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2019-02

Date and time — Representations for information interchange —

Part 1: Basic rules

Date et heure — Représentations pour l'échange d'information —

Partie 1: Règles de base

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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).

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For an explanation of the voluntary nature of standards, 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 154, *Processes, data elements and documents in commerce, industry and administration*.

This first edition of ISO 8601-1, together with ISO 8601-2, cancels and replaces ISO 8601:2004, which has been technically revised.

The main changes compared to ISO 8601:2004 are as follows:

— conversion of the content as Part 1 with the Part title “Basic rules” due to the addition of another Part 2 “Extensions” of ISO 8601;

— replacement of the term “midnight” with “beginning of day”, disallowing the value “24” for hour;

— update of terms and definitions:

  — “time point” is now “time”;

  — “local time” is now “local time of day”;

  — added definition for “time of day” and “local time scale”;

  — updated definitions for “standard time of day”, “local time of day” and “UTC of day” to rely on “time of day”;

  — combined two “day” terms in different domains for consistency;

  — change of the representation of “leap seconds”;

— clarification of “calendar day” expressions intended to mean “calendar day of week” (etc.);

— amendment of the recurring time interval (3.1.1.11) to provide a link to ISO 8601-2:2019 which contains in Clause 5 the “repeat rules for recurring time intervals”.

A list of all parts in the ISO 8601 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The purpose of this document is to provide a standard set of date and time format representations for information interchange, in order to minimize the risk of misinterpretation, confusion and their consequences.

This document specifies a set of date and time format representations utilizing numbers, alphabets and symbols defined in ISO/IEC 646. These representations are meant to be both human recognizable and machine readable.

This document retains the most commonly used expressions for date and time of day and their representations from earlier International Standards in the field, including earlier editions of ISO 8601 and its predecessors.

Date and time — Representations for information interchange —

Part 1: Basic rules

1 Scope

This document specifies representations of dates of the Gregorian calendar and times based on the 24-hour clock, as well as composite elements of them, as character strings for use in information interchange. It is also applicable for representing times and time shifts based on Coordinated Universal Time (UTC).

This document excludes the representation of date elements from non-Gregorian calendars or times not from the 24-hour clock. This document does not address character encoding of representations specified in this document.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and symbols

3.1 Terms and definitions

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

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

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

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

3.1.1 Basic concepts

3.1.1.1
date
time (3.1.1.2) on the *calendar* (3.1.1.18) *time scale* (3.1.1.5)

Note 1 to entry: Common forms of date include *calendar date* (3.1.2.7), *ordinal date* (3.1.2.8) or *week date* (3.1.2.9).

3.1.1.2
time
mark attributed to an *instant* (3.1.1.3) or a *time interval* (3.1.1.6) on a specified *time scale* (3.1.1.5)

Note 1 to entry: The term "time" is often used in common language. However, it should only be used if the meaning is clearly visible from the context.

Note 2 to entry: On a time scale consisting of successive time intervals, such as a *clock* (3.1.1.9) or *calendar* (3.1.1.18), distinct instants may be expressed by the same time.

Note 3 to entry: This definition corresponds with the definition of the term "date" in IEC 60050-113:2011, 113-01-12.

3.1.1.3
instant
point on the *time axis* (3.1.1.4)

Note 1 to entry: An instantaneous event occurs at a specific instant.

[SOURCE: IEC 60050-113:2011, 113-01-08]

3.1.1.4
time axis
mathematical representation of the succession in time according to the space-time model of instantaneous events along a unique axis

Note 1 to entry: According to the theory of special relativity, the time axis depends on the choice of a spatial reference frame.

Note 2 to entry: In IEC 60050-113:2011, 113-01-03, time according to the space-time model is defined to be the one-dimensional subspace of space-time, locally orthogonal to space.

[SOURCE: IEC 60050-113:2011, 113-01-07, modified — The words "according to the space-time" have been added; the phrase "special theory of relativity" has been changed to "theory of special relativity" for clarity; Note 2 to entry has been added.]

3.1.1.5
time scale
system of ordered marks which can be attributed to *instants* (3.1.1.3) on the *time axis* (3.1.1.4), one instant being chosen as the origin

Note 1 to entry: A time scale may amongst others be chosen as:

— continuous, e.g. international atomic time (TAI) (see IEC 60050-713:1998, 713-05-18);

— continuous with discontinuities, e.g. *UTC* (3.1.1.12) due to *leap seconds* (3.1.1.24), *standard time* (3.1.1.14) due to summer time and winter time;

— successive steps, e.g. *calendars* (3.1.1.18), where the *time axis* (3.1.1.4) is split up into a succession of consecutive *time intervals* (3.1.1.6) and the same mark is attributed to all instants of each time interval;

— discrete, e.g. in digital techniques.

[SOURCE: IEC 60050-113:2011, 113-01-11, modified — The words "amongst others" in Note 1 to entry have been added; NOTEs 2 and 3 have been deleted.]

3.1.1.6
time interval
part of the *time axis* (3.1.1.4) limited by two *instants* (3.1.1.3) and, unless otherwise stated, the limiting instants themselves

[SOURCE: IEC 60050-113:2011, 113-01-10, modified — The words "and, unless otherwise stated, the limiting instants themselves" have been added; the NOTEs have been deleted.]

3.1.1.7
time scale unit
unit of measurement of a *duration* (3.1.1.8)

EXAMPLE 1 Calendar year, calendar month and calendar day are time scale units of the Gregorian calendar.

EXAMPLE 2 Clock hour, clock minutes and clock seconds are time scale units of the 24-hour clock.

3.1.1.8
duration
non-negative quantity of time equal to the difference between the final and initial *instants* (3.1.1.3) of a *time interval* (3.1.1.6)

Note 1 to entry: The duration is one of the base quantities in the International System of Quantities (ISQ) on which the International System of Units (SI) is based. The term "time" instead of "duration" is often used in this context and also for an infinitesimal duration.

Note 2 to entry: For the term "duration", expressions such as "time" or "time interval" are often used, but the term "time" is not recommended in this sense and the term "time interval" is deprecated in this sense to avoid confusion with the concept of "time interval".

Note 3 to entry: The exact duration of a *time scale unit* (3.1.1.7) depends on the *time scale* (3.1.1.5) used. For example, the durations of a year, month, week, day, hour or minute, may depend on when they occur [in a *Gregorian calendar* (3.1.1.19), a *calendar month* (3.1.2.19) can have a duration of 28, 29, 30, or 31 days; in a *24-hour clock* (3.1.1.10), a *clock minute* (3.1.2.4) can have a duration of 59, 60, or 61 seconds, etc.]. Therefore, the exact duration can only be evaluated if the exact duration of each is known.

Note 4 to entry: This definition is closely related to NOTE 1 of the terminological entry "duration" in IEC 60050-113:2011, 113-01-13.

3.1.1.9
clock
time scale (3.1.1.5) suited for intra-day time measurements

EXAMPLE The *24-hour clock* (3.1.1.10) is a type of clock.

Note 1 to entry: *clock second* (3.1.2.2), *clock minute* (3.1.2.4) and *clock hour* (3.1.2.6) are often *time scale units* (3.1.1.7) included in a clock.

3.1.1.10
24-hour clock
clock (3.1.1.9) that subdivides a *calendar day* (3.1.2.11) into 24 *clock hours* (3.1.2.6)

Note 1 to entry: *UTC* (3.1.1.12) forms the basis of today's 24-hour clocks and is used in this document as a type of 24-hour clock, as described in 4.2.3.

3.1.1.11
recurring time interval
series of consecutive *time intervals* (3.1.1.6) of identical *duration* (3.1.1.8)

Note 1 to entry: If the duration of the time intervals is measured in *calendar* (3.1.1.18) entities, the duration of each time interval depends on the *calendar dates* (3.1.2.7) of its start and end.

Note 2 to entry: If the starting *instants* (3.1.1.3) of time intervals are repeated according to a set of rules, the "repeat rules for recurring time intervals" in ISO 8601-2:2019, Clause 5 apply.

3.1.1.12
UTC
Coordinated Universal Time
time scale (3.1.1.5) with the same rate as International Atomic Time (TAI), but differing from TAI only by an integral number of *seconds* (3.1.2.1)

Note 1 to entry: UTC is the time standard commonly used across the world from which local time is derived.

Note 2 to entry: UTC is produced by the Bureau International des Poids et Mesures (BIPM), i.e. the International Bureau of Weights and Measures.

Note 3 to entry: TAI is a continuous time scale produced by the BIPM based on the best realizations of the SI second. TAI is a realization of Terrestrial Time (TT) with the same rate as that of TT, as defined by the International Astronomical Union Resolution B1.9 (2000).

[SOURCE: BIPM Recommendation CCTF 3 (2017), modified — The definition of TAI has been included as Note 3 to entry.]

3.1.1.13
UTC of day
time of day (3.1.1.16) in *UTC* (3.1.1.12)

3.1.1.14
standard time
time scale (3.1.1.5) derived from *UTC* (3.1.1.12), by a *time shift* (3.1.1.25) established in a given location by the competent authority

EXAMPLE 1 Some standard times do not vary within a year, such as US Eastern Standard Time (EST), US Eastern Daylight Time (EDT), Australia Western Standard Time (AWST), China Standard Time (CST), Hong Kong Standard Time (HKT), Korea Standard Time (KST) and Japanese Standard Time (JST).

EXAMPLE 2 Some standard times vary within a year, such as US Eastern Time (ET) and Australian Central Standard Time (ACST).

Note 1 to entry: The time shift of a standard time may vary in the course of a year, such as due to daylight savings.

[SOURCE: IEC 60050-113:2011, 113-01-17, modified — The original NOTE has been deleted; EXAMPLE 1 and 2 and Note 1 to entry has been added.]

3.1.1.15
local time scale
locally-applicable *time scale* (3.1.1.5) such as *standard time* (3.1.1.14) or a non-*UTC* (3.1.1.12) based time scale

3.1.1.16
time of day
time (3.1.1.2) occurring within a *calendar day* (3.1.2.11)

Note 1 to entry: Generally, time of day relates to the *duration* (3.1.1.8) elapsed after the beginning of the day. However, this correlation breaks when changes occur in the *time scale* (3.1.1.5) that applies to the time of day, such as *time shifts* (3.1.1.25) and *leap seconds* (3.1.1.24).

Note 2 to entry: This definition corresponds closely with the definition of "clock time" given in IEC 60050-113:2011, 113-01-18, except that the concepts of duration and time scale are not used in this definition.

3.1.1.17
local time of day
time of day (3.1.1.16) in a *local time scale* (3.1.1.15)

3.1.1.18
calendar
time scale (3.1.1.5) that uses the *time scale unit* (3.1.1.7) of *calendar day* (3.1.2.11) as its basic unit

EXAMPLE The *Gregorian calendar* (3.1.1.19) is a type of calendar.

Note 1 to entry: *calendar month* (3.1.2.19) and *calendar year* (3.1.2.21) are time scale units often included in a calendar.

3.1.1.19
Gregorian calendar
calendar (3.1.1.18) in general use that defines a *calendar year* (3.1.2.21) that closely approximates the tropical year

Note 1 to entry: In this document the term "Gregorian calendar" is used to refer to the *time scale* (3.1.1.5) described in 4.2.1.

3.1.1.20
common year
calendar year (3.1.2.21) in the *Gregorian calendar* (3.1.1.19) that has 365 *calendar days* (3.1.2.11)

3.1.1.21
leap year
calendar year (3.1.2.21) in the *Gregorian calendar* (3.1.1.19) that has 366 *calendar days* (3.1.2.11)

Note 1 to entry: A leap year is a calendar year whose year number is divisible by four and is not a *centennial year* (3.1.1.22), or a centennial year whose year number is divisible by four hundred.

3.1.1.22
centennial year
calendar year (3.1.2.21) in the *Gregorian calendar* (3.1.1.19) whose year number is divisible without remainder by one hundred

3.1.1.23
week calendar
calendar (3.1.1.18) based on an unbounded series of contiguous *calendar weeks* (3.1.2.16) that uses the *time scale unit* (3.1.1.7) of calendar week as its basic unit to represent a *calendar year* (3.1.2.21), according to the rule that the first calendar week of a calendar year is the week including the first Thursday of that year, and that the last one is the week immediately preceding the first calendar week of the next calendar year

Note 1 to entry: This rule is based on the principle that a week belongs to the calendar year to which the majority of its *calendar days* (3.1.2.11) belong.

Note 2 to entry: In the week calendar, calendar days of the first and last calendar week of a calendar year may belong to the previous and the next calendar year respectively in the *Gregorian calendar* (3.1.1.19).

Note 3 to entry: The week calendar is described in 4.2.2.

3.1.1.24
leap second
intentional time step of one *second* (3.1.2.1) to adjust *UTC* (3.1.1.12) to ensure appropriate agreement with UT1, a *time scale* (3.1.1.5) based on the rotation of the Earth

Note 1 to entry: See also ITU-R TF.460-6.

Note 2 to entry: An inserted second is called a positive leap second and an omitted second is called a negative leap second. A positive leap second is inserted after [23:59:59Z] and can be represented as [23:59:60Z]. A negative leap second is achieved by the omission of [23:59:59Z]. Insertion or omission takes place as determined by the International Earth Rotation and Reference Systems Service (IERS), normally on 30 June or 31 December, but if necessary on 31 March or 30 September.

3.1.1.25
time shift
constant *duration* (3.1.1.8) difference between *times* (3.1.1.2) of two *time scales* (3.1.1.5)

3.1.2 Time and date units

3.1.2.1
second
base unit of *duration* (3.1.1.8) measurement in the International System of Units (SI)

Note 1 to entry: Second is as defined by the CGPM (Conférence générale des poids et mesures, General Conference on Weights and Measures) on the proposal of the CIPM (Comité international des poids et mesures, International Committee of Weights and Measures).

Note 2 to entry: See also ISO 80000-3.

3.1.2.2
clock second
time scale unit (3.1.1.7) whose *duration* (3.1.1.8) is one *second* (3.1.2.1).

Note 1 to entry: Clock second is in common parlance often referred to as second, however in this document clock second and second have different definitions.

3.1.2.3
minute
duration (3.1.1.8) of 60 *seconds* (3.1.2.1)

Note 1 to entry: See also ISO 80000-3.

Note 2 to entry: The duration of a minute is 60 seconds except if modified by the insertion or deletion of a *leap second* (3.1.1.24).

3.1.2.4
clock minute
time scale unit (3.1.1.7) whose *duration* (3.1.1.8) is one *minute* (3.1.2.3)

Note 1 to entry: Clock minute is in common parlance often referred to as minute, however in this document clock minute and minute have different definitions.

3.1.2.5
hour
duration (3.1.1.8) of 60 *minutes* (3.1.2.3)

Note 1 to entry: See also ISO 80000-3.

3.1.2.6
clock hour
time scale unit (3.1.1.7) whose *duration* (3.1.1.8) is one *hour* (3.1.2.5)

Note 1 to entry: Clock hour is in common parlance often referred to as hour, however in this document clock hour and hour have different definitions.

3.1.2.7
calendar date
particular *calendar day* (3.1.2.11) represented by its *calendar year* (3.1.2.21), its *calendar month* (3.1.2.19) and its *calendar day of month* (3.1.2.13)

3.1.2.8
ordinal date
particular *calendar day* (3.1.2.11) represented by its *calendar year* (3.1.2.21) and its *calendar day of year* (3.1.2.14)

3.1.2.9
week date
particular *calendar day* (3.1.2.11) represented by the *calendar year* (3.1.2.21) to which its *calendar week* (3.1.2.16) belongs, its *calendar week of year* (3.1.2.17) and its *calendar day of week* (3.1.2.12)

3.1.2.10
day
duration (3.1.1.8) of a *calendar day* (3.1.2.11)

Note 1 to entry: The term "day" applies also to the duration of any *time interval* (3.1.1.6) which starts at a certain time of day (3.1.1.16) on a certain calendar day and ends at the same time of day on the next calendar day.

Note 2 to entry: See also ISO 80000-3.

3.1.2.11
calendar day
time scale unit (3.1.1.7) starting at the beginning of the day and ending with the beginning of the next day, the latter being the starting *instant* (3.1.1.3) of the next calendar day

Note 1 to entry: Calendar day is in common parlance often referred to as day, however in this document calendar day and day have different definitions.

Note 2 to entry: The *duration* (3.1.1.8) of a calendar day using the *24-hour clock* (3.1.1.10) is 24 *hours* (3.1.2.5); except if modified by

— the insertion or deletion of *leap seconds* (3.1.1.24), by decision of the IERS, or

— the insertion or deletion of other time intervals, as may be prescribed by local authorities to alter the *time scale* (3.1.1.5) of local time.

3.1.2.12
calendar day of week
day amongst the sequence of *week calendar* (3.1.1.23) days, namely, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday or Sunday

Note 1 to entry: The week calendar is defined in 4.2.2.

3.1.2.13
calendar day of month
ordinal number of a *calendar day* (3.1.2.11) within a *calendar month* (3.1.2.19)

3.1.2.14
calendar day of year
ordinal number of a *calendar day* (3.1.2.11) within a *calendar year* (3.1.2.21)

3.1.2.15
week
duration (3.1.1.8) of a *calendar week* (3.1.2.16)

Note 1 to entry: The term "week" applies also to the duration of any *time interval* (3.1.1.6) which starts at a certain *time of day* (3.1.1.16) at a certain *calendar day* (3.1.2.11) and ends at the same time of day at the same calendar day of the next calendar week.

3.1.2.16
calendar week
time scale unit (3.1.1.7) of seven *calendar days* (3.1.2.11) which begins on Monday and ends on Sunday, according to the *week calendar* (3.1.1.23)

3.1.2.17
calendar week of year
ordinal number of a *calendar week* (3.1.2.16) within a *calendar year* (3.1.2.21) of the *week calendar* (3.1.1.23)

3.1.2.18
month
duration (3.1.1.8) of a *calendar month* (3.1.2.19)

Note 1 to entry: The term "month" applies also to the duration of any *time interval* (3.1.1.6) which starts at a certain *time of day* (3.1.1.16) at a certain *calendar day* (3.1.2.11) of the calendar month and ends at the same time of day at the same calendar day of the next calendar month, if it exists.

Note 2 to entry: In certain applications a month is considered as a duration of 30 calendar days.

3.1.2.19
calendar month
time scale unit (3.1.1.7) resulting from a defined division of a *calendar year* (3.1.2.21), each containing a specific number of *calendar days* (3.1.2.11)

Note 1 to entry: A calendar month is in common parlance often referred to as month, however in this document calendar month and month have different definitions.

3.1.2.20
year
duration (3.1.1.8) of a *calendar year* (3.1.2.21)

Note 1 to entry: In the *Gregorian calendar* (3.1.1.19), a year has 365 or 366 days. The duration is 366 days if the corresponding *time interval* (3.1.1.6) begins February 28 or earlier in a *leap year* (3.1.1.21) or March 2 or later in a year immediately preceding a leap year. If the interval begins February 29 (on a leap year), or March 1 of a year preceding a leap year, the end date has to be agreed on. Otherwise the duration is 365 days.

Note 2 to entry: The term "year" applies also to the duration of any *time interval* (3.1.1.6) which starts at a certain *time of day* (3.1.1.16) at a certain *calendar date* (3.1.2.7) of the calendar year and ends at the same time of day at the same calendar date of the next calendar year with the exception noted in Note 1 to entry.

3.1.2.21
calendar year
time scale unit (3.1.1.7) defined by the *calendar* (3.1.1.18) system

3.1.2.22
decade
time scale unit (3.1.1.7) of 10 *calendar years* (3.1.2.21), beginning with a year whose year number is divisible without remainder by ten

Note 1 to entry: Decade is also used to refer to an arbitrary *duration* (3.1.1.8) of 10 years, however decade is not used as such in this document.

3.1.2.23
century
time scale unit (3.1.1.7) of 100 *calendar years* (3.1.2.21) *duration* (3.1.1.8), beginning with a year whose year number is divisible without remainder by 100

EXAMPLE The 19th century covers the years 1800 through 1899.

Note 1 to entry: Century is also used to refer to an arbitrary duration of 100 years, however century is not used as such in this document.

3.1.3 Representations and formats

3.1.3.1
date and time expression
expression indicating a *time* (3.1.1.2), *time interval* (3.1.1.6) or *recurring time interval* (3.1.1.11)

EXAMPLE '2018-08-01' is a date and time expression that indicates the first day of August of 2018 in the *Gregorian calendar* (3.1.1.19).

3.1.3.2
date and time representation
representation of the format of one or more *date and time expressions* (3.1.3.1)

EXAMPLE [date] is a date and time representation that can be expanded as [year][month][day], which itself can be expanded into [YYYY][MM][DD]; '20180801' is a date and time expression that conforms to this representation.

3.1.3.3
time scale component
representation of a *time scale unit* (3.1.1.7) within a *date and time expression* (3.1.3.1) or *representation* (3.1.3.2)

EXAMPLE 1 *calendar year* (3.1.2.21), *calendar month* (3.1.2.19), *calendar day* (3.1.2.11), *clock hour* (3.1.2.6), *clock minute* (3.1.2.4), *clock second* (3.1.2.2) are time scale components of a *complete representation* (3.1.3.6).

EXAMPLE 2 The calendar year time scale component is considered of a higher order than the calendar month time scale component, which is in turn of a higher order than the calendar day time scale component.

Note 1 to entry: A time scale component is considered of a higher order of another, if the time scale unit it represents has a strictly larger *time interval* (3.1.1.6) than that of another; the latter time scale component is therefore considered to be of a lower order.

Note 2 to entry: Common usage of this term often omits the leading phrase "time scale", such as representing a "time scale component calendar year" by just "calendar year component". This usage is deemed accepted in this document.

3.1.3.4
basic format
date and time representation (3.1.3.2) that does not include separators between its *time scale components* (3.1.3.3)

3.1.3.5
extended format
extension of the *basic format* (3.1.3.4) that includes separators between its *time scale components* (3.1.3.3)

3.1.3.6
complete representation
date and time representation (3.1.3.2) that includes all the *time scale components* (3.1.3.3) associated with the *expression* (3.1.3.1)

3.1.3.7
representation with reduced precision
abbreviation of a *date and time representation* (3.1.3.2) by omission of lower order *time scale components* (3.1.3.3)

3.1.3.8
representation with decimal fraction
expansion of a *date and time representation* (3.1.3.2) by addition of a decimal fraction to the lowest order *time scale component* (3.1.3.3)

3.1.3.9
decimal sign
character used in a *representation with decimal fraction* (3.1.3.8) to separate the integer part from the decimal fraction of a number

Note 1 to entry: The representations of the decimal signs (period or comma) and their usage rules are specified in ISO 80000-1.

3.1.3.10
expanded representation
expansion of a *date and time representation* (3.1.3.2) to allow identification of *calendar dates* (3.1.2.7) where the ordinal number identifying the *calendar year* (3.1.2.21) exceeds four digits

3.2 Symbols

3.2.1 General

Representations and expressions specified in this document make use of the symbols listed in 3.2.2 through 3.2.6.

Representations (also referred to as "format representations") give rise to expressions for dates, times, intervals and recurring intervals.

EXAMPLE 1 [YYYY] is a format representation for a calendar year, where each Y is to be replaced by a single digit creating an expression, for example '1985'.

EXAMPLE 2 The date and time representation [YYYY]["-"][MM]["-"][DD] gives rise to the expression '2003-02-10' which identifies 10 February 2003.

To clearly separate date and time representations from the text, punctuation marks and associated symbols used to describe them, the following symbols are used to demarcate boundaries of expressions and representations in this document:

— single quotation marks enclose expressions (for example '1985'); in some cases they are omitted to reflect the actualities of the examples; they are omitted in Clause 5;

— all individual tokens that are part of a representation are contained between the open and close bracket symbols ("[" and "]");

  EXAMPLE 3 For the date and time representation [YYYY]["-"][MM]["-"][DD], [YYYY], ["-"], [MM], ["-"], and [DD] are individual tokens enclosed by brackets.

— when double quotations marks enclose a string within a representation, that string is literal and becomes part of any expression of that representation.

  EXAMPLE 4 The representation [i]["Y"] represents a positive integer followed by the symbol "Y". '12Y' meaning "12 years" is an expression of that representation.

Quotation marks and brackets are not part of the expression or representation itself and shall be omitted in implementation.

All characters used in date and time expressions and representations are part of the ISO/IEC 646 repertoire, except for "hyphen", "minus" and "plus-minus". In an environment where use is made of a character repertoire based on ISO/IEC 646, "hyphen" and "minus" should be both mapped onto "hyphen-minus".

The character "space" shall not be used in the expressions.

3.2.2 Time scale component symbols

The following time scale component symbols are in implied form, for the representation of date and time.

year time scale component calendar year

month time scale component calendar month

week time scale component calendar week of year

day time scale component calendar day of month

dayk time scale component calendar day of week

dayo time scale component calendar day of year

hour time scale component clock hour

min time scale component clock minute

sec time scale component clock second

dec time scale component decade

cent time scale component century

c(*x*, *y*) time scale component *c* extended to accept a fixed-point number, with *x* digits in the decimal part and *y* digits in the fractional part; for example, [year(6,0)] represents a year time scale component that accepts 6 digits for year; [min(2,3)] represents a minute time scale component that accepts 2 digits in the decimal part and 3 digits in the fraction part, separated by a decimal sign

NOTE If *y* is omitted it is assumed to be zero. Thus [year(6)] means the same as [year(6,0)].

3.2.3 Composite component symbols

date the composite time scale components for the complete representation of a date as determined in 5.2.2.1 a)

dateX the composite time scale components for the complete representation of a date as determined in 5.2.2.1 b)

odate the composite time scale components for the complete representation of an ordinal date of year as determined in 5.2.3.1 a)

odateX the composite time scale components for the complete representation of an ordinal date of year as determined in 5.2.3.1 b)

wdate the composite time scale components for the complete representation of a week date as determined in 5.2.4.1 a)

wdateX the composite time scale components for the complete representation of a week date as determined in 5.2.4.1 b)

shift the composite time scale component for time shift in basic form with hours and minutes, as determined in 4.3.13 a)

shiftH the composite time scale component for time shift in basic hourly form, as determined in 4.3.13 b)

shiftX the composite time scale component for time shift in extended form, as determined in 4.3.13 c)

time the composite time scale components for the complete representation of a time of day as determined in 5.3.1.2 a)

timeX the composite time scale components for the complete representation of a time of day as determined in 5.3.1.2 b)

duration the composite time scale units for the representation of a duration as determined in 5.5.2.2 a) and b)

3.2.4 Symbols used in place of digits or signs

These symbols are used to represent characters in the date and time representations. They are used in representations only, and are replaced by one or more characters, as described, in expressions:

Y a digit used in the time scale component “calendar year”

M a digit used in the time scale component “calendar month”

D a digit used in the time scale component “calendar day”

E a digit used in the time scale component “decade”

C a digit used in the time scale component “century”

W a digit used in the time scale component “calendar week”

h a digit used in the time scale component “clock hour”

m a digit used in the time scale component “clock minute”

s a digit used in the time scale component “clock second”

n a positive integer, may be left absent to signify an unbounded value

i a positive integer

± a plus sign [“+”] to represent a positive value or zero (the plus sign shall not be omitted), or a minus sign [“-”] otherwise

3.2.5 Designator symbols

These symbols are used to represent designators in the date and time expressions:

“H” the hours designator, following a data element which represents the number of hours in a duration expression

“M” the months or minutes designator, following a data element which represents the number of months or minutes in a duration expression

NOTE Although “M” can be used to designate months or minutes, its meaning is unambiguous in expressions because the time portion of a duration statement is preceded by the character “T”.

“P” the duration designator, preceding the component which represents the duration

NOTE The use of the character “P” is based on the historical use of the term “period” for duration.

“R” the recurring time interval designator

“S” the seconds designator, following a data element which represents the number of seconds in a duration expression

“T” the time designator, which indicates

— the start of the representation of local time of day to designate local time of day expressions as such;

— the start of the representation of the time of day in date and time of day expressions;

— the start of the representation of the number of hours, minutes or seconds in expressions of duration

“Y” the years designator, following a data element which represents the number of years in a duration expression

"W" the week designator, following a data element which represents the ordinal number of a calendar week within the calendar year

"Z" the UTC designator, added to the end of a time representation to indicate that a time of day is represented as UTC of day

NOTE The use of character "Z" comes from its commonly known relationship with the "zero meridian", and its usage in the military and navigation as "Zulu time" which was inherited from GMT (Greenwich Mean Time).

"*x*" the representation of character "*x*" according to the textual representation of *"x"* in the ISO/IEC 646 repertoire

3.2.6 Separator symbols

In date and time expressions and date and time representations, the following characters are used as separators.

"-" (hyphen) the "-" hyphen character, in extended format, separates the time scale components for "year" and "month", "year" and "week", "year" and "day", "month" and "day", and "week" and "day".

":" (colon) the ":" colon character, in extended format, separates the time scale components for "hour" and "minute", and "minute" and "second".

"/" (solidus) the "/" solidus character separates start and end times in the representation of a time interval, as well as the symbol 'R' from the remainder of a recurring time interval representation.

NOTE A solidus may be replaced with a double hyphen ["--"] by mutual agreement of the communicating partners.

"." (period), "," (comma) the "." period and "," comma characters are decimal sign used to separate the integer part from the decimal fraction of a number.

4 Fundamental principles

4.1 Basic rules

This document gives a set of rules for the representation of

— dates and times,

— date and time intervals, and

— recurring intervals.

Both accurate and approximate representations can be identified by means of unique and unambiguous expressions specifying the relevant dates, times of day and durations. The degree of precision required and obtainable can be varied by including or deleting the appropriate time scale components (such as seconds).

The decreasing order of time scale components, left-to-right, is common to these representations.

4.2 Time scales

4.2.1 The Gregorian calendar

This document uses the Gregorian calendar for the identification of calendar days.

The Gregorian calendar provides a time scale consisting of a series of contiguous calendar years, each identified by a year number represented by an integer, greater than that of the immediately preceding calendar year by 1. This document allows the identification of calendar years by their year number for years both before and after the introduction of the Gregorian calendar.

The Gregorian calendar distinguishes common years of 365 consecutive calendar days and leap years of 366 consecutive calendar days.

In the Gregorian calendar each calendar year is divided into 12 sequential calendar months, each consisting of a specific number of calendar days as indicated in Table 1. Usage of the Gregorian calendar for identifying dates preceding its introduction (15 October 1582) should only be by mutual agreement of the communicating partners.

Table 1 — Calendar months

Calendar month number	Calendar month name	Number of days in the calendar month	Ordinal dates of calendar days in a common calendar year	Ordinal numbers of calendar days in a leap calendar year
01	January	31	001 to 031	001 to 031
02	February	28 (leap year 29)	032 to 059	032 to 060
03	March	31	060 to 090	061 to 091
04	April	30	091 to 120	092 to 121
05	May	31	121 to 151	122 to 152
06	June	30	152 to 181	153 to 182
07	July	31	182 to 212	183 to 213
08	August	31	213 to 243	214 to 244
09	September	30	244 to 273	245 to 274
10	October	31	274 to 304	275 to 305
11	November	30	305 to 334	306 to 335
12	December	31	335 to 365	336 to 366

4.2.2 The week calendar

This document allows the use of the week calendar time scale for the identification of calendar days within a week.

This time scale is based on an unbounded series of contiguous calendar weeks. The calendar week number identifies the calendar week within the calendar year. Each calendar week has seven calendar days as indicated in Table 2.

The reference point of the time scale assigns Saturday to 1 January 2000.

Table 2 — Calendar days within a week

Ordinal day number in the week	Name of day in the week
1	Monday
2	Tuesday
3	Wednesday
4	Thursday

Table 2 *(continued)*

Ordinal day number in the week	Name of day in the week
5	Friday
6	Saturday
7	Sunday

NOTE When identifying a calendar day using a calendar year, a calendar week of year number and a calendar day of week, it is possible that the resulting calendar day belong to another calendar year in the Gregorian calendar. The week calendar as applied to the Gregorian calendar do not always match. For example, the first day of 2019 Week 1 (a Monday) is 2018-12-31.

4.2.3 The 24-hour clock

This document uses the 24-hour clock for identification of times within a calendar day, where the duration of a calendar day is defined as 24 clock hours, the duration of a clock hour as 60 clock minutes, and the duration of a clock minute generally as 60 clock seconds (except when insertion or omission of a leap second occurs).

Intra-day time scales provide marks which, except in case of discontinuities (e.g. daylight savings time), represent the duration elapsed after the start of the calendar day. These marks are referred to as time of day and are expressed in terms of the number of hours elapsed after the beginning of the day, the number of minutes elapsed after the last full hour, the integral number of seconds elapsed after the last full minute and, if applicable, the fractional part of the last full second. (Alternatively, the marks can be expressed in terms of the number of hours with fractional part of hour with no minute or second component, or hours and minutes with fractional part of minute, with no second component.)

4.3 Time scale components and units

4.3.1 General

Time scale units are represented in two forms within this document:

a) implied form;

b) explicit form.

In this document, time scale components for date and time are represented in implied form. Time scale units for duration (see 5.5.2) are represented in explicit form.

4.3.2 Calendar year and years duration

The Gregorian calendar defines a calendar year to be either 365 or 366 days, which begins on January 1 and ends on December 31. Each Gregorian calendar year can be identified by a 4-digit ordinal number beginning with '0000' for year zero, through '9999'.

The calendar year and years duration are represented as follows:

a) Implied: [YYYY]

EXAMPLE 1 '1985' (calendar year 1985)

b) Explicit: [i]["Y"]

EXAMPLE 2 '12Y' (twelve years)

The number of digits may exceed 4 in the case of expanded representation, in which case the year number may be preceded by a minus sign to indicate a year preceding year zero.

4.3.3 Calendar month and months duration

In the Gregorian calendar, each calendar month within its calendar year is identified by a specific name, and represented by a two-digit ordinal number from '01' for January to '12' for December.

The calendar month and months duration are represented as follows:

a) Implied: [MM]

EXAMPLE 1 '12' (calendar month December)

b) Explicit: [i]["M"]

EXAMPLE 2 '8M' (8 months)

4.3.4 Calendar week number and weeks duration

In the week calendar, the calendar week of year is identified by a two-digit ordinal number from '01' for the first calendar week through '52' or '53', depending on the number of calendar weeks in that calendar year.

The calendar week number and weeks duration are represented as follows:

a) Implied: ["W"][WW]

EXAMPLE 1 'W03' (calendar week three)

b) Explicit: [i]["W"]

EXAMPLE 2 '10W' (ten weeks)

4.3.5 Calendar day of month and days duration

In the Gregorian calendar, the calendar day of month is represented by a two-digit ordinal number identifying the calendar day within a calendar month from '01', identifying the first calendar day of a calendar month, through '28', '29', '30' or '31' (depending on the month), identifying the last day of the month.

See 4.2.1 for the names of the months of the calendar year in the Gregorian calendar, listed in their order of occurrence, for their number of days, and for the ordinal dates of the days in common years and leap years.

The calendar day of month and days duration are represented as follows:

a) Implied: [DD]

EXAMPLE 1 '25' (25th day of the calendar month)

b) Explicit: [i]["D"]

EXAMPLE 2 '25D' (25 days)

4.3.6 Calendar day of week

In the week calendar, the calendar day of week is represented by a single digit ordinal number identifying a calendar day within a week, from '1', identifying Monday through '7', identifying Sunday.

The calendar day of week is represented as the following time scale component:

a) Implied: [K]

EXAMPLE '1' (calendar day of week Monday)

b) Explicit: Not applicable

4.3.7 Calendar day of year

In the Gregorian calendar, the calendar day of year is represented by a three-digit ordinal number identifying the calendar day within a calendar year, from '001', identifying January 1, through '365' (common year) or '366' (leap year), identifying December 31.

The calendar day of year is represented as the following time scale component:

a) Implied: [OOO]

EXAMPLE '350' (ordinal day 350 of the calendar year)

b) Explicit: Not applicable

4.3.8 Clock hour and hours duration

In the 24-hour clock, a clock hour is identified by a two-digit ordinal number from '00', identifying the first hour, through '23', identifying the last hour of a calendar day.

Clock hour and hours duration are represented as follows:

a) Implied: [hh]

EXAMPLE 1 '12' (12 clock hours past start of calendar day)

b) Explicit: [i]["H"]

EXAMPLE 2 '6H' (six hours)

4.3.9 Clock minute and minutes duration

In the 24-hour clock, a clock minute is identified by a two-digit ordinal number from '00', identifying the first minute, to '59', identifying the last minute of a clock hour.

Clock minute and minutes duration are represented as follows:

a) Implied: [mm]

EXAMPLE 1 '30' (30 clock minutes past start of clock hour)

b) Explicit: [i]["M"]

EXAMPLE 2 '30M' (30 minutes)

4.3.10 Clock second and seconds duration

In the 24-hour clock, a clock second is represented by a two-digit ordinal number from '00', identifying the first second, to '58', '59' or '60', identifying the last second of a clock minute ('58' with a negative leap second, '59' without a leap second, '60' with a leap second).

Clock second and seconds duration are represented as follows:

a) Implied: [ss]

EXAMPLE 1 ‘40’ (40 clock seconds past start of clock minute)

b) Explicit: [i][“S”]

EXAMPLE 2 ‘30S’ (30 seconds)

4.3.11 Decade

The decade is represented as the following time scale component:

a) Implied: [YYY]

EXAMPLE ‘196’ (the 1960s)

b) Explicit: Not applicable

Decade shall be expressed only by mutual agreement of the communicating partners.

4.3.12 Century

The century is represented as the following time scale component:

a) Implied: [YY]

EXAMPLE ‘19’ (the 1900s)

b) Explicit: Not applicable

4.3.13 Time shift

A time shift, often used in the representation of local standard time against UTC, is represented as follows:

a) Basic, hours and minutes: [±][hour][min] or [“Z”]

EXAMPLE 1 ‘+0500’ or ‘Z’

b) Basic, hours only: [±][hour] or [“Z”]

EXAMPLE 2 ‘+05’ or ‘Z’

c) Extended, hours and minutes: [±][hour][“:”][min] or [“Z”]

EXAMPLE 3 ‘+05:00’ or ‘Z’

The UTC designator ["Z"] indicates that there is no time shift from UTC of day and is functionally equivalent to the expressions ‘+0000’ and ‘+00:00’. The time shift shall be expressed as positive (i.e. with the leading plus sign [“+”]) if it is ahead of or equal to UTC, and as negative (i.e. with the leading minus sign [“-”]) if it is behind UTC.

4.4 Expansion

By mutual agreement of the communicating partners, it is permitted to expand the component identifying the calendar year, which is otherwise limited to four digits. This enables reference to dates where the calendar year identifier exceeds four digits.

4.5 Leading zeros

If a time scale component in an implied representation has a fixed length, leading zeros shall be used as required.

EXAMPLE The calendar month January is expressed as '01', not '1'.

5 Date and time representations

5.1 General

This clause provides date and time representations which describe date and time expressions.

Examples for date and time representations described in this clause and their expressions can be found in Annex A.

5.2 Date

5.2.1 General

For ease of comparison, in the following examples of representations of dates, the date of 12 April 1985 is used as an illustration, if applicable.

5.2.2 Calendar date

5.2.2.1 Complete representations

The complete representation of a calendar date shall be as follows.

a) Basic format [year][month][day]

EXAMPLE 1 19850412

b) Extended format [year]["-"][month]["-"][day]

EXAMPLE 2 1985-04-12

The representation defined in a) is referred to as [date] and that of b) as [dateX] as described in 3.2.3.

5.2.2.2 Representations with reduced precision

If in a given application it is sufficient to express a calendar date with less precision than a complete representation as specified in 5.2.2.1, either two, four, five or six digits may be omitted, the omission starting from the rightmost digit. The resulting representation indicates a calendar month, a calendar year, a decade or a century, as set out below. When only [day] is omitted, a separator shall be inserted between [year] and [month], but separators are not used in the other reduced precision representations.

a) A specific calendar month

Basic format:	Not applicable		
Extended format:	[year]["-"][month]	EXAMPLE 1	1985-04

b) A specific calendar year

Basic format:	[year]	EXAMPLE 2	1985

Extended format: Not applicable

c) A specific decade

Basic format: [dec] EXAMPLE 3 198 (years 1980 through 1989)

Extended format: Not applicable

d) A specific century

Basic format: [cent] EXAMPLE 4 19 (years 1900 through 1999)

Extended format: Not applicable

5.2.2.3 Expanded representations

If, by agreement, expanded representations are used, the formats shall be as specified below. The interchange parties shall agree on the additional number of digits in the time scale component year. (Decade and century are automatically extended by the same number of digits.)

In the examples below it has been agreed to expand the time scale component year with two digits.

a) A specific calendar day

Basic format: [±][year(6)][month][day]

EXAMPLE 1 +0019850412

Extended format: [±][year(6)]["-"][month]["-"][day]

EXAMPLE 2 +001985-04-12

b) A specific calendar month

Basic format: Not applicable

Extended format: [±][year(6)]["-"][month]

EXAMPLE 3 +001985-04

c) A specific calendar year

Basic format: [±][year(6)]

EXAMPLE 4 +001985

Extended format: Not applicable

d) A specific decade

Basic format: [±][dec(5)]

EXAMPLE 5 +00198

Extended format: Not applicable

e) A specific century

Basic format: [±][cent(4)]

EXAMPLE 6 +0019

Extended format: Not applicable

5.2.3 Ordinal date

5.2.3.1 Complete representations

A complete representation of an ordinal date shall be as follows.

a) Basic format: [year][dayo]

EXAMPLE 1 1985102

b) Extended format: [year]["-"][dayo]

EXAMPLE 2 1985-102

5.2.3.2 Expanded representations

If by agreement, expanded representations are used, the formats shall be as specified below. The interchange parties shall agree on the additional number of digits in the time scale component year.

In the examples below it has been agreed to expand the time scale component year with two digits.

a) Basic format: [±][year(6)][dayo]

EXAMPLE 1 +001985102

b) Extended format: [±][year(6)]["-"][dayo]

EXAMPLE 2 +001985-102

5.2.4 Week date

5.2.4.1 Complete representations

A complete representation of a week date shall be as follows.

a) Basic format: [year]["W"][week][dayk]

EXAMPLE 1 1985W155

b) Extended format: [year]["-"]["W"][week]["-"][dayk]

EXAMPLE 2 1985-W15-5

5.2.4.2 Representations with reduced precision

The time scale component calendar day of week may be omitted from the representation in 5.2.4.1.

a) Basic format: [year]["W"][week]

EXAMPLE 1 1985W15

b) Extended format: [year]["-"]["W"][week]

EXAMPLE 2 1985-W15

5.2.4.3 Expanded representations

If by agreement, expanded representations are used, the formats shall be as specified below. The interchange parties shall agree on the additional number of digits in the time scale component year.

In the examples below it has been agreed to expand the time scale component year with two digits.

a) A specific day

Basic format: [±][year(6)]["W"][week][dayk]

EXAMPLE 1 +001985W155

Extended format: [±][year(6)]["-"]["W"][week]["-"][dayk]

EXAMPLE 2 +001985-W15-5

b) A specific week

Basic format: [±][year(6)]["W"][week]

EXAMPLE 3 +001985W15

Extended format: [±][year(6)]["-"]["W"][week]

EXAMPLE 4 +001985-W15

5.3 Time of day

5.3.1 Local time of day

5.3.1.1 General

Representations of local time of day as defined below make no provisions to prevent ambiguities in expressions that result from discontinuities in the local time scale (e.g. daylight-saving time). When the need arises to prevent these ambiguities, the representations provided in 5.3.4.2 may be useful.

NOTE In accordance with 5.3.5, some of the examples for extended formats below have the prefixed time designator ["T"] omitted.

5.3.1.2 Complete representations

A complete representation of local time of day shall be as follows.

a) Basic format: ["T"][hour][min][sec]

EXAMPLE 1 T232050

b) Extended format: ["T"][hour][":"][min][":"][sec]

EXAMPLE 2 T23:20:50

5.3.1.3 Representations with reduced precision

The time scale component second, or the time scale components of both second and minute, may be omitted from the representation in 5.3.1.2.

a) A specific hour and minute

Basic format:	[“T”][hour][min]
EXAMPLE 1	T2320
Extended format:	[hour][“:”][min]
EXAMPLE 2	23:20

b) A specific hour

Basic format:	[“T”][hour]
EXAMPLE 3	T23
Extended format:	Not applicable

5.3.1.4 Representations with decimal fraction

A decimal fraction of hour, minute or second may be included in a representation. If included, lower order time scale components (if any) shall be omitted and the decimal fraction shall be divided from the integer part by the decimal sign. If the magnitude of the number is less than one, the decimal sign shall be preceded by two zeros.

The interchange parties shall agree upon the maximum number of digits in the decimal fraction, indicated below as “y” (in the examples below, y=1). The format shall be [hhmmss,s], [hhmm,m] or [hh,h] as appropriate (hour minute second, hour minute and hour, respectively). A decimal fraction shall have at least one digit.

a) A specific hour, minute and second and a decimal fraction of the second

Basic format:	[“T”][hour][min][sec(2,y)]
EXAMPLE 1	T232030,5
Extended format:	[hour][“:”][min][“:”][sec(2,y)]
EXAMPLE 2	23:20:30.5

b) A specific hour and minute and a decimal fraction of the minute

Basic format:	[“T”][hour][min(2,y)]
EXAMPLE 3	T2320,8
Extended format:	[hour][“:”][min(2,y)]
EXAMPLE 4	23:20,8

c) A specific hour and a decimal fraction of the hour

Basic format: ["T"][hour(2, y)]

EXAMPLE 5 T23.3

Extended format: Not applicable

5.3.2 Beginning of the day

The complete representations in basic and extended format for the beginning of the day, in accordance with 5.3.1, are as follows:

a) Basic format: T000000 (in the format of 5.3.1.2 a))

b) Extended format: 00:00:00 or T00:00:00 (in the format of 5.3.1.2 b))

NOTE 'T' is always present in basic format. For extended format, 'T' can be omitted for a time-only expression but is included for a date-and-time expression.

The representations may have reduced precision in accordance with 5.3.1.3 or may omit the time designator in accordance with 5.3.5. To represent the beginning of the day the representations may be expanded with a decimal fraction containing only zeros in accordance with 5.3.1.4.

For information interchange there is no representation of end of day. It is recognized that the expression '24:00:00' is used as a natural language expression to denote end of a day; but for the benefit of clarity, '24' shall not be used to represent hour in accordance with this document.

5.3.3 UTC of day

Representations specified in 5.3.1.2 through 5.3.1.4 shall be used to express UTC of day, followed immediately, without space, by the UTC designator ["Z"]. The examples below are complete and reduced precision representations of the UTC of day 20 minutes and 30 seconds past 23 hours:

a)	Basic format:	["T"][hour][min][sec]["Z"]	EXAMPLE 1	T232030Z
		["T"][hour][min]["Z"]	EXAMPLE 2	T2320Z
		["T"][hour]["Z"]	EXAMPLE 3	T23Z
b)	Extended format:	[hour][":"][min][":"][sec]["Z"]	EXAMPLE 4	23:20:30Z
		[hour][":"][min]["Z"]	EXAMPLE 5	23:20Z
		(for hours-only expressions, extended format is not applicable)		

5.3.4 Local time scale and UTC

5.3.4.1 Time shift between local time scale and UTC

The time shift between the local time scale and UTC can be expressed in hours and minutes, or hours only. The minutes time scale component of the difference may be omitted only if the time shift between the time scales is an integral number of hours.

a)	Basic format:	[shift]	EXAMPLE 1	+0100
		[shiftH]	EXAMPLE 2	+01
b)	Extended format:	[shiftX]	EXAMPLE 3	+01:00
		(for hours-only expressions, extended format is not applicable)		

5.3.4.2 Local time of day with the time shift between local time scale and UTC

To express time of day along with the time shift between the local time scale and UTC, the time shift (expressed in hours-and-minutes, or hours-only) shall be appended, without space, to the local time of day.

The complete representation of the time of 27 minutes and 46 seconds past 15 hours locally in Geneva (in winter one hour ahead of UTC) and in New York (in winter five hours behind UTC), together with the indication of the time shift between the local time scale and UTC, are used as examples.

a) Basic format:

[time][shift]	EXAMPLE 1	T152746+0100
		T152746-0500
[time][shiftH]	EXAMPLE 2	T152746+01
		T152746-05

b) Extended format:

[timeX][shiftX]	EXAMPLE 3	15:27:46+01:00
		15:27:46-05:00
[timeX][shiftH]	EXAMPLE 4	15:27:46+01
		15:27:46-05

Local time of day may be expressed with reduced precision as defined in 5.3.1.3, and a decimal fraction may be expressed as defined in 5.3.1.4.

5.3.5 Omissions of time designator

In time-only expressions, UTC of day expressions and time of day with time shift expressions, the time designator ["T"] may be omitted in the representations defined in 5.3 only when there is no risk of confusion.

EXAMPLE ["T"] is necessary for disambiguating the expressions '1920' and 'T1920'; as '1920' expresses a calendar year, 'T1920' expresses a time of day consisting of clock hours and clock minutes.

NOTE Due to expression distinction, the time designator ["T"] is not necessary in extended formats.

5.4 Date and time of day

5.4.1 General

A time can be expressed by combining a date expression — a calendar date (5.2.2), ordinal date (5.2.3) or week dates (5.2.4) — with a time of day expression.

The date is followed (without space) by ["T"] followed (without space) by the time, optionally including the time shift designator. The date part of a date and time expression shall be complete. The time may be incomplete (see 5.3.1.3).

5.4.2 Complete representations

5.4.2.1 Complete representations for calendar date and time of day

The following are complete representations of calendar dates:

a)	Basic format:	[date]["T"][time]	EXAMPLE 1	19850412T232030
		[date]["T"][time]["Z"]	EXAMPLE 2	19850412T232030Z
		[date]["T"][time][shift]	EXAMPLE 3	19850412T232030+0400
		[date]["T"][time][shiftH]	EXAMPLE 4	19850412T232030+04
b)	Extended format:	[dateX]["T"][timeX]	EXAMPLE 5	1985-04-12T23:20:30
		[dateX]["T"][timeX]["Z"]	EXAMPLE 6	1985-04-12T23:20:30Z
		[dateX]["T"][timeX][shiftX]	EXAMPLE 7	1985-04-12T23:20:30+04:00
		[dateX]["T"][timeX][shiftH]	EXAMPLE 8	1985-04-12T23:20:30+04

5.4.2.2 Complete representations for ordinal date and time of day

The following are complete representations of ordinal dates:

a)	Basic format:	[odate]["T"][time]	EXAMPLE 1	1985102T232030
		[odate]["T"][time]["Z"]	EXAMPLE 2	1985102T232030Z
		[odate]["T"][time][shift]	EXAMPLE 3	1985102T232030+0400
		[odate]["T"][time][shiftH]	EXAMPLE 4	1985102T232030+04
b)	Extended format:	[odateX]["T"][timeX]	EXAMPLE 5	1985-102T23:20:30
		[odateX]["T"][timeX]["Z"]	EXAMPLE 6	1985-102T23:20:30Z
		[odateX]["T"][timeX][shiftX]	EXAMPLE 7	1985-102T23:20:30+04:00
		[odateX]["T"][timeX][shiftH]	EXAMPLE 8	1985-102T23:20:30+04

5.4.2.3 Complete representations for week date and time of day

The following are complete representations of week dates:

a)	Basic format:	[wdate]["T"][time]	EXAMPLE 1	1985W155T232030
		[wdate]["T"][time]["Z"]	EXAMPLE 2	1985W155T232030Z
		[wdate]["T"][time][shift]	EXAMPLE 3	1985W155T232030+0400
		[wdate]["T"][time][shiftH]	EXAMPLE 4	1985W155T232030+04
b)	Extended format:	[wdateX]["T"][timeX]	EXAMPLE 5	1985-W15-5T23:20:30

[wdateX]["T"][timeX]["Z"]	EXAMPLE 6	1985-W15-5T23:20:30Z
[wdateX]["T"][timeX][shiftX]	EXAMPLE 7	1985-W15-5T23:20:30+04:00
[wdateX]["T"][timeX][shiftH]	EXAMPLE 8	1985-W15-5T23:20:30+04

5.4.3 Representations other than complete

A complete date expression (including expanded representations) followed by ["T"], may be followed by a reduced precision time of day expression — local time of day (5.3.1), UTC of day (5.3.3) or local time of day with time shift (5.3.4.2). The entire expression shall either be completely in basic format or completely in extended format.

The following are examples of combinations of date and reduced precision time of day expressions:

a) Calendar date and local time of day

Basic format:	[date]["T"][hour][min]
EXAMPLE 1	19850412T1015
Extended format:	[dateX]["T"][hour][":"][min]
EXAMPLE 2	1985-04-12T10:15

b) Ordinal date and UTC of day

Basic format:	[date]["T"][hour][min]["Z"]
EXAMPLE 3	1985102T1015Z
Extended format:	[dateX]["T"][hour][":"][min]["Z"]
EXAMPLE 4	1985-102T10:15Z

c) Week date and local time of day with the time shift between local time scale and UTC

Basic format:	[wdate]["T"][hour][min][shift]
EXAMPLE 5	1985W155T1015+0400
Extended format:	[wdateX]["T"][hour][":"][min][shift]
EXAMPLE 6	1985-W15-5T10:15+04

5.5 Time interval

5.5.1 Means of specifying time intervals

A time interval shall be expressed in one of the following ways:

a) by a start and an end;

b) by a start and a duration;

c) by a duration and an end.

NOTE By mutual agreement of the communicating partners, if the start or end of a time interval is supplied out of band, an expression of duration can be sufficient to express a time interval.

A solidus ["/"] shall be used as a separator to separate the two components specified in a), b) and c).

For expression of a time interval by a start and an end, higher order time scale components may be omitted from the "end of time interval", provided that the resulting expression is unambiguous. In this case the omitted higher order components from the "start of time interval" expression apply.

EXAMPLE 1 '2018-01-15/02-20' represents '2018-01-15/2018-02-20' as the expression '02-08' is unambiguously the last two time components, i.e. a calendar month and a calendar day.

Representations for time zones and UTC included with the component preceding the separator shall be assumed to apply to the component following the separator, unless a corresponding alternative is included.

EXAMPLE 2 '2018-01-15+05:00/2018-02-20' is equivalent to '2018-01-15+05:00/2018-02-20+05:00' as the '+05:00' time shift also applies to the expression after the separator.

5.5.2 Duration

5.5.2.1 General

Duration can be expressed by a combination of units — years, months, weeks, days, hours, minutes and seconds — with designators. A duration expression shall begin with ["P"].

5.5.2.2 Complete representation

The complete representation of the expression for duration shall be one of:

a) ["P"][i]["Y"][i]["M"][i]["D"]["T"][i]["H"][i]["M"][i]["S"];

b) ["P"][i]["W"].

5.5.2.3 Representations other than complete

For representations other than complete, the following rules apply.

a) If the number of years, months, days, hours, minutes or seconds in the representation of 5.5.2.2 a) equals zero, the number and the corresponding designator may be absent; however, at least one number and its designator shall be present.

b) The lowest order component may have a decimal fraction. The decimal fraction shall be divided from the integer part by the decimal sign. It shall have one or more digits; if the magnitude of the number is less than one, the decimal sign shall be preceded by a zero (see ISO 80000-1).

c) The usage of the time designator ["T"] is as specified in 5.3.5.

5.5.2.4 Alternative format

By mutual agreement of the communicating partners, duration may be expressed in conformity with the complete representations used for date (as specified in 5.2.2.1, 5.2.3.1) and time (as specified in 5.3.1.2).

The representation of duration in the alternative format is as follows:

a) Basic format:

["P"][date]["T"][time]	EXAMPLE 1	P00020110T223355
["P"][odate]["T"][time]	EXAMPLE 2	P0002178T223355

b) Extended format:

[“P”][dateX][“T”][timeX]	EXAMPLE 3	P0002-01-10T22:33:55
[“P”][odateX][“T”][timeX]	EXAMPLE 4	P0002-178T22:33:55

NOTE The above examples are equivalent to and are alternative formats for the expression ‘P2Y1M10DT22H33M55S’.

5.5.3 Complete representations

5.5.3.1 Representations of time intervals identified by start and end

A complete representation of a time interval, identified by its start and its end, combines two complete date and time of day representations (as defined in 5.4.2), provided that the resulting expression is either consistently in basic format or consistently in extended format.

a) Basic format:	[date][“T”][time][“/”][date][“T”][time]	
EXAMPLE 1	19850412T232050/19850625T103000	
b) Extended format:	[dateX][“T”][timeX][“/”][dateX][“T”][timeX]	
EXAMPLE 2	1985-04-12T23:20:50/1985-06-25T10:30:00	

NOTE The above examples represent a time interval beginning at 20 minutes and 50 seconds past 23 hours on 12 April 1985 local time of day and ending at 30 minutes past 10 hours on 25 June 1985 local time of day.

5.5.3.2 Representations of time interval identified by start and duration

A complete representation of a time interval, identified by its start and its duration, combines a complete date and time of day representation (5.4.2) with a complete representation of duration (5.5.2).

a) Basic format:	[date][“T”][time][“/”][duration]	
EXAMPLE 1	19850412T232050/P1Y2M15DT12H30M0S	
b) Extended format:	[dateX][“T”][timeX][“/”][duration]	
EXAMPLE 2	1985-04-12T23:20:50/P1Y2M15DT12H30M0S	

NOTE The above examples represent a time interval of 1 year, 2 months, 15 days, 12 hours and 30 minutes, beginning on 12 April 1985 at 20 minutes and 50 seconds past 23 hours local time of day.

5.5.3.3 Representations of time interval identified by duration and end

A complete representation of a time interval, identified by its duration and its end, combines a complete representation of the duration (5.5.2) with a complete representation of date and time of day (5.4.2).

a) Basic format:	[duration][“/”][date][“T”][time]	
EXAMPLE 1	P1Y2M15DT12H30M0S/19850412T232050	
b) Extended format:	[duration][“/”][dateX][“T”][timeX]	
EXAMPLE 2	P1Y2M15DT12H30M0S/1985-04-12T23:20:50	

NOTE The above examples represent a time interval of 1 year, 2 months, 15 days, 12 hours and 30 minutes, ending on 12 April 1985 at 20 minutes and 50 seconds past 23 hours local time of day.

5.5.3.4 Other complete representations

In 5.5.3.1 through 5.5.3.3 representations are shown using calendar date, local time of day and duration units. Other complete representations are found by making the following substitutions in each of 5.5.3.1 through 5.5.3.3:

a) where representations include calendar dates (see 5.2.2.1), a complete representation of ordinal dates (see 5.2.3.1) or of week dates (see 5.2.4.1) may be substituted;

b) where representations include a local time of day component (see 5.3.1), a time shift (see 4.3.13) may be appended.

5.5.4 Representations other than complete

A representation of a time interval, where the representation of the start, end or duration is other than complete, shall be considered a representation other than complete of the time interval.

5.6 Recurring time interval

5.6.1 Means of specifying recurring time intervals

A recurring time interval shall be expressed in one of the following ways:

a) by a number of recurrences (optional), followed by a start and an end which identify the first time interval;

b) by a number of recurrences (optional), followed by a start and a duration which identify the first time interval;

c) by a number of recurrences (optional), followed by a duration and an end which identify the last time interval.

In all cases, if the number of recurrences is absent, the number of occurrences is unbounded.

NOTE 1 In some applications, a recurring time interval is expressed by a number of recurrences (optional) and duration alone, because either the start or end is supplied out-of-band.

NOTE 2 ISO 8601-2:2019, Clause 5 extends this clause by adding a rule to define the repeat pattern.

5.6.2 Separators and designators

A recurring time interval is expressed according to the following rule.

All representations shall

— start with the recurring time interval designator [“R”];

— be followed, without spaces, by the number of recurrences, if present, represented below as [n] (which may be omitted, in which case the number of recurrences is unbounded);

— be followed, without spaces, by a solidus [“/”];

— be followed, without spaces, by the expression of a time interval as per 5.5.1.

5.6.3 Complete representations

A complete representation of a recurring time interval is as follows: