
1	Visual examination and function test.	A.4.2 and A.4.3	Initial check at beginning of test program.
2	Dry heat and cold function control tests.	A.5.4.1, A.4.2 and A.4.4	Function control during dry heat and cold test. Checking of the EUT and test results.
3	Damp heat cyclic test (condensing).	A.5.4.2	Function control after damp heat cyclic test. Checking of the EUT and test results.
	Function control test and visual examination.	A.4.2 and A.4.4	
4	Voltage supply variations function control test.	A.5.4.3, A.4.2 and A.4.4	Function control during and after voltage supply variations test. Checking of the EUT and test results
	Function control test and visual examination.		
5	Random or sinusoidal vibration function control test.	A.5.4.4.1 or A.5.4.4.2, A.4.2 and A.4.4	

	Function control test and visual examination test	A.4.2 and A.4.4	
6	a) Radiated electromagnetic fields test.	A.5.4.5.1	Function control test after test 6 c) only. Checking of the EUT and test results.
	b) Conducted electromagnetic fields test.	A.5.4.5.2	
	c) Electrostatic discharges test.	A.5.4.6	
	Function control test and visual examination test.	A.4.2 and A.4.4	
7	a) Electrical transient conduction along supply lines	A.5.4.7.1	Function control test after test 7 b) only. Checking of the EUT and test results.
	b) Electrical transient conduction via lines other lines than supply lines	A.5.4.7.2	
	Function control test and visual examination test	A.4.2 and A.4.4	

ANNEX A (MANDATORY)

TEST PROCEDURES FOR TAXIMETERS

A.1 EXAMINATION FOR TYPE APPROVAL (5.2)

The following shall normally be applied for type evaluation:

a) Review the documentation that is submitted to determine if it is adequate and correct. Consider the operational manual. For type approval the documentation shall be as specified in 5.2.1;
b) Compare construction with documentation and examine the various devices of the taximeter to ensure compliance with the documentation as specified in 5.2.1;
c) Note the metrological characteristics using the checklist given in the test report format in Annex C.
d) Examine the taximeter for conformity with the technical requirements in Clause 3, in accordance with 5.2.2 and using the checklist given in the test report format in Annex C.
e) Examine the taximeter for conformity with the requirements for electronic instruments in 4.1, 4.2 and 4.3, in accordance with 5.2.2 and using the checklist given in the test report format in Annex C.

A.2 EXAMINATION FOR INITIAL VERIFICATION (5.3)

a) Examine the taximeter for conformity with the approved type and/or the requirements of this Recommendation in accordance with 5.3.
b) Check the descriptive markings in accordance with 3.12 using the checklist given in the test report format in Annex C.
c) Check the arrangement for verification marks and securing in accordance with 5.3.5 using the checklist given in the test report format in Annex C.

A.3 GENERAL TEST REQUIREMENTS

A.3.1 Power supply (2.5.2)

Power-up the EUT and maintain the EUT energised for the duration of each test, unless otherwise specified in the test.

A.3.2 Temperature (2.5.1)

The tests shall be performed at a steady ambient temperature unless otherwise specified.

There shall be no condensation of water on the EUT unless otherwise specified for each test.

A.3.3 Recovery

After each test the EUT shall be allowed to recover sufficiently before the next test.

Supprimé : 6.6 Initial verification tests () Initial verification of a taximeter, including all devices which form the assembly as intended for normal operational use, shall be conducted as follows:¶
¶
<#>Check for conformity with the approved type and verification of time counting, distance counting adjustment of k and programmed tariff. In appropriate situations and to avoid duplicating tests previously performed on the taximeter under , the authority may use the results of observed tests.¶
¶
Verification of the requirements for descriptive markings (3.12), securing methods (3.2.5) and software (3.11).

Supprimé : ¶
A.4 TEST PROGRAM¶
¶
A.4.1 Type approval (5.2)¶
¶
Examination for type approval in A.1 and the performance tests in A.6 shall normally be applied for type evaluation.¶
¶
A.4.2 Initial verification (5.3)¶
¶
Examination for initial verification in A.2 shall normally be applied for initial verification.¶

A.4 FUNCTIONAL TESTS (6.2)

Supprimé : AND VISUAL EXAMINATION

A.4.1 General

A calibrated pulse counter and a calibrated timer with the test connector of the taximeter shall be used for the functional tests.

A.4.2 Visual examination (6.3)

The taximeter shall be inspected visually and before and after each functional test in the test program in Table 2.

A.4.3 Function test (6.2.1)

Initial check at reference conditions of the taximeter at the beginning of the test program test (Table 2) shall be performed once by conducting the function control tests in A.4.4.1 and/or A.4.4.2 in accordance with 6.2.1 and Table 3.

Table 3 - Summary of function test

Test conditions	Criteria		Error allowance
Voltage supply variations (at 9 V and 16 V DC) and reference conditions	Featured calculation method S or D		maximum permissible error (see 2.2.1)
	Time and distance measurement (Tests A.4.4.1 and/or A.4.4.2)		
Voltage supply (12 V DC) and reference conditions	Featured calculation method S or D		
	Lowest, medium and highest values of:	pulse frequency levels	
		pulse voltage levels	
		specified k values	
	Programming modes and/or tariffs including automatic changes		see 3.8
	Checklist for operation and tasks		see Annex C

A.4.4 Function control test (6.2.2)

The distance and time accuracy shall be checked during and/or after the application of the influence factors or disturbances in accordance with details given in 6.2.2 and Table 4.

Table 4 - Summary of function control test

Test conditions	Criteria	Error allowance
Voltage supply (12 V DC) and as specified for each influence or disturbance test	Featured calculation method S or D	maximum permissible error (see 2.2.1)
	Time and distance measurement (A.4.4.1 and/or A.4.4.2) during influences or disturbances test program in Table 2.	
Voltage supply (12 V DC) and reference environment conditions	Featured calculation method S or D	
	Time and distance measurement (A.4.4.1 and/or A.4.4.2) after influences or disturbances test program in Table 2.	

A.4.4.1 Normal calculation method S (single application of tariff)

A.4.4.1.1 Distance measurement

The use of the test connection input “signal to block time counting” (4.2.4) is recommended so that the time and distance can be examined separately without time counting influencing the result.

Test of the initial distance is conducted as follows:

The taximeter in ‘For hire’ (free) position responds to a set of distance pulses and receives data representing a programmed tariff from a source code. The pulse counter measures the number of pulses generated between switching the taximeter to the ‘Hired’ (occupied) position and one fare increment step. The difference between this number of pulses (actual) and the number expected (reference) according to the programmed tariff is checked for compliance with the applicable initial verification maximum permissible error limits in 2.2.1 taking into consideration the distance represented by each pulse.

Test of distance counting accuracy is conducted as follows:

This test can be done at a simulated speed of up to 200 km/h. When using this speed, it should be at least 10 fare increments. With the taximeter in ‘Hired’ (occupied) position, the two test possibilities are given below:

a) The taximeter responds to a set of distance pulses and receives data representing a programmed tariff from a source code, and the pulse counter measures the time for switching the taximeter of a specified number of fare increments. This time (actual) is then compared to the time expected (reference) according to the programmed tariff, and the taximeter constant ‘k’.

b) The taximeter responds to a predetermined number of distance pulses calculated for a number of fare increments and receives data representing a programmed tariff in order to display the corresponding number of fare increments. This number of fare increment pulses is then compared to the number of expected fare increment steps according to the programmed tariff and the taximeter constant ‘k’.

A.4.4.2.1 Time measurement

Test of the initial time is conducted as follows:

With the taximeter in ‘For hire’ (free) position and no pulses present at the pulse input of the taximeter, the timer is used to measure the time elapsed between switching the taximeter to ‘Hired’ (occupied) position and one fare increment step. The difference between this measured time (actual) and time expected (reference) according to the programmed tariff is checked for compliance with the applicable initial verification maximum permissible error limits in 2.2.1.

Test of time counting accuracy is conducted as follows:

The taximeter in ‘Hired (occupied) position responds to a set of time pulses at 10 times higher frequency (see 4.2.4) and receives data representing a programmed tariff from a source code. The pulse counter measures the time pulses for a number of fare increments. The measured time is compared to the time expected according to the programmed tariff,

and checked for compliance with the applicable initial verification maximum permissible errors in 2.2.1.

Supprimé : Note: The pulse frequency is determined by the speed of the vehicle simulated at up to 200 km/h and the number of pulses per distance of the particular transducer being simulated. When using this speed, it should be at least 10 fare increment steps.¶

A.4.4.3 Normal calculation method D (double application of tariff)

The taximeter set in 'For hire' (free) position responds to a first set of pulses representing time and a second set of pulses representing distance and receives data representing a programmed tariff from a source code. The pulse counter measures the first set of distance pulses generated between switching the taximeter to 'Hired' (occupied) position and one fare increment step, and at the same time the timer is used to measure the time elapsed between switching the taximeter to 'Hired' (occupied) position and one fare increment step.

The difference between the number of pulses (actual) counted and the number expected (reference) according to the programmed tariff, and the difference between the time measured (actual) and the time expected (reference) according to the programmed tariff are checked for compliance with the applicable initial verification maximum permissible error limits in 2.2.1, taking into consideration the distance represented by each pulse.

A.5 PERFORMANCE TESTS

A.5.1 General test conditions

Metrological performance tests are intended to verify that taximeters can function as intended in the climatic, mechanical and electromagnetic environments and under the conditions specified. Each test indicates, where appropriate, the reference condition under which the intrinsic error is determined.

Where possible, tests shall be carried out on a taximeter in its normal operational state under laboratory conditions. The permissible effects of the influence factors or disturbances, under these laboratory conditions, are specified for each test in Annex A.

When the effect of one influence factor is being evaluated, all other factors are to be held relatively constant, at a value close to normal. After each test, the taximeter shall be subjected to the recovery condition as specified in A.3.3. The operational status of the taximeter shall be recorded for each test.

When a taximeter is connected in other than a normal configuration, the procedure shall be mutually agreed on by the metrological authority and the applicant.

The rated operating voltage shall be 12 V DC unless otherwise specified.

A.5.2 Interfaces (4.2.3)

Susceptibility that would result from the use of interfaces to other equipment shall be determined in the tests.

A.5.3 Documentation

Simulators shall be defined in terms of hardware and functionality by reference to the EUT, and by any other documentation necessary to ensure reproducible test conditions. This information shall be attached to, or traceable from, the test report.

A.5.4 Influence factor and disturbance tests (2.5, 4.1.1)

Table 5- Summary of tests

Test	Characteristic under test	Criterion	§
Static temperatures	influence	MPE	A.5.4.1
Damp heat (condensing)	disturbance	sf	A.5.4.2
Voltage supply variations	influence	MPE	A.5.4.3
Vibration (random or sinusoidal)	influence	MPE	A.5.4.4
Immunity to electromagnetic fields	disturbance	MPE	A.5.4.5
Electrostatic discharge	disturbance	MPE	A.5.4.6
Electrical transient conduction on supply lines or via lines other than supply lines	disturbance	MPE	A.5.4.7
Note: MPE - maximum permissible error (2.2.1) sf - significant fault (T.4.5.6)			

A.5.4.1 Static temperatures (2.5.1)

Static temperature tests are carried out according to basic standard IEC 60068-2-1 [7], IEC 60068-2-2 [8], IEC 60068-3-1 [9], and according to Table 6.

Table 6 - Dry heat (non-condensing) and cold

Environmental phenomena	Test specification	Test set-up
Temperature	Reference high temperature (2.5.1) for 16 hours	IEC 60068-2-2 IEC 60068-2-1 ~~IEC 60068-3-1~~
	Manufacturer specified high temperature	
	Manufacturer specified low temperature	
	Reference low temperature (2.5.1) for 16 hours	
Note: Use IEC 60068-3-1 for background information.		

Supprimé : of 20 °C

Supprimé : for 2 hours

Supprimé : for 2 hours

Supplementary information to the IEC test procedures:

Object of the test: To verify compliance with the provisions in 4.1.1 under conditions of dry heat (non-condensing) and cold tests conducted separately.

Test procedure in brief:

Pre-condition: None.

Condition of the EUT: Voltage supply (12 V DC) "on" for the duration of the high temperature test, and "off" for the low reference temperature test, with the exception that voltage supply shall be switched on during test of manufacturer specified low temperature. With sufficient temperature stabilisation after each test.

Test sequence: The test consists of exposure of the EUT to each climatic reference (upper and lower) temperature for 16 hours. At the end of the test the temperature is set to the upper and lower limits specified by the manufacturer. Function control shall then be conducted after sufficient temperature stabilisation has occurred. Test is conducted accordance with Table 6:

a) at the reference high temperature;
b) at the manufacturer specified high temperature;
c) at the manufacturer specified low temperature; and
d) at the reference low temperature.

Number of test cycles: At least one cycle.

Test information: After sufficient temperature stabilisation conduct the function control test (A.5.2) and record:

a) date and time;
b) temperature;
c) relative humidity;
d) supply voltage;
e) pulse voltage levels
f) frequency levels
g) errors;
h) functional performance
i) indications (as applicable);

The change of temperature shall not exceed 1 ^{0}C/min during heating and cooling down.

Note: Function control test (A.5.4) at reference environmental conditions is conducted after completion of the static temperatures test. Check the registered information.

Maximum allowable variations: All functions shall operate as designed.
All errors shall be within the maximum permissible errors specified in 2.2.1 for initial verification.

A.5.4.2 Damp heat cyclic (condensing) test (4.1.2)

Damp heat, cyclic tests are carried out according to basic standard IEC 60068-3-4 [10], IEC 60068-2-30 [11], and according to Table 7.

Table 7 - Damp heat, cyclic test

Environmental phenomena	Test specification	Test set-up
Damp heat, cyclic	Temperature variations for 24 hour cycle.	IEC 60068-2-30 IEC 60068-3-4
	Low temperature variation between +20 °C and the specified upper limit (+ 40 °C or + 55 °C), and relative humidity above 95 %.	
	High temperature variation at the specified upper limit (+ 40 °C or + 55 °C), and 93 % relative humidity.	

Supplementary information to the IEC test procedures:

Object of the test: To verify compliance with the provisions in 4.1.2 after conditions of high humidity and cyclic temperature changes.

Test procedure in brief:

Pre-condition: None required.

Condition of the EUT:	Voltage supply "off" for the duration of the test. The handling of the EUT shall be such that condensation should occur on the EUT during the temperature rise. All parts of the EUT are within 3 °C of their final temperature.
Test sequence	24 hour cycle sequence (see Table 7): a) Temperature rise during the first 3 hours; b) Temperature maintained at upper limit until 12 hours from start of the cycle; c) Temperature lowered to reference limit within 3-6 hours; d) Temperature maintained at the reference limit until the 24-hour cycle is completed.
Number of test cycles:	At least two cycles.
Test information:	After sufficient temperature stabilisation, conduct the test and record: a) date and time; b) temperature; c) relative humidity; d) supply voltage; e) pulse voltage levels f) frequency levels; g) errors; h) functional performance; i) indications (as applicable);
Maximum allowable variations:	After the disturbance, no significant fault shall occur.
Note:	Function control test at reference environmental conditions is conducted after completion of the damp heat cyclic test (A.4.3) check the registered information.

A.5.4.3 Voltage supply variations (2.5.2)

A.5.4.3.1 Voltage supply range variations test

Voltage variations test are carried out according to ISO 16750-2 [12], and Table 8.

Table 8 – Voltage variations

Environmental phenomena	Test specification			Test set-up
	U_{nom}	Upper limit	Lower limit	
Voltage variations	12 V	16 V	9 V	ISO 16750-2
Note: The nominal voltage (U_{nom}) of the electrical system in road vehicles is usually 12 V DC. But the practical voltage at the battery-terminal points can vary considerably.				

Supplementary information to the ISO test procedures:

Object of the test:	To verify compliance with the provisions in 4.1.1 of voltage supply variations.

Test procedure in brief:

Preconditioning: None

Condition of the EUT: Voltage supply "on" for the duration of the test.

Test sequence: The test consists of exposure to the specified battery condition for a period sufficient for achieving temperature stability and for performing the required measurements.

Number of test cycles: At least one cycle.

Test information: After stabilization of the EUT at the nominal voltage conduct the function control test (A.4.2) at the upper and lower limits and record:

a) date and time;
b) temperature;
c) relative humidity;
d) supply voltage;
e) pulse voltage levels
f) frequency levels
g) errors;
h) functional performance
i) indications (as applicable);

Maximum allowable variations: All functions shall operate as designed.
All errors shall be within the maximum permissible errors specified in 2.2.1 for initial verification.

Note: Function control test (A.4.4) at reference environmental conditions is conducted after completion of the voltage variations test. Check the registered information.

A.5.4.3.2 Voltage reductions below the lower voltage supply limit (4.2.5)

There is no reference to standards for this test. Refer to Table 9 for the test conditions.

Table 9 - Voltage supply reductions

Environmental phenomena	Test specification			Test set-up
Slow reductions below lower supply limit	% of lower value of voltage reduction (V_L)	Width of reduction (seconds)	Requirement	No reference to standards at present
	90, 40, 0	7, 14	Taximeter should show the previously indicated fare	
		15, 17.5 20	Taximeter should show the previously indicated fare or switch to ‘For hire’ (free) position	
		21, 30	Taximeter should switch to ‘For hire’ position	
Note.	For specifications of the voltage supply used during the test to simulate the battery, refer to ISO 7637-2 [20], clause 4.4 [8].			

Supplementary information:

Supprimé : to the IEC test procedures

Object of the test:	To verify compliance with the provisions in 4.1.1 under conditions of voltage variations below the lower limit of operating voltage supply.
Test procedure in brief:	
Pre-condition:	None
Condition of the EUT:	Before any test stabilise the EUT under constant environmental conditions.
Test sequence:	The test consists of exposure of the voltage supply to the specified conditions in Table 9 and to observe the behaviour of the taximeter. Manually apply slow voltage reductions below the lower voltage limit for the following varying amounts of time listed in Table 9. Additionally, reverse (incorrect) polarity shall be applied for 30 seconds. This shall cause no detectable change in registered information. If a standard voltage supply (with sufficient current capacity) is used in bench testing to simulate the battery, the low internal impedance of the battery shall also be simulated. The continuous supply source shall have an internal resistance R_i less than 0.01 ohms DC and an internal impedance $Z_i = R_i$ for frequencies less than 400 Hz.
Test information:	The function control test in A.4.3 shall run during the application of the dips. Record: a) date and time; b) temperature; c) relative humidity; d) supply voltage; e) indications (as applicable); f) errors; g) functional performance
Maximum allowable variations:	All functions shall operate as designed. All errors shall be within the maximum permissible errors specified in 2.2.1 for initial verification.

Supprimé : A.5

Notes:

1) For battery systems higher than 12 V, the relevant specifications should be applied.
2) Function control test (A.4.4) at reference environmental conditions is conducted after completion of the voltage drop test. Check the registered information.

A.5.4.4 Vibration (random or sinusoidal)

Two different vibration tests (random or sinusoidal) are described below. In general, the random vibration test is recommended. The sinusoidal vibration test may be applied if

specified by the manufacturer. Guidance for the selection amongst both the tests can be found in IEC 60068-3-8 [13].

A.5.4.4.1 Vibration (random)

Vibration (random) tests are carried out according to basic standard IEC 60068-2-64 [14], IEC 60068-2-47 [15], IEC 60068-3-8 [13], and according to Table 9.

Table 9 - Vibration (random) test

Environmental phenomena	Test specification		Test set-up
Random vibrations	Frequency range:	10 to 150 Hz	IEC 60068-2-64 IEC 60068-2-47 IEC 60068-3-8
	Total RMS level:	7 ms^{-2}	
	ASD level 10 - 20 Hz:	1 m^2s^{-3}	
	ASD level 20 - 150 Hz:	-3 dB/octave	
	Number of axes:	3	
	Duration per axis:	At least 30 minutes in each functional mode.	

Supplementary information to the IEC test procedures:

Object of the test: To verify that the taximeter complies with the provisions in 4.1.1 under conditions of random vibrations.

Test procedure in brief:

Pre-condition: None required.

Condition of the EUT: Voltage supply "on" for the duration of the test.

Mount the EUT on a rigid fixture by its normal mounting means, such that the gravitational force acts in the same direction as it would in normal use. Where the effect of gravitational force is not important, the EUT may be mounted in any position.

Test sequence: In accordance with the specifications in Table 9, apply random vibrations, over the specified frequency range, to the EUT, in three mutually perpendicular axes (2 horizontal and 1 vertical) in turn, for 30 minutes per axis in each functional mode.

Number of test cycles: At least one cycle.

Test information: Conduct the function control test (A.4.3) and record:

a) date and time;
b) temperature;
c) frequency range;
d) total RMS
e) ASD levels;
f) number of axes and duration per axis
g) pulse levels
h) frequency levels;
i) errors;
j) functional performance

k) indications (as applicable);

Maximum allowable variations: All functions shall operate as designed.
All errors shall be within the maximum permissible errors specified in 2.2.1 for initial verification.

Note: Function control test (A.4.3) at reference environmental conditions is conducted after completion of the vibration test. Check the registered information.

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A.5.4.4.2 Vibration (sinusoidal)

Vibration (sinusoidal) tests are carried out according to basic standard IEC 60068-2-6 [16], IEC 60068-2-47 [15], IEC 60068-3-8 [13], and according to Table 10.

Table 10 - Vibration (sinusoidal) test

Environmental phenomena	Test specification		Test set-up
Sinusoidal vibrations	Frequency range:	10 to 150 Hz	IEC 60068-2-6 IEC 60068-2-47 IEC 60068-3-8
	Max acceleration level:	10 ms^{-2}	
	Number of axes:	3	
	Number of sweeps per axis	20	

Supplementary information to the IEC test procedures:

Object of the test: To verify that the taximeter complies with the provisions in 4.1.1 under conditions of sinusoidal vibrations.

Test procedure in brief:

Pre-condition: None required.

Condition of the EUT: Normal voltage "on" for the duration of the test.

Mount the EUT on a rigid fixture by its normal mounting means, such that the gravitational force acts in the same direction as it would in normal use. Where the effect of gravitational force is not important, the EUT may be mounted in any position.

Test sequence: In accordance with the specifications in Table 10, apply sinusoidal vibrations, over the specified frequency range, at 1 octave/min, at the specified acceleration level with a specified number of sweep per axis, in three mutually perpendicular main axes (2 horizontal and 1 vertical) of the rigidly mounted EUT

Number of test cycles: At least one cycle.

Test information: Conduct the function control test (A.4.3) and record:

a) date and time;
b) temperature;
c) frequency range;
d) acceleration level
e) sweep per axis;

f) number of axes and duration per axis;
g) pulse levels;
h) frequency levels;
i) errors;
j) functional performance;
k) indications (as applicable).

Maximum allowable variations:

All functions shall operate as designed.
All errors shall be within the maximum permissible errors specified in 2.2.1 for initial verification.

Note:

Function control test (A.4.3) at reference environmental conditions is conducted after completion of the vibration test. Check the registered information.

A.5.4.5 Immunity to electromagnetic fields

Supprimé : A.6

Supprimé : A.6

A.5.4.5.1 Immunity to radiated electromagnetic fields

Radiated, radio frequency, electromagnetic field immunity tests are carried out in accordance to IEC 61000-4-3 [17], and according to Table 11.

The unmodulated carrier of the test signal is adjusted to the indicated test value. To perform the test the carrier is in addition modulated as specified.

Table 11 - Radiated electromagnetic field

Test specification			
Environmental phenomena	Frequency ranges MHz	Field strength (V/m)	Test set-up
Radiated electromagnetic field	80 to 2000(1)	10	IEC 61000-4-3
	26 to 80(2)		
	1400 to 2000		
Modulation	80 % AM, 1 kHz sine wave		
Notes:	1) IEC 61000-4-3 only specifies test levels above 80 MHz. For frequencies in the lower range the test methods for conducted radio frequency disturbances are recommended (A.5.4.2.2). 2) For EUT having no mains or other I/O ports available so that the test according to A.5.4.2.2 cannot be applied, the lower limit of the radiation test is 26 MHz.		

Supprimé : 24

Supplementary information to the IEC test procedures:

Object of the test: To verify compliance with the provisions in 4.1.3 under conditions of specified electromagnetic fields applied to the taximeter.

Test procedure in brief:

Pre-condition: None required.

Condition of the EUT: Before any test stabilise the EUT under constant environmental conditions. The electromagnetic field can be generated in different facilities, the use of which is limited by the dimensions of the EUT

and the frequency range of the facility.

Test sequence: The EUT shall be exposed to electromagnetic field strength as specified in Table 11.

When using an electronic pulse generator to simulate the pulses produced by a typical distance measurement transducer, care should also be taken not to let the pulse generator be affected by the electromagnetic waves by using a suitable method of electromagnetic isolation. Alternatively a mechanically driven pulse generator may be used.

Test information: Record:

a) date and time;
b) temperature;
c) test set-up information;
d) supply voltage;
e) indications (as applicable);
f) errors;
g) functional performance

Maximum allowable variations: All errors shall be within the maximum permissible errors specified in 2.2.1 for initial verification.

A.5.4.5.2 Immunity to conducted radio-frequency, electromagnetic fields

Conducted electromagnetic field immunity tests (radio-frequency electromagnetic fields lower than 80 MHz) are carried out in accordance to IEC 61000-4-6 [18], and according to Table 12.

Table 12 - Immunity to conducted radio-frequency, electromagnetic

Test specification			
Environmental phenomena	Frequency range MHz	RF amplitude (50 ohms) V (e.m.f)	Test set-up
Conducted electromagnetic field	0.15 to 80	10 V	IEC 61000-4-6
Modulation	80 % AM, 1 kHz sine wave		
Note:	This test shall only be performed when the cable lengths connected to the taximeter exceeds 3 metres.		

Supplementary information to the IEC test procedures:

Object of the test: To verify compliance with the provisions in 4.1.3 under conditions of specified conducted electromagnetic fields.

Test procedure in brief:

Pre-condition: The performance of the test equipment, consisting of an RF generator, RF amplifiers, (de-)coupling devices, attenuators, etc., shall be verified before testing commences.

Condition of the EUT: Before any test, stabilise the EUT under constant environmental

conditions.

Test sequence: The EUT shall be exposed to electromagnetic field strength as specified in Table 12.

Radio frequency electromagnetic current, simulating the influence of electromagnetic fields on conductors, shall be coupled or injected into EUT ports for voltage, inputs, and outputs using coupling/decoupling devices as defined in the referred standard.

Test information: Record:

a) date and time;
b) temperature;
c) test set-up information;
d) supply voltage;
e) indications (as applicable);
f) errors;
g) functional performance

Maximum allowable variations: All errors shall be within the maximum permissible errors specified in 2.2.1 for initial verification.

A.5.4.6 Electrostatic discharge tests

Electrostatic discharge tests are carried out in accordance to IEC 61000-4-2 [19], and according to Table 13.

Table 13 - Electrostatic discharge tests

Environmental phenomena	Test specification		Test set-up
Electrostatic discharge	Test voltage	Levels	IEC 61000-4-2
	contact discharge	6 kV(1) (2)	
	air discharge	8 kV(1)	
Notes: 1) Tests shall also be performed at the specified lower voltage levels in the IEC 61000-4-2 standard up to and including the levels given in Table 13. 2) 6 kV is the recommended maximum contact discharge level and shall be applied to conductive accessible parts. Metallic contacts, e.g. in battery compartments or in socket outlets are excluded from this requirement. However, in accordance with national regulation a lower maximum contact discharge level of 4 kV may be applied.			

Supplementary information to the IEC test procedures:

Object of the test: To verify compliance with the provisions in 4.1.3 under conditions where direct and indirect electrostatic discharges are applied.

Test procedure in brief:

Pre-condition: Before starting the tests, the performance of the electrostatic discharge generator as defined in IEC 61000-4-2 shall be verified.

Condition of the EUT:	Before any test stabilise the EUT under constant environmental conditions.
Test sequence:	The EUT shall be exposed to electrostatic discharge tests as specified in Table 13. The taximeter and any relevant devices shall be operational during this test. At least 10 discharges shall be applied. The time interval between successive discharges shall be at least 10 seconds. For EUT not equipped with a ground terminal, the EUT shall be fully discharged between discharges. Contact discharge is the preferred test method. air discharges shall be used were contact discharge cannot be applied. Direct application: In the contact discharge mode to be carried out on conductive surfaces, the electrode shall be in contact with the EUT. In the air discharge mode on insulated surfaces, the electrode is approached to the EUT and the discharge occurs by spark. Indirect application: The discharges are applied in the contact mode to coupling planes mounted near the EUT.
Test information:	Record: a) date and time; b) temperature; c) test set-up information; d) supply voltage; e) indications (as applicable); f) errors; g) functional performance
Maximum allowable variations:	All errors shall be within the maximum permissible errors specified in 2.2.1 for initial verification.
Note:	Function control test (A.4.3) at reference environmental conditions is conducted after completion of the electrostatic discharge test. Check the registered information.

A.5.4.7 Electrical transient conduction

A.5.4.7.1 Conduction along supply lines of external 12 V road vehicle battery.

For this test refer to ISO 7637-2 [20], and according to Table 14.

Table 14 - Electrical transient conduction on supply lines

Environmental phenomena	Test specification		Test set-up
Electrical transient conduction on supply lines	Test pulse	Pulse voltage U_s U_{nom} = 12 V	ISO 7637-2
	1	-100 V	
	2a	+50 V	

	2b	+10 V
	3a	-150 V
	3b	+100 V
	4	-7 V

Notes:
1) Test pulse 2b is only applicable if the instrument is connected to the battery via the main (ignition) switch of the car, i.e. if the manufacturer has not specified that the instrument is to be connected directly (or by its own main switch) to the battery.
2) No reference has been made to test pulses 5a and 5b

Supplementary information to the ISO test procedures

Applicable standards	ISO 7637-2	§ 5.6.1: Test pulse 1 § 5.6.2: Test pulse 2a + b, § 5.6.3: Test pulse 3a + 3b, § 5.6.4: Test pulse 4

Object of the test: To verify compliance with the provisions in 4.1.3 under the following conditions:

- transients on the supply lines due to supply disconnection from inductive loads (pulse 1);
- transients due to a sudden interruption of currents in a device connected in parallel with the device under test due to the inductance of the wiring harness (pulse 2a);
- transients from DC motors acting as generators after the ignition is switched off (pulse 2b);
- transients on the supply lines, which occur as a result of the switching processes (pulses 3a and 3b);
- voltage reductions caused by energizing the starter-motor circuits of internal combustion engines (pulse 4).

Test Procedures in brief:

Preconditioning: None

Condition of the EUT: Before any test, stabilize the EUT under constant environmental conditions.

Test sequence: The test consists of exposure to conducted disturbances on the voltage supply by direct brief coupling onto supply lines of the strength and character as specified in Table 14 while the taximeter is switched on.

Test information: Record:

a) date and time;
b) temperature;
c) test set-up information;
d) supply voltage;
e) indications (as applicable);
f) errors;
g) functional performance.

Maximum allowable variations: No significant error during the disturbance, except for test 2b. For test 2b, no significant error after the disturbance.

A.5.4.7.2 Electrical transient conduction via lines other than supply lines of 12 V road vehicle battery.

Electrical conduction by capacitive and inductive coupling on signal lines are carried out in accordance to ISO 7637-3 [21], and according to Table 15.

Table 15 – Electrical transient conduction via lines other than supply lines

Environmental phenomena	Test specification		Test set-up
Electrical transient conduction via lines other than supply lines	Test pulse	Pulse voltage U_s U_{nom} = 12 V	ISO 7637-3
	a	-60 V	
	b	+40 V	

Supplementary information to the ISO test procedures

Object of the test: To verify compliance with the provisions in 4.1.3 under conditions of transients which occur via lines other than supply lines because of the switching processes (pulses a, and b).

Test procedure in brief:

Preconditioning: None

Condition of the EUT: Before any test stabilise the EUT under constant environmental conditions

Test sequence: The test consists of exposure of the EUT to conducted disturbances (bursts of voltage spikes by capacitive and inductive coupling on signal lines) of the strength and character as specified in Table 15 while the taximeter is switched on.

Test information: Apply the test pulses and record the following:

a) date and time;
b) temperature;
c) test set-up information;
d) supply voltage;
e) indications (as applicable);
f) errors;
g) functional performance

Repeat the test for the defined pulses and record the indications.

Maximum allowable variations: No significant error during the disturbance.

Note: Function control test (A.4.3) at reference environmental conditions is conducted after completion of the electrostatic discharge test. Check the registered information.

ANNEX B (INFORMATIVE)

GENERAL INFORMATION ON THE CONDITIONS FOR THE COMPATIBILITY BETWEEN A TAXIMETER AND A DISTANCE MEASUREMENT TRANSDUCER

B Compatibility for use with distance measurement generator

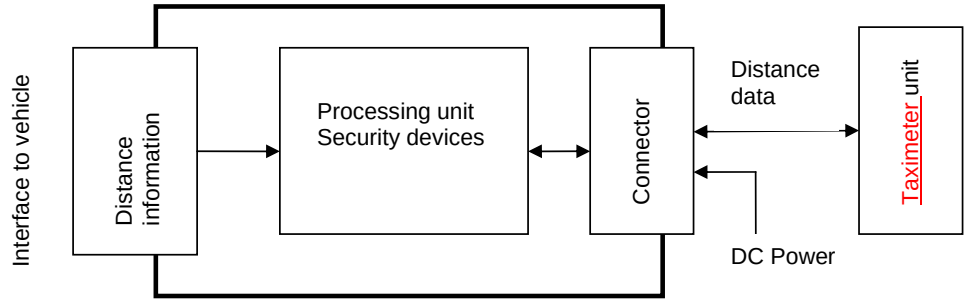
The conditions for the compatibility between the taximeter and the distance measurement generator shall be specified by the manufacturer of the taximeter and checked in accordance with the appropriate parts of R 21.

B.1 Description and purpose

The distance measurement transducer is installed in the taxi and its purpose is to provide a taximeter unit (T.1.3) with secured distance information representative of the distance travelled by the taxi. The transducer is interfaced to a moving part of the taxi and it may be located in any part of the taxi. In its operational mode, the distance measurement transducer is connected to a taximeter to form the taximeter unit.

The typical distance measurement transducer is described in Figure A.

Figure A - Typical distance measurement transducer



B.2 Suitability and security of operation

The design of the distance measurement transducer shall suit the method of operation and vehicle for which it is intended. The distance measurement transducer shall be capable of providing the following functions::

- give a stable signal at every speed travelled.
- have defined characteristics regarding voltage level, pulse width and the relation of speed and frequency.
- be able to establish and authenticate, for any interaction, the identity of any device that it is connected to, at connection and at power supply recovery.
- ensure that motion information may only be processed and derived from the transducer mechanical interface.

- exchange distance information with associated security attributes to ensure integrity and authenticity of measurement data.

The distance measuring transducer may incorporate capabilities for the secure processing, transmission and storage of information pertaining to the transducer identification and connected device identity.

Supprimé : function as intelligent distance measuring transducers (T.2.10) with

B.3 Metrological characteristics of the transducer

The documentation provided by the manufacturer of the distance measurement transducer shall include the following:

- name and address of the manufacturer;
- the technical specifications;
- the metrological characteristics of the transducer;
- a functional description of the transducer;
- a description of securing (e.g. if w can be influenced)
- software information (if applicable);
- drawings, diagrams, and general information, explaining the construction and operation;
- any document or other evidence that the design and construction of the transducer conforms to appropriate international standards.

Annex C Test Report Format

(Mandatory for application within the *OIML Certificate System for Measuring Instruments)*

EXPLANATORY NOTES ON THE TEST REPORT FORMAT

This "test report format" aims at presenting, in a standardized format, the results of the various tests and examinations to which a type of a taximeter shall be submitted with a view to its approval.

The *Test report forma*t consists of two parts, a "checklist" and the "test report" itself.

The checklist is a summary of the examinations carried out on the instrument. It includes the conclusions of the results of the test performed, experimental or visual checks based on the requirements of R 21.

The test report is a record of the results of the tests carried out on the instrument. The "test report" forms have been produced based on the tests detailed in Annex A of this International Recommendation.

It is recommended that all metrology services or laboratories evaluating types of taximeter accordingly to R 21 or to national or regional regulations based on this OIML Recommendation use this *Test report forma*t, directly or after translation into a language other than English or French.

It is also recommended that this *Test report forma*t in English or in French (or in both languages) be transmitted by the country performing these tests to the relevant authorities of another country, under bi- or multilateral cooperation agreements.

In the framework of the *OIML Certificate System for measuring instruments*, use of this *Test report forma*t is mandatory.

The "information concerning the test equipment used for type evaluation" shall cover all test equipment which has been used in determining the test results given in a report. The information may be a short list containing only essential data (name, type, reference number for purpose of traceability). For example:

- Verification standards (accuracy, or accuracy class, and No.)
- Simulator for testing of devices (name, type, traceability and No.)
- Climatic test and static temperature chamber (name, type and No.)
- Electrical tests, bursts (name of the instrument, type and No.)
- Description of the procedure of field calibration for the test of immunity to radiated electromagnetic fields

Note concerning the numbering of the following pages

In addition to a sequential numbering: "R21 page ..." at the bottom of the pages of this publication, a special place is left at the top of each page (starting with the following page) for numbering the pages of reports established following this model. In particular, some tests (e.g. metrological performance tests) shall be repeated several times, each test being reported individually on a separate page following the relevant format.

For a given report, it is advisable to complete the sequential numbering of each page by the indication of the total number of pages of the report.

Taximeter

TYPE EVALUATION REPORT

EXPLANATORY NOTES

Symbols, units and abbreviations:

MPE	Maximum permissible error
Rel. h.	Relative humidity
Temp	Temperature
Res.	Resolution
I	Indication (applicable currency unit)
Ref.	Reference (values)
EUT	Equipment Under Test
Hz	Hertz, cycles per second (unit of frequency measurement)
Ref.	Reference
AM	Amplitude modulation, varying the amplitude of a carrier wave in sympathy with a modulating audio signal
Pulses/km	Pulses per kilometre
ASD	Acceleration spectral density
RMS	Root-mean-square acceleration

The name(s) or symbol(s) of the unit(s) used to express test results shall be specified in each test form.

For each test, the "SUMMARY OF TYPE EVALUATION" and the "CHECKLIST" shall be completed according to this example:

	P	F
when the instrument has passed the test:	X	
when the instrument has failed the test:		X
when the test is not applicable:	/	/

P = Passed
F = Failed

The white spaces in boxes in the headings of the report should always be filled according to the following example:

	At start	At end	
Temp:	20.5	21.1	°C
Rel. h.:			%
Date:	2006:01:29	2006:01:30	yyyy:mm:dd
Time:	16:00:05	16:30:25	hh:mm:ss

"Date" in the test report(s) refers to the date that the test was performed.

In the disturbance tests, faults greater than the value specified in T.4.5.6 are acceptable provided that they are detected and acted upon, or that they result from circumstances such that these faults shall not be considered as significant; an appropriate explanation shall be given in the column "Yes (remarks)".

Section numbers in brackets refer to the corresponding subclauses of R 21.

GENERAL INFORMATION CONCERNING THE TYPE

Application No:…… Manufacturer's name and address:…….

Applicant:…….. Date instrument submitted:……

Type designation:…….. Evaluation period: Start:……. End:……...

Report date:…….. Observer:……

Issuing Institute name and address:……

Testing on: ☐ Taximeter
☐ Device[1]

Characteristic values:

Fare increment step (I)	Time tariff (I/h)			Distance tariff (I/km)			Taximeter constant k (pulses/km)			Measuring range	
	Min	Max	Res.	Min	Max	Res.	Min	Max	Res.	Distance (km)	Time (h)

Power : U_{nom}[2] = ☐ V U_{min} = ☐ V U_{max} = ☐ V

Printer: ☐ Built-in ☐ Connected ☐ Not present but connectable ☐ No Connection

Temperature range: ☐ °C Min: ☐ °C Max: ☐ °C

[1] The test equipment connected to the taximeter shall be defined in the test form(s) used.

[2] The rated operating voltage shall be 12 V DC. For other voltage systems for the instrument the appropriate corresponding voltages shall be applied for the tests.

GENERAL INFORMATION CONCERNING THE TYPE continued….

Additional Remarks: Use this space to indicate additional remarks and/or information: other connected devices and interfaces, choice of the manufacturer regarding protection against disturbances, etc.

IDENTIFICATION OF THE INSTRUMENT

Application No: ……

Report date: ……

Type designation: ……

Manufacturer: ……..

Serial No: ……..

Manufacturing Documentation:

(Record as necessary to identify the equipment under test)

System or device name	Drawing number or software identification	Issue or reference level	Serial or reference No.

IDENTIFICATION OF THE INSTRUMENT (continued)

Description or other information pertaining to identification of the instrument: (*attach photograph here if available*)

INFORMATION CONCERNING THE TEST EQUIPMENT[3] USED FOR TYPE EVALUATION

TEST EQUIPMENT

Application No: ……

Report date: ……

Type designation: ……

Manufacturer: ……..

List all test equipment used in this report:

Equipment name or description	Manufacturer	Type or reference No.	Serial or Identification No.	Calibration date	Measurement Uncertainty (if applicable)	Used for (test references)
Power supply						
Pulse counter						
Timer						
Electrostatic discharge generator						
Pulse generator						
EMC chamber						
Climatic chamber						

[3] For traceability, test equipment with traceable calibration to national and international standards shall be used to perform the measurements.

CONFIGURATION FOR TEST

Provide additional information relating to equipment configuration, interfaces, data rates, EMC protection options etc, for the instrument and/or simulator.

Test connector:

– Input signals:		Output signals:	
Distance pulses:		Distance pulses:	
Low-high		Low-high	
High-low		High-low	
Max freq (Hz):			
Time pulses:		Time pulses:	
Low-high		Low-high	
High-low		High-low	
Min freq		Internal clock freq (Hz):	
Max freq (Hz):		Signal to indicate fare increment:	
Signal to block time-counting when:		Low-high signal	
Signal is low:		High-low signal	
Signal is high:			

Distance sensor interface:

Low voltage	
High voltage	
Trigger:	
Low-high	

Use this space for additional information relating to equipment configuration.

SUMMARY OF TYPE TEST REPORT

Application No: ……

Report date: ……

Type designation: ……

Test category	Annex C	Test	Test reference	Report page	Passed	Failed	Remarks
1	C.1	Function test and visual examination.	A.4.2 and A.4.3				
2	C.2.1	Dry heat and cold function control test and visual examination.	A.5.4.1 A.4.2 and A.4.3				
3	C.2.2	Damp heat cyclic test (condensing).	A.5.4.2				
	C.2.2.1	Function control and visual examination after damp heat cyclic test.	A.4.2 and A.4.3				
4	C.2.3	Voltage variations slow dips function control and visual examination.	A.5.4.3				
	C.2.3.2	Function control and visual examination after voltage variations test.	A.4.2 and A.4.3				
5	C.2.4	Random or sinusoidal vibration function control and visual examination	A.5.4.4				
	C.2.4.4	Function control and visual examination test after random or sinusoidal vibration test.	A.4.2 and A.4.3				
6	C.2.5.1	Radiated electromagnetic fields test.	A.5.4.5.1				
	C.2.5.2	Conducted electromagnetic fields test.	A.5.4.5.2				
	C.2.6	Electrostatic discharges test.	A.5.4.6				
	C.2.6.1	Function control test and visual examination after electrostatic discharges test.	A.4.2 and A.4.3				
7	C.2.7.1	Electrical transient conduction along supply lines	A.5.4.7.1				
	C.2.7.2	Electrical transient conduction via lines other lines than supply lines	A.5.4.7.2				
	C.2.7.3	Function control and visual examination after transient conduction via other lines	A.4.2 and A.4.3				
8	C.3	Examination of the construction					
		Checklist					

C.1 Function test at the beginning of test program (6.2.1, A.4.3)

			At start	At end	
Application No:	.....	Temp:			°C
Type designation:	.....	Rel. h.:			%
Observer:	.....	Date:			yyyy:mm:dd
		Time:			hh:mm:ss

C.1.1 Initial check at reference conditions

C.1.1.1 Voltage supply variations[4] (A.5.4.3, 2.5.2)

Time measurement

Voltage supply range (DC)	Time signal (Hz)		Number of test pulses		Indication (I)		Time tariff (I/h)	Time signal Error		Test pulses Error		MPE %
	Actual	Ref.	Actual	Ref.	Start	End		Hz	%	pulses	%	
9 V												
16 V												

Distance measurement

Voltage supply range (DC)	Number of test pulses		Indication (I)		Taximeter constant k (pulses/km)	Distance tariff (I/km)	Test pulses Error		MPE %
	Actual	Ref.	Start	End			pulses	%	
9 V									
16 V									

☐ Passed ☐ Failed

Remarks:

C.1.1.2 Pulse frequency levels[5]

Distance measurement

Voltage supply (DC)	Pulse frequency[6] (Hz)		Number of test pulses		Indication (I)		Taximeter constant k (pulses/km)	Distance tariff (I/km)	Test pulses Error		MPE %
			Actual	Ref.	Start	End			pulses	%	
12 V	Lowest										
	Medium										
	Highest										

☐ Passed ☐ Failed

Remarks:

[4] Rated operating voltage is 12 V DC. For other voltage systems the appropriate corresponding voltages shall be applied.
[5] By testing different pulse frequencies, time measurement is dispensable.
[6] At least 10 fare increments at simulated speed of up to 200 km/h (6.2.1).

C.1 Function test (continued)

C.1.1.3 Pulse voltage levels[7]

Distance measurement

Voltage supply (DC)	Pulse voltage (V)		Number of test pulses		Indication (I)		Taximeter constant k (pulses/km)	Distance tariff (I/km)	Test pulses Error		MPE %
			Actual	Ref.	Start	End			pulses	%	
12 V	Lowest										
	Medium										
	Highest										

☐ Passed ☐ Failed

Remarks:

C.1.1.4 Specified k values[8]

Distance measurement

Voltage supply (DC)	Taximeter constant k (pulses/km)		Number of test pulses		Indication (I)		Taximeter constant k (pulses/km)	Distance tariff (I/km)	Test pulses Error		MPE %
			Actual	Ref.	Start	End			pulses	%	
12 V	Lowest										
	Medium										
	Highest										

☐ Passed ☐ Failed

Remarks:

[7] By variation of pulse voltage levels, time measurement is dispensable.
[8] k values (minimum 500 pulses / km. Maximum specified by the manufacturer). By variation of k values, time measurement is dispensable

C.1 Function test (continued)

C.1.1.5 Featured calculation method

Time measurement

Voltage supply (DC)	Calculation method	Time measuring signal (Hz)		Number of test pulses		Indication (l)		Time tariff (l/h)	Time signal Error		Test pulses Error		MPE %
		Actual	Ref.	Actual	Ref.	Start	End		Hz	%	pulses	%	
12 V													

Distance measurement

Voltage supply (DC)	Calculation method	Number of test pulses		Indication (l)		Taximeter constant k (pulses/km)	Distance tariff (l/km)	Test pulses Error		MPE %
		Actual	Ref.	Start	End			pulses	%	
12 V										

☐ Passed ☐ Failed

Remarks:

C.1.1.6 Programmed tariff (including automatic changes, if applicable) [9]

Time measurement

Voltage supply (DC)	Tariffs	Time measuring signal (Hz)		Number of test pulses		Indication (l)		Time tariff (l/h)	Time signal Error		Test pulses Error		MPE %
		Actual	Ref.	Actual	Ref.	Start	End		Hz	%	pulses	%	
12 V													

Distance measurement

Voltage supply (DC)	Tariffs	Number of test pulses		Indication (l)		Taximeter constant k (pulses/km)	Distance tariff (l/km)	Test pulses Error		MPE %
		Actual	Ref.	Start	End			pulses	%	
12 V										

☐ Passed ☐ Failed

Remarks:

[9] Tests shall are performed for a selection of the available programming modes and/or tariffs (including automatic changes, if applicable and only testing relevant measurement data).

C.2 Function control tests during and/or after exposure to influence factors or disturbances (6.2.2, A.4.4).

Tests are conducted in accordance with the test program in Table 2. All registered information shall be checked.

			At start	At end	
Application No:	.....	Temp:			°C
Type designation:	.....	Rel. h.:			%
Observer:	.....	Date:			yyyy:mm:dd
		Time:			hh:mm:ss

C.2.1 Dry heat (non-condensing) and cold test (2.5.1, A.5.4.1)

EUT is exposed to the upper temperature (+ 40 °C or +70 °C) and to the lower temperature (-40 °C or -10 °C with voltage 'off') according to climate class reference temperature for 16 hours. Function control shall then be conducted after sufficient temperature stabilisation.

Time measurement

Voltage supply range (DC)	Temperature condition[10]	Time measuring signal (Hz)		Test pulses		Indication (I)		Time tariff (I/h)	Time signal Error		Test pulses Error		MPE %
		Actual	Ref.	Actual	Ref.	Start	End		Hz	%	pulses	%	
12 V	Specified high (dry heat)												
12 V	Specified low (cold test)												

Distance measurement

Voltage supply range (DC)	Temperature condition	Number of test pulses		Indication (I)		Taximeter constant k (pulses/km)	Distance tariff (I/km)	Test pulses Error		MPE %
		Actual	Ref.	Start	End			pulses	%	
12 V	Specified high (dry heat)									
12 V	Specified low (cold test)									

☐ Passed ☐ Failed

Remarks:

[10] 1) Refer to 2.5.1 and A.5.4.1, Table 6 for the climatic reference temperature limits.
2) The test is performed after sufficient temperature stabilization has occurred. The change of temperature shall not exceed 1 ^{0}C/min during heating and cooling down.

C.2.2 Damp heat, cyclic test (4.1.2, 4.1.3, A.5.4.2)

			At start	After 3 h	After 12 h	At end	
Application No:	.....	Temp:					°C
Observer:	.....	Time:					hh:mm:ss

Temperature/humidity sequence[11]	24 h period	Indication I	Significant fault		
			Yes	No	Yes (remarks)[12]
Temperature rise from reference at 95 % Rel. h.	0 to 3				
Specified high temperature at 93 % Rel. h.	3 to 12				
Temperature drop to reference at 95 % Rel. h.	18 to 24				

☐ Passed ☐ Failed

Remarks:

[11] All parts of the EUT are within 3 °C of their final temperature.
[12] Functional status of the instrument during and after exposure to disturbances.

C.2.2.1 Function control and visual examination after damp heat test at reference environmental conditions (6.2.1, A.4.3)

Time measurement

Voltage supply (DC)	Time measuring signal (Hz)		Test pulses		Indication (I)		Time tariff (I/h)	Time signal Error		Test pulses Error		MPE %
	Actual	Ref.	Actual	Ref.	Start	End		Hz	%	pulses	%	
12 V												

Distance measurement

Voltage supply (DC)	Number of test pulses		Indication (I)		Taximeter constant k (pulses/km)	Distance tariff (I/km)	Test pulses Error		MPE %
	Actual	Ref.	Start	End			pulses	%	
12 V									

Visible deterioration detected ☐ Yes ☐ No

Result: ☐ Passed ☐ Failed

Remarks:

C.2.3 Voltage supply variations (2.5.2, A.5.4.3)

C.2.3 Voltage supply limits variations test

The results of the voltage supply limits variations test in C.1.1.1 shall be referred to and recorded with this test.

C.2.3.1 Voltage variations below lower operating limit of 9 V DC (4.2.5, A.5.4)

			At start	At end	
Application No:	.....	Temp:			°C
Type designation:	.....	Rel. h.:			%
Observer:	.....	Date:			yyyy:mm:dd
		Time:			hh:mm:ss

% of lower value of voltage reduction (V_L)	Width of reduction (seconds)	Passed	Failed	Remarks
80	7			
	14			
	15			
	17.5			
	20			
	21			
	30			
40	7			
	14			
	15			
	17.5			
	20			
	21			
	30			
0	7			
	14			
	15			
	17.5			
	20			
	21			
	30			

☐ Passed ☐ Failed

Remarks:

Polarity change: ± 12 V DC	Duration of polarity change (seconds)	Registered information comply	Registered information does not comply

☐ Passed ☐ Failed

Remarks:

C.2.3.2 Function control and visual examination after voltage variation test at reference environmental conditions (6.2.1, A.4.3)

Time measurement

Voltage supply (DC)	Time measuring signal (Hz)		Test pulses		Indication (I)		Time tariff (I/h)	Time signal Error		Test pulses Error		MPE %
	Actual	Ref.	Actual	Ref.	Start	End		Hz	%	pulses	%	
12 V												

Distance measurement

Voltage supply (DC)	Number of test pulses		Indication (I)		Taximeter constant k (pulses/km)	Distance tariff (I/km)	Test pulses Error		MPE %
	Actual	Ref.	Start	End			pulses	%	
12 V									

Visible deterioration detected ☐ Yes ☐ No

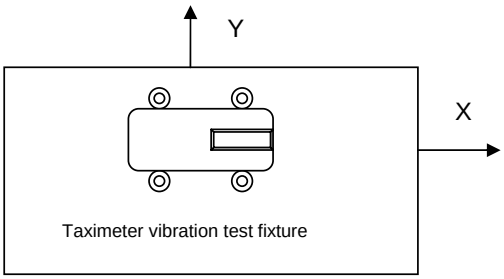
Result: ☐ Passed ☐ Failed

Remarks:

C.2.4 Vibrations test (A.5.4.4)

Figure B EUT and configuration

Figure B.1 - Set up for Z axis vibration: Direction of motion is in and out of page.



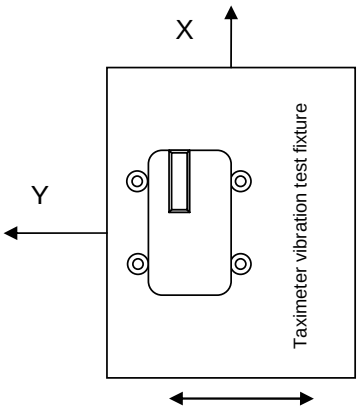


Figure 1.2 - Set up for Y axis vibration

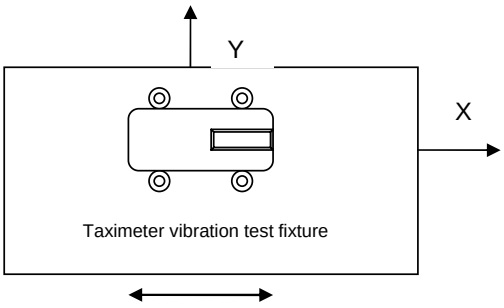


Figure 1.3 - Set up for X axis vibration

C.2.4.1 Vibrations test (A.5.4.4)

Two different vibration tests (random or sinusoidal) are described below. In general, the random vibration test is recommended. The sinusoidal vibration test may be applied if specified by the manufacturer.

C.2.4.2 Random vibrations in three mutually perpendicular axes (A.5.4.4.1)

			At start	At end	
Application No:	.....	Temp:			°C
Type designation:	.....	Rel. h.:			%
Observer:	.....	Date:			yyyy:mm:dd
		Time:			hh:mm:ss

Time measurement

Voltage supply (DC)	In three axes[13]	Time measuring signal (Hz)		Number of test pulses		Indication (I)		Time tariff (l/h)	Time signal Error		Test pulses Error		MPE %
		Actual	Ref.	Actual	Ref.	Start	End		Hz	%	pulses	%	
12 V	First axis												
	Second axis												
	Third axis												

Distance measurement

Voltage supply (DC)	In three axes	Number of test pulses		Indication (I)		Taximeter constant k (pulses/km)	Distance tariff (l/km)	Error Test pulses		MPE %
		Actual	Ref.	Start	End			pulses	%	
12 V	First axis									
	Second axis									
	Third axis									

☐ Passed ☐ Failed

Remarks:

[13] In accordance with the specifications in Table 8, apply random vibrations, over a frequency range of 10-150 Hz, to the EUT, at the specified ASD level, in three mutually perpendicular axes in turn, for 30 minutes per axis in each functional mode.

C.2.4.3 Sinusoidal vibration in three mutually perpendicular axes (A.5.4.4.2)

			At start	At end	
Application No:	.....	Temp:			°C
Type designation:	.....	Rel. h.:			%
Observer:	.....	Date:			yyyy:mm:dd
		Time:			hh:mm:ss

Time measurement

Voltage supply (DC)	In three axes[14]	Time measuring signal (Hz)		Number of test pulses		Indication (I)		Time tariff (l/h)	Time signal Error		Test pulses Error		MPE %
		Actual	Ref.	Actual	Ref.	Start	End		Hz	%	pulses	%	
12 V	First axis												
	Second axis												
	Third axis												

Mis en forme : Gauche

Distance measurement

Voltage supply (DC)	In three axes	Number of test pulses		Indication (I)		Taximeter constant k (pulses/km)	Distance tariff (l/km)	Test pulses Error		MPE %
		Actual	Ref.	Start	End			pulses	%	
12 V	First axis									
	Second axis									
	Third axis									

☐ Passed ☐ Failed

Remarks:

[14] In accordance with the specifications in Table 9, apply sinusoidal vibrations, over a frequency range of 10 -150 Hz, at 1 octave/min, and at 10 ms^{-2} maximum acceleration level with 20 sweep cycles per axis, in three mutually perpendicular main axes of the rigidly mounted EUT

C.2.4.4 Function control and visual examination after random or sinusoidal vibration test at reference environmental conditions (6.2.1, A.4.3)

Time measurement

Voltage supply (DC)	Time measuring signal (Hz)		Number of test pulses		Indication (I)		Time tariff (I/h)	Time signal Error		Test pulses Error		MPE %
	Actual	Ref.	Actual	Ref.	Start	End		Hz	%	pulses	%	
12 V												

Distance measurement

Voltage supply (DC)	Number of test pulses		Indication (I)		Taximeter constant k (pulses/km)	Distance tariff (I/km)	Test pulses Error		MPE %
	Actual	Ref.	Start	End			pulses	%	
12 V									

Visible deterioration detected ☐ Yes ☐ No

Result: ☐ Passed ☐ Failed

Remarks:

C.2.5 Immunity to electromagnetic fields

C.2.5.1 Immunity to radiated electromagnetic fields test (A.5.4.5.1)

			At start	At end	
Application No:	.....	Temp:			°C
Type designation:	.....	Rel. h.:			%
Observer:	.....	Date:			yyyy:mm:dd
		Time:			hh:mm:ss

Disturbances			MPE compliance		Remarks
Frequency range (MHz)	Polarization	Facing EUT	Yes	No	
without disturbance					
26 - 80	Vertical	Front			
		Right			
		Left			
		Rear			
	Horizontal	Front			
		Right			
		Left			
		Rear			
80 - 2000	Vertical	Front			
		Right			
		Left			
		Rear			
	Horizontal	Front			
		Right			
		Left			
		Rear			

Frequency range: 80 MHz to 2 GHz

Amplitude: 10 Volts/m

Modulation: 80 % AM, 1 kHz sine wave

Note: If EUT fails, the frequency and field strength at which this occurs must be recorded.

☐ Passed ☐ Failed

Remarks:

C.2.5.2 Immunity to conducted electromagnetic fields test (A.5.4.5.2)

			At start	At end	
Application No:	.....	Temp:			°C
Type designation:	.....	Rel. h.:			%
Observer:	.....	Date:			yyyy:mm:dd
		Time:			hh:mm:ss

Frequency Range (MHz)	Cable/Interface	Level (Volts RMS)	MPE compliance		Remarks[15]
			Yes	No	
without disturbance					
without disturbance					
without disturbance					
without disturbance					
without disturbance					
without disturbance					

Frequency range: 0.15 to 80 MHz

RF amplitude (EMF): 10 V RMS

Modulation: 80 % AM, 1 kHz sine wave

☐ Passed ☐ Failed

Remarks:

[15] Functional status of the instrument during and after exposure to disturbances. If EUT fails, the frequency and field strength at which this occurs must be recorded.

C.2.5 Immunity to electromagnetic fields (continued)

Include a description of the set-up of EUT, e.g. by photos or sketches.

Note: If EUT fails, the frequency and field strength at which this occurs must be recorded.

Radiated:

Conducted:

C.2.6 Electrostatic discharges (A.5.4.6)

			At start	At end	
Application No:	.....	Temp:			°C
Type designation:	.....	Rel. h.:			%
Observer:	.....	Time:			hh:mm:ss

Polarity[16]: ☐ pos ☐ neg

The taximeter shall be in operation during the test.

Direct application

Type	Discharges			MPE compliance		Remarks[17]
	Test Voltage (kV)[18]	Number of discharges ≥ 10	Repetition Interval (s)	Yes	No	
	without disturbance					
Contact	2					
Contact	4					
Contact	6					
Air	8					

Indirect application (Horizontal coupling plane)

Type	Discharges			MPE compliance		Remarks
	Test Voltage (kV)	Number of discharges ≥ 10	Repetition Interval (s)	Yes	No	
	without disturbance					
Contact	2					
Contact	4					
Contact	6					

Indirect application (Vertical coupling plane)

Type	Discharges			MPE compliance		Remarks
	Test Voltage (kV)	Number of discharges ≥ 10	Repetition Interval (s)	Yes	No	
	without disturbance					
Contact	2					
Contact	4					
Contact	6					

☐ Passed ☐ Failed

Remarks:

[16] IEC 61000-4-2 specifies that the test shall be conducted with the most sensitive polarity.
[17] Functional status of the instrument during and after exposure to disturbances. Significant faults or the test point at which EUT failure occurs shall be recorded.
[18] 6 kV is the recommended maximum level contact discharge. However, in accordance with national regulation a maximum level of 4 kV contact discharge may be applied.

C.2.6 Electrostatic discharges (cont.)

Specification of test points of EUT (direct application), e.g. by photos or sketches

a) Direct application

Contact discharges:

Air discharges:

b) Indirect application

C.2.6.1 Function control and visual examination after electrostatic discharges test at reference environmental conditions (6.2.1, A.4.3)

Time measurement

Voltage supply (DC)	Time measuring signal (Hz)		Number of test pulses		Indication (I)		Time tariff (l/h)	Time signal Error		Test pulses Error		MPE %
	Actual	Ref.	Actual	Ref.	Start	End		Hz	%	pulses	%	
12 V												

Distance measurement

Voltage supply (DC)	Number of test pulses		Indication (I)		Taximeter constant k (pulses/km)	Distance tariff (l/km)	Test pulses Error		MPE %
	Actual	Ref.	Start	End			pulses	%	
12 V									

Visible deterioration detected ☐ Yes ☐ No

Result: ☐ Passed ☐ Failed

Remarks:

C.2.7 Electrical transient conduction (A.5.4.7)

C.2.7.1 Electrical transient conduction along supply lines of voltage supply (A.5.4.7.1)

			At start	At end	
Application No:	.....	Temp:			°C
Type designation:	.....	Rel. h.:			%
Observer:	.....	Date:			yyyy:mm:dd
		Time:			hh:mm:ss

Exposure of the EUT to disturbances on the DC voltage supply line by direct coupling of pulses.

Voltage supply (DC)	Test pulse	Pulse voltage V	MPE compliance		Remarks[19]
			Yes	No	
	1	-100			
	2a	+ 50			
	2b[20]	+10			
	3a	-150			
	3b	+100			
	4	-7			

... [2]

☐ Passed ☐ Failed

Remarks:

[19] Functional status of the instrument during and after exposure to test pulses
[20] Test pulse 2b is only applicable if the instrument is connected to the battery via the main (ignition) switch of the car, i.e. if the manufacturer has not specified that the instrument is to be connected directly (or by its own main switch) to the battery.

C.2.7.2 Electrical transient conduction via lines other than supply lines of voltage supply (A.5.4.7.2)

With the applicable voltage supply on, the various signal lines of the TAXIMETER are exposed to disturbances by capacitive/inductive coupling.

Supprimé : EUT

Voltage supply (DC)	Test pulse	Pulse voltage U_s	MPE compliance Yes	MPE compliance No	Remarks [21]
	Cable/interface:				
	a	-60 V			
	b	+40 V			
	Cable/interface:				
	a	-60 V			
	b	+40 V			
	Cable/interface:				
	a	-60 V			
	b	+40 V			
	Cable/interface:				
	a	-60 V			
	b	+40 V			
	Cable/interface:				
	a	-60 V			
	b	+40 V			

... [3]

☐ Passed ☐ Failed

Remarks:

[21] Functional status of the instrument during and after exposure to test pulses

C.2.7.3 Function control and visual examination after electrical transient conduction test at reference conditions (6.2.1, A.4.3)

Time measurement

Voltage supply (DC)	Time measuring signal (Hz)		Number of test pulses		Indication (I)		Time tariff (l/h)	Time signal Error		Test pulses Error		MPE %
	Actual	Ref.	Actual	Ref.	Start	End		Hz	%	pulses	%	
12 V												

Distance measurement

Voltage supply (DC)	Number of test pulses		Indication (I)		Taximeter constant k (pulses/km)	Distance tariff (l/km)	Test pulses Error		MPE %
	Actual	Ref.	Start	End			pulses	%	
12 V									

Visible deterioration detected ☐ Yes ☐ No

Result: ☐ Passed ☐ Failed

Remarks:

C.3 EXAMINATION OF THE CONSTRUCTION OF THE INSTRUMENT

Use this page to indicate any description or information pertaining to the instrument, additional to that already contained in this report and in the accompanying national type approval or OIML certificate. This may include a picture of the complete instrument, a description of its main devices, and any remark which could be useful for authorities responsible for the initial or subsequent verifications of individual instruments built according to the type. It may also include references to the manufacturer description.

Description:

Remarks:

CHECKLIST

The checklist has been developed based on the following principles:

This checklist is intended to serve as a summary of the results of examinations to be performed and not as a procedure. The items on this checklist are provided to recall the requirements specified in R 21 and they shall not be considered as a substitution for these requirements.

For non-mandatory devices, the checklist provides space to indicate whether or not the device exists and, if appropriate, its type. A cross in the box for “present” indicates that the device exists and that it complies with the definition given in the terminology; when indicating that a device is non-existent, also check the boxes to indicate that the tests are not applicable (see p. 2).

If appropriate, the results stated in this checklist may be supplemented by remarks given on additional pages.

CHECKLIST (continued)

Application No: .....

Type designation:.....

R 21 Clause	Test Clause	Taximeters	Passed	Failed	Remarks
2	A.1	**Metrological requirements**			
2.1		**Main function of the taximeter:**			
		Designed to measure the duration, and			
		To calculate the distance of a journey			
		Calculates and displays the fare to be paid, based on the calculated distance and/or measured duration of the journey			
2.3		**Taximeter accuracy conformance over time:**			
		Manufacturer provides documented description of taximeter design to provide a level of confidence of operational accuracy conformance with the requirements of R 21 for a period of at least one year.			
2.4		**Units of measurement to be used on taximeter are:**			
		Time, in seconds, minutes and hours;			
		Distance, in metres (m) or kilometres (km), or as specified in national regulation;			
		Fare, in accordance with national regulation.			
2.5.1		**Temperature:**			
		Working temperature specified by manufacturer; or			
		Specified according to: lower temperature shall be -40 °C, -25 °C, or -10 °C			
		Specified according to: upper temperature shall be + 40 °C, +55 °C, or +70 °C			
		There is a minimum temperature range of 80 °C for the climatic environment			
2.5.2		**DC voltage supply:**			
		DC voltage supply limits specified by manufacturer; or			
		Voltage supply: 12 V battery			
		Voltage supply: 24 V battery			
		Voltage supply: Other voltage supply	Remarks		
2.6		**Constant k of the taximeter:**			
		Taximeter constant k is not lower than 500 pulses per kilometre and is adjustable.			
		It is possible to display k on the taximeter as a readily accessible decimal number.			
		Every change of k is secured in accordance with 3.2.5.			
		The use of the taximeter is not possible when the change registration capacity is exceeded. That capacity shall be defined by the manufacturer.			

R 21 Clause	Test Clause	Taximeters	Passed	Failed	Remarks
2.7	**A.1**	**Real-time clock:**			
		Taximeter shall be equipped with a real time clock			
		Keeps track of the time of the day and the date			
		The time and/or the date can be used for the automatic change of tariffs			
		Time keeping accuracy shall be ± 2 minutes per week			
		Correction for summer and winter time is performed automatically and complies with the requirements in 3.2.5.			
		Other corrections, automatic or manual, prevented during a journey, unless conducted during a verification process.			
		During interruption to voltage supply, real time clock shall continue to function correctly, and retain the correct time and date for at least one year, or for a period in accordance with national regulation.			
3	**A.1**	**Technical requirements**			
3.1		**Suitability for use**			
		Taximeter suits the method of operation and vehicles for which it is intended.			
		Taximeter is of robust construction to maintain its metrological characteristics			
3.2		**Security of operation:**			
3.2.1		**Fraudulent use:** No characteristics likely to facilitate fraudulent use			
3.2.2		**Accidental maladjustment:** Effect of accidental breakdown or maladjustment is evident			
3.2.3		**Controls:** Controls **c**ome to rest in intended positions and unambiguously marked keys			
3.2.4		**Calculator:**			
		Easy inspection and adjustments of the calculator functions is possible			
		Any malfunction shall be clearly indicated (e.g. by a significant fault indication or by automatic switch off).			
3.2.5	**A.2**	**Securing of functions, hardware, software and pre-set controls**			
		a) Access / adjustment to legally relevant data / functions prohibited and automatically self-evident;			
		b) Access to legally relevant functions only allowed to the metrological authority, e.g. by changeable code (key-word) or of a special device (hard key, etc);			
		c) Protection of device-specific and software functions against intentional, unintentional and accidental changes provided in accordance with 3.11;			
		d) Protection and detection of physical tampering with taximeter hardware provided (e.g. seals);			

R 21 Clause	Test Clause	Taximeters	Passed	Failed	Remarks
3.2.5	**A.2**	**Securing of functions, devices, software and pre-set controls**			
		f) Transmission of legally relevant data via interface is protected against intentional, unintentional and accidental changes in accordance with the interface requirements in 4.2.3;			
		g) Securing possibilities available in taximeter allows for separate securing of the settings;			
		h) Other means of securing specified by the manufacturer shall ensure the integrity and authenticity of measurement data.			
3.3	**A.1**	**Fare calculation:**			
		The interval of fare to pay, and the monetary symbols shall comply with national regulations.	Remarks		
		Fare calculation is performed by:			
		Normal calculation method S (single application of tariff)			
		Normal calculation method D (double application of tariff)			
		If both normal calculation methods S and D are possible in a taximeter, the option of switching between them shall be under the securing conditions specified in 3.2.5.			
		indications for fare calculation comply with 3.9.1			
3.4		**Tariff programming**			
3.4.1		**Each allocated tariff may include following data:**			
		– initial hire fee as an amount of money;			
		– initial time;			
		– initial distance;			
		– time-tariff value as an amount of money per hour;			
		– distance-tariff value as an amount of money per kilometre, or in accordance with national regulations;			
		– supplementary charge increment, if appropriate;			
		– signature of the corresponding tariff data.			
3.4.2		**Input of tariff data**			
		– It shall be possible to secure the access to the level where tariff data can be changed in accordance with the securing requirements 3.2.5.			
		– The tariff data may be entered individually via an appropriately protected interface (4.2.3).			
		– Unauthorized or unintentional tariff re-programming due to interfacing with other equipment shall conform to the securing requirements in 3.2.5.			
		– If the taximeter is capable of having its tariffs re-programmed in advance of the effective date, those tariffs shall not become effective until that date.			

R 21 Clause	Test Clause	Taximeters	Passed	Failed	Remarks
3.5	**A.1**	**Operating position indication**			
		The indication in the operating positions shall be as follows:			
3.5.1		**In 'For hire' (free) position**			
		Time-counting and distance-counting shall be inactive.			
		In 'For hire' (free) position it shall be possible to display, when relevant, the following parameters:			
		– all elements of the indicator display;			
		– the contents of totalizers (see 3.7);			
		– the constant k expressed in pulses per kilometre;			
		– the contents of the event counters;			
		– the tariff data of each allocated tariff (see 3.4.1).			
		– signatures of the corresponding tariff parameters			
		– date and time			
		– software version number and/or checksum			
		The above parameters shall not be displayed for more than 10 seconds when the vehicle is moving.			
		Other indications in 'For hire' (free) position are permitted in accordance with national regulation, and shall not be interpreted as fare or supplement indication and their use is subject to the security of operation requirements in 3.2.			
3.5.2		**In 'Hired' (occupied) position**			
		Time-counting and distance-counting shall be activated.			
		The indications in 'Hired' position at the beginning of the journey shall be in the following order:			
		a) The initial charge,			
		b) The first fare indication, followed by subsequent fare indication changes corresponding to the initial and then successive equal time intervals or distances specified in the applied tariff;			
		Indications in 'Hired' position may also include the distance and time displays provided they comply with the quality of indication requirements in 3.9.1.			
3.5.3		**In 'Stopped' (to pay) position**			
		At the end of a journey, time-counting and distance-counting shall be inactive.			
		The indications in 'Stopped' (to pay) position at the end of the journey shall be:			
		a) The fare to be paid for the journey, or			
		b) If there is a supplementary charge for an extra service, entered by manual command, this shall be displayed separately from the indicated fare. However, in this case a taximeter may indicate temporarily the value of the fare including the supplementary charge.			
		In the case of b) the indication of the supplement shall be made by figures with a height not more than that of the figures indicating the fare.			
		Indications in the 'Stopped' position shall comply with 3.9.1.			

R 21 Clause	Test Clause	Taximeters	Passed	Failed	Remarks
3.5.4	A.1	**In the 'Measure' position:**			
		In calculation method D the distance and duration of the journey are measured and displayed in real time on a separate indicator			
		Indications in the 'Measure' position are:			
		a) Time measured in hours with smallest increment of 1 minute;			
		b) Resolution of distance measured is better than or equal to 0.1 km;			
		c) Both time and duration readings may be given at the same time, or may be recalled one after the other by means of the operating position indicator;			
		d) Period of use shown as hh:mm:ss and the indicated unit of measurement comply with 3.9.1.			
3.6	A.1	**Additional requirements for operating position indicator:**			
		a) In 'Stopped' position and before the start of any new journey, the indication of the fare at the end of a previous journey shall be displayed for at least 10 seconds, or a time in accordance with national regulations;			
		b) The design and setting of the operating position indicator shall ensure that any change in operating positions and their indications comply with the appropriate securing requirements in 3.2.5;			
		c) It shall not be possible to place the operating position indication in any positions other than those mentioned above, unless otherwise specified in national regulation.			
3.7	A.1	**Non-resettable totalizers:**			
		Clear and unambiguous display of:			
		a) Total distance travelled by the taxi;			
		b) Total distance travelled when hired;			
		c) Total number of journeys;			
		d) Total amount of money charged as supplements;			
		e) Total amount of money charged as fare.			
		Other data may be totalled provided they are in accordance with national regulation and comply with 3.9.1.			
		Values saved under conditions of voltage supply loss shall be included in the total.			
		Totalized values displayed for a maximum of 10 seconds, or for a time in accordance with national regulation			
		Totalisers have a minimum number of digits (e.g. 8 digits)			
		Totalized values can be stored for at least one year			
3.8	A.1	**The tariff data may be triggered by the:**			
		a) Distance of the journey;			
		b) Duration of the journey;			
		c) Time of day;			
		d) Date;			
		e) Day of the week, including special days (e.g. Christmas, Easter, ...) if relevant;			
		Any alteration of tariff data complies with 3.2.5.			

R 21 Clause	Test Clause	Taximeters	Passed	Failed	Remarks
3.9	**A.1**	**Indicating and printing**			
3.9.1		**Quality of reading:**			
		Primary indications shall be by means of a display			
		Reading of primary indications reliable, easy and unambiguous under conditions of normal use including in daylight and night			
		The figures forming the primary indications shall be of a size of a size in height, shape and clarity for easy reading			
		Primary indications contain names or symbols of the units of measurement and comply with the requirements of 2.4.			
		Indications of interest to the passenger are suitably identified and readable from a distance of at least 2 metres			
		A digital indication shall display at least one figure beginning at the extreme right.			
		A decimal fraction shall be separated from its integer by a decimal sign (comma or dot), with the indication showing at least one figure to the left of the sign and all figures to the right			
3.9.2		**Printing**	Present [ ]		Not-Present [ ]
		Printing is clear and permanent for the intended use. Printed figures shall be clear, legible and unambiguous.			
		If printing takes place, the name or the symbol of the unit of measurement shall be either to the right of the value or above a column of values, or placed in accordance with national regulation.			
		Multiple copies of the print-out containing the same data must be marked “copy” or “duplicate”.			
		Minimum printout from each measurement operation shall be dependent upon the application of the taximeter and in accordance with national regulation.			
		In general the printout information may include the programmed tariff, fare, supplementary charge, distance and duration of the journey, date and the time of the journey.			
3.10	**A.1**	**Data storage:**	Present [ ]		Not-Present [ ]
		Requirements for securing stored data:			
		a) In all cases, the data adequately protected against intentional and unintentional changes during the data transmission in accordance with the requirements in 3.11;			
		b) Stored data shall contain all relevant information necessary to reconstruct an earlier measurement.			
		c) External storage devices identification and security attributes shall be verified to ensure integrity and authenticity;			
		d) Exchangeable storage media is sealed against removing in accordance with 3.2.5;			
		e) When storage capacity is exhausted, new data shall replace oldest data.			
		f) Other means of securing stored data specified by the manufacturer shall ensure the integrity and authenticity of measurement data			

R 21 Clause	Test Clause	Taximeters	Passed	Failed	Remarks
3.11	**A.1**	**Software:**			
		Legally relevant software of a taximeter identified by the manufacturer			
3.11.1		**Software documentation supplied by manufacturer:**			
		a) A description of the legally relevant software;			
		b) A description of the accuracy of the measuring algorithms (e.g. programming modes);			
		c) A description of the user interface, menus and dialogues;			
		d) The unambiguous software identification;			
		e) An overview of the system hardware, e.g. topology block diagram, type of computer(s), description of software functions, etc, if not described in the operating manual;			
		f) Means of securing software			
		g) The operating manual.			
		h) Other relevant information regarding the software characteristics of the taximeter	Remarks		
3.11.2		**Securing of legally relevant software:**			
		a) in accordance with national regulation (if applicable);			
		b) Adequately protected against accidental or intentional changes by means of an audit trail (T.3.8) from a software event counter (T.2.5) and/or automatic checking facility (T.3.7);			
		c) Evidence of an intervention such as changing, uploading or circumventing the software is non-erasable, automatically recorded and stored for at least one year, or for a period set in accordance with national regulation;			
		d) Legally relevant software is assigned with a software identification (T.2.11.4) adapted in the case of every software change that may affect the functions and accuracy of the taximeter. Software identification shall be easily provided by the taximeter;			
		e) Transmission of legally relevant software is with appended software identification, target equipment identification and security attributes to ensure integrity and authenticity;			
		f) Transmission of legally relevant software and data shall be through appropriate protective interfaces connected to the taximeter;			
		g) Functions that are performed or initiated via a software interface shall meet the relevant requirements and conditions of 4.2.3;			
		h) Other software securing methods as specified by the manufacturer.			

R 21 Clause	Test Clause	Taximeters	Passed	Failed	Remarks
3.12	**A.2**	**Descriptive markings:**			
		Descriptive marking (variable according to national regulation) provided is at each location having a far indicating device			
		– name or identification mark of manufacturer;			
		– name or identification mark of the importer (if applicable);			
		– serial number and type designation of the instrument (if applicable);			
		– type approval sign and/or number of the type examination certificate;			
		– relevant data in respect of the conditions of use;			
		– year of manufacture;			
		– specified range of the constant 'k' (if applicable) in pulses per kilometre;			
		– software identification (if applicable).			
3.12.1		**Supplementary markings:**			
		Are required	Remarks		
3.12.2		**Presentation of descriptive markings:**			
		– Indelible;			
		– Size, shape and clarity that allows easy reading;			
		– Grouped together in a clearly visible place;			
		– Descriptive plate bearing markings to be sealed, unless it cannot be removed without being destroyed			
		– Shown in national language in accordance;			
		– Shown in form of adequate internationally agreed and published pictograms and signs			
		Alternatively, descriptive markings simultaneously displayed by a software solution either permanently or on manual commend.			
		In the case of software solution:			
		– k, w and real-time shall be displayed as long as the taximeter is switched on;			
		– the other markings may be accessed and displayed by a simple manual commend (e.g. a specific keystroke);			
		– it shall be described in the type approval certificate;			
3.13	**A.2**	**Verification Marks**			
		At initial verification and according to national legislation			
		– verification authority identification;			
		– date of verification;			
		– other verification markings specified in accordance with national regulation			
3.13.1		**Position:**			
		Part where verification marks are located cannot be removed from the instrument without damaging the marks			
		Allows easy application of marks without changing the metrological qualities of the instrument			
		Visible when the instrument is in service			

R 21 Clause	Test Clause	Taximeters	Passed	Failed	Remarks
4		**Electronic requirements**			
4.1.3		**Disturbances**			
		indication of significant faults in the display does not lead to confusion with other messages			
4.2	**A.1**	**Functional requirements**			
4.2.1		**Indicator display test:**			
		Upon switch-on, all relevant signs of indicator are active and non-active for sufficient time to be checked by operator			
4.2.2	**A.1**	**Acting upon a significant fault**			
		Either the instrument is made inoperative automatically, or			
		A visual or audible indication is provided automatically and continues until the user takes action or the fault disappears			
4.2.3		**Interfaces:**			
		A taximeter shall be able to supply the following data through appropriate protective interfaces:			
		– operation position: 'For Hire ','Hired 'or 'Stopped';			
		– totalizer data according to 3.7;			
		– general information: constant of the distance measurement transducer, date of securing, vehicle identification, real time, tariff identification;			
		– fare information for a journey: total charged, fare, calculation of the fare, supplement charge, date, start time, finish time, distance travelled;			
		– tariff(s) information: parameters of tariff(s).			
4.2.3.1		Interface documentation provided by the manufacturer includes:			
		– a list of all commands (e.g. menu items);			
		– description of the software interface;			
		– a list of all commands together;			
		– a brief description of their meaning and their effect on the functions and data of the measuring instrument.			
		– Other relevant information regarding the taximeter interfaces			
4.2.3.2		Securing of interfaces:			
		a) Prevents the influencing of the metrological functions by devices or other connected instrument or disturbances acting on the interface,			
		b) Data is protected (e.g. a protective interface) against accidental or deliberate interference during the transfer;			
		c) All functions in the software interface shall be subject to the requirements for securing software in 3.11;			
		d) all functions in the hardware interface shall be subject to the requirements for securing hardware in 3.2.5;			
		e) Metrologically relevant parts of the target instrument shall be included in the initial verification;			
		f) It shall be easily possible to verify the authenticity and integrity of data transmitted to and/or from the taximeter and the target instrument;			

R 21 Clause	Test Clause	Taximeters	Passed	Failed	Remarks
4.2.3.2		**Securing of interfaces**			
		g) Functions performed or initiated by other connected instruments through the interfaces shall meet the appropriate requirements of R 21.			
		h) Secured settings shall automatically prevent the operation of the taximeter in the absence or improper functioning of other instruments required by national regulation to be connected to the interfaces;			
		i) Other means of securing specified by the manufacturer shall ensure the integrity and authenticity of measurement data			
4.2.5	**A.1**	**Voltage drop below the lower voltage limit:**			
		a) Taximeter continue to function correctly or resume its correct functioning without loss of data prior to the voltage drop if the period of voltage drop is temporary (e.g. less than 20 seconds);			
		b) Abort an existing measurement and switch to the 'For hire' position if the period of voltage drop is for a longer period (e.g. greater than 20 seconds); In this case, the taximeter shall resume its correct functioning and retain the correct stored data concerning the journey;			
		c) Show a significant fault or is automatically put out of service if the voltage drop is for a lengthy period.			
		If disconnected from the voltage supply, the taximeter shall maintain the totalized value information for at least one year or for a period set in accordance with national regulation.			
4.2.6		**Repeatability**			
		The difference between the successive measurement results is within the appropriate MPE in 2.2.			

Supprimé : of b)

Supprimé : 60 seconds

Use this space to detail remarks from the checklist

BIBLIOGRAPHY

Below are references to Publications of the International Electro-technical Commission (IEC), where mention is made in some of the tests in Annex A. Use these or refer to the most recent issue of the publication valid at the time of testing the instrument.

Ref.	Standards and reference documents	Description
[1]	International Vocabulary of Basic and General Terms in Metrology (VIM), (1993)	Vocabulary, prepared by a joint working group consisting of experts appointed by BIPM, IEC, IFCC, ISO, IUPAC, IUPAP and OIML
[2]	International Vocabulary of Terms in Legal Metrology, BIML, Paris, (2000)	Vocabulary including only the concepts used in the field of legal metrology. These concepts concern the activities of the legal metrology service, the relevant documents as well as other problems linked with this activity. Also included in this Vocabulary are certain concepts of a general character which have been drawn from the VIM.
[3]	OIML B 3, (2003) OIML Certificate System for Measuring Instruments (formerly OIML P1)	Provides rules for issuing, registering and using OIML Certificates of conformity
[4]	OIML D11, (2004) General requirements for electronic measuring instruments	Provides guidance for establishing appropriate metrological performance testing requirements for influence quantities that may affect the measuring instruments covered by International Recommendations
[5]	IEC 60068-2-1, (1990-05) with amendments 1, (1993-02) and 2, (1994-06)	Basic environmental testing procedures - Part 2: Tests, Test Ad: Cold, for heat dissipating equipment under test (EUT), with gradual change of temperature.
[6]	OIML D 19, (1988)	Provides advice, procedures and influencing factors on pattern evaluation and pattern approval
[7]	OIML D 20, (1988) Initial and subsequent verification of measuring instruments and processes	Provides advice, procedures and influencing factors on the choice between alternative approaches to verification and the procedures to be followed in the course of verification
[8]	IEC 60068-2-2, (1974-01) with amendments 1, (1993-02) and 2, (1994-05)	Basic environmental testing procedures, Part 2: Tests, Test Bd: Dry heat, for heat dissipating equipment under test (EUT) with gradual change of temperature.
[9]	IEC 60068-3-1, (1974)	Background information, section 1: Cold and dry heat tests.
[10]	IEC 60068-3-4, (2001-08)	Environmental testing – Part 3-4: Guidance for damp heat tests.

Ref.	Standards and reference documents	Description
[11]	IEC 60068-2-30, (1980-01) with amendment 1, (1985-01)	Environmental testing - Part 2: Tests. Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle).
[12]	ISO 16750-2, (2003)	Road vehicles – Environmental conditions and testing for electrical and electronic equipment. Part 2: Electrical loads.
[13]	IEC 60068-3-8, (2003-08)	Environmental testing: Supporting documentation and guidance – Selecting amongst vibration tests.
[14]	IEC 60068-2-64 Ed. 1.0, (1993-05)	Environmental testing - Part 2: Test methods - Test Fh: Vibration, broad-band random (digital control) and guidance.
[15]	IEC 60068-2-47 Ed. 2.0, (1999-10)	Environmental testing - Part 2-47: Test methods - Mounting of components, equipment and other articles for vibration, impact and similar dynamic tests.
[16]	IEC 60068-2-6 (1995-03), with Corr. 1, (1995-03)	Environmental testing – Part 2: Tests-Test Fc: Vibration (sinusoidal).
[17]	IEC 61000-4-3 consolidated Edition 2.1, (2002-09) with amendment 1, (2001-08)	Electromagnetic Compatibility (EMC) - Part 4: Testing and measurement techniques - Section 3: Radiated, radio-frequency, electromagnetic field immunity test.
[18]	IEC 61000-4-6 (2003-05) with amendment 1, (2004-10)	Electromagnetic Compatibility (EMC) - Part 4: Testing and measurement techniques - Section 6: Immunity to conducted disturbances, induced by radio-frequency fields.
[19]	IEC 61000-4-2, (1995-01) with amendment 1, (1998-01) and amendment 2, (2000-11) Consolidated Edition: IEC 61000-4-2, (2001-04) Ed. 1.2.	Basic EMC Publication. Electromagnetic Compatibility (EMC) - Part 4: Testing and measurement techniques - Section 2: Electrostatic discharge immunity test. Basic EMC Publication.
[20]	ISO 7637-2, (2004)	Road vehicles - Electrical disturbance by conduction and coupling - Part 2: Electrical transient conduction along supply lines only.
[21]	ISO 7637-3, (1995) with correction 1, (1995)	Road vehicles - Electrical disturbance by conduction and coupling - Part 3: Passenger cars and light commercial vehicles with nominal 12 V supply voltage and commercial vehicles with 24 V supply voltage - electrical transient transmission by capacitive and inductive coupling via lines other than supply lines.

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3.14.2 Taximeter compatibility with distance measurement transducer

A taximeter shall be installed in accordance with the manufacturer's installation instructions providing that it with the requirements of this Recommendation, especially the requirements in Clauses 3 for securing and security of operation and suitability for use.
Taximeters shall be installed non-activated, with all metrological and technical parameters set to appropriate and valid default values. Before activation, taximeters shall neither store nor transmit measurement data. During installation, all known parameters shall be pre-set. Taximeters shall be connected to a distance measurement transducer to ensure the correct functioning of the unit to meet the requirements of this OIML Recommendation, especially the requirements in Clause 3. Further information is provided in Annex B.In-serviceerification markings shall be applied in accordance with 3.13.

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24 V	1	-600			
	2a	+50			
	2b	+20			
	3a	-200			
	3b	+200			
	4	-16			

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24 V	Cable/interface:				
	a	-80 V			
	b	+80 V			
	Cable/interface:				
	a	-80 V			
	b	+80 V			
	Cable/interface:				
	a	-80 V			
	b	+80 V			
	Cable/interface:				
	a	-80 V			
	b	+80 V			
	Cable/interface:				
	a	-80 V			
	b	+80 V			