Product Group 'Air Handling Units' PP – 2019-10-25

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Clarification and extension of case studies supporting Eurovent Position Paper on consideration of moisture recovery in the review of the Commission Regulation (EU) No 1253/2014 (Ventilation Units)

Introduction

In the process of preparation to the Review Study, Eurovent has submitted Position Paper including a proposal for consideration of moisture recovery in the revised VU Regulation. During the First Stakeholder meeting, the study consultant found that case studies supporting the position do not indicate the considered running time and asked for additional information about their background. This document provides clarification to the studies and extended outcomes of calculation covering typical occupant schedules (operating time) for various types of buildings as defined in prEN 16798-1. The original Eurovent Position Paper in question is enclosed in Appendix 2.

Clarification of case studies

The aim of the case studies is to demonstrate additional energy savings resulting from moisture recovery and the corresponding relation between thermal efficiency η_{t_nrvu} and moisture recovery efficiency η_{x_c}.

To keep evaluation simple and to avoid complex calculations, Eurovent put forward an easy equation that facilitates consideration of moisture recovery in min. requirements for applications which demand humidity control.

The proposed approach is primarily focused on savings of energy needed for the cooling of outdoor ventilation air to the required indoors condition, what is related to the reduction of moisture content. Thus, the tabled definition of energy recovery efficiency (η_{e_nrvu}) count humidity efficiency for cooling conditions defined as per prEN 308

$$\eta_{e\_nrvu} = \eta_{t\_nrvu} + c \cdot \eta_{x\_c} = \eta_{t\_nrvu} + 0.08 \cdot \eta_{x\_c} \qquad \{1\}$$

Where

η_{t_nrvu} - thermal efficiency

η_{x_c} - humidity efficiency for cooling conditions defined as per prEN 308 (exhaust air 25°C DB/18°C WB, outdoor air 35°C DB / 25°C WB)

c - conversion factor of the humidity efficiency to the thermal efficiency

This premise by definition limits application of the formula only to exchangers that provide moisture recovery in summer conditions and feature constant humidity efficiency regardless of the actual condensation potential.

Considering the variety of operating parameters in real systems, members of Eurovent have proposed a very conservative value of the conversion factor between η_{t_nrvu} and η_{x_c} equal to 0.08.

To justify the validity of the proposed conversion factor value, the case studies for four different locations (Milano, Valencia, München and Oslo) featuring various climate condition were carried out. Moreover - to give a better overview of outcomes – two design variants were considered:

Variant 1: No moisture gains indoors (supply air moisture content = extract air moisture content)
Variant 2: Internal moisture gains of 1 g/kg (typical value for HVAC systems design)

For these variants, the following fixed supply and extract air conditions were assumed in calculations:

Variant 1 (no indoor moisture gains)

Winter calculations:
Extract air: 22°C / 4.9 g/kg / 30% RH
Supply air: 19°C / 4.9 g/kg / 36% RH

Summer calculations:
Extract air: 22°C / 8.7 g/kg / 53% RH
Supply air: 19°C / 8.7 g/kg / 64% RH

Variant 2 (1.0 g/kg indoor moisture gains)

Winter calculations:
Extract air: 22°C / 5.9 g/kg / 36% RH
Supply air: 19°C / 4.9 g/kg / 36% RH

Summer calculations:
Extract air: 22°C / 9.7 g/kg / 59% RH
Supply air: 19°C / 8.7 g/kg / 64% RH

The goal of the case studies was to demonstrate that for a heat exchanger offering thermal efficiency of 73% (min. Ecodesign requirement) and the corresponding **typical** humidity recovery efficiency of 60%, the percentage of energy saved resulting from the moisture recovery is normally higher than the proposed conversion factor of thermal and moisture efficiency.

In this respect, the energy-wise seasonal energy efficiency of energy recovery defined as follow was calculated {2}.

$$\eta_{e\_nrvu(s)} = \sum_{i=1}^{n} \frac{h_{22,i} - h_{ODA,i}}{h_{d22,i} - h_{ODA,i}} = \frac{REC_{SEN} + REC_{LAT}}{DEM_{TOT}}$$

Where

$h_{22,i}$ - actual enthalpy downstream heat exchanger, supply air in *i* hour

$h_{ODA,i}$ - enthalpy of outdoor air in *i* hour of the year

$h_{d22,i}$ - demanded supply air enthalpy (19°C/4.9g/kg for heating and 19°C/8.7g/kg for cooling)

REC_{SEN} - seasonal recovery of sensible energy (value indicated in case study table)

REC_{LAT} - seasonal recovery of latent energy (value indicated in case study table)

DEM_{TOT} - Total demand for cooling/heating (value indicated in the case study table)

n - number of hours when cooling/heating energy recovery applies

The Total Demand (DEM_{TOT}) is the sum of Sensible Demand and Laten Demand, which are calculated as follow:

Heating Period
Sensible demand: All sensible energy to heat up the outdoor temperature to 19°C
Latent demand: All latent energy to humidify the outdoor air up to 4.9 g/kg a.h.

Cooling Period

Sensible demand: All sensible energy to cool down the outdoor temperature to 19°C

Latent demand: All latent energy to change the humidify the outdoor to 8.7 g/kg a.h.

Next, to determine the **c** conversion factor, it was assumed that for the need for reflecting the annual energy saving:

$\eta_{e\_nrvu} = \eta_{e\_nrvu(s)}$

And, given that {3}

$$\frac{\eta_{t\_nrvu}}{\eta_{e\_nrvu}} = \frac{REC_{SEN}}{REC_{SEN} + REC_{LAT}} = \frac{REC_{SEN}}{REC_{TOT}}$$

Out of {1} and {3} the C factor was derived as:

$$C = \frac{\eta_{t\_nrvu} \cdot \left(\frac{REC_{TOT}}{REC_{SEN}} - 1\right)}{\eta_{x\_c}}$$

Calculated in this way C is presented in the outcomes of the case studies in Appendix 1.

Operating time

For the case studies in the original Position Paper, the annual operating time of 8760h (24/24/7) was assumed. To demonstrate savings for different typically cooling-related applications the calculations were extended. These include now the default occupants' schedules provided in prEN 16798-1 annex C (See Appendix 3) for:

Restaurants: Start/End hour – 6:00 to 24:00, days/week – 7

Offices: Start/End hour – 7:00 to 18:00, days/week – 5

Department stores: Start/End hour – 8:00-21:00, days/week – 7

Additional Information

The bypass hours are covered in calculations but only considered up to the required supply air value. The effective hours which were considered for the demand and recovery vary for each city.

The different kind of hours are:

0% Bypass	Fully considered
1 to 99% bypass	partly considered
100% bypass	not considered

The climate data used came from https://www.meteoblue.com

APPENDIX 1 – Case Studies calculations

VARIANT 1 (No moisture gains indoors)

Continuous operation: 24h/day, 7 days/week

	Milano			Valencia			München			Oslo		
	kWh	%	c	kWh	%	c	kWh	%	c	kWh	%	c
Cooling conditions												
Total demand	42908	100%		83740	100%		16410	100%		1245	100%	
sensible recovery 73%	11202	26%	1.15	12000	14%	3.49	3468	21%	1.59	306	25%	0.02
latent recovery 60%	10612	25%		34434	41%		4533	28%		6	0%	
Heating conditions												
Total demand	109005	100%		56940	100%		153009	100%		193852	100%	
sensible recovery 73%	83053	76%	0.16	46625	82%	0.13	120124	79%	0.12	143440	74%	0.16
latent recovery 60%	10790	10%		4941	9%		11471	7%		18846	10%	
Total												
Demand cooling/heating	151913	100%		140680	100%		169419	100%		195097	100%	
Sensible saving 73%	94255	62%	0.28	58625	42%	0.82	123592	73%	0.16	143746	74%	0.16
latent recovery 60%	21402	14%		39375	28%		16004	9%		18852	10%	
Total Energy saving 73%/60%	**115657**	**76%**		**98000**	**70%**		**139596**	**82%**		**162598**	**83%**	

Restaurants: Start/End hour – 6:00 to 24:00, days/week – 7

	Milano			Valencia			München			Oslo		
	kWh	%	c	kWh	%	c	kWh	%	c	kWh	%	c
Cooling conditions												
Total demand	38553	100%		67529	100%		15956	100%		1239	100%	
sensible recovery 73%	10745	28%	1.02	10780	16%	2.97	3443	22%	1.53	305	25%	0.02
latent recovery 60%	9000	23%		26285	39%		4341	27%		5	0%	
Heating conditions												
Total demand	76021	100%		38556	100%		107738	100%		140502	100%	
sensible recovery 73%	57520	76%	0.17	31118	81%	0.14	84168	78%	0.12	103384	74%	0.16
latent recovery 60%	7803	10%		3501	9%		8355	8%		13979	10%	
Total												
Demand cooling/heating	114574	100%		106085	100%		123694	100%		141741	100%	
Sensible saving 73%	68265	60%	0.30	41898	39%	0.86	87611	71%	0.18	103689	73%	0.16
latent recovery 60%	16803	15%		29786	28%		12696	10%		13984	10%	
Total Energy saving 73%/60%	**85068**	**74%**		**71684**	**68%**		**100307**	**81%**		**117673**	**83%**	

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Offices: Start/End hour – 7:00 to 18:00, days/week – 5 – Monday to Friday

	Milano			Valencia			München			Oslo		
	kWh	%	c	kWh	%	c	kWh	%	c	kWh	%	c
Cooling conditions												
Total demand	16306	100%		28719	100%		7981	100%		391	100%	
sensible recovery 73%	4721	29%	0.92	5060	18%	2.50	1749	22%	1.52	81	21%	0.01
latent recovery 60%	3569	22%		10377	36%		2189	27%		1	0%	
Heating conditions												
Total demand	33232	100%		17779	100%		46546	100%		61703	100%	
sensible recovery 73%	25221	76%	0.16	13932	78%	0.15	36133	78%	0.13	45315	73%	0.16
latent recovery 60%	3351	10%		1726	10%		3763	8%		6142	10%	
Total												
Demand cooling/heating	49538	100%		46498	100%		54527	100%		62094	100%	
Sensible saving 73%	29942	60%	0.28	18991	41%	0.78	37882	69%	0.19	45396	73%	0.16
latent recovery 60%	6920	14%		12103	26%		5952	11%		6143	10%	
Total Energy saving 73%/60%	**36862**	**74%**		**31094**	**67%**		**43834**	**80%**		**51538**	**83%**	

Department store: Start/End hour – 8:00-21:00, days/week – 7

	Milano			Valencia			München			Oslo		
	kWh	%	c	kWh	%	c	kWh	%	c	kWh	%	c
Cooling conditions												
Total demand	31487	100%		52758	100%		13757	100%		1181	100%	
sensible recovery 73%	9349	30%	0.89	9293	18%	2.50	3157	23%	1.37	296	25%	0.02
latent recovery 60%	6847	22%		19091	36%		3567	26%		4	0%	
Heating conditions												
Total demand	50788	100%		24661	100%		72618	100%		98040	100%	
sensible recovery 73%	38245	75%	0.17	19433	79%	0.15	56379	78%	0.13	71818	73%	0.17
latent recovery 60%	5350	11%		2429	10%		5926	8%		9970	10%	
Total												
Demand cooling/heating	82275	100%		77419	100%		86375	100%		99221	100%	
Sensible saving 73%	47593	58%	0.31	28725	37%	0.91	59536	69%	0.19	72115	73%	0.17
latent recovery 60%	12196	15%		21520	28%		9493	11%		9974	10%	
Total Energy saving 73%/60%	**59790**	**73%**		**50245**	**65%**		**69029**	**80%**		**82089**	**83%**	

VARIANT 2 (1.0 g/kg indoor moisture gains))

Continuous operation: 24h/day, 7 days/week

	Milano			Valencia			München			Oslo		
	kWh	%	c	kWh	%	c	kWh	%	c	kWh	%	c
Cooling conditions												
Total demand	42908	100%		83740	100%		16410	100%		1245	100%	
sensible recovery 73%	11202	26%	0.77	12000	14%	2.85	3468	21%	0.97	306	25%	0.00
latent recovery 60%	7120	17%		28080	34%		2779	17%		1	0%	
Heating conditions												
Total demand	109005	100%		56940	100%		153009	100%		193852	100%	
sensible recovery 73%	83053	76%	0.25	46625	82%	0.24	120124	79%	0.20	143440	74%	0.25
latent recovery 60%	17091	16%		9028	16%		19343	13%		29836	15%	
Total												
Demand cooling/heating	151913	100%		140680	100%		169419	100%		195097	100%	
Sensible saving 73%	94255	62%	0.31	58625	42%	0.77	123592	73%	0.22	143746	74%	0.25
latent recovery 60%	24210	16%		37108	26%		22123	13%		29837	15%	
Total Energy saving 73%/60%	**118465**	**78%**		**95733**	**68%**		**145714**	**86%**		**173582**	**89%**	

Restaurants: Start/End hour – 6:00 to 24:00, days/week – 7

	Milano			Valencia			München			Oslo		
	kWh	%	c	kWh	%	c	kWh	%	c	kWh	%	c
Cooling conditions												
Total demand	38553	100%		67529	100%		15956	100%		1239	100%	
sensible recovery 73%	10745	28%	0.68	10780	16%	2.39	3443	22%	0.93	305	25%	0.00
latent recovery 60%	5970	15%		21133	31%		2639	17%		1	0%	
Heating conditions												
Total demand	76021	100%		38556	100%		107738	100%		140502	100%	
sensible recovery 73%	57521	76%	0.26	31118	81%	0.24	84168	78%	0.20	103383	74%	0.26
latent recovery 60%	12178	16%		6175	16%		13792	13%		22195	16%	
Total												
Demand cooling/heating	114574	100%		106084	100%		123694	100%		141741	100%	
Sensible saving 73%	68266	60%	0.32	41898	39%	0.79	87611	71%	0.23	103688	73%	0.26
latent recovery 60%	18148	16%		27308	26%		16431	13%		22195	16%	
Total Energy saving 73%/60%	**86414**	**75%**		**69206**	**65%**		**104042**	**84%**		**125883**	**89%**	

Offices: Start/End hour – 7:00 to 18:00, days/week – 5 – Monday to Friday

	Milano			Valencia			München			Oslo		
	kWh	%	c	kWh	%	c	kWh	%	c	kWh	%	c
Cooling conditions												
Total demand	16306	100%		28719	100%		7981	100%		391	100%	
sensible recovery 73%	4721	29%	0.58	5060	18%	1.96	1749	22%	0.94	81	21%	0.01
latent recovery 60%	2248	14%		8140	28%		1348	17%		1	0%	
Heating conditions												
Total demand	33232	100%		17779	100%		46546	100%		61703	100%	
sensible recovery 73%	25221	76%	0.25	13932	78%	0.26	36133	78%	0.21	45315	73%	0.26
latent recovery 60%	5179	16%		2933	16%		6157	13%		9697	16%	
Total												
Demand cooling/heating	49538	100%		46498	100%		54527	100%		62094	100%	
Sensible saving 73%	29942	60%	0.30	18991	41%	0.71	37882	69%	0.24	45396	73%	0.26
latent recovery 60%	7427	15%		11073	24%		7505	14%		9697	16%	
Total Energy saving 73%/60%	**37368**	**75%**		**30064**	**65%**		**45387**	**83%**		**55093**	**89%**	

Department store: Start/End hour – 8:00-21:00, days/week – 7

	kWh	%	c	kWh	%	c	kWh	%	c	kWh	%	c
Cooling conditions												
Total demand	31487	100%		52758	100%		13757	100%		1181	100%	
sensible recovery 73%	9349	30%	0.58	9293	18%	1.98	3157	23%	0.82	296	25%	0.00
latent recovery 60%	4475	14%		15109	29%		2118	15%		1	0%	
Heating conditions												
Total demand	50788	100%		24661	100%		72618	100%		98040	100%	
sensible recovery 73%	38245	75%	0.26	19433	79%	0.26	56379	78%	0.21	71818	73%	0.27
latent recovery 60%	8245	16%		4102	17%		9590	13%		15819	16%	
Total												
Demand cooling/heating	82275	100%		77419	100%		86375	100%		99221	100%	
Sensible saving 73%	47593	58%	0.33	28725	37%	0.81	59536	69%	0.24	72115	73%	0.27
latent recovery 60%	12720	15%		19212	25%		11708	14%		15819	16%	
Total Energy saving 73%/60%	**60313**	**73%**		**47937**	**62%**		**71244**	**82%**		**87934**	**89%**	

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APPENDIX 2 – Original Eurovent Position Paper 4 of 5 (28 March 2019)

IV. Eurovent Position 4 of 5: The need to set a further tier with tightened Ecodesign requirements for energy recovery taking into consideration different ambient conditions

In a nutshell

With this Position Paper, Eurovent and its members provide the European Commission with a proposal concerning new requirements for energy recovery for NRVUs. Besides the energy efficiency increase, this proposal aims to be better reflect different ambient conditions while matching ecodesign requirements with the Energy Performance of Buildings Directive (EPBD).

Within this Paper, we address the following needs:

1. **Joint assessment of temperature and moisture recovery efficiency,**
2. **Information request on energy consumption for HRS defrosting purposes.**

Background

The European Commission Regulation (EU) No 1253/2014 (Ventilation Units) states within Article 8 the review shall include an assessment of **"the need to set a further tier with tightened ecodesign requirements".**

Proposal

1. Consideration of the moisture recovery efficiency in the ecodesign benchmark for NRVUs

There is no doubt that recovery of sensible heat utilised for warming up the outdoor air supplied to a building in cold period significantly impacts energy consumption for ventilation. Nevertheless, the demand for sensible energy for ventilation differs considerably depending on the climate conditions. This means applying too high thermal efficiency in warm climate countries is not economically legitimised.

Thus, Eurovent holds that setting any higher requirements for minimum thermal efficiency of the HRS would have to be accompanied by the introduction of different thresholds for respective climate zones. The definition of thresholds should be reinforced by in-depth studies.

Moreover, Eurovent members are of the opinion that moisture recovery should be consider in the Ecodesign requirements to better match the performance of a unit to the actual ambient climate conditions and the application type.

The detailed proposal of new requirement and its justification is outlined below. Explanation of the proposed conversion factor for the thermal and humidity efficiency is presented in the Appendix I.

This proposal provides the freedom of choosing the best option for a specific application without introducing a complex climate zones classification. The decision what should be the relation between thermal and humidity efficiency in a specific case would be left to a planner who knows best the system requirements and operating condition.

1.1 Impact of the moisture recovery on energy savings

Energy transferred in exhaust air comprises both the sensible part (temperature) and the latent part (moisture content). Some types of heat exchangers enable recovery of both sensible and latent energy. Recovery of latent energy is by far more relevant in warm climate countries since it leads to further reduction of cooling energy demand compared to sole sensible heat recovery. This in turn, is particularly important in the light of EPBD requirements tending to turn buildings across Europe into nZEBs and addressing the increasing role of cooling energy demand in the total energy consumption balance of a building. A considerable part of this energy is related to ventilation systems. Moreover, the latent energy recovery facilitates maintaining better Indoor Environment Quality (IEQ).

In many applications, indoor humidity control is necessary and required due to comfort or technological reasons. This entails a need to use heat exchangers offering not only the sensitive heat recovery, but recovery of moisture as well. It should be also noted that recovery of moisture, aside from reducing the cooling demand, results in lowering the risk of exchanger freezing, what again leads to considerable energy savings.

However, exchangers for moisture recovery feature higher pressure drops compared to exchangers for sensitive heat recovery only. Since the current ecodesign benchmarks consider only the thermal efficiency, units which must be equipped with moisture recovery exchangers (sorption rotors, enthalpy plate exchangers) due to system design requirements, are at a disadvantage.

1.2 Eurovent proposal of new requirements for minimum HRS efficiency

Taking into consideration the above, Eurovent suggests introducing separate minimum requirements for the HRS featuring only recovery of sensible heat and for the HRS offering both the sensible heat recovery and the moisture recovery under summer conditions.

Only sensible heat recovery exchangers
For the sensible heat recovery exchangers, we suggest maintaining the current requirements for minimum thermal efficiency η_{t_nrvu}:

η_{t_nrvu} = 73% for all HRS expect run-around HRS
η_{t_nrvu} = 68% for run-around HRS

Sensible heat and moisture recovery exchangers
Instead of setting minimum requirements for η_{t_nrvu} , we suggest for the sensible and latent heat recovery exchangers introducing minimum requirements for the efficiency of energy recovery (η_e) defined as:

$$\eta_{e\_nrvu} = \eta_{t\_nrvu} + c \cdot \eta_{x\_c} = \eta_{t\_nrvu} + 0.08 \cdot \eta_{x\_c}$$

Where

η_{t_nrvu}	-	thermal efficiency
η_{x_c}	-	humidity efficiency for cooling conditions defined as per prEN 308 (exhaust air 25°C DB/18°C WB, outdoor air 35°C DB / 25°C WB)
c	-	conversion factor of the humidity efficiency to the thermal efficiency (see Appendix I)

Based on the Eurovent members' expertise, we suggest setting the following requirement for minimum efficiency of energy recovery η_{e_nrvu}

$\eta_{e\_nrvu} = 75\%$

and defining the efficiency bonus as $E = (\eta_{e\_nrvu} - 0.73) \cdot 3000$

The value of 0.73 in the formula for the efficiency bonus (E) is proposed because of the additional pressure drop given by treatment for moisture transfer under non-condensing conditions.

The tabled approach provides for optimum adjustment of η_{t_nrvu} and η_{x_c} in warm climate countries (or applications), where the recovery of moisture is more relevant than recovery of sensible heat, yet still ensuring appropriate recovery of energy. By modifying the efficiency bonus (E) calculation, it also allows for higher air pressure drop typical for moisture recovery HRS.

2. Inclusion of information on annual consumption of energy attributable to HRS defrosting into the information request for NRVUs (Annex V of the Regulation 1253/2014)

The current methodology of the energy efficiency assessment for NRVUs does not distinguish a type of HRS applied in a ventilation unit in terms of its sensitivity to freezing. This could lead to confusing conclusions, particularly when comparing ventilation units operating in cold climate countries.

To ensure continuous, undisturbed operation of the exchanger in cold climate conditions, additional energy for defrosting might need to be supplied. This is not covered in the current Ecodesign benchmark for NRVUs.

To provide for level-playing field for all manufacturers, Eurovent suggest including in the information request (Annex V of the Regulation) an indication of annual energy consumption for defrosting, attributable to applied HRS, most preferably expressed in kWh/a.

Moreover, Eurovent holds that

1. The displayed defrosting energy should be determined based on a simplified calculation method for common reference conditions (climate zone, operating time, temperature and moisture content of extract air)
2. Considered climate zones should be the same as already applied in the assessment for RVUs (Cold, Average, Warm)
3. The calculation method should take into consideration the defrosting strategy and control logic (either offered by an integrated control system or provided in a manufacturer's manual)

Figures calculated separately for each climate zone should be presented in the information requirements.

3. Following revised requirements of ecodesign regulation for fans

Being currently under revision Commission Regulation (EU) 327/2011 implementing ecodesign requirements for fans is expected to introduce new, higher target energy efficiencies reflecting fan technology progress. The Eurovent members are of an opinion, that in the revised regulation for ventilation units, the maximum internal specific fan power factors (SFP_{int_limit}) should be adjusted accordingly to requirements of revised Regulation 327/2011.

<u>Appendix to Eurovent Position 4 of 5:</u> Additional justification to consider the impact of moisture recovery on overall energy saving

Given that providing for correct indoor environmental quality (including humidity indoors) is a common requirement, the presented below case-study for various European climate conditions illustrates potential savings of electric energy for cooling, resulting from applying a heat exchanger offering moisture recovery.

The study includes four locations (Milano, Valencia, München and Oslo) and collates energy consumption for cooling of systems equipped with a sorption rotary heat exchanger (60% humidity recovery efficiency), and an exchanger featuring only the sensitive heat recovery.

The analyses below simulate the energy consumption in different European climate zones.

Simulation

Balanced air mass flow rate 6000 kg/h (5000 m3/h),

<u>Supply air</u> in heating conditions: 19° and 4.9 g humidity (results in 22°30% Inside Air conditions, respectively <u>Return Air conditions</u>)

<u>Supply air</u> in cooling conditions: 19° and 8.7 g humidity (results in 22°53% Inside Air conditions, respectively <u>Return Air conditions</u>)

Baseline: η_t – 73%, no humidity transfer

Sorption Rotary heat exchanger with 73% and 60% humidity efficiency

$$\boldsymbol{\eta_{e\_nrvu} = \eta_{t\_nrvu} + c \cdot \eta_{x\text{-cooling conditions}}}$$

c = 0.08

Outcomes of the simulations prove that the value of **c** conversion factor equal to 0.08 reflects correctly total energy saving even for the worst climatic conditions.

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	Milan		Valencia		Munich		Oslo	
	kWh	%	kWh	%	kWh	%	kWh	%
Cooling conditions								
Total demand	42 908	100%	83 740	100%	16 410	100%	1245	100%
sensible recovery 73%	11 202	26%	12 000	14%	3 468	21%	306	25%
latent recovery 60%	10 612	25%	34 434	41%	4 533	28%	6	0%
Heating conditions								
Total demand	109 005	100%	56 940	100%	153 009	100%	193852	100%
sensible recovery 73%	83 053	76%	46 625	82%	120 124	79%	143440	74%
latent recovery 60%	10 790	10%	4 941	9%	11 471	7%	18846	10%
Total								
Demand cooling/heating	151 913	100%	140 680	100%	169 419	100%	195097	100%
Sensible saving 73%	94 255	62%	58 625	42%	123 592	73%	143746	74%
latent recovery 60%	21 402	14%	39 375	28%	16 004	9%	18852	10%
Total Energy saving 73%/60%	115 657	76%	98 000	70%	139 596	82%	162598	83%

APPENDIX 3 – prEN 16798-1 annex C

Annex C
(informative)
Occupants schedules for energy calculations

School, classroom

Parameters and setpoints

	Parameter	Value	Unit
Operation time	Hour at day, START	8	hour
	Hour at day, END	17	hour
	Breaks, inside range	0	hours
	days/week	5	days
	hours/day	9	hours
	hours/year	2346	hours
Internal gains	Occupants	5.4	m2/pers
	Occupants (Total)	23.3	W/m^2
	Occupants (Dry)	14	W/m^2
	Appliances	8	W/m^2
	Lighting		
	Moisture production	11.11	g/(m2, h)
	CO_2 production	3.46	l/(m2, h)
Setpoints	Min T,op in unoccupied hours	16	°C
	Max T,op in unoccupied hours	32	°C
	Min T,op	20	°C
	Max T,op	26	°C
	Ventilation rate (min.)	3.8	$l/(s\ m^2)$
	Ventilation rate for CO2 emission	1.84	$l/(s\ m^2)$
	Max CO_2 concentration (above outdoor)	500	ppm
	Min. relative humidity	25	%
	Max. relative humidity	60	%
	Lighting, illuminance in working areas	500	lux
Other	Domestic hot water use	100	l/(m2 year)

* u.r. : Usage rate, summed load factors/usage time

Usage schedule

	Energy calculation					
	Weekdays			Weekends		
h	Occupants	Appliances	Lighting	Occupants	Appliances	Lighting
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0.6	0.6	0.6	0	0	0
10	0.7	0.7	0.7	0	0	0
11	0.6	0.6	0.6	0	0	0
12	0.4	0.4	0.4	0	0	0
13	0.3	0.3	0.3	0	0	0
14	0.7	0.7	0.7	0	0	0
15	0.6	0.6	0.6	0	0	0
16	0.4	0.4	0.4	0	0	0
17	0.2	0.2	0.2	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0
21	0	0	0	0	0	0
22	0	0	0	0	0	0
23	0	0	0	0	0	0
24	0	0	0	0	0	0
*u.r.	0.50	0.50	0.50	0.00	0.00	0.00

Restaurant

Parameters and setpoints

	Parameter	Value	Unit
Operation time	Hour at day, START	6	hour
	Hour at day, END	24	hour
	Breaks, inside range	0	hours
	days/week	7	days
	hours/day	18	hours
	hours/year	6570	hours
Internal gains	Occupants	6.1	m2/pers
	Occupants (Total)	23.3	W/m²
	Occupants (Dry)	14	W/m²
	Appliances	4	W/m²
	Lighting		
	Moisture production	9.84	g/(m2, h)
	CO_2 production	3.07	l/(m2, h)
Setpoints	Min T,op in unoccupied hours	16	°C
	Max T,op in unoccupied hours	32	°C
	Min T,op	16	°C
	Max T,op	25	°C
	Ventilation rate (min.)	5.2	l/(s m²)
	Ventilation rate for CO2 emission	1.62	l/(s m²)
	Max CO_2 concentration (above outdoor)	500	ppm
	Min. relative humidity	25	%
	Max. relative humidity	60	%
	Lighting, illuminance in working areas	300	lux
Other	Domestic hot water use	100	l/(m2 year)

* u.r. : Usage rate, summed load factors/usage time

Usage schedule

h	Energy calculation					
	Weekdays			Weekends		
	Occupants	Appliances	Lighting	Occupants	Appliances	Lighting
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0.1	0.13	0.3	0.1	0.13	0.3
8	0.4	0.15	0.3	0.4	0.15	0.3
9	0.4	0.18	0.55	0.4	0.18	0.55
10	0.4	0.21	0.55	0.4	0.21	0.55
11	0.2	0.26	0.75	0.2	0.26	0.75
12	0.5	0.29	0.75	0.5	0.29	0.75
13	0.8	0.27	0.75	0.8	0.27	0.75
14	0.7	0.25	0.75	0.7	0.25	0.75
15	0.4	0.23	0.75	0.4	0.23	0.75
16	0.2	0.23	0.75	0.2	0.23	0.75
17	0.25	0.26	0.7	0.25	0.26	0.7
18	0.5	0.26	0.75	0.5	0.26	0.75
19	0.8	0.24	0.75	0.8	0.24	0.75
20	0.8	0.22	0.75	0.8	0.22	0.75
21	0.8	0.2	0.75	0.8	0.2	0.75
22	0.5	0.18	0.75	0.5	0.18	0.75
23	0.35	0.09	0.5	0.35	0.09	0.5
24	0.2	0.03	0.3	0.2	0.03	0.3
*u.r.	0.46	0.20	0.64	0.46	0.20	0.64

Residential, Detached house

Parameters and setpoints

	Parameter	Value	Unit
Operation time	Hour at day, START	0	hour
	Hour at day, END	24	hour
	Breaks, inside range	0	hours
	days/week	7	days
	hours/day	24	hours
	hours/year	8760	hours
Internal gains	Occupants	42,5	m2/pers
	Occupants (Total)	3,3	W/m^2
	Occupants (Dry)	2	W/m^2
	Appliances	2,4	W/m^2
	Lighting		
	Moisture production	1,41	g/(m2, h)
	CO_2 production	0,44	l/(m2, h)
Setpoints	Min T,op in unoccupied hours	16	°C
	Max T,op in unoccupied hours	32	°C
	Min T,op	20	°C
	Max T,op	26	°C
	Ventilation rate (min.)	0,5	l/(s m^2)
	Ventilation rate for CO2 emission	0,16	l/(s m^2)
	Max CO_2 concentration (above outdoor)	500	ppm
	Min. relative humidity	25	%
	Max. relative humidity	60	%
	Lighting, illuminance in working areas	0	lux
Other	Domestic hot water use	100	l/(m2 year)

* u.r. : Usage rate, summed load factors/usage time

Usage schedule

	Energy calculation					
	Weekdays			Weekends		
h	Occupants	Appliances	Lighting	Occupants	Appliances	Lighting
1	1	0,5	0	1	0,5	0
2	1	0,5	0	1	0,5	0
3	1	0,5	0	1	0,5	0
4	1	0,5	0	1	0,5	0
5	1	0,5	0	1	0,5	0
6	1	0,5	0	1	0,5	0
7	0,5	0,5	0,15	0,8	0,5	0,15
8	0,5	0,7	0,15	0,8	0,7	0,15
9	0,5	0,7	0,15	0,8	0,7	0,15
10	0,1	0,5	0,15	0,8	0,5	0,15
11	0,1	0,5	0,05	0,8	0,5	0,05
12	0,1	0,6	0,05	0,8	0,6	0,05
13	0,1	0,6	0,05	0,8	0,6	0,05
14	0,2	0,6	0,05	0,8	0,6	0,05
15	0,2	0,6	0,05	0,8	0,6	0,05
16	0,2	0,5	0,05	0,8	0,5	0,05
17	0,5	0,5	0,2	0,8	0,5	0,2
18	0,5	0,7	0,2	0,8	0,7	0,2
19	0,5	0,7	0,2	0,8	0,7	0,2
20	0,8	0,8	0,2	0,8	0,8	0,2
21	0,8	0,8	0,2	0,8	0,8	0,2
22	0,8	0,8	0,2	0,8	0,8	0,2
23	1	0,6	0,15	1	0,6	0,15
24	1	0,6	0,15	1	0,6	0,15
*u.r.	0,60	0,60	0,10	0,00	0,00	0,00

Residential, apartment

Parameters and setpoints

	Parameter	Value	Unit
Operation time	Hour at day, START	0	hour
	Hour at day, END	24	hour
	Breaks, inside range	0	hours
	days/week	7	days
	hours/day	24	hours
	hours/year	8760	hours
Internal gains	Occupants	28,3	m2/pers
	Occupants (Total)	5	W/m^2
	Occupants (Dry)	3	W/m^2
	Appliances	3	W/m^2
	Lighting		
	Moisture production	2,12	g/(m2, h)
	CO_2 production	0,66	l/(m2, h)
Setpoints	Min T,op in unoccupied hours	16	°C
	Max T,op in unoccupied hours	32	°C
	Min T,op	20	°C
	Max T,op	26	°C
	Ventilation rate (min.)	0,5	l/(s m^2)
	Ventilation rate for CO2 emission	0,28	l/(s m^2)
	Max CO_2 concentration (above outdoor)	500	ppm
	Min. relative humidity	25	%
	Max. relative humidity	60	%
	Lighting, illuminance in working areas	0	lux
Other	Domestic hot water use	100	l/(m2 year)

Usage schedule

	Energy calculation					
	Weekdays			Weekends		
h	Occupants	Appliances	Lighting	Occupants	Appliances	Lighting
1	1	0,5	0	1	0,5	0
2	1	0,5	0	1	0,5	0
3	1	0,5	0	1	0,5	0
4	1	0,5	0	1	0,5	0
5	1	0,5	0	1	0,5	0
6	1	0,5	0	1	0,5	0
7	0,5	0,5	0,15	0,8	0,5	0,15
8	0,5	0,7	0,15	0,8	0,7	0,15
9	0,5	0,7	0,15	0,8	0,7	0,15
10	0,1	0,5	0,15	0,8	0,5	0,15
11	0,1	0,5	0,05	0,8	0,5	0,05
12	0,1	0,6	0,05	0,8	0,6	0,05
13	0,1	0,6	0,05	0,8	0,6	0,05
14	0,2	0,6	0,05	0,8	0,6	0,05
15	0,2	0,6	0,05	0,8	0,6	0,05
16	0,2	0,5	0,05	0,8	0,5	0,05
17	0,5	0,5	0,2	0,8	0,5	0,2
18	0,5	0,7	0,2	0,8	0,7	0,2
19	0,5	0,7	0,2	0,8	0,7	0,2
20	0,8	0,8	0,2	0,8	0,8	0,2
21	0,8	0,8	0,2	0,8	0,8	0,2
22	0,8	0,8	0,2	0,8	0,8	0,2
23	1	0,6	0,15	1	0,6	0,15
24	1	0,6	0,15	1	0,6	0,15

Residential, apartment, retired

Parameters and setpoints

	Parameter	Value	Unit
Operation time	Hour at day, START	0	hour
	Hour at day, END	24	hour
	Breaks, inside range	0	hours
	days/week	7	days
	hours/day	24	hours
	hours/year	8760	hours
Internal gains	Occupants	28,3	m2/pers
	Occupants (Total)	5	W/m^2
	Occupants (Dry)	3	W/m^2
	Appliances	3	W/m^2
	Lighting		
	Moisture production	2,12	g/(m2, h)
	CO_2 production	0,66	l/(m2, h)
Setpoints	Min T,op in unoccupied hours	16	°C
	Max T,op in unoccupied hours	32	°C
	Min T,op	20	°C
	Max T,op	26	°C
	Ventilation rate (min.)	0,5	$l/(s\ m^2)$
	Ventilation rate for CO2 emission	0,28	$l/(s\ m^2)$
	Max CO_2 concentration (above outdoor)	500	ppm
	Min. relative humidity	25	%
	Max. relative humidity	60	%
	Lighting, illuminance in working areas	0	lux
Other	Domestic hot water use	100	l/(m2 year)

Usage schedule

	Energy calculation					
	Weekdays			Weekends		
h	Occupants	Appliances	Lighting	Occupants	Appliances	Lighting
1	1	0,5	0	1	0,5	0
2	1	0,5	0	1	0,5	0
3	1	0,5	0	1	0,5	0
4	1	0,5	0	1	0,5	0
5	1	0,5	0	1	0,5	0
6	1	0,5	0	1	0,5	0
7	1	0,5	0,15	1	0,5	0,15
8	1	0,7	0,15	1	0,7	0,15
9	1	0,7	0,15	1	0,7	0,15
10	1	0,5	0,15	1	0,5	0,15
11	1	0,5	0,05	1	0,5	0,05
12	1	0,6	0,05	1	0,6	0,05
13	1	0,6	0,05	1	0,6	0,05
14	1	0,6	0,05	1	0,6	0,05
15	1	0,6	0,05	1	0,6	0,05
16	1	0,5	0,05	1	0,5	0,05
17	1	0,5	0,2	1	0,5	0,2
18	1	0,7	0,2	1	0,7	0,2
19	1	0,7	0,2	1	0,7	0,2
20	1	0,8	0,2	1	0,8	0,2
21	1	0,8	0,2	1	0,8	0,2
22	1	0,8	0,2	1	0,8	0,2
23	1	0,6	0,15	1	0,6	0,15
24	1	0,6	0,15	1	0,6	0,15

Office, single

Parameters and setpoints

	Parameter	Value	Unit
Operation time	Hour at day, START	7	hour
	Hour at day, END	18	hour
	Breaks, inside range	0	hours
	days/week	5	days
	hours/day	11	hours
	hours/year	2868	hours
Internal gains	Occupants	10	m2/pers
	Occupants (Total)	8.3	W/m^2
	Occupants (Dry)	5	W/m^2
	Appliances	12	W/m^2
	Lighting		
	Moisture production	6.00	g/(m2, h)
	CO_2 production	1.87	l/(m2, h)
Setpoints	Min T,op in unoccupied hours	16	°C
	Max T,op in unoccupied hours	32	°C
	Min T,op	20	°C
	Max T,op	26	°C
	Ventilation rate (min.)	1	$l/(s\ m^2)$
	Ventilation rate for CO2 emission	0.96	$l/(s\ m^2)$
	Max CO_2 concentration (above outdoor)	500	ppm
	Min. relative humidity	25	%
	Max. relative humidity	60	%
	Lighting, illuminance in working areas	500	lux
Other	Domestic hot water use	100	l/(m2 year)

* u.r. : Usage rate, summed load factors/usage time

Usage schedule

	Energy calculation					
	Weekdays			Weekends		
h	Occupants	Appliances	Lighting	Occupants	Appliances	Lighting
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0	0
10	1	1	1	0	0	0
11	1	1	1	0	0	0
12	1	1	1	0	0	0
13	0	0	0	0	0	0
14	1	1	1	0	0	0
15	1	1	1	0	0	0
16	1	1	1	0	0	0
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0
21	0	0	0	0	0	0
22	0	0	0	0	0	0
23	0	0	0	0	0	0
24	0	0	0	0	0	0
*u.r.	0.55	0.55	0.55	0.00	0.00	0.00

Office, main

Parameters and setpoints

	Parameter	Value	Unit
Operation time	Hour at day, START	7	hour
	Hour at day, END	18	hour
	Breaks, inside range	0	hours
	days/week	5	days
	hours/day	11	hours
	hours/year	2868	hours
Internal gains	Occupants	17	m2/pers
	Occupants (Total)	8.3	W/m^2
	Occupants (Dry)	5	W/m^2
	Appliances	12	W/m^2
	Lighting		
	Moisture production	3.53	g/(m2, h)
	CO_2 production	1.10	l/(m2, h)
Setpoints	Min T,op in unoccupied hours	16	°C
	Max T,op in unoccupied hours	32	°C
	Min T,op	20	°C
	Max T,op	26	°C
	Ventilation rate (min.)	0.8	$l/(s\ m^2)$
	Ventilation rate for CO2 emission	0.53	$l/(s\ m^2)$
	Max CO_2 concentration (above outdoor)	500	ppm
	Min. relative humidity	25	%
	Max. relative humidity	60	%
	Lighting, illuminance in working areas	500	lux
Other	Domestic hot water use	100	l/(m2 year)

* u.r. : Usage rate, summed load factors/usage time

Usage schedule

	Energy calculation					
	Weekdays			Weekends		
h	Occupants	Appliances	Lighting	Occupants	Appliances	Lighting
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0.2	0.2	0.2	0	0	0
9	0.6	0.6	0.6	0	0	0
10	0.6	0.6	0.6	0	0	0
11	0.7	0.7	0.7	0	0	0
12	0.7	0.7	0.7	0	0	0
13	0.4	0.4	0.4	0	0	0
14	0.6	0.6	0.6	0	0	0
15	0.7	0.7	0.7	0	0	0
16	0.7	0.7	0.7	0	0	0
17	0.6	0.6	0.6	0	0	0
18	0.2	0.2	0.2	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0
21	0	0	0	0	0	0
22	0	0	0	0	0	0
23	0	0	0	0	0	0
24	0	0	0	0	0	0
*u.r.	0.55	0.55	0.55	0.00	0.00	0.00

Meeting room

Parameters and setpoints

	Parameter	Value	Unit
Operation time	Hour at day, START	7	hour
	Hour at day, END	18	hour
	Breaks, inside range	0	hours
	days/week	5	days
	hours/day	11	hours
	hours/year	2868	hours
Internal gains	Occupants	2	m2/pers
	Occupants (Total)	8.3	W/m^2
	Occupants (Dry)	5	W/m^2
	Appliances	12	W/m^2
	Lighting		
	Moisture production	30.00	g/(m2, h)
	CO_2 production	9.35	l/(m2, h)
Setpoints	Min T,op in unoccupied hours	16	°C
	Max T,op in unoccupied hours	32	°C
	Min T,op	20	°C
	Max T,op	26	°C
	Ventilation rate (min.)	3.8	$l/(s\ m^2)$
	Ventilation rate for CO2 emission	5.11	$l/(s\ m^2)$
	Max CO_2 concentration (above outdoor)	500	ppm
	Min. relative humidity	25	%
	Max. relative humidity	60	%
	Lighting, illuminance in working areas	500	lux
Other	Domestic hot water use	100	l/(m2 year)

* u.r. : Usage rate, summed load factors/usage time

Usage schedule

	Energy calculation					
	Weekdays			Weekends		
h	Occupants	Appliances	Lighting	Occupants	Appliances	Lighting
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0.5	0.5	0.5	0	0	0
10	0.8	0.8	0.8	0	0	0
11	0.9	0.9	0.9	0	0	0
12	0.8	0.8	0.8	0	0	0
13	0	0	0	0	0	0
14	0.7	0.7	0.7	0	0	0
15	0.8	0.8	0.8	0	0	0
16	0.8	0.8	0.8	0	0	0
17	0.7	0.7	0.7	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0
21	0	0	0	0	0	0
22	0	0	0	0	0	0
23	0	0	0	0	0	0
24	0	0	0	0	0	0
*u.r.	0.55	0.55	0.55	0.00	0.00	0.00

Department store

Parameters and setpoints

	Parameter	Value	Unit
Operation time	Hour at day, START	8	hour
	Hour at day, END	21	hour
	Breaks, inside range	0	hours
	days/week	7	days
	hours/day	13	hours
	hours/year	4745	hours
Internal gains	Occupants	17	m2/pers
	Occupants (Total)	8.3	W/m^2
	Occupants (Dry)	5	W/m^2
	Appliances	1	W/m^2
	Lighting		
	Moisture production	3.53	g/(m2, h)
	CO_2 production	1.10	l/(m2, h)
Setpoints	Min T,op in unoccupied hours	16	°C
	Max T,op in unoccupied hours	32	°C
	Min T,op	16	°C
	Max T,op	25	°C
	Ventilation rate (min.)	2.2	$l/(s\ m^2)$
	Ventilation rate for CO2 emission	0.53	$l/(s\ m^2)$
	Max CO_2 concentration (above outdoor)	500	ppm
	Min. relative humidity	25	%
	Max. relative humidity	60	%
	Lighting, illuminance in working areas	500	lux
Other	Domestic hot water use	100	l/(m2 year)

* u.r. : Usage rate, summed load factors/usage time

Usage schedule

	Energy calculation					
	Weekdays			Weekends		
h	Occupants	Appliances	Lighting	Occupants	Appliances	Lighting
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0.1	1	1	0.1	1	1
10	0.3	1	1	0.3	1	1
11	0.3	1	1	0.6	1	1
12	0.7	1	1	0.9	1	1
13	0.6	1	1	1	1	1
14	0.5	1	1	0.9	1	1
15	0.6	1	1	0.7	1	1
16	0.6	1	1	0.5	1	1
17	0.9	1	1	0.3	1	1
18	0.9	1	1	0.3	1	1
19	1	1	1	0.45	1	1
20	0.9	1	1	0.45	1	1
21	0.7	1	1	0.45	1	1
22	0	0	0	0	0	0
23	0	0	0	0	0	0
24	0	0	0	0	0	0
*u.r.	0.62	1.00	1.00	0.53	1.00	1.00

Daycare, kindergarten

Parameters and setpoints

	Parameter	Value	Unit
Operation time	Hour at day, START	7	hour
	Hour at day, END	19	hour
	Breaks, inside range	0	hours
	days/week	5	days
	hours/day	12	hours
	hours/year	3129	hours
Internal gains	Occupants	3.8	m2/pers
	Occupants (Total)	33.3	W/m^2
	Occupants (Dry)	20	W/m^2
	Appliances	4	W/m^2
	Lighting		
	Moisture production	15.79	g/(m2, h)
	CO_2 production	4.92	l/(m2, h)
Setpoints	Min T,op in unoccupied hours	16	°C
	Max T,op in unoccupied hours	32	°C
	Min T,op	17.5	°C
	Max T,op	25.5	°C
	Ventilation rate (min.)	4.5	$l/(s\ m^2)$
	Ventilation rate for CO2 emission	1.64	$l/(s\ m^2)$
	Max CO_2 concentration (above outdoor)	500	ppm
	Min. relative humidity	25	%
	Max. relative humidity	60	%
	Lighting, illuminance in working areas	500	lux
Other	Domestic hot water use	100	l/(m2 year)

* u.r. : Usage rate, summed load factors/usage time

Usage schedule

	Energy calculation					
	Weekdays			Weekends		
h	Occupants	Appliances	Lighting	Occupants	Appliances	Lighting
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0.4	0.4	0.4	0	0	0
9	0.8	0.8	0.8	0	0	0
10	0.8	0.8	0.8	0	0	0
11	0.3	0.3	0.3	0	0	0
12	0.3	0.3	0.3	0	0	0
13	0.8	0.8	0.8	0	0	0
14	0.1	0.1	0.1	0	0	0
15	0.1	0.1	0.1	0	0	0
16	0.4	0.4	0.4	0	0	0
17	0.3	0.3	0.3	0	0	0
18	0.3	0.3	0.3	0	0	0
19	0.3	0.3	0.3	0	0	0
20	0	0	0	0	0	0
21	0	0	0	0	0	0
22	0	0	0	0	0	0
23	0	0	0	0	0	0
24	0	0	0	0	0	0
*u.r.	0.41	0.41	0.41	0.00	0.00	0.00