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Railway applications — Heating, ventilation and air conditioning systems for rolling stock —

Part 1: Terms and definitions

Applications ferroviaires — Systèmes de chauffage, ventilation et climatisation pour le matériel roulant —

Partie 1: Termes et définitions

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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).

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This document was prepared by Technical Committee ISO/TC 269, *Railway applications*, Subcommittee SC 2, *Rolling stock*.

A list of all parts in the ISO 19659 series can be found on the ISO website.

Introduction

The ISO 19659 series defines terms, thermal comfort, energy efficiency and system installation of heating, ventilation and air conditioning (HVAC) for rolling stock.

The purpose of this document is to standardize the terms, definitions, symbols and abbreviated terms used throughout trains systems for the cooling, heating and internal air circulation that are commonly known as heating, ventilation and air conditioning (HVAC). These can be broken down into multiples of these functions and as an example, ventilation and air conditioning (VAC), etc.

Railway applications — Heating, ventilation and air conditioning systems for rolling stock —

Part 1: Terms and definitions

1 Scope

This document is applicable to rail vehicles and specifies the terms, definitions, symbols and abbreviated terms to be used in the ISO 19659 series, heating, ventilation and air conditioning for rolling stock.

2 Normative references

There are no normative references in this document.

3 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:

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

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

3.1 HVAC system

3.1.1 Function

3.1.1.1
cooling
process which enables the interior temperature to be lowered or maintained

3.1.1.2
pre-cooling
process which enables the interior temperature to be lowered (without the presence of passengers)

3.1.1.3
dehumidification
process which removes water vapour from air to reduce the absolute humidity

[SOURCE: ISO/TR 16344:2012, 2.1.32, modified — “relative humidity” has been changed to “absolute humidity”.]

3.1.1.4
heating
process which enables the interior temperature to be raised or maintained

3.1.1.5
pre-heating
process which enables the interior temperature to be raised (without the presence of passengers)

3.1.1.6
supplementary heating
additional *heating* (3.1.1.4) which provides support for the HVAC system

Note 1 to entry: This can also be referred to as "auxiliary heating".

3.1.1.7
ventilation
movement of fresh (outside) air to and/or recirculating air in an enclosed space

3.1.1.8
natural air ventilation
air circulation generated without a mechanical action

3.1.1.9
forced air ventilation
air circulation generated by a mechanical action

3.1.1.10
emergency ventilation
ventilation (3.1.1.7) if main power source has failed

3.1.1.11
filtering
process which removes particles from the air

3.1.1.12
purifying
process which removes non-particulate contaminants from the air

Note 1 to entry: Odours and pathogens are examples of non-particulate contaminants from the air.

3.1.1.13
heat recovery
process which transfers heat (latent/sensible) between *fresh air* (3.4.1) and *exhaust air* (3.4.10)

3.1.2 Position

3.1.2.1
centralized system
system which consists of one set of *HVAC unit* (3.1.3.1) per car

3.1.2.2
decentralized system
system which consists of two or more sets of *HVAC unit* (3.1.3.1) per car

Note 1 to entry: This can also be referred to as "dispersed system".

3.1.3 Equipment

3.1.3.1
HVAC unit
unit intended for *cooling* (3.1.1.1) and/or *dehumidification* (3.1.1.3) and/or *heating* (3.1.1.4), and/or *ventilation* (3.1.1.7)

3.1.3.2
controller unit
unit which operates the HVAC system in a predetermined behaviour while exchanging data with external devices

3.1.3.3
cooling unit
system which provides *cooling* (3.1.1.1)

Note 1 to entry: See Figure 2 to Figure 5.

3.1.3.4
heating unit
system which provides *heating* (3.1.1.4)

Note 1 to entry: See Figure 2 to Figure 5.

3.1.3.5
supplementary heater
heater that carries out a *heating* (3.1.1.4) function in a decentralized manner either associated with *forced air ventilation* (3.1.1.9) or not

Note 1 to entry: This can also be referred to as "auxiliary heater".

Note 2 to entry: This can include floor heater, roof heater, body side heater, entrance heater, duct heater, etc.

Note 3 to entry: See Figure 5.

3.1.3.6
total heat exchanger
device using temperature and humidity difference to recover energy

3.1.3.7
ventilation unit
system ensuring *ventilation* (3.1.1.7)

Note 1 to entry: See Figure 3.

3.1.3.8
exhaust air fan
exhaust air unit
device or unit providing the extraction of air by mechanical action to the outside

Note 1 to entry: See Figure 4.

3.1.3.9
supplementary fan
device installed outside of *HVAC unit* (3.1.3.1) to move the air locally

Note 1 to entry: See Figure 3.

3.1.3.10
booster fan
supplementary fan (3.1.3.9) used to compensate (part of) the pressure drop inside air ducts

3.1.3.11
pressure protection device
device providing protection against undue vehicle interior tympanic pressure variations caused by exterior pressure variations

3.1.3.12
pressure protection fan
device providing pressure protection while maintaining a certain degree of *ventilation* (3.1.1.7)

3.1.3.13
ducting
installations that guide air flows

3.1.3.14
air diffuser
device for blowing the air in one or more directions while reducing the air velocity

3.1.3.15
air grille
device that provides physical protection, yet allows air to pass through

3.1.3.16
silencer
device to reduce air borne noise

3.1.4 Operation

3.1.4.1
automatic mode
automatic operating mode
operating mode of control in which the HVAC system operates in accordance with the programme data until stopped by the programme or the operator

[SOURCE: ISO 13041-1:2004, 3.3.4, modified and adapted to HVAC system]

3.1.4.2
cooling mode
operating mode in which the *HVAC unit* (3.1.3.1) provides *cooling* (3.1.1.1)

3.1.4.3
forced cooling mode
mode which manually operates *HVAC unit* (3.1.3.1) *cooling mode* (3.1.4.2)

3.1.4.4
pre-cooling mode
mode which enables the interior temperature to be lowered (without the presence of passengers)

3.1.4.5
free cooling mode
operating mode in which the HVAC system provides *cooling* (3.1.1.1) by only introducing *fresh air* (3.4.1)

3.1.4.6
heating mode
operating mode in which the HVAC system provides *heating* (3.1.1.4)

3.1.4.7
heat pump mode
mode which can heat the interior by altering the heat emission and removal from the *heat exchangers* (3.2.3.5) by changing the *refrigerant* (3.2.3.3) flow

3.1.4.8
forced heating mode
mode which manually operates *HVAC unit* (3.1.3.1) *heating mode* (3.1.4.6)

3.1.4.9
pre-heating mode
mode which enables the interior temperature to be raised (without the presence of passengers)

3.1.4.10
ventilation mode
mode which provides *ventilation* (3.1.1.7) only

3.1.4.11
frost protection mode
mode to raise temperatures and avoid interior freezing

3.1.4.12
degraded mode
operation of the HVAC system with defined limitations in performance

3.1.4.13
power save mode
mode which actively reduces its power consumption by allowing parameters to change

Note 1 to entry: Set point and *fresh air* (3.4.1) are examples of parameters.

3.1.4.14
standby mode
mode under which a predetermined interior temperature range is maintained during non-operational activity of the vehicle

3.1.4.15
emergency mode
mode which provides reduced *ventilation* (3.1.1.7), *heating* (3.1.1.4) and/or *cooling* (3.1.1.1) if the main power source has failed

3.1.4.16
maintenance mode
mode used for the purpose of maintenance activities which calls up automatic predefined testing

3.1.4.17
test mode
mode used for the purpose of test activities which calls up a specified routine or requires some specific testing during maintenance

3.1.4.18
washing mode
mode for external cleaning of train

3.1.5 Performance

3.1.5.1
cooling capacity
enthalpy reduction between the *fresh air* (3.4.1) and/or *return air* (3.4.11) on one hand and *primary air* (3.4.4) on the other hand in a defined interval of time

3.1.5.2
pre-cooling time
time needed for lowering the interior temperature to *pre-cooling* (3.1.1.2) set point

3.1.5.3
heating capacity
enthalpy elevation between the *fresh air* (3.4.1) and/or *return air* (3.4.11) on one hand and *primary air* (3.4.4) on the other hand which can be supported by the *supplementary heater* (3.1.3.5) in a defined interval of time

3.1.5.4
pre-heating time
time needed for increasing the interior temperature to *pre-heating* (3.1.1.5) set point

3.1.5.5
design conditions
specified exterior/interior boundary conditions under which the *thermal comfort* (3.7.1) parameters need to be achieved

3.1.5.6
rated conditions
set of operating conditions specified in a contractual/technical specification

3.1.5.7
standard rating conditions
mandatory condition that is used for marking and for comparison or certification purposes

[SOURCE: ISO 13612-2:2014, 3.40]

3.1.5.8
extreme conditions
specified exterior/interior boundary conditions beyond the *design conditions* (3.1.5.5) under which the functionality of the HVAC system installation is maintained but *thermal comfort* (3.7.1) parameters do not need to be achieved

3.1.5.9
volume flow
volumetric air flow rate which passes per unit time

3.1.5.10
water tightness
ability of the closed test specimen to resist water penetration

[SOURCE: ISO 15821:2007, 3.6]

3.2 HVAC unit

3.2.1 Type

3.2.1.1
compact HVAC unit
unit where all *refrigerant* (3.2.3.3) components are installed in the same location

Note 1 to entry: This can also be referred to as “packaged” or “self-contained”.

3.2.1.2
split HVAC unit
unit where *refrigerant* (3.2.3.3) components are installed in different locations

3.2.2 Location

3.2.2.1
roof mounted
mounted on the roof

Note 1 to entry: See Figure 1 a).

3.2.2.2
roof embedded
installed in the roof

Note 1 to entry: See Figure 1 b).

3.2.2.3
ceiling mounted
installed between the ceiling and the roof

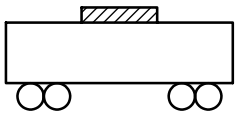
Note 1 to entry: See Figure 1 c).

3.2.2.4
on floor mounted
mounted on the floor

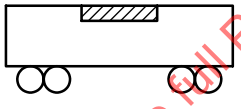
Note 1 to entry: See Figure 1 d).

3.2.2.5
under floor mounted
installed within the underframe

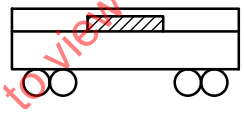
Note 1 to entry: See Figure 1 e).



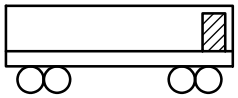
a) roof mounted (3.2.2.1)



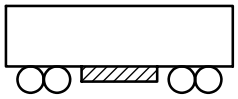
b) roof embedded (3.2.2.2)



c) ceiling mounted (3.2.2.3)



d) on floor mounted (3.2.2.4)



e) underfloor mounted (3.2.2.5)

Figure 1 — Diagram explaining the HVAC unit location

3.2.3 Components and parameters

3.2.3.1
air handling unit
group of components designed to move, filter and/or mix, heat and/or cool the air

Note 1 to entry: See Figure 2 to Figure 5.

3.2.3.2
compressor condenser unit
part of the *HVAC unit* (3.1.3.1) where heat is dissipated

3.2.3.3
refrigerant
fluid used for heat transfer in a refrigerating circuit

[SOURCE: ISO 817:2014, 3.1.35, modified — " system" has been replaced by "circuit".]

3.2.3.4
compressor
device for mechanically increasing the pressure of a refrigerant vapour

[SOURCE: ISO 5149-1:2014, 3.4.2]

3.2.3.5
heat exchanger
device designed to transfer heat between two physically separated fluids

[SOURCE: ISO 5149-1:2014, 3.4.3]

3.2.3.6
condenser
heat exchanger (3.2.3.5) in which refrigerant vapour is liquefied by removal of heat

[SOURCE: ISO 5149-1:2014, 3.4.4]

3.2.3.7
evaporator
heat exchanger (3.2.3.5) in which liquid *refrigerant* (3.2.3.3) is vaporized by absorbing heat

[SOURCE: ISO 5149-1:2014, 3.4.6, modified — "from the substance to be cooled" has been deleted.]

3.2.3.8
gas cooler
heat exchanger (3.2.3.5) in which refrigerant vapour is cooled by removal of heat

3.2.3.9
condenser fan
device providing air flow across the *condenser* (3.2.3.6) to remove heat

3.2.3.10
supply air fan
device providing air circulation and transfer air to the interior

Note 1 to entry: This can also be referred to as "evaporator fan" or "evaporator blower".

3.2.3.11
leak detector
sensing device which responds to a pre-set concentration of *refrigerant* (3.2.3.3) in the environment

[SOURCE: ISO 5149-1:2014, 3.6.9]

3.2.3.12
hermetic system
refrigerating system in which all *refrigerant* (3.2.3.3) containing parts are made tight by welding, brazing, or a similar permanent connection

Note 1 to entry: This can also be referred to as "sealed system".

[SOURCE: ISO 5149-1:2014, 3.1.11, modified — Original Note 1 to entry has been replaced.]

3.2.3.13
semi-hermetic system
refrigerating system in which some or all refrigerant-containing parts are made tight by non-permanent connections such as compression fittings, push connectors or flange connections

3.2.3.14
high-pressure side
part of a refrigerating system operating approximately at the *compressor* (3.2.3.4) output pressure

Note 1 to entry: This can also be referred to as "condensing pressure side" or "discharge pressure side".

[SOURCE: ISO 5149-1:2014, 3.1.7, modified — "condenser" has been replaced by "compressor output" and Note 1 to entry has been added.]

3.2.3.15
low pressure side
part of a refrigerating system operating approximately at the *compressor* (3.2.3.4) input pressure

Note 1 to entry: This can also be referred to as "evaporating pressure side" or "suction pressure side".

[SOURCE: ISO 5149-1:2014, 3.1.8, modified — "evaporator" has been replaced by "compressor input" and Note 1 to entry has been added.]

3.2.3.16
design pressure
gauge pressure chosen for the strength calculation of each component

[SOURCE: ISO 5149-1:2014, 3.3.1, modified — Note 1 to entry has been deleted.]

3.2.3.17
maximum working pressure
maximum gauge pressure which a system or component is operated as specified by the manufacturer

3.2.3.18
rated static pressure of the HVAC unit
difference of the static pressure between the *return air* (3.4.11) port and the *conditioned air* (3.4.3) discharging port at the rated airflow

3.2.3.19
pressure relief device
pressure relief valve or bursting disc device designed to relieve excessive pressure automatically

[SOURCE: ISO 5149-1:2014, 3.6.7]

3.2.3.20
safety switching device for limiting the pressure
pressure activated device that is designed to stop operation of the pressure generator

[SOURCE: ISO 5149-1:2014, 3.6.10, modified — "type-approved" has been deleted.]

3.2.3.21
shut-off device
device to shut off the flow of the *refrigerant* (3.2.3.3)

[SOURCE: ISO 5149-1:2014, 3.5.12, modified — "fluid" has been replaced by "refrigerant".]

3.2.3.22
expansion device
orifice or regulating valve through which the *refrigerant* (3.2.3.3) expands to a lower pressure

[SOURCE: ISO 13043:2011, 3.3.8, modified — "vapour prior to entering the evaporator" has been deleted.]

3.3 Vehicle space

3.3.1
comfort envelope
compartment or saloon area normally occupied by passengers

3.3.2
comfort zone
subset of the *comfort envelope* (3.3.1) such as compartments or other areas

3.3.3
local annexes
places where passengers stay temporarily
EXAMPLE Toilets, washrooms, corridors, telephone booths, etc.

3.3.4
catering service area
space or compartment reserved for staff specializing in the preparation and/or the sale of goods

3.4 Air classification

3.4.1
fresh air
outside air
air taken from outside the vehicle

Note 1 to entry: See Figure 2 to Figure 5.

3.4.2
mixed air
combination of fresh/outside air and *return air* (3.4.11)

Note 1 to entry: See Figure 2 to Figure 5.

3.4.3
conditioned air
treated air
air that can have been filtered and/or had energy exchanged as it passed through the *air handling unit* (3.2.3.1)

Note 1 to entry: See Figure 2 to Figure 5.

3.4.4
primary air
conditioned air (3.4.3) entering the ducts from the *HVAC unit* (3.1.3.1)

Note 1 to entry: See Figure 2 to Figure 5.

3.4.5
induced air
interior air (3.4.7) taken locally and added to the *primary air* (3.4.4) without additional conditioning

Note 1 to entry: See Figure 2 to Figure 5.

3.4.6
supply air
primary air (3.4.4) that can be combined with some *induced air* (3.4.5), supplied to a specified space

Note 1 to entry: See Figure 2 to Figure 5.

3.4.7
interior air
air contained in a specified space

Note 1 to entry: See Figure 2 to Figure 5.

3.4.8
transfer air
air moving from a specified interior space to another interior space

Note 1 to entry: See Figure 2 to Figure 5.

3.4.9
extract air
air leaving an interior specified space to be fed into the *exhaust air* (3.4.10) or *return air* (3.4.11)

Note 1 to entry: See Figure 2 to Figure 5.

3.4.10
exhaust air
air rejected outside the vehicle

Note 1 to entry: See Figure 2 to Figure 5.

3.4.11
return air
air taken from the interior of a specified space and returned to *HVAC unit* (3.1.3.1) to be reused

Note 1 to entry: See Figure 2 to Figure 5.

3.4.12
supplementary air
secondary air
air taken from the interior of a specified space, treated locally and returned to the same space

Note 1 to entry: See Figure 2 to Figure 5.

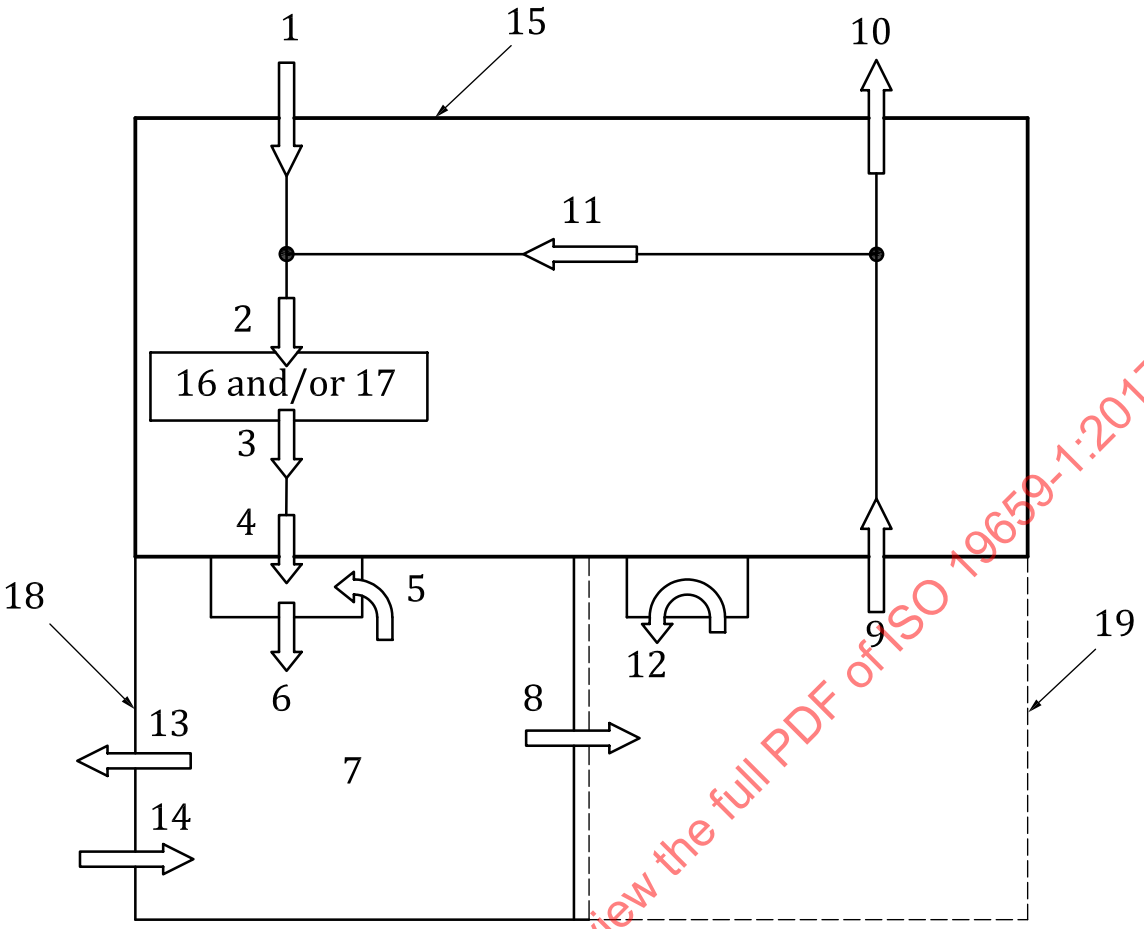
Note 2 to entry: By *supplementary fan* (3.1.3.9) or *heating* (3.1.1.1) are examples of local treatment.

3.4.13
exfiltration air
air movement caused by leakage from interior to exterior depending on *pressure differential* (3.6.1)

Note 1 to entry: See Figure 2 to Figure 5.

3.4.14
infiltration air
air movement caused by leakage from exterior to interior depending on *pressure differential* (3.6.1)

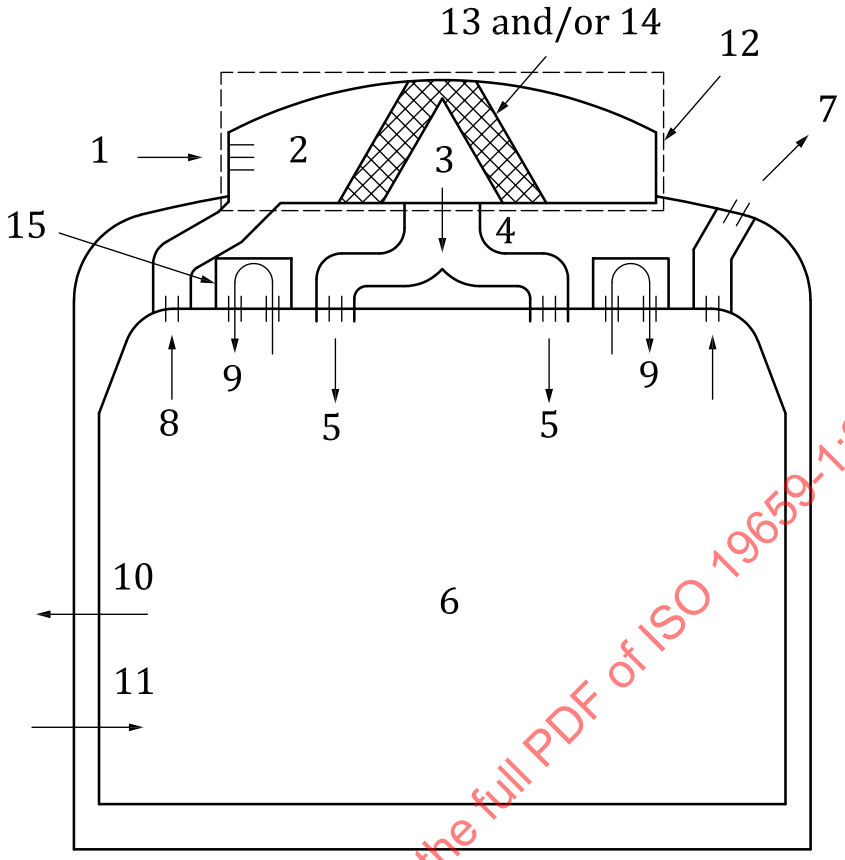
Note 1 to entry: See Figure 2 to Figure 5.



Key

1 fresh air/outside air (3.4.1)
2 mixed air (3.4.2)
3 conditioned air/treated air (3.4.3)
4 primary air (3.4.4)
5 induced air (3.4.5)
6 supply air (3.4.6)
7 interior air (3.4.7)
8 transfer air (3.4.8)
9 extract air (3.4.9)
10 exhaust air (3.4.10)
11 return air (3.4.11)
12 supplementary air/secondary air (3.4.12)
13 exfiltration air (3.4.13)
14 infiltration air (3.4.14)
15 air handling unit (3.2.3.1)
16 cooling unit (3.1.3.3)
17 heating unit (3.1.3.4)
18 compartment 1
19 compartment 2

Figure 2 — Generic diagram explaining certain air classification terms

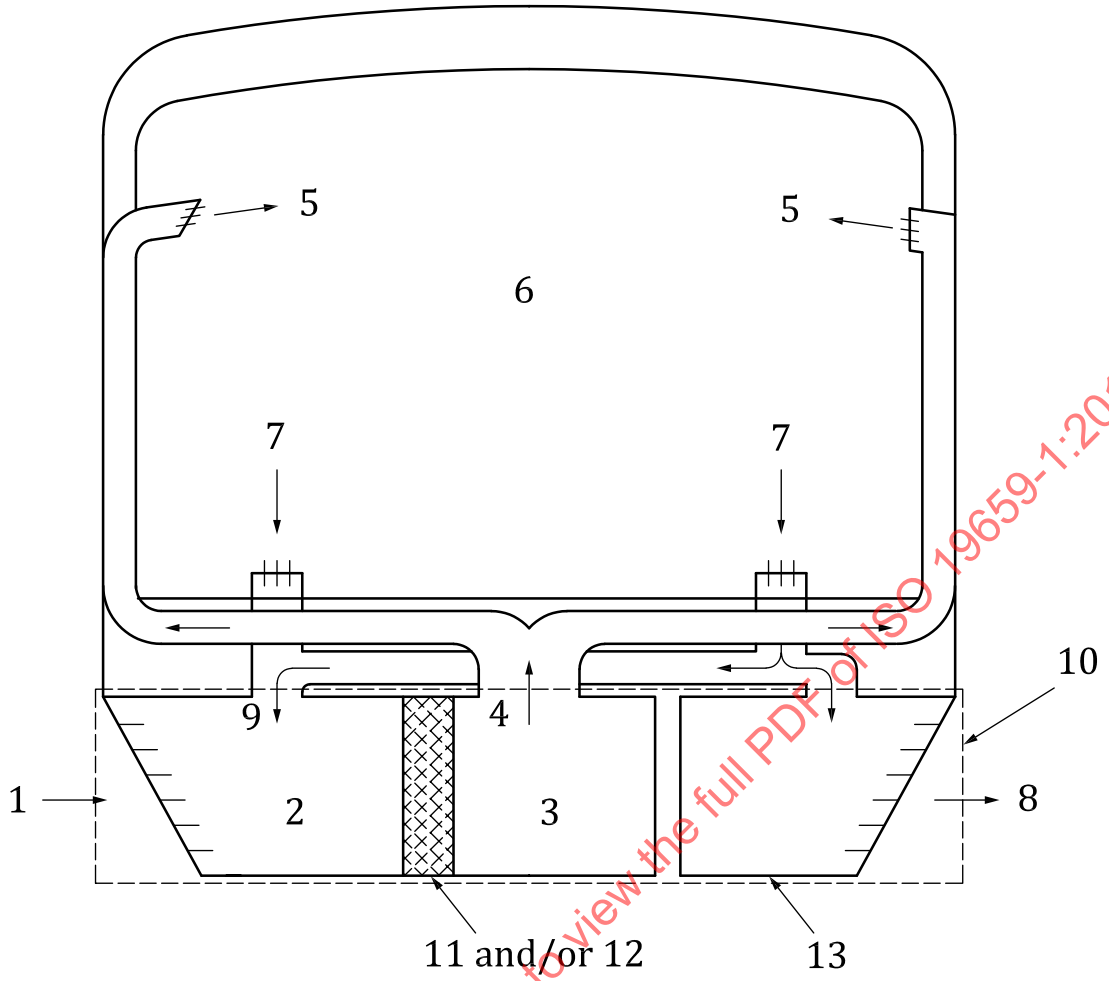


Key

1 fresh air/outside air (3.4.1)
2 mixed air (3.4.2)
3 conditioned air/treated air (3.4.3)
4 primary air (3.4.4)
5 supply air (3.4.6)
6 interior air (3.4.7)
7 exhaust air (3.4.10)
8 return air (3.4.11)
9 supplementary air/secondary air (3.4.12)
10 exfiltration air (3.4.13)
11 infiltration air (3.4.14)
12 air handling unit (3.2.3.1)
13 cooling unit (3.1.3.3)
14 heating unit(3.1.3.4)
15 supplementary fan (3.1.3.9)

NOTE This figure is only given as an example and does not prejudice the design of the installations.

Figure 3 — Diagram explaining certain air classification terms (example of a HVAC system with roof mounted units)

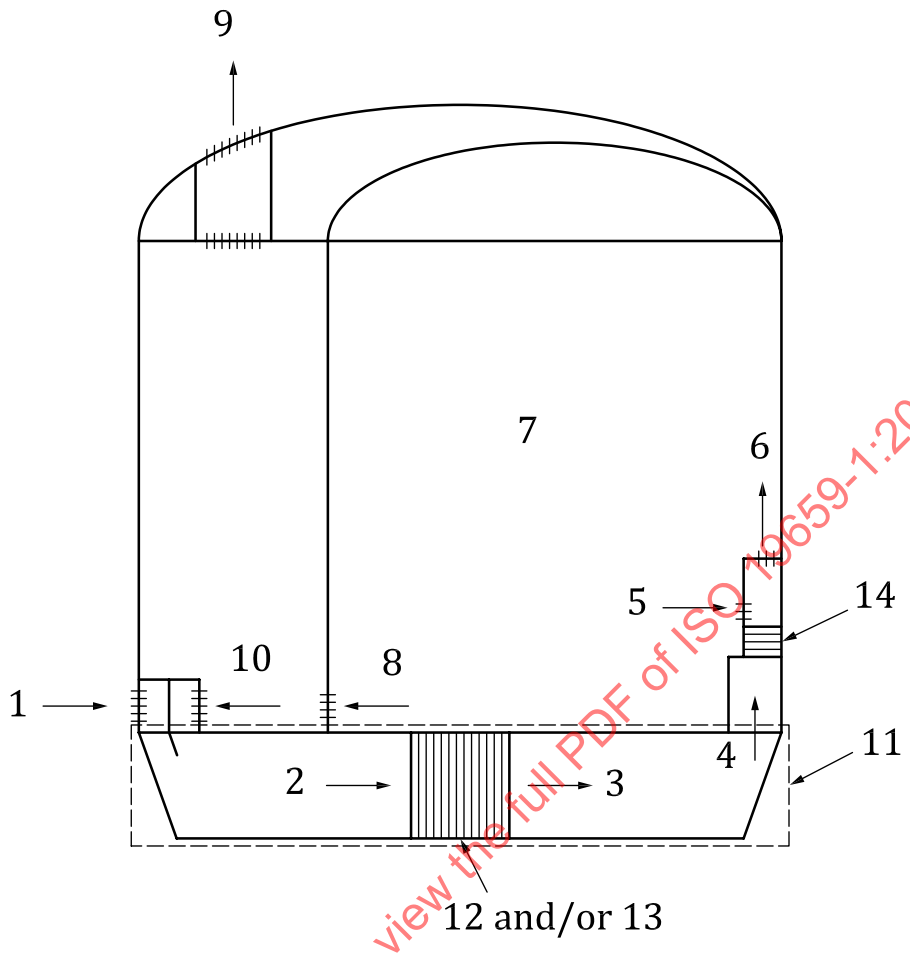


Key

1	fresh air/outside air (3.4.1)	8	exhaust air (3.4.10)
2	mixed air (3.4.2)	9	return air (3.4.11)
3	conditioned air/treated air (3.4.3)	10	air handling unit (3.2.3.1)
4	primary air (3.4.4)	11	cooling unit (3.1.3.3)
5	supply air (3.4.6)	12	heating unit (3.1.3.4)
6	interior air (3.4.7)	13	exhaust air fan/unit (3.1.3.8)
7	extract air (3.4.9)		

NOTE This figure is only given as an example and does not prejudice the design of the installations.

Figure 4 — Diagram explaining certain air classification terms (example of a HVAC system with under floor mounted units)



Key

1	fresh air/outside air (3.4.1)	8	transfer air (3.4.8)
2	mixed air (3.4.2)	9	exhaust air (3.4.10)
3	conditioned air/treated air (3.4.3)	10	return air (3.4.11)
4	primary air (3.4.4)	11	air handling unit (3.2.3.1)
5	induced air (3.4.5)	12	cooling unit (3.1.3.3)
6	supply air (3.4.6)	13	heating unit (3.1.3.4)
7	interior air (3.4.7)	14	supplementary heater (3.1.3.5)

NOTE This figure is only given as an example and does not prejudice the design of the installations.

Figure 5 — Diagram explaining certain air classification terms (example of a HVAC system of compartmented coach/car: with under floor mounted units)

3.5 Thermal load

3.5.1
mean exterior temperature
T_{em}
arithmetic mean of the exterior air temperatures

3.5.2
mean interior temperature
T_{im}
arithmetic mean of the *interior air* (3.4.7) temperatures of one comfort zone

3.5.3
horizontal temperature range
ΔT_h
difference of the maximum to minimum *interior air* (3.4.7) temperatures at a defined height in a horizontal section

3.5.4
vertical temperature range
ΔT_v
difference of the maximum to minimum *interior air* (3.4.7) temperatures for a seated or standing position in a vertical direction

3.5.5
interior temperature setting
T_{ic}
target *interior air* (3.4.7) temperature

3.5.6
heat load
P or $\dot{Q}$
quantity of heat per unit time which flows in or out and generated at the vehicle interior

3.5.7
overall heat transfer coefficient
k
ratio between the density of the heat flow rate per unit of surface area and the prevailing difference in temperature (T_{im}) and (T_{em}) across the relevant walls of the vehicle

3.5.8
solar load
Ps or $\dot{Q}_s$
heat load (3.5.6) by solar radiation

3.5.9
equivalent solar load
E_n
total heat received by 1 m^2 surface perpendicular to the radiation emitted by a luminous source (solar equivalent) when inclined at an angle identified by X degree to the horizontal axis

Note 1 to entry: X can be defined by country.

3.5.10
total solar energy transmittance
g
ratio between the overall energy flow transmitted to the interior of the vehicle through the window and the incident solar radiation

Note 1 to entry: Full reference for transmittance is described in ISO 9050.

Note 2 to entry: This can also be referred to as "solar factor".

3.5.11
heat load per person
P_p or $\dot{Q}_P$
heat load (3.5.6) that a passenger and/or train staff emits

3.5.12
fresh air heat load
heat load (3.5.6) required to cool or heat the *fresh air* (3.4.1) to the required interior condition