



Soneva Fushi Maldives Chilled Water Outline Design

28th September, 2009

Sonova Fushi - Maldives

Scope



Prepare an outline design for an island-wide centralised chilled water system, to include the following activities:

- 1. Advise on the possible re-use of the deep seawater pipework.
- 2. Undertake a due diligence exercise on the fan-coil unit selections (currently on site and some have already been installed). This will involve:
 - a) Sample thermal modelling,
 - b) Sensitivity analysis,
 - c) Comparing the schedules cooling loads with the sample thermal modelling,
 - d) Resolving any apparent anomalies.
- 3. Size distribution pipework to the following five zones:
 - a) Villas 38-42 + 20 Staff Quarters,
 - b) Villas 26-37 + Main Kitchen,
 - c) Villas 1-25 + Main Office ,
 - d) Villas 54-65 +Host Areas,
 - e) Villas 43-53 + Spa.
- 4. Produce chilled water schematic to show all valves and pipe sizes.
- 5. Produce schematic for chiller heat rejection system to show all valves and pipe sizes.
- 6. Make preliminary selection of absorption chillers.

Not included in this work phase is:

- 1. Tender drawings and documents
- 2. Size and location of plant bases

These will be progressed through phase 2:

- 1. Sketch design
- 2. Scheme design
- 3. Concept Guardian

Possible re-use of the deep seawater pipe



The original intention was to use seawater as a free source of cooling, however the seawater never got below about 18 $^{\circ}$ C, which is much too warm for the humid climate.

In addition, the pipe was not sufficiently anchored to the seabed and consequently rose to the surface and substantially disintegrated.

An opportunity does exist to re-use the system, but not as a means of cooling the chillers rather than cooling the buildings directly.

An opportunity exists to use waste heat off the generators, possibly supplemented with solar-heated hot water, to generate cooling via absorption chillers. However, to make this work, a relatively low temperature heat sink is required.

One approach would be to use cooling towers, but these use a very large amount of treated water; it is better by far to use the seawater installation for this.

The absorption chillers require condenser water to be no higher than about 29 °C, but at lower temperatures they can make use of lower temperature waste heat and therefore can increase their cooling output.

The deep seawater pipework needs to be partially replaced, the extent of this replacement will depend upon the optimum condenser water temperature which in turn will depend upon the availability of medium grade heat. The new design incorporates a valve arrangement to allow the flow to reverse. This has two benefits, firstly the system can choose to draw water from the coolest of the two pipe openings, and secondly reversing the flow will help to clear the protective inlet meshes.

Undertake due diligence advice on the purchased fan-coils



The main unknown is the level of infiltration, so the individual building model were tested across a range of possibilities. The results of the sensitivity study is shown on the pages that follow.

The due diligence exercise will not amount to a detailed calculation and check for each unit that has already been purchased, and CAS do not have sufficient details of each building to undertake this level of checking if it were required. However the representative modelling that has been done, together with the floor area schedules, enables potential problems to be identified for consideration during detailed design of individual buildings.

When sizing individual fan-coils, high infiltration rates have been assumed, however these pessimistic assumptions would not in practice apply to every fan-coil in every building simultaneously. For this reason the total cooling load will be less than the sum of the individual units.

To keep maintenance simple, a constant speed chilled water system has been designed. This means that the total chilled water flow rate is equal to the sum of all the peak fan-coil cooling loads. This in turn means that the chillers must be sized for the peak flow rates, even though the peak will never occur.

This is unavoidable with constant flow systems and means that there is a margin of about 30% built into chiller selections.

The schedules show a wide variation in the specific cooling loads of the scheduled fan-coils with areas having cooling loads ranging from circa 50 to 500 W/m². In most cases, 50 W/m² would not even meet the cooling load of the minimum ventilation requirements, and 500 W/m² is more than double the highest cooling load identified from the sensitivity study.

These apparent anomalies in the fan-coil schedule have been identified in the due diligence study, but these, along with all other fan-coils, will ultimately have to be checked on a building-by-building basis during the detailed design of each building.

Even though it might be necessary to use the scheduled fancoils, even if incorrectly sized, because they have already been purchased, it does not follow that any error has to be cascaded through the design of the chilled water distribution network and central plant.



Undertake due diligence advice on the purchased fan-coils cont.

Oversized fan-coils can be supplied with less chilled water provided that the flow through the coil remains turbulent, and undersized fan-coils will benefit with additional chilled water subject to pressure drops being kept within practical maxima.

Fan-coils do not last forever and so it is important that the chilled water infrastructure is in place for the correct cooling loads, irrespective of the scheduled units.

Sea water is extremely corrosive and therefore must be circulated through titanium heat exchangers. The original concept of passing it directly through the fan-coils will certainly have caused damage to the 40 units already installed and all associated valves and other pipework ancillaries. The CAS recommend that all of these are replaced and the pipework flushed. As an absolute minimum the coils should be replaced as they might leak and cause damage as well as system down-time.

The next four pages show the sensitivity study followed by comments on the fan-coil schedule.



Thermal modelling Sensitivity analysis, host accommodation



Cooling loads

Based on Dhondheeni, Windows facing east-west

Modelled area 473m²

Peak day 11-Apr

Infil		Peak (kW)	Peak (W/m ²)	A	Annual (kWh	1)
ac/h	Sen	Lat	Total	Total	Sen	Lat	Total
0.5	29.2	8.6	37.8	80	87,097	32,519	119,616
1.0	30.8	10.3	41.1	87	91,531	52,900	144,431
1.5	32.4	14.6	47.0	99	96,043	68,823	164,866
2.0	34.0	18.9	52.9	112	100,612	82,357	182,969
2.5	35.7	22.9	58.5	124	105,225	94,400	199,625

Chosen, 1 air change per hour (87 W/ m²)



Thermal modelling Sensitivity analysis, guest accommodation



Cooling loads

Based on Soneva Fushi Villa, East

Modelled area 30 m²

Peak dav 20-Mav

1	,	1	,					
	Infil		Peak (kW)	Peak (W/m ²)	ŀ	Annual (kWh	ı)
	ac/h	Sen	Lat	Total	Total	Sen	Lat	Total
	0.5	1.5	0.5	1.9	64	3,520	1,672	5,192
	1.0	1.7	0.8	2.5	82	4,290	2,917	7,207
	1.5	1.8	1.1	3.0	99	5,082	4,170	9,252
	2.0	2.0	1.5	3.5	116	5,882	5,426	11,308
	2.5	2.2	1.8	4.0	133	6,686	6,678	13,364

Chosen, 2 air changes per hour (116 W/ m²)



Thermal modelling Sensitivity analysis, office accommodation



Cooling loads

Based on Admin office

Modelled area 107 m²

Peak day 10-Apr

Infil		Peak (kW)	Peak (W/m ²)	ŀ	Annual (kWh	ı)
ac/h	Sen	Lat	Total	Total	Sen	Lat	Total
0.5	8.2	2.1	10.3	96	16,481	5,650	22,131
1.0	8.4	3.5	12.0	112	17,040	8,430	25,470
1.5	8.8	4.7	13.5	126	17,615	10,773	28,388
2.0	9.1	5.8	14.9	139	18,203	12,817	31,020
2.5	9.4	6.8	16.2	151	18,799	14,645	33,444



Chosen, 2.5 air changes per hour (151 W/ m²)

Thermal modelling Sensitivity analysis, retail



3.0

Cooling loads

Retail (attached to admin)

Modelled area 37 m²

Peak day		20-May					
Infil		Peak (kW)	Peak (W/m ²)	ļ	Annual (kWh	ı)
ac/h	Sen	Lat	Total	Total	Sen	Lat	Total
0.5	3.6	0.9	4.5	122	7,518	2,423	9,941
1.0	3.8	1.3	5.1	137	7,868	3,644	11,512
1.5	4.0	1.8	5.7	155	8,222	4,711	12,933
2.0	4.1	1.8 5.7 2.2 6.4		172	8,579	5,670	14,249
2.5	4.3	2.6	7.0	188	8,939	6,551	15,490

Chosen, 2.0 air changes per hour (172 W/ m²)





Fan-coil units schedule		BIG	UNIT (114	Nos)	SMAL	L UNIT (30	00Nos)	Total	Floor	Specific	Specific	Modelled	Margin	Prop-	Entering	Comments
		5229	6972	8715	1312	1654	2126	Installed	area	cooling	cooling	cooling		ortion	Pipe	(all comments are to be checked and verified
		4500	6000	7500	4480	5650	7260	Load		(schedule)	(model)	load			size	during detailed building design)
		kcal	kcal	kcal	BTU/h	BTU/h	BTU/h	1726				1967	-243			
CONNECTED COOLING CAPACITY (KW)	1726	63	390	802	173	127	170	kW				kW	kW			
TOTAL QUANTITY OF FAN-COILS	449	12	56	92	132	77	80	kW	m²	W/m²	W/m²	kW	kW	%	mm	
KOKAA BLOCK	Host accom.				24			31.5	480	66	87	42	-10.3	75%	50	This is undersized.
Madhoshi Block (Innersphere)	Host accom.				27			35.4	573	62	87	50	-14.4	71%	50	This is undersized.
MIDHILI BLOCK	Host accom.						6	12.8	209	61	87	18	-5.4	70%	32	This is undersized
UNIYA Block	Host accom.				20			26.2	573	46	87	50	-23.6	53%	50	This is too low - infiltration would be at least this
Villa 38, Soneva Fushi Villa	Guest villa		1	1				15.7	60	261	116	7	8.7	225%	25	Villa 38 has larger room, but how much larger? Allow double size for now.
Villa 39, Soneva Fushi Villa	Guest villa			1				8.7	30	290	116	3	5.2	250%	15	Oversized and the same as a two storey one bed Crusoe
Villa 40, Soneva Fushi Villa	Guest villa			1				8.7	30	290	116	3	5.2	250%	15	Oversized and the same as a two storey one bed Crusoe
Villa 41, Soneva Fushi Villa	Guest villa			1				8.7	30	290	116	3	5.2	250%	15	Oversized and the same as a two storey one bed Crusoe
Villa 42, Jungle Reserve	Guest villa		1	1			2	19.9	91	219	116	11	9.4	189%	25	We don't have sufficient details on the Jungle Reserve but this looks generous. Discuss!
OBSERVATORY			1					7.0	20	344	344	7	0.0	100%	25	Instructed to leave as is. Review at nextr site meeting
HK STORE BACK TO VILLA# 38							2	4.3	63	67	87	6	-1.3	77%	25	No comment
MUSHROOM HUT							3	6.4	101	63	63	6	0.0	100%	25	Review during next site visit
Villa 26, 1 bed Crusoe	Guest villa			1				8.7	79	110	116	9	-0.4	95%	25	No comment
Villa 27, 1 bed Crusoe	Guest villa			1				8.7	79	110	116	9	-0.4	95%	25	No comment
Villa 28, 1 bed Crusoe	Guest villa			1				8.7	79	110	116	9	-0.4	95%	25	No comment
Villa 29, 1 bed Crusoe	Guest villa			1				8.7	79	110	116	9	-0.4	95%	25	No comment
Villa 30, 1 bed Crusoe	Guest villa			1				8.7	79	110	116	9	-0.4	95%	25	No comment
Villa 31, 1 bed Crusoe	Guest villa			1				8.7	79	110	116	9	-0.4	95%	25	No comment
Villa 32, 1 bed Crusoe	Guest villa			1				8.7	79	110	116	9	-0.4	95%	25	No comment
Villa 33, 1 bed Crusoe	Guest villa			1				8.7	79	110	116	9	-0.4	95%	25	No comment
Villa 34, 1 bed Crusoe	Guest villa			1				8.7	79	110	116	9	-0.4	95%	25	No comment
Villa 35, 1 bed Crusoe	Guest villa			1				8.7	79	110	116	9	-0.4	95%	25	No comment
Villa 36, 1 bed Crusoe	Guest villa			1				8.7	79	110	116	9	-0.4	95%	25	No comment



Fan_coil units schedule		BIG	UNIT (114	Nos)	SMAL	L UNIT (30	00Nos)	Total	Floor	Specific	Specific	Modelled	Margin	Prop-	Entering	Comments
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		4500	6000	7500	4480	5650	7260	Load		(schedule)	(model)	load			size	during detailed building design)
		kcal	kcal	kcal	BTU/h	BTU/h	BTU/h	1726		1° 1	·	1967	-243			
CONNECTED COOLING CAPACITY (KW)	1726	63	390	802	173	127	170	kW				kW	kW			
TOTAL QUANTITY OF FAN-COILS	449	12	56	92	132	77	80	kW	m²	W/m²	W/m²	kW	kW	%	mm	
Villa 37, 1 bed Crusoe (with pool & spa)	Guest villa		1	1				15.7	109	144	116	13	3.0	124%	32	No comment
BAR PANTRY	Retail			1				8.7	14	634	172	2	6.3	368%	15	Lots of refrigeration equipment - but why are we cooling that twice? Reject heat to outside.
COST CONTROLLER OFFICE	Office					1		1.7	29	56	151	4	-2.8	37%	20	This is undersized - the infiltration could be more than this
IVD OFFICE	Office				1	1		3.0	8	371	371	3	0.0	100%	15	Instructed to leave as is. Review at nextr site meeting
MAIN KITCHEN OFFICE	Office		1					7.0	25	279	151	4	3.2	185%	20	One very large unit over a very small area - why?
PURCHASEING OFFICE	Office					1		1.7	103	16	151	15	-13.8	11%	32	This is undersized - the infiltration would be much more than this
BUTCHERY			1					7.0	13	536	250	3	3.7	215%	15	Needs to be kept very cold, so allow 250 W/m ² rather than 172 W/m ² - need to check at next visit.
Container 4 unit including HK					8			10.5	50	210	85	4	6.2	247%	20	Looks oversized
COOL PREPARAITON ROOM			1					7.0	15	465	465	7	0.0	100%	25	Instructed to leave as is. Review at nextr site meeting
MAIN KITCHEN HOST CANTEEN		1			1			6.5	18	363	363	7	0.0	100%	25	Instructed to leave as is. Review at nextr site meeting
MAIN STORE				1				8.7	135	65	85	11	-2.8	76%	25	No comment
PASTRY ROOM			1					7.0	18	387	387	7	0.0	100%	25	Advised large heat gain, but is this refrigeration? Review at next visit.
White House Bed Room				1				8.7	120	73	116	14	-5.2	63%	32	Undersized
White House Guest Room							2	4.3	120	35	116	14	-9.7	31%	32	Undersized
GIFT SHOP	Retail			1				8.7	300	29	172	52	-42.9	17%	50	Just one unit over 300m2 - this needs to be reviewed
JEWELLARY SHOP	Retail						1	2.1	25	85	172	4	-2.2	49%	20	This seems too low - infiltration could be half of this.
FRONT OFFICE	Office			2	4			22.7	180	126	151	27	-4.5	83%	40	No comment
Villa 01, Soneva Fushi Villa	Guest villa			1				8.7	30	290	290	9	0.0	100%	25	Oversized and the same as a two storey one bed Crusoe. Instructed to leave as is. Review at next site visit.
Villa 02, The Retreat	Guest villa		1	1			3	22.1	81	271	271	22	0.0	100%	40	We don't have sufficient details on the Retreat but this looks generous. Instructed to leave as is. Review at next
Villa 03, 2 bed Crusoe	Guest villa		1	1			1	17.8	122	146	116	14	3.7	126%	32	No comment
Villa 04, 2 bed Crusoe	Guest villa		1	1			1	17.8	122	146	116	14	3.7	126%	32	No comment



Fan-coil units schedule		BIG	UNIT (114	Nos)	SMAL	L UNIT (30	00Nos)	Total	Floor	Specific	Specific	Modelled	Margin	Prop-	Entering	Comments
		5229	6972 Watte	8715	1312	1654 Watte	2126	Installed	area	cooling	cooling	cooling		ortion	Pipe	(all comments are to be checked and verified
		4500	6000	7500	4480	5650	7260	Load		(schedule)	(model)	load			size	during detailed building design)
		kcal	kcal	kcal	BTU/h	BTU/h	BTU/h	1726				1967	-243			
CONNECTED COOLING CAPACITY (KW)	1726	63	390	802	173	127	170	kW				kW	kW			
TOTAL QUANTITY OF FAN-COILS	449	12	56	92	132	77	80	kW	m²	W/m²	W/m²	kW	kW	%	mm	
Villa 05, Soneva Fushi Villa (with pool & spa)	Guest villa		1	1				15.7	60	261	116	7	8.7	225%	25	Looks oversized
Villa 08, 2 bed Crusoe	Guest villa		1	1			1	17.8	122	146	116	14	3.7	128%	32	No comment
Villa 07, Soneva Fushi Villa (with pool & spa)	Guest villa		1	1				15.7	60	261	116	7	8.7	225%	25	Looks oversized
Villa 08, 2 bed Crusoe	Guest villa		1	1			1	17.8	122	146	116	14	3.7	126%	32	No comment
Villa 09, Soneva Fushi Villa (with pool & spa)	Guest villa		1	1				15.7	60	261	116	7	8.7	225%	25	Looks oversized
Villa 10, 2 bed Crusoe	Guest villa		1	1			1	17.8	122	146	116	14	3.7	126%	32	No comment
Villa 11, Rehendhi	Guest villa		1					7.0	25	279	116	3	4.1	240%	15	Oversized - not much less than a one bed Crusoe
Villa 12, Rehendhi	Guest villa		1					7.0	25	279	116	3	4.1	240%	15	Oversized - not much less than a one bed Crusoe
Villa 13, Rehendhi	Guest villa		1					7.0	25	279	116	3	4.1	240%	15	Oversized - not much less than a one bed Crusoe
Villa 14, Rehendhi	Guest villa		1					7.0	25	279	116	3	4.1	240%	15	Oversized - not much less than a one bed Crusoe
Villa 15, Rehendhi	Guest villa		1					7.0	25	279	116	3	4.1	240%	15	Oversized - not much less than a one bed Crusoe
Villa 16, Rehendhi	Guest villa		1					7.0	25	279	116	3	4.1	240%	15	Oversized - not much less than a one bed Crusoe
Villa 17, Rehendhi	Guest villa		1					7.0	25	279	116	3	4.1	240%	15	Oversized - not much less than a one bed Crusoe
Villa 18, Rehendhi	Guest villa		1					7.0	25	279	116	3	4.1	240%	15	Oversized - not much less than a one bed Crusoe
Villa 19, Rehendhi	Guest villa		1					7.0	25	279	116	3	4.1	240%	15	Oversized - not much less than a one bed Crusoe
Villa 20, Rehendhi	Guest villa		1					7.0	25	279	116	3	4.1	240%	15	Oversized - not much less than a one bed Crusoe
Villa 21, Rehendhi	Guest villa		1					7.0	25	279	116	3	4.1	240%	15	Oversized - not much less than a one bed Crusoe
Villa 22, Rehendhi	Guest villa		1					7.0	25	279	116	3	4.1	240%	15	Oversized - not much less than a one bed Crusoe
Villa 23, Rehendhi	Guest villa		1					7.0	25	279	116	3	4.1	240%	15	Oversized - not much less than a one bed Crusoe
Villa 24, Rehendhi	Guest villa		1					7.0	25	279	116	3	4.1	240%	15	Oversized - not much less than a one bed Crusoe
Villa 25, Rehendhi	Guest villa		1					7.0	25	279	116	3	4.1	240%	15	Oversized - not much less than a one bed Crusoe
AD OFFICE	Office					1	1	3.8	25	151	151	4	0.0	100%	20	No comment
ADMIN MEETING ROOM	Office					2		3.3	25	132	151	4	-0.5	88%	20	No comment



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		5229 Watte	6972 Watte	8715 Watte	1312 Watts	1654 Watte	2126 Watte	Installed	area	cooling	cooling	cooling		ortion	Pipe	(all comments are to be checked and verified
		4500	6000	7500	4480	5650	7260	2000		(schedule)	(model)	load			2120	daring detailed barang designy
		kcal	kcal	kcal	BTU/h	BTU/h	BTU/h	1726				1967	-243			
CONNECTED COOLING CAPACITY (KW)	1726	63	390	802	173	127	170						~~~			
TOTAL QUANTITY OF FAN-COILS	449	12	56	92	132	77	80	kW	m²	W/m²	W/m²	kW	kW	%	mm	
IT OFFICE	Office			1				8.7	21	415	200	4	4.5	207%	20	Becasue this has IT equipment as well as people, this has been increased from 112 to 200 W/m ²
MEETING ROOM	Office			1				8.7	59	147	151	9	-0.2	97%	25	No comment
SECURITY OFFICE	Office						1	2.1	?	?	151	1	?	?	15	What is the floor area
Rehendhi (71-80) for Host	Host accom.				4	20	10	59.6	697	85	116	81	-21.3	74%	65	Are these the same as villas 11-25? If so, why not 25 fan- coils of the same size, not 34 at three different sizes? Ans -
CANTEEN BLOCK							6	12.8	100	128	128	13	0.0	100%	32	No comment
CHEESE ROOM						1	1	3.8	22	172	172	4	0.0	100%	20	No comment
GM+FC	Office				3		3	10.3	100	103	151	15	-4.8	68%	32	Looks undersized
HK STORE BACK TO VILLA# 05							2	4.3	63	67	85	5	-1.1	79%	20	No comment
HK STORE BACK TO VILLA# 13							2	4.3	63	67	86	5	-1.2	78%	20	No comment
HOST LIBRARY							1	2.1	24	89	112	3	-0.6	79%	15	Undersized
ICE CREAM PARLOUR		1						5.2	30	174	172	5	0.1	101%	20	No comment
SERVICE BAR (liquor)				2				17.4	12	1452	172	2	15.4	844%	15	This is certainly much too high
HR BLOCK(SECURITY)	Office				1		1	3.4	48	72	151	7	-3.8	47%	25	No comment
HR OFFICE	Office			1		2		12.0	114	106	151	17	-5.1	70%	32	Looks undersized
HR TRAINING OFFICE	Office				2			2.6	34	78	151	5	-2.5	52%	20	This seems too low - infiltration could be half of this.
TRAINING ROOM	Office						1	2.1	60	35	151	9	-6.9	23%	25	Instructed to leave as is. Review at nextr site meeting
BONDANA BLOCK	Host accom.					3		5.0	67	75	87	6	-0.8	86%	25	This would be sufficient for very low ventilation with no margin.
DHONDHEEN BLOCK	Host accom.					12		19.9	307	65	87	27	-6.8	74%	40	This looks under-sized
FAANA BLOCK	Host accom.				4			5.2	56	94	87	5	0.4	109%	20	No comment
FINDANA BLOCK	Host accom.			4				34.9	616	57	87	54	-18.7	65%	50	This is undersized - infiltration could be this high
FUNA BLOCK	Host accom.				30			39.4	1138	35	87	99	-59.7	40%	65	This is undersized - infiltration could be this high
KAANI BLOCK	Host accom.					6		9.9	183	54	87	16	-6.0	62%	32	This is undersized - infiltration could be this high
KAMBILI BLOCK	Host accom.			6				52.3	616	85	87	54	-1.3	98%	50	No comment



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TOTAL QUANTITY OF FAN-COILS	449	12	56	92	132	77	80	kW	m²	W/m²	W/m²	kW	kW	%	mm	
KOMAS BLOCK	Host accom.			2				17.4	128	136	87	11	6.3	157%	25	No comment
KUREDHI BLOCK	Host accom.	5						26.1	130	201	87	11	14.8	231%	25	Are there any especially high heat gains here?
MAKANA BLOCK	Host accom.					6		9.9	325	31	87	28	-18.3	35%	40	This is undersized - infiltration could be this high
NIKA BLOCK	Host accom.					5		8.3	104	79	87	9	-0.8	91%	25	This would be sufficient for very low ventilation with no margin. Instructed Okay.
RATHAFA BLOCK	Host accom.			2				17.4	340	51	87	30	-12.2	59%	40	This is undersized - infiltration could be this high
Villa 54, 1 bed Crusoe	Guest villa			1				8.7	79	110	116	9	-0.4	95%	25	No comment
Villa 55, 1 bed Crusoe	Guest villa			1				8.7	79	110	116	9	-0.4	95%	25	No comment
Villa 56, Soneva Fushi Villa	Guest villa			1				8.7	30	290	116	3	5.2	250%	15	Oversized and the same as a two storey one bed Crusoe
Villa 57, Soneva Fushi Villa	Guest villa			1				8.7	30	290	116	3	5.2	250%	15	Oversized and the same as a two storey one bed Crusoe
Villa 58, Soneva Fushi Villa	Guest villa			1				8.7	30	290	116	3	5.2	250%	15	Oversized and the same as a two storey one bed Crusoe
Villa 59, Soneva Fushi Villa	Guest villa			1				8.7	30	290	116	3	5.2	250%	15	Oversized and the same as a two storey one bed Crusoe
Villa 60, Soneva Fushi Villa	Guest villa			1				8.7	30	290	116	3	5.2	250%	15	Oversized and the same as a two storey one bed Crusoe
Villa 61, The Retreat	Guest villa		2	2			1	33.5	81	412	140	11	22.1	294%	25	We don't have sufficient details on the Retreat but this looks oversized and much more than the other Retreat
Villa 62, 1 bed Crusoe (wityh pool)	Guest villa		1	1			1	17.8	109	163	116	13	5.2	141%	32	Looks oversized
Villa 63, Soneva Fushi Villa (with pool & spa)	Guest villa			1			2	13.0	60	216	116	7	6.0	186%	25	Why does this SF Villa with pool and spa have less cooling than the others?
Villa 64, 2 bed Crusoe	Guest villa		1	1			2	19.9	122	163	116	14	5.8	141%	32	Oversized
Villa 65, Tree House	Guest villa		1	1				15.7	58	270	116	7	9.0	233%	25	We don't have sufficient details on the retreat but this looks oversized. Discuss
DRINKING WATER PLANT ROOM					2			2.6	28	95	95	3	0.0	100%	15	No comment
HOST GYM						1		1.7	43	38	200	9	-7.0	19%	25	Much too low - fresh air would be more than this
HOST MUSIC ROOM						1		1.7	43	38	112	5	-3.2	34%	20	Much too low - infiltration would be about this
MALAAFAIYA STORE							2	4.3	18	236	236	4	0.0	100%	20	Instructed to leave as is. Review at nextr site meeting
MOSQUE				1				8.7	137	64	100	14	-5.0	64%	32	Undersized
PRIME DARE BLOCK (Small 2 Bed Room)						9		14.9	357	42	87	31	-16.1	48%	40	What is this? Seems too low



Fan-coil units schedule		BIG	UNIT (114	Nos)	SMAL	L UNIT (30	(ONos)	Total	Floor	Specific	Specific	Modelled	Margin	Prop-	Entering	Comments
		5229 Watts	6972 Watts	8715 Watts	1312 Watts	1654 Watts	2126 Watts	Installed	area	cooling	cooling	cooling		ortion	Pipe	(all comments are to be checked and verified during detailed building design)
		4500	6000	7500	4480	5650	7260			(schedule)	(model)	10010			5.20	during detailed building design)
		kcal	kcal	kcal	BTU/h	BTU/h	BTU/h	1726 kW				1967 kW	-243 kW			
CONNECTED COOLING CAPACITY (KW)	1726	63	390	802	173	127	170									
TOTAL QUANTITY OF FAN-COILS	449	12	56	92	132	77	80	kW	m²	W/m²	W/m²	kW	kW	%	mm	
TAILOR	Retail						2	4.3	75	57	151	11	-7.1	38%	25	Undersized
ENGINEERING OFFICE	Office						3	6.4	87	73	151	13	-6.8	48%	32	This seems too low - infiltration could be half of this.
ENGINEERING STORE	Office					2		3.3	170	19	151	26	-22.4	13%	40	Why is air-con required in a store. 19 W/m ² is too low to be of much use
IT STORE (OLD OFFICE)	Office					1		1.7	141	12	151	21	-19.7	8%	40	This is tobecome Piet's new office
Robinson House	Guest villa	3	1				2	26.9	125	215	215	27	0.0	100%	40	Instructed to leave as is. Review at nextr site meeting
CAJAN CITY KITCHEN STORE							1	2.1	264	8	87	23	-20.8	9%	40	What is this for? Looks too low to be of any use at all. Review
CCTV ROOM		1						5.2	10	519	519	5	0.0	100%	20	Looks oversized - review
DR CLINIC							1	2.1	24	89	151	4	-1.5	59%	20	Undersized
HK CRYSTALL WATER STORE						2		3.3	20	165	137	3	0.6	121%	15	No comment
HK OFFICE	Office			1				8.7	180	48	151	27	-18.5	32%	40	Much too low - infiltration would be about this
HK STORE	Office			1				8.7	326	27	87	28	-19.7	31%	40	Much too low - infiltration would be more than this
HK STORE BACK TO VILLA# 61	Office						2	4.3	63	67	87	6	-1.3	77%	25	No comment
LINEN	Office			1				8.7	76	115	87	7	2.1	132%	25	No comment
POWER ROOM	Office	1			1			6.5	1158	6	6	7	0.0	100%	25	Review at next site visit. Need more details
DIVING SCHOOL +ACCO	Retail		1				5	17.6	350	50	172	60	-42.6	29%	65	Undersized
DIVING SCHOOL SHOP	Retail		2					13.9	55	251	172	10	4.4	146%	25	No comment
SPA GIFT SHOP	Retail			1				8.7	12	711	172	2	6.6	414%	15	One very large unit over a very small area - why?
SPA STORE	Retail			1				8.7	2	4357	172	0	8.4	2533%	15	One very large unit over a very small area - why?
SPA OFFICE	Office			1				8.7	6	1394	151	1	7.8	923%	15	This is much too high!
Villa 43, Soneva Fushi Villa	Guest villa			1				8.7	30	290	116	3	5.2	250%	15	Oversized and the same as a two storey one bed Crusoe
Villa 44, Soneva Fushi Villa	Guest villa			1				8.7	30	290	116	3	5.2	250%	15	Oversized and the same as a two storey one bed Crusoe
Villa 45, Soneva Fushi Villa	Guest villa			1				8.7	30	290	116	3	5.2	250%	15	Oversized and the same as a two storey one bed Crusoe



Fan-coil units schedule		BIG	UNIT (114	Nos)	SMAL	L UNIT (30	00Nos)	Total	Floor	Specific	Specific	Modelled	Margin	Prop-	Entering	Comments
		5229 Watte	6972 Watte	8715	1312 Watte	1654 Watte	2126	Installed	area	cooling	cooling	cooling		ortion	Pipe	(all comments are to be checked and verified
		4500	6000	7500	4480	5650	7260	LOad		(schedule)	(model)	load			Size	during detailed building design)
		kcal	kcal	kcal	BTU/h	BTU/h	BTU/h	1726				1967	-243			
CONNECTED COOLING CAPACITY (KW)	1726	63	390	802	173	127	170	kW				kW	kW			
TOTAL QUANTITY OF FAN-COILS	449	12	56	92	132	77	80	kW	m²	W/m²	W/m²	kW	kW	%	mm	
Villa 46, Soneva Fushi Villa (with pool & spa)	Guest villa			1			1	10.8	60	181	116	7	3.9	156%	25	Why does this SF Villa with pool and spa have less cooling than the others?
Villa 47, Soneva Fushi Villa (with pool & spa)	Guest villa			1				8.7	60	145	116	7	1.8	125%	25	Why does this SF Villa with pool and spa have less cooling than the others?
Villa 48, Soneva Fushi Villa (with pool & spa)	Guest villa		1	1				15.7	60	261	116	7	8.7	225%	25	Oversized
Villa 49, Soneva Fushi Villa (with pool & spa)	Guest villa		1	1				15.7	60	261	116	7	8.7	225%	25	Oversized
Villa 50, Soneva Fushi Villa (with pool & spa)	Guest villa		1	1				15.7	60	261	116	7	8.7	225%	25	Oversized
Villa 51, Soneva Fushi Villa	Guest villa			1				8.7	30	290	116	3	5.2	250%	15	Oversized and the same as a two storey one bed Crusoe
Villa 52, Soneva Fushi Villa	Guest villa			1				8.7	30	290	116	3	5.2	250%	15	Oversized and the same as a two storey one bed Crusoe
Villa 53, 1 bed Crusoe	Guest villa			1				8.7	79	110	116	9	-0.4	95%	25	No comment
GUEST GYM				1				8.7	68	128	200	14	-4.9	64%	32	What is nett area of the gym? This looks too low
GUEST LIBRARY				1				8.7	55	157	112	6	2.5	140%	25	No comment
GUEST LIBRARY			1					7.0	30	232	232	7	0.0	100%	25	Lots of glass. To be reviewed.
SPA TREATMENT ROOM			7					48.8	178	274	274	49	0.0	100%	50	Instructed to leave as is. Review at nextr site meeting
WINE CELLAR				1				8.7	54	163	200	11	-2.0	81%	25	Needs checking
OWNERS VILLA	Guest villa		1	5				50.5	1269	40	116	147	-96.7	34%	80	If all of this area is cooled, then the units are much too small. This is a very large area to cool. Need to check
HK STORE BACK TO VILLA# 50							2	4.3	63	67	88	6	-1.3	76%	25	No comment
MEDUNIYA KITCHEN			3					20.9	145	144	144	21	0.0	100%	40	Review during next site visit
MEDUNIYA SERVICE BAR				1				8.7	40	219	137	5	3.3	160%	20	Oversized







ZONE 1										
Node	Building	Calc'd	Margin	Applied	Flow	Dia	Delta P	Vel.	Eq. Lgth	1
		Cooling		Cooling						
		kW		kW	l/s	mm	Pa/m	m/s	m	
1	KOKAA BLOCK	41.8	10%	45.9	1.823	50	193	0.88	2.02]
1	Madhoshi Block (Innersphere)	49.8	10%	54.8	2.175	50	267	1.05	2.08	
1	MIDHILI BLOCK	18.2	10%	20.0	0.792	40	139	0.62	1.40]
1	UNIYA Block	49.8	10%	54.8	2.175	50	267	1.05	2.08	
1	OBSERVATORY	7.0	10%	7.7	0.304	25	217	0.59	0.79	
1	MUSHROOM HUT	3.5	10%	3.8	0.152	20	192	0.46	0.56	Check node?
2	Villa 38, Soneva Fushi Villa	3.5	10%	3.8	0.152	20	192	0.46	0.56]
2	Villa 39, Soneva Fushi Villa	3.5	10%	3.8	0.152	20	192	0.46	0.56]
2	Villa 40, Soneva Fushi Villa	10.6	10%	11.6	0.461	25	463	0.89	0.85]
2	Villa 41, Soneva Fushi Villa	7.0	10%	7.7	0.304	25	217	0.59	0.79	
2	Villa 42, Jungle Reserve	5.5	10%	6.1	0.240	25	142	0.46	0.75	
2	HK STORE BACK TO VILLA# 38	6.4	10%	7.0	0.278	25	185	0.54	0.78]
Total		194.5	NA	213.9	9.01	100	117	1.07	4.92	1
										-



ZONE 2

Node	Building	Calc'd	Margin	Applied	Flow	Dia	Delta P	Vel.	Eq. Lgth
		Cooling		Cooling					
		kW		kW	l/s	mm	Pa/m	m/s	m
1	Villa 34, 1 bed Crusoe	9.2	10%	10.1	0.400	25	357	0.77	0.83
1	Villa 35, 1 bed Crusoe	9.2	10%	10.1	0.400	25	357	0.77	0.83
1	Villa 36, 1 bed Crusoe	9.2	10%	10.1	0.400	25	357	0.77	0.83
1	Villa 37, 1 bed Crusoe (with pool & spa)	12.6	10%	13.9	0.552	32	156	0.60	1.14
2	Villa 30, 1 bed Crusoe	9.2	10%	10.1	0.400	25	357	0.77	0.83
2	Villa 31, 1 bed Crusoe	9.2	10%	10.1	0.400	25	357	0.77	0.83
2	Villa 32, 1 bed Crusoe	9.2	10%	10.1	0.400	25	357	0.77	0.83
2	Villa 33, 1 bed Crusoe	9.2	10%	10.1	0.400	25	357	0.77	0.83
3	Villa 26, 1 bed Crusoe	9.2	10%	10.1	0.400	25	357	0.77	0.83
3	Villa 27, 1 bed Crusoe	9.2	10%	10.1	0.400	25	357	0.77	0.83
3	Villa 28, 1 bed Crusoe	9.2	10%	10.1	0.400	25	357	0.77	0.83
3	Villa 29, 1 bed Crusoe	9.2	10%	10.1	0.400	25	357	0.77	0.83
4	BAR PANTRY	2.4	10%	2.6	0.103	15	442	0.59	0.40
4	COST CONTROLLER OFFICE	4.4	10%	4.9	0.194	20	297	0.59	0.59
4	IVD OFFICE	3.0	10%	3.3	0.130	15	667	0.74	0.41
4	MAIN KITCHEN OFFICE	3.8	10%	4.2	0.165	20	222	0.50	0.57
4	PURCHASEING OFFICE	15.5	10%	17.0	0.676	32	226	0.73	1.18
4	BUTCHERY	3.3	10%	3.6	0.142	20	169	0.43	0.56
4	Container 4 unit including HK	4.3	10%	4.7	0.186	20	274	0.57	0.59
4	COOL PREPARAITON ROOM	7.0	10%	7.7	0.304	25	217	0.59	0.79
4	MAIN KITCHEN HOST CANTEEN	6.5	10%	7.2	0.286	25	194	0.55	0.78
4	MAIN STORE	11.5	10%	12.6	0.501	32	131	0.54	1.12
4	PASTRY ROOM	7.0	10%	7.7	0.304	25	217	0.59	0.79
4	White House Bed Room	13.9	10%	15.3	0.608	32	186	0.66	1.16
4	White House Guest Room	13.9	10%	15.3	0.608	32	186	0.66	1.16
Total		209.8	NA	230.8	9.2	100	121	1.09	4.93



ZONE 3									
Node	Building	Calc'd Cooling	Margin	Applied Cooling	Flow	Dia	Delta P	Vel.	Eq. Lgth
		kW		kW	l/s	mm	Pa/m	m/s	m
1	Villa 01, Soneva Fushi Villa	8.7	10%	9.6	0.380	25	325	0.73	0.82
1	Villa 02, The Retreat	22.1	10%	24.3	0.963	40	198	0.76	1.45
1	Villa 03, 2 bed Crusoe	14.2	10%	15.6	0.618	32	192	0.67	1.17
1	Villa 04, 2 bed Crusoe	14.2	10%	15.6	0.618	32	192	0.67	1.17
1	Villa 05, Soneva Fushi Villa (with pool & spa)	7.0	10%	7.7	0.304	25	217	0.59	0.79
1	Villa 06, 2 bed Crusoe	14.2	10%	15.6	0.618	32	192	0.67	1.17
1	Villa 07, Soneva Fushi Villa (with pool & spa)	7.0	10%	7.7	0.304	25	217	0.59	0.79
1	Villa 08, 2 bed Crusoe	14.2	10%	15.6	0.618	32	192	0.67	1.17
1	Villa 09, Soneva Fushi Villa (with pool & spa)	7.0	10%	7.7	0.304	25	217	0.59	0.79
1	Villa 10, 2 bed Crusoe	14.2	10%	15.6	0.618	32	192	0.67	1.17
2	Villa 11, Rehendhi	2.9	10%	3.2	0.127	15	639	0.73	0.41
2	Villa 12, Rehendhi	2.9	10%	3.2	0.127	15	639	0.73	0.41
2	Villa 13, Rehendhi	2.9	10%	3.2	0.127	15	639	0.73	0.41
2	Villa 14, Rehendhi	2.9	10%	3.2	0.127	15	639	0.73	0.41
2	Villa 15, Rehendhi	2.9	10%	3.2	0.127	15	639	0.73	0.41
2	Villa 16, Rehendhi	2.9	10%	3.2	0.127	15	639	0.73	0.41
2	Villa 17, Rehendhi	2.9	10%	3.2	0.127	15	639	0.73	0.41
2	Villa 18, Rehendhi	2.9	10%	3.2	0.127	15	639	0.73	0.41
2	Villa 19, Rehendhi	2.9	10%	3.2	0.127	15	639	0.73	0.41
2	Villa 20, Rehendhi	2.9	10%	3.2	0.127	15	639	0.73	0.41
3	Villa 21, Rehendhi	2.9	10%	3.2	0.127	15	639	0.73	0.41
3	Villa 22, Rehendhi	2.9	10%	3.2	0.127	15	639	0.73	0.41
3	Villa 23, Rehendhi	2.9	10%	3.2	0.127	15	639	0.73	0.41
3	Villa 24, Rehendhi	2.9	10%	3.2	0.127	15	639	0.73	0.41
3	Villa 25, Rehendhi	2.9	10%	3.2	0.127	15	639	0.73	0.41
4	GIFT SHOP	51.6	10%	56.8	2.252	50	284	1.09	2.09
4	JEWELLARY SHOP	4.3	10%	4.7	0.188	20	280	0.57	0.59
4	FRONT OFFICE	27.2	10%	29.9	1.186	40	290	0.93	1.51
4	AD OFFICE	3.8	10%	4.2	0.165	20	222	0.50	0.57
4	ADMIN MEETING ROOM	3.8	10%	4.2	0.165	20	222	0.50	0.57
4	IT OFFICE	4.2	10%	4.6	0.183	20	269	0.56	0.59
4	MEETING ROOM	9.0	10%	9.8	0.391	25	342	0.75	0.83
4	SECURITY OFFICE	1.0	10%	1.1	0.044	15	66	0.25	0.47
4	Rehendhi (71-80) for Host	80.9	10%	88.9	3.529	65	175	1.00	2.86
4	CANTEEN BLOCK	12.8	10%	14.0	0.557	32	159	0.60	1.14
4	CHEESE ROOM	3.8	10%	4.2	0.165	20	223	0.51	0.57
4	GM+FC	15.1	10%	16.6	0.659	32	216	0.71	1.18
4	HK STORE BACK TO VILLA# 05	5.4	10%	5.9	0.235	25	136	0.45	0.75
4	HK STORE BACK TO VILLA# 13	5.4	10%	6.0	0.237	25	139	0.46	0.75
4	HOST LIBRARY	2.7	10%	3.0	0.117	15	557	0.67	0.41
4	ICE CREAM PARLOUR	5.2	10%	5.7	0.225	25	127	0.43	0.75
4	SERVICE BAR (liquor)	2.1	10%	2.3	0.090	15	346	0.52	0.39
Total		403.9	NA	444.3	17.6	150	57	0.94	7.85



ZONE 4 Node Buildina Calc'd Margin Applied Flow Dia Delta P Vel. Eq. Lgth Coolina Coolina kW kW Pa/m l/s mm m/s m HR BLOCK(SECURITY) 7.2 10% 0.316 233 0.80 1 8.0 25 0.61 HR OFFICE 17.2 10% 0.59 1 18.9 0 749 40 126 1.39 HR TRAINING OFFICE 10% 25 1 5.1 5.6 0.221 123 0.43 0.74 TRAINING ROOM 9.1 10% 25 350 0.83 10.0 0.395 0.76 1 10% 1 BONDANA BLOCK 58 64 0.253 25 156 0 4 9 0 76 DHONDHEEN BLOCK 26.7 10% 29.3 281 0.92 1.50 1 1.165 40 1 FAANA BLOCK 4.8 10% 5.3 0 211 20 346 0.65 0.60 FINDANA BLOCK 53.6 10% 59.0 2.339 65 82 0.66 2.67 1 FUNA BLOCK 99.0 10% 109.0 4.324 80 113 0.88 3 44 1 10% 237 KAANI BI OCK 15.9 0 6 9 4 32 0 75 1 19 1 17 5 KAMBILI BLOCK 53.6 10% 59.0 2.339 82 0.66 2.67 1 65 KOMAS BLOCK 10% 510 1 11.1 12.2 0.486 25 0.94 0.86 1 KUREDHI BLOCK 11.3 10% 12.5 0.494 32 128 0.54 1.12 1 MAKANA BLOCK 28.3 10% 31.1 1.233 40 312 0.97 1 51 10% 350 0.83 NIKA BLOCK 9.1 10.0 0.396 25 0.76 1 RATHAFA BLOCK 29.6 10% 32.6 1.292 40 340 1.02 1.53 1 14.2 10% 32 192 Villa 64, 2 bed Crusoe 15.6 0.618 0.67 1.17 1 Villa 65. Tree House 6.7 10% 7.4 0.294 25 204 0.57 0.79 1 HOST GYM 8.7 10% 9.5 0.378 25 323 0.73 0.82 1 1 HOST MUSIC ROOM 4.9 10% 5.3 0.212 20 349 0.65 0.60 1 MALAAFAIYA STORE 4.3 10% 4.7 0.186 20 275 0.57 0.59 PRIME DARE BLOCK (Small 2 Bed Room) 31.0 10% 34.1 370 1.354 40 1.07 1.54 1 284 Robinson House 26.9 10% 29.6 1.173 40 0.92 1.50 Check node? HK OFFICE 27.2 10% 29.9 1.186 40 290 0.93 Check node? 1.51 1 1 HK STORE 28.4 10% 31.2 1.239 40 314 0.98 1.52 Villa 60, Soneva Fushi Villa 3.5 20 0.56 2 10% 3.8 0.152 192 0.46 2 Villa 61. The Retreat 11.4 10% 12.5 0.497 32 130 0.54 1.12 10% 32 Villa 62, 1 bed Crusoe (witvh pool) 12.6 0.552 156 0.60 2 13.9 1.14 Villa 63. Soneva Fushi Villa (with pool & spa) 7.0 10% 7.7 0.304 25 217 0.59 0.79 2 HK STORE BACK TO VILLA# 61 5.5 10% 142 0.75 2 6.1 0.240 25 0.46 3 Villa 57, Soneva Fushi Villa 3.5 10% 3.8 0.152 20 192 0.46 0.56 3 Villa 58. Soneva Fushi Villa 3.5 10% 3.8 0.152 20 192 0.46 0.56 Villa 59. Soneva Fushi Villa 3.5 10% 3.8 0.152 20 192 0.46 0.56 3 DRINKING WATER PLANT ROOM 2.6 10% 533 0.66 0.40 4 2.9 0.115 15 10% 0.597 32 180 4 MOSQUE 13.7 15.0 0.65 1.16 4 TAILOR 11.3 10% 12.4 0.494 32 128 0.53 1.12 ENGINEERING OFFICE 13.2 10% 14.5 0.577 32 169 0.62 1.15 4 ENGINEERING STORE 25.7 261 4 10% 28.2 1.120 40 0.88 1 4 9 4 IT STORE (OLD OFFICE) 21.4 10% 23.5 0.932 40 187 0.73 1.44 Check node? CAJAN CITY KITCHEN STORE 4 23.0 10% 25.3 1.003 40 213 0.79 1.46 Check node? 4 CCTV ROOM 10% 0.228 25 130 0.44 0.75 Check node? 5.2 5.8 DR CLINIC 3.6 10% 4.0 0.158 20 206 0.48 0.57 4 Check node? HK CRYSTALL WATER STORE 2.7 10% 3.0 15 577 0.69 4 0.120 0.41 Check node? 4 LINEN 6.6 10% 7.2 0.287 25 196 0.55 0 78 Check node? 4 POWER ROOM 6.5 10% 7.2 0.286 25 194 0.55 0.78 Check node? 357 5 Villa 54, 1 bed Crusoe 9.2 10% 10.1 0.400 25 0.77 0.83 9.2 25 5 Villa 55, 1 bed Crusoe 10% 10.1 0.400 357 0.77 0.83 5 Villa 56. Soneva Fushi Villa 3.5 10% 3.8 0.152 20 192 0.46 0.56 Total 747.2 NA 822.0 32.618 200 42 0.97 11.22



ZONE 5										_
Node	Building	Calc'd	Margin	Applied	Flow	Dia	Delta P	Vel.	Eq. Lgth]
		Cooling		Cooling						
		kW		kW	l/s	mm	Pa/m	m/s	m	
1	DIVING SCHOOL +ACCO	60.2	10%	66.2	2.628	65	102	0.75	2.73]
1	DIVING SCHOOL SHOP	9.5	10%	10.5	0.417	25	385	0.80	0.84	
1	SPA GIFT SHOP	2.1	10%	2.3	0.092	15	359	0.53	0.39]
1	SPA STORE	0.3	10%	0.4	0.015	15	18	0.09	0.20]
1	SPA OFFICE	0.9	10%	1.0	0.041	15	55	0.24	0.51	
1	GUEST GYM	13.6	10%	15.0	0.594	32	179	0.64	1.16]
1	GUEST LIBRARY	6.2	10%	6.8	0.271	25	177	0.52	0.77]
1	GUEST LIBRARY	7.0	10%	7.7	0.304	25	217	0.59	0.79]
1	SPA TREATMENT ROOM	48.8	10%	53.7	2.130	50	257	1.03	2.07]
1	WINE CELLAR	10.7	10%	11.8	0.468	25	476	0.90	0.85	
1	OWNERS VILLA	147.2	10%	161.9	6.426	80	235	1.31	3.65	Check node?
1	MEDUNIYA KITCHEN	20.9	10%	23.0	0.913	40	180	0.72	1.44	Check node?
1	MEDUNIYA SERVICE BAR	5.4	10%	6.0	0.238	25	139	0.46	0.75	Check node?
2	Villa 43, Soneva Fushi Villa	3.5	10%	3.8	0.152	20	192	0.46	0.56]
2	Villa 44, Soneva Fushi Villa	3.5	10%	3.8	0.152	20	192	0.46	0.56	
2	Villa 45, Soneva Fushi Villa	3.5	10%	3.8	0.152	20	192	0.46	0.56	
2	Villa 46, Soneva Fushi Villa (with pool & spa)	7.0	10%	7.7	0.304	25	217	0.59	0.79	1
3	Villa 47, Soneva Fushi Villa (with pool & spa)	7.0	10%	7.7	0.304	25	217	0.59	0.79]
3	Villa 48, Soneva Fushi Villa (with pool & spa)	7.0	10%	7.7	0.304	25	217	0.59	0.79	
3	Villa 49, Soneva Fushi Villa (with pool & spa)	7.0	10%	7.7	0.304	25	217	0.59	0.79]
3	Villa 50, Soneva Fushi Villa (with pool & spa)	7.0	10%	7.7	0.304	25	217	0.59	0.79	
3	HK STORE BACK TO VILLA# 50	5.6	10%	6.1	0.243	25	145	0.47	0.76	1
4	Villa 51, Soneva Fushi Villa	3.5	10%	3.8	0.152	20	192	0.46	0.56	1
4	Villa 52, Soneva Fushi Villa	3.5	10%	3.8	0.152	20	192	0.46	0.56	1
4	Villa 53, 1 bed Crusoe	9.2	10%	10.1	0.400	25	357	0.77	0.83	1
Total		399.9		439.9	17.5	150	56	0.93	7.84	1



Legend







Plate heat exchanger



Pot strainer



Motorised 2-port valve

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Capped 2-port valve

Chilled water pipework, schematic





Heat rejection pipework, schematic



Preliminary chiller selection





Preliminary chiller selection, Cont.



Technical data

Hot-water absorption chillers

16LJ		11	12	13	14	21	22	23	24	31	32	41	42	51	52	53
Cooling capacity	kW	264	316	387	475	545	633	738	844	949	1055	1178	1319	1477	1653	1846
Chilled water system*																
Flow rate	l/s	11.4	13.6	16.7	20.4	23.5	27.3	31.8	36.3	40.9	45.4	50.7	56.8	63.6	71.2	79.5
Pressure drop	kPa	55	60	36	39	35	37	74	79	76	80	75	75	62	32	42
Connection (ANSI)	inch	3	3	4	4	5	5	5	5	6	6	8	8	8	8	8
Retention volume	m³	0.12	0.13	0.15	0.17	0.22	0.24	0.28	0.30	0.34	0.36	0.46	0.48	0.65	0.71	0.77
Cooling water system*																
Flow rate	l/s	17.0	20.4	25.0	30.7	35.2	40.9	47.7	54.4	61.3	68.1	76.1	85.2	95.4	106.7	119.2
Pressure drop	kPa	36	39	105	111	108	112	103	106	97	98	98	102	146	88	117
Connection (ANSI)	inch	5	5	5	5	6	6	8	8	8	8	10	10	12	12	12
Retention volume	m³	0.35	0.38	0.43	0.48	0.60	0.65	0.72	0.79	0.99	1.06	1.25	1.35	2.03	2.18	2.32
Hot-water system*																
Flow rate	l/s	10.4	12.4	15.2	18.7	21.4	24.9	29	33	37	41	46	52	58	65	73
Pressure drop	kPa	31	12	29	32	30	31	30	30	29	29	28	28	28	37	49
Connection (ANSI)	inch	4	4	4	4	5	5	6	6	6	6	8	8	8	8	8
Retention volume	mª	0.09	0.10	0.12	0.13	0.17	0.18	0.20	0.22	0.27	0.29	0.34	0.36	0.44	0.48	0.51
Rupture disk connection	inch	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3
Length (L)	mm	2720	2720	3740	3740	3830	3830	4860	4860	4990	4990	5070	5070	5200	5740	6240
Width (W)	mm	1295	1295	1295	1295	1455	1455	1455	1455	1515	1515	1615	1615	1950	1950	1950
Height (H)	mm	2215	2215	2215	2215	2350	2350	2350	2350	2620	2620	2870	2870	3200	3200	3200
Tube removal space	mm	2400	2400	3400	3400	3400	3400	4500	4500	4500	4500	4500	4500	4600	5200	5700
Operating weight	kg	4000	4200	5200	5500	6700	7100	8200	8700	10600	11100	12900	13400	18200	19700	21100
Max. shipping weight	kg	3500	3600	4500	4700	5700	6000	7000	7300	9000	9400	10800	11200	15100	16400	17600
Total shipping weight	kg	3500	3600	4500	4700	5700	6000	7000	7300	9000	9400	10800	11200	15100	16400	17600
Shipping method		One-p	iece													
Power supply		400 V-	-3 ph-5	0 Hz												
Apparent power	kVA	4.0	4.0	4.0	4.0	5,8	5,8	5,9	5,9	7.3	7.3	7.3	7.3	7.3	7.3	7.3
Total electric current	Α	6.2	6.2	6.2	6.2	8.9	8.9	9.0	9.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Absorbent pump	kW	1.1	1.1	1.1	1.1	2.2	2.2	2.2	2.2	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	Α	2.8	2.8	2.8	2.8	5.5	5.5	5.5	5.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Refrigerant pump	kW	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
· · · · · · · · · · · · · · · · · · ·	Α	1.25	1.25	1.25	1.25	1.25	1.25	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35
Purge pump	kW	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	A	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pd cell heater	W	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38
Control circuit	W	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400

Preliminary chiller selection, Cont.



Item	Standard	Option
Chilled water		
Temperature	Entering: 12.2°C, leaving: 6°C through 12°C Leaving: 6.7°C, temperature difference 3 K through 10 K	
Flow rate	0.043 l/s x kW - Temperature difference (min. 50 %)	
Max. working pressure	1034 kPa	
Hydraulic test pressure Fouling factor	Max.working pressure x 1.5 0.018 m ² K/kW Max. 0.18 m ² K/kW	
Tube material	Copper tube	Cu Ni tube
Water quality	Reter to JRA-GL02E-1994	
Structure of water header Manufacturing standard of water header	Carrier SANVO standard	No option
	Camer-SANTO Standard	
Temperature	Entering: 29.4°C, entering: 20°C through 33°C Leaving: 38.4°C	
Flow rate	0.065 l/s x kW, within water flow rate range of each model	
Max. working pressure Hydraulic test pressure Fouling factor Tube material Water quality Structure of water header	1034 kPa Max. working pressure x 1.5 0.044 m² K/kW Copper tube Refer to JRA-GL02E-1994 Hinged type and epoxy treated	
Manufacturing standard of water header	Flanges ANSI	No option
Hot water Temperature	Entering: 95.0°C, entering: 80°C through 98°C Leaving: 86.0°C, leaving: min. 75°C	
Flow rate	0.039 l/s x kW, within water flow rate range of each model	
Max. working pressure Hydraulic test pressure Fouling factor Tube material Water quality Structure of water header	1034 kPa Max. working pressure x 1.5 0.018m ² K/kW Copper tube Refer to JRA-GL02E-1994 Removable type	
Manufacturing standard of water header	Flanged ANSI	No option

System description



The chilled water will circulated in insulated HDPE pipework buried 500 mm beneath the ground adjacent to the existing concrete trench system.

There shall be four constant flow chilled water, one primary chilled water circuit, one condenser water circuit, and an open-loop deep seawater system.

The chillers are piped in series to maintain a constant flow temperature of 6 °C. The design return temperature is 12 °C.

The seawater system shall incorporate motorised valves to allow the flow to be reversed in order to back-flush for cleaning and also to select the coolest sea water.

The seawater is highly corrosive and so all heat exchangers, pumps, valves and other ancillaries coming into contact with the seawater shall be specified with suitable corrosiveresistant materials, such as titanium.

The two absorption chillers shall meet the base cooling load. A conventional vapour compression chiller shall meet the peak loads and provide standby capacity, space and blanked connections shall be provided for a fourth chiller for possible future expansion.

Pipework has been sized in accordance with the CIBSE design criteria, but where there is a choice of suitable sizes the larger size has been used.