RESPIRATORY CARE Standard Abbreviations and Symbols

Editor's Note: This compilation is adapted from the recommendations of the American Physiological Society and the ACCP-ATS Committee on Pulmonary Nomenclature. Some additions have been made.

Primary Symbols

Primary symbols are denoted by upper case, or capital letters.

C	Compliance	S	Saturation in the blood phase
D	Diffusing capacity	t	Time
F	Fractional concentration of a gas	T	Temperature
P	Pressure	V	Gas volume
$\dot{Q}$	Blood flow	X	Any variable
Q	Blood volume	$\bar{X}$	Mean value

A bar over a primary symbol denotes a mean or averaged value; for example, $\bar{P}$ is a mean pressure. A dot over a primary symbol denotes a time derivative, for example, $\dot{V}$ is dV/dt, or flow. The second derivative, with respect to time, is denoted by two dots above the primary symbol, for example, $\ddot{V}$ is d^2V/dt^2, or acceleration.

Qualifying Symbols

Qualifying symbols may be denoted by characters of regular size following the primary symbol or by subscripted characters—depending on printing capabilities.

A	Alveolar	I	Inspired
B	Barometric	L	Lung
D	Dead space; wasted ventilation	T	Tidal
E	Expired		

ATPD	Ambient temperature and pressure, dry
ATPS	Ambient temperature and pressure, saturated with water vapor at these conditions
BTPS	Body temperature and pressure, saturated with water vapor at these conditions
STPD	Standard conditions: temperature 0 °C (273 °K), pressure 760 torr and dry

a	Arterial	est	Estimated
an	Anatomic	max	Maximal
b	Blood, in general	rb	Rebreathing
c	Capillary	v	Venous
ć	Pulmonary end-capillary	$\bar{v}$	Mixed venous

Abbreviations & Symbols in Common Use

Lung Volumes

TLC	Total lung capacity: the volume in the lungs at maximal inflation
RV	Residual volume: the volume of air remaining in the lungs after a maximal exhalation
ERV	Expiratory reserve volume: the maximal volume of air that can be exhaled from the end-expiratory position
IRV	Inspiratory reserve volume: the maximal volume that can be inhaled from the end-inspiratory level
IC	Inspiratory capacity: the sum of IRV and TV
IVC	Inspiratory vital capacity: the maximum volume of air inhaled from the point of maximum expiration
VC	Vital capacity: the volume equal to TLC – RV
VT	Tidal volume: that volume of air moved into or out of the lungs during quiet breathing (VT indicates a subdivision of the lung; when tidal volume is precisely measured, as in gas exchange calculation, the symbol VT or V_T is used.)
FRC	Functional residual capacity: the volume in the lungs at the end-expiratory position
RV/TLC%	Residual volume expressed as percent of TLC
V_A	Alveolar gas volume
V_L	Actual volume of the lung including the volume of the conducting airways

Forced Spirometry

FVC	Forced vital capacity: the determination of the vital capacity from a maximally forced expiratory effort
FEV_t	Forced expiratory volume (time): a generic term indicating the volume of air exhaled under forced conditions in the first *t* seconds
FEV_1	Volume that has been exhaled at the end of the first second of forced expiration

FEF_x	Forced expiratory flow related to some portion of the FVC curve; modifiers refer to amount of FVC already exhaled
FEF_{max}	The maximum instantaneous flow achieved during a FVC maneuver
$FEF_{25-75\%}$	Forced expiratory flow over the middle half of the FVC, that is, the average flow from the point where 25% of the FVC has been exhaled to the point where 75% has been exhaled. This formerly has been called the maximal midexpiratory flow rate (MMEFR).
FIF	Forced inspiratory flow: (Specific measurement of the forced inspiratory curve is denoted by nomenclature analogous to that for the forced expiratory curve. For example, maximum inspiratory flow is denoted FIF_{max}. Unless otherwise specified, volume qualifiers indicate the volume inspired from RV at the point of measurement.)
PEF	The highest forced expiratory flow measured with a peak flow meter
MVV	Maximal voluntary ventilation: volume of air expired in a specified period during repetitive maximal effort

Ventilation

f	Breathing frequency (breaths/minute or breaths/min)
$\dot{V}_A$	Alveolar ventilation/min
$\dot{V}_D$	Physiologic dead space ventilation/min
$\dot{V}_E$	Expired volume/min; V_E is exhaled volume/breath
$\dot{V}_{CO_2}$	Carbon dioxide production/min corrected for STPD conditions
$\dot{V}_{O_2}$	Oxygen consumption/min corrected for STPD conditions

Pulmonary Mechanics

C_{dyn}	Dynamic compliance: compliance measured at point of zero gas flow at the mouth during active breathing
C_{st}	Static compliance: compliance measured under conditions of prolonged interruption of airflow
E	Elastance: the reciprocal of compliance
G_{aw}	Airway conductance: the reciprocal of R_{aw}
sG_{aw}	Airway conductance at a specific lung volume
P_{aw}	Pressure in the airway; further modifiers to be specified
P_A	Alveolar pressure
P_{es}	Esophageal pressure used to estimate P_{pl}
P_L	Transpulmonary pressure
P_{pl}	Intrapleural pressure
P_{tm}	Transmural pressure, pertaining to an airway or blood vessel
PI_{max}	Maximal inspiratory pressure; this term is often symbolized as MIP
PE_{max}	Maximal expiratory pressure; this term is often symbolized as MEP
R	Resistance (ie, pressure per unit flow)
$\bar{R}$	Mean total resistance ($[R_I + R_E] \div 2$)
R_{aw}	Airway resistance
R_E	Total expiratory resistance measured by esophageal balloon method
R_I	Total inspiratory resistance measured by esophageal balloon method
R_L	Lung resistance
WOB	Work of breathing

Blood Gas, Acid-Base, & Gas Exchange Terms

P_{aO_2}	Arterial oxygen tension, or partial pressure
P_{AO_2}	Alveolar oxygen tension, or partial pressure
P_{aCO_2}	Arterial carbon dioxide tension, or partial pressure
P_{ACO_2}	Alveolar carbon dioxide tension, or partial pressure
$P_{\bar{v}O_2}$	Oxygen tension of mixed venous blood
$P_{(A\text{-}a)O_2}$	Alveolar-arterial oxygen tension difference. The term formerly used (A-a DO_2) is discouraged.
$P_{(a/A)O_2}$	Alveolar-arterial tension ratio; $Pa_{O_2} : P_{AO_2}$. We propose the term *oxygen exchange index* to describe this ratio.
$C_{(a\text{-}v)O_2}$	Arteriovenous oxygen content difference
S_{aO_2}	Oxygen saturation of the hemoglobin of arterial blood
S_{pO_2}	Oxygen saturation as measured by pulse oximetry
C_{aO_2}	Oxygen content of arterial blood
pH	Symbol relating the hydrogen ion concentration or activity of a solution to that of a standard solution; approximately equal to the negative logarithm of the hydrogen ion concentration. pH is an indicator of the relative acidity or alkalinity of a solution.

Blood Flow and Shunts

Q	Blood volume
$\dot{Q}$	Blood flow (volume units and time must be specific)

Q_c	Pulmonary capillary blood volume
Q_{sp}	Physiologic shunt flow (total venous admixture)
$\dot{Q}_{sp}/\dot{Q}_{tot}$	Shunt as percent of total blood flow

Diffusing Capacity

D_{LCOsb}	Diffusing capacity of the lung for carbon monoxide determined by the single-breath technique
D_m	Diffusing capacity of the alveolocapillary membrane (STPD)
D/V_A	Diffusion per unit of alveolar volume, with D at STPD and VA in liters BTPS

SI Units with Abbreviations

SI units are decimal units of measurement for physical properties and quantities that have been adopted by the scientific community worldwide. The reader is referred to Respir Care 1988;33:861-873, Respir Care 1989;34:145, and Respir Care 1997;42(6):639-640 for more information.

Variable	Unit	Abbreviation
temperature	kelvin	K
length	meter	m
mass	kilogram	kg
time	second	s
pressure	pascal	Pa
work, or energy	joule	J

Système International:
Examples of Conversions Commonly Used in Respiratory Physiology and Respiratory Care

Physical Quantity	Known Unit	Desired Unit	Example of Conversion Calculation
Force (or mass)	lb	kg	$150\ \text{lb} \times \frac{0.4536\ \text{kg}}{1\ \text{lb}} = 68\ \text{kg}$
	kg	lb	$68\ \text{kg} \times \frac{1\ \text{lb}}{0.4536\ \text{kg}} = 150\ \text{lb}$
Pressure	torr	kPa	$35\ \text{torr} \times \frac{0.1333\ \text{kPa}}{1\ \text{torr}} = 4.7\ \text{kPa}$
	kPa	torr	$4.7\ \text{kPa} \times \frac{1\ \text{torr}}{0.1333\ \text{kPa}} = 35\ \text{torr}$
	psi	torr	$1.0\ \text{psi} \times \frac{70.31\ \text{cm}\ H_2O}{1\ \text{psi}} \times \frac{0.7355\ \text{torr}}{1\ \text{cm}\ H_2O} = 52\ \text{torr}$
	torr	psi	$51.72\ \text{torr} \times \frac{1\ \text{cm}\ H_2O}{0.7355\ \text{torr}} \times \frac{1\ \text{psi}}{70.31\ \text{cm}\ H_2O} = 1.0\ \text{psi}$
Work	L · cm H_2O	kg · m	$20\ \text{L} \cdot \text{cm}\ H_2O \times \frac{0.09806\ \text{J}}{1\ \text{L} \cdot \text{cm}\ H_2O} \times \frac{1\ \text{kg} \cdot \text{m}}{9.807\ \text{J}} = 0.2\ \text{Kg} \cdot \text{m}$
	J	L · cm H_2O	$2\ \text{J} \times \frac{1\ \text{kg} \cdot \text{m}}{9.807\ \text{J}} \times \frac{1\ \text{L} \cdot \text{cm}\ H_2O}{0.01\ \text{kg} \cdot \text{m}} = 20\ \text{L} \cdot \text{cm}\ H_2O$
Power	kg · m · min^{-1}	W	$2.5\ \text{kg} \cdot \text{m} \cdot \text{min}^{-1} \times \frac{0.1634\ \text{W}}{1\ \text{kg} \cdot \text{m} \cdot \text{min}^{-1}} = 0.41\ \text{W}$
Compliance	mL/cm H_2O	L/kPa	$100\ \text{mL} \cdot \text{cm}\ H_2O \times \frac{1\text{L}}{1000\ \text{mL}} \times \frac{10.20\ \text{L} \cdot \text{kPa}^{-1}}{1\ \text{L} \cdot \text{cm}\ H_2O^{-1}} = 1.02\ \text{L} \cdot \text{kPa}^{-1}$
Resistance	cm $H_2O \cdot s \cdot L^{-1}$	kPa · s · L^{-1}	$55\ \text{cm}\ H_2O \cdot s \cdot L^{-1} \times \frac{0.090806\ \text{kPa} \cdot L^{-1}}{1\ \text{cm}\ H_2O \cdot s \cdot L^{-1}} = 5.4\ \text{kPa} \cdot s \cdot L^{-1}$

Note: Retain all digits during computation to avoid roundoff error. However, the least precise measurement used in a calculation determines the number of significant digits in the answer. Thus, the final product or quotient should be written with the same number of significant figures as the term with the fewest significant figures, as shown in the examples above. The least ambiguous method of indicating the number of significant figures is to write the number in scientific notation. For example, the number 30 may have either one or two significant figures, but written as 3.0×10^1, it is understood that there are two significant figures. For more information about scientific notation, significant figures, and rounding off, see Lough MD, Chatburn RL, Shrock WA, Handbook of respiratory care. Chicago: Yearbook Medical Publishers, 1985:170-173.

Système International: Conversion Factors for Units Commonly Used in Medicine

Physical Quantity	Conventional Unit	SI Unit	Conversion Factor*
Length	inch (in.)	meter (m)	0.025 4
	foot (ft)	m	0.304 8
Area	$in.^2$	m^2	6.452×10^{-4}
	ft^2	m^2	0.092 90
Volume	dL (= 100 mL)	L	0.01
	ft^3	m^3	0.028 32
	ft^3	L	28.32
	fluid ounce	mL	29.57
Amount of substance	mg/dL	mmol/L	10/molecular weight
	mEq/L	mmol/L	valence
	mL of gas at STPD	mmol	0.044 62
Force (weight)	pound (lb)	newton (N)	4.448
	dyne	N	0.000 01
	kilogram-force	N	9.807
	pound	kilogram-force	0.453 6
	ounce	gram-force	28.35
Pressure	cm H_2O	kilopascal (kPa)	0.098 06
	mm Hg (torr)	kPa	0.133 3
	pounds/$in.^2$ (psi)	kPa	6.895
	psi	cm H_2O	70.31
	cm H_2O	torr	0.7355
	standard atmosphere	kPa	101.3
	millibar (mbar)	kPa	0.100 0
Work, energy	kg · m	joule (J)	9.807
	L · cm H_2O	joule (J)	0.098 06
	calorie (cal)	joule (J)	4.185
	kilocalorie (kcal)	J	4 185
	British thermal unit (BTU)	—	1055
Power	kg · m · min^{-1}	watt (W)	0.163 4
Surface tension	dyn/cm	N/m	0.001
Compliance	L/cm H_2O	L/kPa	10.20
Resistance	cm H_2O · s · L^{-1}	kPa · s · L^{-1}	0.098 06
	cm H_2O · min · L^{-1}	kPa · s · L^{-1}	5.884
Gas transport (ideal gas, STPD)	mL · s^{-1} · cm H_2O^{-1}	mmol · s^{-1} · kPa^{-1}	0.455 0
Temperature	°C	°K	°K = °C + 273.15
	°F	°C	°C = (°F – 32)/1.8
	°C	°F	°F = (1.8 · °C) + 32

*To convert from conventional to SI unit, multiply conventional unit by conversion factor. To convert in the opposite direction, divide by conversion factor. Examples: 10 torr = 10 × 0.133, 3 kPa = 1.333 kPa, 1 L = 1 L/0.10 = 10 dL

Key to Abbreviations & Acronyms

a-A	arterial-alveolar
AARC	American Association for Respiratory Care
ABG	arterial blood gas
ACCP	American College of Chest Physicians
AHA	American Hospital Association
AI	artificial intelligence
AIDS	acquired immunodeficiency syndrome
ALS	amyotrophic lateral sclerosis
AMP	adenosine monophosphate
APRV	airway pressure release ventilation
ARDS	acute respiratory distress syndrome
ARF	acute respiratory failure
ATS	American Thoracic Society
auto-PEEP	unintended positive end-expiratory pressure
B-P	bronchopleural (eg, B-P fistula or air leak)
BPD	bronchopulmonary dysplasia
CAI	computer-assisted instruction
CCC	chondroplasia calcificans congenita
CDC	Centers for Disease Control
CINAHL	Cumulative Index to Nursing & Allied Health Literature
CLD	chronic lung disease
CO	carbon monoxide
COLD	chronic obstructive lung disease
COP	colloid oncotic pressure
COPD	chronic obstructive pulmonary disease
CO_2	carbon dioxide
CPAP	continuous positive airway pressure
CPR	cardiopulmonary resuscitation
CPT	chest physical therapy
CT	computerized tomography
D_{LCOsb}	single-breath diffusion of carbon monoxide across the lung
DME	durable medical equipment
DRG	diagnosis-related group
ECMO	extracorporeal membrane oxygenation
EIB	exercise-induced bronchospasm
EOA	esophageal obturator airway
EPAP	end-positive airway pressure
FDA	U.S. Food & Drug Administration
$FEF_{25-75\%}$	forced expiratory flow over middle half of FVC
FEV	forced expiratory volume
FEV_1	forced expiratory volume in first second
F_{IO_2}	fraction of inspired oxygen
F_{DO_2}	fraction of oxygen delivered (by device)
FRC	functional residual capacity
FVC	forced vital capacity
HCFA	Health Care Financing Administration
HFV	high-frequency ventilation
HFJV	high-frequency jet ventilation
HFO	high-frequency oscillation
HFOV	high-frequency oscillatory ventilation
HFPPV	high-frequency positive-pressure ventilation
HFPV	high-frequency percussive ventilation
HIV	human immunodeficiency virus
HMD	hyaline membrane disease
HME	heat & moisture exchanger (artificial nose)
HMEF	heat & moisture exchanging filter
ICP	intracranial pressure
ICU	intensive care unit
I-E	inspiration-expiration (ratio)
ILD	interstitial lung disease
IMV	intermittent mandatory ventilation
IPPB	intermittent positive-pressure breathing
MIGET	multiple inert gas elimination technique
MIP	maximal inspiratory pressure
MLT	minimal leak technique (of cuff inflation)
MRI	magnetic resonance imaging
MV	mechanical ventilation
NBRC	National Board for Respiratory Care
NFPA	National Fire Protection Association
NG	nasogastric (tube)
NHLBI	National Heart, Lung, & Blood Institute
NIH	National Institutes of Health
NOTT	Nocturnal Oxygen Therapy Trial
NO_2	nitrous oxide
NPPV	noninvasive positive pressure ventilation
OSA	obstructive sleep apnea
O_2	oxygen
$P_{(A-a)O_2}$	alveolar-arterial oxygen-tension difference
P_{aCO_2}	arterial carbon dioxide tension
P_{aO_2}	arterial oxygen tension
PCP	*Pneumocystis carinii* pneumonia
PDA	patent ductus arteriosus
PEEP	positive end-expiratory pressure
PFC	persistent fetal circulation
PFT	pulmonary function test or testing
PIE	pulmonary interstitial emphysema
P_{O_2}	oxygen tension
PSV	pressure-support ventilation
$P_{\bar{v}O_2}$	mixed venous oxygen tension

RCP	respiratory care practitioners (professionals)
RDS	respiratory distress syndrome (of infants)
RICU	respiratory intensive care unit
RIP	respiratory inductive plethysmography
RQ	respiratory quotient
S_{aO_2}	arterial oxygen saturation
SCCM	Society for Critical Care Medicine
SI	Système International d'Unités (a system of units of measure)
SIDS	sudden infant death syndrome
SIMV	synchronized intermittent mandatory ventilation
S_{pO_2}	saturation measured via pulse oximetry
$S_{\bar{v}O_2}$	mixed venous oxygen saturation
tcP_{O_2}	transcutaneous oxygen tension
T-E	tracheoesophageal (fistula)
TGV	thoracic gas volume
TLC	total lung capacity
USP	United States Pharmacopeia
VA	Veterans Administration
VC	vital capacity
V_{CO_2}	carbon dioxide production
VDR	volumetric diffusion respiration
V/Q	ventilation-perfusion ratio
V_T	tidal volume
WOB	work of breathing