Apêndice A

Neste apêndice estão expostos os valores das cargas térmicas obtidos com o dimensionamento dos sistemas de climatização inerentes ao modelo concebido, bem como os valores totais resultantes do seu somatório.

Edificio A

Totais:

Carga térmica Arrefecimento [W]	14225
Carga térmica Aquecimento [W]	3955

Sistema A1

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1100 COOLING OA DB / WB 25,4 °C / 20,0 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 11,7 °C / 6,9 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	1 m²	50	-	1 m²	-	-
Wall Transmission	20 m²	185	-	20 m²	389	-
Roof Transmission	0 m²	0	-	0 m²	0	-
Window Transmission	1 m²	0	-	1 m²	36	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	15 m²	0	-	15 m²	123	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	40 W	35	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	2861 W	2860	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	4	95	-	68	-1
Miscellaneous	-	0	0	-	0	0
Safety Factor	5% / 5%	157	5	5%	31	0
>> Total Zone Loads	-	3291	100	-	647	-1
Zone Conditioning	-	5371	100	-	643	-1
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	5371	100	-	643	-1
Terminal Unit Cooling	-	5371	0	-	0	0
Terminal Unit Heating	-	0	-	-	643	-
>> Total Conditioning	-	5371	0	-	643	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Carga térmica Arrefecimento [W]	5371
Carga térmica Aquecimento [W]	643

Sistema A2

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1800 COOLING OA DB / WB 26,2 °C / 20,3 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 11,7 °C / 6,9 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	20 m²	1790	-	20 m²	-	-
Wall Transmission	87 m²	1011	-	87 m²	1381	-
Roof Transmission	0 m²	0	-	0 m²	0	-
Window Transmission	20 m²	104	-	20 m²	925	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	132 m²	0	-	132 m²	201	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	464 W	423	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	950 W	920	-	0	0	-
People	32	2262	1724	0	0	0
Infiltration	-	96	96	-	611	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	5% / 5%	330	91	5%	156	0
>> Total Zone Loads	-	6937	1910	-	3274	0
Zone Conditioning	-	6965	1910	-	3312	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	6965	1910	-	3312	0
Terminal Unit Cooling	-	6965	1889	-	0	0
Terminal Unit Heating	-	0	-	-	3312	-
>> Total Conditioning	-	6965	1889	-	3312	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Carga térmica Arrefecimento [W]	8854
Carga térmica Aquecimento [W]	3312

Edificio B

Totais:

Carga térmica Arrefecimento [W]	180356
Carga térmica Aquecimento [W]	51192

Sistema B1

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jun 1500 COOLING OA DB / WB 26,7 °C / 20,6 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 11,7 °C / 6,9 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	0 m²	0	-	0 m²	-	-
Wall Transmission	0 m²	0	-	0 m²	0	-
Roof Transmission	0 m²	0	-	0 m²	0	-
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	16 W	15	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	0 W	0	-	0	0	-
People	2	139	158	0	0	0
Infiltration	-	13	-14	-	61	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	5% / 5%	8	7	5%	3	0
>> Total Zone Loads	-	175	151	-	64	0
Zone Conditioning	-	183	151	-	63	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	183	151	-	63	0
Terminal Unit Cooling	-	183	151	-	0	0
Terminal Unit Heating	-	0	-	-	63	-
>> Total Conditioning	-	183	151	-	63	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Carga térmica Arrefecimento [W]	334
Carga térmica Aquecimento [W]	63

Sistema B2

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1000 COOLING OA DB / WB 24,6 °C / 19,8 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 11,7 °C / 6,9 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	471 m²	28762	-	471 m²	-	-
Wall Transmission	612 m²	2426	-	612 m²	10507	-
Roof Transmission	0 m²	0	-	0 m²	0	-
Window Transmission	471 m²	-1070	-	471 m²	17458	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	235 m²	0	-	235 m²	969	-
Partitions	29 m²	-64	-	29 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	15626 W	15446	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	92410 W	78811	-	0	0	-
People	39	2181	2188	0	0	0
Infiltration	-	-366	5147	-	9580	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	5% / 5%	6306	367	5%	1926	0
>> Total Zone Loads	-	132432	7701	-	40440	0
Zone Conditioning	-	131000	7701	-	39948	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	131000	7701	-	39948	0
Terminal Unit Cooling	-	131000	8090	-	0	0
Terminal Unit Heating	-	0	-	-	39948	-
>> Total Conditioning	-	131000	8090	-	39948	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Carga térmica Arrefecimento [W]	139090
Carga térmica Aquecimento [W]	39948

Sistema B3

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1000 COOLING OA DB / WB 24,6 °C / 19,8 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 11,7 °C / 6,9 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	41 m²	1830	-	41 m²	-	-
Wall Transmission	73 m²	67	-	73 m²	1106	-
Roof Transmission	0 m²	0	-	0 m²	0	-
Window Transmission	41 m²	-83	-	41 m²	1347	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	8 m²	-19	-	8 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	2099 W	2099	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	12953 W	11044	-	0	0	-
People	2	124	84	0	0	0
Infiltration	-	-36	676	-	950	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	5% / 5%	751	38	5%	170	0
>> Total Zone Loads	-	15779	798	-	3574	0
Zone Conditioning	-	15566	798	-	3587	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	15566	798	-	3587	0
Terminal Unit Cooling	-	15566	821	-	0	0
Terminal Unit Heating	-	0	-	-	3587	-
>> Total Conditioning	-	15566	821	-	3587	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Carga térmica Arrefecimento [W]	16377
Carga térmica Aquecimento [W]	3587

Sistema B 6.1

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1000 COOLING OA DB / WB 24,6 °C / 19,8 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 11,7 °C / 6,9 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	4 m²	255	-	4 m²	-	-
Wall Transmission	7 m²	2	-	7 m²	107	-
Roof Transmission	33 m²	77	-	33 m²	273	-
Window Transmission	4 m²	-8	-	4 m²	135	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	106 W	106	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	2201 W	1877	-	0	0	-
People	0	21	14	0	0	0
Infiltration	-	-6	106	-	146	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	5% / 5%	116	6	5%	33	0
>> Total Zone Loads	-	2439	126	-	693	0
Zone Conditioning	-	2399	126	-	679	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	2399	126	-	679	0
Terminal Unit Cooling	-	2399	131	-	0	0
Terminal Unit Heating	-	0	-	-	679	-
>> Total Conditioning	-	2399	131	-	679	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Carga térmica Arrefecimento [W]	2530
Carga térmica Aquecimento [W]	679

Sistema B 6.2

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jun 1900 COOLING OA DB / WB 25,1 °C / 20,1 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 11,7 °C / 6,9 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	4 m²	489	-	4 m²	-	-
Wall Transmission	20 m²	133	-	20 m²	294	-
Roof Transmission	17 m²	56	-	17 m²	136	-
Window Transmission	4 m²	0	-	4 m²	135	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	98 W	98	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	236 W	215	-	0	0	-
People	0	18	14	0	0	0
Infiltration	-	1	54	-	72	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	5% / 5%	50	3	5%	32	0
>> Total Zone Loads	-	**1060**	**72**	-	**669**	**0**
Zone Conditioning	-	1034	72	-	671	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	**1034**	**72**	-	**671**	**0**
Terminal Unit Cooling	-	1034	73	-	0	0
Terminal Unit Heating	-	0	-	-	671	-
>> Total Conditioning	-	**1034**	**73**	-	**671**	**0**
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Carga térmica Arrefecimento [W]	1107
Carga térmica Aquecimento [W]	671

Sistema B 6.3

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 2300 COOLING OA DB / WB 23,6 °C / 19,5 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 11,7 °C / 6,9 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	0 m²	0	-	0 m²	-	-
Wall Transmission	11 m²	112	-	11 m²	168	-
Roof Transmission	16 m²	62	-	16 m²	135	-
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	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	54 W	54	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	2300 W	1846	-	0	0	-
People	0	20	14	0	0	0
Infiltration	-	-11	53	-	72	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	5% / 5%	104	3	5%	19	0
>> Total Zone Loads	-	**2188**	**71**	-	**393**	**0**
Zone Conditioning	-	2153	71	-	394	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	**2153**	**71**	-	**394**	**0**
Terminal Unit Cooling	-	2153	72	-	0	0
Terminal Unit Heating	-	0	-	-	394	-
>> Total Conditioning	-	**2153**	**72**	-	**394**	**0**
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Carga térmica Arrefecimento [W]	2225
Carga térmica Aquecimento [W]	394

Sistema B 6.4

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1000 COOLING OA DB / WB 24,6 °C / 19,8 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 11,7 °C / 6,9 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	4 m²	674	-	4 m²	-	-
Wall Transmission	7 m²	19	-	7 m²	107	-
Roof Transmission	16 m²	38	-	16 m²	135	-
Window Transmission	4 m²	-8	-	4 m²	135	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	98 W	98	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	708 W	604	-	0	0	-
People	0	21	14	0	0	0
Infiltration	-	-3	53	-	72	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	5% / 5%	72	3	5%	22	0
>> Total Zone Loads	-	1514	71	-	471	0
Zone Conditioning	-	1491	71	-	459	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	1491	71	-	459	0
Terminal Unit Cooling	-	1491	72	-	0	0
Terminal Unit Heating	-	0	-	-	459	-
>> Total Conditioning	-	1491	72	-	459	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Carga térmica Arrefecimento [W]	1563
Carga térmica Aquecimento [W]	459

Sistema B 6.5

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jun 0900 COOLING OA DB / WB 23,3 °C / 19,5 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 11,7 °C / 6,9 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	4 m²	501	-	4 m²	-	-
Wall Transmission	20 m²	-12	-	20 m²	294	-
Roof Transmission	17 m²	33	-	17 m²	136	-
Window Transmission	4 m²	-25	-	4 m²	135	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	54 W	54	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	690 W	581	-	0	0	-
People	0	20	14	0	0	0
Infiltration	-	-14	56	-	72	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	5% / 5%	57	4	5%	32	0
>> Total Zone Loads	-	1196	74	-	669	0
Zone Conditioning	-	1179	74	-	651	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	1179	74	-	651	0
Terminal Unit Cooling	-	1179	75	-	0	0
Terminal Unit Heating	-	0	-	-	651	-
>> Total Conditioning	-	1179	75	-	651	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Carga térmica Arrefecimento [W]	1254
Carga térmica Aquecimento [W]	651

Sistema B7

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 0900 COOLING OA DB / WB 23,9 °C / 19,5 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 11,7 °C / 6,9 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	4 m²	217	-	4 m²	-	-
Wall Transmission	7 m²	0	-	7 m²	107	-
Roof Transmission	28 m²	68	-	28 m²	232	-
Window Transmission	4 m²	-16	-	4 m²	135	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	361 W	361	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	2159 W	1818	-	0	0	-
People	0	20	14	0	0	0
Infiltration	-	-15	92	-	124	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	5% / 5%	123	5	5%	30	0
>> Total Zone Loads	-	2575	111	-	627	0
Zone Conditioning	-	2568	111	-	614	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	2568	111	-	614	0
Terminal Unit Cooling	-	2568	113	-	0	0
Terminal Unit Heating	-	0	-	-	614	-
>> Total Conditioning	-	2568	113	-	614	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Carga térmica Arrefecimento [W]	2681
Carga térmica Aquecimento [W]	614

Sistema B 8.1

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Oct 1600 COOLING OA DB / WB 24,9 °C / 19,4 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 11,7 °C / 6,9 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	4 m²	831	-	4 m²	-	-
Wall Transmission	7 m²	29	-	7 m²	107	-
Roof Transmission	17 m²	-21	-	17 m²	136	-
Window Transmission	4 m²	-14	-	4 m²	135	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	0 W	0	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	0 W	0	-	0	0	-
People	0	7	0	0	0	0
Infiltration	-	-1	41	-	72	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	5% / 5%	42	2	5%	22	0
>> Total Zone Loads	-	873	43	-	472	0
Zone Conditioning	-	858	43	-	432	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	858	43	-	432	0
Terminal Unit Cooling	-	858	44	-	0	0
Terminal Unit Heating	-	0	-	-	432	-
>> Total Conditioning	-	858	44	-	432	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Carga térmica Arrefecimento [W]	902
Carga térmica Aquecimento [W]	432

Sistema B 8.2

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jun 1000 COOLING OA DB / WB 24,0 °C / 19,8 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 11,7 °C / 6,9 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	4 m²	222	-	4 m²	-	-
Wall Transmission	7 m²	-9	-	7 m²	107	-
Roof Transmission	28 m²	52	-	28 m²	232	-
Window Transmission	4 m²	-19	-	4 m²	135	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	361 W	361	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	2159 W	1841	-	0	0	-
People	0	21	14	0	0	0
Infiltration	-	-14	100	-	124	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	5% / 5%	123	6	5%	30	0
>> Total Zone Loads	-	2576	120	-	627	0
Zone Conditioning	-	2564	120	-	620	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	2564	120	-	620	0
Terminal Unit Cooling	-	2564	121	-	0	0
Terminal Unit Heating	-	0	-	-	620	-
>> Total Conditioning	-	2564	121	-	620	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Carga térmica Arrefecimento [W]	2685
Carga térmica Aquecimento [W]	620

Sistema B 8.3

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1900 COOLING OA DB / WB 25,6 °C / 20,1 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 11,7 °C / 6,9 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	0 m²	0	-	0 m²	-	-
Wall Transmission	11 m²	98	-	11 m²	168	-
Roof Transmission	17 m²	51	-	17 m²	136	-
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	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	0 W	0	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	0 W	0	-	0	0	-
People	0	18	14	0	0	0
Infiltration	-	5	-5	-	72	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	5% / 5%	9	0	5%	19	0
>> Total Zone Loads	-	181	9	-	395	0
Zone Conditioning	-	179	9	-	389	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	179	9	-	389	0
Terminal Unit Cooling	-	179	9	-	0	0
Terminal Unit Heating	-	0	-	-	389	-
>> Total Conditioning	-	179	9	-	389	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Carga térmica Arrefecimento [W]	188
Carga térmica Aquecimento [W]	389

Sistema B 8.4

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1000 COOLING OA DB / WB 24,6 °C / 19,8 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 11,7 °C / 6,9 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	4 m²	539	-	4 m²	-	-
Wall Transmission	7 m²	8	-	7 m²	107	-
Roof Transmission	28 m²	50	-	28 m²	232	-
Window Transmission	4 m²	-10	-	4 m²	135	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	361 W	361	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	2159 W	1841	-	0	0	-
People	0	21	14	0	0	0
Infiltration	-	-6	92	-	124	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	5% / 5%	140	5	5%	30	0
>> Total Zone Loads	-	2943	111	-	627	0
Zone Conditioning	-	2917	111	-	598	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	2917	111	-	598	0
Terminal Unit Cooling	-	2917	114	-	0	0
Terminal Unit Heating	-	0	-	-	598	-
>> Total Conditioning	-	2917	114	-	598	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Carga térmica Arrefecimento [W]	3061
Carga térmica Aquecimento [W]	598

Sistema B 9.1

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1900 COOLING OA DB / WB 25,6 °C / 20,1 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 11,7 °C / 6,9 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	0 m²	0	-	0 m²	-	-
Wall Transmission	11 m²	100	-	11 m²	168	-
Roof Transmission	17 m²	53	-	17 m²	136	-
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	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	0 W	0	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	0 W	0	-	0	0	-
People	0	18	14	0	0	0
Infiltration	-	6	-2	-	72	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	5% / 5%	9	1	5%	19	0
>> Total Zone Loads	-	186	13	-	395	0
Zone Conditioning	-	183	13	-	389	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	183	13	-	389	0
Terminal Unit Cooling	-	183	12	-	0	0
Terminal Unit Heating	-	0	-	-	389	-
>> Total Conditioning	-	183	12	-	389	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Carga térmica Arrefecimento [W]	195
Carga térmica Aquecimento [W]	389

Sistema B 9.2

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1000 COOLING OA DB / WB 24,6 °C / 19,8 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 11,7 °C / 6,9 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	4 m²	524	-	4 m²	-	-
Wall Transmission	7 m²	9	-	7 m²	107	-
Roof Transmission	28 m²	53	-	28 m²	233	-
Window Transmission	4 m²	-8	-	4 m²	135	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	361 W	361	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	2159 W	1841	-	0	0	-
People	0	21	14	0	0	0
Infiltration	-	-5	92	-	124	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	5% / 5%	140	5	5%	30	0
>> Total Zone Loads	-	2935	112	-	629	0
Zone Conditioning	-	2911	112	-	602	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	2911	112	-	602	0
Terminal Unit Cooling	-	2911	114	-	0	0
Terminal Unit Heating	-	0	-	-	602	-
>> Total Conditioning	-	2911	114	-	602	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Carga térmica Arrefecimento [W]	3025
Carga térmica Aquecimento [W]	602

Sistema B 9.3

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1700 COOLING OA DB / WB 26,8 °C / 20,4 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 11,7 °C / 6,9 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	0 m²	0	-	0 m²	-	-
Wall Transmission	11 m²	102	-	11 m²	168	-
Roof Transmission	18 m²	60	-	18 m²	149	-
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	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	0 W	0	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	0 W	0	-	0	0	-
People	0	7	0	0	0	0
Infiltration	-	17	4	-	79	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	5% / 5%	9	0	5%	20	0
>> Total Zone Loads	-	196	4	-	416	0
Zone Conditioning	-	196	4	-	410	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	196	4	-	410	0
Terminal Unit Cooling	-	196	5	-	0	0
Terminal Unit Heating	-	0	-	-	410	-
>> Total Conditioning	-	196	5	-	410	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Carga térmica Arrefecimento [W]	201
Carga térmica Aquecimento [W]	410

Edificio C

Totais:

Carga térmica Arrefecimento [W]	1923
Carga térmica Aquecimento [W]	0

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1500 COOLING OA DB / WB 27,2 °C / 20,6 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 11,7 °C / 6,9 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	0 m²	0	-	0 m²	-	-
Wall Transmission	10 m²	88	-	10 m²	141	-
Roof Transmission	0 m²	0	-	0 m²	0	-
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	56 m²	0	-	56 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	396 W	291	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	843 W	727	-	0	0	-
People	5	260	176	0	0	0
Infiltration	-	73	147	-	263	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	5% / 5%	72	16	5%	20	0
>> Total Zone Loads	-	1511	339	-	425	0
Zone Conditioning	-	1584	339	-	1	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	1584	339	-	1	0
Terminal Unit Cooling	-	1584	339	-	0	0
Terminal Unit Heating	-	0	-	-	0	-
>> Total Conditioning	-	1584	339	-	0	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Carga térmica Arrefecimento [W]	1923
Carga térmica Aquecimento [W]	0

Edificio D

Totais:

Carga térmica Arrefecimento [W]	60437
Carga térmica Aquecimento [W]	14713

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1900 COOLING OA DB / WB 25,6 °C / 20,1 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 11,7 °C / 6,9 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	82 m²	5545	-	82 m²	-	-
Wall Transmission	437 m²	3899	-	437 m²	6491	-
Roof Transmission	251 m²	779	-	251 m²	2066	-
Window Transmission	82 m²	242	-	82 m²	3706	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	198 m²	0	-	198 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	3610 W	3601	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	45441 W	38252	-	0	0	-
People	11	1448	2372	0	0	0
Infiltration	-	203	965	-	2383	1
Miscellaneous	-	0	0	-	0	0
Safety Factor	5% / 5%	2698	167	5%	732	0
>> Total Zone Loads	-	56668	3504	-	15379	2
Zone Conditioning	-	56203	3504	-	15353	2
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	0 L/s	0	0	0 L/s	0	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	640	-	-	-640	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	56843	3504	-	14713	2
Terminal Unit Cooling	-	56843	3594	-	0	0
Terminal Unit Heating	-	0	-	-	14713	-
>> Total Conditioning	-	56843	3594	-	14713	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Carga térmica Arrefecimento [W]	60437
Carga térmica Aquecimento [W]	14713

Potências instalada de climatização [RP]

Carga térmica Arrefecimento [kW]	236
Carga térmica Aquecimento [kW]	269

Potências determinadas HAP

Carga térmica Arrefecimento [W]	256941
Carga térmica Aquecimento [W]	69860

Validação

Carga térmica Arrefecimento [kW]	256,941	>>>>> >>>>>	1,088733	>>>	8,87 %	VERDADERO
Carga térmica Aquecimento [kW]	69,86					

Apêndice B

Neste apêndice estão expostos os valores dos consumos energéticos de cada edifício obtidos com a simulação dinâmica do modelo concebido, bem como o valor total resultante do seu somatório.

Edificio A

Component	Site Energy (kWh)
Air System Fans	0
Cooling	8.295
Heating	129
Pumps	0
Heat Rejection Fans	0
HVAC Sub-Total	**8.425**
Lights	18.132
Electric Equipment	72.900
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	**91.033**
Grand Total	**99.457**

Edificio B

Component	Site Energy (kWh)
Air System Fans	0
Cooling	50.993
Heating	351
Pumps	0
Heat Rejection Fans	0
HVAC Sub-Total	**51.344**
Lights	106.804
Electric Equipment	268.658
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	**375.462**
Grand Total	**426.806**

Edificio C

Component	Site Energy (kWh)
Air System Fans	0
Cooling	804
Heating	0
Pumps	0
Heat Rejection Fans	0
HVAC Sub-Total	**804**
Lights	67.465
Electric Equipment	124.440
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	**191.905**
Grand Total	**192.710**

Edificio D

Component	Site Energy (kWh)
Air System Fans	5.606
Cooling	12.672
Heating	4
Pumps	7.404
Heat Rejection Fans	0
HVAC Sub-Total	**25.686**
Lights	17.680
Electric Equipment	43.855
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	**61.535**
Grand Total	**87.221**

Validação

Consumo total obtido com simulação dinâmica [kWh]	806,2
Consumo total reportado no relatório de auditoria [kWh]	784,3

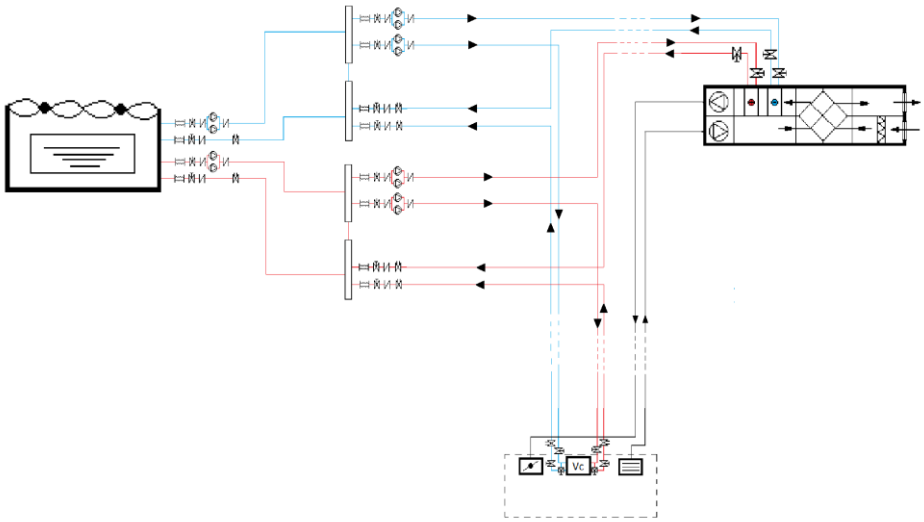
1,027915 >>> 2,79 % VERDADERO

Apêndice C

Neste apêndice estão expostos obtidos com o pré-dimensionamento do sistema de climatização. Contudo em anexo a este trabalho é apresentada a folha de cálculo em formato digital de modo a apresentar todos os dados utilizados neste procedimento.

Pré dimensionamento Sistema de Climatização centralizado Edifício B

1. Esquema de princípio do Sistema



2. Descrição do Sistema

Trata-se de um sistema de climatização centralizado munido de um chiller/Bc. A climatização dos espaços é efetuada através da insuflação de ar novo tratado e da ação de ventilo-convectores.

O ar que é insuflado nos espaços é captado e tratado através de uma unidade de tratamento de ar. Este ar é condicionado através de baterias de aquecimento e arrefecimento alimentadas pelo chiller, instaladas na UTA.

Os ventilo-convectores realizam circulação e climatização do ar interior dos espaços. Analogamente às baterias térmicas instaladas na UTA, estes equipamentos são também eles sustentados por água fria ou quente proveniente do chiller/bc

Todo este sistema está instalado na cobertura do edifício.

Descrição teórica do problema

O dimensionamento de um sistema de climatização trata-se de um rigoroso conjunto de complexos métodos de cálculo, dos quais poderão surgir variadas questões e demorados cálculos para obter incógnitas chave no processo.

Não sendo objetivo concreto do trabalho, o dimensionamento realizado a jusante trata-se na verdade um pré-dimensionamento, o qual não será de todo realizado com o rigor nem contemplando todas as variáveis que um dimensionamento real requer.

Com o concreto objetivo de determinar o consumo do sistema este pré-dimensionamento tem 3 variáveis alvo distintas a determinar: os caudais de ar, os caudais de água proveniente do chiller e as perdas de carga no sistema.

O consumo do sistema de climatização será então obtido através da soma do consumo energético do chiller/ bc com as 3 parcelas referidas a montante.

Consumo energético chiller/bc (necessidades dos edifícios):

Estação de arrefecimento: 236 kW

Estação de aquecimento: 269 kW

1. Caudais de Ar

É proeminente determinar os caudais de ar no sistema pois estes têm grande influência no consumo total do sistema. Na verdade tais caudais irão determinar o consumo energético dos ventiladores instalados na UTA.

O caudal de ar novo a insuflar em cada espaço será estipulado de acordo com o RECS.

Todo o ar insuflado dentro dos espaços é ar novo não existindo qualquer tipo de mistura entre o ar a insuflar e o ar de retorno.

Assumindo esta característica do sistema o caudal de ar admitido pela UTA é igual ao somatório dos caudais necessários em cada espaço. O caudal de retorno será logicamente igual ao caudal admitido pela UTA.

Valores a determinar:

$$\dot{Q}_{ar}\,UTA = \sum \dot{Q}_{\text{insuflação todos os espaços}}\,.$$

- Caudais de Ar para os diferentes espaços requeridos pelo RECS – $\dot{Q}\,[m^3/h]$.

2. Caudais de água proveniente do Chiller

É necessário também determinar os caudais de água provenientes do chiller. Tais caudais serão úteis para a determinação do consumo energético parcial por parte das bombas de circulação de água.

Valores a determinar:

$$Q = \dot{m}\; cp\; \Delta T$$

- Q – Potência térmica fornecida pela máquina [W]
- Cp- Calor específico da água $[kJ/kg]$;
- ΔT – Diferença de temperaturas da água à entrada e à saída da máquina;

3. Perdas de carga no sistema

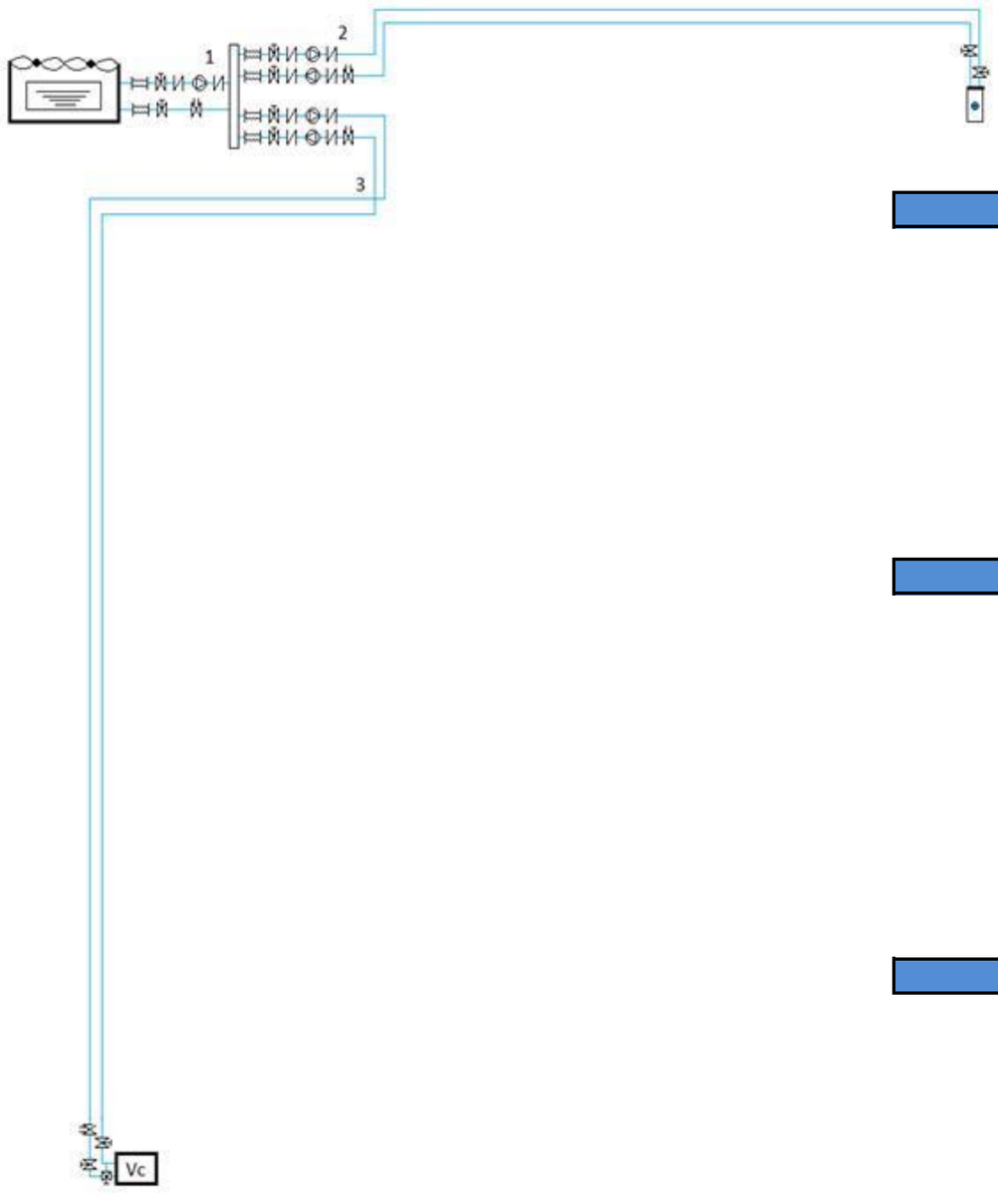
Determinar as perdas de carga nas redes de fluidos do sistema é estritamente necessário pois com tais valores é possível determinar os consumos energéticos por parte dos ventiladores e das bombas.

Valores a determinar:

$$\Delta P_{ar} = \Delta P_{rede} + \sum \Delta P_{Equipamentos}$$

- $\Delta P_{rede} = \Delta P/m \times Comrpimento\ de\ rede$

Caudais de água



Rede 1	Anel Primário / Água fria proveniente do chiller

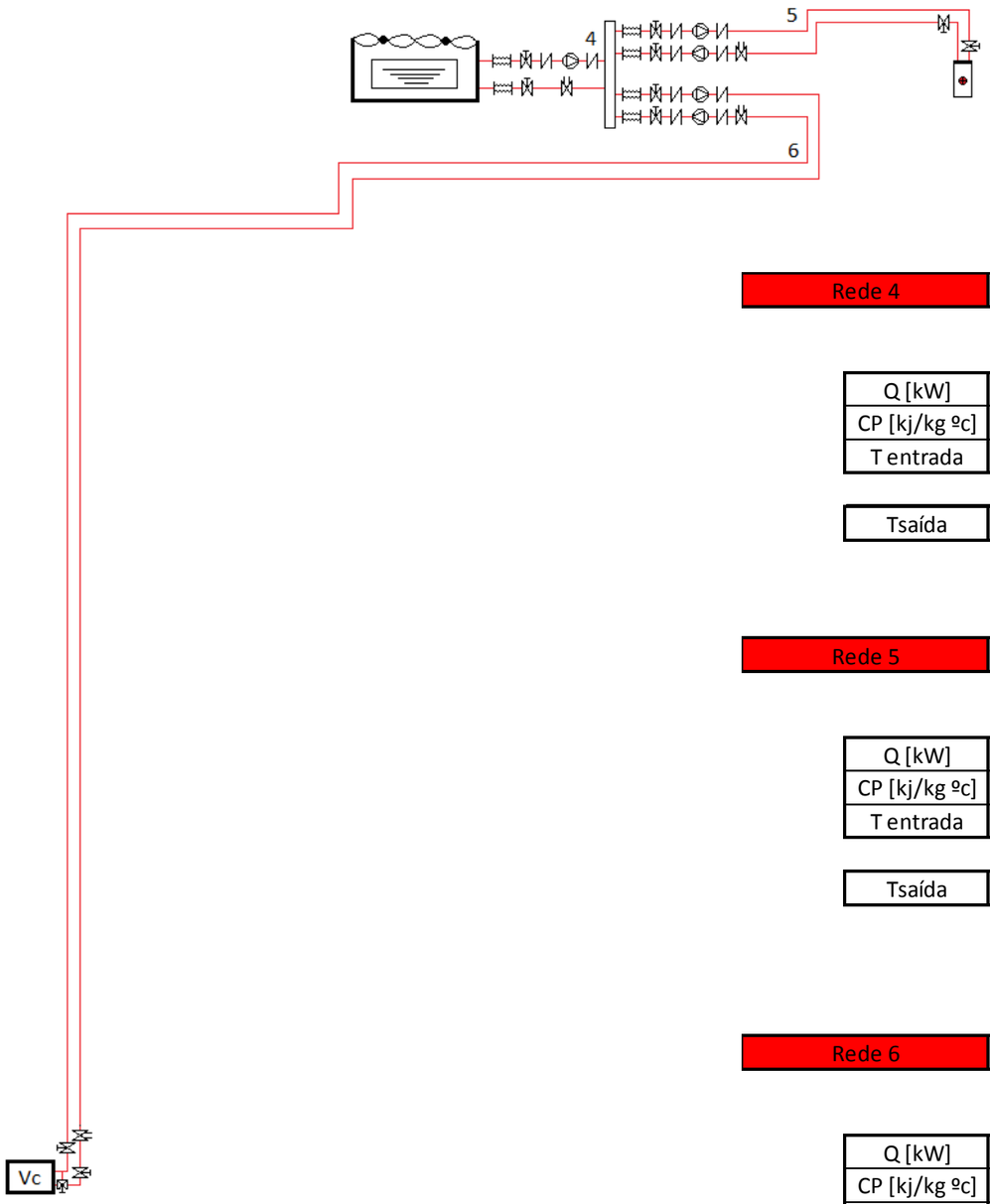
Q [kW]	237,496				m [m^3 / s]
CP [kj/kg ºc]	4,18				
T entrada	12	ΔT [ºc]	5	m [kg / s]	11,36
Tsaída	7				0,0113634

Rede 2	Anel Secundário / Água fria alimentação bateria Uta

Q [kW]	57,14				m [m^3 / s]
CP [kj/kg ºc]	4,18				
T entrada	12	ΔT [ºc]	5	m [kg / s]	2,73
Tsaída	7				0,002734

Rede 3	Anel Secundário / Água fria alimentação VC

Q [kW]	180,356				m [m^3 / s]
CP [kj/kg ºc]	4,18				
T entrada	12	ΔT [ºc]	5	m [kg / s]	8,63
Tsaída	7				0,0086295



Rede 4	Anel primário / Água quente proveniente da BC

Q [kW]	95,602				m [m^3 / s]
CP [kj/kg ºc]	4,18			m [kg / s]	0,0045743
T entrada	35	ΔT [ºc]	5	4,57	
Tsaída	40				

Rede 5	Anel Secundário / Água quente alimentação bateria Uta

Q [kW]	44,41				m [m^3 / s]
CP [kj/kg ºc]	4,18			m [kg / s]	0,0021249
T entrada	35	ΔT [ºc]	5	2,12	
Tsaída	40				

Rede 6	Anel Secundário / Água quente alimentação VC

Q [kW]	51,192				m [m^3 / s]
CP [kj/kg ºc]	4,18			m [kg / s]	0,0024494
T entrada	35	ΔT [ºc]	5	2,45	
Tsaída	40				

$$Q = \dot{m}\, cp\, \Delta T$$

- Q – Potência térmica fornecida pela máquina [W]
- Cp- Calor específico da água $[kJ/kg]$;
- ΔT – Diferença de temperaturas da água à entrada e à saída da máquina;

	m [kg / s]
Rede 1	11,36
Rede 2	2,73
Rede 3	8,63
Rede 4	4,57
Rede 5	2,12
Rede 6	2,45

Caudais de Ar novo

Método Analítico

Código zona	Nome Zona	Área [m^2]	Volume [m^3]	Nº de pessoas	Taxa de metabolismo [Met]	G CO2 [m^3 / h.pessoa]	Q ar novo [m^3 / h]	
B.P 0_00	Sala de jogos	236,2	885,75	50	1,75	1,481	1721,51	
B.P 0_01	Ginásio	46,7	175,125	6	5	0,508	590,23	
⋮				⋮		⋮		
B.P9_11	Zona Técnica(Elevadores)	10,42	27,092			0,000	0,00	
B.P10_00	Escadas acesso à cobertura	15,24	39,624			0,000	0,00	
B.P10_01	Zona técnica Cobertura	29,86	77,636			0,000	0,00	
							10041,82	Total [m^3 / h]

Métodos Prescritivos

Em Função da Carga Poluente devida à Ocupação

Código zona	Nome Zona	Área [m^2]	Volume [m^3]	Nº de pessoas	Taxa de metabolismo [Met]	Caudal de ar novo [m^3 / h.pessoa]	Caudal de ar novo [m^3 / h]	
B.P 0_00	Sala de jogos	236,2	885,75	50	1,75	35	1750	
B.P 0_01	Ginásio	46,7	175,125	6	5	98	588	
⋮				⋮		⋮		
B.P9_11	Zona Técnica(Elevadores)	10,42	27,092				0	
B.P10_00	Escadas acesso à cobertura	15,24	39,624				0	
B.P10_01	Zona técnica Cobertura	29,86	77,636				0	
							10196	Total [m^3 / h]

Em Função da Carga Poluente devida ao Edificio

Código zona	Nome Zona	Área [m^2]	Volume [m^3]	Caudal de ar novo [m^3 / h . m^2]	Caudal de ar novo [m^3 / h]	
B.P 0_00	Sala de jogos	236,2	885,75	3	708,6	
B.P 0_01	Ginásio	46,7	175,125	3	140,1	
⋮			⋮		⋮	
B.P9_11	Zona Técnica(Elevadores)	10,42	27,092	0	0	
B.P10_00	Escadas acesso à cobertura	15,24	39,624	0	0	
B.P10_01	Zona técnica Cobertura	29,86	77,636	0	0	
					15066,84	Total [m^3 / h]

Seleção do Caudal de Ar novo

Código zona	Caudal de ar novo [m^3 / h]	
B.P 0_00	1750	
B.P 0_01	588	
⋮	⋮	
B.P9_11	0	
B.P10_00	0	
B.P10_01	0	
	18615,83	Total [m^3 / h]

Caudal de ar novo [l / s]	
486,11	
163,33	
⋮	
0,00	
0,00	
0,00	
5171,06	Total [m^3 / h]

Perdas de carga

Rede 1	Anel Primário / Água fria proveniente do chiller

Comprimento da rede [m]	5

Obstruções na rede		C. equivalente [m]	OU	ΔP obstrução [m.c.a.]	ΔP obstrução [kPa]
	1 entrada	0,3			0
	1 apoio antivibração	1			0
	1 v. de corte	1			0
	1 v. anti retono	1			0
	1 bomba	1			0
	1 v. anti retono	1			0
	5 joelhos	5,5			0
	1 coletor	1			0
	1 v. controlo de caudal	0		0,6	5,8836
	1 v. de corte	1			0
	1 apoio antivibração	1			0
	1 entrada	1			0
	1 permutador	1			0
	Total [m]	15,8		Total [kPa]	5,8836

ΔP / comprimento [kPa /m]	0,2

ΔP rede [kPa]	10,0436

Rede 2	Anel Secundário / Água fria alimentação bateria Uta

Comprimento da rede [m]	30

Obstruções na rede		C. equivalente [m]	OU	ΔP obstrução [m.c.a.]	ΔP obstrução [Pa]
	1 entrada	0,3			
	1 apoio antivibração	1			
	1 v. de corte	1			
	1 v. anti retono	1			
	1 bomba	1			
	1 v. anti retono	1			
	8 joelhos	8,8			
	1 v. de corte	1			
	1 bateria	0		3	29,419
	1 v. de corte	1			
	1 v. controlo de caudal	0		0,6	5,8836
	1 v. anti retono	1			
	1 bomba	1			
	1 v. anti retono	1			
	1 v. de corte	1			
	1 entrada	1			
	1 coletor	1			

Total [m]	22,1

Total [kPa]	35,3026

ΔP / comprimento [kPa /m]	0,2

ΔP rede [kPa]	45,7226

Rede 3	Anel Secundário / Água fria alimentação VC

Comprimento da rede [m]	64

Obstruções na rede		C. equivalente [m]	OU	ΔP obstrução [m.c.a.]	ΔP obstrução [Pa]
	1 entrada	0,3			0
	1 apoio antivibração	1			0
	1 v. de corte	1			0
	1 v. anti retono	1			0
	1 bomba	1			0
	1 v. anti retono	1			0
	12 joelhos	13,2			0
	18 Tês	12,6			0
	1 v. controlo de caudal	1		0,6	5,8836
	1 v. de corte	1			0
	1 v. 3 vias	0		3	29,419
	1 ventilo convector	0		3	29,419
	1 v. de corte	1			0
	1 v. controlo de caudal	0		0,6	5,8836
	1 v. anti retono	1			0
	1 bomba	1			0
	1 v. anti retono	1			0
	1 v. de corte	1			0
	1 entrada	1			0
	1 coletor	1			0
	Total [m]	40,1		Total [kPa]	70,6052

ΔP / comprimento [kPa /m]	0,2	→	ΔP rede [kPa]	91,4252

Rede 4	Anel Primário / Água quente proveniente da BC

Comprimento da rede [m]	5

Obstruções na rede		C. equivalente [m]	OU	ΔP obstrução [m.c.a.]	ΔP obstrução [kPa]
	1 entrada	0,3			0
	1 apoio antivibração	1			0
	1 v. de corte	1			0
	1 v. anti retono	1			0
	1 bomba	1			0
	1 v. anti retono	1			0
	5 joelhos	5,5			0
	1 coletor	1			0
	1 v. controlo de caudal	0		0,6	5,8836
	1 v. de corte	1			0
	1 apoio antivibração	1			0
	1 entrada	1			0
	1 permutador	1			0
	Total [m]	15,8		Total [kPa]	5,8836

ΔP / comprimento [kPa /m]	0,2

ΔP rede [kPa]	10,0436

Rede 5	Anel Secundário / Água quente alimentação bateria Uta

Comprimento da rede [m]	30

Obstruções na rede		C. equivalente [m]	OU	ΔP obstrução [m.c.a.]	ΔP obstrução [Pa]
	1 entrada	0,3			
	1 apoio antivibração	1			
	1 v. de corte	1			
	1 v. anti retono	1			
	1 bomba	1			
	1 v. anti retono	1			
	8 joelhos	8,8			
	1 v. de corte	1			
	1 bateria	0		3	29,419
	1 v. de corte	1			
	1 v. controlo de caudal	0		0,6	5,8836
	1 v. anti retono	1			
	1 bomba	1			
	1 v. anti retono	1			
	1 v. de corte	1			
	1 entrada	1			
	1 coletor	1			

Total [m]	22,1	Total [kPa]	35,3026

ΔP / comprimento [kPa /m]	0,2	ΔP rede [kPa]	45,7226

Rede 6	Anel Secundário / Água quente alimentação VC

Comprimento da rede [m]	64

Obstruções na rede		C. equivalente [m]	OU	ΔP obstrução [m.c.a.]	ΔP obstrução [Pa]
	1 entrada	0,3			0
	1 apoio antivibração	1			0
	1 v. de corte	1			0
	1 v. anti retono	1			0
	1 bomba	1			0
	1 v. anti retono	1			0
	12 joelhos	13,2			0
	18 Tês	12,6			0
	1 v. controlo de caudal	1		0,6	5,8836
	1 v. de corte	1			0
	1 v. 3 vias	0		3	29,419
	1 ventilo convector	0		3	29,419
	1 v. de corte	1			0
	1 v. controlo de caudal	0		0,6	5,8836
	1 v. anti retono	1			0
	1 bomba	1			0
	1 v. anti retono	1			0
	1 v. de corte	1			0
	1 entrada	1			0
	1 coletor	1			0
	Total [m]	40,1		Total [kPa]	70,6052

ΔP / comprimento [kPa /m]	0,2

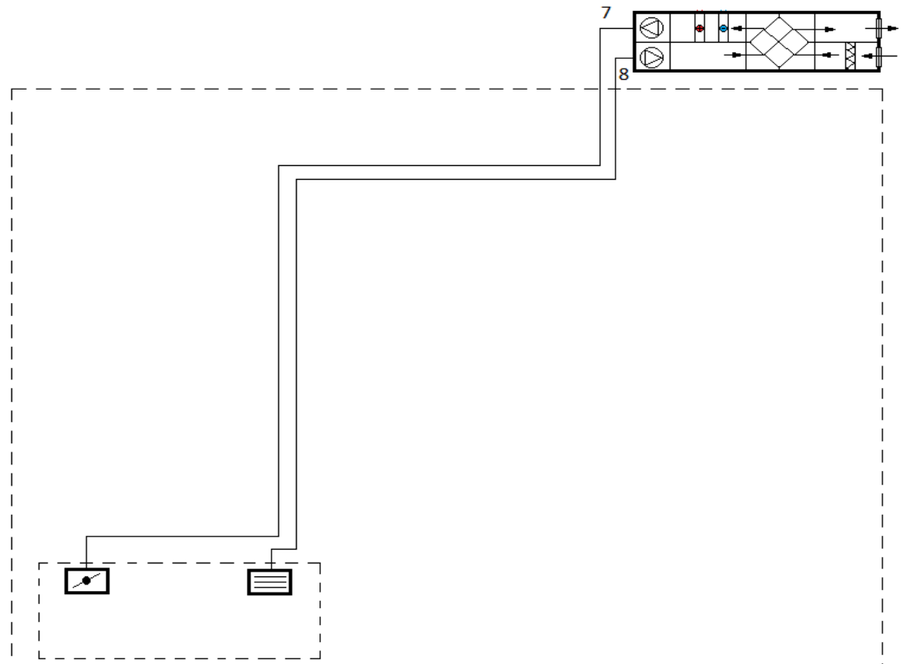
ΔP rede [kPa]	91,4252

Rede 7	Rede de insuflação de Ar novo

Comprimento da rede [m]	66		
Acessórios:			
	12 joelhos	C. equivalente [m]	12
Total [m]	78		

Acessórios ΔP definido:		ΔP [m.c.a.]	ΔP [kPa]
	1 UTA	-	0,6
	1 grelha de insuflação	-	0,03

ΔP / comprimento [Pa /m]	1	ΔP rede [kPa]	0,708



Rede 8	Rede de retorno de Ar

Comprimento da rede [m]	66		
Acessórios:			
	12 joelhos	C. equivalente [m]	12
Total [m]	78		

Acessórios ΔP definido:		ΔP [m.c.a.]	ΔP [kPa]
	1 UTA	-	0,6
	1 grelha de retorno		0,03

ΔP / comprimento [Pa /m]	1	ΔP rede [kPa]	0,708

Consumos equipamentos

	[W]
REDE 1	190,22
REDE 2	208,34
REDE 3	1314,92
REDE 4	76,57
REDE 5	125,02
REDE 6	373,22
REDE 7	6128,92
REDE 8	5822,12

Total Bombas Arrefecimento [kW]	1,71
Total Bombas Aquecimento [kW]	0,57
Total Ventiladores [kW]	11,95

Rendimento Bombas e Ventiladores
0,6

Consumos Chiller /BC

→ Carga térmica a remover + Potência necessária Ar novo

Potência necessária no chiller Arrefecimento [kW]	237,5
Potência necessária na BC Aquecimento [kW]	95,6

Consumos totais sistema

→ Potência necessária + Consumos nos equipamentos

Potência no sistema Arrefecimento [kW]	251,2
Potência no sistema Aquecimento [kW]	108,1