

GREENHOUSE SPECIFICATION
PH 35 and PH40 Greenhouse Construction SC-340-06
under WorldVeg Research Infrastructure Modernization (RIM) Project

亞蔬-世界蔬菜中心總部改建計劃
 第 35 號及第 40 號溫室興建工程 SC-340-06
 溫室設置規範

NO.	CONTENT 內容	
GREENHOUSE SPECIFICATIONS 溫室規範索引表		
01	STRUCTURAL	結構
02	BASIC DESIGN REQUIREMENTS	基本設計需求
03	ROOM CONDITIONS	室內條件
04	CONTROL SYSTEM	控制系統
05	ALARM SYSTEM	警報系統
06	TEMPERATURE AND HUMIDITY SENSORS	溫度和濕度傳感器
07	WEATHER STATION	氣象站
08	COOLING	降溫系統
09	HEATING	增溫系統
10	VENTILATION	通風
11	GRILLS	導風板
12	MECHANICAL SWITCH BOARD	機械控制開關版
13	HYDRAULIC	給排水
14	ELECTRICAL	電力
15	SERVICING DURING THE DEFECTS LIABILITY PERIOD	保固期間服務
16	KEY CARD SYSTEM	門禁卡系統
17	OTHER FACILITY	其他設施
18	COMMISSIONING AND TESTING	功能驗證和測試
19	COMMISSIONING PROGRAM	功能驗證計畫
20	COMMISSIONING TESTS	功能測試
21	AIR DISTRIBUTION, AIR HANDLING and VENTILATION SYSTEM TESTS	氣流分佈和通風循環系統測試
22	ELECTRICAL SYSTEM TESTS	電力系統測試
23	CONTROL SYSTEM TESTS	控制系統測試

01 STRUCTURAL**結構**

1. Reinforced concrete slab engineered to suit existing soil type. Provide all necessary excavation for services, footings etc. Finished floor level of new slab to be nominated on site with client.
根據鑽探結果，採用適當結構尺寸之鋼筋混凝土底版、基礎、管路設施等，並合理開挖。樓板完成面高程現地與業主放樣確認。
2. Grade the perimeter of slab at a maximum grade of 1 in 10 to keep any ground water 1 m from the footing. New concrete slab to have 150mm high up-stand walls to perimeter with coving into rooms.
樓板較四周土壤抬高 1m，土壤坡度不大於 1/10。溫室地面裝修材圓弧捲上牆面 150mm
3. Use galvanised steel framing with Plexiglass AllTop cladding, minimum three metre height, 23-degree roof pitch.
鋼構部分使用鍍鋅鋼，皮層選用玻璃或中空壓克力玻璃 Plexiglass AllTop，屋頂最低處高度 3M，屋頂坡面與地面角度為 23 度。
4. Electric window opener will be powered by UPS when it comes power or refrigeration system failure.
停電或空調系統故障時，須以 UPS 驅動自動開窗機開窗。
5. Design to suit local wind loading.
皮層強度須符合當地風壓抗風需求。
6. Install sandwich panel (composite panel) 90 cm above the slab.
牆面非透明部分高度 90cm 以上採用三明治版。
7. Glasshouse plan dimension: 665cm*335cm typical, finish thickness not included.
溫室平面淨尺寸為 665cm*335cm，不含粉刷厚度。
8. Automatic external shade screens and automatic internal shade screens, ALUMINET or equivalent, to be provided to each compartment. The shade must be able to be deployed on demand by the user and by the control system to enable set points to be achieved.
Virology Greenhouse: external 60%; internal 60%
Insectary Greenhouse: external 80%; internal 60%
Manual Control Side shade: 60% manual control.
Cooling load calculating is based on 60% shading.
電控內外遮蔭網，網面材質選用 ALUMINET 或同等品。控制需可由人員控制或由溫室

控制系統自動控制。

病毒溫室：外遮蔭遮蔽率 60%；內遮蔭遮蔽率 60%。

昆蟲溫室：外遮蔭遮蔽率 80%；內遮蔭遮蔽率 60%。

手動側遮陽：遮蔽率 60%。手動控制

溫室空調負載以 60%遮蔽率計算。

02 BASIC DESIGN REQUIREMENTS

基本設計需求

1. The mechanical services shall be designed to achieve the lowest total owning and operating cost over the life of the building.

設備設計須以降低建築物維護及營運成本為目標。

2. All manufactured items included in the mechanical services shall be of a type with a proven trouble-free record of operation, in quantity production, with service and spare parts back-up readily available in Taiwan.

所有設備需有可驗證之操作零故障紀錄。並在台灣有隨時能夠替換之備品。

3. All systems shall utilise basic, tried and proven design concepts, shall be kept as simple as possible and shall provide a high degree of operational reliability.

所有系統應採用簡明、經時間考驗之系統。操作簡單並有高度穩定性。

4. All equipment and fittings shall be constructed from materials that are inherently corrosion resistant or corrosion protection treatments shall be applied to ensure a minimum life of 15 years.

所有設備和配件應採用本身耐腐蝕的材料或應採用防腐蝕處理，以確保最短壽命為 15 年。

5. It is the intent of this functional brief that the asset provided will contain Mechanical Services provisions of an extent and quality commensurate with the standard required for buildings erected by the Taiwan Government.

本章內容所提之服務程度與質量，應不低於台灣政府之規定。

03 ROOM CONDITIONS

室內條件

1. Temperature range: winter time from 18-22°C and summer time from 24-35 °C.

溫室設定溫度範圍：冬季為 18~22 °C；夏季為 24~35 °C。

2. Humidity not controlled.

濕度不控制。

3. Greenhouse with no AC requires more than 20-time space volume/hour air-change rate during the environment is cooler enough to not use AC.

環境溫度容許不開啟空調時，溫室每小時換氣量應可大於 20 倍該室內體積。

04 CONTROL SYSTEM

控制系統

1. Control system to be ARGUS™ Titan II Control System.
控制系統採用 ARGUS Titan II 系統。
2. Control sensors to be readily accessible and simple to calibrate.
控制傳感器應易於操作且易於校準。
3. The following data will need to be logged on the site's local area network and a secure web site:
 - 1) Temperature: hourly averages and maximum and minimum values for that hour.
 - 2) Humidity and vapor pressure deficit: hourly averages and maximum and minimum values for that hour.
 - 3) Light data collected each minute and hourly averages and daily totals logged.
4. Set point changes will need to be password protected and available on the web site and the local area network (LAN).

以下數據應以安全的區域網路紀錄：

- 1) 溫度：每小時均溫以及該小時之最高、最低溫。
- 2) 濕度與蒸氣壓力差：每小時平均以及該小時之最大、最小值。
- 3) 收集每分鐘和每小時平均值的光數據以及每日總數記錄。

設定點更改需要受密碼保護，並且可在網站，區域網路(LAN)和總機上使用

05 ALARM SYSTEM

警報系統

Provide a common alarm (red warning) lamp over the greenhouse door. Control system to have programmable capabilities to send a text alarm notification to designated personnel.

在溫室門上方提供一個紅色警告燈。控制系統具有可編程功能，可向指定人員發送文本報警通知。

06 TEMPERATURE AND HUMIDITY SENSORS

溫度和濕度傳感器

1. Temperature and humidity sensors shall be provided within the glass house space for monitoring internal conditions in each room. The sensors shall be located within an aspirated box (Vaisala HMT337 or equivalent) that can be hung below the interior shade screens or placed on a bench. The aspirated box shall be designed to maximize the free flow of air over the temperature & humidity sensor while shielding the sensor from any incident radiation from any source. A small axial fan on top of the box shall draw the space air through the box to sample the air (dry bulb) temperature and relative humidity. Provide a 12 Volt DC power supply cable to the aspirator (axial) fan. Light levels to be monitored by Apogee quantum sensors (**SQ-110**) mounted on top of the aspirated box.

玻璃溫室空間內應設有溫度和濕度傳感器，用於監控每個溫室隔間的內部狀況。傳感器應位於吸氣箱（Vaisala HMT337 或同等產品）內，可懸掛在內遮蔭下方或放在植床上。吸氣箱的設計應使溫度和濕度傳感器上的空氣自由流動最大化，同時保護傳感器受到任何來源的入射輻射。箱體頂部的小型軸流風扇應將空氣吸入箱內，對空氣（乾球）的溫度和相對濕度進行記錄。為吸氣器（軸流）風扇提供 12 伏直流電源。以安裝在吸氣箱頂部的 Apogee 量子傳感器（SQ-110）監測照明度。

2. The temperature & humidity sensors shall be provided with a length of flexible cable that will allow placement of the sensor at any location within the greenhouse space. The cable would be attached to window mullions or the overhead thermal screen supports and be placed by the users as required. Provide suitable clips on all window mullions and overhead thermal screen supports for the attachment of the sensor cable.

溫度和濕度傳感器應配備一段軟性電纜，以便將傳感器放置在溫室空間內的任何位置。電纜由用戶根據需要放置，可連接到玻璃框料框或結構支架上。在所有玻璃橫豎料及結構支架上提供合適的掛鉤，用於連接傳感器電纜。

3. Vapour pressure deficit data will also need to be calculated and collected.
需要收集並計算蒸汽壓力差數據。

07 WEATHER STATION

氣象站

A weather station for both greenhouses to monitor temperature, humidity, wind speed, rainfall and total radiation should be installed on an adjacent location with at least 1.5m higher than the greenhouses. Data from this installation will be used to provide information to the control system to enable the efficient control of the greenhouse environment.

應在溫室附近高於溫室屋頂 1.5 米以上之位置安裝一座溫室氣象站，用於監測溫度，濕度，風速，雨量和總輻射。來自該裝置的數據用於向控制系統提供信息，以實現對溫室環境的有效控制。

08 COOLING

降溫系統

1. Refrigerated Greenhouse Ventilation: Use VRF system with packaged refrigeration units for each room to suit nominated environmental conditions.

溫室降溫通風：使用 VRF 系統，以適應指定的環境條件。

2. The maximum discharge velocity of air into the greenhouse is 3.5m/s at the face of the outlet grille and a maximum air velocity of 0.5m/s over the plants.

出風口最大風速度為 3.5m/s，植物周遭最大速為 0.5m/s。

09 HEATING

增溫系統

1. Use VRF system which can provide both cooling and heating.

VRF 系統同時具有供冷及供暖功能。

2. Warm air heating shall be provided in the greenhouse for automatic operation as required maintaining minimum indoor conditions (18 deg C minimum) during cooler weather. Vents to be controlled automatically by the greenhouse controller. Heated air shall be introduced at low level. Ducting external to the greenhouse shall be thermally insulated with 50mm internal insulation.

溫室須具備可由控制系統控制之暖風加熱，以在天冷時保持最低室內溫度設定條件 (18°C)。暖風出風口須位於低處。風管須有 50mm 厚的保溫層。

10 VENTILATION

通風

1. When ambient conditions allow set points to be achieved by mechanical ventilation only, air shall be relieved from the greenhouse through electric operated sky windows.

當環境條件達到許可值時，溫室須能僅由機械通風運作，進氣由空調機送風，排氣由電動天窗排出。

2. The greenhouse natural ventilation shall be designed to be fail-safe in terms of power outages, failure of the refrigeration system, air compressor or control system.

溫室自然通風應設計成在停電，空調設備或控制系統故障時仍可運作。

11 GRILLS

導風板

All grills shall have a powder-coated finish. Provide double deflection air grills with opposed blade dampers to each grill for balancing purposes.

所有的導風板須以粉底塗裝烤漆。為了使氣流平均，須使用帶雙閘瓣蝶閘的對開式風門。

12 MECHANICAL SWITCH BOARD

機械控制開關版

Provide a weather proof mechanical switch board with the following features:

須為下列設施提供耐候機械開關版：

1. Digital display of individual room temperature & humidity, indoor set points and outdoor temperature. The set points shall be easily adjustable at TSO computer or any other computer with password authority.

數位面板顯示各溫室之溫濕度、目標溫度及室外溫度。目標溫度須能簡單被有權限者調控。

2. Run and fault lights for all items of equipment, including indication of operation of the refrigeration units, heater and compressed air plant.

所有設備的運行和故障指示燈，包含空調冷暖氣及壓縮機。

3. Auto/off/manual selection for each item of mechanical equipment or stage of operation, including the sky windows and side vents of the greenhouse. Sky windows and side vents to operate independently via controls.

為每個機械設備或操作階段提供自動/關閉/手動選項。包含溫室天窗及側窗。溫室天窗及側窗須能經由控制系統個別操作。

4. Provide a common alarm (red warning) lamp over the greenhouse door. Allow to program alarms to suit the clients' requirements.

在溫室門上方提供一個一般警報（紅色警告）燈。允許編程報警以滿足客戶的要求。

13 HYDRAULIC

給排水

1. Floor drains with removable silt traps in each compartment.

排水口皆需含可拆式上蓋以便清淤。

- Greenhouse rooms: 3 non-potable water outlets, 1 for hand washing sink, 1 for tool washing on corridor side, and 1 for watering plants on perimeter side.
溫室內有三個出水口(非飲用水)，包含靠走廊側的洗手、清潔器皿用水與靠遠端的灌溉用水。

14 ELECTRICAL

電力

- All rooms: install two waterproof 10 amp double power points per room at each end.
所有溫室須有兩座 10 安培防水雙插座，位於該溫室之兩端。
- One Control System switched 15 amp waterproof power point for future photoperiod lights and one Control System switchable point for automatic watering solenoid valve (12V) in each room.
一個 15 安培防水電源點，供控制系統開關未來新增的光週期燈使用。另為每間自動澆水 12V 電磁閥提供一個控制系統開關點。

15 SERVICING DURING THE DEFECTS LIABILITY PERIOD

保固期間服務

- The duration is 12 months for HVAC and EPFS, 24 months for control system, and 36 months for structure.
保固期間機水電為 12 個月，控制系統為 24 個月，結構物為 36 個月。
- The Contractor shall maintain and provide regular servicing to mechanical plant and equipment during the Defects Liability period in accordance with the manufacturer's recommendations.
承包商須於保固期內根據製造商的建議進行機械設備定期維護。
- The Contractor shall attend promptly to all defects and breakdowns which occur during the Defects Liability period. The maximum response time shall be same day if notified before noon, or next morning if notified in the afternoon.
承包商須及時處理保固期內的所有缺陷與故障。若當日上午接獲通知，則當日需反應處理；若為下午接獲通知，則最遲隔日早上需反應處理。
- Before commencement of the Defect Liability Period the Contractor shall supply a list of names, addresses and phone numbers of service organisations which will be responsible for the servicing detailed above.
於保固期生效前，承包商應提供前述相關提供服務廠商之有效名稱、地址、電話清單。

16 KEY CARD SYSTEM

門禁卡系統

Key card system design conduit & pulling wire only.

門禁卡系統僅預埋管及拉線。

17 OTHER FACILITY

其他設施

1. Greenhouse screen will be stainless steel Mesh with Maximum aperture 0.25 mm and wire gauge 0.17 mm. (60 mesh).
溫室紗窗使用不鏽鋼製，孔目最大 0.25mm，線寬 0.17mm (60 目)。
2. Non-greenhouse (before dark path) screen will be 18 mesh.
非溫室空間(暗通道之前)紗窗網目為 18 目。
3. The height for the planting bed is 60cm.
植床高度為 60CM。

18 COMMISSIONING AND TESTING

功能驗證和測試

1. The whole of the engineering services installation shall satisfy the various operational modes and performance requisites before the building is deemed to be practically complete (i.e. to ensure that all services systems are capable of operating effectively in unison).
在建築物被認為實際完成之前，整個工程服務裝置應滿足各種操作模式和性能要求（即確保所有服務系統能夠有效地一致運行）。
2. Performance achievement shall be demonstrated after all routine testing, adjusting, commissioning, approvals and building work associated with the contract is completed.
在完成與合約相關的所有常規測試，調整，調試，批准和建築工作後，應證明性能成果。
3. Emergency modes shall be simulated in the presence of the Client.
應在業主在場情況下模擬緊急模式。
4. Contractor is to provide all necessary training to nominated staff of the operating procedures.
承包商將為指定的工作人員提供操作程序的所有必要培訓。

5. As a minimum requirement the following operational modes shall be demonstrated and in particular the effective transition from one mode to the other.
作為最低要求，應證明以下所列操作模式，特別是模式間的有效過渡。
6. The normal automatic mode (i.e. the condition the building will normally operate in when occupied).
正常的自動模式（即建築物在被使用時通常會運行的狀態）。
7. The manual call up modes (i.e. the start-up of each Engineering Services installation as a whole on a manual basis)
手動調用模式（即手動啟動每個工程服務安裝的整體）。
8. Notwithstanding the normal warranty/performance guarantees the whole of the engineering services systems shall operate in unison and in a normal automatic mode for five consecutive working days to demonstrate that satisfactory operation can be maintained before the installation can be considered to have attained practical completion. (Note: This shall be performed after the above operational modes have been satisfactorily demonstrated).
儘管有正常的保修/性能保證，整個工程服務系統應連續五個工作日以正常自動模式運行，已在被證明安裝完畢前呈現令人滿意的運行狀態。（注意：應在證明前述操作模式正常運作後執行）。
9. Failure to satisfy the above shall not be deemed to be a defect to be rectified after practical completion.
不滿足上述規定的部分不得視為完工後需要改善的缺陷。
10. Fuel, energy or other costs incurred to demonstrate performance achievement shall be borne by the Contractor.
證明性能成就而所需的燃料，能源或其他費用應由承包商承擔。

19 COMMISSIONING PROGRAM

功能驗證計畫

1. A commissioning program shall be submitted during the construction to ensure commissioning of equipment is progressively completed and not delayed until just prior to overall project completion.
施工期間應提出功能驗證計畫，以確保設備的調試逐步完成，並且不會造成項目延遲。

2. A minimum period of two (2) weeks must be allowed for commissioning testing of all engineering services by the Contractor in the presence of the Client. The period is to commence after all services have been fully commissioned and faults repaired. The Client shall decide in what order the tests are to be performed.

承包商在業主在場的情況下，必須至少允許兩週的時間對所有工程服務進行調校測試。此期間自所有服務完全投入使用並修復故障後開始。業主應決定測試的執行順序。

3. Faults found during the commissioning by the Contractor shall be immediately repaired and the tests again repeated.

承包商在調校過程中發現的故障應立即修復，並再次重複測試。

4. If any service fails two (2) consecutive tests, two (2) out of any three (3) consecutive tests, or the same test twice, the commissioning tests shall be abandoned. The Contractor shall then arrange to fully recommission the service and the commissioning time and tests shall recommence.

如果任何服務連續兩次測試失敗，連續三次測試中有兩次測試，或兩次相同測試失敗，則應放棄調校測試。然後，承包商應安排完全重新啟動服務，並且調校時間和測試應重新開始。

5. The Contractor shall give two (2) weeks clear notice in writing to the Client of his intention to start the commissioning tests. The Contractor shall also pay all the Client's costs associated with any commissioning which is performed outside normal working hours.

承包商應於2周前向業主提供明確的書面通知，表明他意圖開始調校。承包商還應支付與在正常工作時間以外進行的任何調校相關的所有客戶費用。

6. The Contractor shall supply all labour, materials and instruments which shall be certified as to their accuracies, dates when calibrated, by whom and of types approved by the Client required for carrying out the tests.

承包商應提供所有勞力，材料和儀器，這些勞力，材料和儀器應證明其精度，校準日期，由誰校準，並應業主同意。

7. Practical Completion will NOT be given until the Client is satisfied that all services are operating satisfactorily.

在業主確認所有服務均完好運作前，不會認定該工項完成。

20 COMMISSIONING TESTS

功能驗證測試

1. All materials, equipment and workmanship shall be subjected to and shall withstand satisfactorily such tests and inspections as are customary, or may reasonably be required to provide compliance with the requirements.
所有材料，設備和施作品質均應經受此類檢驗和檢查通過，或依慣例或合理要求提供符合要求的檢驗和檢查。
2. The Client shall be allowed to inspect the installation works at any stage and the Contractor shall be present at such inspections.
業主應能在任何階段檢查施工情況，承包商應在此類檢查中陪同。
3. No inspection or testing of the materials, work or plant, whether executed by a contractor, his suppliers or sub-contractors, shall relieve the Contractor from his liabilities to complete the Contract or absolve him from any of his guarantees.
任何檢查或測試均不得免除承包商(包含其下包及供應商)履行合約或免除其任何保證之責任。
4. The Contractor shall arrange for all necessary factory tests to be performed on all items of equipment. He shall advise the Client of times at what equipment will be available for testing in order that they may witness any tests.
承包商應安排對所有設備進行所有必要的工廠測試。他應告知業主哪些設備可供測試，以使業主得以見證任何測試過程。
5. During commissioning and testing the Contractor shall record, in addition to the test figures specified, all adjustments and modifications made.
在調校和測試期間，除了指定的測試數據外，承包商還應記錄所做的所有調整和修改。
6. Before completion, the whole of the works shall be subjected to acceptance tests and inspections. The Client may then provide a list of defects and these shall be rectified within 14 days, unless otherwise agreed to in writing. The installation shall then be re-tested and re-inspected to ensure that the listed defects have been remedied.
在項目完工前，整個工程應進行驗收測試和檢查。業主可以提供缺陷清單，除非另有書面約定，否則應在 14 天內予以改善。並應對裝置進行重新測試和重新檢查，以確保所列缺陷得到改善。

21 AIR DISTRIBUTION, AIR HANDLING and VENTILATION SYSTEM TESTS

氣流分佈和通風循環系統測試

1. Adjust all air quantities to within 10% of the determined air quantities and make such further minor adjustments to supply air quantities as are later found necessary to maintain satisfactory space conditions.

將所有空氣量調整到確定的空氣量的 10% 誤差範圍內，並對進氣量進行進一步的微調，以保持預期的必要空間條件。

2. Test and adjust all ventilation systems and controls and conduct capacity tests on the systems.

測試並調整所有的換氣系統及控制，並執行容量負載測驗。

3. Submit a report to the Client's Representative showing the settings of all operating and safety controls.

送交報告予業主，載明所有操作設定及安全控制之方式。

4. Forward to the Client's Representative one print of each relevant drawings, marked up to show the measured air to all conditioners, each outlet, return or exhaust grille, exhaust hoods, etc.

提供業主之代表一份圖說紙本，內容標記所有調節器、進回風口格柵、排氣罩等空調設備。

22 ELECTRICAL SYSTEM TESTS

電力系統測試

1. Adjust each thermal overload for 10% above the actual load on each motor on a hot day and not more than the rated full load amps for the motor.

於高溫日調整每個馬達負載高於其負荷 10%，並且不超過電機的額定滿載電流。

2. Submit a report in duplicate to the Client's Representative showing the name plate rating, the measured current draw on each phase and the thermal overload setting for each motor and electric heater.

向業主代表提交一式兩份的報告，顯示銘牌額定值，每相的測量電流消耗以及每個電機和電加熱器的熱過載設置。

23 CONTROL SYSTEM TESTS

控制系統測試

1. Check all control systems for correct sequence of operation. Calibrate all sensors and thermostats; adjust throttling ranges where necessary to set thermostats to the correct set points. Record, in a report to the Client's Representative, the sensors and thermostat

number and set point. Set a computer in TSO's office linked to the controller via the local area network (LAN).

檢查所有控制系統的正確操作順序。校準所有傳感器和調溫器；在必要時調節節流範圍，將調溫器設置到正確的設定值。在向業主代表的報告中，記錄傳感器和調溫器編號和設定值。在 TSO 的辦公室中設置一台通過區域網（LAN）連接到控制器的主機。

2. Also record in the report the make and break points of any electric switches, the start and finish points of modulating actuators, the time taken to trip electric duct heater safety thermostats when the fans are not operating and any other information requested by the Clients.

另外，需在報告中記錄任何電動開關接點、調節執行器的起點值和終點值，當風扇不運行時跳開電熱管加熱器安全恆溫器所需的時間以及客戶要求的任何其他信息，或其他經業主要求的資料。

3. All field wiring and sensors shall be separately tested before connection to field ports to ensure that installation is correct and that sensing devices perform satisfactorily.

所有現場接線和傳感器在連接現場端口之前應單獨進行測試，以確保安裝正確及傳感器完好。

4. Following the successful completion of the commissioning tests the system shall be demonstrated to operate for a period of at least two months achieving a minimum availability of 99%. If the system fails to meet this availability requirement or particular components show excessive fault incidence, the whole or part of the system should be rejected by the Contractor.

在成功完成調校測試後，控制系統應需以最低妥善率 99% 運行兩個月。如果系統無法滿足此可用性要求，或特定組件顯示過多的故障發生率，承包商應責成退件部分或全部系統。

(END)

(全文完)