# Detailed Rule concerned with units of ECALS Dictionary

[Rule Number : ECALSDS08]

Version 2.7

Abstract: This rule specifies the extended range and detailed rule about the unit set for the 'Description Rule of Property Dictionary'.

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## 1. Purpose and Scope

(1) Purpose

This rule specifies the extended range and detailed rule about the unit set for the ‘Description Rule of Property Dictionary’.

(2) Scope

This rule is applied to Property Dictionary and EXCEL Dictionary Files.

(3) Normative References

- ISO31: 1992 General principles concerning quantities, units and symbols
- ISO1000: 1992 SI units and recommendations for the use of their multiples and certain other units Amendment 1 (1998)
- IEC61360-1: 1995 Standard data element types with associated classification scheme for electric components—Part1:Definitions-Principles and methods
- JIS Z 8203:2000 (ISO1000:1992)
- JIS X 0124:1993

## 2. Available units in ECALS Dictionary

(1) SI Units

Available units are SI base units, SI derived units and units that are accepted for use with SI base units.

(a) SI base Units

The International System of Units (SI) is founded on seven SI base units shown in Appendix 1.

(b) SI Derived Units

SI derived units are obtained from the seven SI basic units. The unit is combined using the symbol of the multiplying and dividing method in mathematics.

Ex) Electric field strength: V/m  Moment: N.m  Resistance: Ω

(c) Units which are accepted for use with SI base unit

Ex) Time: min, h, d  Mass: t  Volume: l(liter)

(2) Authorized Units by Technical Committee for Standardization

(a) Mass unit ‘g’ is accepted to use

Mass unit adopted in ECALS Dictionary is "kg" or "g." When "g" is used as a mass unit, it is recommended to add a note in the ‘Remark’ of the Property, ‘Pay attention to ‘g’ is not SI unit.’

Reason: ‘kg’ must be requested to use as SI basic unit. But it is confusing in some case.
Ex) mkg (milli-kilogram , milli-kilo-gram ?).

(b) Area unit ‘$mm^2$’ and ‘$cm^2$’ are accepted to use

Ex.1) (mm**2)
Ex.2) kg/cm**2

Note: Describe it so that it may not be confused with a prefix.

(c) Reasonable Units to be approved in connecting with a prefix.

A customary unit consists of a unit that contains a prefix in a denominator. When this unit system is divided into a basic unit and a prefix, it will lose an original meaning. In this case it is allowed to use the customary unit.

Ex.1) Accepted: A customary unit for throughput: V/micro.s
Unaccepted: Based on a rule, a prefix M(Mega) and a unit V/s is connected.

Ex2) Accepted: A customary unit for Gate Power Consumption: W/MHz
Unaccepted: Based on a rule, a prefix micro and a unit W/Hz is connected.

Reason: When a unit contains a prefix in a denominator, the unit having the prefix becomes very important. In many cases, converting a prefix in the denominator into the equivalent one in the numerator will lose the original meaning.

(d) 10**-6

It is allowed to use a 10**-6 unit and ‘ppm’ to represent an extremely small value.

Ex1) Frequency tolerance: 10**-6 (QUARTZ CRYSTAL UNITS)
Ex2) Temperature Coefficient of Cap: 10**-6/Cel (CERA-CAP, CLASS1)
Ex3) Frequency Aging: 10**-6/year (QUARTZ CRYSTAL UNITS)

Note: it is allowed to use ‘10**-6’ as a description of ‘ppm’ in case of using customary in a class. It is not allowed to use ‘10-**6’ and ‘ppm’ in a same category (Class).

## 3. Prefix

Use a prefix defined by SI unit. Basically Prefix is not included in Unit in ECALS Dictionary. Unit with Prefix can be used only when it is allowed in this rule.

When the DataType is ‘IntC’, ’ IntM’, ‘RealC’ or ‘RealM’, it is allowed to describe a value with Prefix. However in case of ‘Int’ or ‘Real’ DataType, it is not allowed to use Prefix in a value.

## 4. How to describe a Unit.

(1) A first formulation which is defined in JIS X 0124:1993 should be used as a rule.

Ex) Time unit(Second) in ECALS Dictionary
Accepted: ‘s’ Unaccepted ‘sec’

(2) A plural form and period are unavailable for description of Unit.
Period ‘.’ is used as a sign of multiplication.

(3) Describe in alphabets for Greek characters.
Ex) Resistance: Ω description: Ohm

(4) How to use an Upper case / a Lower case for the first letter of Unit
Normally, a Lower case is used. If the Unit is a proper noun, the first letter should be an Upper case.

(5) A period can be inserted between two letters for a multiple units. If there is no room to misunderstand, a period can be omitted.
Ex) torque: N.m or Nm

(6) In case of a unit which has an exponential expression
It is represented a unit with a number followed by the unit symbol
Ex) $A^2s$→A2s

To make it clearer, two asterisks (**) are following a unit, then a number follows asterisks.
Ex) $m^2$→ m**2

Even though JIS X 0124:1993 uses a unit symbol like m2, exponential symbols are used in ECALS Dictionary.

(7) A quotient of a unit can be expressed with inserting a slash between a numerator and a denominator.
Ex) Velocity : m/s

(8) In case of more complicated formulation, parentheses '()' should be used to avoid misunderstanding.
Ex) Thermal conductor: W/(m.K)
sensitivity: V/(lx.s)
compressed density: N/m**(3/2)

Note )

1. Technical Committee for Standardization (TCS) is the only authority who is able to modify and withdraw ECALSDS08.
2. This specification was opened to the public.
3. Revision history

| Date | Status | Version /Revision | Major changes |
|---|---|---|---|
| 2001/ 3/14 | Published | 001-01 | |
| 2002/10/23 | Revised | 002-01 | ・ Clauses are modified.<br>・ A purpose and a scope are added.<br>・ An example of units is deleted. A list of units is added. |
| 2003/ 6/17 | Revised | 002-02 | ・ Table 2.1 in Appendix 2 is modified. |
| 2004/12/01 | Revised | 002-03 | ・ Totally reviewed |
| 2005/ 4/28 | Revised | 002-04 | ・ Change of disclosure scope. |
| 2005/ 5/20 | Revised | 002-05 | ・ Modification of Table 2.1 in Appendix 2 |
| 2005/ 7/28 | Revised | 002-06 | ・ Modification of Table 2.1 in Appendix 2 |
| 2005/10/25 | Revised | 002-07 | ・ Modification of Table 2.1 in Appendix 2 |

## Appendix 1. Unit system (excerpt from JIS Z 8203:2000)

### 1. Structure of Unit System

Fig1.1 shows the structure of the Units system. The SI consists of elements described in table 1.1, table 1.2 and table 1.4.

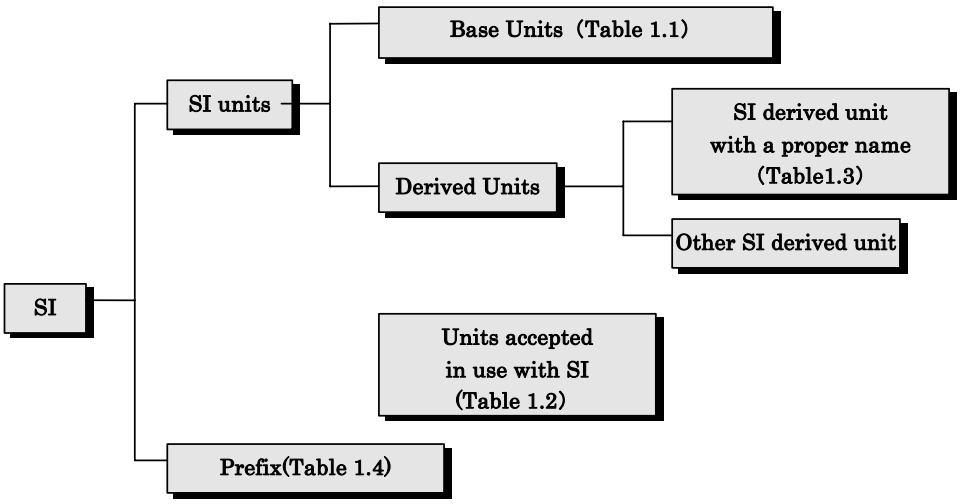


Fig. 1.1 Structure of Unit system

Table 1.1 SI Base Units

| Base quantity | Name | Symbol |
|---|---|---|
| Length | meter | m |
| Mass | kilogram | kg |
| Time | second | s |
| Electric Current | ampere | A |
| Thermodynamic temperature | kelvin | K |
| Amount of substance | mole | mol |
| Luminous intensity | candela | cd |

Table 1.2 Units accepted in use with the SI

| Base quantity | Name | Symbol |
|---|---|---|
| Time | minute<br>hour<br>day | min<br>h<br>d |
| Plane angle | degree<br>minute<br>second | °<br>′<br>″ |
| Volume | liter | l, L |
| Mass | metric ton<br>(tonne) | t |

Table 1.3 SI derived units with a proper name

| Base quantity | Name | Symbol | Expression in terms of SI base units and SI derived units |
|---|---|---|---|
| Plane angle | radian | rad | 1rad=1m/m=1 |
| Solid angle | steradian | sr | $1sr=1m^2/m^2=1$ |
| Frequency | Hertz | Hz | $1Hz = 1s^{-1}$ |
| Force | Newton | N | $1N = 1kg·m/s^2$ |
| Pressure, stress | Pascal | Pa | $1Pa = 1N/m^2$ |
| Energy, work,<br>Quantity of heat | Joule | J | 1J = 1N·m |
| Power,<br>Radiant flux | Watt | W | 1W = 1J/s |
| Electric charge,<br>Quantity of electricity | Coulomb | C | 1C = 1A·s |
| Electric potential,<br>Potential difference,<br>Tension,<br>Electromotive force | Volt | V | 1V = 1J/C |
| Capacitance | Farad | F | 1F = 1C/V |
| Electric resistance | Ohm | Ω | $1Ω = 1V/A$ |
| Electric conductance | Siemens | S | $1S = 1Ω^{-1}$ |
| Magnetic flux | Weber | Wb | 1Wb = 1V·s |
| Magnetic flux density | Tesla | T | $1T = 1Wb/m^2$ |
| Inductance | Henry | H | 1H = 1Wb/A |
| Celsius temperature | degree<br>Celsius | ℃ | 1℃ = 1K |
| Luminous flux | lumen | lm | 1 lm = 1 cd·sr |

| | | | |
|---|---|---|---|
| Illuminance | lux | lx | 1 lx = 1 $lm/m^2$ |
| Activity( of a radionuclide ) | Becquerel | Bq | 1Bq = 1 $s^{-1}$ |
| Absorbed dose, Specific energy imparted, Kerma | Gray | Gy | 1Gy = 1J/kg |
| Dose equivalent | Sievert | Sv | 1Sv = 1J/kg |

Table 1.4 SI prefixes

| | Prefix | | |
|---|---|---|---|
| Factor | Name | Symbol | Description |
| $10^{18}$ | Exa | E | E |
| $10^{15}$ | Peta | P | P |
| $10^{12}$ | Tera | T | T |
| $10^{9}$ | Giga | G | G |
| $10^{6}$ | Mega | M | M |
| $10^{3}$ | Kilo | k | k |
| $10^{2}$ | Hecto | h | h |
| 10 | Deca | da | da |
| $10^{-1}$ | Deci | d | d |
| $10^{-2}$ | Centi | c | c |
| $10^{-3}$ | Milli | m | m |
| $10^{-6}$ | Micro | $\mu$ | micro |
| $10^{-9}$ | Nano | n | n |
| $10^{-12}$ | Pico | p | p |
| $10^{-15}$ | Femto | f | f |
| $10^{-18}$ | Atto | a | a |

Note): prefixes more than10**21 and less than 10**-21 are omitted

## Appendix 2 List of units used in ECALS Dictionary

Table 2.1 List of units used in ECALS Dictionary

| Name of Unit | Symbol | Usage |
|---|---|---|
| Parts per million | $10^{-6}$ | 10**-6 |
| Percentage | % | % |
| % per degree Celsius | %/℃ | %/Cel |
| Parts per million per milli-Tesla | $(10^{-6})$/ (mT) | (10**-6)/ (mT) |
| Square millimeter | $mm^2$ | (mm**2) |
| Per degree Celsius | 1/℃ | 1/Cel |
| Parts per million per degree Celsius | $10^{-6}$/℃ | 10**-6/Cel |
| Parabolic coefficient | $10^{-6}$/$℃^2$ | 10**-6/Cel**2 |
| Parts per million per kelvin | $10^{-6}$/K | 10**-6/K |
| Parts per million per meter | $10^{-6}$/m | 10**-6/m |
| Parts per million per year | $10^{-6}$/year | 10**-6/year |
| Ampere | A | A |
| Ampere per meter | A/m | A/m |
| Ampere per million instructions per second | A/MIPS | A/MIPS |
| Ampere per volt | A/V | A/V |
| Square Ampere second | $A^2s$ | A2s |
| Bit | bit | bit |
| Bit per second | bit/s | bit/s |
| Byte | byte | byte |
| Coulomb | C | C |
| Candela | cd | cd |
| Candela per square meter | cd/$m^2$ | cd/m**2 |
| Degree Celsius | ℃ | Cel |
| Degree Celsius per Watt | ℃/W | Cel/W |
| Channel | ch | ch |
| Character per second | character/s | character/s |
| Column | column | column |
| Character per inch | cpi | cpi |
| Cycle | cycle | cycle |
| Decibel | dB | dB |
| Decibel per meter | dB/m | dB/m |
| Decibel per Pascal | dB/Pa | dB/Pa |
| Decibel per Carrier | dBc | dBc |
| Milli-Watt decibel | dBm | dBm |
| Angle | deg | deg |
| Dot | dot | dot |
| Dot per inch | dot/inch | dot/inch |
| Dot per millimeter | dot/mm | dot/mm |

| | | |
|---|---|---|
| Dot per second | dot/s | dot/s |
| Farad | F | F |
| Farad per meter | F/m | F/m |
| Frequency per second | f/s | f/s |
| Gram | g | g |
| Gram per cubic meter | $g/m^3$ | g/m**3 |
| Gal | Gal | Gal |
| Hour | h | h |
| Henry | H | H |
| Hertz | Hz | Hz |
| Hertz meter | Hz.m | Hz.m |
| Hertz per Volt | Hz/V | Hz/V |
| Joule | J | J |
| Joule per kilogram kelvin | J/(kg.K) | J/(kg.K) |
| Joule per cubic meter | $J/m^3$ | J/m**3 |
| Kelvin | K | K |
| Kilogram per square centimeter | $kg/cm^2$ | kg/cm**2 |
| Kilogram per cubic meter | $kg/m^3$ | kg/m**3 |
| Line | line | line |
| Line per second | line/s | line/s |
| Least significant bit | LSB | LSB |
| Lux second | lx.s | lx.s |
| Meter | m | m |
| Per meter | $m^{-1}$ | m**-1 |
| Meter per second | m/s | m/s |
| Meter per Volt | m/V | m/V |
| Mean character between failure lines | MCBF lines | MCBF lines |
| Megahertz kilometer | MHz.km | MHz.km |
| Million instructions per second | MIPS | MIPS |
| Newton | N | N |
| Torque | Nm | N.m |
| Newton per cubic root meter | $N/m^{3/2}$ | N/m**(3/2) |
| Ohm | Ω | Ohm |
| Ohm meter | Ωm | Ohm.m |
| Ohm per meter | Ω/m | Ohm/m |
| Pascal | Pa | Pa |
| Pixel | pixel | pixel |
| Parts per million | ppm | ppm |
| Parts per million per degree Celsius | ppm/℃ | ppm/Cel |
| Pulse | pulse | pulse |
| Revolution per minute | r/min | r/min |
| Radian | rad | rad |
| Second | s | s |

| | | |
|---|---|---|
| Electric conductance(Siemens) | S | S |
| Tesla | T | T |
| Track per millimeter | tpmm | tpmm |
| Turn | turn | turn |
| Volt | V | V |
| Volt Ampere | VA | V.A |
| Volt per root Hertz | $V/(Hz^{1/2})$ | V/(Hz**(1/2)) |
| Volt per Lux second | V/(lx.s) | V/(lx.s) |
| Volt per micro second | V/(μs) | V/(micro.s) |
| Volt per degree Celsius | V/℃ | V/Cel |
| Volt per meter | V/m | V/m |
| Volt per second | V/s | V/s |
| Volt meter per Newton | Vm/N | Vm/N |
| Watt | W | W |
| Watt per meter Kelvin | W/(m.K) | W/(m.K) |
| Watt per Ampere | W/A | W/A |
| Watt per degree Celsius | W/℃ | W/Cel |
| Watt per Hertz | W/Hz | W/Hz |
| Watt per kilogram | W/kg | W/kg |
| Watt per cubic meter | $W/m^3$ | W/m**3 |
| Word | word | word |
| Year | year | year |