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INSTALLATION QUALIFICATION FOR HVAC SYSTEM

PROJECT: NEW EXPANSION OPERATING THEATRE &
SUPPORTING CLEAN ROOM FOR EXISTING EYE CENTRE
IN NEXUS, BANGSAR SOUTH FOR OASISEYE
SPECIALISTS SDN. BHD.

APPROVAL OF PROTOCOL

Signatures below signify that both vendor and client have read, understand, and agree with the content of this document. Approval of protocol must be granted by both parties before its execution.

This document was prepared and approved by the below representatives from Lufter Sdn. Bhd.

Name	Job Title or Role	Signature	Date (dd-mmm-yyyy)
Authored by: Wong Peng Peng	Validation Executive		23-May-2023
Reviewed by: Ahmad Aslam	Design Assistant Manager		23-May-2023
Reviewed by: Shawn Eng	Assistance Project Manager		23-May-2023

By signing below, OasisEye Specialists Sdn. Bhd. confirms that all their requirements for this project have been reflected in this document.

Name	Job Title or Role	Signature	Date (dd-mmm-yyyy)
Reviewed by:			
Reviewed by:		N/A	
Approved by:	GOO CHUI HOONG Operations Manager OasisEye Specialists		24-May-2023

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1.0 REFERENCE DOCUMENTS

No.	Document No.	Document Title
1.	L-POEBS01-OT&SCR-VD-URS-R01	User Requirement Specification for HVAC System - New Expansion Operating Theatre & Supporting Clean Room for Existing Eye Centre in Nexus, Bangsar South for OasisEye Specialists Sdn. Bhd.
2.	L-POEBS01-OT&SCR-VD-FSDS-R01	Functional Specification Design Specification for HVAC System– New Expansion Operating Theatre & Supporting Clean Room for Existing Eye Centre in Nexus, Bangsar South for OasisEye Specialists Sdn. Bhd.
3.	L-POEBS01-OT&SCR-VD-CQP-R00	Commissioning & Qualification Plan - New Expansion Operating Theatre & Supporting Clean Room for Existing Eye Centre in Nexus, Bangsar South for OasisEye Specialists Sdn. Bhd.
4.	L-POEBS01-OT&SCR-VD-DQ-R01	Design Qualification for HVAC System for HVAC System– New Expansion Operating Theatre & Supporting Clean Room for Existing Eye Centre in Nexus, Bangsar South for OasisEye Specialists Sdn. Bhd.

2.0 VERSION HISTORY

Revision No.	Date	Revised By	Reason for Revision
00	16 MAR 2022	Peng Peng	New
01	24 MAY 2023	Peng Peng	Additional Heater Control and TRH

3.0 INTRODUCTION AND SCOPE

This document qualifies the new HVAC system installation for the New Expansion Operating Theatre & Supporting Clean Room for Existing Eye Centre in Nexus, Bangsar South for OasisEye Specialists Sdn. Bhd. is to be in compliance with the principle of Ministry of Health Malaysia - Operating Theatre Management System, current ISO clean room guidelines, and World Health Organization (WHO) guidelines in accordance to Current Good Manufacturing Practice (cGMP) of the Pharmaceutical Inspection Co-operation Scheme (PIC/S). The HVAC is designed with reference to the HVAC standard for Air-Conditioning, Heating and Refrigeration Institute (AHRI), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), American Society for Testing and Materials (ASTM), The American Society of Mechanical Engineers (ASME) and Sheet Metal and Air Conditioning Contractors' National Association. (SMACNA) and Good Engineering Practices (GEP). The system has been assessed and categorized as "Direct Impact".

4.0 PURPOSE

This document is created to justify that the critical components have been installed as per the requirements in the design qualification and all necessary supporting documents are in place.



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5.0 ROLES & RESPONSIBILITY

The following personnel have been designated to prepare, execute, review and approve the protocol.

Company	Job Title	Responsibility
OasisEye Specialist Sdn. Bhd.	Client Representative	To review and approved the qualification protocol. To assist in the execution of the qualification protocol. To provide approval to the executed qualification protocol.
Lufter Sdn. Bhd.	Project Manager Project Engineer Validation Executive	To review and approve the qualification protocol. To prepare and ensure the qualification protocol is reviewed and approved before execution. To perform testing and compile analysis data during execution of the protocol.



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6.0 ABBREVIATION

No.	Term/Abbreviation	Definition
1.	A/C	Acceptance Criteria
2.	AHU	Air Handling Unit
3.	AHRI	Air-Conditioning, Heating and Refrigeration Institute
4.	ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
5.	ASME	The American Society of Mechanical Engineers
6.	ASTM	American Society for Testing and Materials
7.	Cert	Certificate
8.	cfm	Cubic Feet per Minute
9.	cGMP	Current Good Manufacturing Practice
10.	CQP	Commissioning & Qualification Plan
11.	DQ	Design Qualification
12.	DPG	Differential Pressure Gauge
13.	DPS	Dew Point Sensor
14.	FSDS	Functional Specification and Design Specification
15.	GEP	Good Engineering Practices
16.	HEPA	High-Efficiency Particulate Air
17.	HVAC	Heating, Ventilation and Air Conditioning
18.	Hz	Hertz
19.	IQ	Installation Qualification
20.	ISO	International Standardization for Organization
21.	kW	Kilowatt
22.	No	Number
23.	OT	Operation Theatre
24.	Pa	Pascal
25.	PIC/S	Pharmaceutical Inspection Co-Operation Scheme
26.	Ref	Reference
27.	RH	Relative Humidity
28.	SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
29.	TRH	Temperature and Relative Humidity
30.	URS	User Requirement Specification
31.	WHO	World Health Organization

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7.0 SYSTEM DESCRIPTION

7.1 Heating, Ventilation and Air Conditioning System (HVAC)

The HVAC System designed to serve the ISO 7 and 8 area consists of one (1) unit of AHU which is:

No.	AHU
1.	AHU-OT-02

Table 1: AHUs supplying ISO 7 and 8 area

The HVAC System designed for the classified cleanroom consists of one (1) units of new AHU which are designed to supply condition air to the cleanroom of the Operation Theatre 3, Operation Theatre 4, Scrub 2, Scrub 3 and Packing & Autoclave Room 2 as per Table 1 under Section 8.2.

The new AHU-OT-02 unit consists of only one (1) section. The fresh air passes through a filter box equip with filter grade G4(B) to filter any dust before going into heat recovery wheel where energy from the exhaust air is recovered for conditioning of the air. Then, the air passing through the AHU shall then be forced through another set of grades F9 filters for filtration before it is conditioned in the direct expansion (DX) post coil to reduce its temperature and moisture content.

After exiting the AHU unit, the post-cooled air will flow through three (3) heaters to be heated to the required temperature as per the URS. The supply air is then further filtrated by H14 HEPA filters at the HEPA Filter Terminal before being released into respective rooms.

For AHU-OT-02, the supply air enters the cleanroom via a network of ducting/branch ducts and flexible duct. Air control devices like aluminum blade volume control dampers are strategically installed along the main duct and branch duct to throttle the supply, and exhaust air. Manual dampers will be installed at each of the supply air diffusers and exhaust air grilles for fine adjustment.

Air exiting from all cleanrooms served by AHU-OT-02 will then pass through the same heat recovery wheel for energy recovery before being exhausted out.

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7.2 Cleanrooms Operating Conditions

Table 2 below shows the cleanroom parameters designed to meet the design parameters required for ISO 7 and 8 areas as stated in the URS document (L-POEBS01-OT&LAB-VD-URS; under section 8.2).

AHU	Room Description	Room No.	Room ISO Class	Pressure (Pa) (ref. atmosphere)	Relative Humidity (RH) (%)	Temperature (°C)	Air Change
AHU-OT-02	Operation Theatre 3	001	ISO 7	20	50-60	18-22	≥ 25
	Operation Theatre 4	002	ISO 7	20	50-60	18-22	≥ 25
	Scrub 2	003	ISO 7	10	50-60	18-22	≥ 25
	Janitor 3	004	ISO 8	10	50-60	18-22	≥ 20
	Packing & Autoclave Room 2	005	ISO 8	10	50-60	18-22	≥ 20

Table 2: Cleanroom Parameters

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8.0 SYSTEM BOUNDARIES

The airflow schematic diagram (L/POEBS01/OT&LAB/DC/HVAC/05) illustrates the components which comprise the HVAC System and the airflow direction.

The installation qualification covers at the minimum the following equipment/components:

- Air Handling Unit (AHU) System
- High Efficiency Particulate Air (HEPA) Filter
- Ducting System
- Room and Terminal HEPA Differential Pressure Gauge (DPG)
- Temperature and Relative Humidity (TRH) Sensor
- Dew Point Sensor (DPS)
- Heat Recovery Wheel
- Electrical Heater
- Exhaust Air Fan
- Control System

9.0 TEST SHEETS

This section details the checks to be carried out in support of the system.

A/C Ref.	Test Sheet Title	Test No.
1	Design - Design Documentation Record (General)	IQ-01
2	Nameplate Verification	IQ-02
3	Documentation Verification - Calibration Verification Record	IQ-03
4	Documentation Verification - Filter Grade Certification	IQ-04
5	Installation Verification - Pre-Operational Check (Ducting System)	IQ-05
6	Installation Verification - HEPA Filter Installation	IQ-06
7	Installation Verification (System) - Installation Against Drawing	IQ-07
8	Installation Verification (System) - Electrical Control Panel	IQ-08
9	Support - Change Control Record	IQ-09

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10.0 TESTING RATIONALE

A/C Ref.	Acceptance Criteria (A/C)	Rationale
1	Approved system design documentation is available.	To provide documented evidence that all required design documentation(s) are available and has been approved by the relevant parties.
2	The data on equipment nameplates is consistent with the design specification.	To provide documented evidence that the data on all equipment nameplates conforms to the design specification.
3	A valid calibration certificate is available for all critical instruments to prove that these instruments have been calibrated.	To provide documented evidence that all critical instruments have been calibrated.
4	Filter efficiency certification is available for all HEPA filters to prove their efficiencies are up to the design requirements.	To provide documented evidence that all HEPA filters conforms to their target efficiency and are able to satisfy the design requirements.
5	The installation of the ducting system complies with the specification of ductwork Installation and all mechanical works are as per the latest layout drawing.	To provide documented evidence that all ducting has been installed according to the general specification of ductwork installation.
6	HEPA filters of the correct grade have been installed and their efficiencies are not compromised during the installation process.	To provide documented evidence that all HEPA filters have been installed correctly, in good condition and conforms to their target efficiency.
7	The installation of all mechanical work is as per the approved design layout.	To provide documented evidence that the mechanical work has been installed according to the approved design layout.
8	The construction of control panels and other electrical installations complies with the safety standard.	To provide documented evidence to proof the safety of the control panels and other electrical installations.
9	Records for all changes made to the system throughout the execution of this checking procedure are available and further tests required after the changes made have been conducted.	To provide documented records of all changes made to the system upon installation.

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Title:		Design -- Design Documentation Record (General)			
Objective:		To provide documented evidence that all required design documentation(s) are available and has been approved by the relevant parties.			
Pre-requisites:		All documents should be reviewed and approved.			
Method:		Record details of the design documentation; include the document reference, title, version, and status and approval date.			
Acceptance Criteria:		Approved system design documentation is available.			
Results:					
Document Type	Document Ref.	Document Title	Document Version	Document Status	Approval Date Verified By (Initial & Date)
Validation	L-POEBS01-OT&SCR-VD-02	Design Qualification for HVAC System	201	Approved	24 May 2023 07 Jul 2023
		N/A			
Comments/Deviations/Supporting Documentation: NIL					
Overall Test Outcome (PASS/FAIL)		Verified By (Signature): 		Date: 08 Jul 2023	
		GOO CHUI HOONG Operations Manager OasisEye Specialists			



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Title:	Nameplate Verification	Test No: IQ-02
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Objective:

To provide documented evidence that the data on all equipment nameplates conforms to the design specification.

Method:

Document the name, model, and other information found on the nameplate and compare against the design specification. Serial number shall be recorded in the test sheet as found at site. Other information not available on the name plate should be verified against the documents supplied by contractor. (Picture of the nameplate should be attach at the attachment section).

Acceptance Criteria:

The data on all equipment nameplates is consistent with the design specification.

Results:

Equipment Name	Description	Acceptance Criteria	As Found	Conformity (Yes/No)	Verified By (Initial & Date)
Air Handling Unit (AHU-OT-02)	Model	A1(M)1138H-1443W	A1 (M) 1138 H - 1443 W	Yes/No	☒ 07-Jul-2023
	Serial No.	* Record at site	M 19950	Yes/No	☒ 07-Jul-2023
	Manufacturer	Welcome Air-Tech (M) Sdn. Bhd.	Welcome Air-Tech (M) Sdn. Bhd.	Yes/No	☒ 07-Jul-2023
	Total Supply Air Quantity, CFM	2797	2797	Yes/No	☒ 07-Jul-2023
	External Static Pressure, Pa	875	875	Yes/No	☒ 07-Jul-2023
	Fan Brand	Kruger	Kruger	Yes/No	☒ 07-Jul-2023
	Fan Model	BNC-R335/DII (II)	BNC - R335 / DII (II)	Yes/No	☒ 07-Jul-2023
	Fan Motor Serial No.	* Record at site	2303541M-1 2371	Yes/No	☒ 07-Jul-2023
	Fan Motor, kW	3	3	Yes/No	☒ 07-Jul-2023
	Poles/Volts/Hz	2P/415/50	2P / 415 / 50	Yes/No	☒ 07-Jul-2023

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Title:		Nameplate Verification			Test No: IQ-02	
Equipment Name	Description	Acceptance Criteria	As Found	Conformity (Yes/No)	Verified By (Initial & Date)	
Electrical Heater (EH-OT-02-1A)	Manufacturer	Maltec-H	Maltec - H	<u>Yes</u> /No	<i>HA</i> 07-Jul-2023	
	Serial Number	* Record at site	HX 5191 DFH	<u>Yes</u> /No	<i>HA</i> 07-Jul-2023	
	Total Power, kW	7.1	7.1	<u>Yes</u> /No	<i>HA</i> 07-Jul-2023	
Electrical Heater (EH-OT-02-1B)	Manufacturer	Maltec-H	Maltec - H	<u>Yes</u> /No	<i>HA</i> 07-Jul-2023	
	Serial Number	* Record at site	HX 5192 DFH	<u>Yes</u> /No	<i>HA</i> 07-Jul-2023	
	Total Power, kW	6.5	6.5	<u>Yes</u> /No	<i>HA</i> 07-Jul-2023	
Electrical Heater (EH-OT-02-1C)	Manufacturer	Maltec-H	Maltec - H	<u>Yes</u> /No	<i>HA</i> 07-Jul-2023	
	Serial Number	* Record at site	HX 5803 DFH	<u>Yes</u> /No	<i>HA</i> 07-Jul-2023	
	Total Power, kW	2.22	2.22	<u>Yes</u> /No	<i>HA</i> 07-Jul-2023	
Heat Recovery Wheel (HRW-OT-02)	Manufacturer	Bry-Air (Malaysia) Sdn. Bhd.	Bry-Air (Malaysia) Sdn. Bhd.	<u>Yes</u> /No	<i>HA</i> 07-Jul-2023	
	Model	HRW-1100	HRW-1100	<u>Yes</u> /No	<i>HA</i> 07-Jul-2023	
	Volts/PH/Hz	415/3/50	415 / 3 / 50	<u>Yes</u> /No	<i>HA</i> 07-Jul-2023	

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Title:		Test No: IQ-02		
Equipment Name	Description	Acceptance Criteria		As Found
Exhaust Fan (EAF-OT-02)	Model	BSB355 U11		BSB 355
	Serial Number	* Record at site		KA 22 120283
	Static Pressure, Pa	500		500
	Fan Brand	Kruger		Kruger
	Fan Motor, kW	2.2		2.2
	Volts/Poles/Hz	415/2/50		415/2/50
Comments/Deviations/Supporting Documentation: Refer to Attachment 1 : Name plate for major Equipments.				
Overall Test Outcome (PASS/FAIL)		Verified By (Signature): 		Date: 08 - Jul - 2023

GOO CHUI HOONG
 Operations Manager
 OasisEye Specialists

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Title: Documentation Verification – Calibration Verification Record **Test No:** IQ-03

Objective:
 To provide documented evidence that all critical instruments have been calibrated.

Pre-requisites:
 Device Assessment (Catalogues) should be provided at the attachment section.

Method:
 Review calibration certification available for each of the critical instruments; note the calibration certificate reference, calibration frequency and calibration due date.

Acceptance Criteria:
 A valid calibration certificate is available for all critical instruments to prove that these instruments have been calibrated.

Results:

Instrument Ref.	Instrument Description	Room/Location	Calibration Frequency	Calibration Date	Calibration Due Date	Calibration Ref./Serial No.	Verified By (Initial & Date)
DPS-02-01	Temperature & Dewpoint Transmitter Vaisala Model: HMD 112 Duct Mount	At offcoil postcoil (AHU-OT-02)	Yearly	14-Jun-2023	14-Jun-2024	CTT 3408-23 V1310434	<i>[Signature]</i> 07-Jul-2023
TRH-02-01	Temperature & Humidity Transmitter Vaisala Model: HMD 112 Duct Mount	At exhaust duct from Operation Theatre 3	Yearly	14-Jun-2023	14-Jun-2024	CTT 3409-23 V1310435	<i>[Signature]</i> 07-Jul-2023
TRH-02-02	Temperature & Humidity Transmitter Vaisala Model: HMD 112 Duct Mount	At exhaust duct from Operation Theatre 4	Yearly	14-Jun-2023	14-Jun-2024	CTT 3407-23 V1310433	<i>[Signature]</i> 07-Jul-2023



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Title: Documentation Verification – Calibration Verification Record						Test No: IQ-03	
Instrument Ref.	Instrument Description	Room/Location	Calibration Frequency	Calibration Date	Calibration Due Date	Calibration Ref./Serial No.	Verified By (Initial & Date)
TRH-02-03	Temperature & Humidity Transmitter Vaisala Model: HMD 112 Duct Mount	At exhaust duct from Scrub 2, Janitor 3 and Packing & Autoclave Room 2	Yearly	13 - Jun - 2023	13 - Jun - 2024	C7T 3582 - 23 V19104 21	<i>[Signature]</i> 07-Jul-2023
DPG-02-01	Dwyer Magnehelic Pressure Gauge: 0-500 Pa Model: 2000-500PA	At terminal HEPA from Packing & Autoclave Room 2	Yearly	02 - Jun - 2023	02 - Jun - 2024	C7P 4082 - 23	<i>[Signature]</i> 07-Jul-2023
DPG-02-02	Dwyer Magnehelic Pressure Gauge: 0-500 Pa Model: 2000-500PA	At terminal HEPA from Janitor 3	Yearly	02 - Jun - 2023	02 - Jun - 2024	C7P 4079 - 23	<i>[Signature]</i> 07-Jul-2023
DPG-02-03	Dwyer Magnehelic Pressure Gauge: 0-500 Pa Model: 2000-500PA	At terminal HEPA from Scrub 2	Yearly	02 - Jun - 2023	02 - Jun - 2024	C7P 4084 - 23	<i>[Signature]</i> 07-Jul-2023
DPG-02-04	Dwyer Magnehelic Pressure Gauge: 0-500 Pa Model: 2000-500PA	At terminal HEPA from Operation Theatre 4	Yearly	02 - Jun - 2023	02 - Jun - 2024	C7P 4085 - 23	<i>[Signature]</i> 07-Jul-2023

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Title: Documentation Verification – Calibration Verification Record						Test No: IQ-03	
Instrument Ref.	Instrument Description	Room/Location	Calibration Frequency	Calibration Date	Calibration Due Date	Calibration Ref./Serial No.	Verified By (Initial & Date)
DPG-02-05	Dwyer Magnehelic Pressure Gauge: 0-500 Pa Model: 2000-500PA	At terminal HEPA from Operation Theatre 4	Yearly	02-Jun-2023	02-Jun-2024	CTP 4085-23	<i>[Signature]</i> 07-Jul-2023
DPG-02-06	Dwyer Magnehelic Pressure Gauge: 0-500 Pa Model: 2000-500PA	At terminal HEPA from Operation Theatre 3	Yearly	02-Jun-2023	02-Jun-2024	CTP 4080-23	<i>[Signature]</i> 07-Jul-2023
DPG-02-07	Dwyer Magnehelic Pressure Gauge: 0-500 Pa Model: 2000-500PA	At terminal HEPA from Operation Theatre 3	Yearly	02-Jun-2023	02-Jun-2024	CTP 4081-23	<i>[Signature]</i> 07-Jul-2023
DPG-02-08	Dwyer Magnehelic Pressure Gauge: 0-500 Pa Model: 2000-500PA	At terminal HEPA from Operation Theatre 3	Yearly	02-Jun-2023	02-Jun-2024	CTP 4078-23	<i>[Signature]</i> 07-Jul-2023
DPG-02-09	Dwyer Magnehelic Pressure Gauge: 0-60 Pa Model: 2000-60PA	Operation Theatre 4/Dayward 2	Yearly	02-Jun-2023	02-Jun-2024	CTP 4093-23	<i>[Signature]</i> 07-Jul-2023



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Instrument Ref.	Instrument Description	Room/Location	Calibration Frequency	Calibration Date	Calibration Due Date	Calibration Ref./Serial No.	Verified By (Initial & Date)
DPG-02-10	Dwyer Magnehelic Pressure Gauge: 0-60 Pa Model: 2000-60PA	Operation Theatre 4/Scrub 2	Yearly	02-Jun-2023	02-Jun-2024	CTP 4090-23	<i>[Signature]</i> 07-Jul-2023
DPG-02-11	Dwyer Magnehelic Pressure Gauge: 0-60 Pa Model: 2000-60PA	Operation Theatre 4/Janitor 3	Yearly	02-Jun-2023	02-Jun-2024	CTP 4087-23	<i>[Signature]</i> 07-Jul-2023
DPG-02-12	Dwyer Magnehelic Pressure Gauge: 0-60 Pa Model: 2000-60PA	Operation Theatre 4/Packing & Autoclave Room 2	Yearly	02-Jun-2023	02-Jun-2024	CTP 4088-23	<i>[Signature]</i> 07-Jul-2023
DPG-02-13	Dwyer Magnehelic Pressure Gauge: 0-60 Pa Model: 2000-60PA	Operation Theatre 3/ Packing & Autoclave Room 2	Yearly	02-Jun-2023	02-Jun-2024	CTP 4091-23	<i>[Signature]</i> 07-Jul-2023
DPG-02-14	Dwyer Magnehelic Pressure Gauge: 0-60 Pa Model: 2000-60PA	Operation Theatre 3/ Janitor 3	Yearly	02-Jun-2023	02-Jun-2024	CTP 4092-23	<i>[Signature]</i> 07-Jul-2023



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Title: Documentation Verification – Calibration Verification Record							Test No: IQ-03
Instrument Ref.	Instrument Description	Room/Location	Calibration Frequency	Calibration Date	Calibration Due Date	Calibration Ref./Serial No.	Verified By (Initial & Date)
DPG-02-15	Dwyer Magnehelic Pressure Gauge: 0-60 Pa Model: 2000-60PA	Operation Theatre 3/Scrub 2	Yearly	02-Jun-2023	02-Jun-2024	CTP 4086-23	 07-Jul-2023
DPG-02-16	Dwyer Magnehelic Pressure Gauge: 0-60 Pa Model: 2000-60PA	Operation Theatre 3/Dayward 2	Yearly	02-Jun-2023	02-Jun-2024	CTP 4089-23	 07-Jul-2023
Comments/Deviations/Supporting Documentation: Refer to Attachment 2 & 3 : Calibration Certificate for ops and TR4 , Calibration Certificate for DPG .							
Overall Test Outcome (PASS/FAIL)			Verified By (Signature):  GOO CHUI HOONG Operations Manager OasisEye Specialists		Date: 08-Jul-2023.		

Installation Qualification		Doc. No.	L-POEBS01-OT&SCR-VD-IQ	Effective Date	24 MAY 2023	
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Title: Documentation Verification – Filter Grade Certification						
Test No: IQ-04						
Objective/Purpose: To provide documented evidence that all HEPA filters conforms to their target efficiency and are able to satisfy the design requirements.						
Pre-requisites: System design reviews have been completed.						
Method: For each filter referenced below, ensure a fully valid filter efficiency certificate is available and attach this to report.						
Acceptance Criteria: Filter efficiency certification is available for all HEPA filters to prove their efficiencies are up to the design requirements.						
Results:						
Equipment	HEPA Filter ID Tag No.	Acceptance Criteria Grade & Type	As Found Grade & Type	Serial No.	Certificate Ref.	Verified By (Initial & Date)
AHU-OT-02	THF-02-01	Camfil 600 X 600 X 110 mm Grade H14	Camfil 600 X 600 X 110 mm Grade H14	000001 - 3968688	3968688	<i>HA</i> 07-Jul-2023
	THF-02-02	Camfil 450 X 450 X 110 mm Grade H14	Camfil 450 X 450 X 110 mm Grade H14	000001 - 3968968	3968966	<i>HA</i> 07-Jul-2023
	THF-02-03	Camfil 450 X 450 X 110 mm Grade H14	Camfil 450 X 450 X 110 mm Grade H14	000002 - 3968968	3968966	<i>HA</i> 07-Jul-2023
	THF-02-04	Camfil 1210 X 600 X 110 mm Grade H14	Camfil 1210 X 600 X 110 mm Grade H14	000005 - 3968978	3968977	<i>HA</i> 07-Jul-2023

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Title:		Documentation Verification – Filter Grade Certification			Test No: IQ-04	
Equipment	HEPA Filter ID Tag No.	Acceptance Criteria		As Found		Verified By (Initial & Date)
		Grade & Type	Grade & Type	Serial No.	Certificate Ref.	
AHU-OT-02	THF-02-05	Camfil 1210 X 600 X 110 mm Grade H14	Camfil 1210 X 600 X 110 mm Grade H14	000003 - 3968978	396897	<i>[Signature]</i> 07-Jul-2023
	THF-02-06	Camfil 1210 X 600 X 110 mm Grade H14	Camfil 1210 X 600 X 110 mm Grade H14	000004 - 3968978	396897	<i>[Signature]</i> 07-Jul-2023
	THF-02-07	Camfil 1210 X 600 X 110 mm Grade H14	Camfil 1210 X 600 X 110 mm Grade H14	000001 - 3968978	396897	<i>[Signature]</i> 07-Jul-2023
	THF-02-08	Camfil 1210 X 600 X 110 mm Grade H14	Camfil 1210 X 600 X 110 mm Grade H14	000002 - 3968978	396897	<i>[Signature]</i> 07-Jul-2023



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Title:		Documentation Verification – Filter Grade Certification			Test No: IQ-04
Comments/Deviations/Supporting Documentation: <i>Refer to Attachment 4 : Filter Efficiency Certificate.</i>					
Overall Test Outcome (PASS/FAIL)		Verified By (Signature):  GOO CHUI HOONG Operations Manager OasisEye Specialists		Date: 08 - Jul - 2023	



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Title:	Installation Verification - Pre-Operational Check (Ducting System)	Test No.: IQ-05
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Objective/Purpose:
To provide documented evidence that all ducting has been installed according to the general specification of ductwork installation.

Pre-requisites:
Approved System Handover package is available.

Method:
Verify each aspect of the system installation, as detailed within the results section.

Acceptance Criteria:
The installation of the ducting system complies with the specification of ductwork installation and all mechanical works are as per the latest layout drawing.

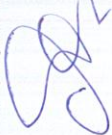
Results:

Acceptance Criteria		Conformity (Yes/No)	Verified By (Initial & Date)
System installation has been completed according to the ducting layout drawing and all connections have been made.		Yes / No	JA 07-Jul-2023
Inspection for ducting is present and correctness of the tag number for the supply and return air grilles.		Yes / No	JA 07-Jul-2023
Ductwork and bracket are mounted adequately.		Yes / No	JA 07-Jul-2023
Ductwork insulation is correctly installed and properly finished with labels indicating air flow direction. Insulation for cleanliness of the ducting is present.		Yes / No	JA 07-Jul-2023
Probes/pressure gauges/flexible duct/taps are installed as specified.		Yes / No	JA 07-Jul-2023
Connections to equipment are correct in relation to design flow direction.		Yes / No	JA 07-Jul-2023
Volume control damper are installed and free to operate.		Yes / No	JA 07-Jul-2023
All components are properly secured.		Yes / No	JA 07-Jul-2023
Anti-vibration mountings have precise deflection and all shipping braces have been removed.		Yes / No	JA 07-Jul-2023
Flushing/forced circulation cleaning has been completed.		Yes / No	JA 07-Jul-2023
External cleanliness of AHU.		Yes / No	JA 07-Jul-2023

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Title:	Installation Verification - Pre-Operational Check (Ducting System)			
Comments/Deviations/Supporting Documentation:	Test No: IQ-05			

NIL

Overall Test Outcome (PASS/FAIL):	Verified By (Signature):  GOO CHUI HOONG Operations Manager OasisEye Specialists	Date: 08 - Jul - 2023
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Title: Installation Verification – HEPA Filter Installation					
Purpose: To provide documented evidence that all HEPA filters have been installed correctly, in good condition and conforms to their target efficiency.					
Pre-requisites: Certificates of conformity for HEPA filters indicate compliance with design specification.					
Method:					
1. Initiate the system shutdown procedure and confirm electrical isolation. Identify HEPA filter(s) to be installed. Clean filter housing with alcohol taking care to remove all dust and dirt. Allow to dry. 2. To install a new filter, invert box so filter falls from box, minimising physical contact. Record filter grade and visually inspect filter for any damage. If a test certificate is included, attach this to report. Take filter to housing, remove from bag and carefully smear a thin layer of grease around it to assist insertion. Taking care not to touch the filter media, insert into housing and tighten into place. 3. Repeat steps 1 and 2 for subsequent HEPA filters. Once all HEPA filters have been installed, start-up system and record clean filter pressure drops for information (do this after the air flow design has been achieved).					
Acceptance Criteria: HEPA filters of the correct grade have been installed and their efficiencies are not compromised during the installation process.					

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Title: Installation Verification – HEPA Filter Installation		Test No: IQ-06
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Results:

Equipment	HEPA Filter Ref.	Acceptance Criteria	As Found		Verified By (Initial & Date)
		HEPA Filter Grade	HEPA Filter Grade	Visual Inspection Satisfactory (Yes/No)	
AHU-OT-02	THF-02-01	Camfil 600 X 600 X 110 mm Grade H14	Camfil 600 X 600 X 110 mm Grade H14	<u>Yes</u> / No	<i>[Signature]</i> 07-Jul-2023
	THF-02-02	Camfil 450 X 450 X 110 mm Grade H14	Camfil 450 X 450 X 110 mm Grade H14	<u>Yes</u> / No	<i>[Signature]</i> 07-Jul-2023
	THF-02-03	Camfil 450 X 450 X 110 mm Grade H14	Camfil 450 X 450 X 110 mm Grade H14	<u>Yes</u> / No	<i>[Signature]</i> 07-Jul-2023
	THF-02-04	Camfil 1210 X 600 X 110 mm Grade H14	Camfil 1210 X 600 X 110 mm Grade H14	<u>Yes</u> / No	<i>[Signature]</i> 07-Jul-2023

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Title:		Installation Verification – HEPA Filter Installation			Test No: IQ-06	
Equipment	HEPA Filter Ref.	Acceptance Criteria		As Found		Verified By (Initial & Date)
		HEPA Filter Grade	HEPA Filter Grade	HEPA Filter Grade	Visual Inspection Satisfactory (Yes/No)	
AHU-OT-02	THF-02-05	Camfil 1210 X 600 X 110 mm Grade H14	Camfil 1210 X 600 X 110 mm Grade H14	Camfil 1210 X 600 X 110 mm Grade H14	<u>Yes</u> /No	<u>HA</u> 07-Jul-2023
	THF-02-06	Camfil 1210 X 600 X 110 mm Grade H14	Camfil 1210 X 600 X 110 mm Grade H14	Camfil 1210 X 600 X 110 mm Grade H14	<u>Yes</u> /No	<u>HA</u> 07-Jul-2023
	THF-02-07	Camfil 1210 X 600 X 110 mm Grade H14	Camfil 1210 X 600 X 110 mm Grade H14	Camfil 1210 X 600 X 110 mm Grade H14	<u>Yes</u> /No	<u>HA</u> 07-Jul-2023
	THF-02-08	Camfil 1210 X 600 X 110 mm Grade H14	Camfil 1210 X 600 X 110 mm Grade H14	Camfil 1210 X 600 X 110 mm Grade H14	<u>Yes</u> /No	<u>HA</u> 07-Jul-2023

Installation Qualification	Doc. No. Rev. No.	L-POEBS01-OT&SCR-VD-IQ 01	Effective Date Total Page(s)	24 MAY 2023 27 of 41
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Title:	Installation Verification – HEPA Filter Installation	Test No: IQ-06
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Comments/Deviations/Supporting Documentation:

Refer to Attachment 4 : Filter efficiency certificate.

Overall Test Outcome (PASS/FAIL)	Verified By (Signature):  GOO CHUI HOONG Operations Manager OasisEye Specialists	Date: 08-Jul-2023
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Title:	Installation Verification (System) – Installation Against Drawing	Test No: IQ-07
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Objective:

To provide documented evidence that the mechanical work has been installed according to the approved design layout.

Pre-requisites:

Approved as-built drawing should be attached.

Method:

1. Take a copy of the required drawings to be verified and record the revision numbers in the results table.
2. Compare the drawing against the installation and mark the drawing to clearly indicate areas or items that are correct, that are incorrect and items that could not be verified.
3. Identify the marked-up copy of the drawing with the protocol and test reference then sign and date.

Acceptance Criteria:

The installation of all mechanical work is as per the approved design layout.

Results:

Drawing Title	Ref. No.	Revision No.	Conformity (Yes/No)	Verified By (Initial & Date)
Airflow Schematic	L/POEBS01/07 t SCR / DA / HVAC / 05	00	Yes	HA 07-Jul-2023.
Reflected Ceiling Layout	L/POEBS01/07 t SCR / DA / IFO / 04	00	Yes	HA 07-Jul-2023.
Ducting Layout	L/POEBS01/07 t SCR / DA / HVAC / 06	00	Yes	HA 07-Jul-2023.
	N/A			



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Title:	Installation Verification (System) – Installation Against Drawing				Test No: IQ-07
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Comments/Deviations/Supporting Documentation:
Refer to Attachment 5, 6, 7.

Overall Test Outcome (PASS/FAIL)	Verified By (Signature):  GOO CHUI HOONG Operations Manager OasisEye Specialists	Date: <i>08 - Jul - 2023.</i>
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Installation Qualification	Doc. No. Rev. No.	L-POEBS01-OT&SCR-VD-IQ 01	Effective Date Total Page(s)	24 MAY 2023 30 of 41
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Title:	Installation Verification (System) – Electrical Control Panel	Test No: IQ-08
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Objective:
 To provide documented evidence to proof the safety of the control panels and other electrical installations.

Pre-requisites:
 Approved electrical control panel drawing should be attached.

Method/Acceptance Criteria/Results:
 The construction of control panels and other electrical installations complies with the safety standard.

No.	Test Method	Acceptance Criteria	Conformity (Yes/No)	Verified By (Initial & Date)
1	Verify isolator provided.	Isolator provided.	Yes/No	HA 07-Jul-2023
2	Verify the voltage present and supply references are labelled.	Voltage present and supply reference labelled.	Yes/No	HA 07-Jul-2023
3	Verify that the electrical devices are identified.	Electrical devices identified.	Yes/No	HA 07-Jul-2023
4	Verify that an earth strap is fitted in the switchboard.	Earth strap is fitted to the switchboard.	Yes/No	HA 07-Jul-2023
5	Verify that the terminals of electrical components adequately shrouded to prevent contact with live parts.	Terminals of electrical components adequately shrouded to prevent contact with live parts.	Yes/No	HA 07-Jul-2023
6	Verify that main live terminals are adequately shrouded.	Main live terminals are adequately shrouded.	Yes/No	HA 07-Jul-2023
7	Verify that components and wiring are segregated.	Components and wiring are segregated.	Yes/No	HA 07-Jul-2023

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Title:	Installation Verification (System) – Electrical Control Panel	Test No: IQ-08
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Comments/Deviations/Supporting Documentation:

Refer to Attachment 8.9.10

Overall Test Outcome (PASS/FAIL)	Verified By (Signature):  GOO CHUI HOONG Operations Manager OasisEye Specialists	Date: 08 - Jul - 2023
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Title:	Support – Change Control Record
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Objective:

To provide documented records for all changes made to the system upon installation.

Pre-requisites:

All approved change form must be attached.

Method:

1. Record each change made to the system during the completion of the protocol. Record the change reference, a brief description of the change and the date of the change. Clearly and concisely outline what needs to be changed, so the impacted areas can review and analyze.
2. Review the changes made to the system and determine whether further testing is required. If further testing is required determine whether this has been completed satisfactorily.

Acceptance Criteria:

1. Records for all changes made to the system throughout the execution of this checking procedure are available.
2. Further tests required after the changes made have been conducted.

Results:

[illegible]

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Title:		Test No: IQ-09			
Support – Change Control Record					
Comments/Deviations/Supporting Documentation					
Nil					
Overall Test Outcome (PASS/FAIL)		Verified By (Signature):		Date:	
(PASS/FAIL)		 GOO CHUI HOONG Operations Manager OasisEye Specialists		08-Jul-2023	

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11.0 SUMMARY OF TEST

This section, detailing system specific Acceptance Criteria (A/C), should be completed following a review of the test sheets, within Section 8, and supporting data, contained within the referenced project files.

Design

A/C Ref.	Acceptance Criteria (A/C)	A/C Met? (Yes/No)	Deviation Ref.	Initial & Date
1	Approved system design documentation is available.	Yes	N/A	HA 07-Jul-2023
2	The data on equipment nameplates is consistent with the design specification.	Yes	N/A	HA 07-Jul-2023

Documentation

A/C Ref.	Acceptance Criteria (A/C)	A/C Met? (Yes/No)	Deviation Ref.	Initial & Date
3	A valid calibration certificate is available for all critical instruments to prove that these instruments have been calibrated.	Yes	N/A	HA 07-Jul-2023
4	Filter efficiency certification is available for all HEPA filters to prove their efficiencies are up to the design requirements.	Yes	N/A	HA 07-Jul-2023

Installation

A/C Ref.	Acceptance Criteria (A/C)	A/C Met? (Yes/No)	Deviation Ref.	Initial & Date
5	The installation of the ducting system complies with the specification of ductwork Installation and all mechanical works are as per the latest layout drawing.	Yes	N/A	HA 07-Jul-2023
6	HEPA filters of the correct grade have been installed and their efficiencies are not compromised during the installation process.	Yes	N/A	HA 07-Jul-2023
7	The installation of all mechanical work is as per the approved design layout.	Yes	N/A	HA 07-Jul-2023
8	The construction of control panels and other electrical installations complies with the safety standard.	Yes	N/A	HA 07-Jul-2023

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Additional

A/C Ref.	Acceptance Criteria (A/C)	A/C Met? (Yes/No)	Deviation Ref.	Initial & Date
9	Records for all changes made to the system throughout the execution of this checking procedure are available and further tests required after the changes made have been conducted.	Yes	N/A	 07.04.2023



24 MAY 2023

[illegible]

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14.0 INTERIM APPROVAL

This section is only required when all discrepancies in the deviation list have been considered, the HVAC System may proceed for Operational Qualification pending resolution finalization. If there are no discrepancies or all discrepancies found have been suitably resolved, may proceed for Post-Execution Approval.

Name	Job Title or Role	Signature	Date (dd-mmm-yyyy)
Reviewed by:			
Reviewed by:		N/A	07-Jul-2023
Approved by:			

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15.0 POST-EXECUTION APPROVAL

CONDITIONAL ACCEPTANCE			
The system operational checks have been reviewed. All testing associated during Installation Qualification are completed with all criteria being met. Any deviations that were noted (if any) have been resolved and closed out.			
Name	Job Title or Role	Signature	Date (dd-mmm-yyyy)
Reviewed by:		N/A	
Reviewed by:			
Approved by:	GOO CHUI HOONG Operations Manager OasisEye Specialists		08-Jul-2023



24 MAY 2023

16.0 DEVIATION LIST

Summary of all the deviations documented throughout the execution of the Installation Qualification.

[illegible]



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DEVIATION REPORT	Report no.:
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A. Description of Deviation:	
Documented By:	Date:

RESPONSE		
A. Reason of Deviation:		
B. Correction/preventive action to be taken:		
Evaluation by:	Signature	Date (dd-mmm-yyyy)
Reviewed By:		

N/A
07 Jul 2023

ACCEPTANCE		
C. Corrective/preventive action taken:		
Performed by:	Signature	Date (dd-mmm-yyyy)
Performed By:		
Reviewed By:		
Approved By:		

Note: This page to be re-printed as required

