General results heating

No. of sources		1
Total number of terminal units		17
Total number of pipe-runs		30
Total number of manifolds		4
Total number of pumps		0
Spec. total rooms heat loss Φ_H		**20687 W**
Spec. total req. heat output of other TU's		**0 W**
Spec. total rooms req. heat output Φ_{req}		**20687 W**
Calculation standards:		
Radiators sizing standard	EN 442-2	
Floor heating standard	EN 1264-1,2,3:1999, EN 1264-4:2003	

Source: Other (hor.): 1, Application: Heating engineering/Refrigerating engineering, Medium: Water

Source elevation	-2,8 m
Supply and return temperature	**40,8 / 28,0 °C**
Total output	**19251 W**
Total output of convectors $\Phi_{conv,H}$	0 W
Total output of radiant heaters $\Phi_{rh,H}$	16500 W
Total output of other heaters	0 W
Heat gains from pipe-runs accounted for in balance	0 W
Not utilized heat loss of pipe-runs	258 W
Losses of radiant heating (outside building)	2492 W
Losses of radiant heating (inside buidling)	0 W
Available pressure	**54,6 kPa**
Pressure drop along critical route	54,6 kPa
Pressure drop on critical terminal unit	11,7 kPa
Press. drop on source	0,0 kPa
Flow rate in source	1293,6 kg/h
Critical receptor: 0,8-4-4	
Critical TU route length	79,7 m
Capacity of system incl. terminal units	**226,8 dm³**

Radiant heating general results

Source/Source: 1	Application: Heating engineering/ Refrigerating engineering	Medium: Water
Temperatures $\theta_{s,H}$ and $\theta_{r,H}$ [°C]	40,8	28,0

Temperature source for control circuits	Source/1	
Temperatures $\theta_{s,H}$ and $\theta_{r,H}$ [°C]	40,8	28,0
Required heat capacity $\Phi_{req,H}$ [W]	16500	
Obtained heat output Φ_H [W]	16500	
Heat capacity lost $\Phi_{OS,H}$ [W]	2492	
Mass flow rate m [kg/h]	1293,6	

Manifold symbol	Storey symbol	Number of heating/ cooling zones fed	Obtained heat output of heat./cool. zone (heating mode)	Output lost of heat./ cool. zone (heating mode)	Return temperature on manifold (heating mode)	Temperature difference on manifold (heating mode)	Mass flow rate	Required min. pressure difference	Resultant pressure difference	Total pipe length
Manifold	**Stor.**	**N**	**Φ_H**	**$\Phi_{OS,H}$**	**$\theta_{r,H}$**	**$\Delta\theta_H$**	**m**	**Δp_{min}**	**Δp**	**L_{tot}**
			W	**W**	**°C**	**K**	**kg/h**	**kPa**	**kPa**	**m**
M1	2	6	5556	849	27,5	13,2	417,9	7,6	15,0	610,1
M2	2	5	5540	846	27,5	13,1	419,2	13,1	13,1	592,2
M3	2	3	2895	427	28,8	11,9	239,8	9,2	10,4	266,4
M4	2	3	2509	370	29,1	11,5	216,7	9,1	9,1	238,3

Radiant cooling general results

Source/Source: 1	Application: Heating engineering/ Refrigerating engineering	Medium: Water
Temperatures $\theta_{s,C}$ and $\theta_{r,C}$ [°C]	17,0	???

Temperature source for control circuits	Source/1	
Temperatures $\theta_{s,C}$ and $\theta_{r,C}$ [°C]	17,0	???
Required heat capacity $\Phi_{req,C}$ [W]	13500	
Obtained heat output Φ_C [W]	8574	
Heat capacity lost $\Phi_{OS,C}$ [W]	112	
Mass flow rate m [kg/h]	1293,6	

Manifold symbol	Storey symbol	Number of heating/ cooling zones fed	Obtained heat output of heat./cool. zone (cooling mode)	Output lost of heat./ cool. zone (cooling mode)	Return temperature on manifold (cooling mode)	Temperature difference on manifold (cooling mode)	Mass flow rate	Required min. pressure difference	Resultant pressure difference	Total pipe length
Manifold	**Stor.**	**N**	**Φ_C**	**$\Phi_{OS,C}$**	**$\theta_{r,C}$**	**$\Delta\theta_C$**	**m**	**Δp_{min}**	**Δp**	**L_{tot}**
			W	**W**	**°C**	**K**	**kg/h**	**kPa**	**kPa**	**m**
M1	2	6	2890	41	22,9	-5,9	417,9	7,6	15,0	610,1
M2	2	5	2882	41	22,9	-5,9	419,2	13,1	13,1	592,2
M3	2	3	1501	16	22,4	-5,4	239,8	9,2	10,4	266,4
M4	2	3	1301	14	22,2	-5,2	216,7	9,1	9,1	238,3

Detailed radiant heating results

Heating/cooling zone symbol	Area	Occupied / peripheral zone	Surface temperature	Thermal resistance of covering	Power required for heating	Output gained	Output lost	Unit power	Pipe spacing	Temp. diff. supply-return	Area occupied by passing feeds	Heating power from passing feeds	Length of circuit feeds	Overall circuit length (feeds + loop)	Mass flow rate	Flow velocity	Pressure loss in circuit	Pressure drop on regulating valves	Total pressure loss	Valve setting
HCZ	**A**	**Type**	**$\theta_{surface,H}$**	**$R_{\lambda,B}$**	**$\Phi_{req,H}$**	**Φ_H**	**$\Phi_{OS,H}$**	**q_H**	**VA**	**$\Delta\theta_H$**	**A_{feed}**	**$\Phi_{feeds,H}$**	**L_{feeds}**	**L_{tot}**	**m**	**v**	**Δp**	**$\Delta p_{reg,z}$ $\Delta p_{reg,p}$**	**Δp_{tot}**	**n**
	m²		**°C**	**(m²·K)/W**	**W**	**W**	**W**	**W/m²**	**mm**	**K**	**m²**	**W**	**m**	**m**	**kg/h**	**m/s**	**kPa**	**kPa**	**kPa**	
Double apartment manifold: M1; Storey: 2; Bld. unit: NONE; $\theta_{s,H}$: 40,8 °C;																				
Room: 0,8; $\theta_{i,H}$: 20,0 °C; Φreq,H: 11096 W; Φ surplus: 0 W;																				
0,8-1-1	17,7	OZ	28,5	0,000	973	973	149	55,0	200	13,2	0,0	0	5,7	94,2	73,1	0,18	5,2	6,4 3,4	15,0	3,00
0,8-1-2	17,7	OZ	28,5	0,000	973	973	149	55,0	200	13,2	0,0	0	11,8	100,2	73,1	0,18	5,6	6,4 3,0	15,0	3,00
0,8-1-3	17,7	OZ	28,5	0,000	973	973	149	55,0	200	13,2	0,0	0	18,1	106,6	73,1	0,18	5,9	6,4 2,7	15,0	3,00
0,8-1-4	17,7	OZ	28,5	0,000	973	973	149	55,0	200	13,2	0,0	0	24,2	112,6	73,1	0,18	6,3	6,4 2,3	15,0	3,00
0,8-1-5	17,7	OZ	28,5	0,000	973	973	149	55,0	200	13,2	0,0	0	30,5	118,9	73,1	0,18	**6,6**	**6,4 2,0**	**15,0**	3,00
0,8-2-1	12,6	OZ	28,5	0,000	692	692	106	55,0	200	13,1	0,0	0	14,7	77,6	52,4	0,13	1,6	11,0 2,4	15,0	1,50
Double apartment manifold: M2; Storey: 2; Bld. unit: NONE; $\theta_{s,H}$: 40,8 °C;																				
Room: 0,8; $\theta_{i,H}$: 20,0 °C; Φreq,H: 11096 W; Φ surplus: 0 W;																				
0,8-3-1	12,5	OZ	28,5	0,000	686	686	105	55,0	200	13,1	0,0	0	13,2	75,6	51,9	0,13	1,6	10,8 0,8	13,1	1,50

HCZ	A	Type	$\theta_{surface,H}$	$R_{\lambda,B}$	$\Phi_{req,H}$	Φ_H	$\Phi_{OS,H}$	q_H	VA	$\Delta\theta_H$	A_{feed}	$\Phi_{feeds,H}$	L_{feeds}	L_{tot}	m	v	Δp	$\Delta p_{reg,z}$ $\Delta p_{reg,p}$	Δp_{tot}	n
	m²		°C	(m²·K)/W	W	W	W	W/m²	mm	K	m²	W	m	m	kg/h	m/s	kPa	kPa	kPa	
0,8-4-1	22,1	OZ	28,5	0,000	1214	1214	185	55,0	200	13,1	0,0	0	7,1	117,5	91,8	0,23	9,7	2,7 0,7	13,1	5,00
0,8-4-2	22,1	OZ	28,5	0,000	1214	1214	185	55,0	200	13,1	0,0	0	14,9	125,2	91,8	0,23	10,4	2,2 0,6	13,1	5,50
0,8-4-3	22,1	OZ	28,5	0,000	1214	1214	185	55,0	200	13,1	0,0	0	22,7	133,1	91,8	0,23	11,0	1,4 0,7	13,1	6,50
0,8-4-4	22,1	OZ	28,5	0,000	1214	1214	185	55,0	200	13,1	0,0	0	30,5	140,8	91,8	0,23	**11,7**	**0,9** **0,6**	**13,1**	8,00
Double apartment manifold: M3; Storey: 2; Bld. unit: NONE; $\theta_{s,H}$: 40,8 °C;																				
Room: 0,1; $\theta_{i,H}$: 20,0 °C; Φreq,H: 5404 W; Φ surplus: 0 W;																				
0,1-1-1	18,3	OZ	29,0	0,000	1077	1077	159	58,7	200	12,0	0,0	0	8,7	100,5	89,0	0,22	**7,8**	**2,0** **0,6**	**10,4**	5,50
0,1-1-2	18,3	OZ	29,0	0,000	1077	1077	159	58,7	200	12,0	0,0	0	2,8	94,5	89,0	0,22	7,4	2,0 1,0	10,4	5,50
0,1-2-1	12,6	OZ	29,0	0,000	740	740	109	58,7	200	11,8	0,0	0	8,4	71,4	61,9	0,15	3,0	6,9 0,5	10,4	2,50
Double apartment manifold: M4; Storey: 2; Bld. unit: NONE; $\theta_{s,H}$: 40,8 °C;																				
Room: 0,1; $\theta_{i,H}$: 20,0 °C; Φreq,H: 5404 W; Φ surplus: 0 W;																				
0,1-3-1	6,2	OZ	29,0	0,000	365	365	54	58,7	200	9,1	0,0	0	13,5	44,6	39,7	0,10	0,7	6,3 2,1	9,1	1,50
0,1-4-1	18,3	OZ	29,0	0,000	1072	1072	158	58,7	200	12,0	0,0	0	8,4	99,7	88,5	0,22	**7,7**	**0,8** **0,5**	**9,1**	8,00
0,1-4-2	18,3	OZ	29,0	0,000	1072	1072	158	58,7	200	12,0	0,0	0	2,8	94,1	88,5	0,22	7,3	1,0 0,8	9,1	7,00

Detailed radiant cooling results

Heating/cooling zone symbol	Area	Occupied / peripheral zone	Surface temperature	Thermal resistance of covering	Power required for cooling	Power gained	Output lost	Unit power	Pipe spacing	Temp. diff. supply-return	Area occupied by passing feeds	Cooling output of passing pipe feeds	Length of circuit feeds	Overall circuit length (feeds + loop)	Mass flow rate	Flow velocity	Pressure loss in circuit	Pressure drop on regulating valves	Total pressure loss	Valve setting
HCZ	**A**	**Type**	**$\theta_{surface,C}$**	**$R_{\lambda,B}$**	**$\Phi_{req,C}$**	**Φ_C**	**$\Phi_{OS,C}$**	**q_C**	**VA**	**$\Delta\theta_C$**	**A_{feed}**	**$\Phi_{feeds,C}$**	**L_{feeds}**	**L_{tot}**	**m**	**v**	**Δp**	**$\Delta p_{reg,z}$ $\Delta p_{reg,p}$**	**Δp_{tot}**	**n**
	m²		**°C**	**(m²·K)/W**	**W**	**W**	**W**	**W/m²**	**mm**	**K**	**m²**	**W**	**m**	**m**	**kg/h**	**m/s**	**kPa**	**kPa**	**kPa**	
Double apartment manifold: M1; Storey: 2; Bld. unit: NONE; $\theta_{s,C}$: 17,0 °C;																				
Room: 0,8; $\theta_{i,C}$: 26,0 °C; Φreq,C: 9079 W; Φ surplus,C: -3307 W;																				
0,8-1-1	17,7	OZ	23,4	0,000	796	506	7	28,6	200	-5,9	0,0	0	5,7	94,2	73,1	0,18	5,2	6,4 3,4	15,0	*3,00*
0,8-1-2	17,7	OZ	23,4	0,000	796	506	7	28,6	200	-5,9	0,0	0	11,8	100,2	73,1	0,18	5,6	6,4 3,0	15,0	*3,00*
0,8-1-3	17,7	OZ	23,4	0,000	796	506	7	28,6	200	-5,9	0,0	0	18,1	106,6	73,1	0,18	5,9	6,4 2,7	15,0	*3,00*
0,8-1-4	17,7	OZ	23,4	0,000	796	506	7	28,6	200	-5,9	0,0	0	24,2	112,6	73,1	0,18	6,3	6,4 2,3	15,0	*3,00*
0,8-1-5	17,7	OZ	23,4	0,000	796	506	7	28,6	200	-5,9	0,0	0	30,5	118,9	73,1	0,18	**6,6**	**6,4 2,0**	**15,0**	*3,00*
0,8-2-1	12,6	OZ	23,4	0,000	566	360	5	28,6	200	-5,9	0,0	0	14,7	77,6	52,4	0,13	1,6	11,0 2,4	15,0	*1,50*

HCZ	A	Type	$\vartheta_{surface,C}$	$R_{\lambda,B}$	$\Phi_{req,C}$	Φ_C	$\Phi_{OS,C}$	q_C	VA	$\Delta\theta_C$	A_{feed}	$\Phi_{feeds,C}$	L_{feeds}	L_{tot}	m	v	Δp	$\Delta p_{reg,z}$ $\Delta p_{reg,p}$	Δp_{tot}	n
	m²		°C	(m²·K)/W	W	W	W	W/m²	mm	K	m²	W	m	m	kg/h	m/s	kPa	kPa	kPa	
Double apartment manifold: M2; Storey: 2; Bld. unit: NONE; $\theta_{s,C}$: 17,0 °C;																				
Room: 0,8; $\theta_{i,C}$: 26,0 °C; Φreq,C: 9079 W; Φ surplus,C: -3307 W;																				
0,8-3-1	12,5	OZ	23,4	0,000	561	357	5	28,6	200	-5,9	0,0	0	13,2	75,6	51,9	0,13	1,6	10,8 0,8	13,1	*1,50*
0,8-4-1	22,1	OZ	23,4	0,000	993	631	9	28,6	200	-5,9	0,0	0	7,1	117,5	91,8	0,23	9,7	2,7 0,7	13,1	*5,00*
0,8-4-2	22,1	OZ	23,4	0,000	993	631	9	28,6	200	-5,9	0,0	0	14,9	125,2	91,8	0,23	10,4	2,2 0,6	13,1	*5,50*
0,8-4-3	22,1	OZ	23,4	0,000	993	631	9	28,6	200	-5,9	0,0	0	22,7	133,1	91,8	0,23	11,0	1,4 0,7	13,1	*6,50*
0,8-4-4	22,1	OZ	23,4	0,000	993	631	9	28,6	200	-5,9	0,0	0	30,5	140,8	91,8	0,23	**11,7**	**0,9** **0,6**	**13,1**	*8,00*
Double apartment manifold: M3; Storey: 2; Bld. unit: NONE; $\theta_{s,C}$: 17,0 °C;																				
Room: 0,1; $\theta_{i,C}$: 26,0 °C; Φreq,C: 4421 W; Φ surplus,C: -1619 W;																				
0,1-1-1	18,3	OZ	23,2	0,000	881	559	6	30,5	200	-5,4	0,0	0	8,7	100,5	89,0	0,22	**7,8**	**2,0** **0,6**	**10,4**	*5,50*
0,1-1-2	18,3	OZ	23,2	0,000	881	559	6	30,5	200	-5,4	0,0	0	2,8	94,5	89,0	0,22	7,4	2,0 1,0	10,4	*5,50*
0,1-2-1	12,6	OZ	23,2	0,000	605	384	4	30,5	200	-5,4	0,0	0	8,4	71,4	61,9	0,15	3,0	6,9 0,5	10,4	*2,50*

HCZ	A	Type	$\vartheta_{surface,C}$	$R_{\lambda,B}$	$\Phi_{req,C}$	Φ_C	$\Phi_{OS,C}$	q_C	VA	$\Delta\theta_C$	A_{feed}	$\Phi_{feeds,C}$	L_{feeds}	L_{tot}	m	v	Δp	$\Delta p_{reg,z}$ $\Delta p_{reg,p}$	Δp_{tot}	n
	m²		°C	(m²·K)/W	W	W	W	W/m²	mm	K	m²	W	m	m	kg/h	m/s	kPa	kPa	kPa	
Double apartment manifold: M4; Storey: 2; Bld. unit: NONE; $\theta_{s,C}$: 17,0 °C;																				
Room: 0,1; $\theta_{i,C}$: 26,0 °C; Φreq,C: 4421 W; Φ surplus,C: -1619 W;																				
0,1-3-1	6,2	OZ	23,2	0,000	299	189	2	30,4	200	-4,2	0,0	0	13,5	44,6	39,7	0,10	0,7	6,3 2,1	9,1	*1,50*
0,1-4-1	18,3	OZ	23,2	0,000	877	556	6	30,5	200	-5,4	0,0	0	8,4	99,7	88,5	0,22	**7,7**	**0,8** **0,5**	**9,1**	*8,00*
0,1-4-2	18,3	OZ	23,2	0,000	877	556	6	30,5	200	-5,4	0,0	0	2,8	94,1	88,5	0,22	7,3	1,0 0,8	9,1	*7,00*

List of rooms - heating

Room Symbol	Room surface area	Thermal resistance of covering	Room temperature during heating period	Heat loss in room	Required output of heating function	Required specific output of heating function	Required radiant heating output	Required convection heating output	Obtained radiant heating output	Obtained convection heating output	Output recovered from pipe-runs	Coverage of heat loss in room
Room	**A**	**$R_{\lambda,B}$**	**$\theta_{i,H}$**	**$\Phi_{std,H}$**	**$\Phi_{req,H}$**	**$q_{req,H}$**	**$\Phi_{req,rad,H}$**	**$\Phi_{req,conv,H}$**	**$\Phi_{rh,H}$**	**$\Phi_{conv,H}$**	**$\Phi_{pipe,H}$**	**%$\Phi_{req,H}$**
	m²	**(m²·K)/W**	**°C**	**W**	**W**	**W/m²**	**W**	**W**	**W**	**W**	**W**	**%**
Storey: 1, Elevation 0 m												
Bld. unit: 01												
0,1	98,3	0,000	20,0	0	5404	55,00	5404	0	5404	0	0,00	100
0,10	2,9		20,0	0	159	55,00	0	159	0	0	0,00	0
0,11	3,3		20,0	0	183	55,00	0	183	0	0	0,00	0
0,12	9,2		20,0	0	504	55,00	0	504	0	0	0,00	0
0,2	5,7		20,0	0	315	55,00	0	315	0	0	0,00	0
0,3	2,9		20,0	0	159	55,00	0	159	0	0	0,00	0
0,4	3,3		20,0	0	183	55,00	0	183	0	0	0,00	0
0,5	4,3		20,0	0	238	55,00	0	238	0	0	0,00	0
0,6	29,2		20,0	0	1606	55,00	0	1606	0	0	0,00	0
0,7	9,5		20,0	0	524	55,00	0	524	0	0	0,00	0
0,8	201,8	0,000	20,0	0	11096	55,00	11096	0	11096	0	0,00	100
0,9	5,7		20,0	0	315	55,00	0	315	0	0	0,00	0

List of rooms - cooling

Room Symbol	Room surface area	Thermal resistance of covering	Room temperature during cooling period	Required output of cooling function	Required specific output of cooling function	Required radiant cooling output	Required convection cooling output	Obtained radiant cooling output	Obtained convection cooling output	Coverage of required cooling output	
Room	**A**	**$R_{\lambda,B}$**	**$\theta_{i,C}$**	**$\Phi_{req,C}$**	**$q_{req,C}$**	**$\Phi_{req,rad,C}$**	**$\Phi_{req,conv,C}$**	**$\Phi_{rh,C}$**	**$\Phi_{conv,C}$**	**%$\Phi_{req,C}$**	
	m²	**(m²·K)/W**	**°C**	**W**	**W/m²**	**W**	**W**	**W**	**W**	**%**	
Storey: 1, Elevation 0 m											
Bld. unit: 01											
0,1	98,3	0,000	26,0	4421	45	4421	0	2802	0	63	
0,8	201,8	0,000	26,0	9079	45	9079	0	5771	0	64	