

Station Hill North Site. Section 106 - Energy Responses .

This document has been produced in response to the section 106 obligations that relate to the energy strategy for the station hill phase 2 North site development, the obligations and relevant responses are as follows.

1. To provide a future connection to a District Heating Network within the boundary of the First 2020 Development in either Phase 2 or Phase 3.

The provision for a connection to a District Heating Network within the boundary will be provided as part of Phase 3. As described and highlighted in Appendix A we are also providing the provision for future energy sharing between phase 3 and phase 2.

2. Not to Commence Phase 2 unless and until details of an air source heat pump system or an alternative ground source system have been submitted to, and Approved by, the Council PROVIDED THAT the details shall be in accordance with the Energy Strategy and shall include the following information:
 - a. a timetable for implementation;
 - b. a full specification;
 - c. details of infrastructure to be provided for future connection to a District Heating Network within the boundary of the First 2021 Development PROVIDED THAT for the avoidance of doubt this connection may be in Phase 3 and does not need to be in Phase 2;
 - d. proposals to provide capped off pipework and space in plant rooms within Phase 2; and
 - e. proposals to ensure Decentralised Energy Export.

Refer to Appendix A which provides previously submitted and accepted details of the Energy strategy which includes Air Source Heat Pumps and the relevant information as requested above.

Refer to Appendix B for full specification of the proposed ASHP.

It is anticipated that the ASHP will be fully operational in 4th Quarter 2024.

3. Not to carry out Phase 2 otherwise than in accordance with the details Approved by the Council pursuant to Paragraph 9.1 above AND to ensure the connection points between Phase 2 and Phase 3 shall be located as shown on Plan [X] (unless an alternative location(s) is Approved by the Council.

Refer to Appendix A which highlights connections points.

Appendix A - RBC Energy Response

Station Hill North Site. RBC Energy Comments.

This document summaries the comments received for the 192032/HYB - Station Hill - North Site - ENERGY STRATEGY.

The comments are based on advice received from Element Energy and subsequent discussions with the Council's Sustainability Manager.

The comments received and our response are set as follows with the **most recent HL responses in yellow**:

1. **RBC:** The applicant needs to provide further evidence why GSHP, which would normally be expected to result in better carbon reductions, has been omitted in Phase 2 (and not confirmed in Phase 3). This evidence may be in the form of, for example, detailed spatial analysis of GSHP plant and boreholes in relation to the wider Station Hill Phase 2/3 sites. This should be more detailed evidence than that which was provided in the planning application's energy statement.

Initial HL Response: Coordinated studies have been carried out to review the possibility of using GSHP closed loop system.

The drawing indicated below (See Figure 1) highlights the extent of existing foundations and utilities such as the Thames Water sewer on site, the majority of which cannot be removed, considering that a minimum distance of 6m between each borehole is required this will limit the space where boreholes can be located. The space in green indicates the available area that could potentially be used, this works out at approximately 33No. boreholes. If the boreholes were 150m deep, it should be possible to extract 9kW per borehole, this gives approximately 300kW maximum capacity from the GSHP network. This only provides 10% of the overall required load for the building, making this option not viable for the scheme.

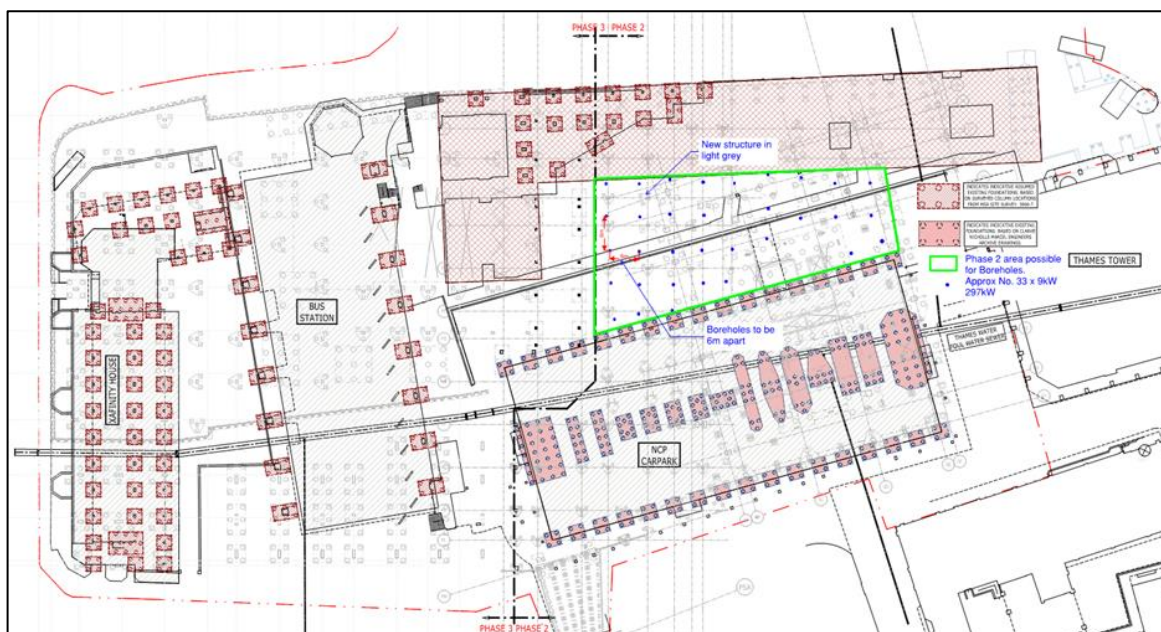


Figure 1

Sam Benjamin (EE) Response (19/05/20): This is Clear.

Further HL Response: No further response required.

2. **RBC:** Open-loop GSHP is currently discounted due to an imbalance of annual heating/cooling loads, which are required for optimal open-loop GSHP operation. However, the applicant's current carbon compliance models for Phase 2 differ significantly from the expected energy consumption of the building in operation (heating-led from compliance modelling, cooling-led from Hoare Lea experience of office buildings).

The applicant should therefore demonstrate confidence in assertions that cooling will dominate the thermal energy load in operation (contrary to the current carbon compliance models), and thus why an open-loop GSHP system is not appropriate at Phase 2.

Initial HL Response: The Part L model uses a National Calculation Methodology (NCM) which is an assessment tool used to demonstrate compliance with ADL2A. However, NCM is not intended to predict energy use when the building is in operation, NCM uses templates which consist of standard operational inputs for variables such as occupancy density and hours of operation to determine energy use and excludes the energy consumption associated with small power loads, servers, external lighting etc... Thermal dynamic modelling using IES software has been undertaken for the detailed cooling and heating loads show that the cooling load is higher than the heating load, this information is comparable with other benchmark data for a new office building.

Sam Benjamin (EE) Response (19/05/20): It still looks like heating is more significant than cooling in total kW, although the W/m² for cooling is higher (assuming there are fewer areas that require cooling vs heating?).

I think the main issue was with the annual consumption of heating vs cooling – this is where the balance of thermal energy with the open loop GSHP comes into play. Would you be able to show this in a similar way to the image below, i.e. annual cooling (kWh/a) > annual heating (kWh/a)?

Further RBC/ EE Comments (08/07/20): (No. 4) Please provide the estimated annual heating and cooling consumption based on benchmark data and list out any assumptions made.

Further HL Response: Please refer to Appendix 1 for the report that details the annual heating and cooling loads

3. **RBC:** GSHP systems are generally more efficient than ASHPs. The Applicant should provide evidence to quantify the extent to which simultaneous heating/cooling demand may in fact result in similar annual efficiencies as has been suggested.

HL Response: We have looked at the energy comparison between GSHP systems compared to ASHPs. In general, a low temperature heating only GSHP would typically achieve a COP of 5, for a system that is providing both heating and cooling this would typically achieve a COP of 4.

The ASHP that will be used for station hill Phase 2 recovers waste heat when there is a simultaneous heating and cooling demand, therefore the Seasonal Energy Efficiency Ratio (SEER) for the proposed ASHP is 4.24. The ASHP proposed are more energy efficient when used to produce chilled water and LTHW at the same time, as the waste heat can be used to help provide heating and/or cooling.

When there is a requirement for heating and cooling at the same time, then instead of rejecting waste heat/coolth to atmosphere it can be used as shown in images below.

Figure 2 is of the building with a cooling demand 75% and heating demand 25%. The image shows some waste heat is still rejected to atmosphere.

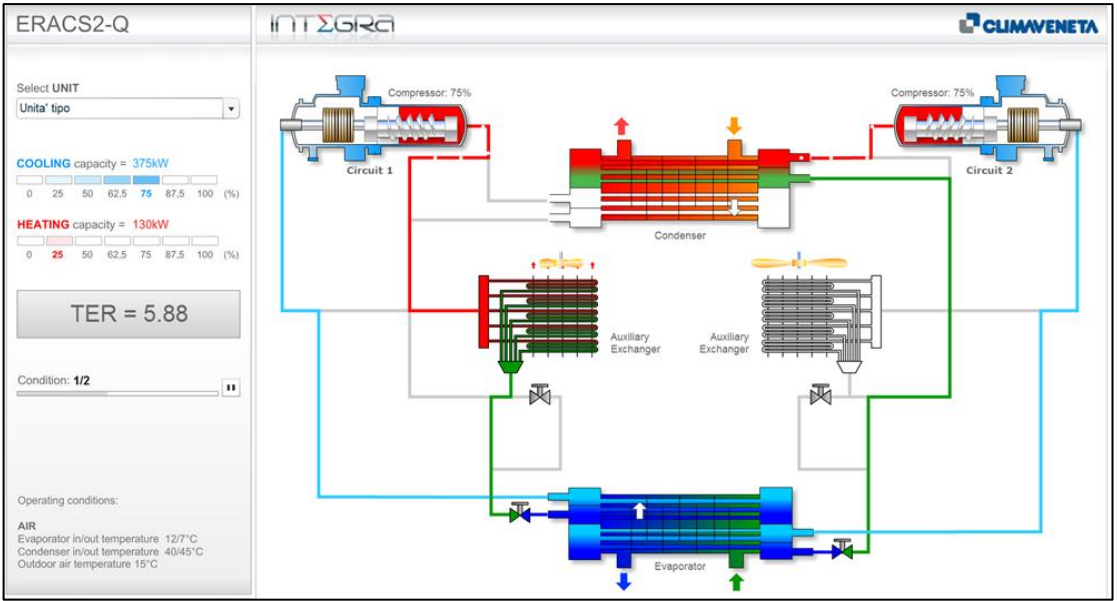


Figure 2

Figure 3 shows the cooling demand 50% and heating demand 50%. The image shows no waste heat is being rejected to atmosphere and very high energy performance.

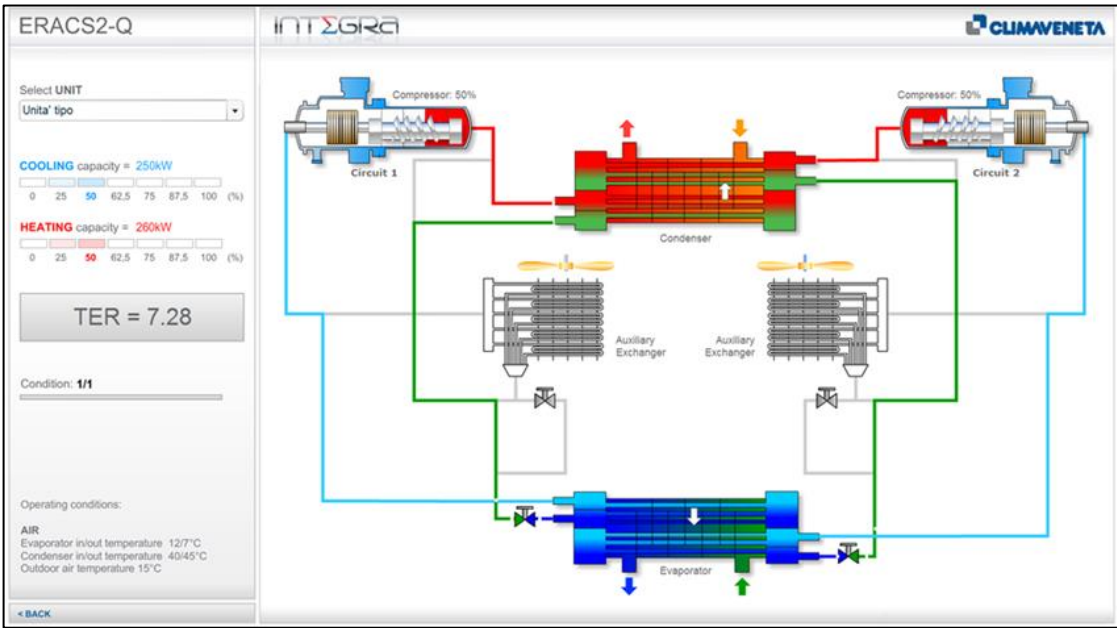


Figure 3

In reviewing the energy usage for the year, we have considered the Total Energy Ratio (TER) when the unit is in cooling/heating mode versus different external temperatures and this is shown in the table below. We have highlighted in green the TER we are expecting to achieve for the office building based on external temperatures and internal gains. This shows that the minimum TER is likely to be 2.35-2.55 with maximum likely to be 7.38. However, given the average weather temperatures for Reading the ASHP TER will be in region of 3.66 to 7.38. This demonstrates that the ASHP will achieve a similar annual efficiency to GSHP system.

ASHP Ambient Condition TER Data											
Heating Load	100	90	80	70	60	50	40	30	20	10	0
Cooling Load	0	10	20	30	40	50	60	70	80	90	100
Ambient Air Temp											
-6	2.04	2.67	4.02	6.55	7.21	7.25	7.15	6.77	6.38	5.98	5.42
-3	2.35	3.2	4.57	6.93	7.66	7.42	7.11	6.71	6.31	5.93	5.38
0	2.55	3.42	4.76	6.98	7.6	7.36	7.05	6.65	6.25	5.88	5.34
3	2.83	3.72	5.01	7.05	7.55	7.3	6.97	6.59	6.2	5.83	5.3
6	3.3	4.2	5.44	7.17	7.5	7.25	6.92	6.53	6.14	5.79	5.26
9	3.66	4.58	5.75	7.22	7.43	7.17	6.85	6.47	6.1	5.74	5.23
12	4	4.94	5.96	7.22	7.38	7.13	6.8	6.42	6.05	5.7	5.19
15	4.44	5.25	6.17	7.23	7.31	7.06	6.72	6.36	6	5.65	5.15
18	4.82	5.58	6.4	7.29	7.23	6.89	6.51	6.06	5.64	5.21	5.15
21	5.08	5.9	6.83	7.89	7.62	6.97	6.39	5.81	5.32	4.78	4.28
25	5.08	5.91	6.88	7.99	7.57	6.74	6.02	5.37	4.85	4.22	3.74
28	5.08	5.92	6.92	8.1	7.51	6.56	5.72	5.03	4.43	3.81	3.36
31	5.08	5.92	6.97	8.1	7.48	6.42	5.37	4.82	4.25	3.72	3.17

Sam Benjamin (EE) Response (19/05/20): This is clear – a graph of hourly heating and cooling over a year would be useful to see when the two loads overlap, assume this should be available from the IES model?

Further RBC/ EE Comments (08/07/20): (No. 3) Calculated seasonal coefficient of performance (COP) for the proposed air source heat pump system should be provided

Further HL Response: The calculated COP for the ASHP is as per the below:

End use	Annual demand/sqm	Weighted CoP	
		Independent	Simultaneous
Heating	19.6	3.43	5.96
Cooling	50.7	5.06	5.55

The results show when operating to meet the heating and cooling loads independently (i.e. no efficiency benefit from simultaneous heating and cooling), the anticipated coefficient of performance of the heat pump is ~3.4 for space heating and ~5.0 for space cooling.

When including the benefit of increased generation efficiency when the heat pump is meeting simultaneous heating and cooling demands, the anticipated coefficient of performance of the heat pump increases to ~6 for space heating and ~5.5 for space cooling. The benefit to the space heating efficiency of capturing the rejected heat from the cooling side is plain to see.

- RBC: The applicant should demonstrate the difference in total thermal energy supply system efficiency when employing ASHP versus open-loop GSHP.

Initial HL Response: we have consulted with ground source heat pump and energy specialists ESB Energy who have obtained data on the existing ground conditions and suitability for an open loop system, this has identified that there are a number of very old wells in the area installed within the chalk, and this would

provide an average yield of around 4.0l/s. Based on approximately 4 to 5l/s this would equate to 300kW of heating which would be insufficient.

Considering there will be an imbalance in cooling and heating loads during the year and in the summer the cooling demand will be more than the heating demand, there will be excess heat that will need to be "dumped". The heat dump from when a building requires more cooling than heating is not allowed to be returned to the underground water source so either the heat dump needs to be sold off locally to property with a very high water load or air cooled chillers would be required to meet the cooling load.

The graphs mentioned above shows the energy efficiency of the ASHP that will be similar to an open loop GSHP system.

Sam Benjamin (EE) Response (19/05/20): I have been involved in the design of an open-loop system that does employ this system (i.e. balanced heating/cooling). This was quite a complex design and required additional water-cooled chillers to avoid the "dumping" of heat into the ground as you note (and potentially more than 2 boreholes required if I remember correctly). This was more of a district energy system rather than a single building, so likely to be too complex for Station Hill, especially given the overall efficiency of the ASHP system is relatively good as shown above.

Further HL Response: No further response required.

5. **RBC:** If confidence in the thermal loads and the comparative efficiencies of ASHP versus open-loop GSHP cannot be demonstrated, (and it is expected that in most cases it cannot), then the following should be undertaken in respect of open-loop GSHP:

- Demonstrate whether open-loop GSHP is technically feasible considering available aquifer water within the vicinity of the Station Hill North development. A hydrological/geological study is required but to save some time/effort, the Council understands there to be plenty of water in the aquifer.
- Demonstrate whether open-loop GSHP is technically feasible with regard to utility clashes in the surrounding area. This should be a detailed assessment and not a general overview.

If the proposed ASHP system energy supply strategy can be shown to perform similarly to an open-loop GSHP thermally, or that GSHP is technically unfeasible, only then will it be accepted that the proposed energy strategy is acceptable as the best solution for Station Hill North Phase 2.

Initial HL Response: As mentioned above an open loop system will not be feasible due to the limitation of the flow available and the in balance of loads. However, the energy efficiencies shown in table above shows that we can achieve high COPs throughout the year and at many times greater efficiencies using the proposed ASHP.

Sam Benjamin (EE) Response (19/05/20): As above – the system could be set up to balance heating/cooling with open-loop GSHP but is complex and requires further equipment such as water-cooled chillers (and potentially additional boreholes).

Further RBC/ EE Comments (08/07/20): (No. 1) Confirmation of where we obtained the ground water availability data from, (i.e. British Geological Survey database) should be provided alongside **(No. 2)** further clarity and narrative on the constraints drawing showing existing structure and utilities etc.

Further HL Response: As confirmed by EBS Energy the ground water availability data came from the British Geological Survey Database.

Please refer to the Borehole and Existing Structure mark up in Appendix 2 to provide further narrative on the site constraints.

6. **RBC:** Potential disadvantages of ASHP on this scale, noise levels, high electrical load at peak times (exacerbating peak demand on the local electricity network) and localised cooling effects in cold weather should be addressed and balanced against claimed benefits.

Initial HL Response: The noise from the ASHP has considered and coordinated with architect and acoustic consultant, to meet the acoustic criteria, this includes mitigation measures such as screening at roof level. If an open loop GSHP solution were to be adopted then it would need to be provided with a backup heating and cooling system to provide resilience and top up the cooling/heating capacities at peak times. This will add additional plant and pumping with the backup ASHP/chillers at roof level and GSHP within the basement.

To minimise the peak demand, we have included thermal storage to help meet with the peak load. The benefit of using the ASHP with simultaneous heating and cooling outputs does help improve the efficiency of the ASHP.

Sam Benjamin (EE) Response (19/05/20): This is Clear.

Further RBC/ EE Comments (08/07/20): (No. 5) Confirmation of thermal storage vessel capacity should be provided.

Further HL Response: There are 2No. for heating at 6,000l capacity each and the same for the chilled water - 6,000l for each.

7. **RBC:** Regardless of the technology adopted the SPD is clear in seeking a heat network at Station Hill, beyond the current site boundary: "Station Hill and around – centred on seven plots of the large Station Hill redevelopment site and includes three other planned redevelopments at Sainsbury's, Garrard House and Weldale Street."

The applicant should engage further with the Council and Element Energy to ensure that adequate provisions are put in place to facilitate future connection of the Station Hill development to a wider area DH scheme. For example, this might include agreeing a position for connecting pipework to be laid to and capped off, ready for later connection. This should address the neighbouring sites referred to in the SPD.

Initial HL Response: The proposed energy strategy for the North Site is future proofed enabling a connection to a wider heat network, when one materialises. It is proposed that the ASHP provided for the Office building will connect into the Phase 3 energy network. The details for this network will be developed when more is known about the usages for Phase 3.

The thermal model results for Phase 2 show there is a higher cooling load than heating load, which means there is an opportunity to recover the waste heat when producing the chilled water for the cooling.

When there is a demand for cooling in the office development, the ASHP will produce the required chilled water and the waste heat from this process will be captured. The captured waste heat is then used to charge the buffer vessels with low temperature hot water. This low temperature hot water will be stored in highly insulated buffer vessels and it can be used for hot water requirements in Phase 3.

When there is a demand for hot water in Phase 3 and the heating buffer vessels have available hot water, it can be pumped to Phase 3 to help meet the heating demand requirements.

There shall be a plate heat exchanger to provide a physical separation between the office building (Phase 2) and the Phase 3 network. The buffer vessels shall be installed in Phase 2 with connections in the tank for the Phase 3 connections.

The pipework shall be extended from the buffer vessel in Phase 3 with pumps and plate heat exchanger also being installed in Phase 3. The below shows the concept schematic of the system showing how the heat can be used by Phase 3

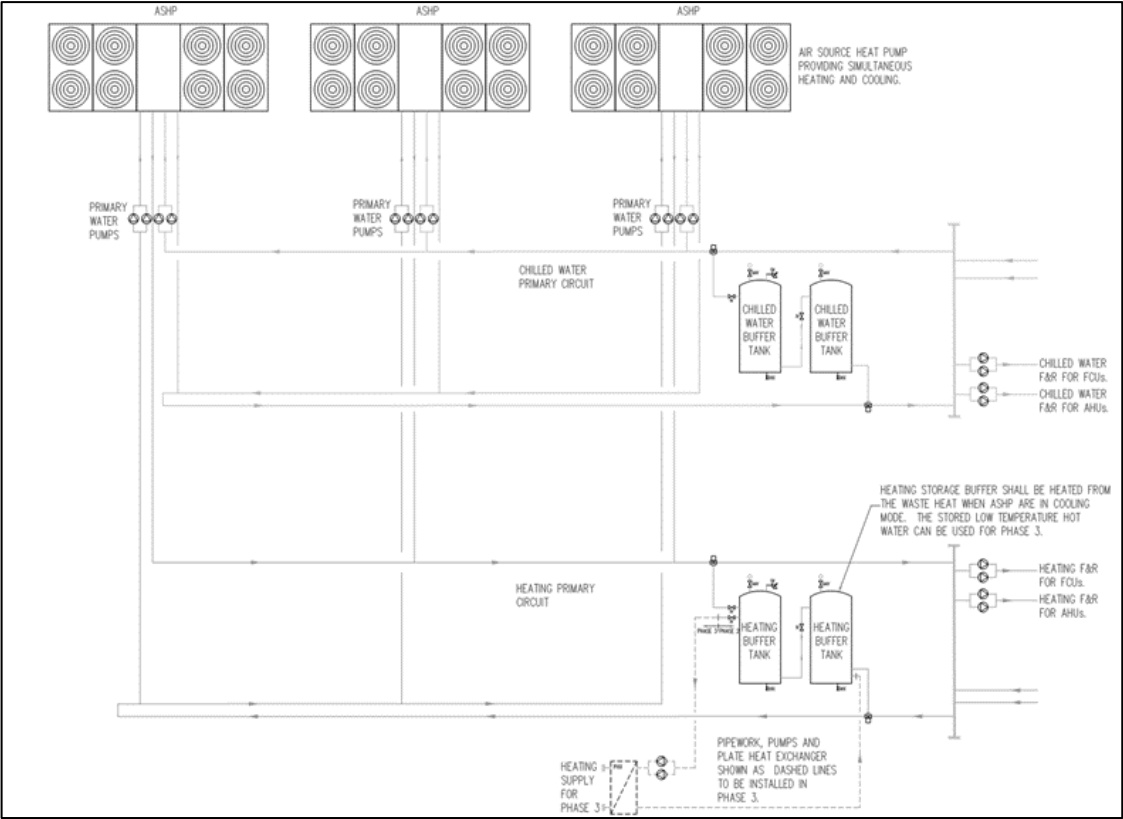


Figure 4

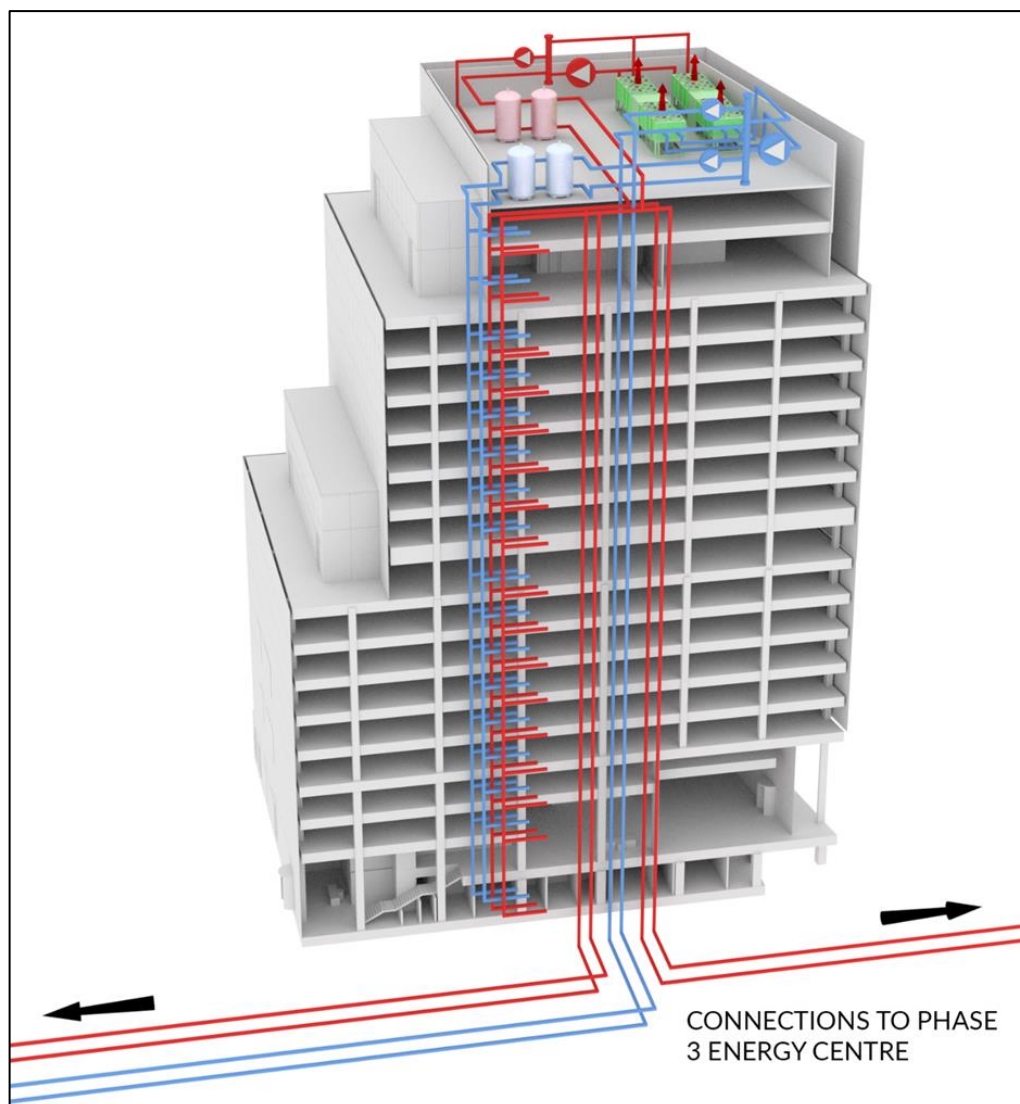


Figure 5

Sam Benjamin (EE) Response (19/05/20): Might be worth being absolutely clear that Station Hill Phase 2 will be connectable to a future DH network even if Phase 3 does not materialise. Otherwise all seems reasonable.

Further RBC/ EE Comments (08/07/20): (No. 6) Further narrative on future connection provision for Phase 3.

Further HL Response: As outlined in our initial response the proposed energy strategy for the North Site is future proofed enabling a connection to a wider District Heating Network, when one materialises, regardless of whether Phase 3 of the development comes forward.

If Phase 3 of the development comes forward the ASHP network provided for the Office building will connect into the Phase 3 energy network. The details for this network will be developed when more is known about the usages for Phase 3.

The future connection and PHX in dashed lines in the schematic SHRN-HL-BG-SM-M-590-0002, specific area clouded in Figure 6 (the full drawing is located in Appendix 3)

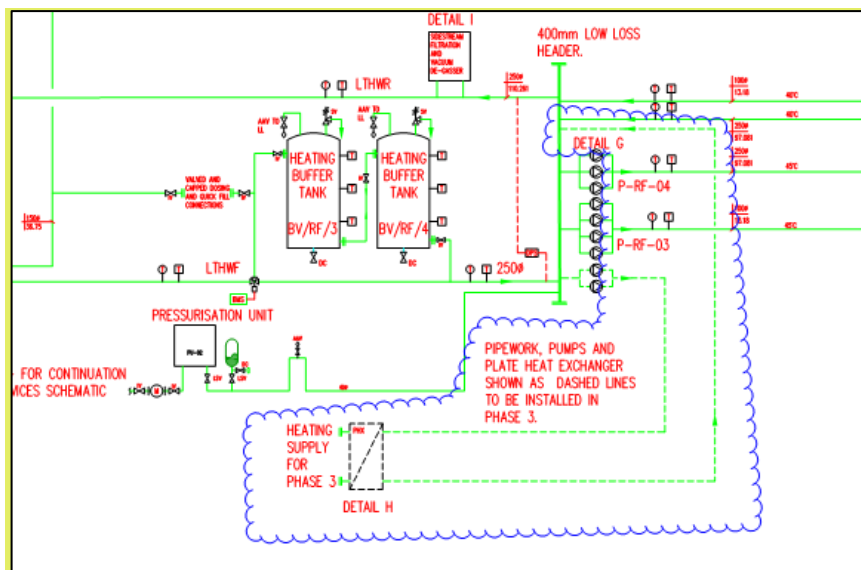


Figure 6

The space allowance for the equipment on the roof layout (space allocated in north plantroom at L17-Roof Mezzanine) is shown in Figure 7 below (the full drawing is located in Appendix 3)

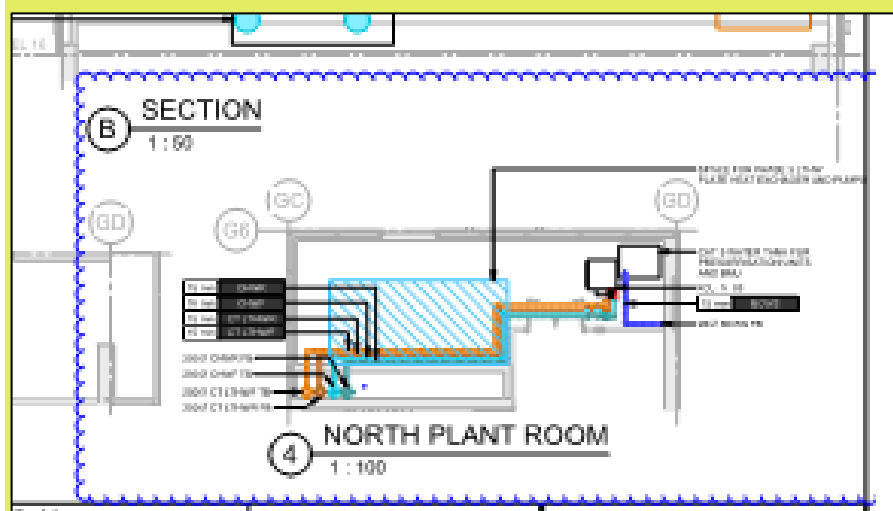


Figure 7

Further RBC/ EE Comments (08/07/20): (No. 7) Further narrative highlighting key considerations /difficulties of having a ground source heat pump system combined with ASHP for a multi-tenanted cooling led office building.

Further HL Response: The heat provided from the incorporation of a GSHP is not significant enough to reduce the requirement for roof plant, as can be seen from the estimated energy load assessment carried out for Phase 2 of station hill this is a cooling led building, therefore, although we have incorporated some buffer/storage vessels which are capable of storing small loads, if a ground source heat pump system were to be utilised we would need to have additional heat rejection plant on the roof to remove the excess heat, this would have a negative impact on the overall efficiency of the system and will also add more material and plant to the site which will increase the developments embodied carbon.

Appendix 1: Borehole & Existing Structure Drawing.

Closed loop boreholes
need to be 6m apart and
they are 100m deep.

Existing NCP Carpark
pilecaps will be removed
as part of the demolition
works but piles will
remain in situ.
Minimum distance
between new piles and
boreholes

Existing foundations -

OSH pilecaps - not
possible to install
boreholes

Phase 2 area possible
for boreholes. Approx
No 31 boreholes x
9KW each = 279 KW

Access road to NCP
car park and Thames
Tower serviceyard -
utilities corridor

OSH attenuation
tank - not possible to
install boreholes

Thames Water main
sewer

Thames Water main
sewer 3m easement
zone

Thames Water main
sewer 15m vibration
control zone

Access road to NCP
car park and Thames
Tower serviceyard -
utilities corridor

Thames Water limits
vibration in a zone
within 15m of the
sewer. Boreholes are
not likely to comply with
Thames Water vibration
requirements

Thames Water main
sewer. 3m easement
zone either side of the
sewer indicated in
dashed magenta line.

OSH attenuation tank -
not possible to provide
boreholes in this area

Potential area
where boreholes
can be installed
-will need to be
connected to the
boreholes in the
other side of the
building

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NOTES

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL DIMENSIONS ARE IN MILLIMETRES U.N.O.
3. ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM U.N.O.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
5. FOR PODIUM DRAWINGS, Lvl P3, P2, P1 AND FOUNDATIONS REFER TO:-
SHRN-RAM-PN-P3-DR-S-010085
SHRN-RAM-PN-P3-DR-S-010086
SHRN-RAM-PN-P3-DR-S-010087
SHRN-RAM-PN-P3-DR-S-010088

BACKGROUND MSA SITE SURVEY REF. 3868-T

INDICATES INDICATIVE ASSUMED EXISTING FOUNDATIONS, BASED ON SURVEYED COLUMN LOCATIONS FROM MSA SITE SURVEY, 3868-T

INDICATES INDICATIVE EXISTING FOUNDATIONS, BASED ON SURVEYED COLUMN LOCATIONS FROM MSA SITE SURVEY, 3868-T

UTILITIES SURVEY FLOWMAN CRAWEN REF. 40652T-01A

INDICATES INDICATIVE 1.5m EASEMENT ZONE BASED ON FLOWMAN CRAWEN SURVEY

INDICATES INDICATIVE 3.0m EASEMENT ZONE BASED ON FLOWMAN CRAWEN SURVEY

THAMES WATER SEWER LOCATIONS - FROM HOARE LEA WITH THE CAVEAT - BIM MODEL FROM CRTKL TOPOGRAPHICAL AND UTILITY INFORMATION FROM FLOWMAN CRAWEN AND ASSET INFORMATION FROM THAMES WATER. THIS INFORMATION GENERALLY SHOWS DEFINED 'POINTS' AND THESE POINTS HAVE BEEN CONNECTED VIA STRAIGHT LINES ON THIS DRAWING TO SHOW A INDICATIVE ROUTE OF THE SEWERS. THE DRAWING SHOWS THE INDICATIVE POSITION OF THE SEWER FROM THESE SOURCES. EXACT POSITION AND LEVEL OF THE SEWERS WILL NEED TO BE CONFIRMED PRIOR TO DETAILED DESIGN AND ANY WORKS ON SITE.

OSH pilecaps - not possible to install boreholes

Phase 2 area possible for boreholes. Approx No 31 boreholes x 9KW each = 279 KW

Access road to NCP car park and Thames Tower serviceyard - utilities corridor

OSH attenuation tank - not possible to install boreholes

Thames Water main sewer

Thames Water main sewer 3m easement zone

Thames Water main sewer 15m vibration control zone

Access road to NCP car park and Thames Tower serviceyard - utilities corridor

P04	STAGE 4 ISSUE	08/07/2020	J.F.	K3
P03	DESIGN OPTIMISATION	17/01/2020	J.F.	K3
P02	STAGE 3 ISSUE	15/11/2019	J.F.	K3
P01	ISSUED FOR STAGE 2	13/06/2019	J.F.	K3
Rev	Description	Date	By	App

STAGE 4

STATION HILL NORTH
READING

RAMBOLL

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TEL: 020 7631 5291 london@ramboll.co.uk
www.ramboll.co.uk

**SITE OVERLAY
BELOW GROUND
OBSTRUCTIONS AND
SURVEY INFORMATION**

Project No:	Scale (B A0):	Date:	Drawn:
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Drawing No:	Rev:		
SHRN-RAM-SW-FN-DR-S-0020	P04		

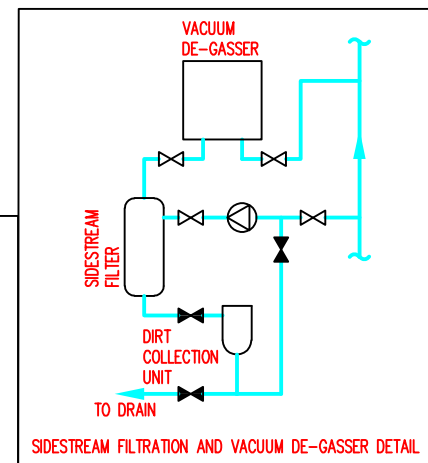
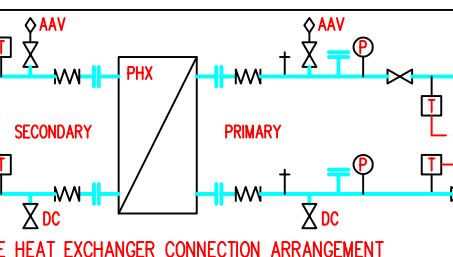
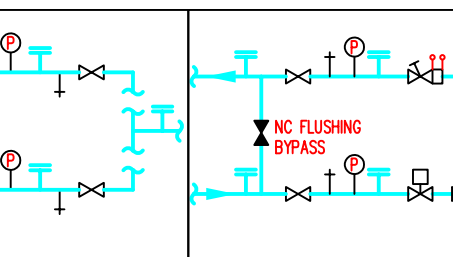
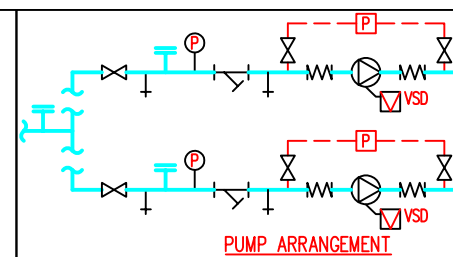
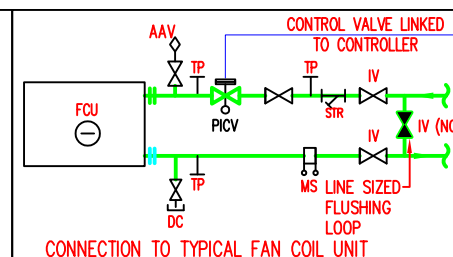
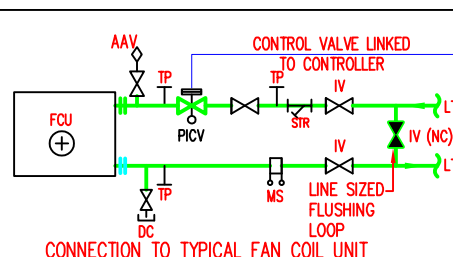
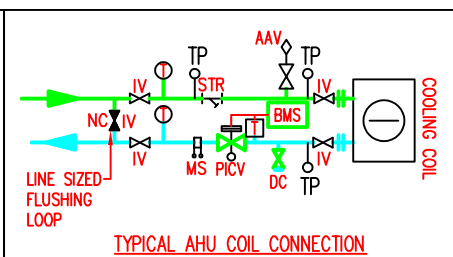
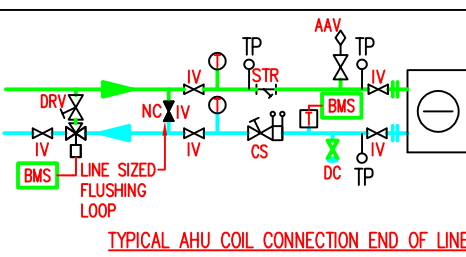
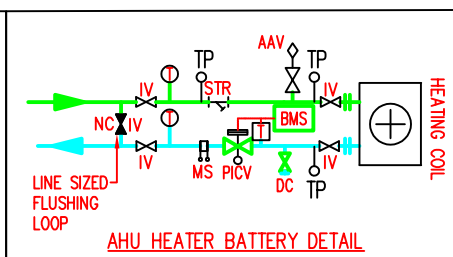
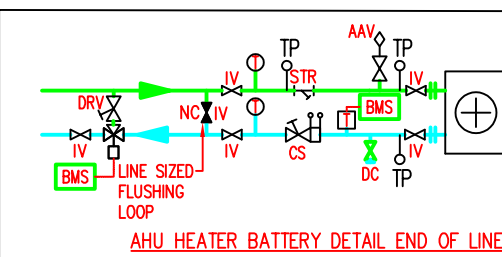
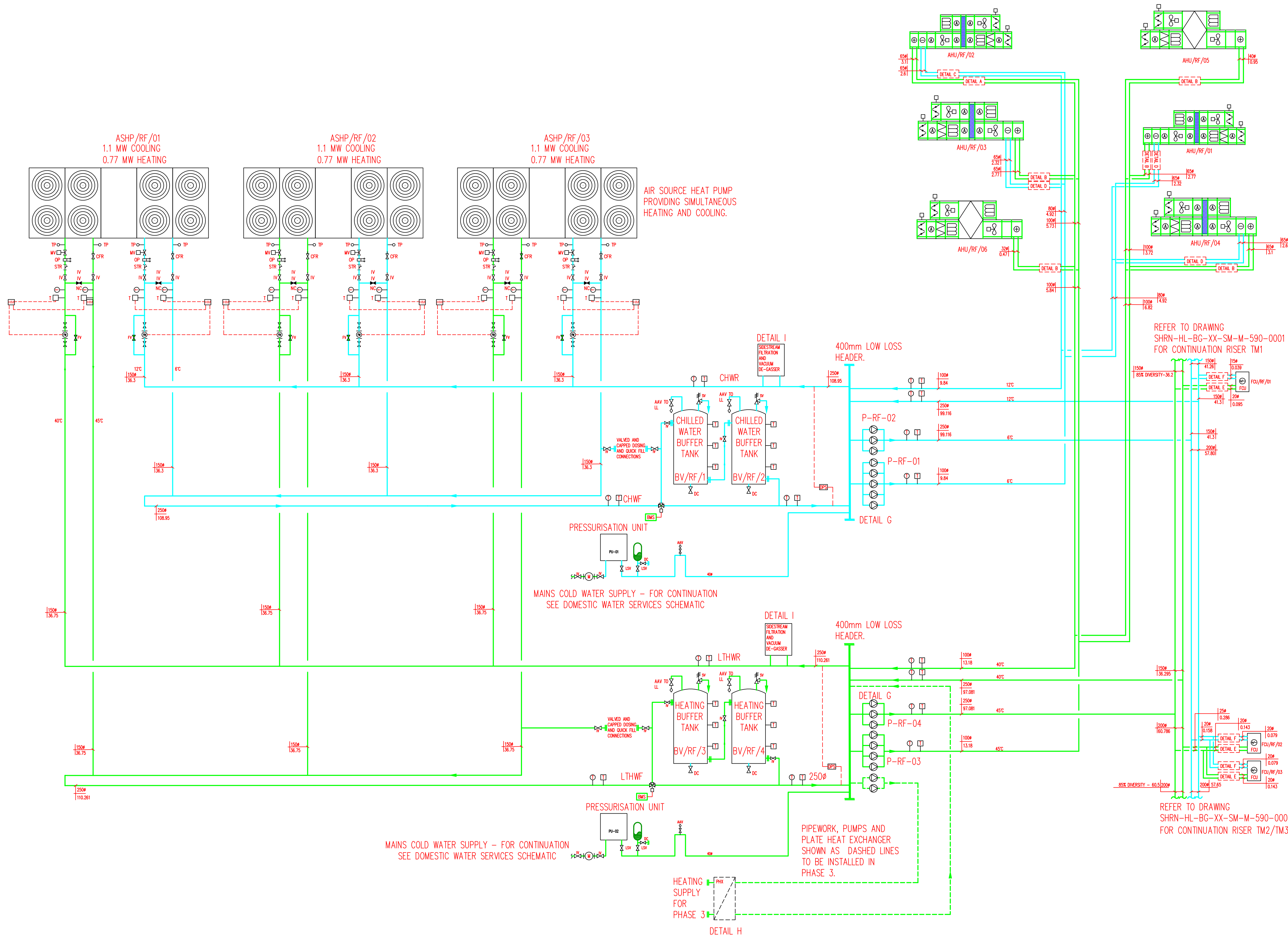
KEY:-

BOUNDARY LINE		
THAMES TOWER	MSA SURVEY – AUGUST 2018 & CLARKE NICHOLLS MARCEL EXISTING DRAWINGS – OCTOBER 2018	
NCP CAR PARK	MSA SURVEY – AUGUST 2018 & CLARKE NICHOLLS MARCEL EXISTING DRAWINGS – OCTOBER 2018	
XAFINITY HOUSE	MSA SURVEY – AUGUST 2018	
WESTERN TOWER AND RETAIL PARADE	MSA SURVEY – AUGUST 2018	
BUS STATION	MSA SURVEY – AUGUST 2018	
SITE UTILITIES	PLYMANN CRAVEN SURVEY – SEPTEMBER 2018	
SOUTH SITE CONNECTION TO NORTH SEWER	RAMBOLL DRAWING - SHR-RAM-ZZ-00-DR-C-000102	

INFORMATION SOURCE:-

Appendix 2: Site Schematic & Layout.

This drawing shall not be scaled.
Work from the dimensions shown in the
drawing or given in relevant specifications



CDM Regulations:

In addition to any information included in this drawing or the model from which it is derived, refer also to the project CDM Risk Register for information on residual risks.

General Notes:

- The drawing does not necessarily show all the information needed to interpret the design intent or the construction details.
- The drawing contains information from more than one source and must be read in conjunction with all relevant specifications.
- Any apparent drafting errors and differences between other drawings and specifications shall be brought to our attention.

Project Notes:

LEGEND :

- CHILLED WATER FLOW AND RETURN
- LTHW WATER FLOW AND RETURN
- ISOLATION VALVE
- DIFFERENTIAL PRESSURE CONTROL VALVE
- CONSTANT FLOW REGULATOR
- ATMOSPHERE AIR VENT
- DRAIN VALVE
- FLUSH VALVE
- DIFFERENTIAL PRESSURE SENSOR
- STRAINER
- NON RETURN VALVE
- PUMP

T1	TENDER ISSUE	MW	OP	IG	05.06.2020
Index	Description	Designed	Reviewed	Authorised	Date

REVISIONS:

HOARE LEA **HL**

ARCHITECT:

GENSLER

CLIENT:

SH READING MASTER LLP

PROJECT TITLE:

STATION HILL NORTH SITE
ONE STATION HILL

DRAWING TITLE:

MECHANICAL ENGINEERING SYSTEMS
HEATING AND COOLING PLANTROOM SCHEMATIC

TENDER ISSUE

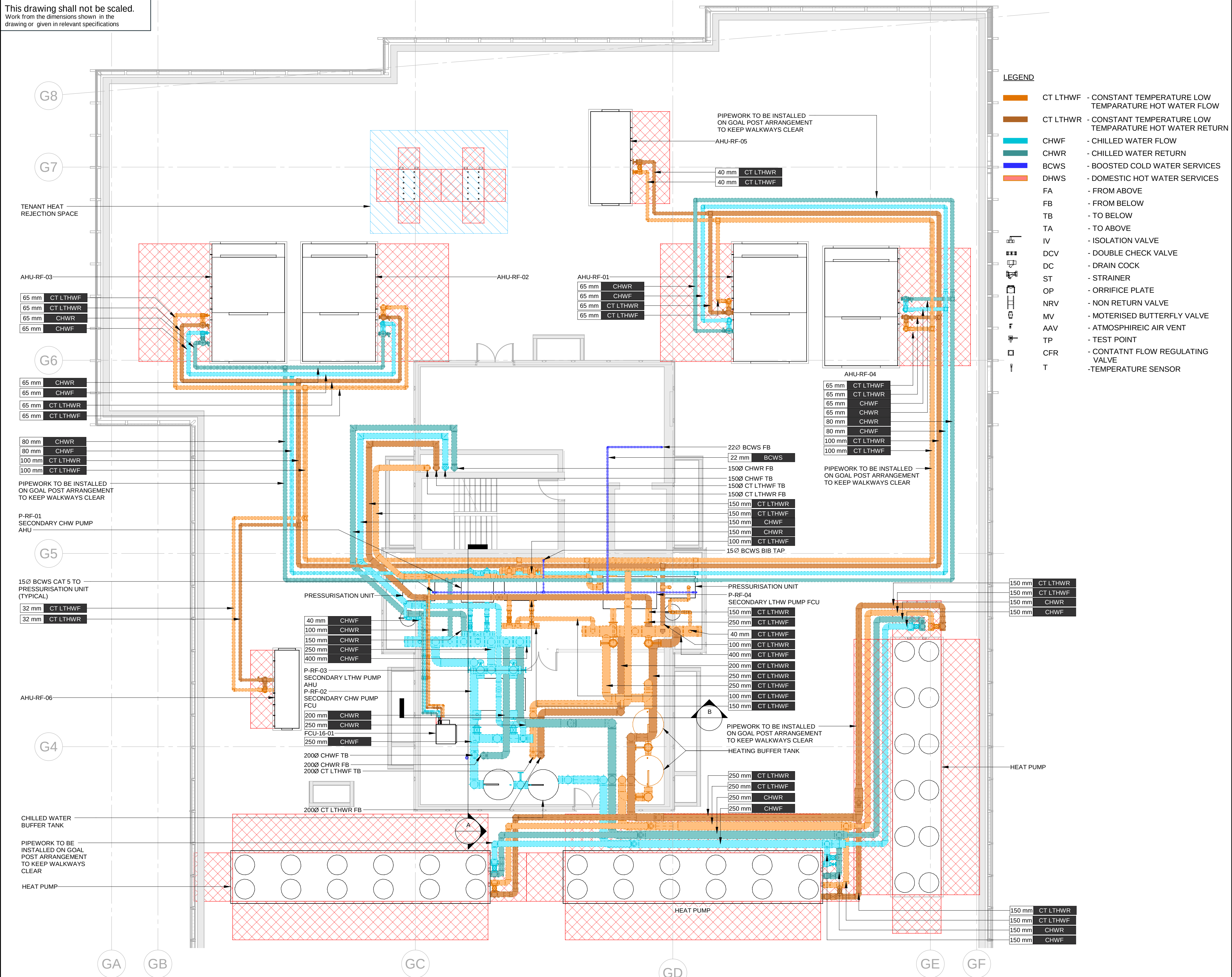
PERSON RESPONSIBLE FOR:

Design: MW	Review: OP	Authorising Issue: IG
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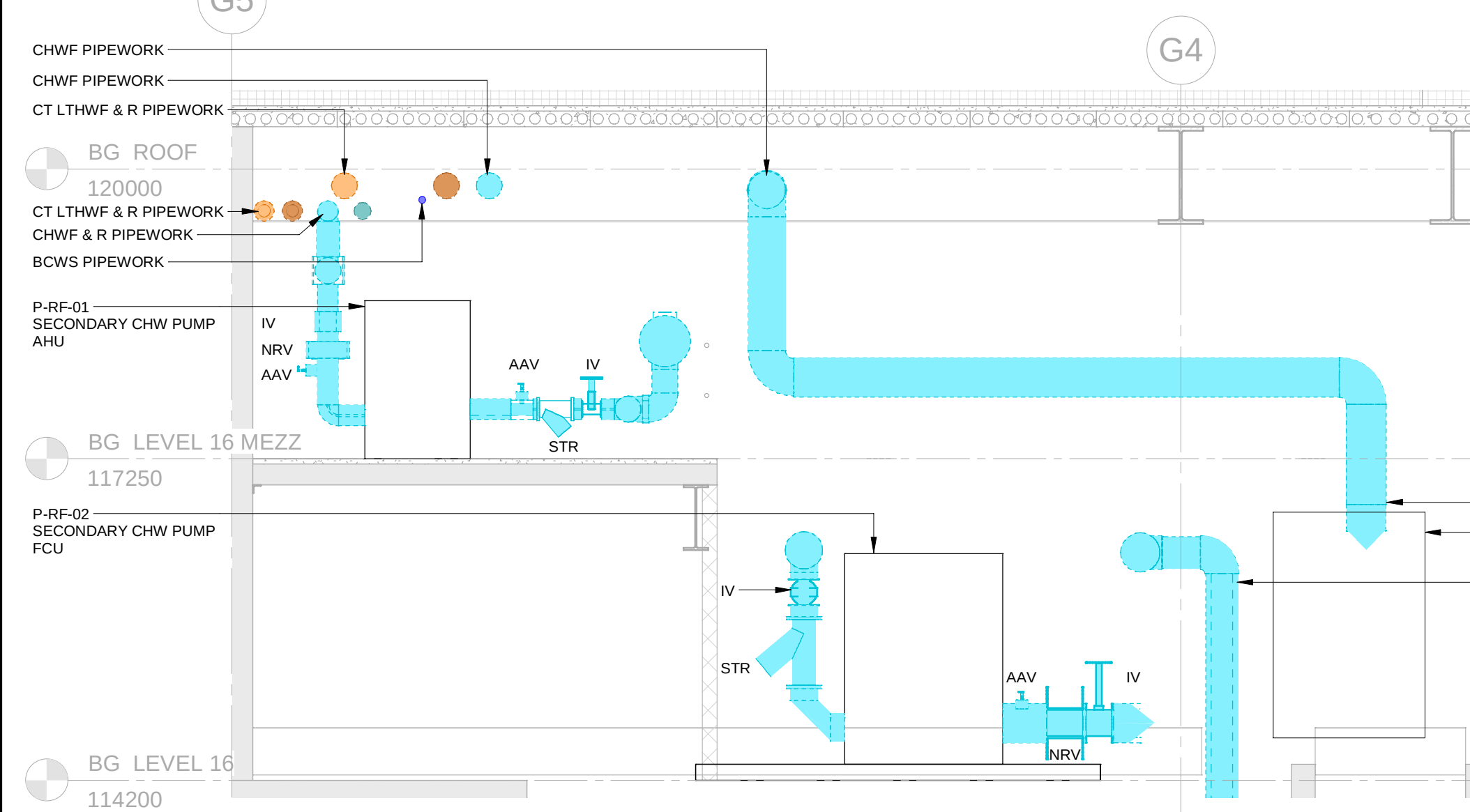
Project No: 0512193	Date: MAY 2020	Scale @ A1: NTS
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DRAWING NUMBER: SHRN-HL-BG-XX-SM-M-590-0002	Revision: T1
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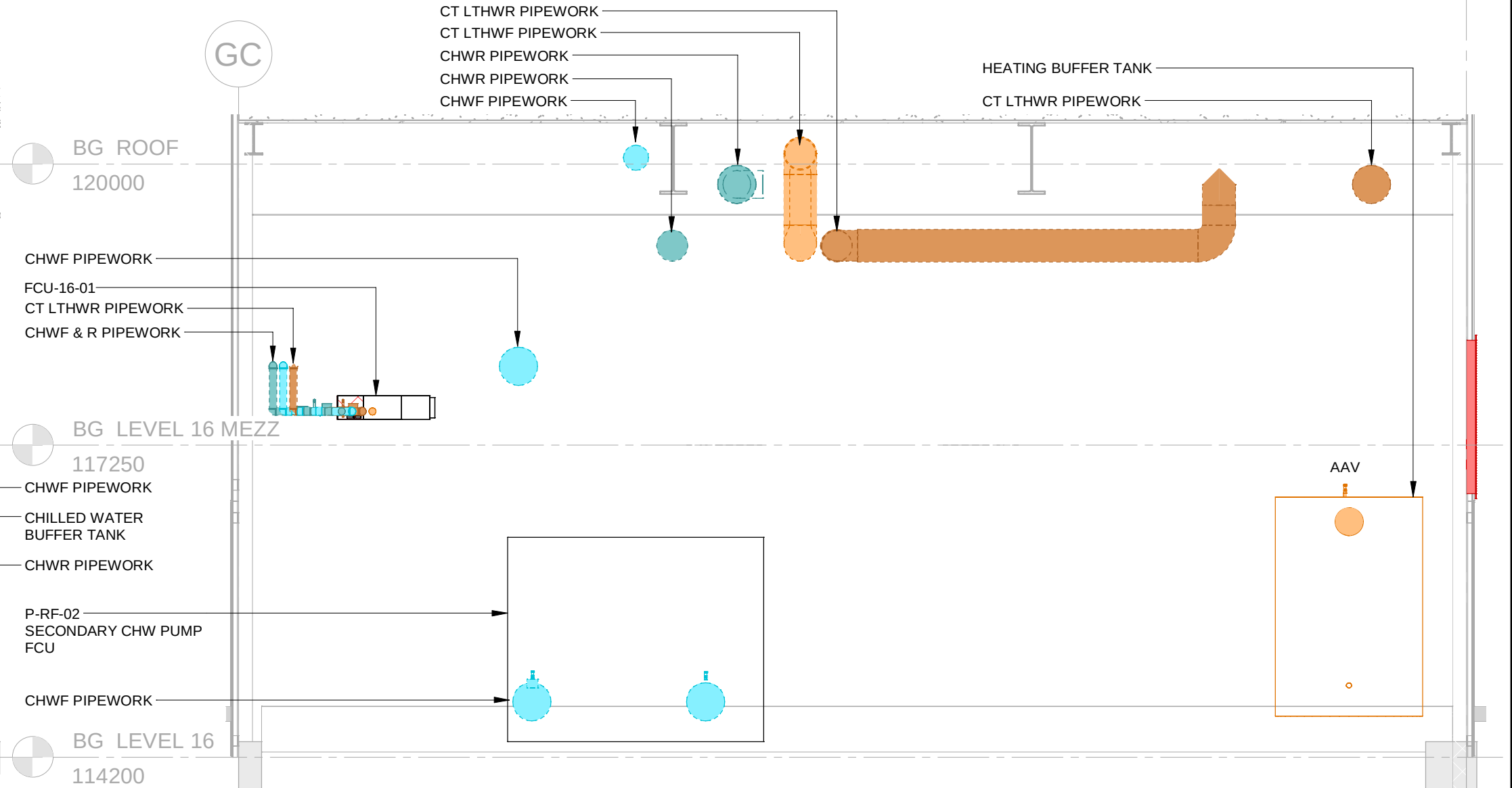
This drawing shall not be scaled.
Work from the dimensions shown in the
drawing or given in relevant specifications



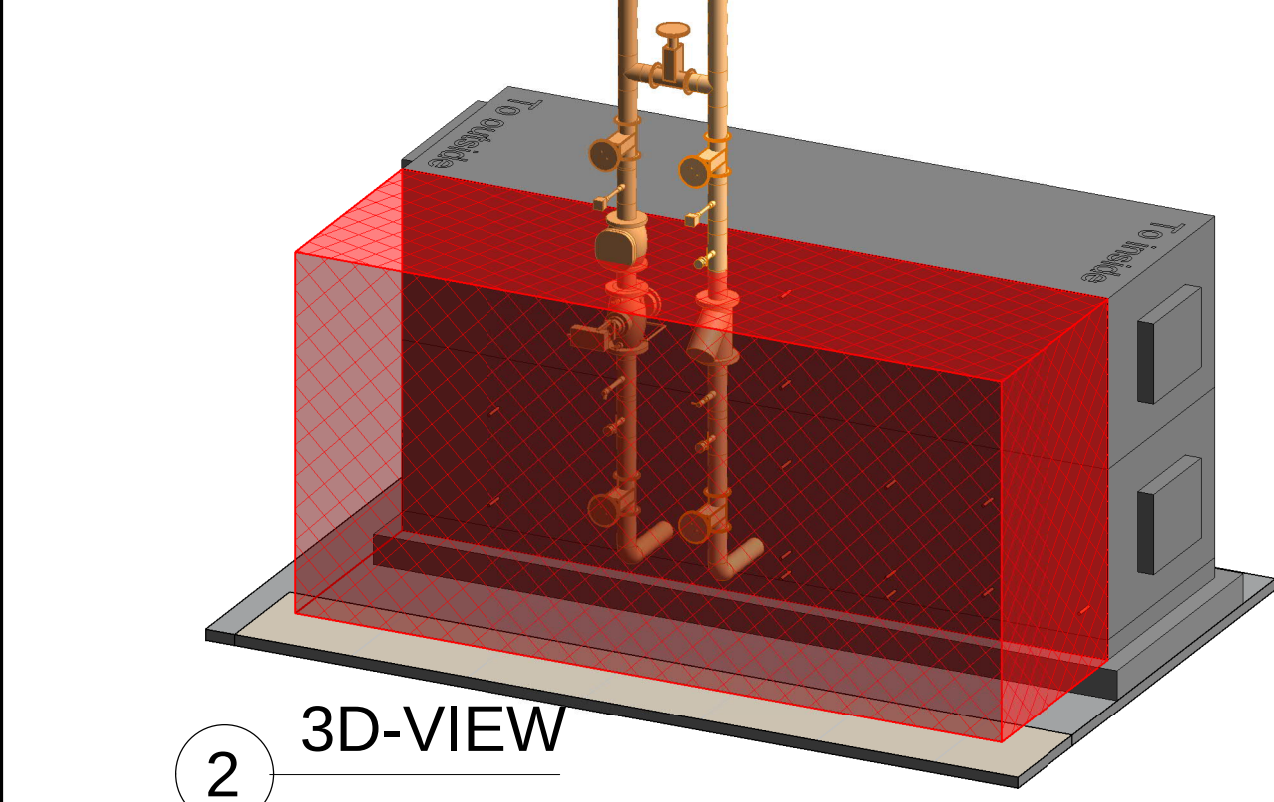
1 Heating & Cooling Treatment - BG 16 FFL - Building G
1 : 100



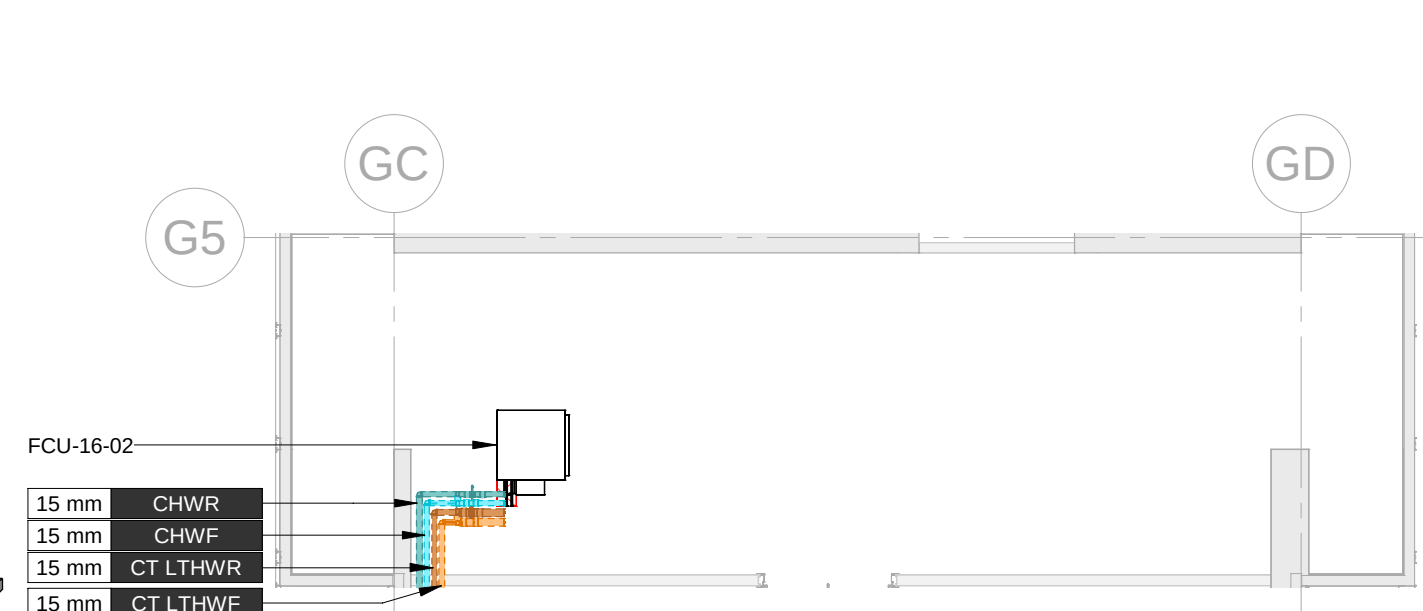
A SECTION
1 : 50



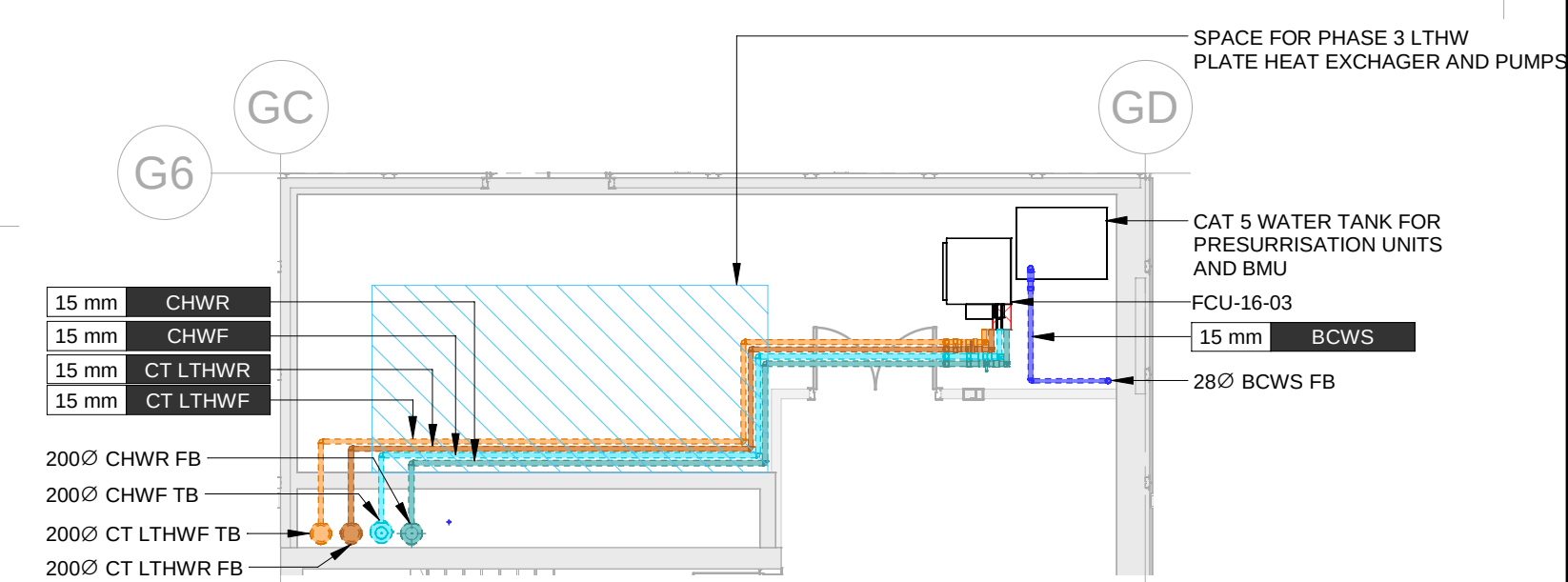
B SECTION
1 : 50



2 3D-VIEW



3 LIFT MOTOR ROOM
1 : 100



4 NORTH PLANT ROOM
1 : 100

General Notes: - The drawing does not necessarily show all the information needed to interpret the design intent or the construction details. - The drawing contains information from more than one source and must be read in conjunction with all relevant specifications. - Any apparent drafting errors and differences between other drawings and specifications shall be brought to our attention. Project Notes:					ARCHITECT: GENSLER		CDM Regulations: In addition to any information included in this drawing or the model from which it is derived, refer also to the project CDM Risk Register for information on residual risks.		HOARE LEA		TENDER ISSUE	
					CLIENT: SH READING MASTER LLP		PROJECT TITLE: STATION HILL NORTH SITE ONE STATION HILL		DRAWING TITLE: Mechanical Systems Piped Services Layout Level 16		PERSON RESPONSIBLE FOR:	
											Design: BB	
											Review: MW/OP	
											Authorising Issue: IG	
											Project No: 0512193	
											Date: 05.06.2020	
											Scale @ A1: 1:100	
											DRAWING NUMBER: SHRN-HL-BG-16-GA-M-531-0012	
											Revision: T1	

Appendix B- ASHP Specification

i-FX-Q2-G05 /CA/S /1102

Software version: ELCA World 1.4.1.0
Database version: 1.5.1.0
User:
Print data:
Calculation type: EN 14511 - EN 14825



Code	i-FX-Q2-G05 /CA /1102	
Version	CA	
Size	1102	
UNIT DESCRIPTION	INTEGRA unit for 4-pipe systems, air source, VSD screw compressors and EC fans, for outdoor installation. SPECIAL VERSION	
Power supply	V/ph/Hz	400/3/50

PERFORMANCE AT DESIGNED CONDITIONS

■ RUNNING CONDITIONS

■ CHILLED WATER HEAT EX. USER SIDE

Fluid inlet temperature (cooling mode)	°C	12.00
Fluid outlet temperature (cooling mode)	°C	6.00
Fluid type		WATER
Glycol	%	0
Fouling factor	m²K/kW	0.000

■ WARM WATER HEAT EX. USER SIDE

Fluid inlet temperature (heating mode)	°C	40.00
Fluid outlet temperature (heating mode)	°C	45.00
Fluid		WATER
Glycol	%	0
Fouling factor	m²K/kW	0.000

■ OUTDOOR CONDITION

Air temperature (cooling mode)	°C	35.0
Air temperature (heating mode)	°C	-4.0

■ COOLING (EN 14511)

Capacity control	%	100.0
Cooling capacity	kW	1089
Compressors power input	kW	371.6
Fans power input (cooling mode)	kW	34.00
Total power input	kW	407.9
EER	kW/kW	2.670
ESEER EN 14511 (referiment)	kW/kW	4.330

■ COOLING WITH HEAT RECOVERY (EN 14511 VALUE)

% part load CHREC	%	100.0
Cooling capacity	kW	1103
Recovery heat exchanger capacity	kW	1427
Total power input	kW	345.1
TER	kW/kW	7.331

■ HEATING (EN14511)

% Capacity control on heating	%	100.0
Total heating capacity	kW	770.5
Compressors power input (heating mode)	kW	291
Fan power input (heating mode)	kW	17.00
Total power input	kW	303.5
COP	kW/kW	2.440

i-FX-Q2-G05 /CA/S /1102

Software version: ELCA World 1.4.1.0
 Database version: 1.5.1.0
 User:
 Print data:
 Calculation type: EN 14511 - EN 14825

HEATING

EC FAN

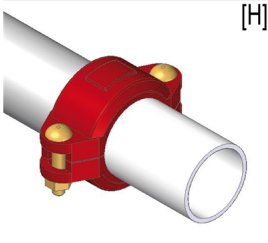
SCREW

R R513A

EXCHANGERS

CHILLED WATER HEAT EX. USER SIDE

Typology		SHELL&TUBE
Quantity	N°	1
Fluid type		WATER
Glycol	%	0
Fouling factor	m²K/kW	0.000
Type of connections		[H] - Grooved coupling with weld end counter-pipe user side
Diameter of connections		8"
Min flow	l/s	30.56
Max flow	l/s	72.22
K pressure drop		1.48
Water content	l	565



COOLING

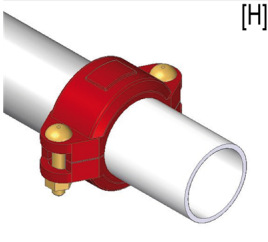
Fluid inlet temperature (cooling mode)	°C	12.00
Fluid outlet temperature (cooling mode)	°C	6.00
Water flow	l/s	43.46
Pressure drop at the heat exchanger	kPa	36.2
Available unit's head	kPa	0.00

COOLING + HEAT RECOVERY

Water flow	l/s	44.14
Pressure drop at the heat exchanger	kPa	37.4

WARM WATER HEAT EX. USER SIDE

Typology		SHELL&TUBE
Quantity	N°	1
Fluid		WATER
Glycol	%	0
Fouling factor	m²K/kW	0.000
Type of connections		[H] - Grooved coupling with weld end counter-pipe user side
Diameter of connections		8"
Min flow	l/s	29.69
Max flow	l/s	75.69
K pressure drop		0.96
Water content	l	400



i-FX-Q2-G05 /CA/S /1102

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 Database version: 1.5.1.0
 User:
 Print data:
 Calculation type: EN 14511 - EN 14825



HEATING

Fluid inlet temperature (heating mode)	°C	40.00
Fluid outlet temperature (heating mode)	°C	45.00
Water flow	l/s	39.94
Pressure drop at the heat exchanger	kPa	19.8
Available unit's head	kPa	0.00

FANS

Fans type		EC FAN
Fans number	N°	20
Fans power input	kW	1.70
F.L.I.	kW	1.780
F.L.A.	A	3

COOLING

Fans number	N°	20
Fans power input	kW	1.70
Air flow	m³/s	111.24
Fan available static pressure	Pa	0

HEATING

Quantity	N°	20
Fans power input	kW	0.85
Air flow	m³/s	86.09
Fan available static pressure	Pa	0

COMPRESSORS

Compressor type		SCREW
Compressors nr.	N°	2
No. Circuits	N°	2
Refrigerant		R513A
Number of capacity steps	N°	0
Min. capacity step	%	
Regulation		STEPLESS
Oil charge	kg	60.0
Refrigerant charge	kg	473
F.L.I. - Max absorbed power	kW	2x200
F.L.A. - Max absorbed current	A	2x321
L.R.A. - Locked rotor amperes for single compressor	A	1xna+1xna

i-FX-Q2-G05 /CA/S /1102

Software version: ELCA World 1.4.1.0
 Database version: 1.5.1.0
 User:
 Print data:
 Calculation type: EN 14511 - EN 14825

HEATING

EC FAN

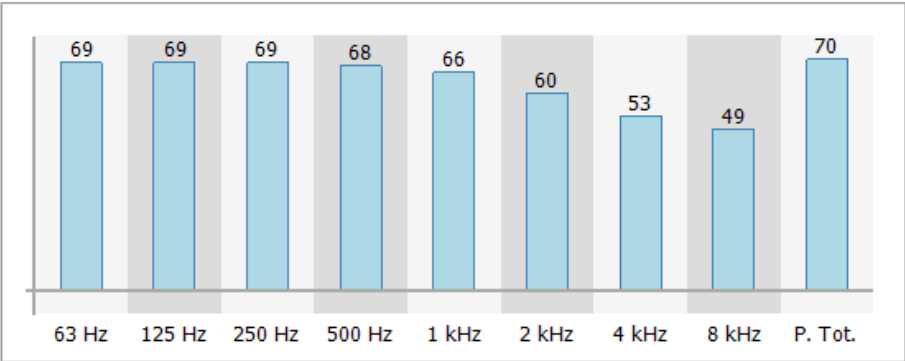
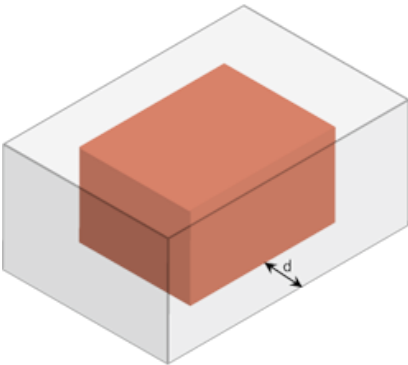
SCREW

R513A

NOISE DATA

SOUND DATA COLD

Frequencies	Hz	63	125	250	500	1000	2000	4000	8000
Sound power (spectrum)	dB	102	102	102	101	99	93	86	82
Sound power level in cooling	dB(A)	103							
Sound pressure level (spectrum)	dB	69	69	69	68	66	60	53	49
Sound Pressure	dB(A)	70							



SOUND DATA OUTDOOR HOT

Sound power level in heating	dB(A)	103
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Note

Distance	m	10
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Note
 Average sound pressure level at 10 m distance, unit in a free field on a reflective surface;
 non-binding value calculated from the sound power level.
 Sound power on the basis of measurements made in compliance with ISO 9614.

i-FX-Q2-G05 /CA/S /1102

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HEATING

EC FAN

SCREW

R R513A

OPERATING LIMITS



ELECTRICAL DATA

Power supply	V/ph/Hz	400/3/50
F.L.I. - Max absorbed power	kW	436.0
F.L.A. - Max absorbed current	A	699
S.A. - Inrush current	A	-

i-FX-Q2-G05 /CA/S /1102

Software version: ELCA World 1.4.1.0
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WEIGHT & DIMENSIONS

A	mm	11900
B	mm	2260
H	mm	2530
Operating weight	kg	14150
R1	mm	2000
R2	mm	2000
R3	mm	1500
R4	mm	1500

