Base Load Power Hub (BLPH)

B-300 HVAC CALCULATION REPORT
(Incl HVAC SYS CALC and HEAT DISSIPATION CALC)
E&I SHELTERS

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ALEXSISTEMI spa

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Revision / Change Log

Rev.	Description
0	Issue for Review (IFR)
1	Issue for Review (IFR)
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HOLDS LIST

No.	Description
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1 INTRODUCTION

1.1 PURPOSE OF THE PROJECT

Scope of this document is to report the Cooling and Heating Loads calculations, of the HVAC system provided for the Technical Shelter B-300.

Cooling and Heating loads calculations have been carried out by means of CARRIER II 20 Hourly Analysis Program Version 5.11.

1.2 MEASURING SYSTEM

Length	m, mm
Area	m2, mm2
Volume	3, mm3
Mass	Kg
Airflow	l/s
Pressure	Pa = N/m2, kPa = kN/m2
Temperature	° C
Thermal Load	W, kW
Specific Enthalpy	kJ/kg
Specific Volume	m3/kg

1.3 DESIGN INPUT DATA

Outdoor design conditions:

Summer temperature:	+25°C D.B. (Dry Bulb) with RH 90 %
Winter temperature:	-8,4°C D.B. (Dry Bulb) with RH 100 %
Shelter U-Value:	0,450 W/(m^2 K).
Safe Area	

Indoor design conditions:

Room Pressurization:	+50 Pa
Summer temperature:	+35°C D.B. (Dry Bulb) with RH 30÷70%.
Winter temperature:	+5°C D.B. (Dry Bulb) with RH 30÷70%.
Internal Load Equipment:	10 kW
ACH Min.:	6
Safe Area	

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2 SYSTEM DESCRIPTION

To guarantee the necessary overpressure and internal design temperatures in the summer and winter seasons, two Roof-Top type units have been provided, one duty and one stand-by.

3 ARCHITECTURAL DATA

Geometric data are based on document listed below:

1724000049-AR-DA-00016 Base load power HUB (BLPH) B-300 general arrangement drawing.

3.1 ROOM PRESSURIZATION

In order to guarantee the pressurization, where external doors are provided, fresh air flow requirement to maintain specified positive pressure shall be calculated based on following formula in accord to

ASHRAE:

$Q = Cd * A * Vp = m^3/s$

where ΔP = pressure difference across opening, Pa

Q = Airflow rate, m3/s

Cd = Discharge coefficient for opening, dimensionless (0,625 assumed)

Generally general 0.5 for large gaps and 0,625 for small openings.

A = Leakage area (m^2).

Vp: Velocity through crack area to maintain required pressure (2 ΔP/d) ^0.5

d = Density of air (kg/m^3) assumed 1.225 kg/m^3.

Note:

Leakage area for double leaf door = 0,03 m^2
Leakage area for single leaf door = 0,02 m^2

Container structures, walls, floor and the ceiling are joined together by continuous welding.

Therefore, there isn't air leakage.

Vp for overpressure required 50 Pa = (2 x 50 / 1,225) ^0,5 = 9,03

Single Door overpressure required: (0,625x0,02x9,03) = 0,112 m^3/s that become 0,112x 3600 = 403 m^3/h

Double Door overpressure required: (0,625x0,03x9,03) = 0,169 m^3/s that become 0,112 x 3600 = 608 m^3/h

Total pressurization air flow equal to 403 m^3/h + 608 m^3/h = 1011 m^3/h -> 280,8 l/s

Air change required for room: (B 30 m^2 x H 3,5) x 6 = 630 m^3/h -> 175 l/s

According to the calculation above, the pressurizing air flow rate is greater than the ACH required.
So, the fresh air rate will be equal to 280,8 l/s (pressurizing air flow rate).

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4 WEATER REPORT FROM HAP CARRIER

Design Weather Parameters & MSHGs

4112 - B 300
Frigotermica

05/06/2024
03:47

Design Parameters:

City Name	..	
Location	..	
Latitude	52.3	Deg.
Longitude	-4.8	Deg.
Elevation	30.0	m
Summer Design Dry-Bulb	25.0	°C
Summer Coincident Wet-Bulb	23.7	°C
Summer Daily Range	8.2	K
Winter Design Dry-Bulb	-8.4	°C
Winter Design Wet-Bulb	-8.4	°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.

5 SYSTEM DESIGN REPORT FROM HAP CARRIER

Air System Sizing Summary for B-300

Project Name: 4112 - B 300
Prepared by: Frigotermica

05/06/2024
03:49

Air System Information

Air System Name	B-300		Number of zones	1	
Equipment Class	PKG ROOF		Floor Area	30.0	m²
Air System Type	SZCAV		Location	.., ..	

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	11.8	kW	Load occurs at	Jul 1400	
Sensible coil load	6.5	kW	OA DB / WB	24.8 / 23.6	°C
Coil L/s at Jul 1400	450	L/s	Entering DB / WB	28.9 / 23.2	°C
Max block L/s	450	L/s	Leaving DB / WB	17.0 / 16.5	°C
Sum of peak zone L/s	450	L/s	Coil ADP	15.6	°C
Sensible heat ratio	0.548		Bypass Factor	0.100	
L/(s kW)	38.2		Resulting RH	31	%
m²/kW	2.5		Design supply temp.	16.4	°C
W/m²	393.0		Zone T-stat Check	1 of 1	OK
Water flow @ 5.6 K rise	N/A		Max zone temperature deviation	0.0	K

Central Heating Coil Sizing Data

Max coil load	5.6	kW	Load occurs at	Des Htg	
Coil L/s at Des Htg	450	L/s	W/m²	185.5	
Max coil L/s	450	L/s	Ent. DB / Lvg DB	-3.4 / 6.9	°C
Water flow @ 11.1 K drop	N/A				

Supply Fan Sizing Data

Actual max L/s	450	L/s	Fan motor BHP	0.26	BHP
Standard L/s	448	L/s	Fan motor kW	0.21	kW
Actual max L/(s·m²)	15.00	L/(s·m²)	Fan static	300	Pa

Outdoor Ventilation Air Data

Design airflow L/s	281	L/s	L/s/person	0.00	L/s/person
L/(s·m²)	9.36	L/(s·m²)			

Zone Sizing Summary for B-300

Project Name: 4112 - B 300 — 05/06/2024
Prepared by: Frigotermica — 03:49

Air System Information

Air System Name **B-300**
Equipment Class ..... **PKG ROOF**
Air System Type ..... **SZCAV**

Number of zones **1**
Floor Area ..... **30.0** m²
Location ..... **.., ..**

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 @ 11.1 K	Zone Htg Unit Coil Load (kW)	Zone Htg Unit Water L/s @ 11.1 K	Mixing Box Fan Airflow (L/s)
Zone 1	450	450	15.00	0.0	-	0.0	-	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)
Zone 1	10.1	Jul 1600	1.4	30.0

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)
Zone 1							
B 300	1	10.1	Jul 1600	450	1.4	30.0	15.00

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Ventilation Sizing Summary for B-300

Project Name: 4112 - B 300
Prepared by: Frigotermica

05/06/2024
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1. Summary

Ventilation Sizing Method ..... **Sum of Space OA Airflows**
Design Ventilation Airflow Rate ..... **281** 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)
Zone 1									
B 300	1	30.0	0.0	450.0	0.00	0.00	280.8	0.0	280.8
Totals (incl. Space Multipliers)				**450.0**					**280.8**

Air System Design Load Summary for B-300

Project Name: 4112 - B 300
Prepared by: Frigotermica

05/06/2024
03:49

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 24.8 °C / 23.6 °C			HEATING DATA AT DES HTG HEATING OA DB / WB -8.4 °C / -8.4 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	0 m²	0	-	0 m²	-	-
Wall Transmission	111 m²	-593	-	111 m²	669	-
Roof Transmission	30 m²	-160	-	30 m²	181	-
Window Transmission	0 m²	0	-	0 m²	0	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	8 m²	-180	-	8 m²	207	-
Floor Transmission	30 m²	-310	-	30 m²	181	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	360 W	360	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	10000 W	10000	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 0%	912	0	10%	124	0
>> Total Zone Loads	-	**10027**	**0**	-	**1361**	**0**
Zone Conditioning	-	9967	0	-	1306	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	169 L/s	0	-	169 L/s	0	-
Ventilation Load	281 L/s	-3715	5331	281 L/s	4467	0
Supply Fan Load	450 L/s	208	-	450 L/s	-208	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	**6460**	**5331**	-	**5565**	**0**
Central Cooling Coil	-	6460	5331	-	0	0
Central Heating Coil	-	0	-	-	5565	-
>> Total Conditioning	-	**6460**	**5331**	-	**5565**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

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Zone Design Load Summary for B-300

Project Name: 4112 - B 300
Prepared by: Frigotermica

05/06/2024
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Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1600 COOLING OA DB / WB 24.8 °C / 23.6 °C			HEATING DATA AT DES HTG HEATING OA DB / WB -8.4 °C / -8.4 °C		
	OCCUPIED T-STAT 35.0 °C			OCCUPIED T-STAT 5.0 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	0 m²	0	-	0 m²	-	-
Wall Transmission	111 m²	-568	-	111 m²	669	-
Roof Transmission	30 m²	-154	-	30 m²	181	-
Window Transmission	0 m²	0	-	0 m²	0	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	8 m²	-176	-	8 m²	207	-
Floor Transmission	30 m²	-306	-	30 m²	181	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	360 W	360	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	10000 W	10000	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 0%	916	0	10%	124	0
>> Total Zone Loads	-	10071	0	-	1361	0

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Space Design Load Summary for B-300

Project Name: 4112 - B 300
Prepared by: Frigotermica

05/06/2024
03:49

TABLE 1.1.A. Component Loads For Space "B 300" In Zone "Zone 1"

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1600 COOLING OA DB / WB 24.8 °C / 23.6 °C OCCUPIED T-STAT 35.0 °C			HEATING DATA AT DES HTG HEATING OA DB / WB -8.4 °C / -8.4 °C OCCUPIED T-STAT 5.0 °C		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(W)**	**(W)**	**Details**	**(W)**	**(W)**
Window & Skylight Solar Loads	0 m²	0	-	0 m²	-	-
Wall Transmission	111 m²	-568	-	111 m²	669	-
Roof Transmission	30 m²	-154	-	30 m²	181	-
Window Transmission	0 m²	0	-	0 m²	0	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	8 m²	-176	-	8 m²	207	-
Floor Transmission	30 m²	-306	-	30 m²	181	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	360 W	360	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	10000 W	10000	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 0%	916	0	10%	124	0
>> Total Zone Loads	**-**	**10071**	**0**	**-**	**1361**	**0**

TABLE 1.1.B. Envelope Loads For Space "B 300" In Zone "Zone 1"

				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(m²)	(W/(m²·K))	Coeff.	(W)	(W)	(W)
N EXPOSURE						
WALL	46	0.450	-	-234	-	276
E EXPOSURE						
WALL	12	0.450	-	-59	-	69
DOOR	2	1.930	-	-48	-	57
S EXPOSURE						
WALL	46	0.450	-	-234	-	276
W EXPOSURE						
WALL	8	0.450	-	-40	-	48
DOOR	6	1.930	-	-128	-	150
H EXPOSURE						
ROOF	30	0.450	-	-154	-	181

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System Psychrometrics for B-300

Project Name: 4112 - B 300 — 05/06/2024
Prepared by: Frigotermica — 03:49

July DESIGN COOLING DAY, 1400

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	24.8	0.01804	281	400	-3715	5331
Vent - Return Mixing	Outlet	28.9	0.01561	450	403	-	-
Central Cooling Coil	Outlet	17.0	0.01158	450	403	6460	5331
Central Heating Coil	Outlet	17.0	0.01158	450	403	0	-
Supply Fan	Outlet	17.3	0.01158	450	403	208	-
Cold Supply Duct	Outlet	17.3	0.01158	450	403	-	-
Zone Air	-	35.8	0.01158	450	408	9967	0
Zone Direct Exhaust	Outlet	35.8	0.01158	281	408	-	-
Return Plenum	Outlet	35.8	0.01158	169	408	0	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.207; At site altitude = 1.203 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947.6; At site altitude = 2937.1 W/(L/s)
Site Altitude = 30.0 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)
Zone 1	10027	Cooling	9967	35.8	450	408	0	0

System Psychrometrics for B-300

Project Name: 4112 - B 300
Prepared by: Frigotermica

05/06/2024
03:49

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	-8.4	0.00185	281	400	-4467	0
Vent - Return Mixing	Outlet	-3.4	0.00185	450	403	-	-
Central Cooling Coil	Outlet	-3.4	0.00185	450	403	0	0
Central Heating Coil	Outlet	6.9	0.00185	450	403	5565	-
Supply Fan	Outlet	7.2	0.00185	450	403	208	-
Cold Supply Duct	Outlet	7.2	0.00185	450	403	-	-
Zone Air	-	4.8	0.00185	450	408	-1306	0
Zone Direct Exhaust	Outlet	4.8	0.00185	281	408	-	-
Return Plenum	Outlet	4.8	0.00185	169	408	0	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.207; At site altitude = 1.203 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947.6; At site altitude = 2937.1 W/(L/s)
Site Altitude = 30.0 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)
Zone 1	-1361	Heating	-1306	4.8	450	408	0	0

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6 COOLING COIL SELECTION

In order to ensure the good functioning of the unit we chose to select the cooling coil with the following characteristics.

D.B.M. SpA a Socio Unico
Via Ugo La Malfa 10 – 28040 Varallo Pombia (NO) – Italy
Tel. +39 0321 956794 – E mail: sales@dbmcoils.com

03/04/2024

Offer

Contact	
Delivery Schedule	
Goods rendered	ex DBM factory
Packing	Included
Payment	As usual
Offer validity	30 days

NOTE

24 months guarantee according to DBM sales terms

CC User-185-00115/2 0 538 *Rel. 6.5.0.4 01-10-2022*

DESIGN DATA

EXTERNAL FLUID:	**Air**				
Ambient pressure	mmHg	760			
Capacity	**kW**	**12.14**			
Gas quantity	**Sm³/h**	**2700**			
Air treated weight	kg/h	3251	Sensible heat factor		0.76
Inlet temperature	**°C**	**26.00**	Condensed water	kg/h	4.00
Relative humidity	%	50.00	Actual velocity	m/s	2.47
Outlet temperature	**°C**	**15.95**	Pressure drop	Pa	117
Outlet relative humidity	%	82.26	Dry fin pressure drop	Pa	48
INTERNAL FLUID:	**R32**				
Evaporating pressure	**bar(a)**	**10.12**	**Evaporating temperature**	**°C**	**7.00**
Condensing pressure	bar(a)	31.41	Liquid temperature	°C	50.00
Superheating	°C	5.00	Subcooling	°C	2.00
Liquid weight	kg/h	189	Pressure drop	bar	0.06
Distributor diameter	mm	16.00	Distributors pressure drop	bar	0.67
Capillars Ø 5 lenght 550 mm			Capillars pressure drop	bar	0.40

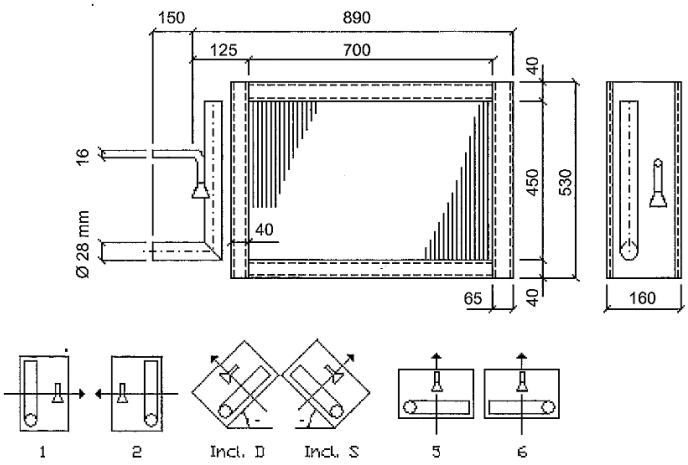
N°·1 Coil Cu-Cu-FeZn P3012ED 4R-15T-700A-2.5pa 5C 28 mm

TECHNICAL FEATURES

Tubes	**Cu**	**12.45 x 0.35**	mm	Weight	28	Kg
Fins	**Cu**	**0.10**	mm	Internal volume	6	dm3
Frame	**FeZn**	**1.50 / 1.50**	mm	Total exchange surface	23.63	m2
Manifolds material	**Cu**			**PED 2014/68/UE Cat.**	**Class I**	
				Maximum allowable pressur	21.0	bar
				Min/Max allowable temp	-10/80	°C

ACCESSORIES

Certified calculation - Counterflow



7 SYSTEM SUMMARY

Below is the system performance:

Fresh Air intake: 1112 m³/h -> 281 l/s

Supply Air: 2700 m³/h -> 750 l/s as per cooling coil sizing.

Cooling Coil Capacity: 12 kW (design required 11.8 kW)

Heating Coil Capacity: 6,0 kW

8 DUCT PRESSURE DROP

The HVAC Ducts, have been sized with the criterion of constant pressure drop.

In this paper we have calculated the static pressure drop of the most unfavorable sections of the air duct distribution according to ASHRAE standards.

METHOD:

To calculate the friction losses, the following equation have been used as detailed below. These equations have a wide and internationally recognised application for this kind of calculation.
The friction losses (Dp) in terms of specific energy (mm w.g.) have been evaluated by means of the below equation:

$$Dp = k \times pd$$

where:

- K Accidental Resistance (see value attach in table 1)
- pd Dynamic Pressure (mm w.g) $pd = \frac{c^2 \times \gamma}{2 \times g}$

Where:

- γ: Air density (1,22 Kg/m^3)
- c velocity of air m/s

If the Duct are linear the Dp are independent of Dynamic Pressure but depend of:

$$Dp = 0{,}00117722 \frac{c^{1,9}}{d_{eq}{}^{1,22}}$$

This value is for each meter of linear duct

where:

- c velocity of air m/s
- d_{eq} Diameter of equivalent duct

$$d_{eq} = \frac{4{,}5 \times A}{P}$$

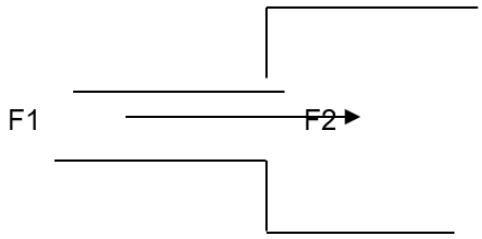
where:

- A Cross section of duct
- P Perimeter

Tab. 1

Pos	Description	K for special peace
1	Linear duct	0
2	Bend 90°	0,1
3	Outlet	1
4	Inlet	0,35
5	Section reduction	0,35

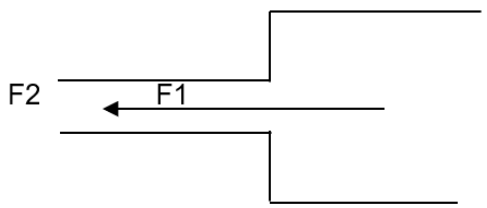
POS .6 Inlet in the Plenum



See detail

AxB/A1xB1	0,1	0,2	0,4	0,6	0,8
K	1	0,7	0,4	0,2	0,1

POS.7 Outlet from Plenum



See detail

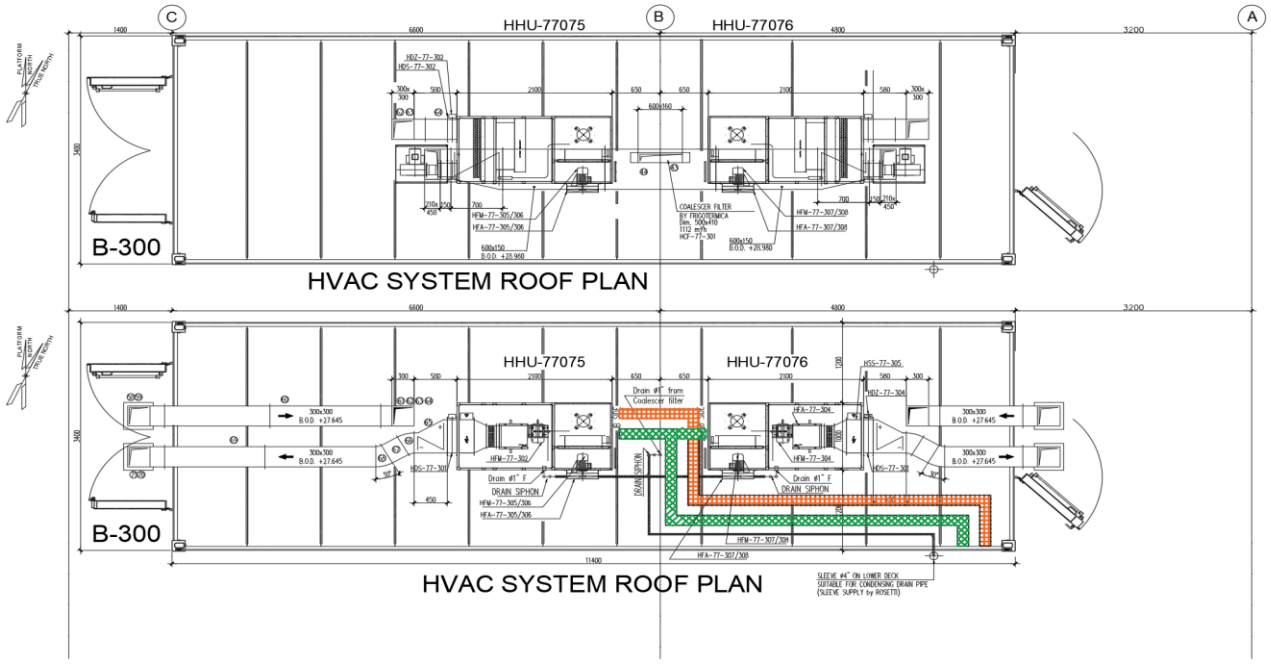
AxB/A1xB1	0,2	0,4	0,6	0,8
K	0,45	0,3	0,2	0,1

-300 duct layout pressure drop:

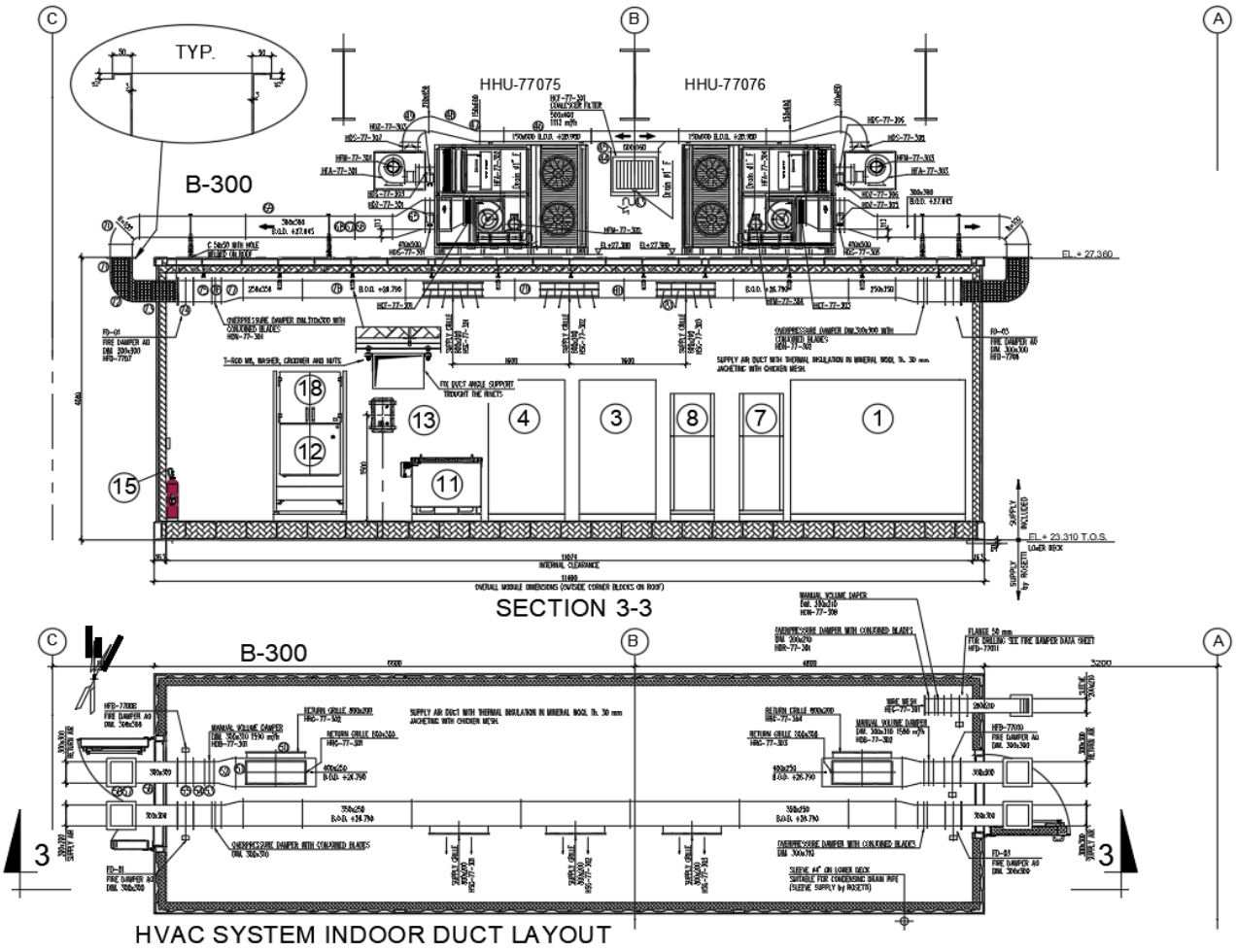
B-300					Duct pressure loss calculation					
	POS.	Inlet air dimens. (mm)		Outlet air dimens. (mm)		Lenght	Air Flow	Velocity	POS.	Dp for linear duct	DP for special pieces
		A	B	A1	B1	L (mm)	mc/h	m/s		mm w.g.	mm w.g.
HHU-77005/77006	**43**	COALESCER FILTER 500 x 400					1112			0,00	1,53
	44	600	160	600	160	300	1112	3	1	0,01	0,00
	45	600	160	600	150	150	1112	3	4	0,00	0,20
	46	600	150	600	150	2132	1112	3	1	0,10	0,00
	47	600	150	600	150	0	1112	3	7	0,00	0,06
	48	600	150	450	210	730	1112	3	5	0,00	0,20
	49	450	210	450	210	0	1112	3	2	0,00	0,28
	50	RETURN GRILLES					1588	#VALORE!		0,00	1,02
	51	400	250	400	250	550	1588	4	1	0,03	0,00
	52	400	250	300	300	300	1588	4	5	0,00	0,35
	53	MANUAL VOLUME DAMPER					1588	#VALORE!		0,00	19,60
	54	300	300	300	300	150	1588	5	1	0,01	0,00
	55	FIRE DAMPER					1588	#VALORE!		0,00	1,02
	56	300	300	300	300	770	1588	5	1	0,07	0,00
	57	300	3300	300	300	0	1588	0	2	0,00	0,00
	58	300	3300	300	300	900	1588	0	1	0,00	0,00
	59	300	3300	300	300	0	1588	0	2	0,00	0,00
	60	300	300	300	300	2920	1588	5	1	0,27	0,00
	61	300	300	300	300	0	1588	5	2	0,00	0,80
	62	300	300	300	300	800	1588	5	1	0,08	0,00
	63	300	300	300	300	0	1588	5	2	0,00	0,80
	64	300	300	300	300	300	1588	5	1	0,03	0,00
	65	410	500	300	300	415	2700	4	5	0,00	0,35
	66	300	300	300	300	0	2700	8	2	0,00	2,00
	67	300	300	300	300	215	2700	8	1	0,05	0,00
	68	300	300	300	300	0	2700	8	2	0,00	2,00
	69	300	300	300	300	3725	2700	8	1	0,86	0,00
	70	300	300	300	300	0	2700	8	2	0,00	2,00
	71	300	300	300	300	910	2700	8	1	0,21	0,00
	72	300	300	300	300	0	2700	8	2	0,00	2,00
	73	300	300	300	300	785	2700	8	1	0,18	0,00
	74	FIRE DAMPER					2700	#VALORE!		0,00	1,02
	75	300	300	300	300	250	2700	8	1	0,06	0,00
	76	OVERPRESSURE DAMPER				0	2700	#VALORE!		0,00	6,94
	77	300	300	250	350	300	2700	8	5	0,00	1,40
	78	250	350	250	350	2880	2700	9	1	0,86	0,00
	79	250	350	250	350	1600	1800	6	1	0,22	0,00
	80	250	350	250	350	1600	900	3	1	0,06	0,00
	81	SUPPLY GRILLE				0	900	#VALORE!		0,00	0,51
									1	1,96	43,56
									TOTAL LOSS Pa	446,42	

B-300 → DUCT LAYOUT:

A:



B:


TYP.
B-300
HHU-77075
HHU-77076
SECTION 3-3
B-300
HVAC SYSTEM INDOOR DUCT LAYOUT

9 CONCLUSION

The pressure drop duct layout of the B-300 loss: 446.42Pa

The ducts were built based on the flow rate required by the thermal calculation and the fans were sized based on the pressure loss, obtained with the calculation sheet illustrated above.

The fan's air flow is sufficient to guarantee the required overpressure of 50 Pa.

