CONFIDENTIAL

ROTTERDAM SITE DEVELOPMENT – DEFINITION PHASE
NESTE

LABORATORY EXPANSION

HVAC CALCULATION REPORT

REV.	DATE	STATUS	WRITTEN BY (name & visa)	CHECKED BY (name & visa)	APPROV./AUTHOR. BY (name & visa)
			Signed By Chiara Cassese	Signed By Valerie Cavallari 2020.12.23 14:35:35 +01'00'	Signed By Alessandro Frattini 2020.12.23 18:11:26 +01'00' Signed By Olimpia Loiacono 2020.12.23 18:47:45 +01'00'
A	23/12/2020	ISSUE FOR REVIEW	M.P.	V.C.	A.F. / O.L.

DOCUMENT REVISIONS

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1. GENERAL

Scope of this document is to show the thermal calculations and the utilities consumptions as result of the basic design of the Heating, Ventilating and Air Conditioning (HVAC) system to be provided for the Laboratory expansion in the existing Operation Center building, as part of “ROTTERDAM SITE DEVELOPMENT”.

The HVAC systems performances, hereinafter shown, are based on preliminary thermal calculations and shall be updated during the detail design phase.
For any technical – economical evaluation to be correlated to the HVAC systems supply, said performances shall be verified by Supplier and assumed as valid, under their responsibility.

2. REFERENCE DOCUMENTS

This document is complementary to the “HVAC process flow diagram” and to the “HVAC layout” relevant to the HVAC system and complies with the following Technip Specifications:

a. 080871C-000-JSD-3400-001 “Job Design Specification for HVAC Systems”.
b. 080871C-000-JSS-3480-001 “General supply rules for HVAC Systems”.

Calculations are based on following drawings:

- 080871C-75-DW-2023-01-01 rev.A: “Laboratory expansion – Building architectural design – Plan views and schedules”
- 080871C-75-DW-2023-01-02 rev.A: “Laboratory expansion – Building architectural design – Elevations”
- 080871C-75-DW-2023-01-03 rev.A: “Laboratory expansion – Building architectural design – Sections and detail”

3. THERMAL CALCULATIONS

3.1. General

The thermal calculations, shown in the attached printout, are to be considered preliminary and shall be checked/updated, taking into account the latest revision of architectural and structural drawings and the above mentioned Technip Specifications.
The used calculation software is the widely known and recognized Carrier HAP program v.5.11.

The figures used as input data are those shown in the above mentioned 080871C-000-JSD-3400-001 “Job Design Specification for HVAC Systems”.
Particularly, the internal heat gains due to equipment are preliminary: they shall be checked/updated during the Detail design phase.

3.2. Thermal calculations summary

The preliminary thermal calculation results are summarized in the following table: it shows the minimum required capacity for each equipment.

Equipment	*quantity (no.)*	*supply air (l/s)*	*fresh air (l/s)*	*exhaust air (l/s)*	*Cooling cap. (kW)*	*Electrical Heating cap. (kW)*
OC-ACWC-02A/B – Air cooled water chiller (n.1 duty, n.1 stand-by, each sized for 100% of total cooling capacity)	2				73	-
OC-AHU-04 – Once-through Air handling unit	1	2251	2251		73	66
OC-EF-05 – Exhaust fan	1			2190		
Electrical duct heating coils						32
Electrical radiators						8
Electric chilled water pumps (n.1 duty, n.1 stand-by)	2					

4. ELECTRICAL LOADS SUMMARY

The preliminary electrical consumptions for HVAC are summarized in the following table: it shows the maximum contemporary consumption for the duty units, during winter operation (worst case):

Equipment	*Tot. el. power input (kW)*
OC-AHU-04 – Once-through Air handling unit	72
OC-EF-05 – Exhaust fan	3
Electrical duct heating coils	32
Electrical radiators	8
TOTAL	***115***

CARRIER HAP THERMAL CALCULATIONS PRINTOUT

5.1. Design weather parameters

Design Weather Parameters & MSHGs

Rotterdam - Laboratory expansion 16-12-20 — 12/21/2020
Ing. Mauro Petriccione — 12:07

Design Parameters:

City Name	Rotterdam	
Location	Netherlands	
Latitude	52,3	Deg.
Longitude	-4,8	Deg.
Elevation	5,0	m
Summer Design Dry-Bulb	28,0	°C
Summer Coincident Wet-Bulb	21,0	°C
Summer Daily Range	9,3	K
Winter Design Dry-Bulb	-10,0	°C
Winter Design Wet-Bulb	-10,0	°C
Atmospheric Clearness Number	1,00	
Average Ground Reflectance	0,20	
Soil Conductivity	1,385	W/(m K)
Local Time Zone (GMT +/- N hours)	-1,0	hours
Consider Daylight Savings Time	No	
Simulation Weather Data	N/A	
Current Data is	User Modified	
Design Cooling Months	January to December	

Design Day Maximum Solar Heat Gains

(The MSHG values are expressed in W/m²)

Month	N	NNE	NE	ENE	E	ESE	SE	SSE	S
January	38,8	38,8	38,8	98,7	308,2	473,1	618,1	687,5	715,2
February	55,8	55,8	72,2	288,0	480,0	639,4	730,3	775,6	780,0
March	74,7	74,7	242,5	454,2	611,0	724,2	761,7	755,4	742,3
April	94,1	186,7	400,6	555,9	679,0	712,3	689,8	650,0	629,4
May	113,0	305,1	487,7	621,3	687,3	680,1	627,5	556,8	529,7
June	156,7	346,4	514,5	633,8	681,4	657,2	591,6	514,4	481,4
July	121,5	292,0	483,9	602,9	676,6	664,8	608,7	547,0	515,0
August	99,5	190,3	383,3	541,5	652,7	690,1	668,2	630,2	608,5
September	78,4	78,4	207,4	425,5	567,6	686,1	722,0	721,7	716,9
October	58,7	58,7	84,1	257,4	462,4	607,7	708,1	747,1	757,4
November	40,0	40,0	40,0	117,9	278,2	473,7	589,8	681,0	706,2
December	31,5	31,5	31,5	44,3	228,7	378,7	538,8	614,4	652,4
Month	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**	**HOR**	**Mult**
January	695,2	617,9	473,7	306,6	106,1	38,8	38,8	185,7	1,00
February	770,8	727,7	643,5	465,5	291,7	68,1	55,8	353,1	1,00
March	752,0	759,6	711,4	622,6	440,4	251,6	74,7	526,9	1,00
April	649,4	697,7	714,0	674,0	564,6	399,0	191,9	661,6	1,00
May	559,0	630,7	685,8	678,1	624,4	477,2	311,6	738,6	1,00
June	516,8	595,8	664,1	679,6	633,7	511,7	348,8	760,6	1,00
July	548,1	616,6	672,1	670,4	611,6	473,1	308,7	731,3	1,00
August	629,1	674,2	688,9	648,8	544,4	385,3	190,6	652,5	1,00
September	719,3	718,7	685,0	574,3	424,7	206,4	78,4	511,0	1,00
October	748,8	707,9	596,6	464,8	253,0	86,0	58,7	352,7	1,00
November	679,4	594,2	473,7	285,1	117,6	40,0	40,0	189,4	1,00
December	623,5	529,5	397,8	216,4	62,0	31,5	31,5	128,0	1,00

Mult. = User-defined solar multiplier factor.

Cooling Design Temperature Profiles

Rotterdam - Laboratory expansion 16-12-20 — 12/21/2020 12:07
Ing. Mauro Petriccione

Location: Rotterdam, Netherlands

(Dry and Wet Bulb temperatures are expressed in °C)

Hr	January		February		March		April		May		June	
	DB	WB	DB	WB	DB	WB	DB	WB	DB	WB	DB	WB
0000	8,9	8,6	10,4	10,1	13,5	13,2	15,6	15,3	18,2	17,4	19,8	18,6
0100	8,4	8,1	9,9	9,6	13,0	12,8	15,1	14,8	17,7	17,2	19,4	18,5
0200	7,9	7,7	9,4	9,1	12,6	12,3	14,6	14,3	17,2	16,9	18,9	18,3
0300	7,6	7,3	9,0	8,8	12,2	11,9	14,2	14,0	16,8	16,6	18,5	18,2
0400	7,3	7,0	8,8	8,5	11,9	11,7	14,0	13,7	16,6	16,3	18,2	18,0
0500	7,2	6,9	8,7	8,4	11,8	11,6	13,9	13,6	16,5	16,2	18,1	17,9
0600	7,4	7,1	8,9	8,6	12,0	11,7	14,1	13,8	16,7	16,4	18,3	18,1
0700	7,8	7,6	9,3	9,1	12,5	12,2	14,5	14,3	17,1	16,9	18,8	18,3
0800	8,7	8,4	10,2	9,9	13,3	13,0	15,4	15,1	18,0	17,3	19,6	18,6
0900	9,9	9,6	11,4	11,1	14,5	14,3	16,6	16,3	19,2	17,7	20,8	18,9
1000	11,3	11,0	12,8	12,5	15,9	15,7	18,0	17,0	20,6	18,2	22,2	19,4
1100	12,9	12,6	14,4	14,1	17,5	16,4	19,6	17,6	22,2	18,7	23,8	19,9
1200	14,3	13,5	15,8	14,7	19,0	16,9	21,0	18,1	23,6	19,2	25,3	20,4
1300	15,5	13,9	17,0	15,1	20,1	17,3	22,2	18,5	24,8	19,6	26,4	20,7
1400	16,2	14,2	17,7	15,3	20,9	17,6	22,9	18,7	25,5	19,8	27,2	20,9
1500	16,5	14,3	18,0	15,4	21,1	17,7	23,2	18,8	25,8	19,9	27,4	21,0
1600	16,2	14,2	17,7	15,3	20,9	17,6	22,9	18,7	25,5	19,8	27,2	20,9
1700	15,6	14,0	17,0	15,1	20,2	17,4	22,2	18,5	24,8	19,6	26,5	20,7
1800	14,5	13,6	16,0	14,7	19,2	17,0	21,2	18,1	23,8	19,3	25,5	20,4
1900	13,3	13,1	14,8	14,3	18,0	16,6	20,0	17,7	22,6	18,9	24,3	20,0
2000	12,1	11,8	13,6	13,3	16,8	16,1	18,8	17,3	21,4	18,5	23,1	19,7
2100	11,1	10,8	12,6	12,3	15,7	15,5	17,8	17,0	20,4	18,2	22,1	19,3
2200	10,2	9,9	11,7	11,4	14,8	14,5	16,9	16,6	19,5	17,8	21,1	19,0
2300	9,4	9,1	10,9	10,6	14,1	13,8	16,1	15,8	18,7	17,6	20,4	18,8

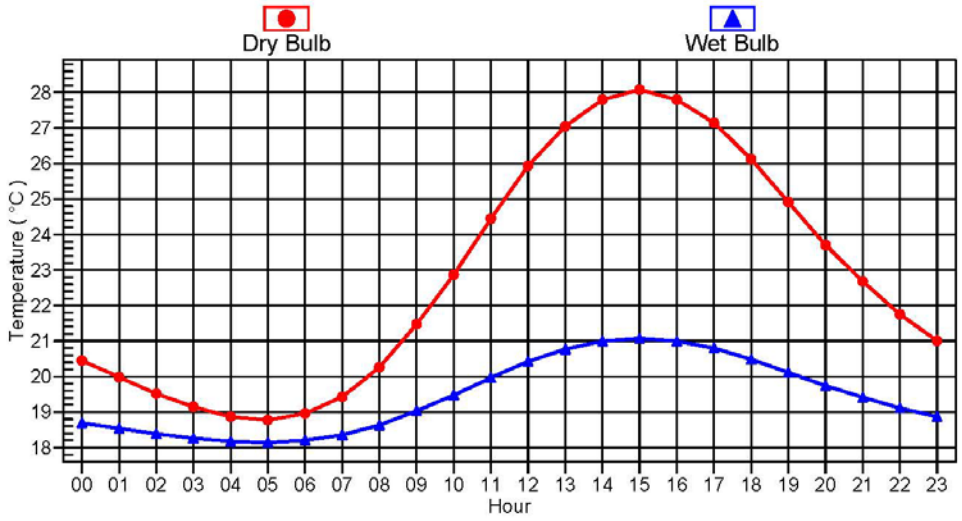
Hr	July		August		September		October		November		December	
	DB	WB	DB	WB	DB	WB	DB	WB	DB	WB	DB	WB
0000	20,4	18,6	20,4	18,6	19,3	18,0	16,7	16,4	13,0	12,7	9,8	9,5
0100	19,9	18,5	19,9	18,5	18,8	17,9	16,2	15,9	12,5	12,2	9,3	9,1
0200	19,4	18,3	19,4	18,3	18,3	17,7	15,7	15,5	12,0	11,7	8,9	8,6
0300	19,1	18,2	19,1	18,2	18,0	17,6	15,4	15,1	11,6	11,4	8,5	8,2
0400	18,8	18,1	18,8	18,1	17,7	17,4	15,1	14,8	11,4	11,1	8,2	7,9
0500	18,7	18,1	18,7	18,1	17,6	17,3	15,0	14,7	11,3	11,0	8,1	7,8
0600	18,9	18,1	18,9	18,1	17,8	17,5	15,2	14,9	11,5	11,2	8,3	8,0
0700	19,4	18,3	19,4	18,3	18,2	17,7	15,6	15,4	11,9	11,7	8,8	8,5
0800	20,2	18,6	20,2	18,6	19,1	17,9	16,5	16,2	12,8	12,5	9,6	9,3
0900	21,4	19,0	21,4	19,0	20,3	18,3	17,7	16,7	14,0	13,7	10,8	10,5
1000	22,8	19,4	22,8	19,4	21,7	18,8	19,1	17,2	15,4	15,1	12,2	11,9
1100	24,4	19,9	24,4	19,9	23,3	19,3	20,7	17,8	17,0	16,4	13,8	13,5
1200	25,9	20,4	25,9	20,4	24,7	19,8	22,1	18,3	18,4	16,9	15,3	14,7
1300	27,0	20,7	27,0	20,7	25,9	20,1	23,3	18,6	19,6	17,3	16,4	15,1
1400	27,7	20,9	27,7	20,9	26,6	20,4	24,0	18,9	20,3	17,6	17,1	15,3
1500	28,0	21,0	28,0	21,0	26,9	20,4	24,3	19,0	20,6	17,7	17,4	15,4
1600	27,7	20,9	27,7	20,9	26,6	20,4	24,0	18,9	20,3	17,6	17,1	15,3
1700	27,1	20,7	27,1	20,7	26,0	20,2	23,4	18,7	19,6	17,3	16,5	15,1
1800	26,0	20,4	26,0	20,4	24,9	19,8	22,3	18,3	18,6	17,0	15,5	14,7
1900	24,8	20,0	24,8	20,0	23,7	19,5	21,1	17,9	17,4	16,6	14,3	14,0
2000	23,6	19,7	23,6	19,7	22,5	19,1	19,9	17,5	16,2	15,9	13,1	12,8
2100	22,6	19,3	22,6	19,3	21,5	18,7	18,9	17,2	15,2	14,9	12,0	11,8
2200	21,7	19,0	21,7	19,0	20,6	18,4	18,0	16,8	14,3	14,0	11,1	10,8
2300	20,9	18,8	20,9	18,8	19,8	18,2	17,2	16,6	13,5	13,2	10,4	10,1

Design Temperature Profile

Rotterdam - Laboratory expansion 16-12-20 — 12/21/2020
Ing. Mauro Petriccione — 12:07

Location: Rotterdam, Netherlands

Design Temperature Profiles for July



5.2. Walls, roof, doors construction

Wall Constructions

Rotterdam - Laboratory expansion 16-12-20 — 12/21/2020 12:08
Ing. Mauro Petriccione

External concrete insulated wall

Wall Details

Outside Surface Color ..... Medium
Absorptivity 0,675
Overall U-Value ..... 0,574 W/(m²·K)

Wall Layers Details (Inside to Outside)

Layers	Thickness mm	Density kg/m³	Specific Ht. kJ / (kg K)	R-Value (m²·K)/W	Weight kg/m²
Inside surface resistance	0,000	0,0	0,00	0,12064	0,0
Gypsum board	16,000	750,0	0,84	0,03300	15,0
Min.wool insulation	50,000	80,0	0,84	1,25000	4,0
Reinforced concrete	250,000	1800,0	0,88	0,25000	450,0
Plaster	20,000	1400,0	0,84	0,03000	28,0
Outside surface resistance	0,000	0,0	0,00	0,05864	0,0
Totals	**336,000**	-		**1,74228**	**497,0**

Roof Constructions

Rotterdam - Laboratory expansion 16-12-20 12/21/2020
Ing. Mauro Petriccione 12:08

Insulated roof

Roof Details

Outside Surface Color ..... **Medium**
Absorptivity **0,675**
Overall U-Value ..... **0,221** W/(m²·K)

Roof Layers Details (Inside to Outside)

Layers	Thickness mm	Density kg/m³	Specific Ht. kJ / (kg K)	R-Value (m²·K)/W	Weight kg/m³
Inside surface resistance	0,000	0,0	0,00	0,12064	0,0
Reinforced concrete	300,000	1800,0	0,84	0,30000	540,0
Polystyrene insulation	150,000	30,0	1,25	3,75000	4,5
Water proofing membrane	5,000	1000,0	0,92	0,03000	5,0
Light concrete	50,000	800,0	0,88	0,17000	40,0
Concrete panel	50,000	1200,0	0,88	0,10000	60,0
Outside surface resistance	0,000	0,0	0,00	0,05864	0,0
Totals	**555,000**	**-**		**4,52928**	**649,5**

Door Constructions

Rotterdam - Laboratory expansion 16-12-20 — 12/21/2020
Ing. Mauro Petriccione — 12:08

Door SD 03

Door Details:

Gross Area	6,8	m²
Door U-Value	0,500	W/(m²·K)

Glass Details:

Glass Area	0,0	m²
Glass U-Value	3,293	W/(m²·K)
Glass Shade Coefficient	0,880	
Glass Shaded All Day?	No	

Door SD 04

Door Details:

Gross Area	2,6	m²
Door U-Value	0,500	W/(m²·K)

Glass Details:

Glass Area	0,0	m²
Glass U-Value	3,293	W/(m²·K)
Glass Shade Coefficient	0,880	
Glass Shaded All Day?	No	

5.3. Air system sizing summary

Air System Sizing Summary for Fresh air AHU

Project Name: Rotterdam - Laboratory expansion 16-12-20 — 12/18/2020
Prepared by: Ing. Mauro Petriccione — 08:35

Air System Information

Air System Name	Fresh air AHU		Number of zones	4
Equipment Class	CW AHU		Floor Area	196,2 m²
Air System Type	CAV/RH		Location	Rotterdam, Netherlands

Sizing Calculation Information

Calculation Months	Jan to Dec	Zone L/s Sizing	Sum of space airflow rates
Sizing Data	Calculated	Space L/s Sizing	Individual peak space loads

Central Cooling Coil Sizing Data

Total coil load	65,7	kW	Load occurs at	Jul 1500	
Sensible coil load	40,3	kW	OA DB / WB	28,0 / 21,0	°C
Coil L/s at Jul 1500	2251	L/s	Entering DB / WB	28,0 / 21,0	°C
Max block L/s	2251	L/s	Leaving DB / WB	13,2 / 12,6	°C
Sum of peak zone L/s	2251	L/s	Coil ADP	11,5	°C
Sensible heat ratio	0,613		Bypass Factor	0,100	
L/(s kW)	34,3		Resulting RH	53	%
m²/kW	3,0		Design supply temp.	14,0	°C
W/m²	335,0		Zone T-stat Check	4 of 4	OK
Water flow @ 5,0 K rise	3,15	L/s	Max zone temperature deviation	0,0	K

Preheat Coil Sizing Data

Max coil load	59,8	kW	Load occurs at	Des Htg	
Coil L/s at Des Htg	2251	L/s	Ent. DB / Lvg DB	-10,0 / 12,0	°C
Max coil L/s	2251	L/s			
Water flow @ 10,0 K drop	N/A				

Supply Fan Sizing Data

Actual max L/s	2251	L/s	Fan motor BHP	2,84	BHP
Standard L/s	2250	L/s	Fan motor kW	2,25	kW
Actual max L/(s·m²)	11,47	L/(s·m²)	Fan static	600	Pa

Outdoor Ventilation Air Data

Design airflow L/s	2251	L/s	L/s/person	217,86	L/s/person
L/(s·m²)	11,47	L/(s·m²)			

Zone Sizing Summary for Fresh air AHU

Project Name: Rotterdam - Laboratory expansion 16-12-20 — 12/18/2020
Prepared by: Ing. Mauro Petriccione — 08:35

Air System Information

Air System Name ..... Fresh air AHU
Equipment Class ..... CW AHU
Air System Type ..... CAV/RH

Number of zones 4
Floor Area ..... 196,2 m²
Location ..... Rotterdam, Netherlands

Sizing Calculation Information

Calculation Months ..... Jan to Dec
Sizing Data ..... Calculated

Zone L/s Sizing ..... Sum of space airflow rates
Space L/s Sizing ..... Individual peak space loads

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (L/s)	Minimum Supply Airflow (L/s)	Zone L/(s·m²)	Reheat Coil Load (kW)	Reheat Coil Water L/s @ 10,0 K	Zone Htg Unit Coil Load (kW)	Zone Htg Unit Coil Water L/s @ 10,0 K	Mixing Box Fan Airflow (L/s)
201 - Laboratory expans.	1944	1944	14,91	49,3	-	4,2	-	0
202 - New Sample room	246	246	10,01	6,2	-	0,7	-	0
203-Ventil.machine room	52	52	1,64	0,0	-	2,2	-	0
204 - Corridor	9	9	0,97	0,0	-	0,1	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (kW)	Time of Peak Sensible Cooling Load	Zone Heating Load (kW)	Zone Floor Area (m²)
201 - Laboratory expans.	15,7	Jun 2300	4,2	130,4
202 - New Sample room	3,0	Jul 2200	0,7	24,6
203-Ventil.machine room	1,2	Aug 2100	1,8	31,6
204 - Corridor	0,1	Jun 0400	0,1	9,6

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (kW)	Time of Peak Sensible Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (m²)	Space L/(s·m²)
201 - Laboratory expans.							
201 - Laboratory expans.	1	15,7	Jun 2300	1944	4,2	130,4	14,91
202 - New Sample room							
202 - New Sample room	1	3,0	Jul 2200	246	0,7	24,6	10,01
203-Ventil.machine room							
203 -Ventil.machine room	1	1,2	Aug 2100	52	1,8	31,6	1,64
204 - Corridor							
204 - Corridor	1	0,1	Jun 0400	9	0,1	9,6	0,97

Ventilation Sizing Summary for Fresh air AHU

Project Name: Rotterdam - Laboratory expansion 16-12-20 — 12/18/2020
Prepared by: Ing. Mauro Petriccione — 08:35

1. Summary

Ventilation Sizing Method ..... **Sum of Space OA Airflows**
Design Ventilation Airflow Rate ..... **2251** L/s

2. Space Ventilation Analysis

Zone Name / Space Name	Mult.	Floor Area (m^2)	Maximum Occupants	Maximum Supply Air (L/s)	Required Outdoor Air (L/s/person)	Required Outdoor Air (L/(s·m^2))	Required Outdoor Air (L/s)	Required Outdoor Air (% of supply)	Uncorrected Outdoor Air (L/s)
201 - Laboratory expans.									
201 - Laboratory expans.	1	130,4	8,7	1944,0	0,00	0,00	1944,0	0,0	1944,0
202 - New Sample room									
202 - New Sample room	1	24,6	1,6	246,1	0,00	0,00	0,0	100,0	246,1
203-Ventil.machine room									
203 -Ventil.machine room	1	31,6	0,0	51,8	0,00	0,00	51,8	0,0	51,8
204 - Corridor									
204 - Corridor	1	9,6	0,0	9,3	0,00	0,00	9,3	0,0	9,3
Totals (incl. Space Multipliers)				**2251,2**					**2251,2**

Air System Design Load Summary for Fresh air AHU

Project Name: Rotterdam - Laboratory expansion 16-12-20 — 12/18/2020
Prepared by: Ing. Mauro Petriccione — 08:35

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 28,0 °C / 21,0 °C			HEATING DATA AT DES HTG HEATING OA DB / WB -10,0 °C / -10,0 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	0 m²	0	-	0 m²	-	-
Wall Transmission	201 m²	226	-	201 m²	3612	-
Roof Transmission	196 m²	178	-	196 m²	1368	-
Window Transmission	0 m²	0	-	0 m²	0	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	15 m²	-35	-	15 m²	224	-
Floor Transmission	196 m²	0	-	196 m²	941	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	3512 W	3512	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	13400 W	13399	-	0	0	-
People	10	742	621	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	1802	62	10%	615	0
>> Total Zone Loads	-	19825	683	-	6760	0
Zone Conditioning	-	20105	683	-	6695	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	2251 L/s	0	-	2251 L/s	0	-
Ventilation Load	2251 L/s	15025	24764	2251 L/s	86095	0
Supply Fan Load	2251 L/s	2251	-	2251 L/s	-2251	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	37381	25447	-	90538	0
Central Cooling Coil	-	40276	25447	-	0	0
Preheat Coil	-	0	-	-	59753	-
Terminal Reheat Coils	-	-2895	-	-	28478	-
Zone Heating Unit Coils	-	0	-	-	2307	-
>> Total Conditioning	-	37381	25447	-	90538	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Space Design Load Summary for Fresh air AHU

Project Name: Rotterdam - Laboratory expansion 16-12-20 — 12/18/2020
Prepared by: Ing. Mauro Petriccione — 08:35

TABLE 1.1.A. Component Loads For Space "201 - Laboratory expans." In Zone "201 - Laboratory expans."

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jun 2300 COOLING OA DB / WB 20,4 °C / 18,8 °C OCCUPIED T-STAT 24,0 °C			HEATING DATA AT DES HTG HEATING OA DB / WB -10,0 °C / -10,0 °C OCCUPIED T-STAT 22,0 °C		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	Details	(W)	(W)	Details	(W)	(W)
Window & Skylight Solar Loads	0 m²	0	-	0 m²	-	-
Wall Transmission	119 m²	401	-	119 m²	2189	-
Roof Transmission	130 m²	224	-	130 m²	921	-
Window Transmission	0 m²	0	-	0 m²	0	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	3 m²	-4	-	3 m²	42	-
Floor Transmission	130 m²	0	-	130 m²	624	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	2608 W	2608	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	10432 W	10432	-	0	0	-
People	9	624	522	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	1429	52	10%	378	0
>> Total Zone Loads	-	15714	575	-	4154	0

TABLE 1.1.B. Envelope Loads For Space "201 - Laboratory expans." In Zone "201 - Laboratory expans."

				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(m²)	(W/(m²·K))	Coeff.	(W)	(W)	(W)
N EXPOSURE						
WALL	43	0,574	-	68	-	786
E EXPOSURE						
WALL	76	0,574	-	333	-	1403
DOOR	3	0,500	-	-4	-	42
H EXPOSURE						
ROOF	130	0,221	-	224	-	921

Space Design Load Summary for Fresh air AHU

Project Name: Rotterdam - Laboratory expansion 16-12-20 — 12/18/2020
Prepared by: Ing. Mauro Petriccione — 08:35

TABLE 2.1.A. Component Loads For Space "202 - New Sample room" In Zone "202 - New Sample room"

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 2200 COOLING OA DB / WB 21,7 °C / 19,0 °C OCCUPIED T-STAT 24,0 °C			HEATING DATA AT DES HTG HEATING OA DB / WB -10,0 °C / -10,0 °C OCCUPIED T-STAT 22,0 °C		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	Details	(W)	(W)	Details	(W)	(W)
Window & Skylight Solar Loads	0 m²	0	-	0 m²	-	-
Wall Transmission	19 m²	85	-	19 m²	345	-
Roof Transmission	25 m²	39	-	25 m²	174	-
Window Transmission	0 m²	0	-	0 m²	0	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	3 m²	-2	-	3 m²	42	-
Floor Transmission	25 m²	0	-	25 m²	113	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	492 W	492	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	1968 W	1968	-	0	0	-
People	2	118	99	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	270	10	10%	67	0
>> Total Zone Loads	-	2970	108	-	741	0

TABLE 2.1.B. Envelope Loads For Space "202 - New Sample room" In Zone "202 - New Sample room"

				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(m²)	(W/(m²·K))	Coeff.	(W)	(W)	(W)
E EXPOSURE						
WALL	19	0,574	-	85	-	345
DOOR	3	0,500	-	-2	-	42
H EXPOSURE						
ROOF	25	0,221	-	39	-	174

Space Design Load Summary for Fresh air AHU

Project Name: Rotterdam - Laboratory expansion 16-12-20 — 12/18/2020
Prepared by: Ing. Mauro Petriccione — 08:35

TABLE 3.1.A. Component Loads For Space "203 -Ventil.machine room" In Zone "203-Ventil.machine room"

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 2100 COOLING OA DB / WB 22,6 °C / 19,3 °C OCCUPIED T-STAT 35,0 °C			HEATING DATA AT DES HTG HEATING OA DB / WB -10,0 °C / -10,0 °C OCCUPIED T-STAT 20,0 °C		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	Details	(W)	(W)	Details	(W)	(W)
Window & Skylight Solar Loads	0 m²	0	-	0 m²	-	-
Wall Transmission	63 m²	-85	-	63 m²	1078	-
Roof Transmission	32 m²	-46	-	32 m²	209	-
Window Transmission	0 m²	0	-	0 m²	0	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	9 m²	-56	-	9 m²	141	-
Floor Transmission	32 m²	0	-	32 m²	204	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	316 W	316	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	1000 W	1000	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	113	0	10%	163	0
>> Total Zone Loads	-	1242	0	-	1795	0

TABLE 3.1.B. Envelope Loads For Space "203 -Ventil.machine room" In Zone "203-Ventil.machine room"

				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(m²)	(W/(m²·K))	Coeff.	(W)	(W)	(W)
S EXPOSURE						
WALL	47	0,574	-	-47	-	809
DOOR	3	0,500	-	-16	-	39
E EXPOSURE						
WALL	16	0,574	-	-38	-	269
DOOR	7	0,500	-	-41	-	102
H EXPOSURE						
ROOF	32	0,221	-	-46	-	209

Space Design Load Summary for Fresh air AHU

Project Name: Rotterdam - Laboratory expansion 16-12-20 — 12/18/2020
Prepared by: Ing. Mauro Petriccione — 08:35

TABLE 4.1.A. Component Loads For Space "204 - Corridor" In Zone "204 - Corridor"

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jun 0400 COOLING OA DB / WB 18,2 °C / 18,0 °C OCCUPIED T-STAT 26,0 °C			HEATING DATA AT DES HTG HEATING OA DB / WB -10,0 °C / -10,0 °C OCCUPIED T-STAT 20,0 °C		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	Details	(W)	(W)	Details	(W)	(W)
Window & Skylight Solar Loads	0 m²	0	-	0 m²	-	-
Wall Transmission	0 m²	0	-	0 m²	0	-
Roof Transmission	10 m²	14	-	10 m²	64	-
Window Transmission	0 m²	0	-	0 m²	0	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	10 m²	0	-	10 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	96 W	96	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	0 W	0	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	11	0	10%	6	0
>> Total Zone Loads	-	121	0	-	70	0

TABLE 4.1.B. Envelope Loads For Space "204 - Corridor" In Zone "204 - Corridor"

				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(m²)	(W/(m²·K))	Coeff.	(W)	(W)	(W)
H EXPOSURE						
ROOF	10	0,221	-	14	-	64

System Psychrometrics for Fresh air AHU

Project Name: Rotterdam - Laboratory expansion 16-12-20 — 12/18/2020
Prepared by: Ing. Mauro Petriccione — 08:35

July DESIGN COOLING DAY, 1500

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (°C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	28,0	0,01272	2251	400	15025	24764
Vent - Return Mixing	Outlet	28,0	0,01272	2251	400	-	-
Preheat Coil	Outlet	28,0	0,01272	2251	400	0	-
Central Cooling Coil	Outlet	13,2	0,00888	2251	400	40276	25447
Supply Fan	Outlet	14,0	0,00888	2251	400	2251	-
Cold Supply Duct	Outlet	14,0	0,00888	2251	400	-	-
Zone Air	-	22,5	0,00899	2251	426	20105	683
Return Plenum	Outlet	22,5	0,00899	2251	426	0	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,206 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2945,8 W/(L/s)
Site Altitude = 5,0 m

TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (°C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
201 - Laboratory expans.	15605	Heating	15804	22,0	1944	425	2895	0
202 - New Sample room	2960	Deadband	2957	24,0	246	438	0	0
203-Ventil.machine room	1145	Deadband	1222	33,6	52	400	0	0
204 - Corridor	115	Deadband	121	24,8	9	400	0	0

System Psychrometrics for Fresh air AHU

Project Name: Rotterdam - Laboratory expansion 16-12-20 — 12/18/2020
Prepared by: Ing. Mauro Petriccione — 08:35

WINTER DESIGN HEATING

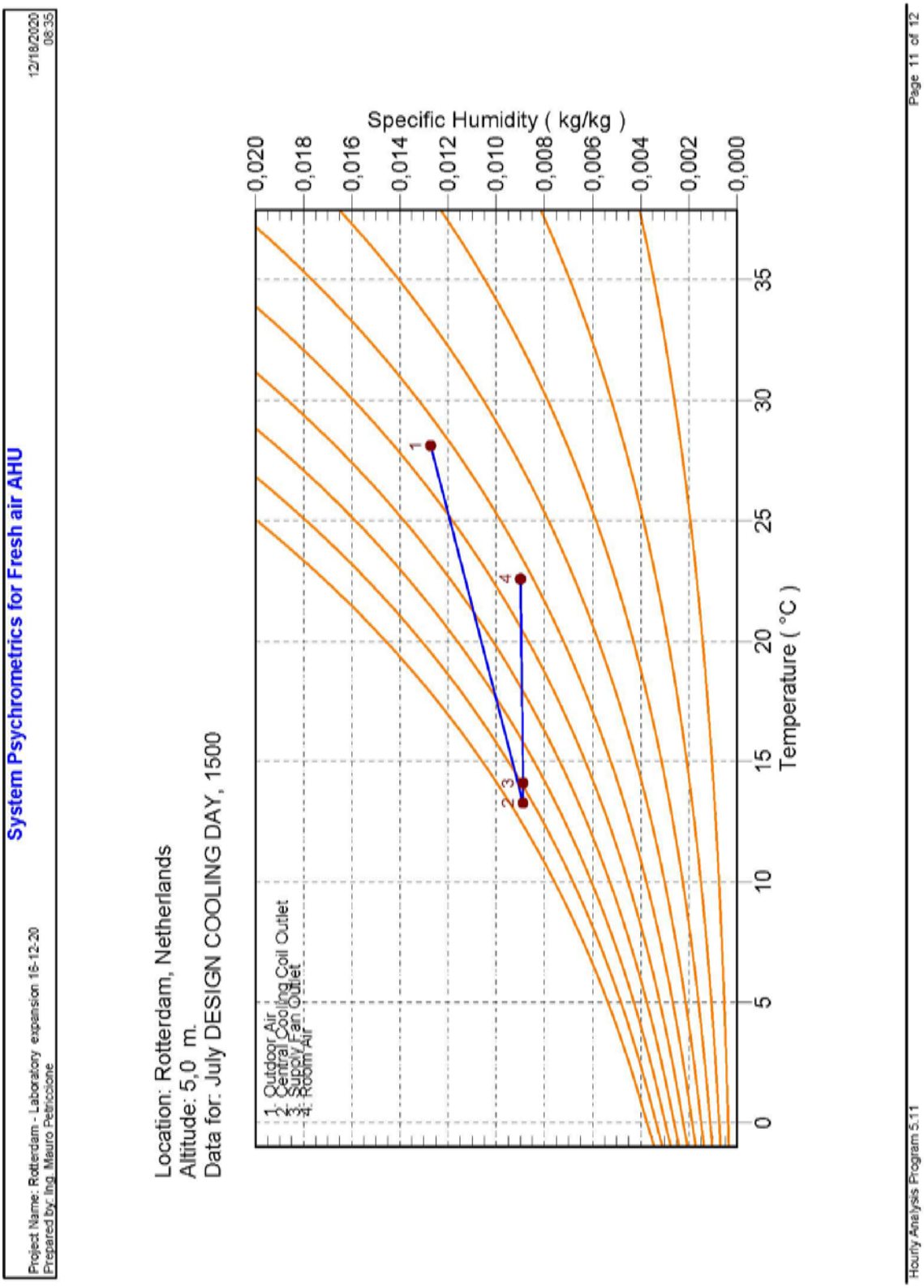
TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (°C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	-10,0	0,00160	2251	400	-86095	0
Vent - Return Mixing	Outlet	-10,0	0,00160	2251	400	-	-
Preheat Coil	Outlet	12,0	0,00160	2251	400	59753	-
Central Cooling Coil	Outlet	12,0	0,00160	2251	400	0	0
Supply Fan	Outlet	12,8	0,00160	2251	400	2251	-
Cold Supply Duct	Outlet	12,8	0,00160	2251	400	-	-
Zone Air	-	21,7	0,00160	2251	400	-6695	0
Return Plenum	Outlet	21,7	0,00160	2251	400	0	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,206 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2945,8 W/(L/s)
Site Altitude = 5,0 m

TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (°C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
201 - Laboratory expans.	-4154	Heating	-4131	21,8	1944	400	25089	0
202 - New Sample room	-741	Heating	-737	21,8	246	400	3388	0
203-Ventil.machine room	-1795	Heating	-1762	19,4	52	400	0	2170
204 - Corridor	-70	Heating	-66	19,2	9	400	0	137


System Psychrometrics for Fresh air AHU
12/18/2020
08:35
Project Name: Rotterdam - Laboratory expansion 16-12-20
Prepared by: Ing. Mauro Petriccione
Location: Rotterdam, Netherlands
Altitude: 5,0 m.
Data for: July DESIGN COOLING DAY, 1500
1: Outdoor Air
2: Central Cooling Coil Outlet
3: Supply Fan Outlet
4: Room Air
Specific Humidity (kg/kg)
0,020
0,018
0,016
0,014
0,012
0,010
0,008
0,006
0,004
0,002
0,000
Temperature (°C)
0
5
10
15
20
25
30
35
Hourly Analysis Program 5.11
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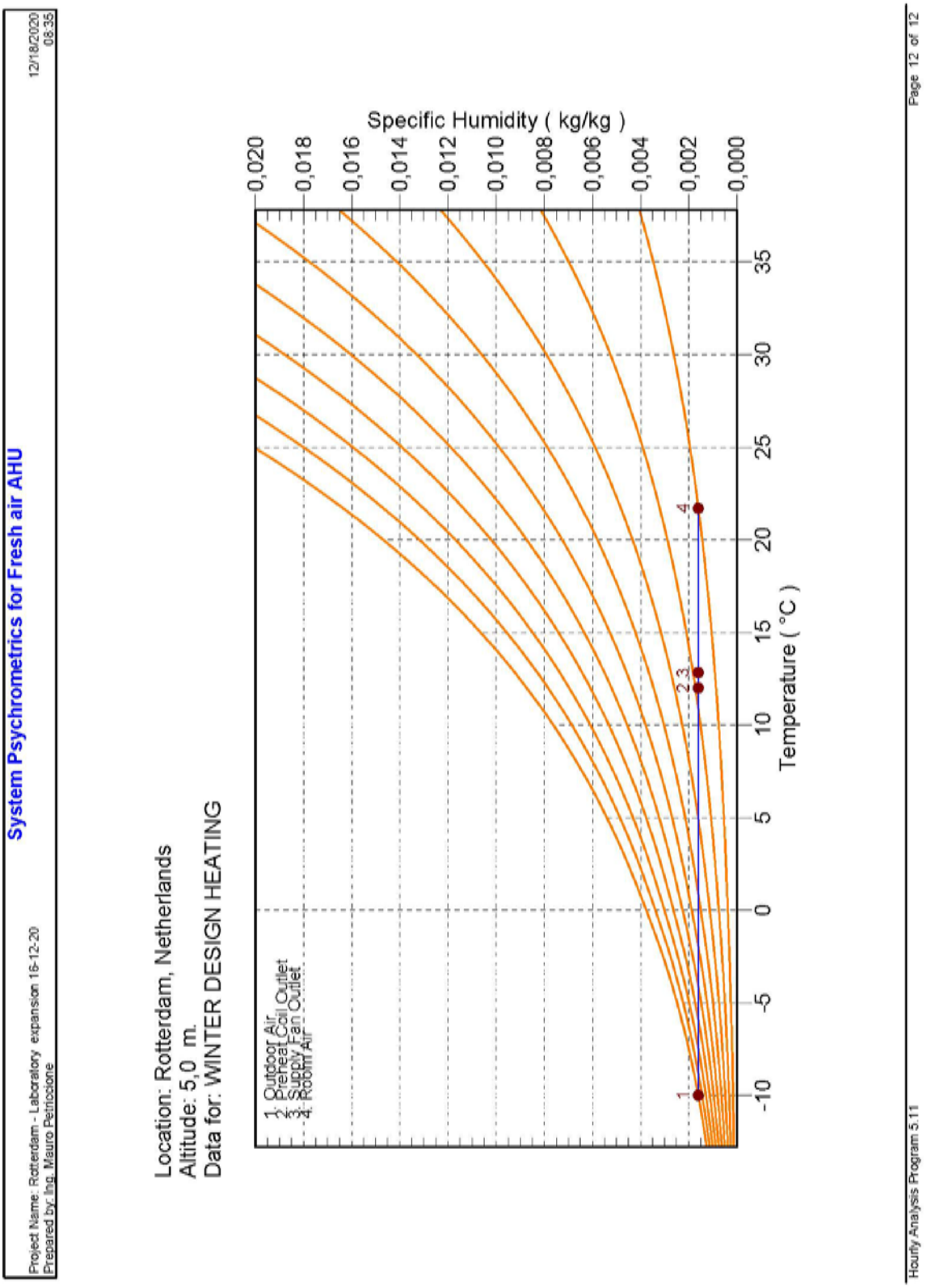
System Psychrometrics for Fresh air AHU
12/18/2020
08:35
Project Name: Rotterdam - Laboratory expansion 16-12-20
Prepared by: Ing. Mauro Petriccione
Location: Rotterdam, Netherlands
Altitude: 5,0 m.
Data for: WINTER DESIGN HEATING
1: Outdoor Air
2: Preheat Coil Outlet
3: Supply Fan Outlet
4: Room Air
Specific Humidity (kg/kg)
0,020
0,018
0,016
0,014
0,012
0,010
0,008
0,006
0,004
0,002
0,000
Temperature (°C)
-10
-5
0
5
10
15
20
25
30
35
1
2,3
4
Hourly Analysis Program 5.11
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