Terms used to describe the performance of chillers, air conditioners and heat pumps

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While chillers, air conditioners and heat pumps used to be rated at one standard condition, a process is on its way for the development and generalisation of figures for seasonal values, which goal is to come closer to the behaviour of the units over the year in order to better represent its efficiency. We expose here as simply as possible the main terms for these units and the key equations.

Terms	Cooling mode	Heating mode	unit
reference design conditions reference temperature conditions cooling mode: 35ºC dry bulb (24ºC wet bulb) outdoor and 27ºC dry bulb (19ºC wet bulb) indoor heating: for average: -10°C, colder : -22°C and warmer: +2°C climates	$T_{designc}$	$T_{designh}$	°C
load or demand load of the building at certain temperature conditions	P_c	P_h	kW
full load load at reference design conditions	$P_{designc}$	$P_{designh}$	kW
part load ratio load divided by the full load	**PLR**		%
capacity capacity a unit can deliver at certain conditions	**DC**		
capacity ratio load divided by the declared capacity	**CR**		
bin hours duration at a given temperature for a specific location	h_j		h
bivalent temperature (CR=100%) lowest outdoor temperature where capacity is equal to the load		$T_{bivalent}$	°C
operation limit temperature lowest outdoor temperature where the unit still delivers capacity		T_{OL}	°C
reference annual demand(s) representative annual demand(s)	Q_c	Q_h	kWh
efficiency (energy efficiency ratio and coefficient of performance) capacity divided by the effective power input at standard conditions: at conditions of EN 14511 at part load: at conditions of EN 14825 (degraded for fixed stage units)	**EER** EER_j	**COP** COP_j	kW/ kW
electric back up heater (below Tbivalent) supplementary electric heater, with a COP of 1		**elbu**	kW
thermostat off corresponding to the hours with no load	TO		
standby unit partially switched off but reactivable by a control device or timer	sb		
off unit completely switched off	off		
crankcase heater (to limit refrigerant concentration in oil at compressor start) where a crankcase heater is activated	CK		
auxiliary power consumptions $\sum h_{aux}.P_{aux} = h_{TO}.P_{TO} + h_{sb}.P_{sb} + h_{CK}.P_{CK} + h_{off}.P_{off}$	**TO, sb, off, ck**		kWh
degradation coefficient for fixed stage units (same equations for COPj) efficiency loss due to the cycling of respectively chillers and ACs $EER_j = EER.\frac{CR}{c_c.CR+(1-c_c)}$; $EER_j = EER.\left(1 - C_d.(1-CR)\right)$ = *EER.(Part Load Factor)*	**Cc / Cd**		% kW/ kW
reference seasonal efficiency [reference: EN 14825, 2013] seasonal efficiency calculated for the reference annual demand $SEER = \frac{Q_c}{\frac{Q_c}{\sum h_j.P_{c,j}} + \sum h_{aux}.P_{aux}}$; $SCOP = \frac{Q_h}{\frac{Q_h}{\sum h_j.P_{h,j}} + \sum h_{aux}.P_{aux}}$	**SEER**	**SCOP**	kWh/ kWh
active seasonal efficiency seasonal efficiency excluding auxiliary consumptions	$SEER_{on}$	$SCOP_{on}$	kWh/ kWh
European seasonal energy efficiency ratio [reference: Eurovent Certification, 2008] Antecedent term used for SEER before European standard was issued $ESEER = 0.03.EER_{100\%} + 0.33.EER_{75\%} + 0.41.EER_{50\%} + 0.23.EER_{25\%}$	**ESEER**	-	kWh/ kWh
integrated part load value [reference AHRI, 1998] (EER in kW/Ton) First equivalent to ESEER, with weighting coefficients related to the United States $IPLV = 0.01.EER_{100\%} + 0.42.EER_{75\%} + 0.45.EER_{50\%} + 0.12.EER_{25\%}$	**IPLV**	-	kW/ Ton