TECHNICAL SPECIFICATION

ISO/TS 15143-3

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Earth-moving machinery and mobile road construction machinery — Worksite data exchange —

Part 3: Telematics data

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Engins de terrassement et machines mobiles de construction de routes — Échange de données sur le chantier —
Partie 3: Données télématiques

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Foreword

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

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

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The committee responsible for this document is Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 3, *Machine characteristics, electrical and electronic systems, operation and maintenance*.

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This part of ISO 15143 is intended to be used in conjunction with ISO 15143-1 and ISO 15143-2.

A list of all parts in the ISO 15143 series can be found on the ISO website.

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Introduction

This document is a data schema having the purpose of providing data directly from the equipment manufacturer or provider to the equipment owner in a standardized format for the use and convenience of equipment owners with mixed fleets of equipment.

It defines a set of web services that provide information about fleets of mobile equipment and their associated telematics data. The information about a fleet is provided as a resource, typically on the Internet, at a known Uniform Resource Location (URL). Any number of fleets can be represented, each with its own URL.

Clients can access these resources by sending HTTPS GET requests to the server at the given location. The server responds with an equipment information document whose vocabulary is defined in this document.

ISO/TC 127/SC 3 wishes to acknowledge the Association of Equipment Manufacturers and the Association of Equipment Management Professionals for their contributions to prior work on this subject.

The goal of this document is to provide direct access by end users to their specific fleet data, and not to enable third parties for data aggregation across end users or other purposes. The use of this document enables each end user or assigned third-party application developer to develop applications for purposes deemed appropriate by the end user.

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Earth-moving machinery and mobile road construction machinery — Worksite data exchange —

Part 3: Telematics data

1 Scope

This document specifies the communication schema designed to provide mobile machinery status data from a telematics provider's server to third-party client applications via the Internet. The data are collected from a mobile machine using telematics data-logging equipment and stored on a telematics provider's server. This document describes the communications records used to request data from the server and the responses from the server containing specified data elements to be used in the analysis of machine performance and health.

It is applicable to mobile earth-moving machinery as defined in ISO 6165 and mobile road construction machinery as defined in ISO 22242 equipped with location and time instrumentation.

It is not applicable to the on-board data collection, on-board communication protocol (e.g. CANbus) or wireless transmission of the mobile machinery data to the telematics provider's server *after* the data have been collected at the data logger. See Figure 1.

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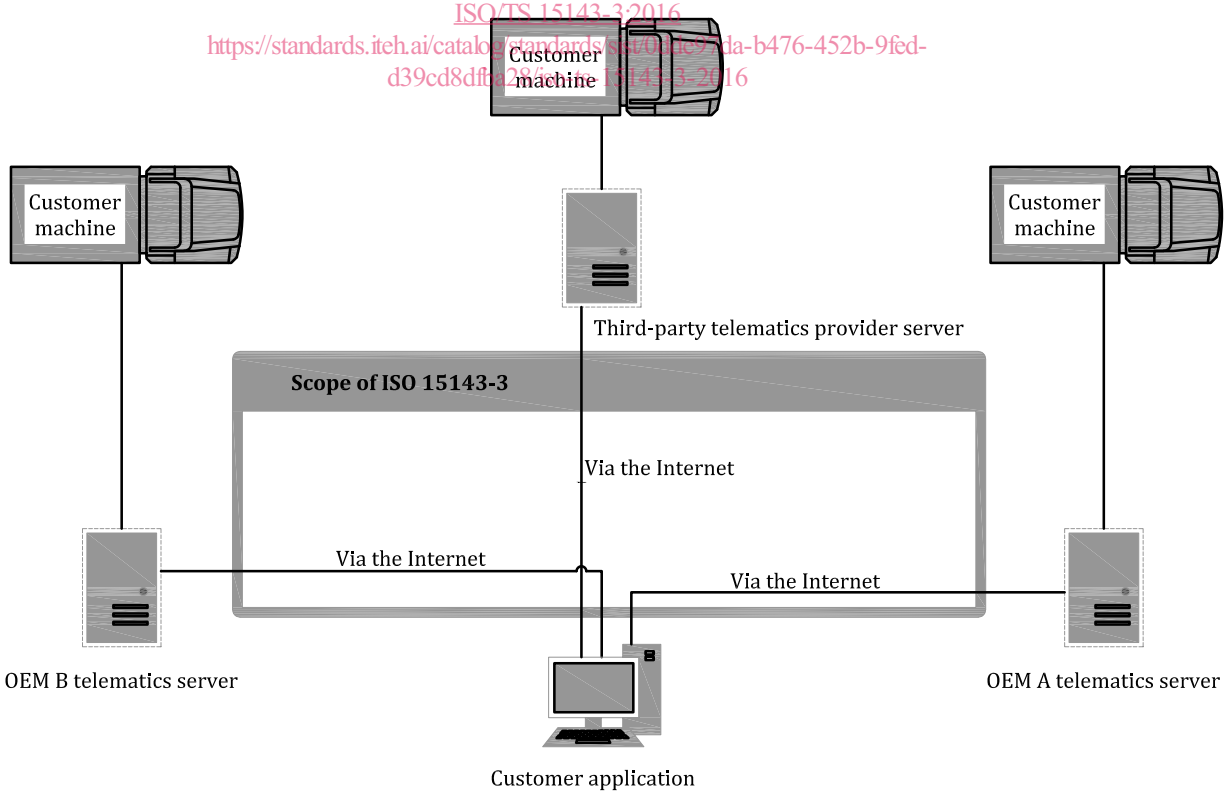

Figure 1 — Topography of conceptual mixed fleet telematics system within the scope of this document

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2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3779, *Road vehicles — Vehicle identification number (VIN) — Content and structure*

ISO 6405-1, *Earth-moving machinery — Symbols for operator controls and other displays — Part 1: Common symbols*

ISO 6405-2, *Earth-moving machinery — Symbols for operator controls and other displays — Part 2: Specific symbols for machines, equipment and accessories*

ISO 8601, *Data elements and interchange formats — Information interchange — Representation of dates and times*

ISO 10261, *Earth-moving machinery — Product identification numbering system*

ISO 15143-1:2010, *Earth-moving machinery and mobile road construction machinery — Worksite data exchange — Part 1: System architecture*

ISO 15143-2:2010, *Earth-moving machinery and mobile road construction machinery — Worksite data exchange — Part 2: Data dictionary*

ECMA-404, *The JSON Data Interchange Format*

IETFRFC 7231, *Hypertext Transfer Protocol (HTTP/1.1): Semantics and Context*

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3 Terms, definitions and abbreviated terms

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For the purposes of this document, the following terms, definitions and abbreviated terms (see Table 1) apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
caution codes referencing number
ISO/IEC symbol registration number as defined in ISO 7000 and referenced in ISO 6405-1

Note 1 to entry: Caution codes referencing numbers are returned from the telematics provider server and refer to standardized symbols representing various conditions present on EMM.

3.2
construction worksite
location of the operation of a fleet of mobile equipment generally identified as construction machines where the machines are used to perform work

3.3
data element
instance of data transmitted by the OEM server to the third-party application adhering to the definition of the quantity or condition described by Clause 11 of this document

3.4
discoverability
requirement that the data be stored in such a manner that it can be accessed if necessary

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3.5
endpoint
address or connection point to the provider's server for a specific API method

Note 1 to entry: Endpoints are associated by a URL.

3.6
end user
organization owning and or operating the mobile machinery

Note 1 to entry: The end user utilizes the telematics data for the purpose of managing the tasks associated with work performed on a construction worksite.

3.7
fault code
set of codes unique to each OEM related to diagnostic trouble codes as defined in SAE J1939-73

Note 1 to entry: Fault codes are defined by the OEM and might not be standardized. The third-party application developer needs to obtain fault code definitions from each OEM.

3.8
Internet media-type
two-part identifier for file formats on the Internet

3.9
link
element to allow the third party or end user to be directed to additional data or resources

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3.10
make code
alphabetic string representing the OEM of a specific piece of equipment

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3.11
model
alphanumeric string representing the machine form type and series as defined by the OEM

3.12
namespace
set of symbols that are used to organize objects of various kinds, so that these objects may be referred to by name

3.13
namespace URI
uniquely named elements and attributes in an XML document

Note 1 to entry: Namespaces are defined in a W3C recommendation. An XML instance might contain element or attribute names from more than one XML vocabulary.

3.14
serial number
alphanumeric string defined by the OEM identifying a specific piece of equipment

Note 1 to entry: The serial number is generally the PIN as defined in ISO 10261.

3.15
snapshot time
date and time at which the snapshot of the fleet was created

3.16
telematics provider
either OEM or third party providing telematics equipment or services

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3.17
time series
sequence of data points, typically consisting of successive measurements made over a period of time

Note 1 to entry: Examples of a time series would be the geospatial position of a piece of equipment or the set of fault codes generated by a piece of equipment over a period of time.

3.18
version
integer that is used to distinguish different versions of the contract

3.19
XML declaration
processing instruction that identifies the document as being XML

Note 1 to entry: All XML documents should begin with an XML declaration, which should be situated at the first position of the first line in the XML document.

Table 1 — Abbreviations and acronyms

API	Application programming interface
DEF	Diesel exhaust fluid
EI	Electronic interface
FMI	Failure mode indicator
GPS	Global positioning system
HREF	Hypermedia reference URL
ID	Identification
IETF	Internet engineering task force
OEM	Original equipment manufacturer
PIN	Product identification number
REL	Reference attribute
SI	*Systeme internationale* (international system of units)
SOAP	Simple object access protocol
SPN	Suspect parameter number
URI	Uniform resource identifier
URL	Universal resource location
URN	Universal Resource Name
UTC	Universal Coordinated Time
UTF-8.EI	Unicode transformation format, 8 bit
VIN	Vehicle Identification Number
XML	Extensible Markup Language

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4 Data management and access control

4.1 Minimum requesting period

The recommended minimum response period from the telematics provider server to the third-party application is one response per 15 min. The data provider may choose to provide the data less often.

The server supplies the last known data to the application independent of the update rate from the machine to the server. The actual call-in times from the machine can vary due to cell coverage, telematics settings, etc., so the last known data can be significantly older and can remain unchanged between server data transmissions to the application.

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4.2 Editing the data elements over time

The data set identified in this document is expected to be modified over time in a controlled fashion as set forth in ISO 15143-1:2010, A.2 with updated .XSD files to be posted at http://standards.iso.org/iso/15143/-3/ as they become available.

4.3 Data element use case

A use case as defined in ISO 15143-1 for each data element defined in this document is presented in Table A.2.

4.4 Data element cross reference

The data element names and attributes identified in this document have been harmonized with similar data elements defined in ISO 15143-2:2010, Table A.1 and further defined in ISO 15143-2:2010, Table A.2. The relationships between the data elements in this document and the related ones in ISO 15143-2 are presented in Annex A.

4.5 Access authentication

Implementers control access via OAuth Version 1.0A or OAuth Version 2.0 using HTTPS, as defined by the Internet engineering task force (IETF). Refer to http://www.ietf.org for additional information.

The telematics provider assigns security credential and access information when the end user registers the fleet. Each telematics provider has its own registration procedure. End users should contact the telematics provider for information on how to register for access to data via this document.

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The response is a full snapshot of the fleet. If the fleet contains no equipment at the time of the snapshot, an empty document is returned. To prevent excessively frequent access, the provider may return "503 Service Unavailable" for requests that are more frequent than one per 15 min interval as expressed in 4.1.

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OAuth provides client applications a secure delegated access to server resources on behalf of a resource owner. It specifies a process for resource owners to authorize third-party access to the server resources without sharing credentials. OAuth allows access tokens to be issued to third-party clients by an authorization server, with the approval of the resource owner, or end-user. The client then uses the access token to access the protected resources hosted by the resource server.

5 Response formats

This international standard recommends and describes the use of either of two representation formats: XML version 1.0 or JSON.

For examples in this document, XML version 1.0 is used. The recommended encoding is UTF-8. XML files are expected to be stand-alone documents. Each endpoint provides its own XML schema, with a common schema being located at http://standards.iso.org/iso/15143/-3/common.xsd. The file or stream that contains one XML document consists of zero or more records. Each record consists of several fields, which are detailed below. An XML document is sent without a wrapper (such as SOAP). Its Internet Media-Type is text/xml. XML is the preferred representation format.

JSON shall be compliant with the ECMA-404 standard representation. Naming conventions for JSON shall follow XML protocols.

If schema validation is required, use of the XML representation formats is recommended.

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6 XML Declaration links to definition segments

XML documents shall begin with an XML declaration which includes the following attributes:

— Namespace 1;

— snapshotTime;

— version;

— Name Space URI.

XML Namespace: XML namespaces provide a simple method for qualifying element and attribute names used in Extensible Markup Language documents by associating them with namespaces identified by URI references.

Declaration Version specifies the version of the XML standard to which the XML document conforms.

The snapshot time is the date and time at which the snapshot of the fleet was created. Its format is described in 11.18.

URL identifies the Internet domain address. < Fleet snapshotTime="2015-05-29T10:57:19Z" version=**"1"** xmlns="http://standards.iso.org/iso/15143/-3"

7 Paging

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Any endpoints that return more than one piece of equipment or list of telematics data shall be paged. This navigation is controlled by the page number parameter present on the endpoint URL. Each endpoint that provides paging shall also include links for easy navigation to the current, previous, next, and last pages. By default, a maximum of 100 records is returned per page.

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8 Discoverability

8.1 General

Integrators using this document are encouraged to discover the data being supplied. For this reason, endpoints presented in this document contain sets of links that allow traversal of pages of data, as well as linking to other endpoints within the standard. This allows a program to travel these links and find the data that is supported for each implementation. There are two classifications of endpoints: snapshot (see 8.2) and time series (see 8.3). Snapshot endpoints return data for a fleet (see 8.2.1) or a single piece of equipment (see 8.2.2).

8.2 Snapshot endpoint

The set of snapshot endpoints listed in 8.2.1 and 8.2.2 use the common schema to provide a snapshot view of a fleet or an individual piece of equipment. A snapshot is a single point in time. Time-series data, such as fault codes and switch status, are not included in the snapshot view.

8.2.1 Fleet snapshot

The snapshot fleet endpoint is defined to be: URL:/Fleet/{pageNumber}. The snapshot fleet endpoint uses the Common Schema. See Annex A.

This endpoint provides a snapshot view of the fleet. This endpoint is paginated with a default of 100 records per page. See Annex C.

The detailed specification of each data element is listed in Clause 11.

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Fleet snapshot data elements defined in this document are listed here:

— Header information (EquipmentHeader);

— Last Known Location (Location);

— Operating Hours (CumulativeOperatingHours);

— Cumulative Fuel Used (FuelUsed);

— Fuel Used in the Preceding 24 hours (FuelUsedLast24);

— Cumulative Distance Travelled (Distance);

— Cumulative Idle Hours (CumulativeIdleHours);

— Fuel Remaining Ratio (FuelRemaining);

— DEF Remaining Ratio (DEFRemaining);

— Engine Condition (EngineStatus);

— Cumulative Power Take Off Hours (CumulativePowerTakeOffHours);

— Average Daily Engine Load Factor (AverageDailyLoadFactorLast24);

— Peak Daily Speed (MaximumSpeedLast24);

— Cumulative Load Count (CumulativeLoadCount);

— Cumulative Payload Total (CumulativePayloadTotals);

— Cumulative Nonproductive Regeneration Hours (CumulativeActiveRegenerationHours);

— Cumulative Non-Productive Idle Hours (CumulativeNonProductiveIdleHours).

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8.2.2 Single-element snapshot

The single-element snapshot endpoint is defined to be: URL: /Fleet/Equipment/{identifier}.

The single-element snapshot uses the Common Schema. See Annex C.

The single-element snapshot provides the same data as the Fleet Snapshot Endpoint, but is limited to a single piece of equipment. This piece of equipment is identified by the inclusion of a PIN or VIN as parameters in the URL.

The PIN or VIN identifier is chosen depending upon the classification of the machine as earth-moving machinery according to ISO 6165 or mobile road construction machinery according to ISO 22242.

The single-element snapshot contains the data elements listed below describing a single piece of equipment. The details of each data element are provided in Clause 11.

Single-element snapshot data elements defined in this document are listed here:

— Header information (EquipmentHeader);

— Last Known Location (Location);

— Operating Hours (CumulativeOperatingHours);

— Cumulative Fuel Used (FuelUsed);

— Fuel Used in the Preceding 24 h (FuelUsedLast24);

— Cumulative Distance Travelled (Distance);

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