ISO7 AHU-B-700

ISSUE 10

7. December 2022

Project ISO7
FSL Backweston

Location Biology 2
Wing 'B' - 1. Floor

System AHU-B-700 CMR VAV CONTROL SYSTEM

Serving Rooms FB02 - 03 - 04 - 15 - 16 - 17 - 18 - 19 - Corridor 22

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1.0 Introduction

This manual describes the function and room schematics of the VAV Control System in the ISO7 Area. There shall be a CMR Interface Panel per AHU System together with the associated VAV control equipment. As the system gets more designed, this schematic book becomes the basis of the entire design and finally it becomes the description and operating instructions.

From time to time, this manual gets updated. The updated manual shall be issued as a complete new book showing the changes. The Issue Number and date shall change with each issue. Everybody must always work with the latest Issue. This PDF book can be printed on A4 or A3 Paper and the format is designed to present it on Teams, WebEx and other conference meetings easily..

The contents of this book is subject to change without prior notice and it is best to check with CMR if a new Revision was issued after the issue number quoted on the front page.

2.0 Index

2.0 Index continued...

2.0 Index continued...

3.0 Revision History

Date	Issue	Comments
5. June 2020	Issue 1	First Issue
5. October 2020	Issue 2	Revised according to comments on the Technical Transmittal TS-M-ISO-04 -VAV/CAV Valves and added 2 Hepa Filter sensors omitted on Issue 1
20.October 2020	Issue 3	Added new Fume Hood Volumes and checked all volumes - updated AHU-B-700 spreadsheet. Added points list Revised Spread sheet, BMSI/O List and EMS I/O List. Changed Tag numbers on LSV and LEV to new Format. Added Pressure Nomogram, added P&ID
6. December 2020	Issue 4	Changed Air Flow rates and added Compliance Statement. Removed the Hepa Filter Sensor which is in the scope for the BMS. Added the Damper Closed contact to BMS Interface
8. December 2020	Issue 5	Added Alarm Plate drawing to Alarm section. Removed Hepa Filters from Schematics
30.March 2021	Issue 6	Added Noise Levels. Rectified FB19_LEV1 size on schematic 200h x 450w
28. April 2021	Issue 7	Updated Volume according to Arup's comments FB04 and FB19. Changed Valves in all gowning rooms from 160 to 200mm diameter for acoustic improvements.
30. April 2021	Issue 8	Changed all gowning room valves from 200mm to 180mm diameter to have better authority of the valve. Added new noise levels for 100Pa
30. June 2021	Issue 9	Modified Modbus cable from 8104 to Belden 9504NH.DCA as DG could not get delivery of 8104 Belden. Added CMR Panel to all 230Vac labels. Added 230Vac termination panel to PLC Panel. Added more description text to Page 29 and Page 36. Removed Copy Right text from Page 2.
07. December 2022	Issue 10	HLPS Sensor's added FB22 Room Pressure Modified.

4.0 Glossary

Short Form	Explanation
AHU	Air Handling Unit
EF	Extract Fan
VSD	Variable Speed Drive
BMS	Building Management System (Standard Controls)
FT	Flow Transmitter
PT	Pressure Transmitter
AL	Alarm Plate
SF	Supply Fan
AFG	CMR Variable Volume Flow grid and Damper Assembly
AP	Air Probe Plate
ATG	VCD Damper
VSD	Variable Speed Drive
CMR	CMR CONTROLS
VVR	Variable Volume Round Valve

Short Form	Explanation
CVS	Constant Volume Supply
VVS	Variable Volume Supply
VVE	Variable Volume Extract
CAV	Constant Air Volume
Modbus rtu	RS484 Communication Protocol
BACnet	Communication Protocol
LSV	Laboratory Supply Valve
LEV	Laboratory Extract Valve
Profinet	Siemens Communication Protocol
Modbus TC/IP	Modbus Ethernet Connection
DO	Digital Output
DI	Digital Input
AI	Analogue Input
AO	Analogue Output

4.0 Glossary continued ...

Short Form	Explanation
PFR-C	PPs Plastic Valve

Short Form	Explanation

5.0 System Overview

The new FSL Building will have laboratories which are situated on the Ground and First Floor with the plant Room being on the top floor. All ventilation controls and dampers shall be situated in the plant room with the exception of the Fume Hood valves and controls, they will be installed above the fume hood.

The CMR variable air volume control dampers shall have all the controls and actuators factory fitted and the complete units are factory commissioned and tested.

Each damper will have a DPC controller mounted to it and a built in air volume sensor will measure the actual air volume on the Venturi, on round valves and the Flow grid on rectangular dampers.
The power supply to the DPC controller shall be 230Vac which is supplied by the electrical contractor to each VAV DPC damper controller in the field. There will be a CMR interface panel per AHU system which is powered by a 230Vac single phase supply.

The supply air VAV and extract air VAV have volume sensors fitted and will be configured to achieve the specified air change rate. The Actuator is fitted to the VVR Valve or AFG damper and is wired to the DPC which controls the actuator. The DPC controller has an adjustable set point and will guarantee a constant air change rate into the space regardless of back pressure changes from the fan system.

An air probe plate with multiple connections will be installed in the ceiling of the room. A red tube is fitted to the air probe plate on the ceiling of the clean room and then connected to the DPC controller which contains the pressure transducer.
The extract shall be controlled by measuring the room pressure against the plant room datum and driving the damper to achieve the room pressure set point i.e. +35 Pa in the Lab and +20 in the Gowning Room. In the Corridor Area, the DPC shall provide a tracking function to maintain a slight positive pressure of approximately 2 Pa.

One CMR Interface Panel is assigned per AHU system and provides the Modbus rtu communication to the supply and extract variable volume DPC controllers. The Modbus rtu is connected via individual Belden cables to each DPC in the field.

The critical rooms will have an alarm plate installed inside the room showing a single combined changing 25mm square RED and GREEN Led light. When the room pressure goes into high or low alarm, which is controlled by the interface panel, the LED changes to RED and a buzzer shall annunciate the alarm. The Alarm can be muted locally and also from the CMR Interface Panel. When the room is healthy again, then the LED changes to GREEN and the alarm will reset. There is either a GREEN or a RED Led illuminated at any time.

The interface panel is equipped with a Modbus TC/IP communication module for the BMS. An Ethernet cable will be connected by the IT Contractor from the interface panel to the BMS and EMS panel. It also has some hardwired digital inputs and outputs to and from the BMS to communicate night set back - common alarm - Fumigation Routine - Stop/Start and System Stop.

There will be a colour HMI display on the front of the Interface panel for the operator to view and control the VAV systems. The password structure is according to the users requirement. The CMR Interface Panel has a standard Siemens PLC and is only configured to interface between the VAVs, BMS and EMS. There is no data monitoring storage facilities within the CMR Interface panel.

The interface panel is connected to the EMS system via Profinet which is the standard Siemens Protocol. The EMS system shall collect all specified measured values from a pre-defined data block from the Interface Panel via Profinet. i.e.. Duct Pressures, room pressures, room pressure alarms, Supply Volume and damper position.

6.0 DPC Controllers

The DPC controller is mounted on the VAV assembly - round valve or rectangular damper. The controller is factory pre-wired to the actuator and tested.

The DPC is powered by 230Vac and has a 3m flying lead and is fitted with a UK type fused plug. It is recommended to fit a standard switched socket close to the DPC controller for easy installation and maintenance removal. The 230Vac shall come from a dedicated distribution panel with isolation fused terminals. The electrical contractor must install the 230Vac cable from all VAVs to the CMR distribution panel which is part of the CMR Interface panel.

The DPC controller has a Modbus rtu interface termination box which is connected to the CMR interface panel via a CMR specified Belden cable. The interface panel shall send and receive all data necessary to control the complete VAV unit. Night set back - force closed - position of damper - pressure and air volume. There is no heating and cooling air change rate change required.

One clean room can be shut down in case of planned maintenance without affecting the rest of the clean rooms.

On the front of the DPC controller is an LCD Display with keyboard for the maintenance engineers to make adjustments or repairs locally. It is password protected.

All built in sensors carry a traceable calibration certificate to national and international standards and they can be field calibrated if required in future. Care must be taken to install the DPCs for easy reach for the calibration engineer.

The DPC shall be factory configured to control either on direct Room pressure in the clean rooms or tracking with pressure offset in the corridor area. The DPC controller is a standard off the shelf unit which has embedded software.

Fume Hood control system
The CMR DPC320 Fume Hood controller has been designed specifically for fume hood control and is an off the shelf item. The exhaust damper and controller is a compact factory commissioned system.

The Fume Hood control valve is made of PPs Plastic and it is a combined Venturi and damper complete with DPC320 Fume Hood Controller. A VMS fast acting damper actuator (4s for 90 degrees rotation) is fitted to the valve and is powered by the DPC. The fume hood controller and valve shall be located in the space above the fume hood but below the ceiling void which must be accessible via a front lid. It should be mounted directly onto the exhaust spigot of the fume hood. A vertical operator display panel shall be fitted to the front of the fume hood. Sash high, face velocity control and alarms are all incorporated in the DPC320. The system is factory tested and pre-commissioned.

The controller is powered by 230Vac which is supplied by the electrical contractor. It should come from the same distribution panel which serves all VAVs. It needs a switched socket to accommodate the UK Plug on a 3m flying lead. A Belden Cable shall be installed for the Modbus rtu communication cable from the Fume Hood Controller to the CMR Interface Panel. The CMR Interface Panel takes care of the tracking and room pressure control. The fume hood controllers are stand alone and work independently. The DPC320 communicates via Modbus rtu with the CMR Interface panel.

As the fume hood sash is opened or closed, the room pressure shall change and the general extract DPC will measure the change and adjust the room pressure accordingly. The extract air either goes through the fume hoods or it is discharged via the general extract valve which is controlled by room pressure in the ISO7 area.

The fume hood supplier must provide an aperture cut out to fit the CMR Operator display panel and drill two 9.5mm holes 100mm to the left and right hand side of the fume hood light fitting for the tube of the face velocity sensor. The electrical contractor shall install the display plate and connect a 5m cable supplied by CMR. The fume hood manufacturer must install a free issued potentiometer in their fume hoods which measures the opening height of the sash. The electrical contractor shall connect the potentiometer cable to the DPC and connect the tubes to the Face Velocity sensor. CMR shall provide the installation instructions.

BSC Safety Cabinets
The safety cabinets have dedicated constant volume control valves made of PPs Plastic fitted with a DPC220 controller and a VMS actuator. The PPs valves are similar to the VVR Valves except they have flange connections and made of PPs plastic.

Two contacts shall be made available by the BSC Supplier, one for when the BSC is switched 'ON' and one for 'Alarm'. The CMR interface panel shall receive these independent volt free contacts via hardwired digital inputs.

When a BSC is switched to 'ON' the CMR Interface panel shall switch the DPC of the extract valve to 'ON' and a constant air volume is controlled to exhaust the air out of the BSC.

If the BSC is not working properly then an alarm is sent to the CMR Interface panel via the alarm contact and is shown on the HMI.

The room pressure is automatically adjusted to cope with the additional extract air and the general extract is reduced

When the BSC safety cabinet is switched 'OFF' the DPC controller shall close the BSC extract valve. The room pressure is automatically adjusted.

VVR Round Valves (Galvanised Steel)
The VVR valves are manufactured in standard round duct dimensions starting from 80mmØ to 400mmØ complete with brackets mount the actuator and DPC controller. The round VAV valves Type VVR are complete with a built in Venturi which provides the velocity pressure. A single damper blade has a silicon seal which is sandwiched between two damper blade discs and is riveted. When the damper is closed, it is shut air tight to DIN 1946 Part 4.

A very sturdy drive shaft is connected to the damper blade and an actuator is fitted to the shaft. The valve can be pushed into standard spiral ducting. A lip seal is fitted as standard to seal the valve against the internal duct and duct tape is sufficient to seal the outside without riveting the valve into the duct. Riveting the valve would move the valve out of the centre and start leaking through the duct ends.

VVR Round Valves (PPs Plastic)
These valves are used for the BSC cabinet exhausts and are similar in construction as the metal valve except for the plastic construction and mounting flanges. The DPC and actuator are the same as the VVR valve.

AFG Rectangular Flow grid Damper (Galvanised Steel and Aluminium)
The AFG consists of a standard ATG Damper and an FGG Flow grid which are bolted together. The AFG is manufactured in 100mm height increments and 50mm width increments, up to 1200mm x 1200mm. Please note, the actuator and DPC Controller is always fitted on the height side, where the shaft comes out of the damper. It is important to make sure that there is approx. 600mm space on site to have access for maintenance in future.

The rectangular or square dampers have corner mounting holes and the contractor normally supplies duct clamps which are fitted in between. A standard duct seal is used to seal the damper and Flow grid flange to the duct flange.

The damper has a depth of 110mm and the Flow grid of 300mm which makes the overall depth 410mm. The duct frame flange is 30mm. A DPC Controller bracket is fitted to the Flow grid. The damper is airtight to DIN 1946 Part 4.

VVR Round Valves- AFG Rectangular Damper Actuators
The CMR actuators are factory fitted and wired up to the DPC controller. The actuator has a clamp on mechanism and fits the shaft of the dampers. The 8NM VMS-408 actuator with a speed of 4 seconds for 0-90 degrees is fitted.

The actuator is powered by 24Vac and has a brushless dc Motor. The ac is converted to dc internally and the electronics are part of the construction.

The actuator has a power consumption of 13VA.
It has a signal input of 2-10V to drive the actuator from 0-90° open/close in 4 seconds. The DPC controls the speed.
A feed back of the actual position of 2-10V for 0-90°is provided.
The actuator can drive against a blockage and shall be protected against overload.

The DPC processes the driving signals and controls the actuator to the final set points as dictated by the system. The actuator has a maximum rotation angle adjustment on the drive as well as a rotation change over switch.
The actuator has a fully open and fully closed scaling routine to memorise the min and max opening positions for 2-10V.

The actuator is manufactured by BELIMO of Switzerland for CMR CONTROLS LTD and CMR CONTRLOLS GmbH.

Clean Room Control (ISO7 Area)
The supply DPC Controller has a built in air volume sensor to provide a constant air change rate or night set back. A low and high air volume alarm is provided from the CMR Interface panel. The general extract DPC controller has a built in pressure sensor to measure the room pressure and control the room pressure against the plant room datum. An L (low) and H (high) room pressure alarm is produced in the CMR Interface panel. The Room Pressure is not controlled against the adjacent room or corridor as these pressures change when opening doors and would affect the entire clean room suite. The datum is the plant room.

Room Over/Under Pressure Alarms (ISO7 Area)
An LL (low-low) and HH (high-high) alarm is provided by the CMR Interface Panel using the same sensor from the DPC which controls the room pressure to indicate that there is either a fault on the supply or extract and provides a status signal for the BMS to reduce the speed or shut down the AHU and extract fans. This will be determined during commissioning and also depending on the clean room construction.

Corridor Control
The corridor shall have a constant air change rate and the extract shall be tracked to the supply volume with a controllable offset to keep the corridor at approx. 2 Pa pressure. Therefore it does not matter if the corridors doors are opened or closed as it will not cause any disturbance in air volume.

Differential pressure monitoring in cascade between the Lab rooms and the corridor (ISO7 Area)
The supply DPC controller is equipped with a differential pressure sensor which shall be connected via tube to the ceiling of the monitored Lab room and the reference shall be connected to the corridor via the CMR Interface panel to measure the differential pressure. All reference tubes shall go to the CMR Interface Panel where they are interlinked with the rooms. The Gowning room has a differential pressure sensor connected to the Gowning room and the reference is connected to the corridor.

Therefore, the pressure measurement is available from room to the plant room to show actual pressure in the room and from room to corridor to show the cascading pressure between rooms.

Night set back Function

The BMS controls the night set back. The time is synchronised by a time server and the BMS, CMR and EMS uses the same time server to have the same time on their systems. The BMS provides a Volt Free Contact output for the CMR interface panel to switch in the night set back. The CMR Interface Panel shall communicate a night set back command to the DPC to reduce the air change rate. Rooms with Fume Hoods shall be interrogated first by the CMR Interface panel to see if the sashes are closed. If they are not closed than the night set back shall not be switched on for this room to avoid room pressure deviations. This is fully configurable on the HMI. Although a 50% reduction is requested it depends on the leakage of the room. The actual night set back set points have to be determined during commissioning as the room pressures still have to be achieved.

During night set back, the CMR supply dampers shall drive to night set back set point. The static pressure shall increase in the duct and therefore the speed of the fans will be reduced by the BMS automatically to always have the same static duct pressure. It follows the night set back automatically. The static pressure must always be kept the same in the duct for the VAV to control efficiently. There is no need to change any set points on the AHU controls during night set back.

There shall be a switch in a central location i.e.. a corridor, which can be operated by a user to signal to the BMS to take the system out of night set back when the clean rooms have to be used out of hours. In this case the BMS removes the night set back output to the CMR Interface panel and all reverts back to day set points.

CMR Interface Panel

The interface panel consists of a free standing panel normally 1200mm wide x 1900mm high x 400mm deep, depending on the size of the system. The panel shall be connected to a 230V power supply a dedicated circuit breaker in the Distribution board. Within the panel is the 24Vdc power supply and all circuits have fuse terminals and isolation terminals in order to isolate any remote equipment from the panel. The cable colour coding is a CMR standard and cannot be changed as it is a mass production unit. There are no switches or lights on the door except for the HMI and a System Stop switch.

The interface panel shall have a Siemens HMI with colour graphic display which displays the clean room layout, individual rooms, configuration screens and alarm screens. The room pressures, air volumes, position of dampers, door contacts and all required information is also displayed. Alarms can be programmed and muted via the interface panel. All thresholds and alarm set points are adjustable on the HMI. The interface panel shall receive all selected door open contacts. The interface panel provides the logic to freeze a DPC controller in the specified room. This contact must be instant.

There is a complete Modbus rtu network and the logic is within the PLC. A single room can be isolated from the system in case it needs maintenance or shutting down. The function for fumigation for the entire suite as described in the OPW specification is standard. All parameters of the remote DPCs can be reached via the HMI so that the maintenance can be done from the front interface panel. Future expansions are possible and a remote diagnostic can be undertaken by CMR Controls with the appropriate service contract.

A Modbus TC/IP module shall communicate with the Trend BMS and the BMS shall collect all the data from a data block in the CMR Interface Panel as described in the BMS Point schedule. A separate Profinet module shall communicate with the EMS which has the Siemens WinCC system installed. A data block is produced within the CMR Interface PLC for the EMS to collect all data as described in the point schedule of the EMS system. It is not advisable to reset set points from the BMS or EMS, as the system is validated at commissioning and no changes should be made without proper change control. There are also hardwire digital inputs and outputs for night set back and alarm functions.

Modbus TC/IP Communication between the PLC Interface Panel and the BMS in the ISO7 Area

The point schedule of the BMS specifies the points which are made available as a data block within the CMR Interface Panel for the BMS to collect. The BMS only collects the data, it does not reset or mute alarms of the VAV system as it needs individual investigation of an alarmed system in order to have a safe room pressure. The muting and resetting of alarms are made on the CMR Interface Panel HMI

The following data is in a data block for CMR to the BMS

Main Labs
LSV Supply Air volume
LSV Volume High Alarm
LSV Volume Low Alarm
Lab Pressure against Plant room datum
LEV Extract Volume
LEV Extract Volume High Alarm
LEV Extract Volume Low Alarm
Gowning Pressure against Plant room Datum
Fume Hoods Fault Alarm
BSC Fault Alarm

The following data must be made available by the BMS to CMR via Modbus TC/IP for CMR to collect:
Room Pressure Alarm High PDSH
Room Pressure Alarm Low PDSL (this is not on the I/O List)

The BMS and CMR Interface Panel has also hardwire Digital Inputs and outputs.

Digital outputs (Volt free contacts) from BMS to CMR

1 off Start/Stop AHU (When the AHU is switched on by the BMS - the VAV system knows it has started)
1 off VAV Open/Close. When the BMS switches the VAV 'Close' ON - all VAVs drive to closed.
1 off Unoccupied (Night Set Back). When the BMS switches on the 'Night Set Back' to ON.
1 off Fumigation 'ON'. When the BMS switches the Fumigation 'ON' then the AHU must be 'OFF' and the VAVs must be closed then the Blow Off function is activated in the VAV control routine.)

Digital Output (Volt free contacts) from CMR to BMS

1 off CMR Panel Healthy
1 off LL Pressure alarm to drive to a reduced set point to protect the building (Supply and Extract Fans must work together)
1 off HH Pressure alarm to i.e. drive to a reduced set point to protect the building (Supply and Extract Fans must work together)
1 off System Stop (This output triggers the AHU Fans and Extract Fans to shut down completely preferably in a coaster Stop)

EMS and CMR PLC Interface

Profinet Communication between the PLC Interface Panel and the EMS in the ISO7 Area

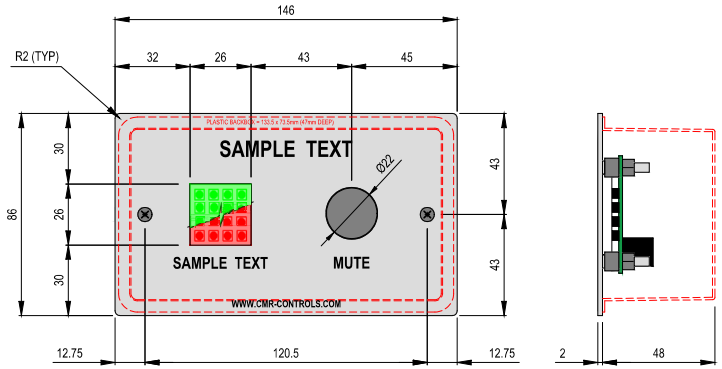
The EMS point schedule specifies the points which are made available as a data block within the CMR Interface Panel for the EMS to collect. The EMS only collects the data. It does not reset or mute alarms of the VAV system as it needs individual investigation of an alarmed system in order to have a safe room pressure. The muting and resetting of alarms should be made on the CMR Interface Panel HMI.

The following data is made available in a data block for the EMS

Main Labs
LSV Supply Air volume
LSV Volume High Alarm
LSV Volume Low Alarm
Lab Pressure against Plant room datum
Differential Pressure Lab to corridor
LEV Extract Volume
LEV Extract Volume High Alarm
LEV Extract Volume Low Alarm
PDSH Pressure Alarm from BMS
Gowning
Room Pressure against Plant room Datum
Fume Hoods
Fault Alarm
BSC On
BSC Fault

LED ALARM PLATES

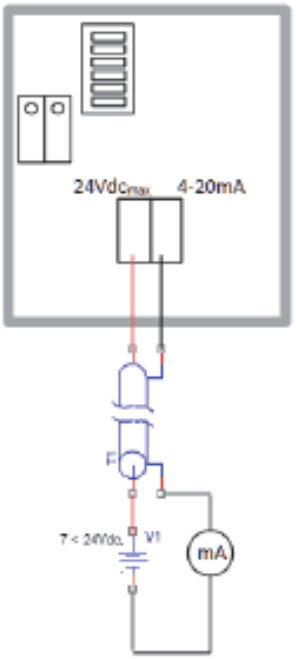
The critical rooms shall have an alarm plate fitted inside the room showing a single combined changing 25mm square RED and GREEN Led light. When the room pressure goes into high or low alarm, which is controlled by the interface panel, the LED changes to RED and a buzzer shall annunciate the alarm. The Alarm can be muted locally and also from the CMR Interface Panel. When the room is healthy again, then the LED changes to GREEN and the alarm shall reset. There is either a GREEN or a RED Led illuminated at any time. The plates communicate with Modbus rtu to the PLC.



14.0 Room Pressure Safety

Room Pressure Safety Sensor
At present, the system has the LL and HH alarm as part of the controlling sensor built into the CMR Interface panel.

The BMS has one High and one Low Pressure switch in one room only. As ultimate safety, it is recommended to fit a 2-wire Pressure Sensor to each clean room to safeguard the fabric from collapsing in case of excessive over room pressure. The clean room manufacturer would be able to quote a safe pressure of approx. 250 Pa normally. This would mean, the positive pressure sensor would be set to plus 240 Pa. The sensor will be installed in the CMR PLC Panel. The tube should also be sized correctly to achieve the speed.
This was not specified in the OPW documentation, but needs to be addressed before installation starts. It would be best for the BMS to monitor the I-Sensor pressure sensors to be able to act fast to switch off the Fans.



Equipment Warranty Statement

CMR manufactured goods such as the

DPC Controllers
Pressure Sensors
Alarm Plates
Dampers and actuators

Are subject to a one year warranty from date of handover on site. The warranty covers a replacement part, provided it is a product failure and not caused by mishandling or faulty third party intervention. The warranty must be approved by CMR first after inspection of the goods.

If the components are bought by a contractor for a particular Installation and the goods were specified by the client then CMR shall arrange for the replacement of the parts or repair on site. Otherwise, the warranty only covers the replacement part and not the labour to change it.

The Siemens Hardware is covered by the Siemens Warranty as these are items CMR would purchase. CMR shall arrange for the replacement but shall be subject to the final confirmation by Siemens.

CE MARKING - ISO 9001 - UKAS

CMR manufactured goods and bought in goods such as the

DPC Controllers
Pressure Sensors
Alarm Plates
Dampers and actuators
Siemens Components

are all CE marked which means they all conform to the relative EN and DIN standards.

A declaration of conformity is issued for the relevant components as standard. Whilst the specification of the project of the FSL lists many standards, we only comply to the standards relevant to our product.

CMR CONTROLS is ISO 9001 and UKAS accredited.

CMR CONTROLS has experience in the Pharmaceutical Industry.

Factory Commissioning

The factory testing and pre-commissioning is part of the supply by CMR CONTROLS. The VAV controls shall be configured with the agreed operating set points. Complete testing of the valve or damper operation and attaching the correct TAG numbers.
Air Volume tests at min - 50% and max shall be carried out during factory testing.

Factory calibration certificates shall be established and a complete factory test protocol shall be issued.
The products shall be packed individually and numbered ready for shipping to site. A CE declaration is supplied as standard.

Site Preparation and Commissioning

Note: The SAT (Site Acceptance Test) document must be approved before site commissioning starts.

Step 1

CMR shall explain the installation procedure to the Mechanical and Electrical Contractor on Site
CMR shall check with visits the installation progress and check that the installation is done according to the CMR procedure.
When the Site has installed the VAVs and Power is supplied to the CMR Interface panel only then can CMR start pre-commissioning the site.

At this stage, each VAV shall be powered up by CMR one at a time.
The test will include rotation of damper actuators 0-25-50-100%, communication and feed back confirmation.
Tube checks from room to Interface panel, Room to DPC controllers and Reference tubes.
Once this is completed the Dampers shall be left in fully open position and the panel is powered down.

Site Commissioning

Step 2

The 'System Stop' switch must be simulated and tested to provide the correct PLC output to the digital output to the BMS. This functions is required when the AHU is operating via the BMS in Hand or Auto Mode.

When the Supply and Extract fan is ready to run in hand mode and the clean rooms are relatively clean, Step 2 can start.

All rooms must be fully open - no doors shut.

The BMS shall operate the supply and extract fan in hand mode at low speed. CMR shall switch the VAVs in pairs supply and extract per room and test the air volume sensors and room pressure sensor.

Once all VAVs are commissioned, the BMS shall slowly increase the speed of the fans supply and extract proportional equal. The VAVs shall follow the increased static pressure and shall starting closing to achieve set point.

Once all VAVs have reached a safe set point and are controlling, the static pressure set point of the fans can be determined. If some rooms are complete with operating doors than one room at a time can be tested for room pressure control. Once this testing is finished and documented then the VAV dampers shall be opened fully and locked in position.

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Site Commissioning

Step 3

When the Supply and Extract fans are ready to run in automatic control and the BMS is ready to work with CMR then Step 3 starts. The CMR and BMS interfaces must be tested and each function must be verified by CMR and documented.

All rooms must be fully operational and the clean room doors can be opened and shut.
The door contact is fitted and available to the Interface Panel. **The speed of the Door contact must be verified.**

A room shall be put in automatic control and the DPCs can be checked if the control is working to specification.
The door contact must be checked that the DPC freezes the control when opening the door.
The Test shall continue room by room until all VAVs are working in automatic control.

Once all VAVs are in Automatic control, the BMS shall put the fans on automatic static pressure control with a low set point
As the system ramps up the VAVs shall be checked that they follow. The set point of the Fans shall be increased slowly.
Once the system is running automatically, fan fail tests can be carried out.

It is important that the BMS shuts down fails all fans if a Supply or Extract Fan fails.

Step 4

Once the system is fully tested, then CMR shall go into the final stage of the SAT (Site Acceptance Test)

The SAT shall be executed by CMR and a representative from the must be present to sign off the SAT at the same time..
The SAT shall include all the set points and component information.
Test certificates.
Conformance Certificates

CMR shall provide:
Wiring diagrams as installed.
Operating and maintenance Manual
Recommended Spares List.

CMR does not execute the IQ/OQ.

18.0 Room Schematics Typical Overview

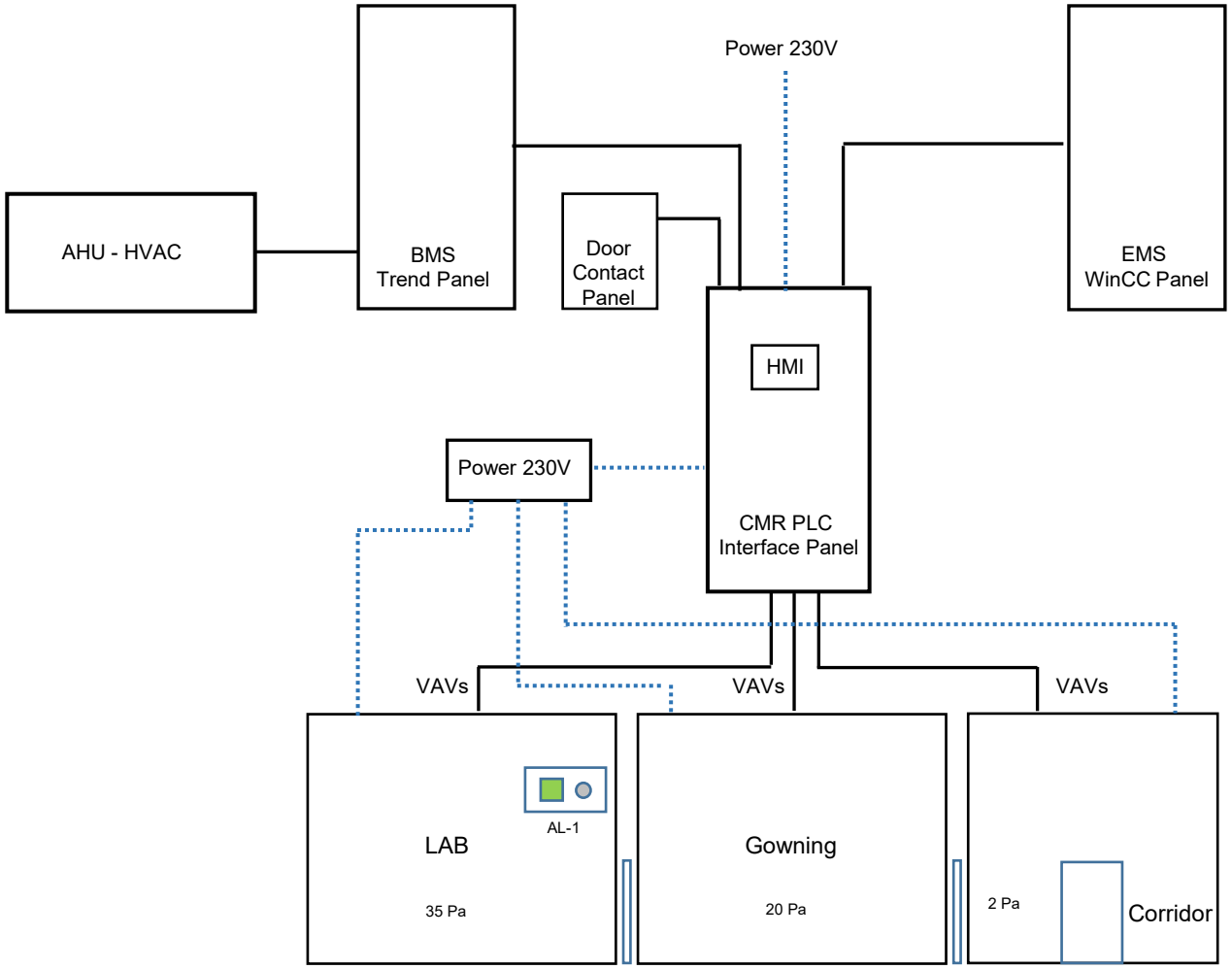
Typical Schematics to provide an overview of a Search Lab, Gowning Room and Corridor.

The following pages show an overview of the system, power wiring, control cable wiring, comms wiring and the tube installation. It is meant to provide an overview of what is involved in the installation of the CMR VAV system.

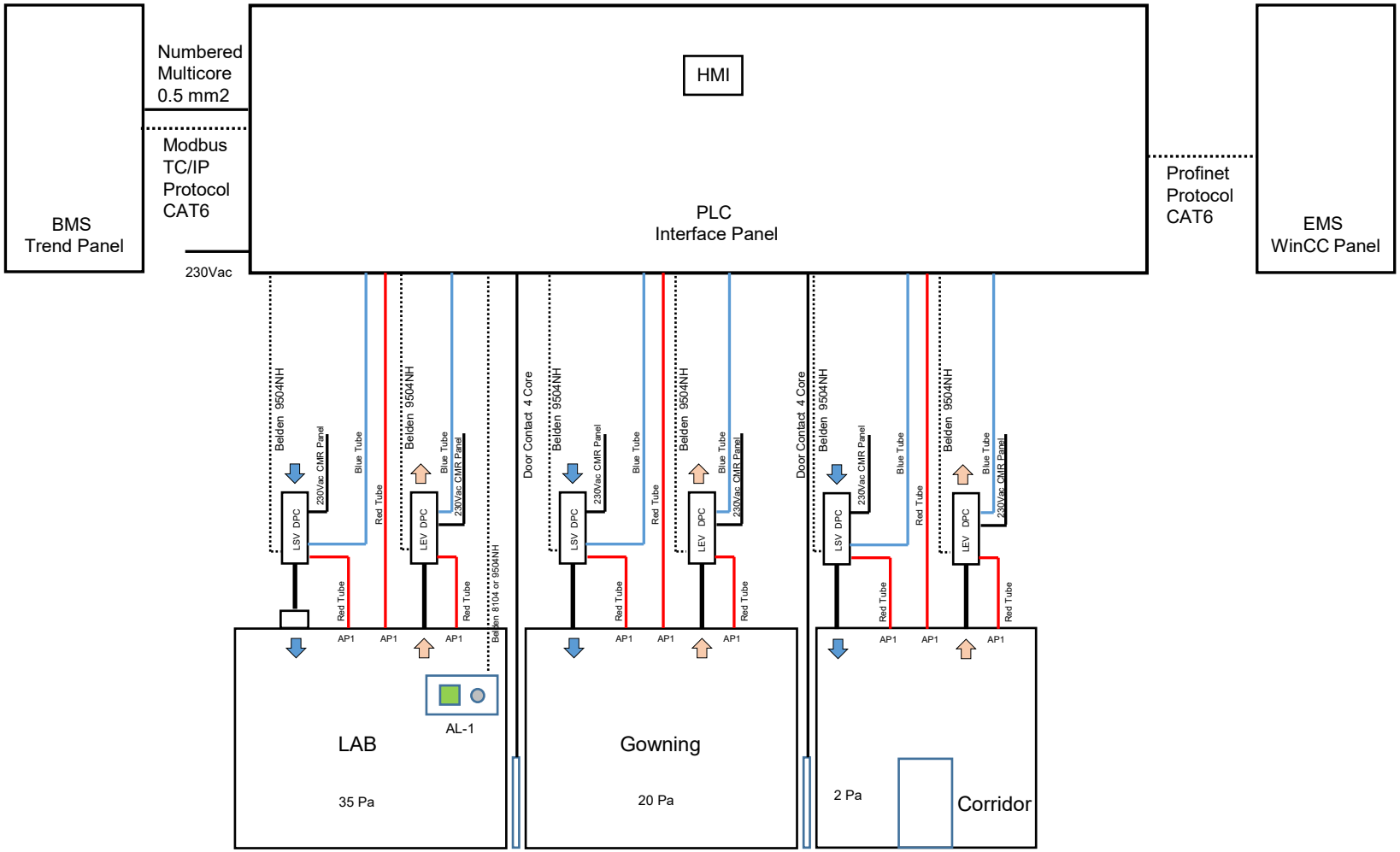
The contents of these pages are to be taken as a general overview for the electrical contractor to see the scope of the installation.

18.0 Room Schematics Typical Overview continued...

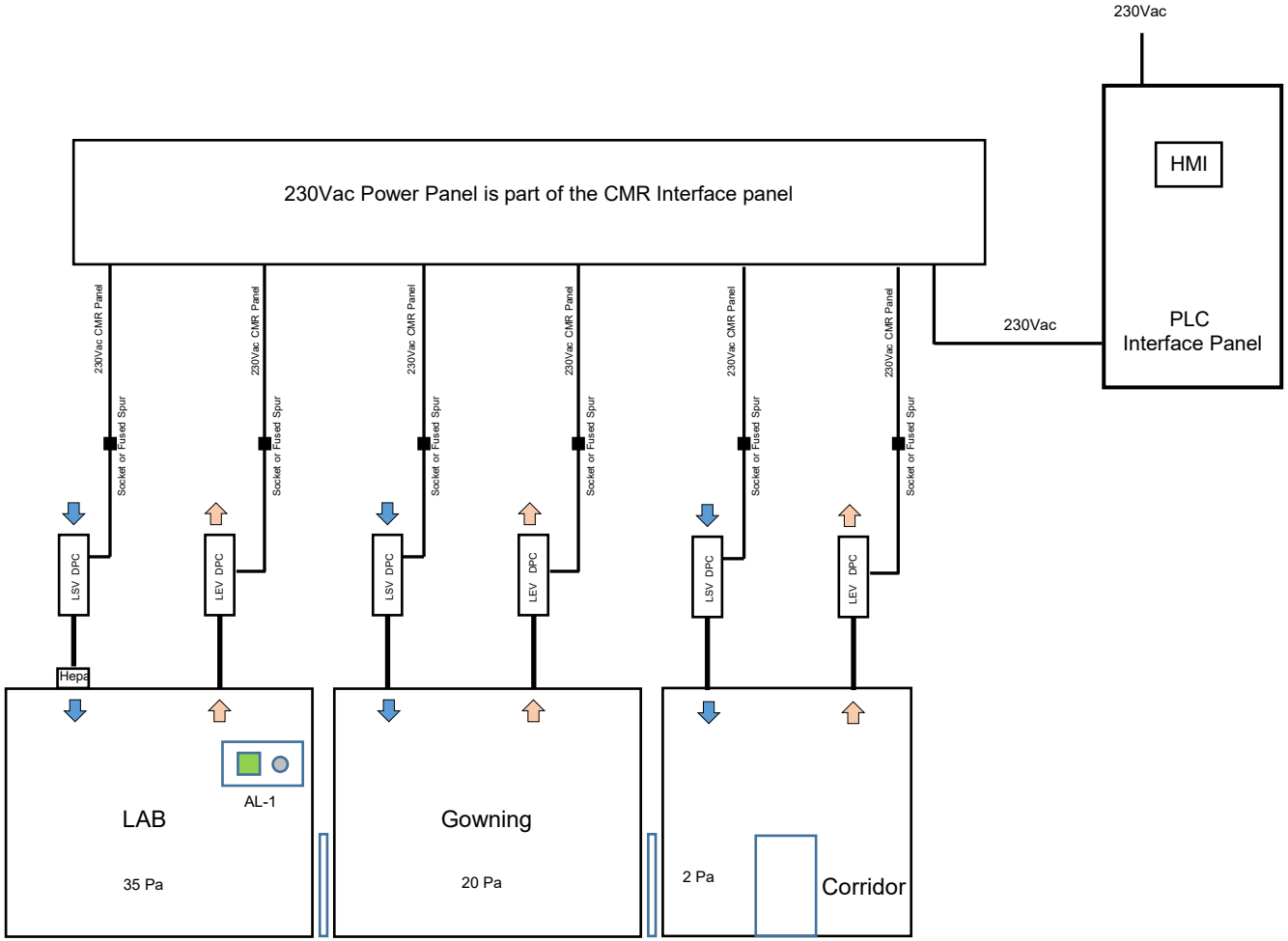
System Architecture



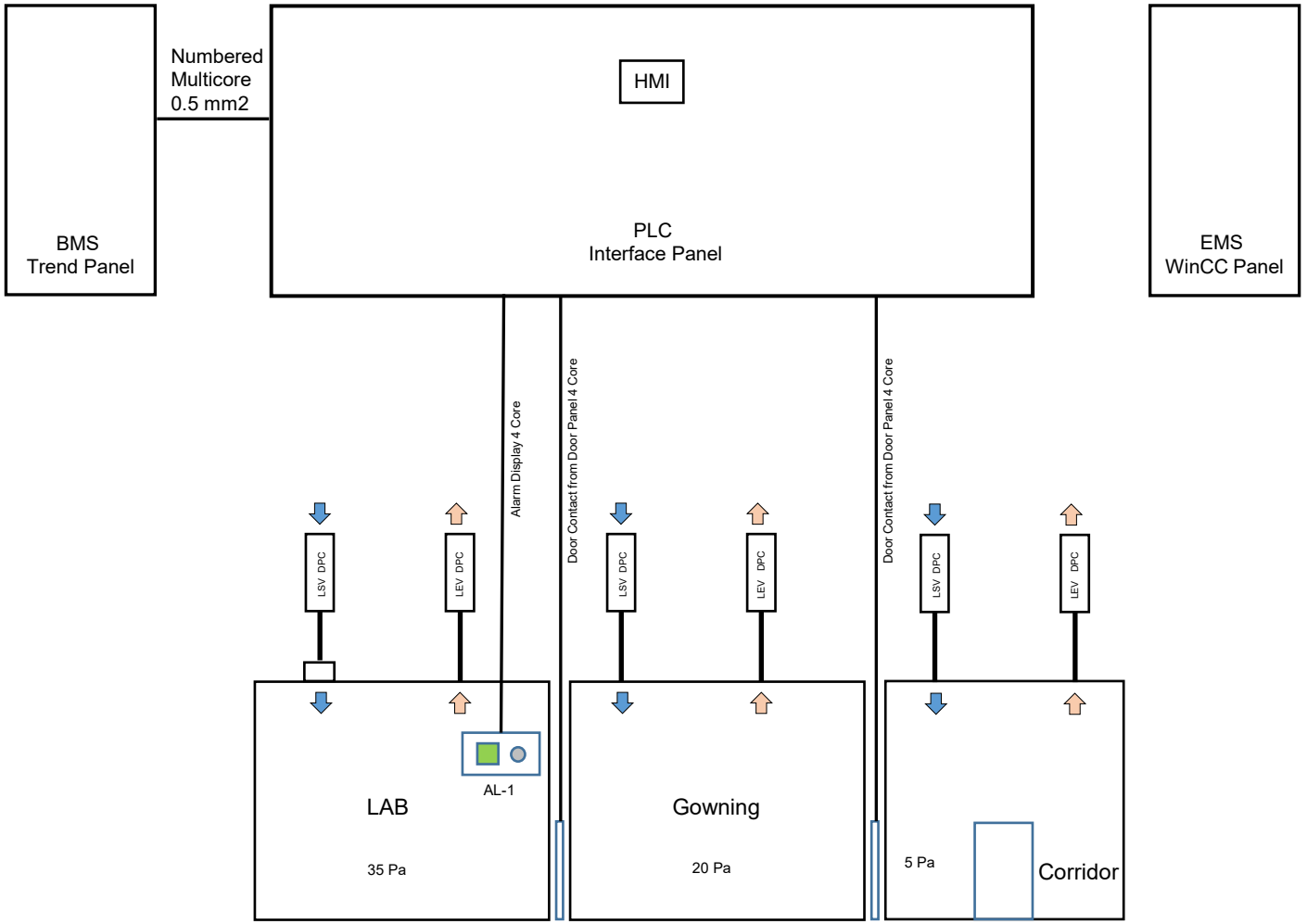
VAV System Overview



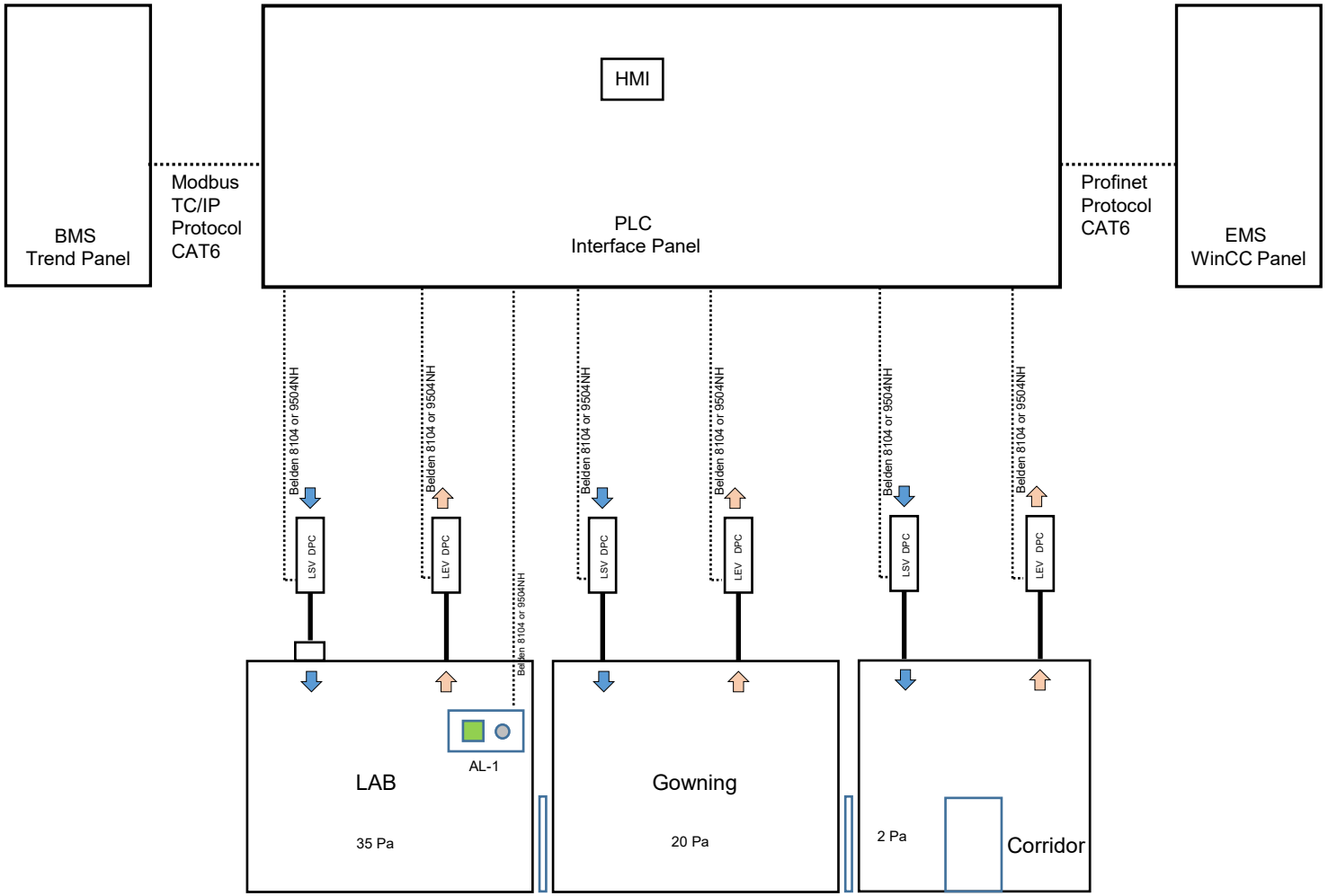
Power Cable Installation



Control Wiring installation



Comms Wiring Installation

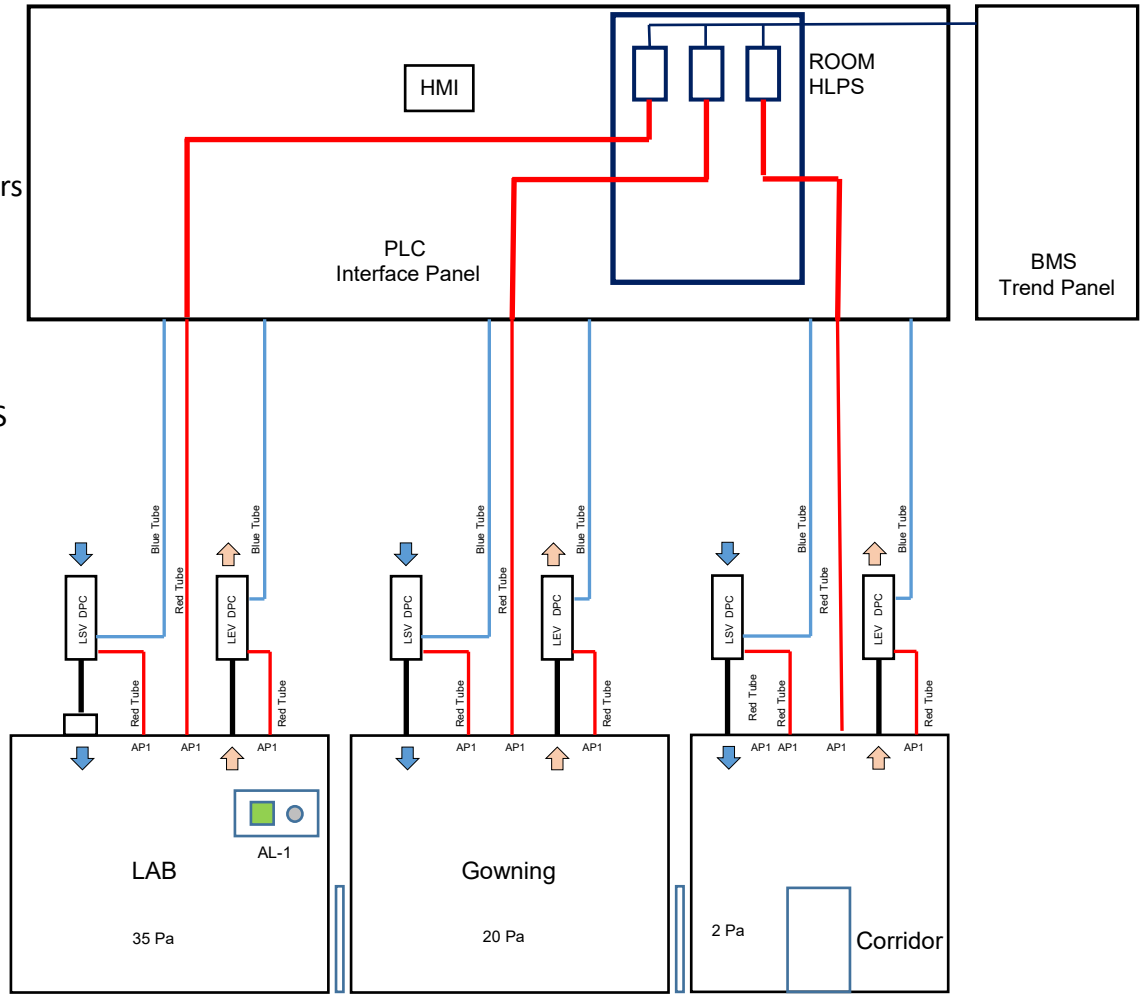


18.0 Room Schematics Typical Overview continued

Room Over/Under Pressure Sensors
I-Sensor +/- 250Pa
AO = 4-20mA
24vDC 2 Wire
Installed into the right hand door of the CMR PLC Panel.
The Sensors are connected to BMS Trend Panel.

FB15 Room Over/Under Pressure Switch JB
Installed In Ceiling Area.
Cable connection from the BMS Trend Panel.

Tube Installation



Room Schematics to show Red and Blue Tube, Power Cable, Modbus Cable Installation

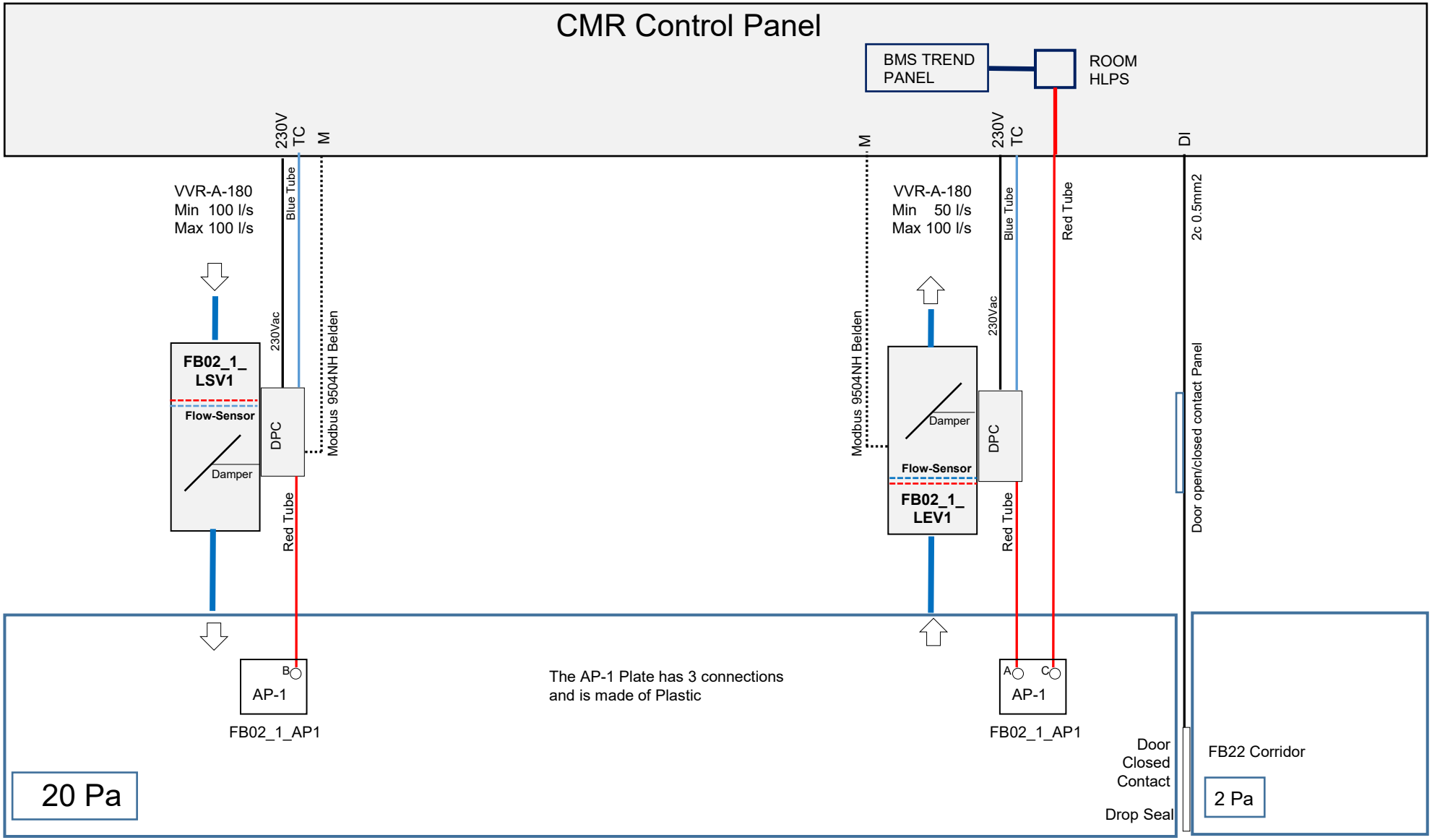
The following schematics show the individual rooms and VAV equipment to control the Rooms. The AHU area has a dedicated interface panel and the schematics refer to one complete AHU Area.

The room numbering follows in sequence to the actual Room Layout Drawing.

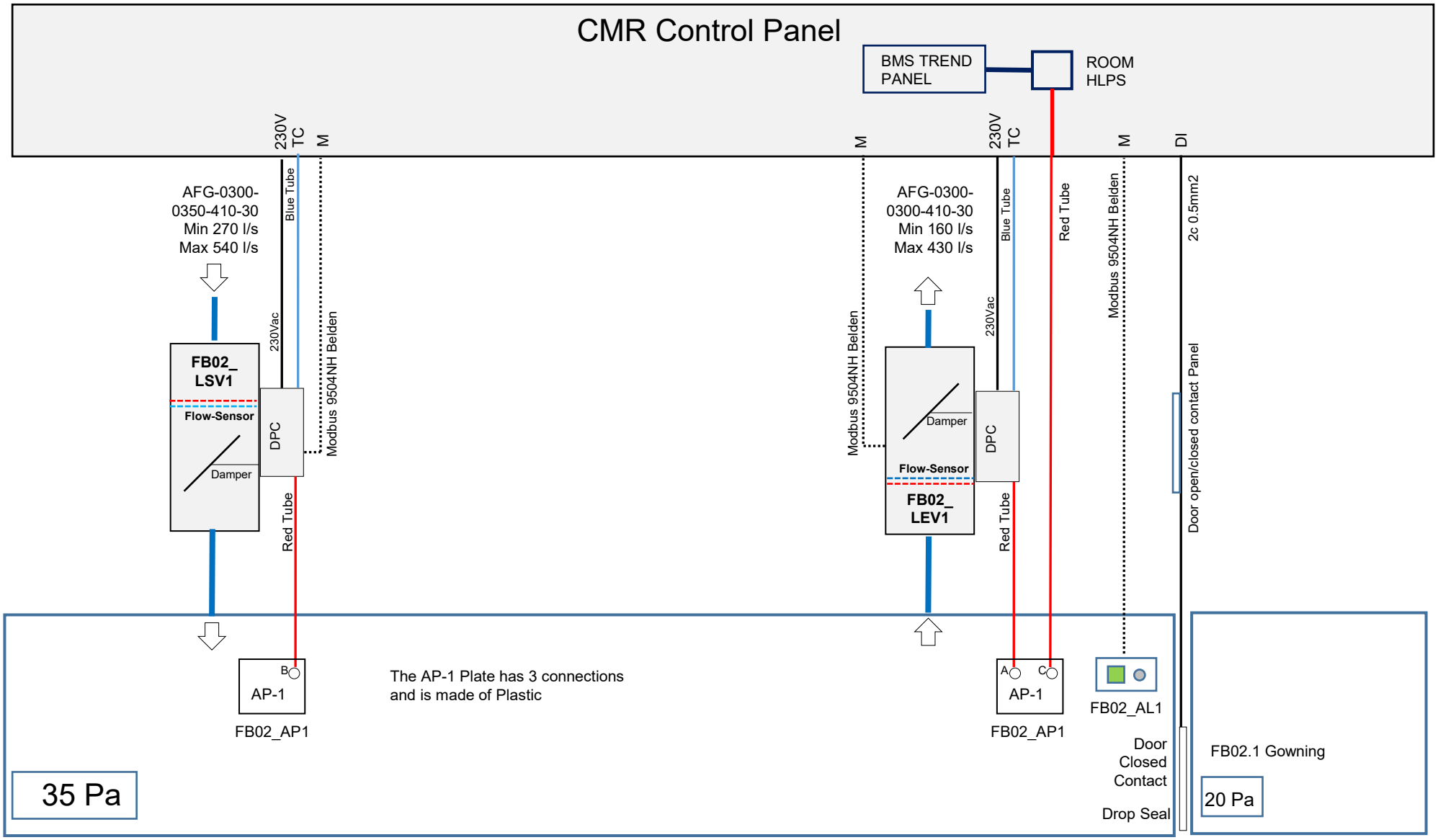
The contents of these pages are based on the Equipment Spreadsheet supplied by Arup. and have been approved by having received a Type 'A' approval.

It can be used to install all tubing, Belden Cable and power cable from the VAVs to the CMR PLC Panel. The CMR wiring diagram is there to terminate all tubes and wires and to check the system.

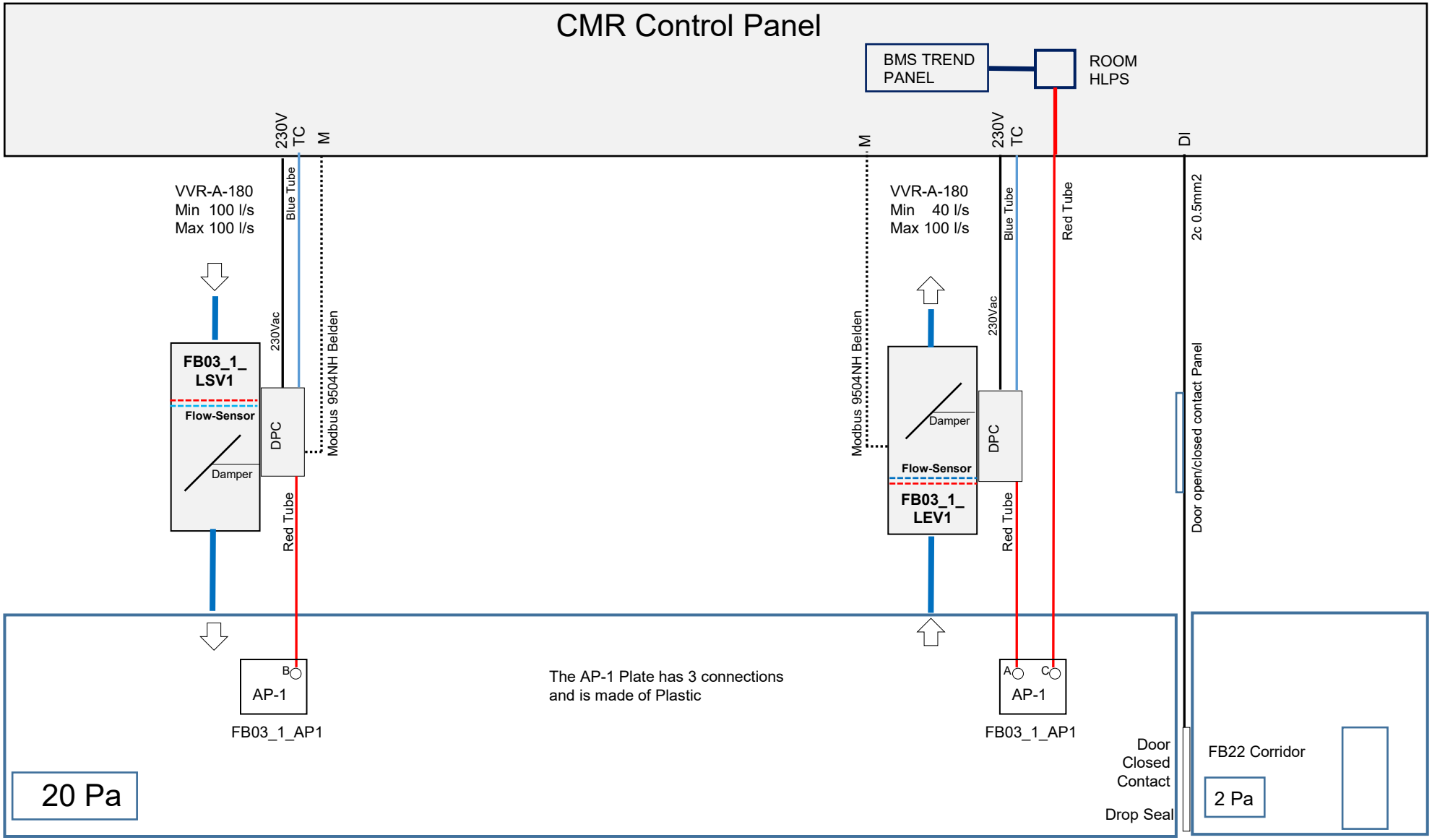
FB02.1 Gowning



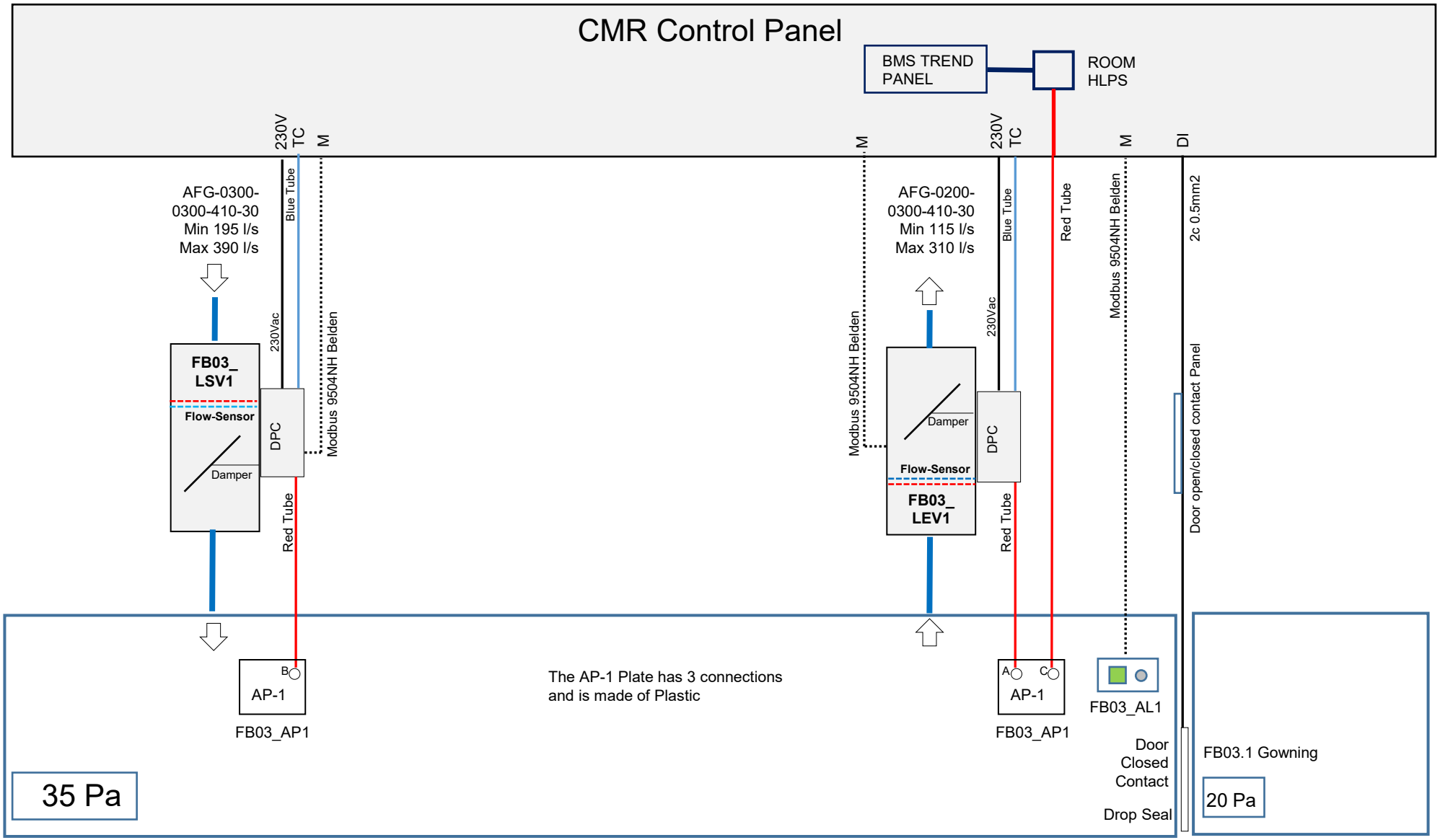
FB02 Search Room



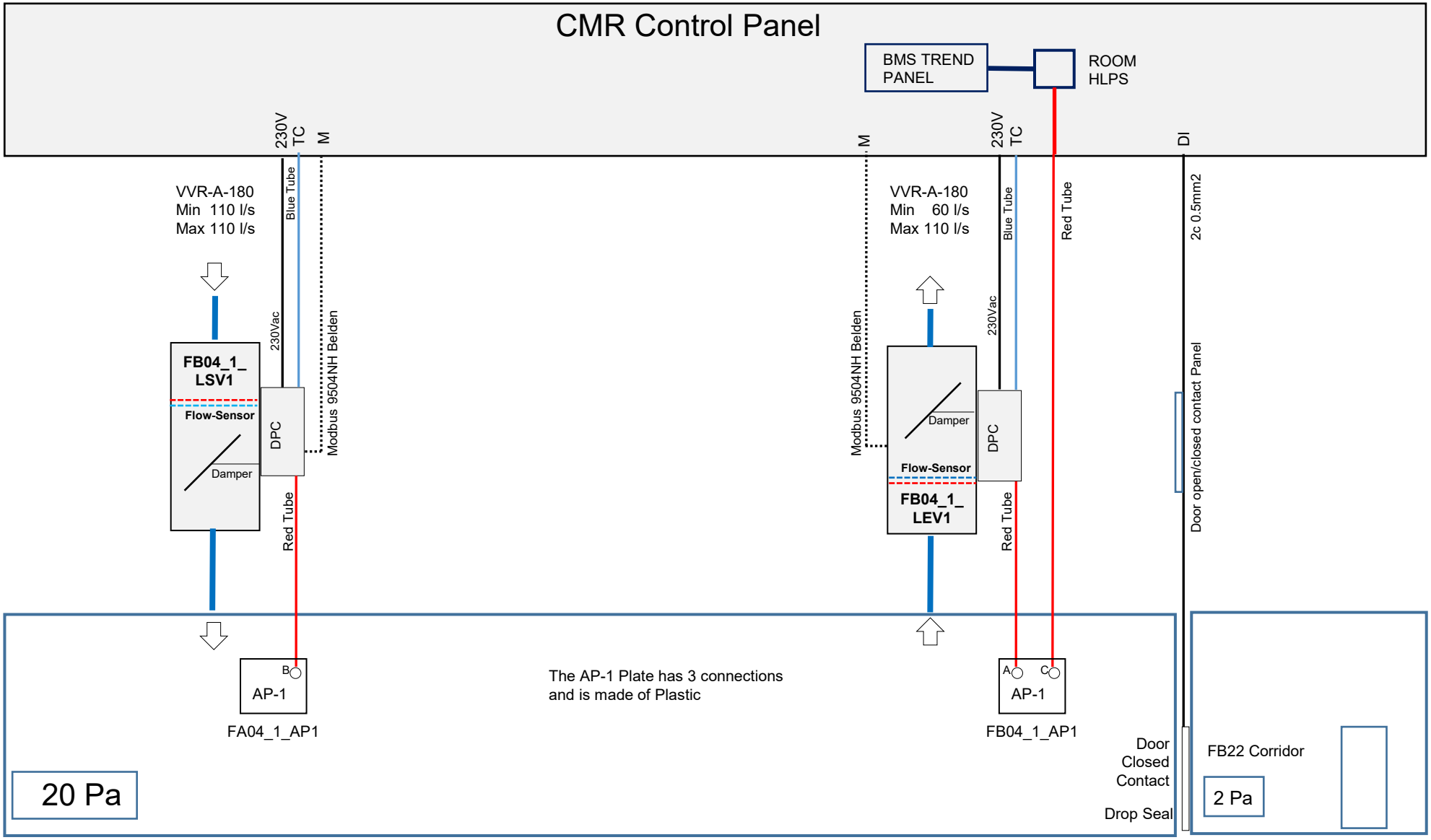
FB03.1 Gowning



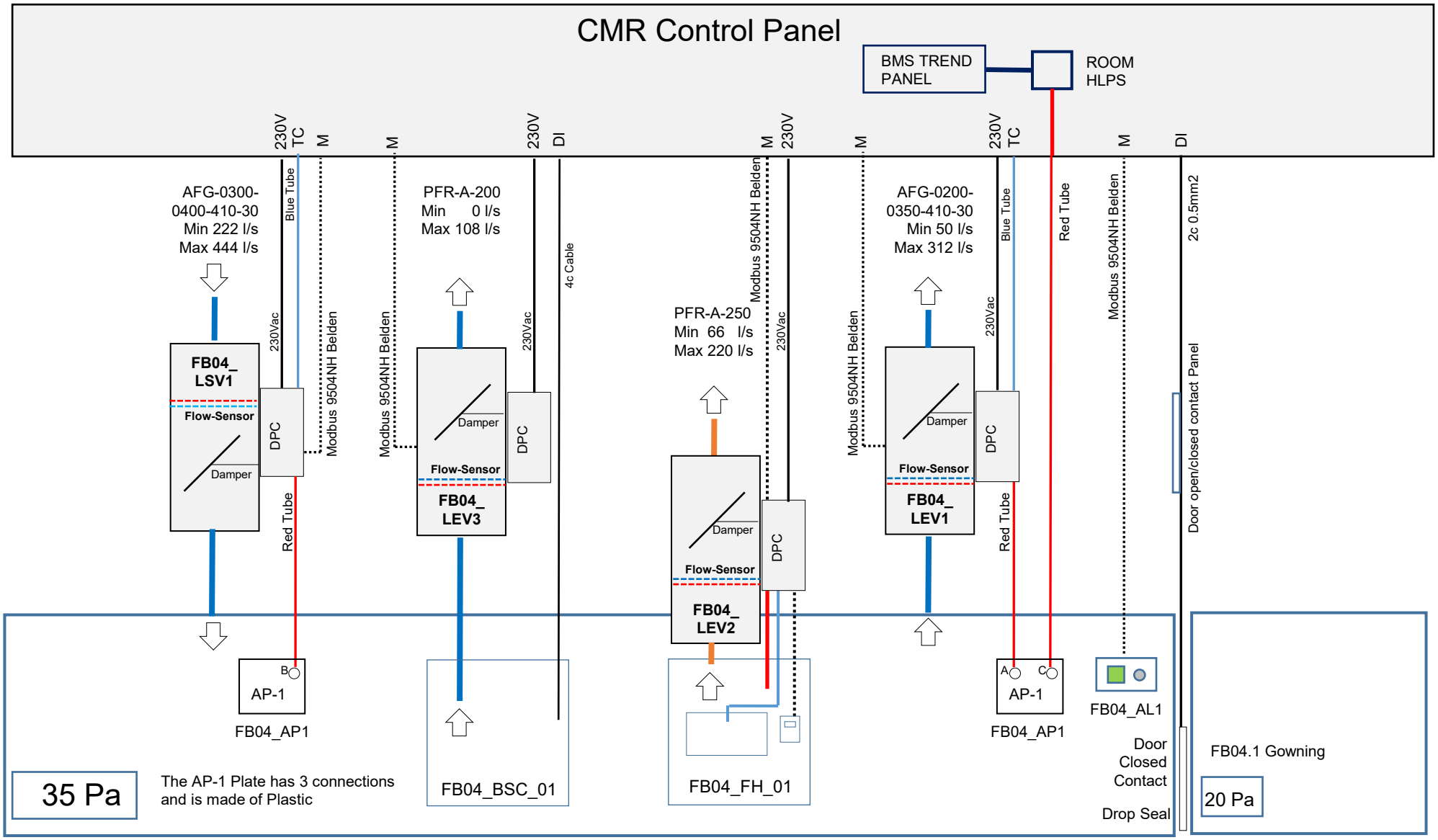
FB03 Search Room



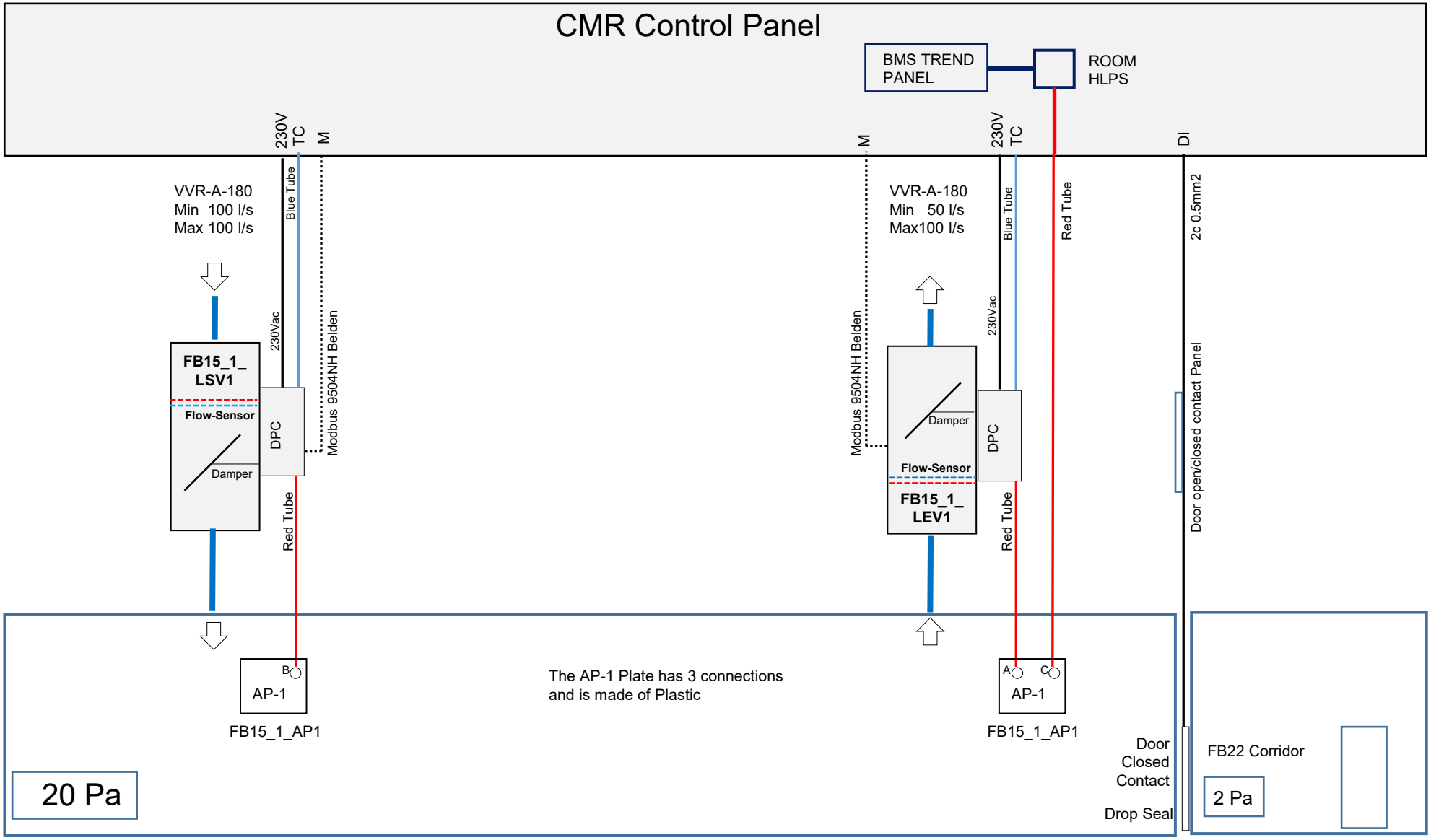
FB04.1 Gowning



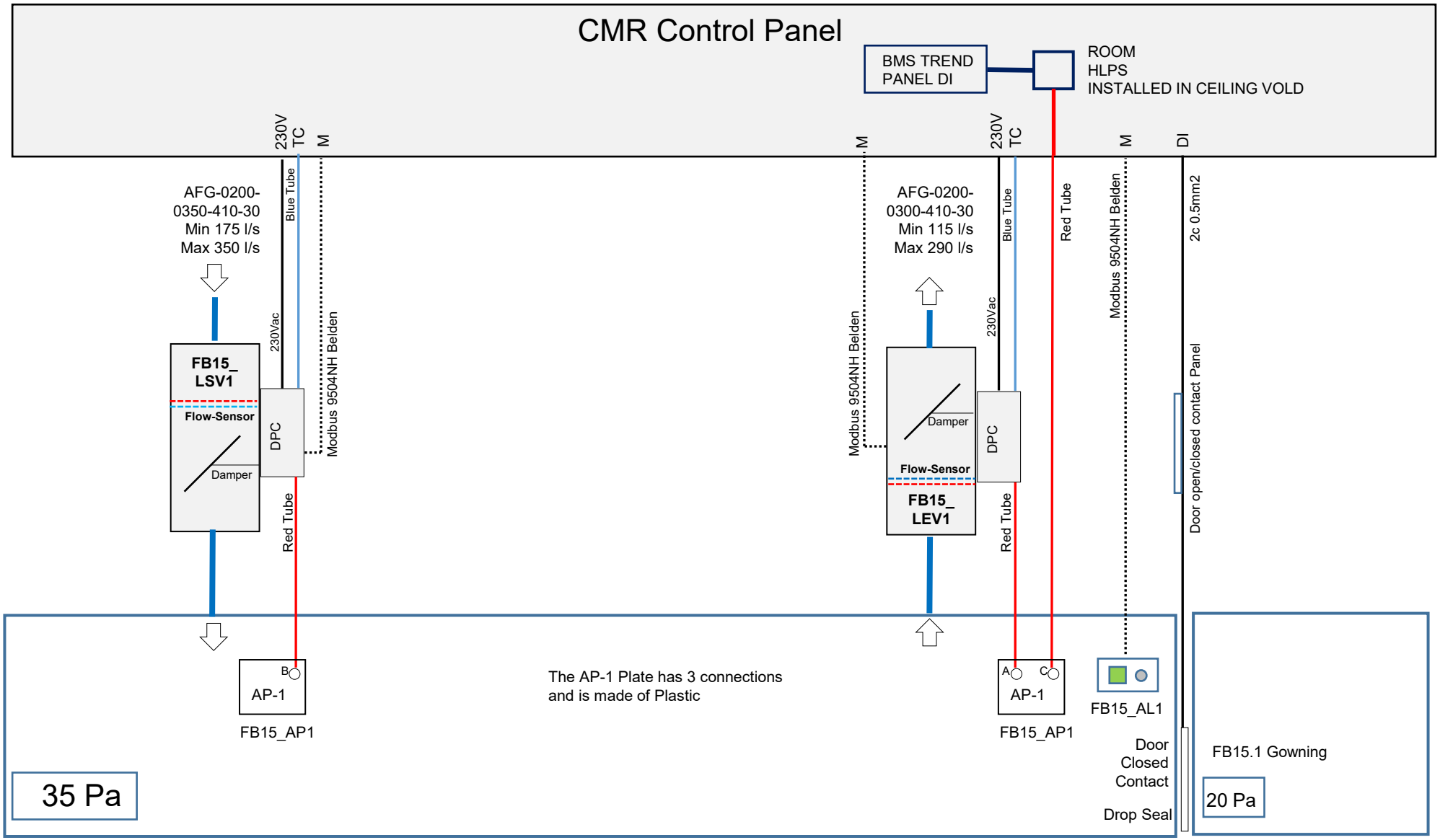
FB04 Research



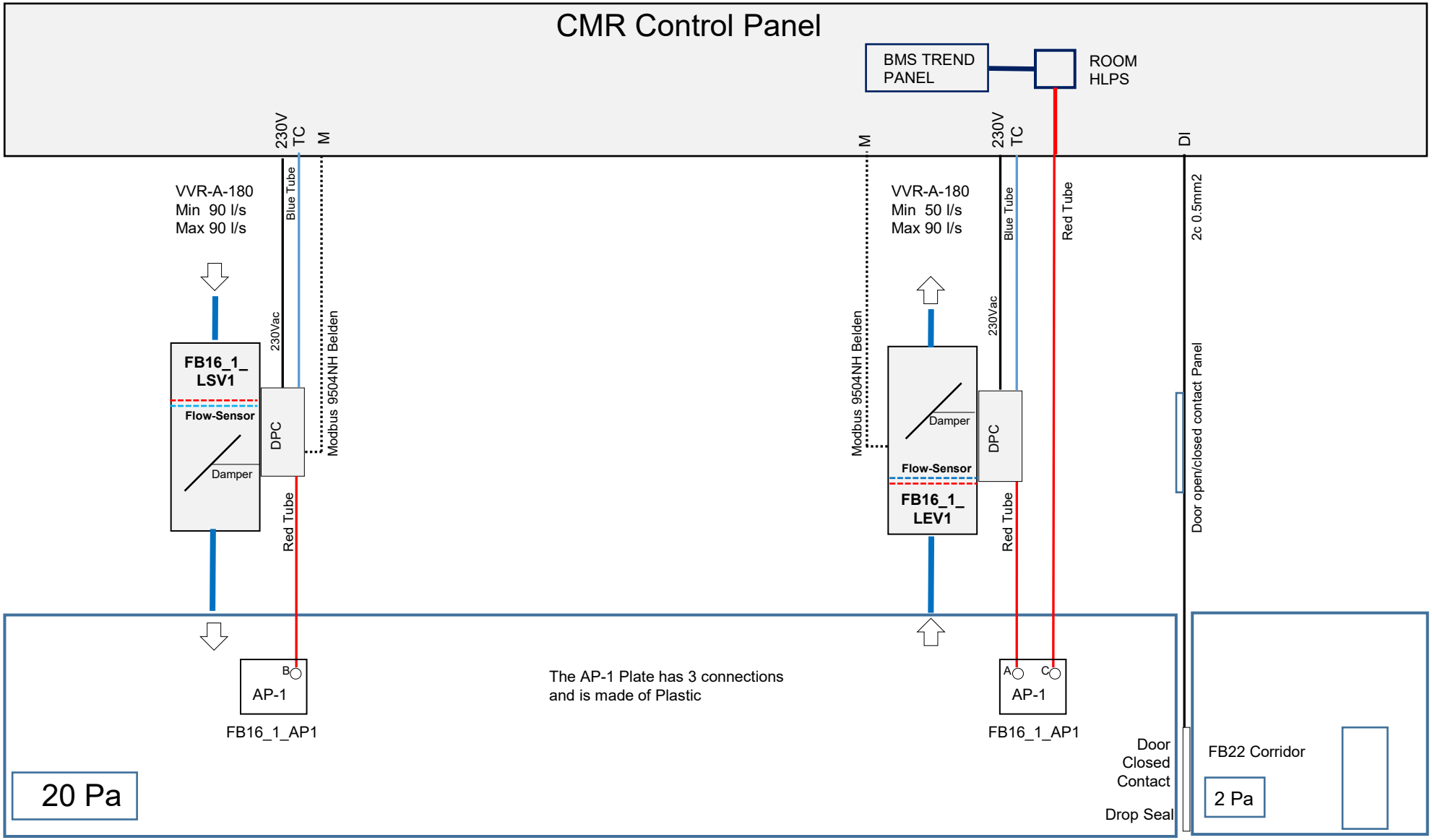
FB15.1 Gowning



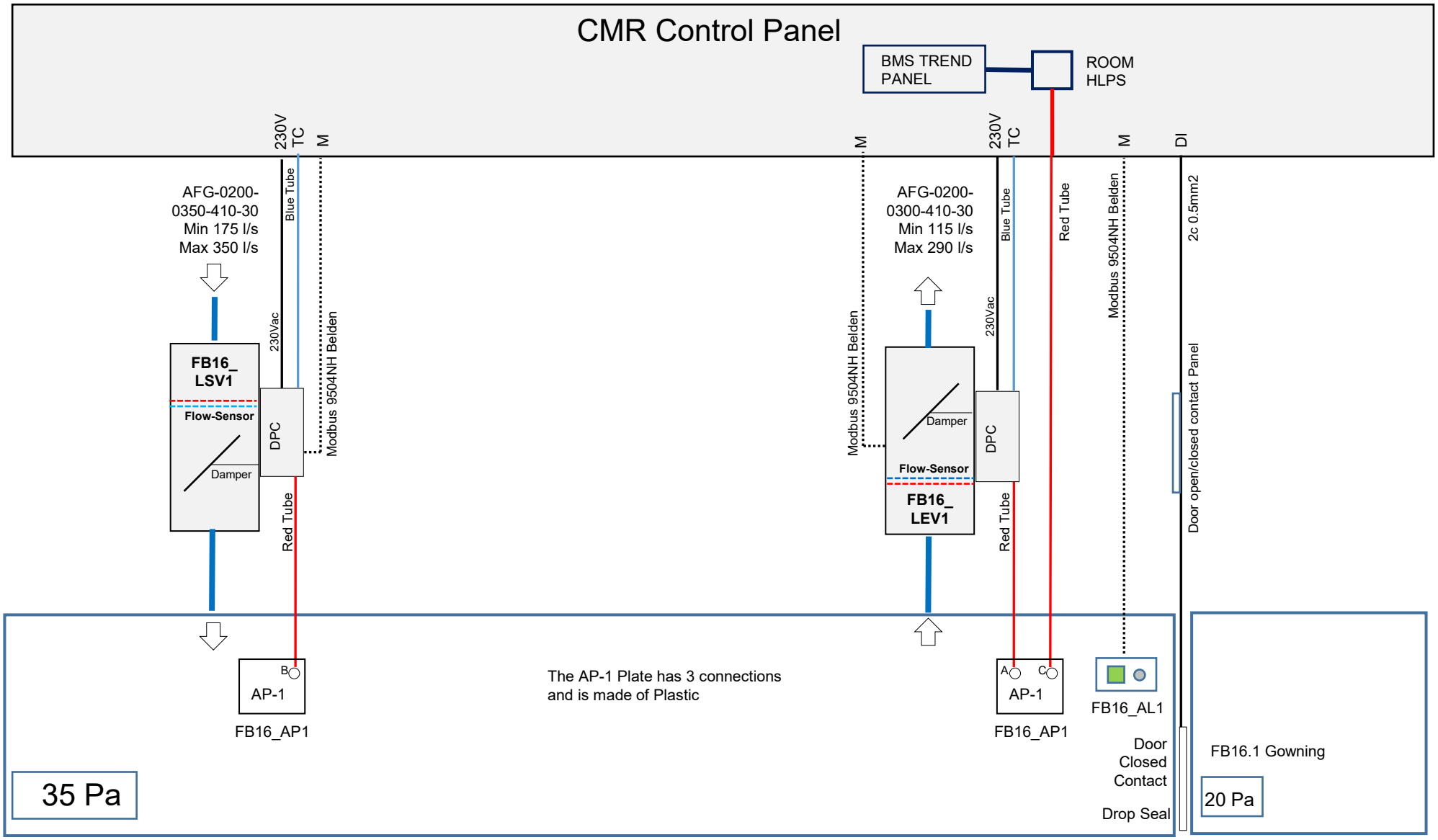
FB15 Search Room



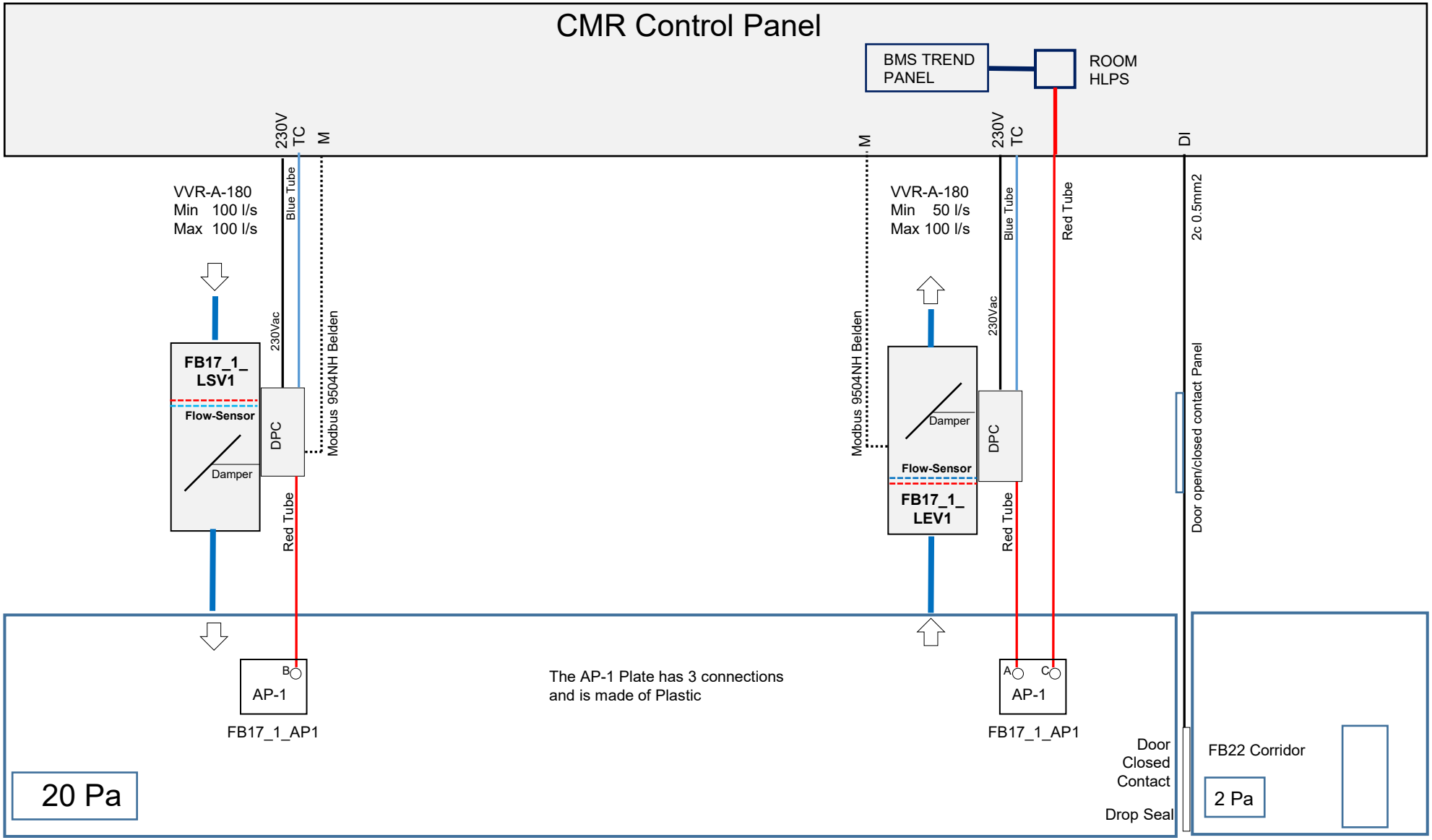
FB16.1 Gowning



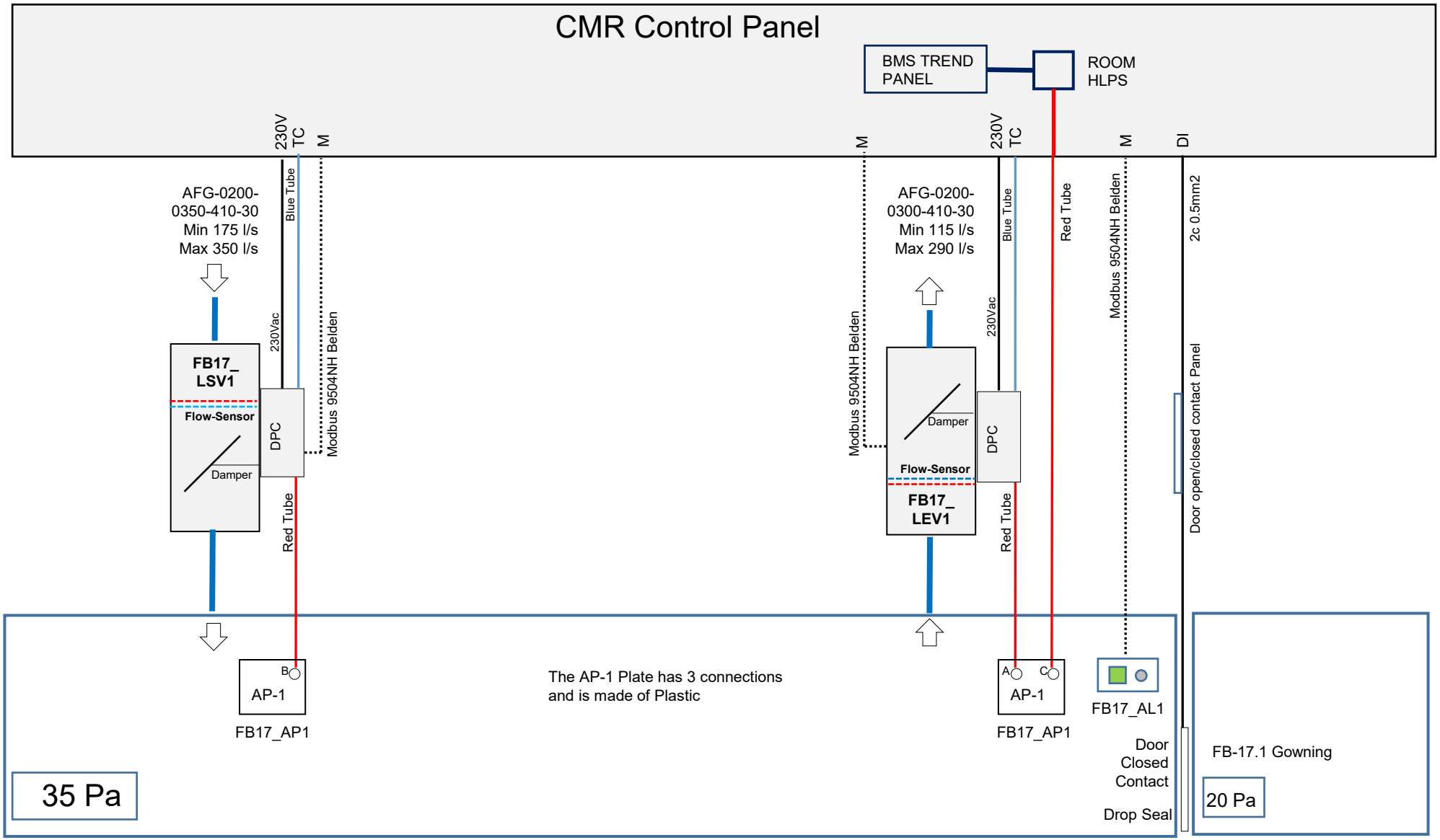
FB16 Search Room



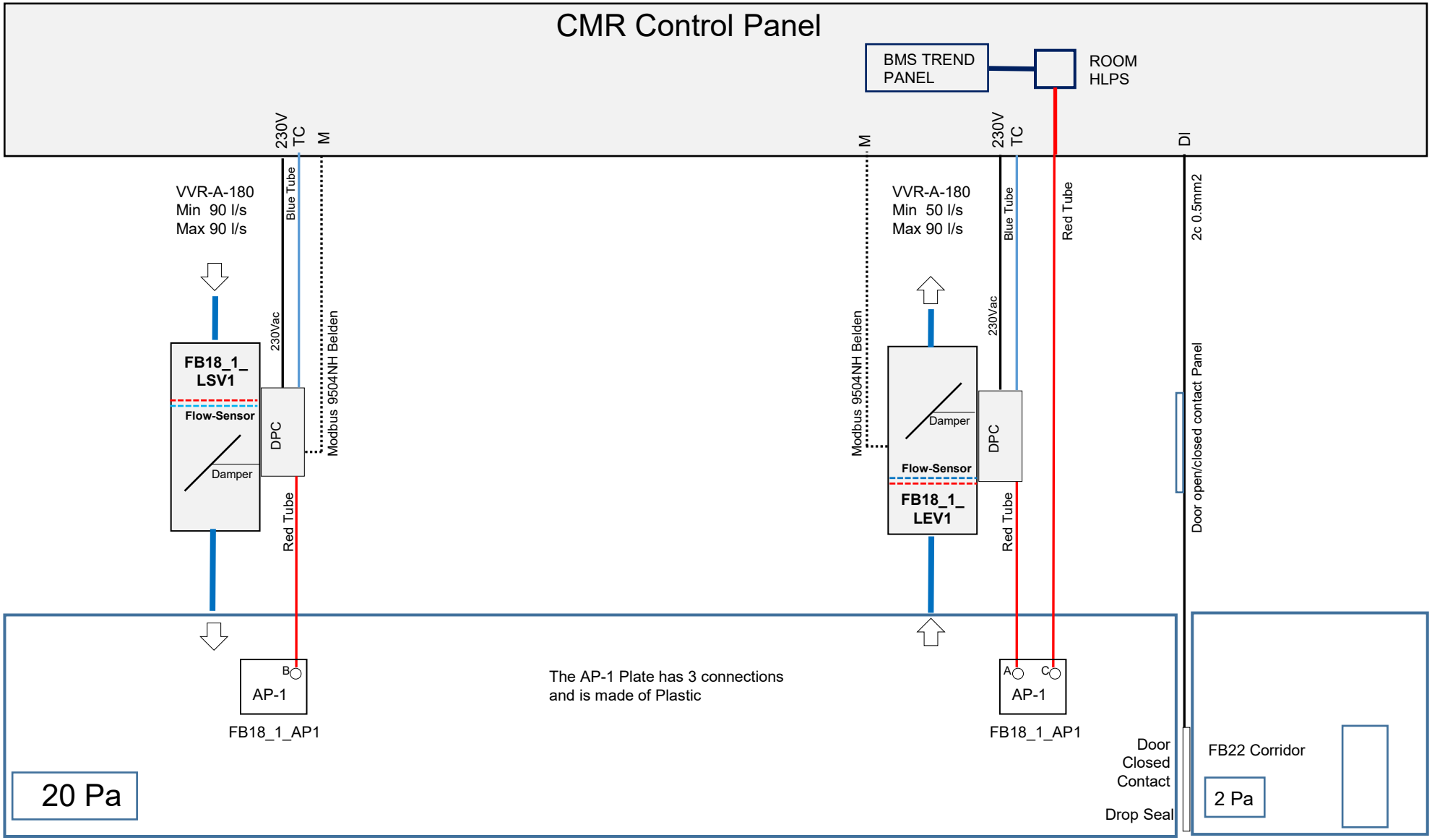
FB17.1 Gowning



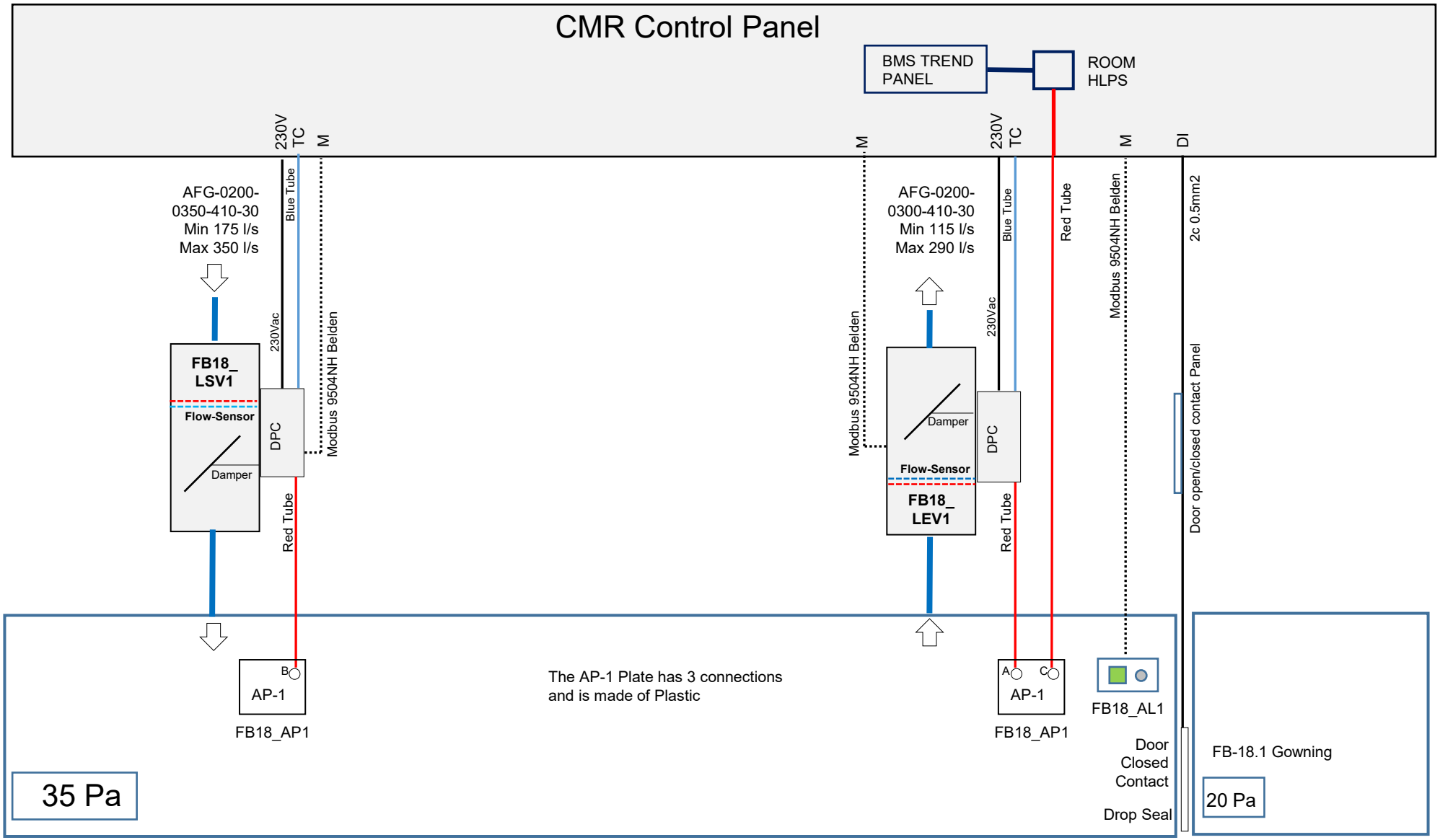
FB17 Search Room



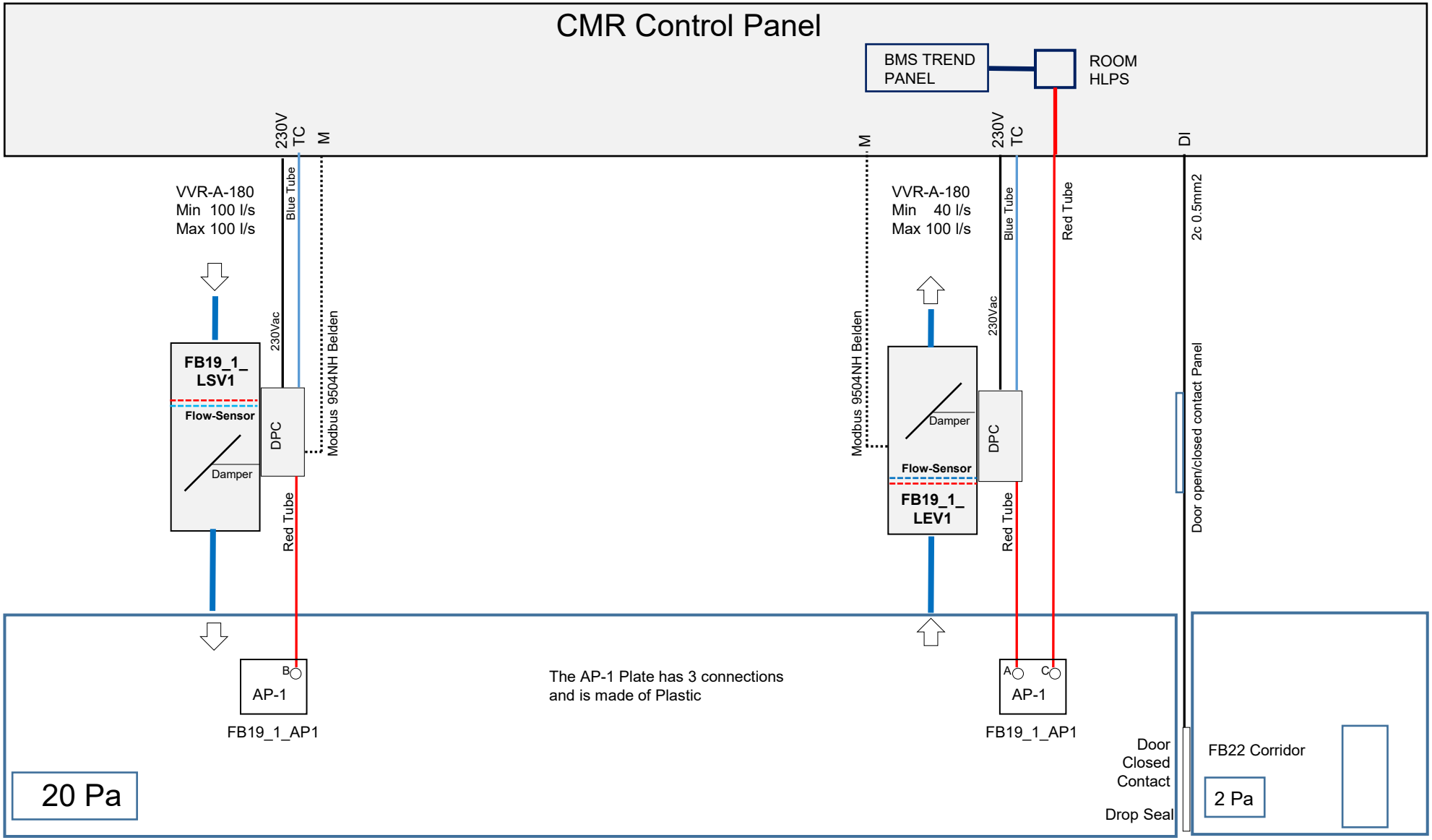
FB18.1 Gowning



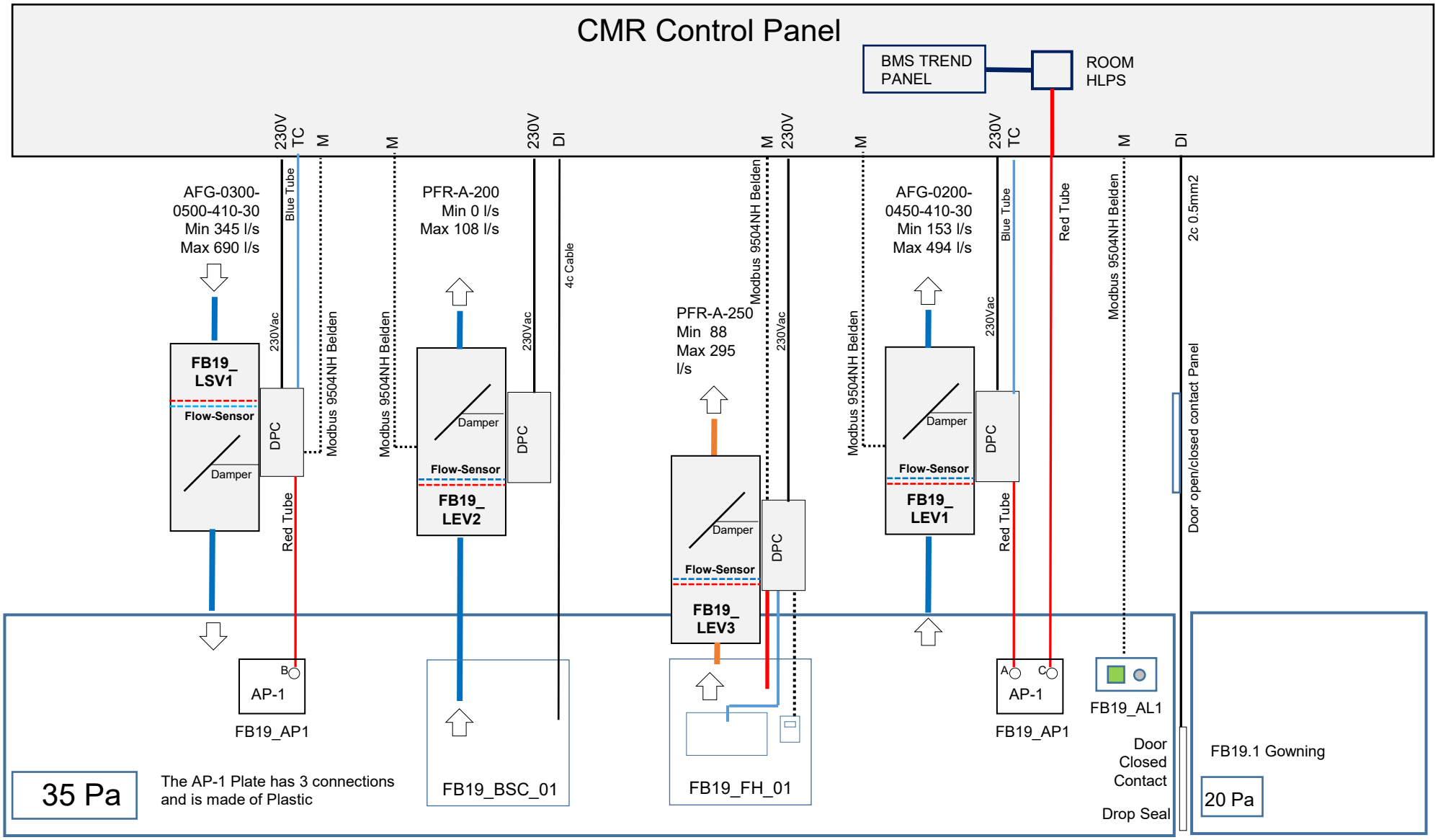
FB18 Search Room



FB19.1 Gowning



FB19 Dirty Room



FB22 Corridor