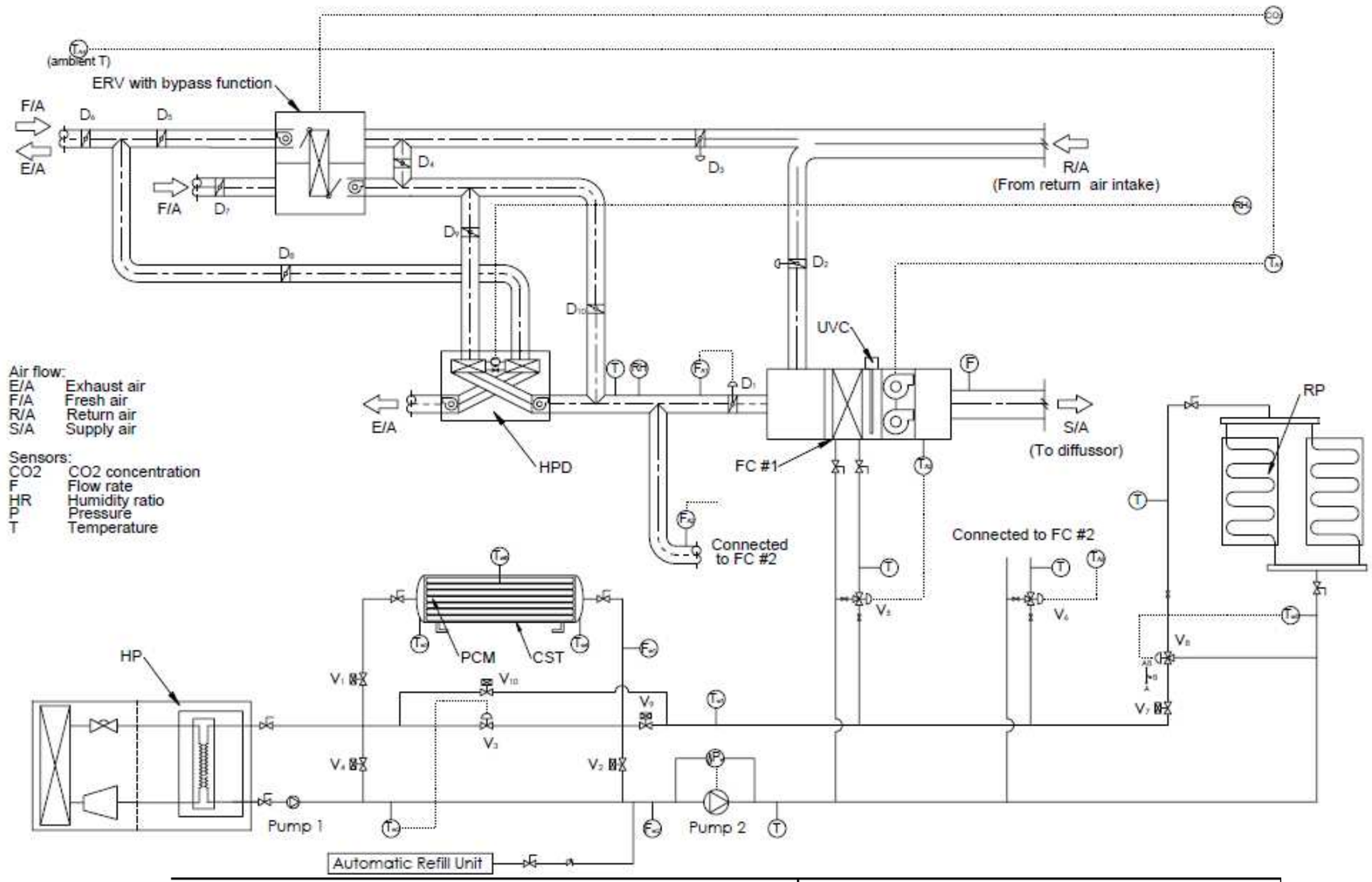

Air flow:
E/A Exhaust air
F/A Fresh air
R/A Return air
S/A Supply air

Sensors:
CO2 CO2 concentration
F Flow rate
HR Humidity ratio
P Pressure
T Temperature

Equipment list

Symbol	Item	Description	Specification	Quantity
CST	Cold storage unit	TubeICE PCM tank	D825mm*1200mm	2
ERV	Enthalpy recovery ventilator	Daikin VAM-350GJVE	350m3/h	1
FC	Chilled water fan coil	Daikin FWC03C	2.9kW (cooling)	1
		Daikin FWC11C	11.14kW (cooling)	1
HPD	Heat pump dehumidifier	Daikin Desica HDMP25D	250m3/h	1
HP	Air to water heat pump	Daikin ERLQ-008CV3	7.4kW	1
		Daikin EHBX08C3V		1
PCM	Phase change material	PCM E8 TubeICE	D50mm*1000mm	338
RP	Radiant panel	B!klimax radiant panel	1220mm*600mm	4
UVC	UVC emitter	Steril-Aire UVC emitter	24" and 42"	2

Other system components

Symbol	Item	Specification	Quantity
	Pump	GrUNdfos MAGNA	2
	Ball valve	Reece	17
	On/off ball valve	Siemens	6
	Modulating valve	Siemens	1
	3-wary modulating valve	Siemens	3
	Balance valve	-	5
	Variable damper	Holyoake	5
	Damper	Holyoake	7

* See detail list of HVAC equipment for more information

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HVAC DISTRIBUTION SCHEMATIC

ME-001

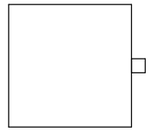
MECHANICAL ABBREVIATIONS

CST	COLD STORAGE TANK
ERV	ENERGY RECOVERY VENTILATOR
FCU	FAN COIL UNIT
HPD	HEAT PUMP DEHUMIDIFIER
HP	HEAT PUMP
PCM	PHASE CHANGE MATERIAL
RPB	RADIANT PANEL BOARD
RPM	RADIANT PANEL MANIFOLD
WP	WATER PUMP
SP	SUPPLY PLENUM
RP	RETURN PLENUM
DP	DIFFUSER PLENUM
SG	SUPPLY GRILLE
IG	INTAKE GRILLE
EG	EXHAUST GRILLE
RG	RETURN GRILLE
CD	CEILING DIFFUSER
E/A	EXHAUST AIR
R/A	RETURN AIR
F/A	FRESH AIR
S/A	SUPPLY AIR
MAP	MAINTANACE ACCESS PANELS
HCB	HVAC CONTROLLER BOARD
HCP	HVAC CONTROL POWER (230V/24V AC TRANSFORMER)

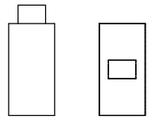
Mechanical Legends

1 : 1

MECHANICAL SYMBOLS



RECTANGULAR VOLUME CONTROL DAMPER



ROUND VOLUME CONTROL DAMPER

GLOBE VALVE

3-WAY VALVE

Mechanical Symbols

1 : 20

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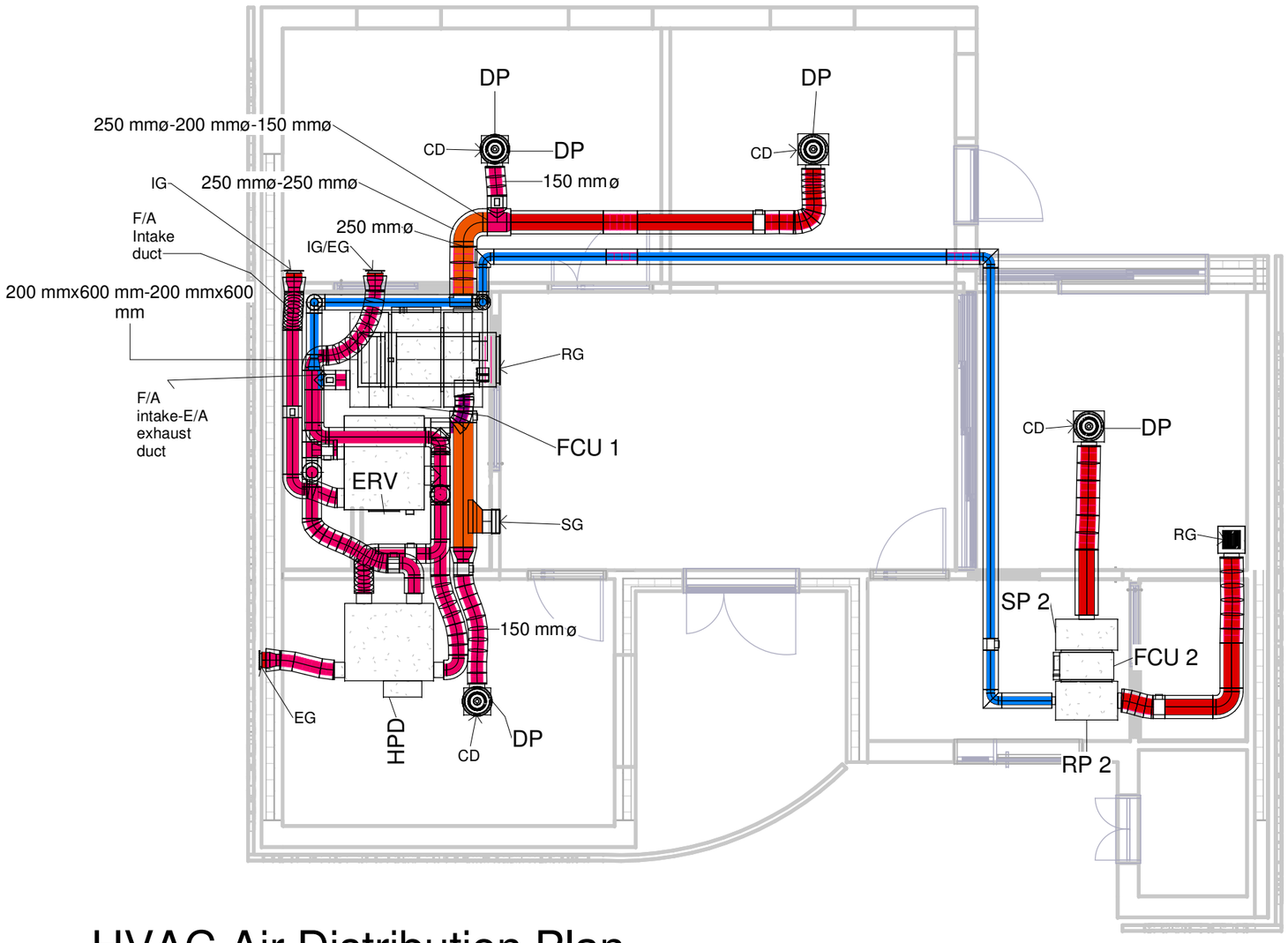
MECHANICAL LEGENDS

ME-002

NOTES:

1. ALL RIGID AND FLEXIBLE DUCTS HAVE 50MM THICK INSULATION
2. FCU 1, SP 1 AND RP 1 ARE PLACED ON THE BATHROOM CEILING UNDER THE RECTANGULAR RIGID DUCT CONNECT TO THE RETURN AIR GRILLE (RG)
3. ALL ROUND DUCTS OF CERTAIN DIAMETER FILLED WITH SAME COLOUR



VISUAL SCALE 1:70 @ A3

0m 1.4m 2.8m 4.2m 5.6m 7m

1 HVAC Air Distribution Plan

1 : 70

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NORTH

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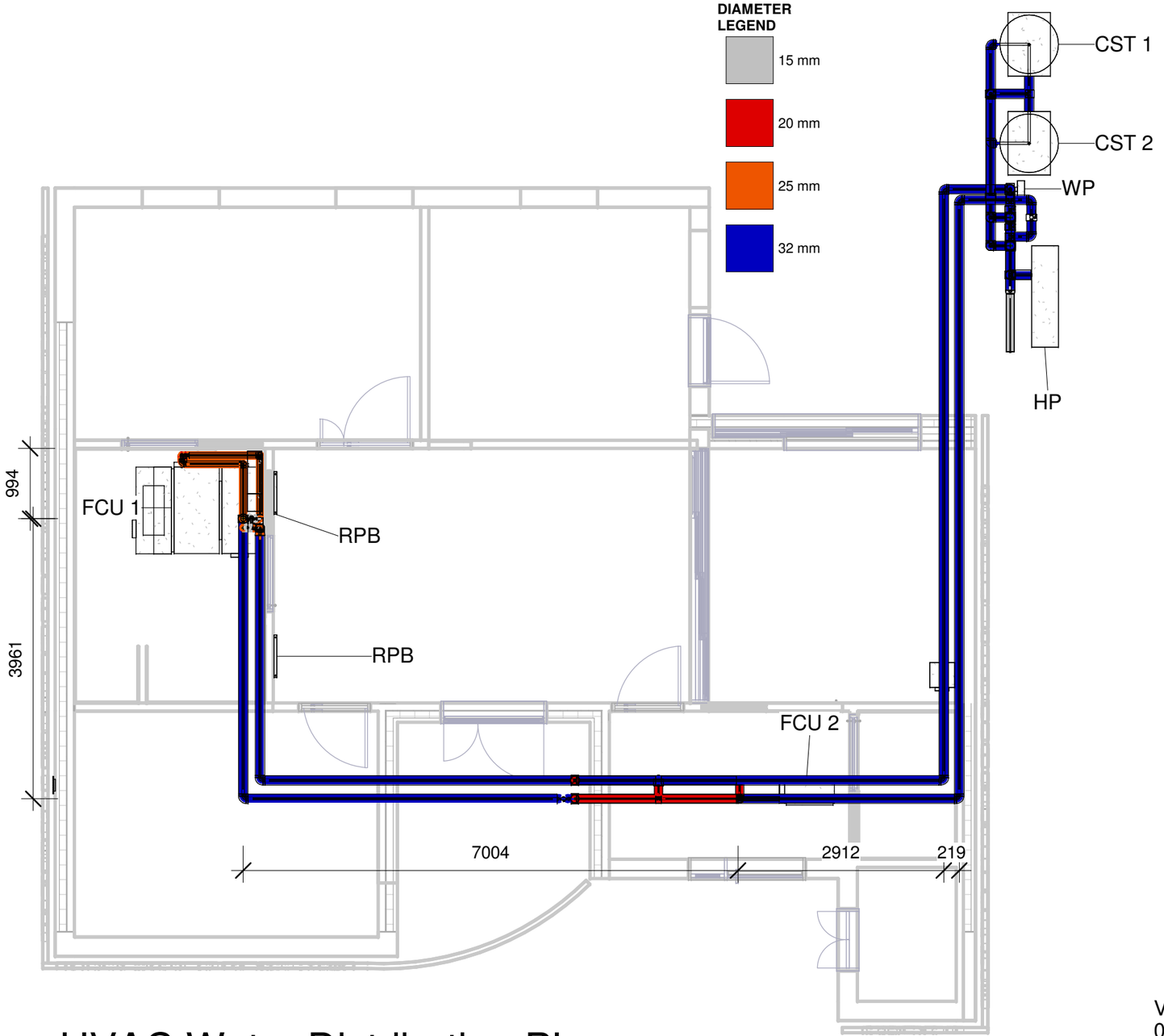
HVAC AIR DISTRIBUTION PLAN

ME-003

PIPE DIAMETER LEGEND

- 15 mm
- 20 mm
- 25 mm
- 32 mm



Notes:

1. All pipes have 50mm thick insulation
2. HP Indoor Unit is placed in the bathroom enclosed in the cupboard
3. Pipes from FCU1, FCU2, HP Indoor Unit are brought down beside the walls and run under the house to connect to the CST and HP Outdoor Unit

VISUAL SCALE 1:70 @ A3

0m 1.4m 2.8m 4.2m 5.6m 7m

1 HVAC Water Distribution Plan

1 : 70

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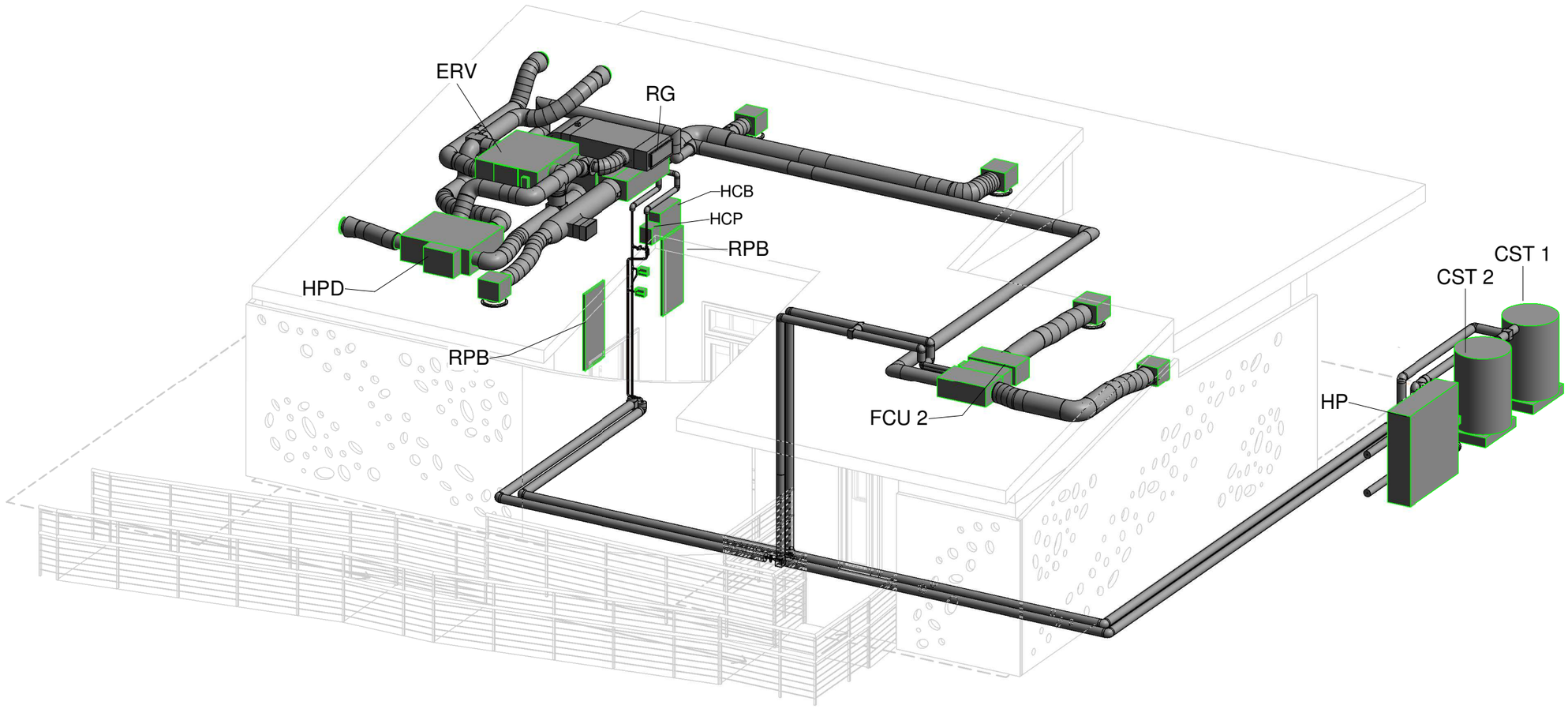
HVAC WATER DISTRIBUTION PLAN

ME-004



HVAC System Isometric View

1

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HVAC SYSTEM ISOMETRIC VIEW

ME-005

AIR-TO-WATER HEAT PUMP **(HP)**

The air-to-water heat pump selected for the HVAC system of Desert Rose is Daikin Altherma EBHQ-BB6V3, as shown in Figure 7. The selected heat pump has a nominal cooling and heating capacities of 12.85 kW and 11.2 kW, the corresponding EER/COP are 3.32 and 4.38, respectively. At design condition (*i.e.* Ta 41.8oC, LWE 13oC), the cooling capacity is 10.23 kW with a EER of 2.58. Refer to Table 1 for details of EBHQ-BB6V3.

Table 1 Detail information for the air-to-water heat pump

Item		Value
Capacity and power input		
Heating capacity (kW)	Nominal	11.20 (1) /10.87 (2)
Cooling capacity (kW)	Nominal	12.85 (1) / 10.00 (2)
Heating power input (kW)	Nominal	3.87 (1) / 3.69 (2)
Cooling power input (kW)	Nominal	2.56 (1) / 3.31 (2)
COP	Nominal	4.38 (1) / 3.28 (2)
EER	Nominal	3.32 (1) / 2.71 (2)
Water flow rate		
Water flow rate (L/min)	Minimal	16
	Maximal	58
Electrical characteristics		
Power supply - outdoor unit	Phase	1~
	Frequency (Hz)	50
	Voltage (V)	230
Power supply - indoor unit	Phase	1~
	Frequency (Hz)	50
	Voltage (V)	230
Dimension and weight		
Dimension (mm)	Height	1418
	Width	1435
	Depth	382
Weight (kg)		180

Figure: The air-to-water heat pump: Daikin Altherma low temperature split

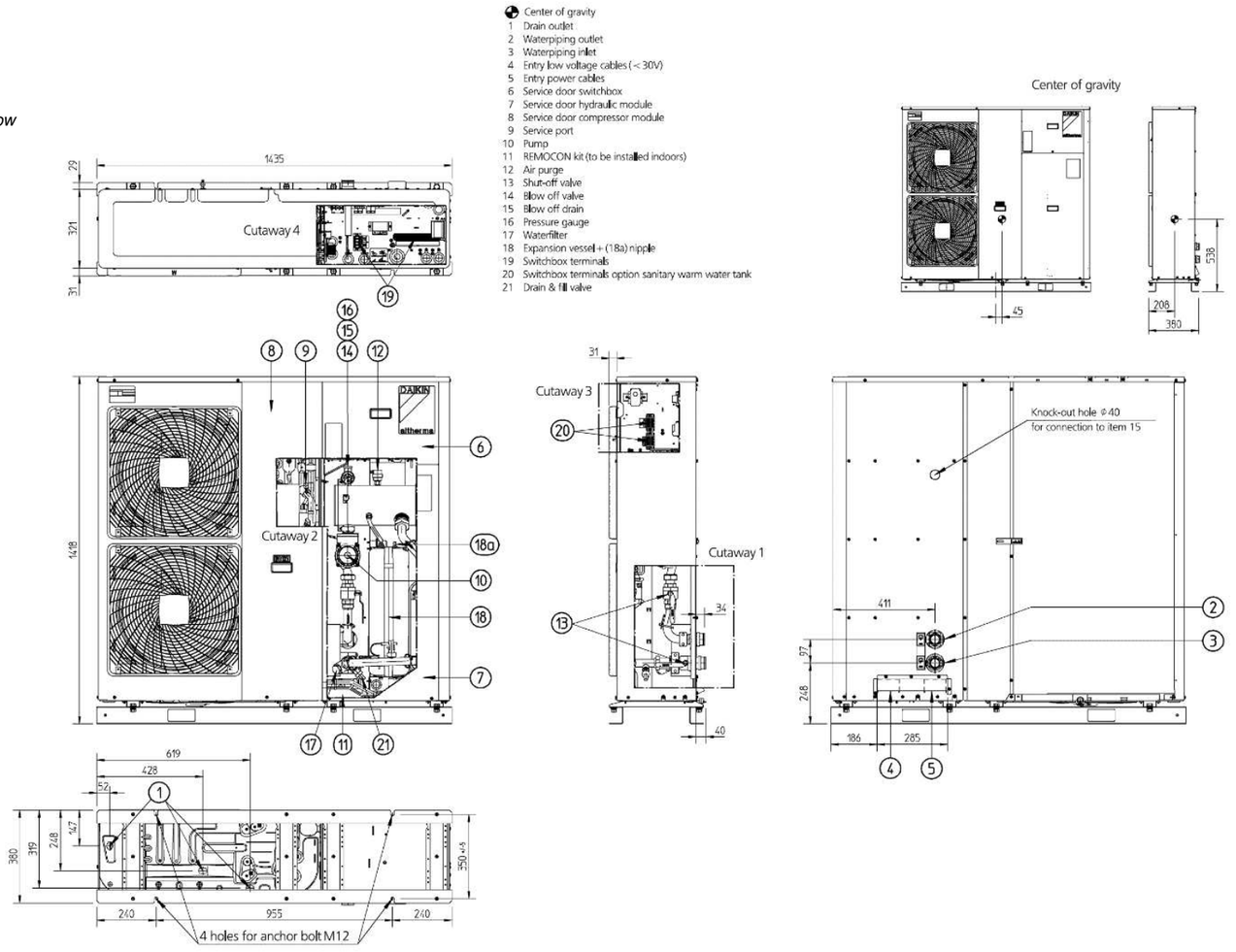

Figure The dimension and installation requirement of the air-to-water heat pump

Notes

(1) Condition 1: cooling Ta 35oC-LWE 18oC (DT=5oC); heating Ta DB /WB 7oC/6oC-LWC 35oC (DT=5oC)
(2) Condition 1: cooling Ta 35oC-LWE 7oC (DT=5oC); heating Ta DB /WB 7oC/6oC-LWC 45oC (DT=5oC)
Design condition: cooling Ta 41.8oC-LWE 13oC

Nomenclature

COP	Coefficient of performance
DB	Dry bulb temperature
EER	Energy efficiency ratio
WB	Wet bulb temperature
LWE	Leaving water evaporator
LWC	Leaving water condenser
Ta	Ambient temperature

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HVAC EQUIPMENT AND DETAILS

ME-011

HEAT PUMP DEHUMIDIFIER-DESICA **(HPD)**

THE DESICCANT SYSTEM SELECTED FOR THE HVAC SYSTEM OF DESERT ROSE IS DAIKIN DESICA HDMP25D, AS SHOWN IN *FIGURE 3*. THE DESICA RELIES ON A HEAT PUMP WITH THE TWO HEAT EXCHANGERS (I.E. EVAPORATOR AND CONDENSER) COATED WITH DESICCANT MATERIALS TO ACHIEVE EFFICIENT DEHUMIDIFICATION. THE DETAIL DESCRIPTION FOR THE OPERATION MECHANISM OF THE DESICA CAN BE FOUND IN DESICCANT SYSTEM 7-9. THE DIMENSION AND INSTALLATION REQUIREMENTS FOR THE SELECTED HDMP25D ARE SHOWN IN *FIGURE 4*. IT HAS A NOMINAL COOLING AND DEHUMIDIFICATION CAPACITY OF 2.6 KW, IN WHICH THE LATENT CAPACITY FOR DEHUMIDIFICATION IS 2.2 KW, WITH A COP OF 3.77. AT DESIGN CONDITION WITH OUTDOOR AIR TEMPERATURE OF 33.4OC AND HUMIDITY RATIO OF 25.3G/KG, THE TOTAL AND LATENT COOLING AND DEHUMIDIFICATION CAPACITIES CAN REACH 3.21 KW AND 2.77 KW, RESPECTIVELY, WITH A COP OF 4.79. THE DETAIL INFORMATION FOR HDMP25D IS SUMMARISED IN TABLE 2.

FIGURE 3 THE DESICA HDMP25D

TABLE 2 DETAIL INFORMATION FOR THE DESICA

ITEM		VALUE
CAPACITY AND POWER INPUT		
COOLING AND DEHUMIDIFICATION CAPACITY (KW)	TOTAL	2.6
	SENSIBLE	0.4
COOLING AND DEHUMIDIFICATION POWER INPUT (KW)		0.69
HEATING AND HUMIDIFICATION CAPACITY (KW)	TOTAL	3.3
	SENSIBLE	2
HEATING AND HUMIDIFICATION POWER INPUT (KW)		0.82
DESIGN COOLING AND DEHUMIDIFICATION CAPACITY (KW)	TOTAL	3.21
	SENSIBLE	0.44
DESIGN COOLING AND DEHUMIDIFICATION POWER INPUT (KW)		0.67
AIR FLOW RATE M3/H)	NOMINAL	250
EXTERNAL STATIC PRESSURE (PA)	NOMINAL	120
ELECTRICAL CHARACTERISTICS		
POWER SUPPLY	PHASE	1~
	FREQUENCY (HZ)	50/60
	VOLTAGE (V)	220
DIMENSION AND WEIGHT		
DIMENSION (MM)	HEIGHT	398
	WIDTH	1044
	DEPTH	1150
WEIGHT (KG)		130
DUCT CONNECTION (MM)		150

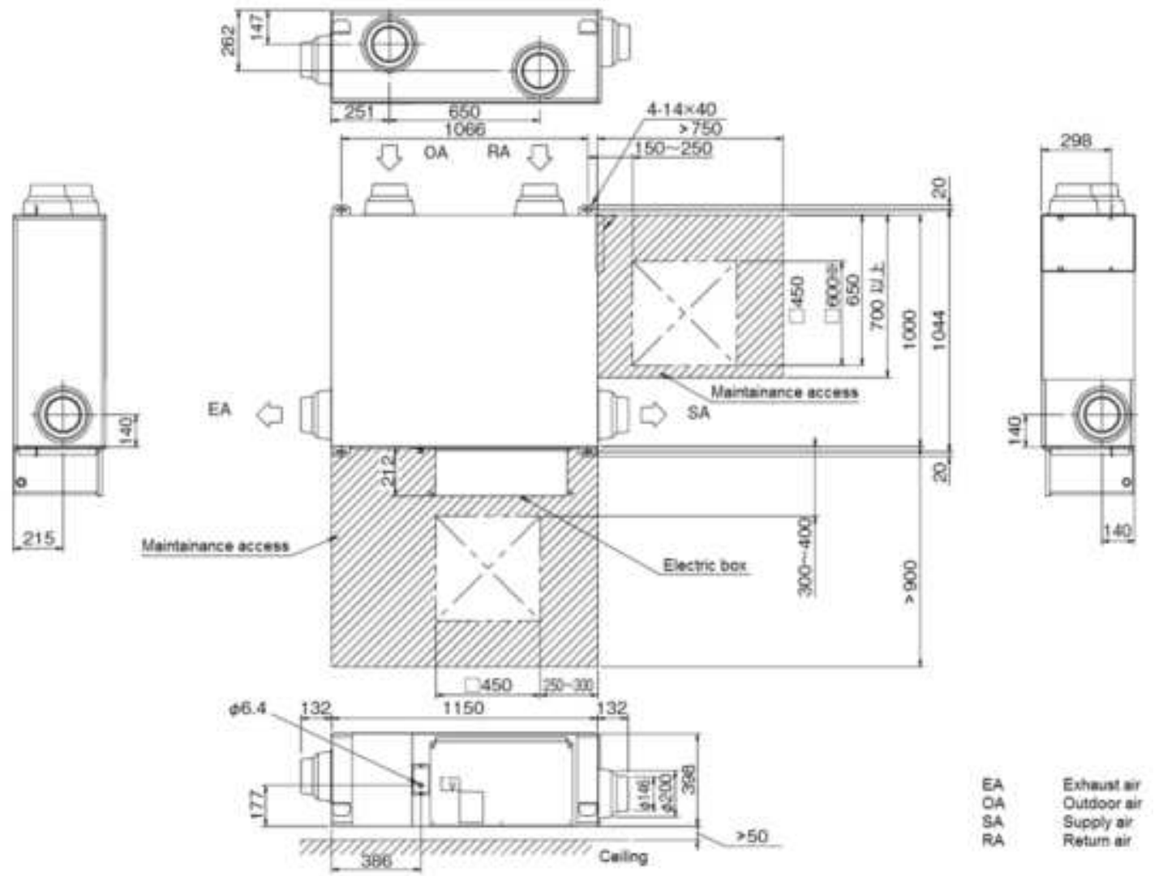

FIGURE 4 THE DIMENSION AND INSTALLATION REQUIREMENT OF THE DESICANT

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HVAC EQUIPMENT AND DETAILS

ME-012

HEAT PUMP DEHUMIDIFIER DESCRIPTION

THE DEHUMIDIFICATION SYSTEM USED IN THE HEATING, VENTILATION AND AIR CONDITIONING SYSTEM OF DESERT ROSE IS A COMMERCIAL HEAT PUMP DESICCANT UNIT (HPD), NAMELY DESICA, FROM DAIKIN (DAIKIN 2017), AS ILLUSTRATED IN FIG. 1. DESICA CONSISTS OF TWO HEAT EXCHANGERS, AN EXPANSION VALVE, A COMPRESSOR, A 4-WAY VALVE, TWO FANS (*I.E.* SUPPLY FAN AND EXHAUST FAN), AND FOUR SWITCH DAMPERS (CORRESPONDING TO FOUR INLETS AND OUTLETS). CORRESPONDING TO THE FOUR SWITCHING DAMPERS, THERE ARE FOUR INLETS AND OUTLET IN DESICA, INCLUDING THE INLETS FOR RETURN AIR (RA) AND OUTDOOR AIR (OA), AND THE OUTLETS FOR SUPPLY AIR (SA) AND EXHAUST AIR (EA). THE HEAT EXCHANGERS, EXPANSION VALVE, COMPRESSOR, AND 4-WAY VALVE FORM HEAT PUMP, WHICH IS DIFFERENT FROM A CONVENTIONAL HEAT PUMP, BECAUSE NOVEL DESICCANT HUMIDIFICATION/DEHUMIDIFICATION HEAT EXCHANGERS WERE USED AS EVAPORATOR AND CONDENSER. THE NOVEL HUMIDIFICATION/DEHUMIDIFICATION HEAT EXCHANGERS WERE MADE BY DIRECTLY COATING SOLID DESICCANT MATERIALS ONTO THE SURFACE OF THE FIN TUBES OF THE HEAT EXCHANGERS (JIANG ET AL. 2017). AS THE MOISTURE CAN BE MORE EFFECTIVELY TRAPPED ON THE DESICCANT MATERIAL WITH LOWER TEMPERATURE (AYNUR ET AL. 2008), THE DESICCANT COATED HEAT EXCHANGER (DCHE) ENABLES THE REMOVAL OF THE ADSORPTION HEAT DURING THE AIR DEHUMIDIFICATION PROCESS WHEN IT SERVES AS AN EVAPORATOR, WHICH SIGNIFICANTLY IMPROVES THE DEHUMIDIFICATION PERFORMANCE (ZHAO ET AL. 2016). THE DESICCANT CAN THEN BE REGENERATED BY USING THE RELEASED HEAT WHEN THE DCHE IS SERVED AS A CONDENSER, WHICH PROVIDES A RELIABLE AND ENERGY-SAVING APPROACH FOR REGENERATION.

DESICA CAN FULFIL THE CONTINUOUS DEHUMIDIFICATION OF OUTDOOR FRESH AIR BY SWAPPING THE TWO DESICCANT COATED HEAT EXCHANGERS (DCHES), AS SHOWN IN FIG.2. AS IT CAN BE SEEN FROM FIG. 2A, THE HOT AND HUMID OUTDOOR AIR CAN BE DRAWN THROUGH DCHE 1 BY SWITCHING ON THE SUPPLY FAN AND DAMPERS D1 AND D2. DCHE 1 SERVING AS THE EVAPORATOR IS COOLED BY THE THROTTLED REFRIGERANT FROM THE EXPANSION VALVE. THE OUTDOOR FRESH AIR PASSING THROUGH DCHE 1 CAN THEREFORE BE DEHUMIDIFIED AND COOLED. AFTERWARDS, THE COOL AND DRY AIR CAN BE SUPPLIED INTO THE INDOOR ENVIRONMENT AS THE SUPPLY AIR. IN THE MEANWHILE, THE RETURN AIR FROM THE INDOOR ENVIRONMENT IS DRAWN THROUGH DCHE2 BY SWITCHING ON THE EXHAUST FAN AND DAMPERS D3 AND D3. DCHE2 WHICH SERVES AS A CONDENSER IS HEATED BY THE COMPRESSED REFRIGERANT FROM THE COMPRESSOR. ONCE THE DESICCANT MATERIAL COATED ON DCHE 2 IS HEATED, THE MOISTURE TRAPPED ON THE DESICCANT SURFACE CAN THEN BE RELEASED AND CARRIED BY THE RETURN AIR PASSING THROUGH IT. AFTERWARDS, THE HUMID AND HOT AIR IS EXHAUSTED TO THE AMBIENT AS EXHAUST AIR.

ONCE THE DESICCANT MATERIAL COATED ON DCHE 2 COMPLETES THE REGENERATION AND THAT ON DCHE 1 CANNOT SATISFY THE DEHUMIDIFICATION REQUIREMENT, THE 4-WAY VALVE IS CONVERTED, SO THAT THE DCHE1 AND DCHE 2 ARE SWAPPED, AS SHOWN IN FIG. 2B. AS A CONSEQUENCE, DCHE 1 SERVES AS A CONDENSER WHICH WILL BE HEATED BY THE COMPRESSED REFRIGERANT FROM COMPRESSOR. THE DESICCANT MATERIAL THEREFORE CAN BE REGENERATED, AND THE HOT AND HUMID AIR CAN BE EXHAUSTED. IN CONTRAST, DCHE 2 SERVES AS AN EVAPORATOR WHICH WILL BE COOLED BY THE THROTTLED REFRIGERANT FROM EXPANSION VALVE. THE HOT AND HUMID OUTDOOR FRESH AIR CAN THEREFORE BE DEHUMIDIFIED AND COOLED, AND THEN SUPPLIED INTO THE INDOOR ENVIRONMENT. BY SWAPPING THE TWO HEAT EXCHANGERS PERIODICALLY, THE CONTINUOUS DEHUMIDIFICATION OF THE OUTDOOR FRESH AIR CAN BE ACHIEVED.

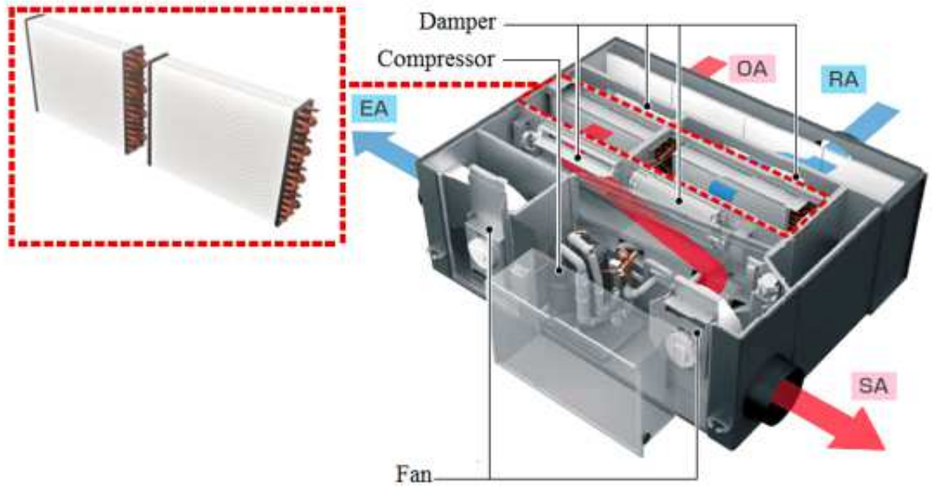

Fig. Schematic of the heat pump desiccant unit - Desica (SA-supply air, OA-outdoor air, RA-return air, EA-exhaust air) (Daikin 2017).

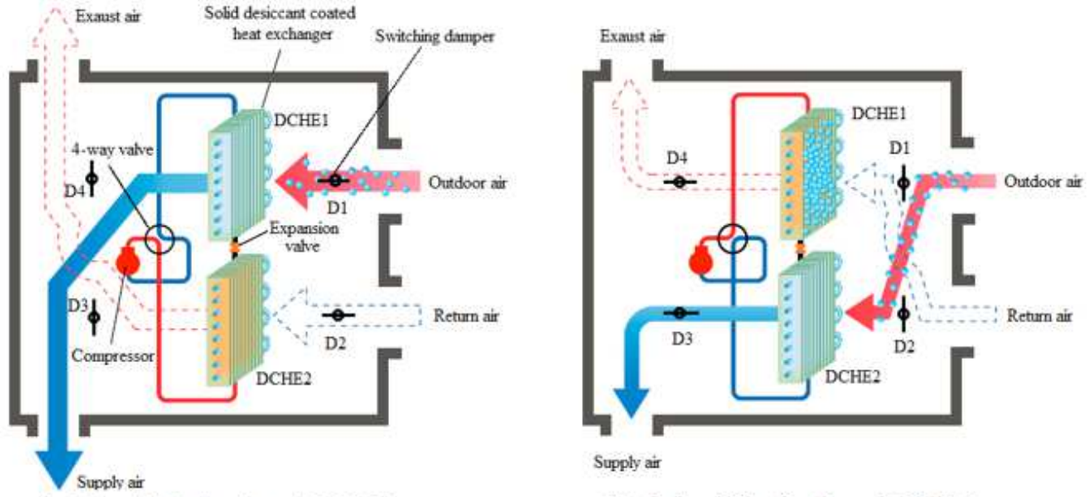

Fig. 2 The operation of the desiccant system (D- switching damper; DCHE - desiccant coated heat exchanger).

REFERENCE

AYNUR T.N., HWANG Y.H. AND RADERMACHER R. 2008, 'FIELD PERFORMANCE MEASUREMENTS OF A HEAT PUMP DESICCANT UNIT IN DEHUMIDIFICATION MODE', ENERGY AND BUILDINGS, 40, PP.2141-2147.

DAIKIN 2017, HYPERLINK "http://www.Daikin.com" WWW.DAIKIN.COM, <ACCESSED AT 25/08/2017>.

JIANG Y., GE T. S. AND WANG R.Z., PERFORMANCE SIMULATION OF A NOVEL SOLID DESICCANT HEAT PUMP SYSTEM IN ENERGYPLUS, AVAILABLE AT HYPERLINK "http://www.ibpsa.org/proceedings/asim2012/0103.pdf" WWW.IBPSA.ORG/PROCEEDINGS/ASIM2012/0103.PDF, <ACCESSED AT 10/09/09>.

ZHAO Y., DAIA Y.J., GE T.S., WANG H.H. AND WANG R.Z. 2016, 'A HIGH PERFORMANCE DESICCANT DEHUMIDIFICATION UNIT USING SOLID DESICCANT COATED HEAT EXCHANGER WITH HEAT RECOVERY', ENERGY AND BUILDINGS, VOL.116 , PP583-592.

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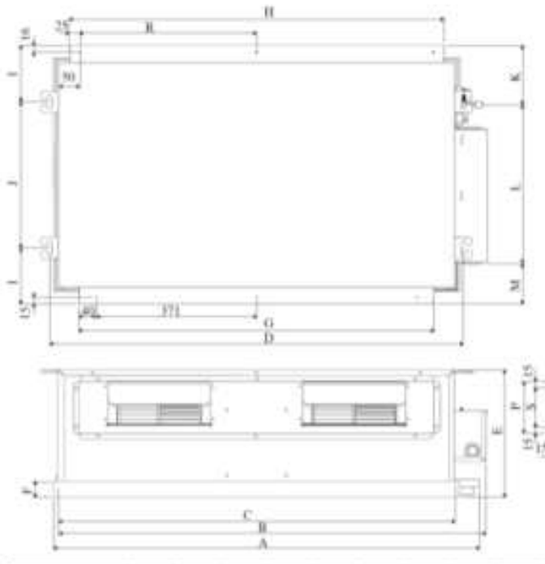
HVAC EQUIPMENT AND DETAILS

ME-013

FAN COIL UNIT (FCU)

THE FAN COILS SELECTED FOR THE HVAC SYSTEM OF DESERT ROSE IS DAIKIN CHILLED WATER FAN COILS: FWC11C AND FWC03C. *FIGURE 7* AND *FIGURE 8* SHOW AN EXAMPLE OF THE FAN COILS AND THE DIMENSIONS OF THE FWC11C AND FWC03C. TWO FAN COILS ARE SELECTED IN ORDER TO OPTIMISE THE AIR DISTRIBUTION OF THE HVAC SYSTEM WITH CONSIDERING THE AVAILABLE ROOF SPACE FOR SYSTEM INSTALLATION, SO AS TO REDUCE THE PRESSURE DROP AND HEAT LOSS. THE TOTAL NOMINAL CAPACITY OF THE TWO FAN COILS ARE 11.14 KW AND 2.9 KW, RESPECTIVELY. THEY ARE OVERSIZED AS THE CHILLED WATER TEMPERATURE WILL BE IMPROVED FROM 7OC TO 13OC TO AVOID CONDENSATION IN THE FAN COILS, SO THAT THEY ONLY COVER THE INDOOR SENSIBLE COOLING LOAD, WHICH WILL IMPROVE THE EFFICIENCY OF THE AIR-TO-WATER HEAT PUMP. TABLE 4 SUMMARISES THE DETAIL INFORMATION OF THE TWO FAN COILS.

FIGURE 7 THE CHILLED WATER FAN COIL



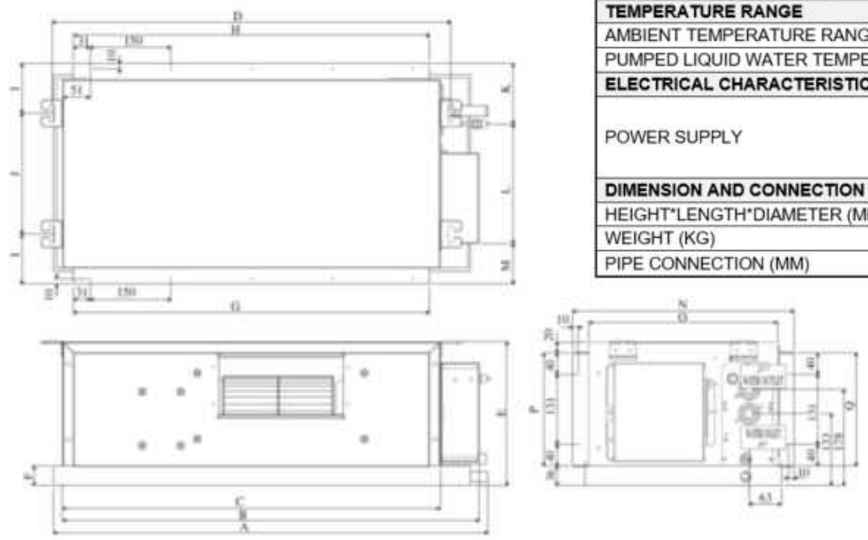
Model \ Dimension	A	B	C	D	E	F	G	H	I	J	K	L
FWC11C	1292	1297	1225	1264	316	36	824	1174	119	401	147	394

Model \ Dimension	M	N	O	P	Q	R	S	T	U	V	W
FWC11C	97	638	559	186	233	563	156	148	97	149	51

A) FAN COIL FWC11C

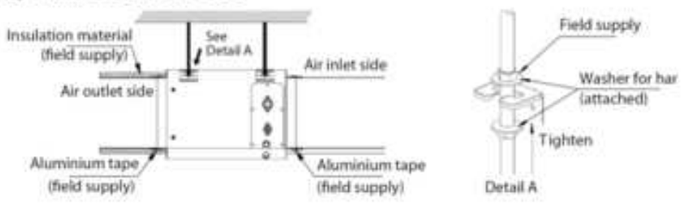
TABLE 5 DETAIL INFORMATION FOR THE PUMPS

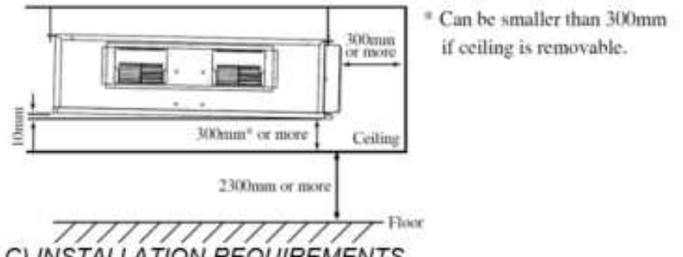
ITEM		VALUE
CAPACITY AND POWER INPUT RANGE		
WATER FLOW RAGE RANGE (L/S)		0-6
PRESSURE DIFFERENCE RANGE (KPA)		0-115
INPUT POWER RANGE (KW)		0.015-0.345
TEMPERATURE RANGE		
AMBIENT TEMPERATURE RANGE (OC)		0-40
PUMPED LIQUID WATER TEMPERATURE RANGE (OC)		-10-110
ELECTRICAL CHARACTERISTICS		
POWER SUPPLY	PHASE	1~
	FREQUENCY (HZ)	50
	VOLTAGE (V)	230
DIMENSION AND CONNECTION		
HEIGHT*LENGTH*DIAMETER (MM)		366*220*140
WEIGHT (KG)		15.3
PIPE CONNECTION (MM)		32



Model \ Dimension	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
FWC03C	606	774	702	741	267	36	662	662	93	225	115	218	76	411	361	211	211

B) FAN COIL FWC03C





* Can be smaller than 300mm if ceiling is removable.

C) INSTALLATION REQUIREMENTS

FIGURE 8 THE DIMENSION AND INSTALLATION REQUIREMENTS OF THE FAN COILS

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HVAC EQUIPMENT AND DETAILS

ME-014

PUMP (WP)

The pump selected for Pump 2 in the HVAC system is Stratos-Z 30/1-12 from Wilo, as shown in *Figure 9*. A constant pressure control mode is available for the selected variable speed pump, through which the pump frequency will be adjusted to maintain a constant pressure difference. With its flexibility, the pump therefore can be applied in different war, the pump can be applied to different water circuits. The pump dimension and installation requirements are shown in *Figure 10*, while the details are summarised in *Table below:*

Figure The variable speed pump

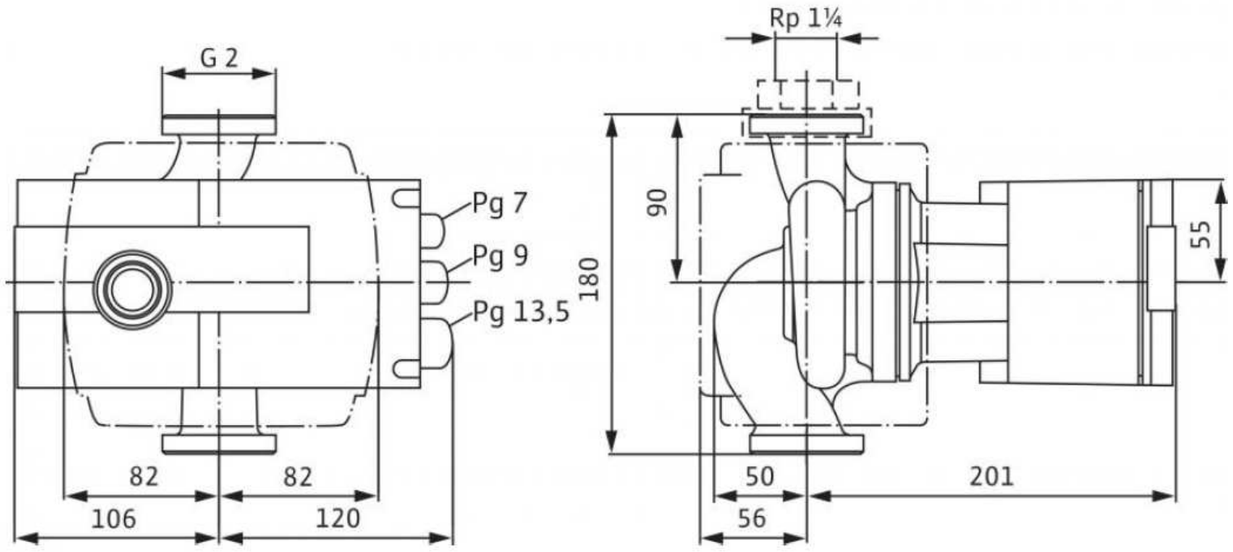

Figure The dimension and installation requirements of the pump

Table 5 Detail information for the pumps

Item		Value
Capacity and power input range		
Max water flow rage range (m3/h)		12
Maximal delivery head (m)		12.5
Input power range (kW)		0.012-0.30
Temperature range		
Ambient temperature range (°C)		0-40
Pumped liquid water temperature range (°C)		-10-110
Electrical characteristics		
Power supply	Phase	1~
	Frequency (Hz)	50/60
	Voltage (V)	230
Dimension and connection		
Width*Length*Deep (mm)		226*180*251
Weight (kg)		6
Pipe connection (mm)		32 G2 thread

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HVAC EQUIPMENT AND DETAILS

ME-015

RADIANT PANELS **(RPB)**

THE RADIANT PANELS SELECTED FOR THE HVAC SYSTEM OF DESERT ROSE ARE RADIANT HEATING AND COOLING SOLUTIONS B!KLIMAX+ RADIANT PANELS, AS SHOWN IN *FIGURE 11*. THE SELECTED B!KLIMAX+ RADIANT PANELS ARE MADE UP OF 12.5-MM THICK PLASTERBOARD AND 40 MM OF MOULDED POLYSTYRENE OF 2.88 M² (1200 MM * 2400 MM). EACH PIECE OF RADIANT PANEL HAS 4 HYDRAULIC CIRCUITS OF PB PIPE OF 6 MM (DIAMETER), WHICH CAN BE FURTHER CUT INTO 4 SUB-PANELS TO SUIT SMALL AREA APPLICATION. THE UNIT WEIGHT OF THE RADIANT PANEL IS 29.4 KG/M2.

FIGURE 11 THE RADIANT PANELS

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HVAC EQUIPMENT AND DETAILS

ME-016

PCM THERMAL ENERGY STORAGE (CST)

THE PHASE CHANGE MATERIAL SELECTED FOR THE HVAC SYSTEM OF DESERT ROSE IS PCM PRODUCT E8, WHICH IS A TYPE OF INORGANIC SALT HYDRATE WITH A NOMINAL MELTING TEMPERATURE OF 10OC. IT IS ENCAPSULATED IN TO HDPE TUBES, AND THEREFORE BOAST FOR EASY INSTALLATION, AS SHOWN IN *FIGURE 12A*. TWO PCM THERMAL ENERGY STORAGE TANK WAS DESIGNED AND FABRICATED TO HOLD THE PCM TUBES AND PROVIDE THE HEAT TRANSFER BETWEEN THE PCM AND WATER, AS SHOWN IN *FIGURE 12A*. TWO PCM TANKS WILL BE USED, WITH 338 PCM TUBES IN TOTAL. THE DETAIL INFORMATION OF THE PCM IS SUMMARISED IN *TABLE 6*, WHILE THE DETAILS FOR THE PCM TANKS CAN BE FOUND IN CORRESPONDING ENGINEERING DRAWINGS.

TABLE 6 DETAIL INFORMATION FOR THE PCM

ITEM	VALUE
PCM E8 AND PCM TUBE	
PHASE CHANGE TEMPERATURE (OC)	10
NOMINAL HEAT STORAGE CAPACITY (KWH)	0.099
WEIGHT (KG)	2.6
HEIGHT*DIAMETER (MM)	1000*50
PCM TANK	
HEIGHT*DIAMETER (MM)	1200*825
INSULATION THICKNESS (MM)	50
NUMBER OF PCM TUBES	169*2

A) PCM E8 ENCAPSULATED IN HDPE TUBES *B) PCM TANK DESIGN*

FIGURE 12 THE PCM E10 ENCAPSULATED IN HDPE TUBES AND PCM TANK DESIGN

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HVAC EQUIPMENT AND DETAILS

ME-017

ENTHALPY RECOVERY VENTILATOR (ERV)

THE ENTHALPY RECOVERY VENTILATOR SELECTED FOR THE HVAC SYSTEM OF DESERT ROSE IS DAIKIN VAM350GJVE, AS SHOWN IN *FIGURE 5*. *FIGURE 6* PROVIDES THE DETAIL DIMENSION AND INSTALLATION REQUIREMENT OF THE ERV. THE VAM-GJ ERV BOAST FOR ITS HIGH EFFICIENT TOTAL AND SENSIBLE HEAT RECOVERY EFFICIENCIES OF AROUND 70% AND 80%, RESPECTIVELY, BY USING A THIN FILE ENTHALPY EXCHANGER ELEMENT. THE NOMINAL FLOW RATE OF VAM350GJVE IS 350M3/H, WHICH IS OVERSIZED FOR A HOUSE WITH 2 PEOPLE, BUT IS ABLE TO SUPPLY ENOUGH FRESH AIR TO MAINTAIN A SUITABLE INDOOR CO2 CONCENTRATION RIGHT BELOW 800 PPM DURING A DINNER PARTY WITH 8 PEOPLE. THE DETAIL INFORMATION OF THE VAM350GJVE WAS SUMMARISED IN *TABLE 3*.

FIGURE 5 THE ENTHALPY RECOVERY VENTILATOR

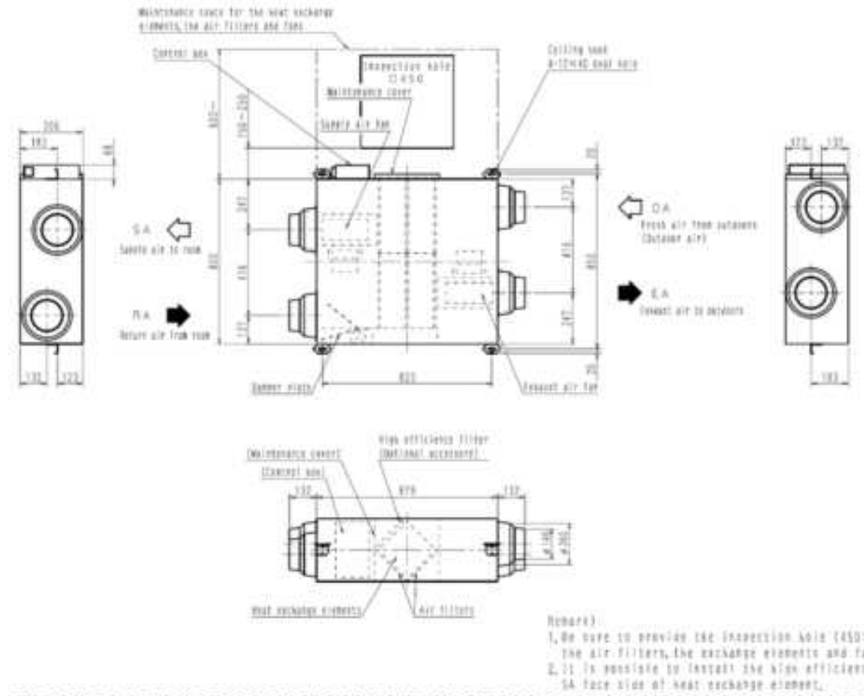

FIGURE 6 THE DIMENSION AND INSTALLATION REQUIREMENT OF THE ERV

TABLE 3 DETAIL INFORMATION FOR THE ERV

ITEM		VALUE
EFFICIENCY AND POWER INPUT		
TEMPERATURE EXCHANGE EFFICIENCY (%)	ULTRA-HIGH	79
	HIGH	79
	LOW	82
ENTHALPY EXCHANGE EFFICIENCY WHEN COOLING (%)	ULTRA-HIGH	66
	HIGH	66
	LOW	70
ENTHALPY EXCHANGE EFFICIENCY WHEN HEATING (%)	ULTRA-HIGH	70
	HIGH	70
	LOW	77
POWER INPUTS UNDER 50HZ/60HZ (KW)	ULTRA-HIGH	0.2/0.226
	HIGH	0.182/0.211
	LOW	0.122/0.12
ELECTRICAL CHARACTERISTICS		
POWER SUPPLY	PHASE	1~
	FREQUENCY (HZ)	50/60
	VOLTAGE (V)	220-240
AIR FLOW RATE AND PRESSURE		
AIR FLOW RATE (M3/H)	ULTRA-HIGH	350
	HIGH	350
	LOW	230
EXTERNAL STATIC PRESSURE UNDER 50HZ/60HZ (PA)	ULTRA-HIGH	169/222
	HIGH	141/145
	LOW	67/30
DIMENSION AND WEIGHT		
DIMENSION (MM)	HEIGHT	306
	WIDTH	879
	DEPTH	800
WEIGHT (KG)		32
DUCT CONNECTION (MM)		150

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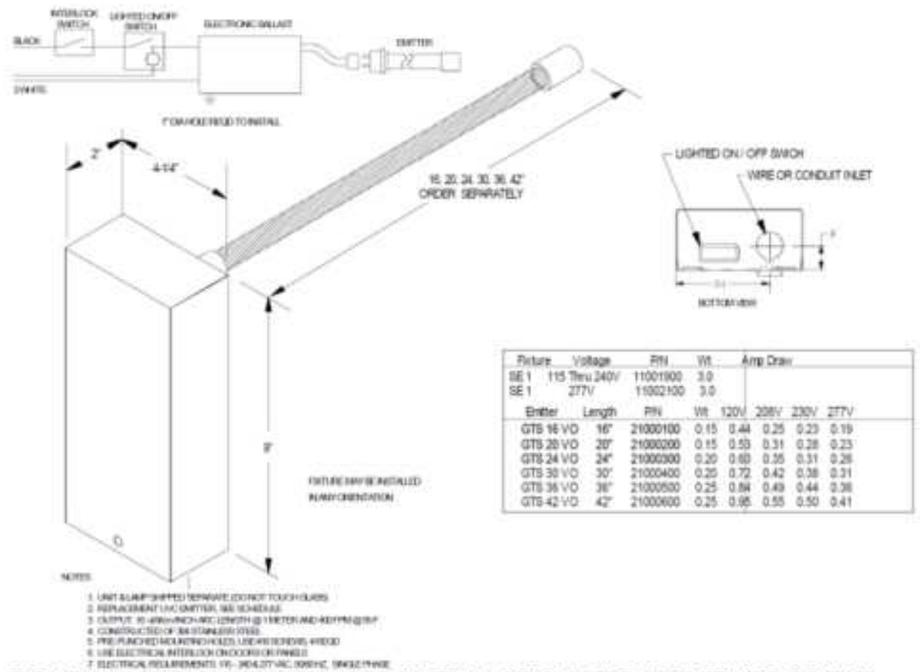
HVAC EQUIPMENT AND DETAILS

ME-018

UV EMITTER

TO ENSURE A HEALTHY INDOOR ENVIRONMENT, THE UVC EMITTERS FROM STERIL-AIRE ARE SELECTED AND INSTALLED IN THE FAN COILS OF HVAC SYSTEM FOR DESERT ROSE, AS SHOWN IN *FIGURE 15*. THE UVC EMITTERS CAN PROVID UVC IRRADIATION TO INACTIVATE THE MOULD, BACTERIA AND VIRUSES TO BE GROW ON THE SURFACE OF FAN COILS DUE TO CONDENSATION. TWO STANDARD UVC EMITTERS WITH THE LENGTH OF 24''AND 42'' WILL BE USED FOR THE TWO FAN COILSAND THE CORRESPONDING POWER INPUT ARE ONLY 0.072 KW AND 0.1 KW, RESPECTIVELY. *FIGURE 16* SHOWS THE DIMENSION AND INSTALLATION REQUIREMENTS OF THE UVC EMITTER.

FIGURE 15 THE PCM E10 ENCAPSULATED IN HDPE TUBES



Fixture	Voltage	PIN	Wt	Amp Draw
SE 1	115 Thru 240V	11001900	3.0	
SE 1	277V	11002100	3.0	

Emitter	Length	PIN	Wt	120V	208V	230V	277V
GTS 16 VO	16"	21000100	0.15	0.44	0.25	0.23	0.19
GTS 20 VO	20"	21000200	0.15	0.53	0.31	0.28	0.23
GTS 24 VO	24"	21000300	0.20	0.60	0.35	0.31	0.26
GTS 30 VO	30"	21000400	0.25	0.72	0.42	0.38	0.31
GTS 36 VO	36"	21000500	0.25	0.84	0.49	0.44	0.36
GTS 42 VO	42"	21000600	0.25	0.95	0.55	0.50	0.41

FIGURE 16 THE DIMENSION AND INSTALLATION REQUIREMENTS OF THE PCM TUBE AND PCM TANK

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HVAC EQUIPMENT AND DETAILS

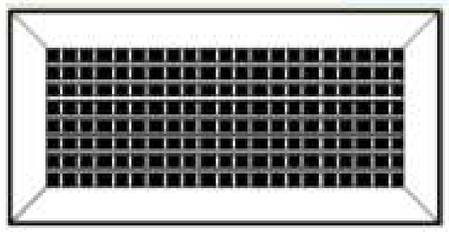
ME-019

DIFFUSERS, RETURN AIR GRILLES AND WEATHERPROOF GRILLES

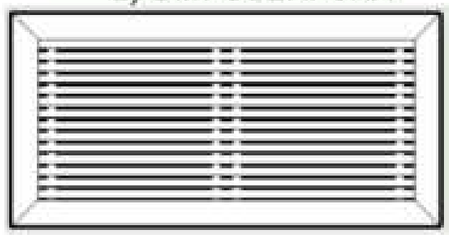
TO DISTRIBUTE THE SUPPLY AIR EFFECTIVELY INTO THE AIR-CONDITIONED SPACE, THREE TYPES OF DIFFUSERS ARE USED IN DIFFERENT ZONES TO MATCH DIFFERENT AIR DISTRIBUTION REQUIREMENT AND ENSURE AN ACCEPTABLE INDOOR AIR FLOW ORGANISATION. TWO RETURN AIR GRILLS ARE USED CORRESPONDING TO THE TWO FAN COILS IN THE HVAC AIR DISTRIBUTION SYSTEM. THE DIFFUSERS AND RETURN AIR GRILLES ARE SUMMARIZED IN *TABLE 8*.

A) DIFFUSER: CFPP-R 400

B) DIFFUSER: CRA



C) DDL-20



D) RETURN AIR GRILLES

FIGURE 17 THE THREE TYPES OF DIFFUSERS AND TWO RETURN AIR GRILLES SELECTED

TABLE 8 DETAIL INFORMATION FOR THE DIFFUSERS AND RETURN AIR GRILLES

ITEMS	DIFFUSERS			RETURN AIR GRILLE	
LOCATION	BEDROOM AND OFFICE	KITCHEN AND LIVING ROOM	DINING ROOM	DINING ROOM	LIVING ROOM
TYPE	CFPP-R40	CRA	DDL-20	RLHL	RLHL
SIZE: DIAMETER OR WEIGHT*HEIGHT (MM)	400	387	300*200	600*200	300*200
CORRESPONDING DUCT SIZE (MM)	200	200	250	200	200
FLOW RATE (L/S)	50	75	75	250	75

WEATHERPROOF GRILLES INTERFACE BETWEEN THE HOUSE AND THE AMBIENT ARE USED TO EXHAUST THE INDOOR AIR, AND INTAKE OF FRESH AIR. ALL THE WEATHERPROOF GRILLES ARE THE SAME SIZE OF 200 MM*150 MM AND HAVE 150 MM (DIAMETER) SPIGOTS FOR THE CONNECTION OF AIR DISTRIBUTION SYSTEM.

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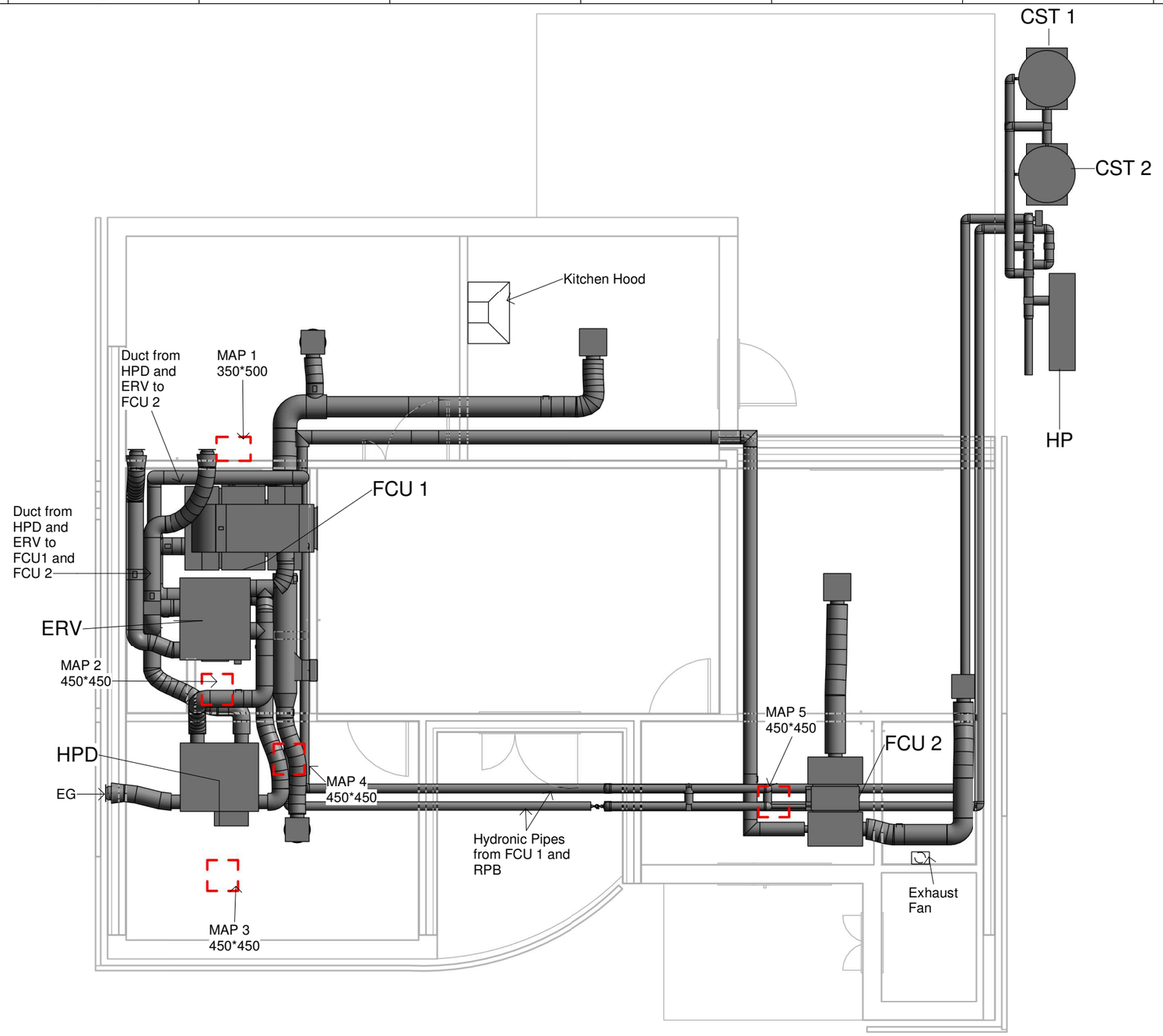
HVAC EQUIPMENT AND DETAILS

ME-020



NOTES:

1. FCU1, FCU2, ERV, HPD ARE PLACED ABOVE THE CEILING. THEY WILL BE STRAPPED FROM THE ROOF.
2. CST AND HP IS PLACED ON THE GROUND.

Mechanical Rooms Plan

1 : 70

VISUAL SCALE 1:70 @ A3

0m 1.4m 2.8m 4.2m 5.6m 7m

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SCALE	1 : 70 @ A3

NORTH

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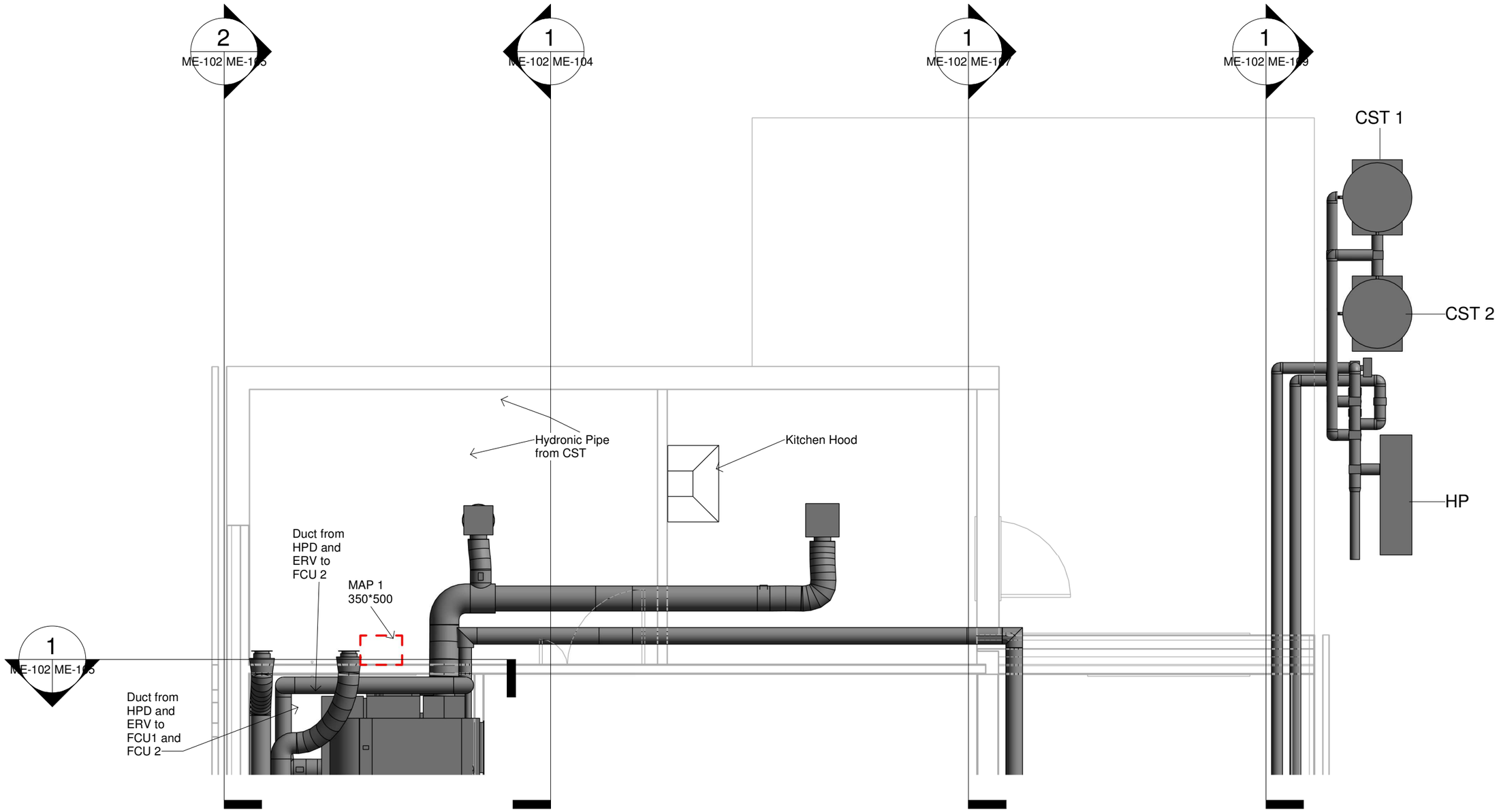
MECHANICAL ROOMS PLAN

ME-101



1 Mechanical Rooms Plan (Split 1)

1 : 50

VISUAL SCALE 1:50 @ A3

0m 1m 2m 3m 4m 5m

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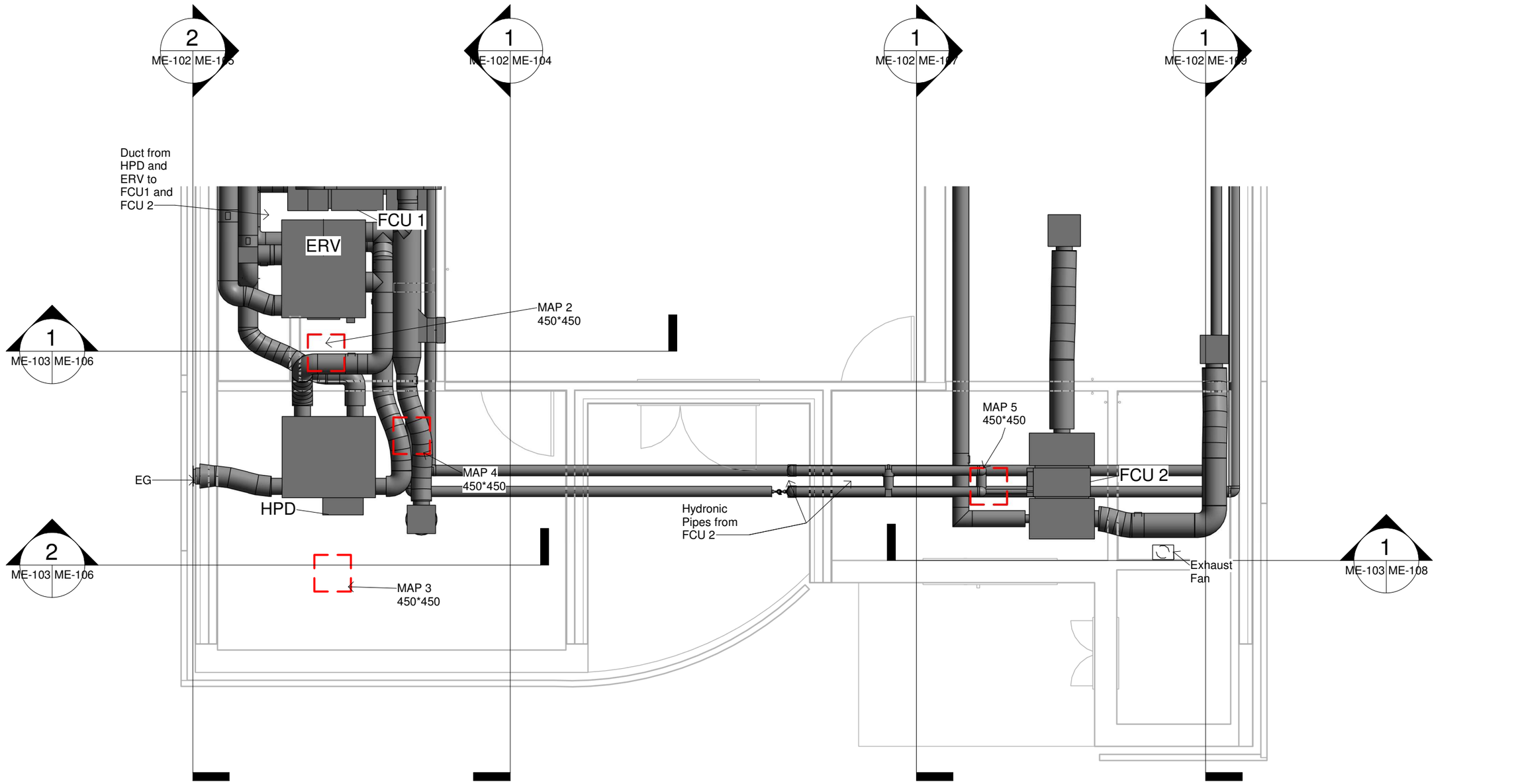
MECHANICAL ROOM PLAN (SPLIT AREA1)

ME-102



1 Mechanical Rooms Plan (Split 2)

1 : 50

VISUAL SCALE 1:50 @ A3

0m 1m 2m 3m 4m 5m

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SCALE	1 : 50 @ A3

NORTH

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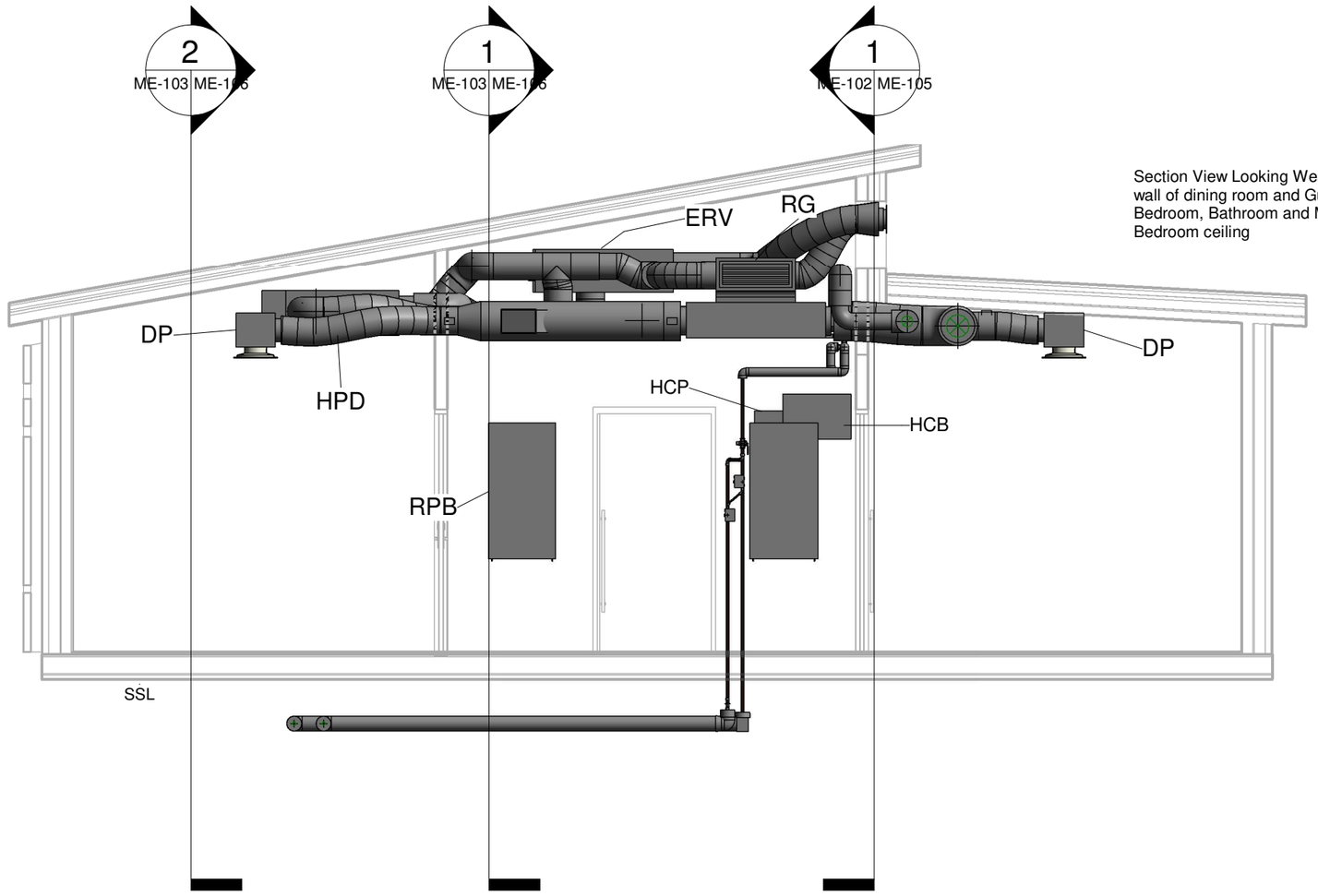
MECHANICAL ROOM PLAN (SPLIT AREA2)

ME-103



Section View Looking West at wall of dining room and Guest Bedroom, Bathroom and Main Bedroom ceiling

1 Mechanical Section 1 (Longitudinal)

1 : 50

VISUAL SCALE 1:50 @ A3

0m 1m 2m 3m 4m 5m

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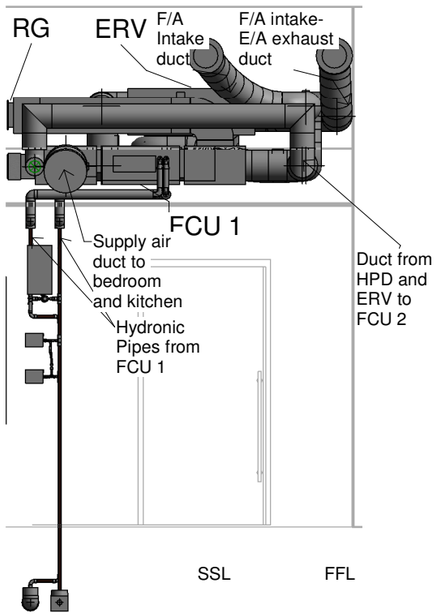
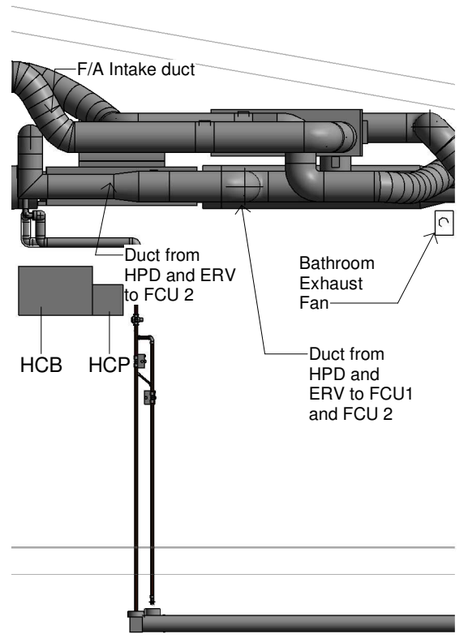
MECHANICAL INTERIOR ELEVATION

ME-104



1 South Elevation (Bahthroom)

1 : 50



2 West Elevation (Bathroom)

1 : 50

VISUAL SCALE 1:50 @ A3

0m 1m 2m 3m 4m 5m

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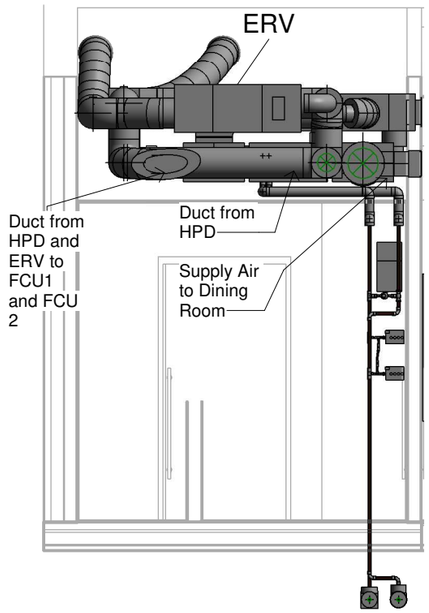
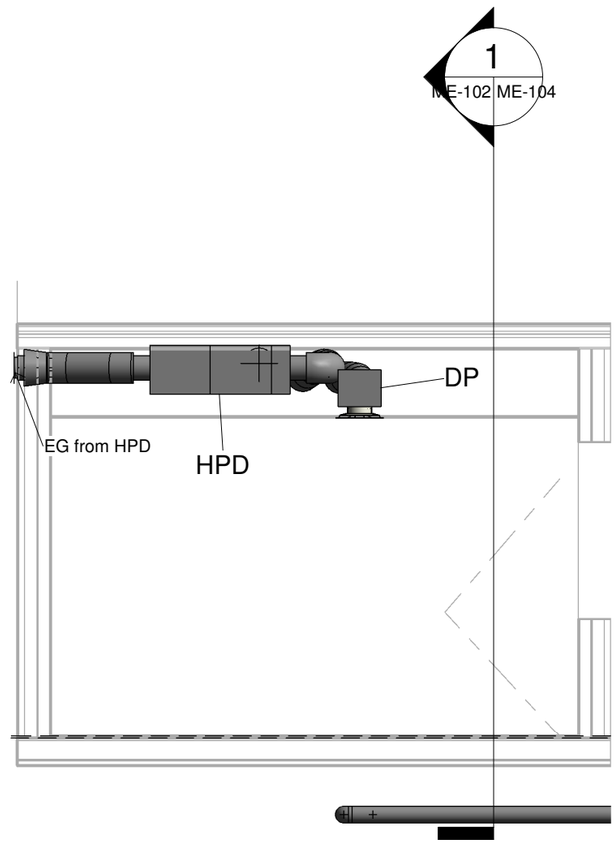
MECHANICAL INTERIOR ELEVATION

ME-105





1 North Elevation (Bathroom)

1 : 50

2 North Elevation (Guest Bedroom)

1 : 50

VISUAL SCALE 1:50 @ A3

0m 1m 2m 3m 4m 5m

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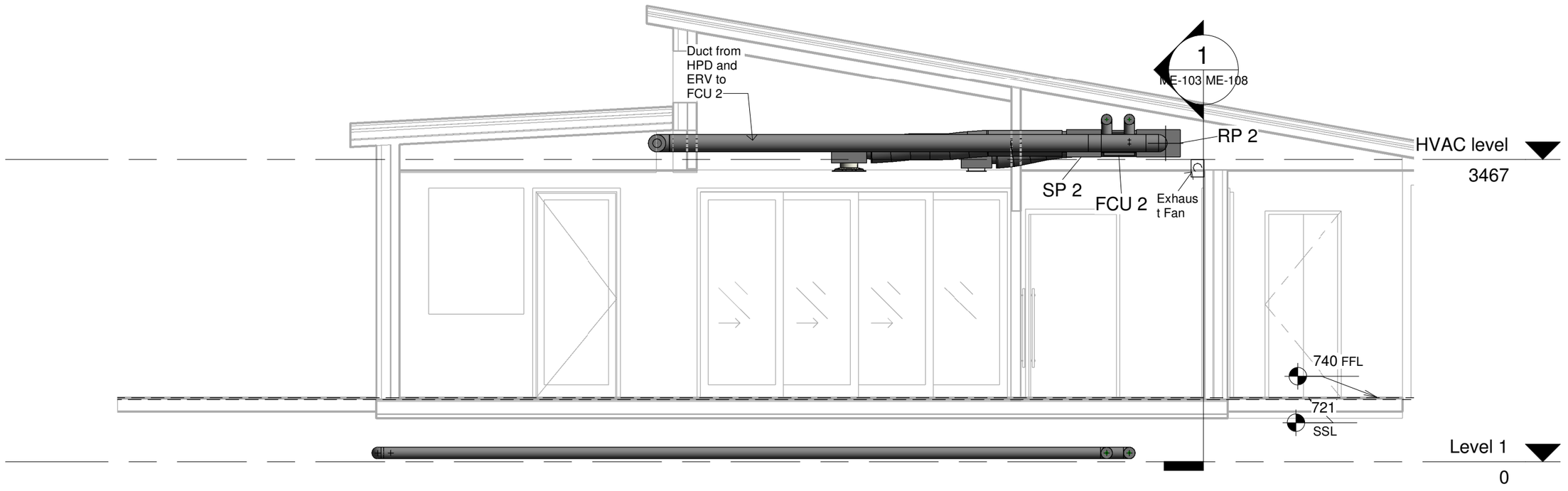
MECHANICAL INTERIOR ELEVATION

ME-106



1 Mechanical Section 2 (Longitudinal)

1 : 50

VISUAL SCALE 1:50 @ A3

0m 1m 2m 3m 4m 5m

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Dubai Electricity and Water Authority

SOLAR DECATHLON MIDDLE EAST DUBAI, UAE - 2018

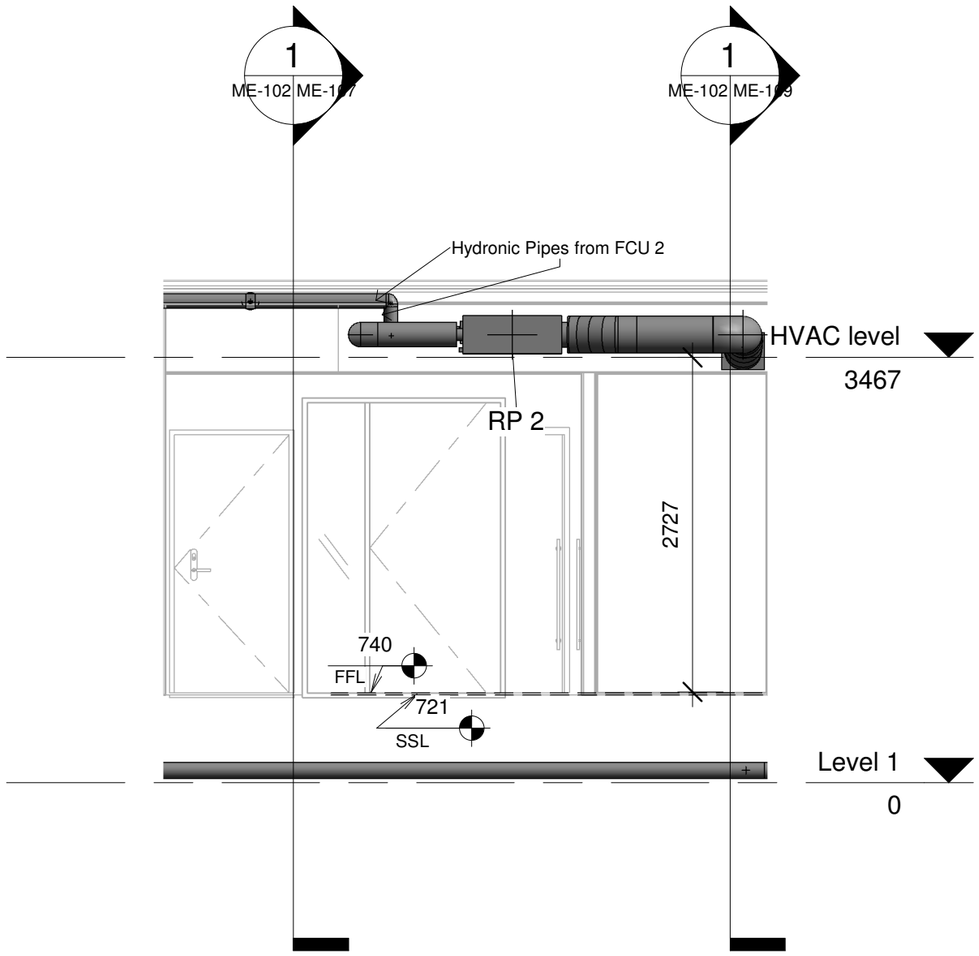
AMENDMENTS				
REV.	DESCRIPTION	DATE	DRAWN	CHECK

LOT	# M
DRAWER	R. AHMED
CHECKED	C. MCDOWELL
DATE	14-09-2018
SCALE	1 : 50 @ A3

SHEET: 1 OF 1

MECHANICAL INTERIOR ELEVATION

ME-107



1 North Elevation (Entrance and WC)

1 : 50

VISUAL SCALE 1:50 @ A3

0m 1m 2m 3m 4m 5m

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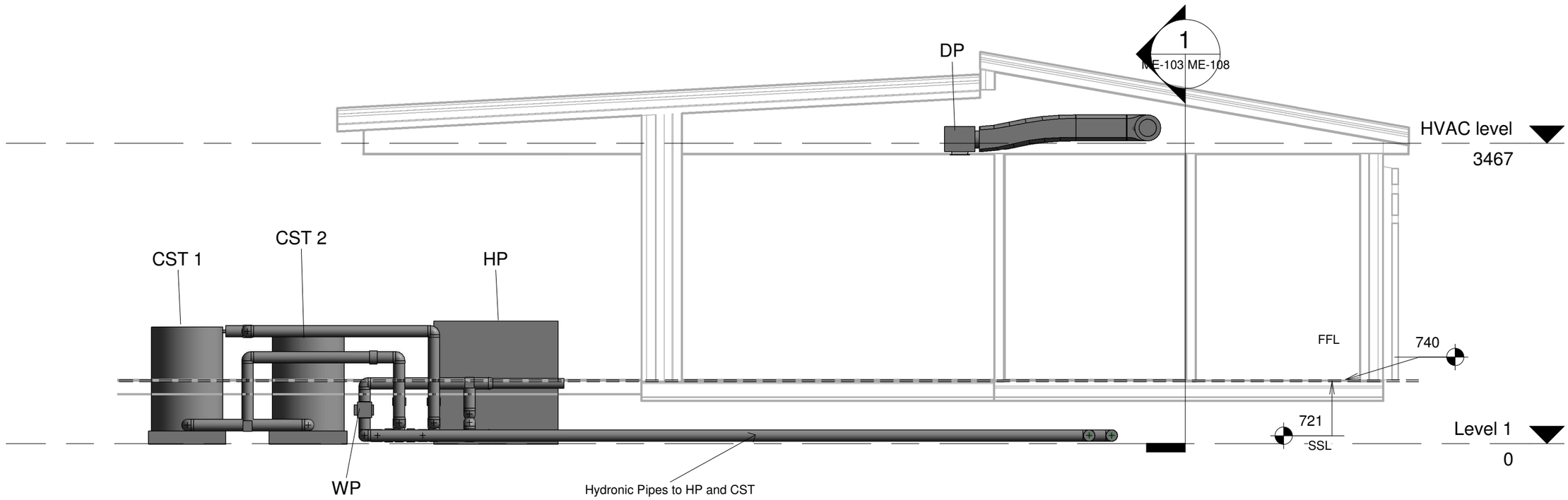
SHEET: 1 OF 1

MECHANICAL INTERIOR ELEVATION

ME-108



1 Mechanical Section 3 (Longitudinal)

1 : 50

VISUAL SCALE 1:50 @ A3

0m 1m 2m 3m 4m 5m

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AMENDMENTS

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NORTH

SHEET: 1 OF 1

MECHANICAL INTERIOR ELEVATION

ME-109

MECHANICAL AUTOMATION SCHEDULE			
DESCRIPTION	**MAKE**	**MODEL**	**QTY**
HVAC CONTROLLER	SIEMENS	PXC3.E75-100A	1
UNIVERSAL I/O MODULE	SIEMENS	TXM1.8U	8
RELAY MODULE	SIEMENS	TXM1.6R	1
BUS CONNECTION MODULE	SIEMENS	TXS1.EF10	1
IMERSION TEMPERATURE SENSOR	SIEMENS	QAE2120.010	4
DUCT TEMPERATURE SENSOR	SIEMENS	QAE2120.040	1
DUCT VELOCITY SENSOR	SIEMENS	QVM62.1	2
DUCT HUMIDITY SENSOR	SIEMENS	QFM2100	1
KNX WALL MOUNTED TEMP, HUMIDITY, C02 SENSOR	SIEMENS	QMX3.P70	4
WATER FLOW SENSOR	SIEMENS	QVE3000.020	2
DAMPER ACTUATOR	SIEMENS	GDB161.1E	10
3-WAY VALVE ACTUATOR	SIEMENS	GSD161.9A	2
2-WAY VALVE ACTUATOR	SIEMENS	GLB161.9E	6
DIFFERENTIAL PRESSURE SENSOR	SIEMENS	QBE3000-D4	1
KNX/DAIKIN GATEWAY	INTESISBOX	DK-RC-KNX-1	2

NOTES

THE DESERT ROSE HVAC SYSTEM PRIMARY CONTROLLER IS A SIEMENS PXC3.E75-100A WHICH IS A BACnet CONTROLLER WITH KNX ON BOARD

THE CONTROLLER CONNECTES TO I/O MODULES FOR ANALOG INPUTS/OUTPUTS AND DIGITAL INPUTS/OUTPUTS TO CONTROL VALVES AND ACTUATORS AND MONITORE THE INDOOR ENVIRONMENT

SIEMENS PXC3.E75-100A HVAC CONTROLLER

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LOT # M
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CHECKED Checker
DATE
SCALE @ A3

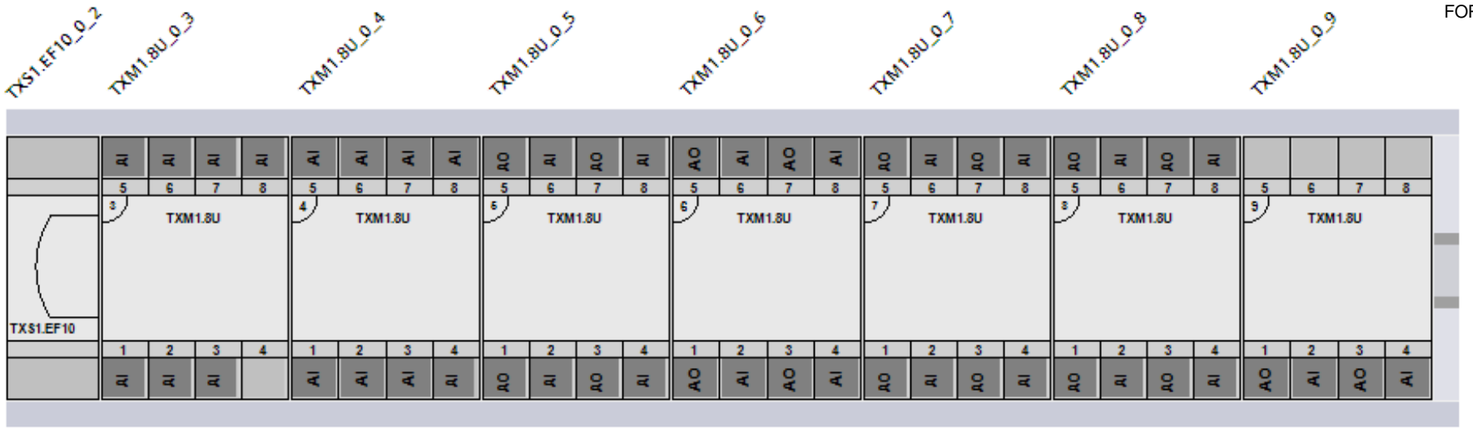
SHEET:

CONTROL AND AUTOMATION DETAILS

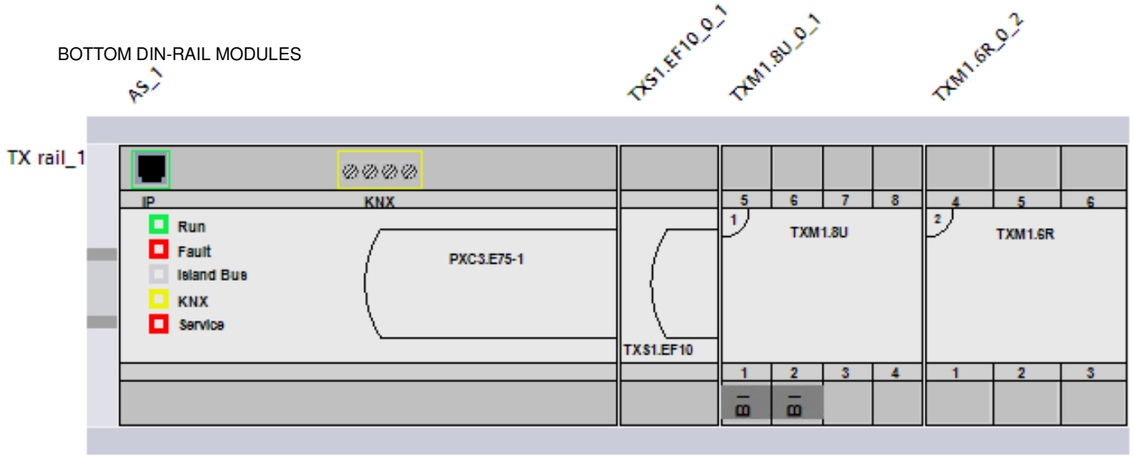
ME-231

DIN RAIL LAYOUT FOR HVAC CONTROLLERS LOCATED IN SERVICES CUPBOARD IN BATHROOM

TOP DIN-RAIL MODULES



BOTTOM DIN-RAIL MODULES

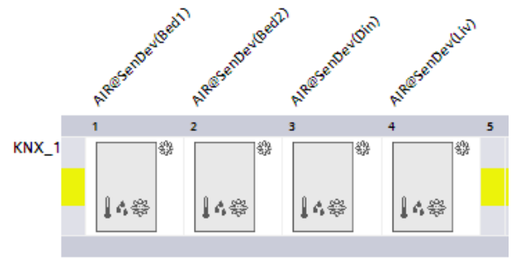


NOTES

CONTROLLER AND I/O MODULES LOCATED IN 600x400x200mm DIN-RAIL ENCLOSURE LOCATED IN TOP OF CUPBOARD LOCATED IN BATHROOM

FOR CONTROL PANEL LOCATION, REFER TO ME-005

KNX WALL SENSORS FOR TEMP, HUMIDITY AND C02. FOR LOCATION REFER TO BAS-101



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REV.	DESCRIPTION	DATE	DRAWN	CHECK

LOT # M
DRAWER B.BANFIELD
CHECKED Checker
DATE 14, SEPT 2018
SCALE N.T.S @ A3

SHEET:

CONTROL AND AUTOMATION - DIN LAYOUT

ME-232

FIELD

SWITCHBOARD
HOUSE DB

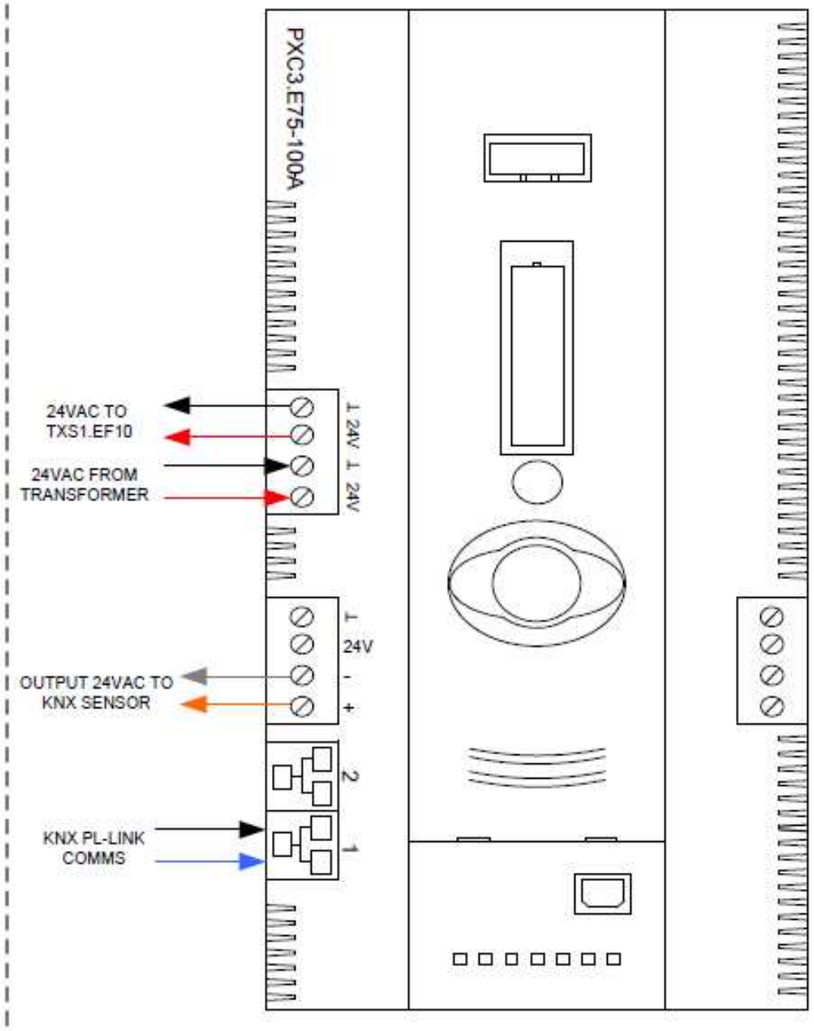
BMS
SECTION

BMS
SECTION

SWITCHBOARD
HOUSE DB

FIELD

MAIN CONTROLLER
START OF BOTTOM RAIL



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SOLAR DECATHLON MIDDLE EAST DUBAI, UAE - 2018

AMENDMENTS

REV.	DESCRIPTION	DATE	DRAWN	CHECK

LOT	# M
DRAWER	B.BANFIELD
CHECKED	Checker
DATE	14, SEPT 2018
SCALE	N.T.S @ A3

SHEET:

PXC3.E75-100A ELECTRICAL CONNECTIONS

ME-233

FIELD | SWITCHBOARD HOUSE DB | BMS SECTION | BMS SECTION | SWITCHBOARD HOUSE DB | FIELD

PXC3.E75-100A ABOVE

TXS1.EF10

TO TXS1.EF10 ON TOP RAIL
1 CS
2 CD

24VAC Supply
3 ~
4 ⊥
FROM BMS TRANSFORMER VIA PXC3
5 CS
6 CD

TXIO ADD 001 TXM1.8U

H708 CURRENT SWITCH
THERMOCOUPLE ADAPTER

2		(1)	UOW.DR.HP.STATUS 0.1.1	LDI	SPARE 0.1.5	LDI	(5) 19
4							21
6							23
7	V	(2)	UOW.DR.PCM AVG 0.1.2	LDI	SPARE 0.1.6	LDI	(6) V 24
8							25
10							27
12		(3)	SPARE 0.1.3	LAO	SPARE 0.1.7	LAO	(7) 29
14							31
15	V	(4)	SPARE 0.1.4	LDI	SPARE 0.1.8	LDI	(8) V 32
16							33

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SCALE N.T.S @ A3

SHEET:

I/O MODULE 1 CONNECTIONS

ME-234

FIELD

SWITCHBOARD HOUSE DB

BMS SECTION

BMS SECTION

SWITCHBOARD HOUSE DB

FIELD

24VAC Permanent Active

24VAC Permanent Active

TXIO ADD 002 TXM1.6R

2	(1)	SPARE 0.2.1	LDO	SPARE 0.2.4	LDO	(4)	19
3							20
4							21
8	(2)	SPARE 0.2.2	LDO	SPARE 0.2.5	LDO	(5)	25
9							26
10							27
14	(3)	SPARE 0.2.3	LDO	SPARE 0.2.6	LDO	(6)	31
15							32
16							33

TXIO ADD 003 TXM1.8U

2	(1)	UOW.DR.FCU-1.5A TEMP 0.3.1	LAI	UOW.DR.FCU-2.5A TEMP 0.3.5	LAI	(5)	19
4							21
6	(2)	UOW.DR.FCU-1.5A VELOCITY 0.3.2	LAI	UOW.DR.FCU-2.5A VELOCITY 0.3.6	LAI	(6)	23
7							24
8							25
10	(3)	UOW.DR.FCU-1.FAN SPEED 0.3.3	LAO	UOW.DR.FCU-2.FAN SPEED 0.3.7	LAO	(7)	27
12							29
14	(4)	SPARE 0.3.4	LAI	UOW.DR.DESICA.5A HUMIDITY 0.3.8	LAI	(8)	31
15							32
16							33

Part No. QAM2120.040

Part No. QVM62.1

At DAIKIN TERMINALS

Part No. QAM2120.040

Part No. QVM62.1

At DAIKIN TERMINALS

Part No. QFM2100

END OF BOTTOM RAIL

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SOLAR DECATHLON MIDDLE EAST DUBAI, UAE - 2018

AMENDMENTS

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DATE 14, SEPT 2018

SCALE N.T.S @ A3

SHEET: ME-235

I/O MODULE 2 & 3 CONNECTIONS

FIELD

SWITCHBOARD HOUSE DB

BMS SECTION

START OF TOP RAIL

FROM TXS1.EF10 ON MAIN CONTROLLER

TXS1.EF10

1 CS
2 CD

24VAC Supply
3
4
FROM BMS TRANSFORMER VIA PXC3
CS 5
CD 6

TXIO ADD 004 TXM1.8U

NEUTRAL LINKED AT SENSOR TERMINAL BOX TO CWS.FCU.SUPPLY TEMP

Part No. QBE3000-D4 — M, U, G

Part No. QAE2120.010

Part No. QAE2120.010

Part No. QAE2120.010

2, 4	(1)	UOW.DR.HP.DIFF PRESS 0.4.1 LAI	UOW.DR.CWS.PCM.INLET TEMP 0.4.5 LAI
6, 7, 8	(2)	UOW.DR.CWS.FCU.SUPPLY TEMP 0.4.2 LAI	UOW.DR.CWS.PCM.OUTLET TEMP 0.4.6 LAI
10, 12	(3)	UOW.DR.CWS.FCU.RETURN TEMP 0.4.3 LAI	UOW.DR.CWS.FW1 0.4.7 LAI
14, 15, 16	(4)	UOW.DR.CWS.PCM.TANK TEMP 0.4.4 LAI	UOW.DR.CWS.FW2 0.4.8 LAI

19, 21	(5)	Part No. QAE2120.010
23, 24, 25	(6)	Part No. QAE2120.010
27, 29	(7)	Part No. QVE3000.020
31, 32, 33	(8)	Part No. QVE3000.020

NEUTRAL LINKED AT SENSOR TERMINAL BOX TO CWS.PCM.OUTLET TEMP

FIELD

SWITCHBOARD HOUSE DB

BMS SECTION

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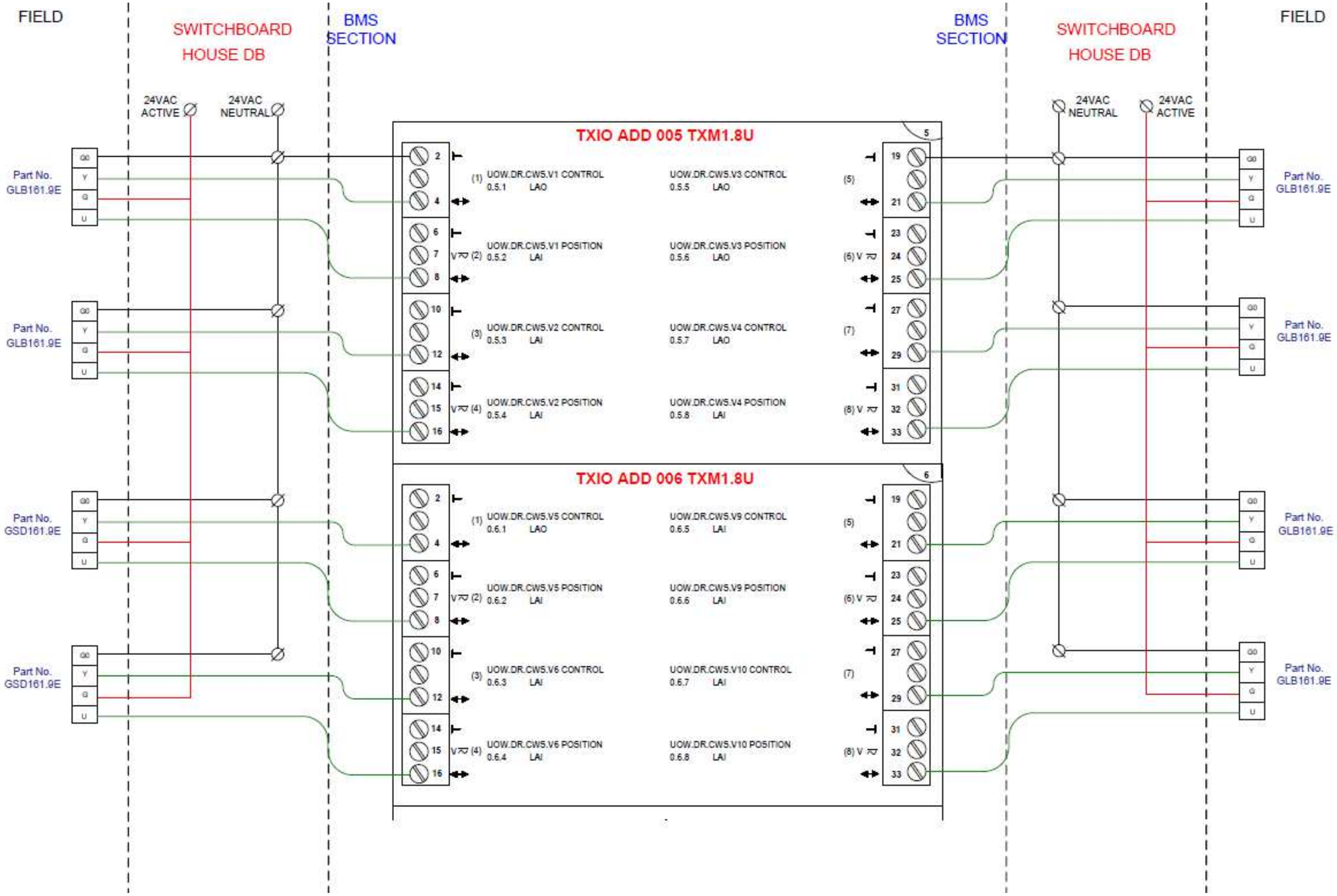
CHECKED	Checker
DATE	14, SEPT 2018
SCALE	N.T.S @ A3

SHEET:

I/O MODULE 4 CONNECTIONS

ME-236



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AMENDMENTS

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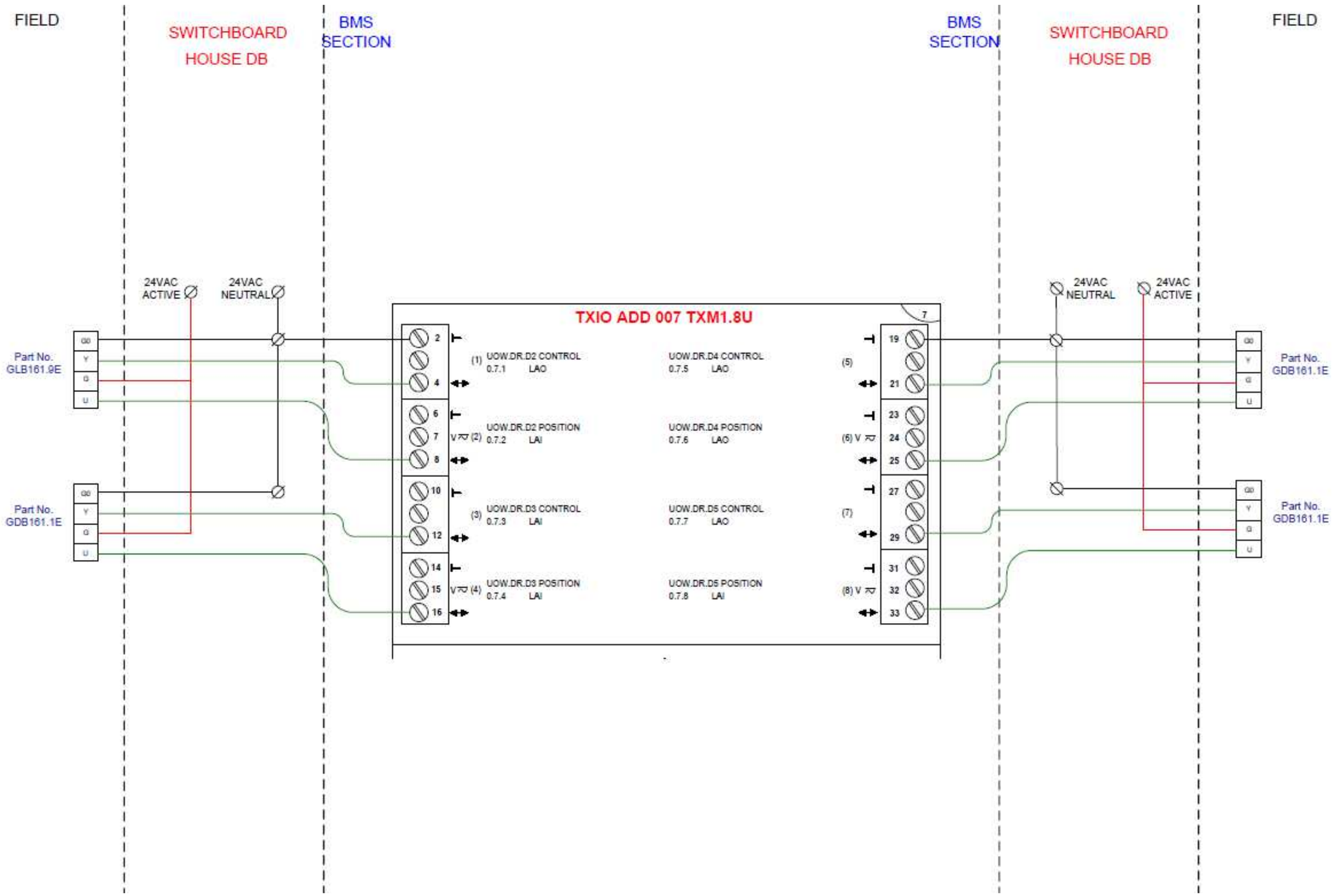
LOT	# M
DRAWER	B.BANFIELD
CHECKED	Checker
DATE	14, SEPT 2018
SCALE	N.T.S @ A3

SHEET:

I/O MODULE 5 & 6 CONNECTIONS

ME-237



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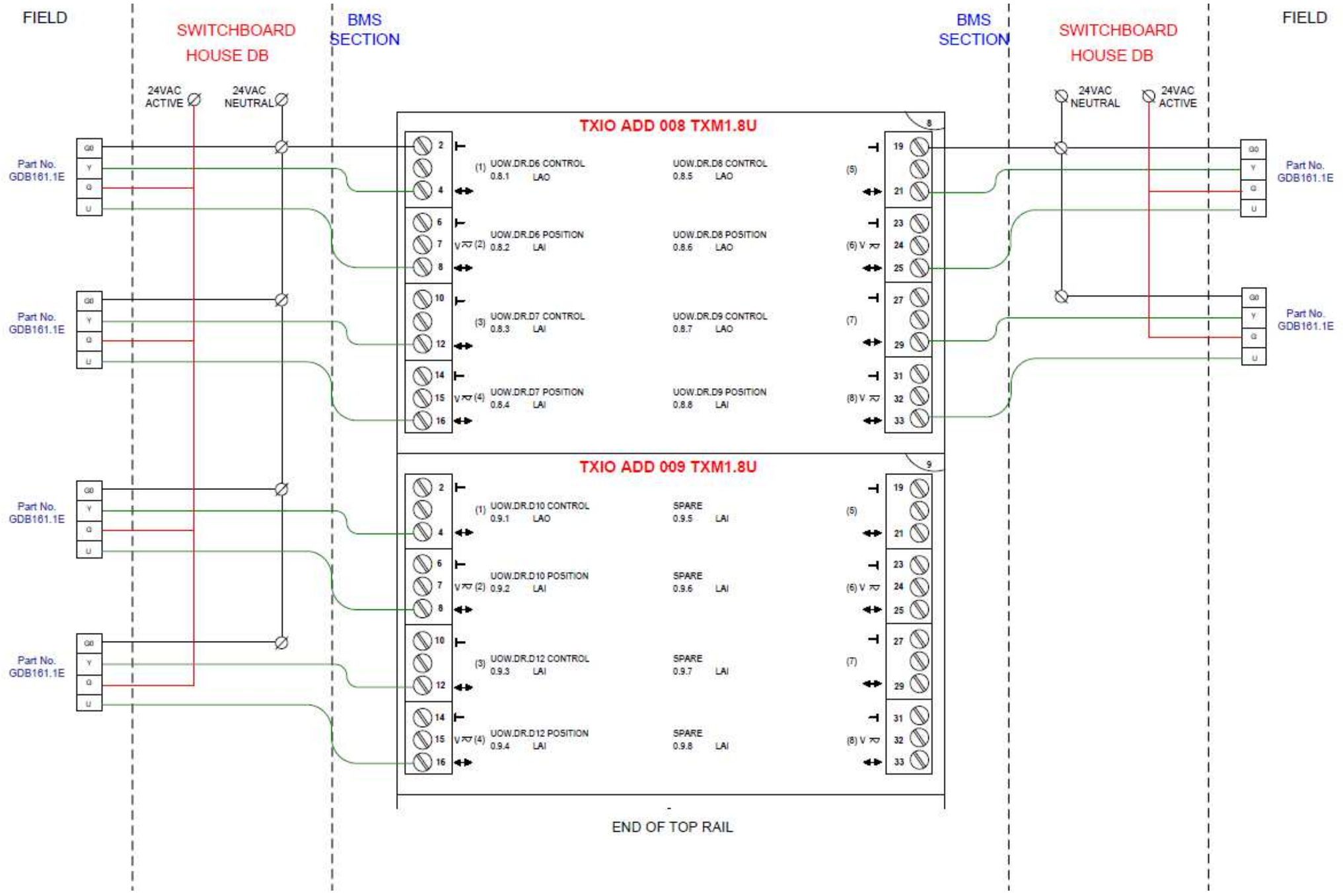
SCALE N.T.S @ A3

SHEET:

I/O MODULE 7 CONNECTIONS

ME-238



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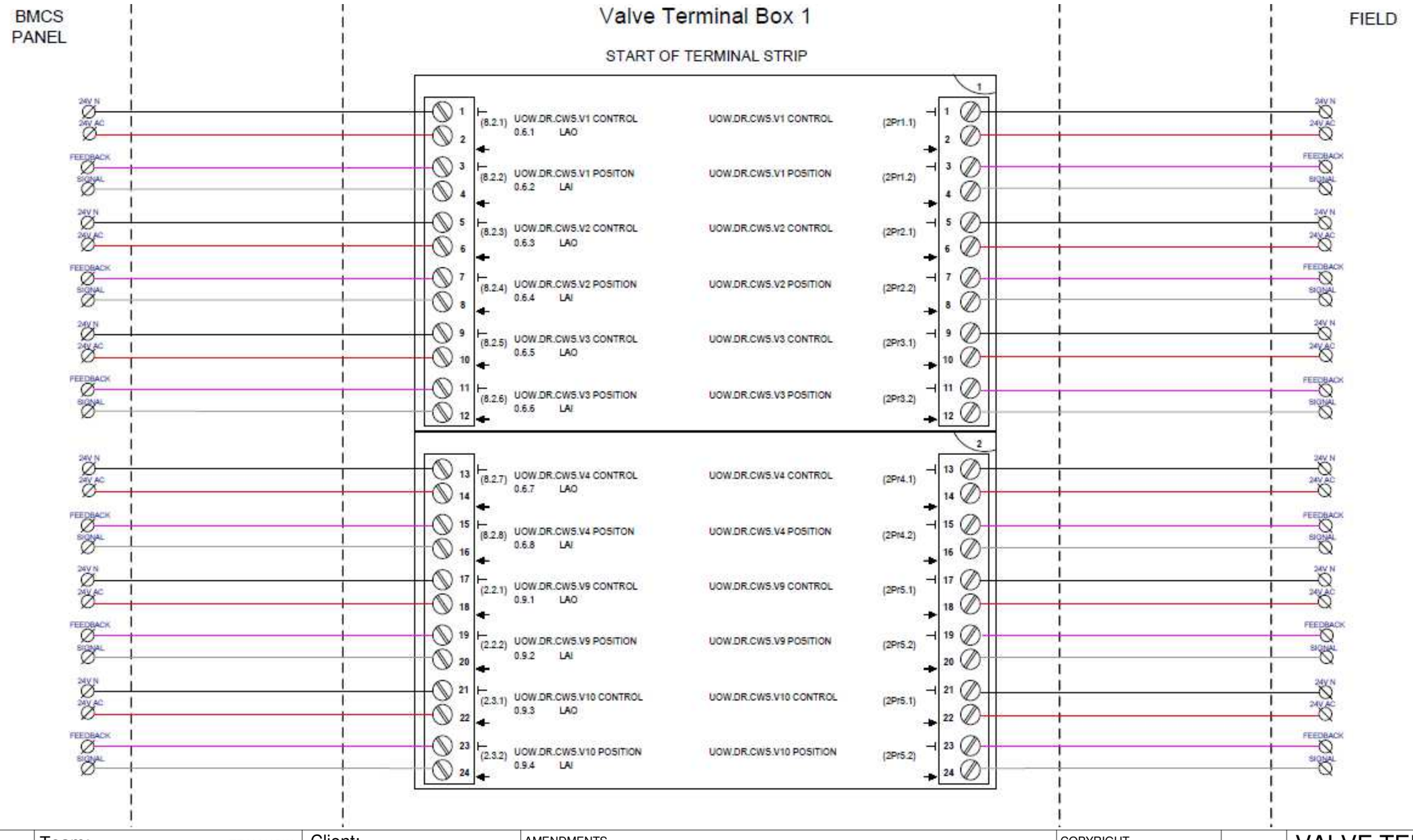
NOTES

VALVE TERMINAL BOX IS A WEATHER PROOF ENCLOSURE THAT CONNECTS CABLES FROM I/O MODULES IN SERVICES CUPBOARD TO VALVE ACUATORS ON HVAC SKID



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DRAWER	B.BANFIELD
CHECKED	Checker
DATE	14, SEPT 2018
SCALE	N.T.S @ A3

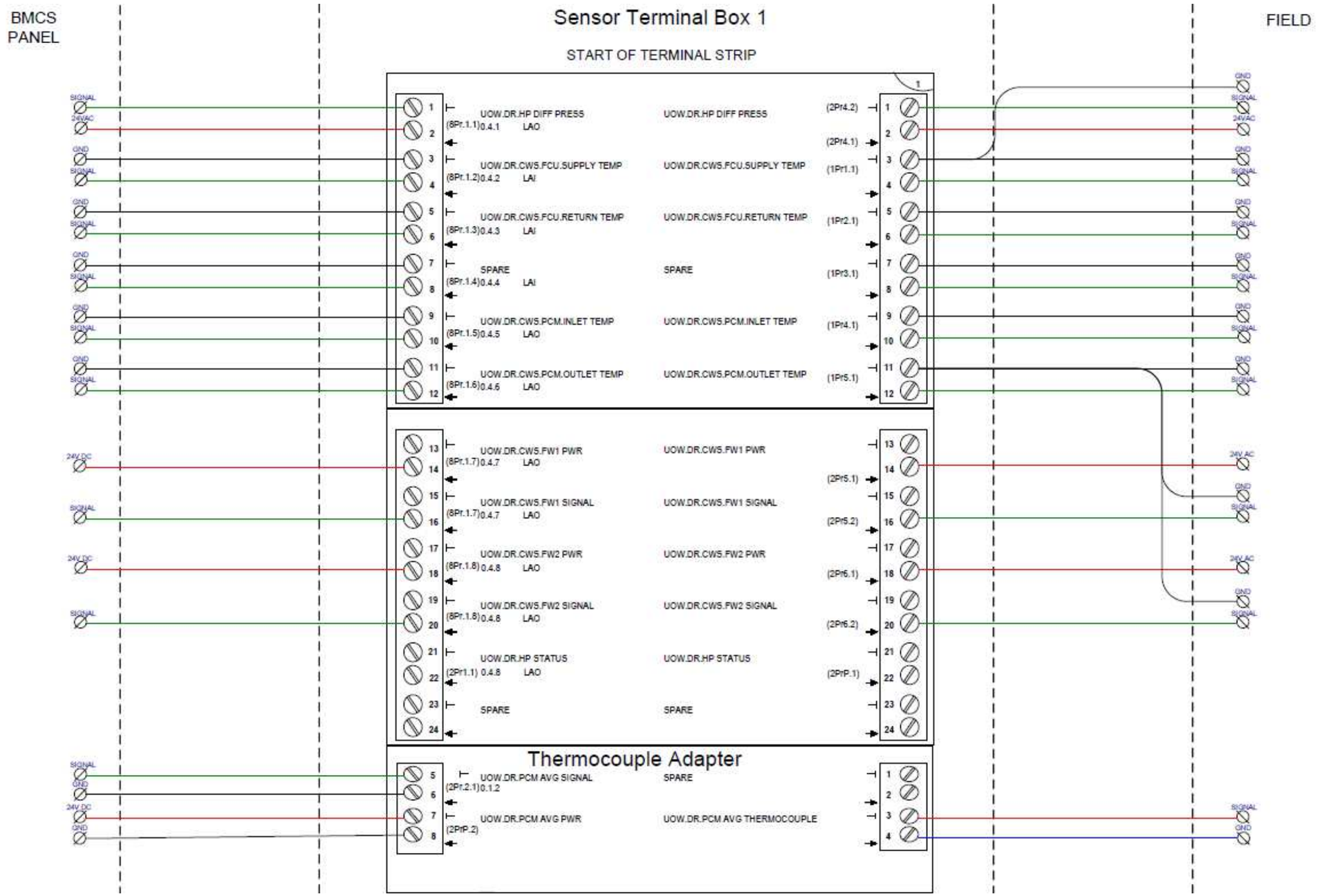
SHEET:

VALVE TERMINAL BOX CONNECTIONS

ME-240

NOTES

SENSOR TERMINAL BOX IS A WEATHER PROOF ENCLOSURE THAT CONNECTS CABLES FROM I/O MODULES IN SERVICES CUPBOARD TO SENSORS ON HVAC SKID



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				CHECKED Checker	SHEET: ME-241
				DATE 14, SEPT 2018	
				SCALE N.T.S @ A3	