Design Features Brief for M&E Services

Proposed Educational Institution Building Comprising of 6 Storey Amenities Block with Carpark and Communal Facilities

Prepared for **German European School Singapore**

By Beca Carter Hollings & Ferner (S.E.Asia) Pte Ltd (BECA)

6 July 2015

Report

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1 DESCRIPTION OF PROPOSED MECHANICAL AND ELECTRICAL SYSTEMS

1.1 GENERAL

This report covers a brief of the proposed Mechanical & Electrical (M&E) Services for the **"PROPOSED EDUCATIONAL INSTITUTION BUILDING COMPRISING OF 6 STOREY EDUCATIONAL BLOCK, 2 STOREY AMENITIES BLOCK WITH CARPARK AND COMMUNAL FACILITIES".**

The report encompasses the following 2 Sections:-

Section 1 - Description of Proposed M&E Systems

Section 2 - Preliminary Schematics of Proposed M&E Systems

A brief description of the Mechanical and Electrical Services design criteria involved in Contract is given hereunder for the guidance of the Contractor. The Contractor shall undertake fully the supply, delivery, installation, testing, commissioning and maintenance during defect liability period.

This section of the specifications shall be read in conjunction with all other section / parts contain in the tender documents. All reference shall be made to the latest Architectural drawings for details whenever required. Any works, which shall be provided as being necessary and complementary to one another for a complete functional system, shall be deemed included in the tender price.

The tender price shall include the design (if required eg. specialist system), supply, delivery, installation, testing & commissioning and maintenance during defects liability period, as specified in the tender documents. The price shall also include complying with all statutory requirements of the local Authorities and Code of Practice.

The Contractor is fully responsible to read the tender document thoroughly to understand the actual extent and nature of the works required under this contract prior to the submission of his tender. It shall be noted that the specifications herein indicate the minimum requirements. The Contractor shall clarify with the Employer should they have any doubt as to the actual extent of or nature of the works prior to tender submission. The Employer shall entertain no claims arising from the lack of clarity and/or non-availability of information.

The system, plant and equipment including cable support system, pipe works, electrical accessories etc. to be used, supplied and installed under this Contract shall be of the design and construction that is suitable for the intended project.

All equipment supplied and installed shall comply fully with the specifications. The Employer reserves the right to reject any equipment found to be deviating from the specification and the Contractor shall replace at his own cost. No extension of time shall be granted.

The Contractor shall note that the drawings / Schematic Diagram are generic and indicative in the depiction of the system design intent & requirement and the Contractor shall include all necessary works not shown in the drawing but required for complete functional system. The Employer must approve any change to the design intent.

All parts of the equipment shall be designed for long, continuous and uninterrupted operation. There shall be provisions for easy access for service or replacement of parts. Corresponding parts of multiple units shall be interchangeable.

It shall be Contractor's responsibility to ensure that the plant and equipment to be supplied and installed in this Contract shall be able to fit into the space and site allocated as shown in the drawings. The Contractor shall also be responsible to co-ordinate all services and check the layout and positioning of the pipe work, plant, equipment etc. before installation and ensure adequate headroom's and clearances for operation and maintenance etc. by maintenance personnel. The services co-ordination shall include those services supplied and installed by Employer's appointed specialist contractors.

The Contractor shall provide adequate and ample accesses e.g. ceiling access panels, equipment come complete with integral or separate maintenance platform for equipment mounted above 3.5m high etc. to all plant and equipment etc. that require regular servicing/maintenance and space planning shall also take into consideration future removal, replacement or addition of the plant and equipment etc. All plants and equipment etc. shall be designed to allow easy cleaning.

The Contractor's scope shall include all the provision for manufactured items, materials, labour, tools and appliances necessary for the proper execution of works, together with all minor and incidental works.

The Contractor shall provide proper training on the operation and maintenance of the completed Mechanical & Electrical Systems to Employer's or its agent.

The Contractor's scope shall include comprehensive maintenance including replacement of any faulty / consumables material such as lamps, filter etc. during the defect liability period for each of the Mechanical & Electrical System. The Contractor shall submit the scope of the comprehensive maintenance during the tender submission.

The Contractor shall include in his tender price for co-ordination with Employer's appointed specialist contractors to design & make all the necessary M&E provisions / interfacing to suit the specialist Equipment/system requirements for a full operational system.

All necessary submissions including fee submissions where applicable to the Authorities / Service Providers by Contractors Qualified Persons/LEW for approval, supply turn-on, shall be included in the tender price except for Utility connection charges and deposits for opening of Utilities account. The contractor shall include liaison with the Authorities for site inspection and turn-on of supply. The cost of application for license including renewal during defect liability period shall be included. The Contractor shall submit their as-built drawings and relevant documents/certificates endorsed by their supervising PEs/LEWs timely for application for supply turn on and Temporary Occupation Permit.

2 ELECTRICAL SYSTEM

2.1 SCOPE OF WORKS

a) Low Voltage (400V) System

The electrical estimated load for the development is 4,000kVA which includes future expansion of 800kVA.

The low voltage distribution system can generally be sub-divided into the following three categories:-

Category A Main switchboard and LV power distribution to major equipment such as air-conditioning plant, ventilating system, lift equipment, pumps and distribution boards in riser ducts, etc.

Category B LV power distribution from respective major sub-boards to intermediate/final distribution boards for lighting and power.

Category C LV wiring installation from intermediate/final distribution boards to the final sub-circuit such as lighting, switch socket outlets, isolator, etc.

b) LV Standby Generating System

c) Installation of interior and exterior light fittings including functional lights, common areas lights and exit lights, etc.

d) Artificial Lighting Design complying with Vision Care Specifications from MOE.

e) Lightning Protection System

f) Earthing System including all earth continuity conductors, earthing leads and earthing electrodes

g) Telephone Wiring System including basic telephone wiring facilities such as telephone lead-in pipes, conduits, cable trays, trunkings, conduits and telephone outlets.

h) Public Address (PA)/Bell/Background Music (BGM)/One-Way Voice Communication System including amplifiers, turner, paging station, power supply unit and speakers, etc.

i) Emergency Call button for handicapped toilets

j) Security Alarm System

- Access Control System
- CCTV System

k) IT Structured Cabling System

l)

2.2 CODES OF PRACTICE

The design and construction of the installation will be based on the current edition of local codes and authorities' requirement. British/IEC Standards will be adopted if the local standards do not exist. Some of the codes are listed as follows:-

(a) CP5 Code of Practice for Electrical Installation

(b) CP19 Code of Practice for the Installation and Maintenance of Emergency Evacuation Lighting and Power Supply System in Buildings

(c) SS530 Code of Practice for Energy efficiency standard for building services and equipment

(d) SS531 Code of Practice for lighting of work places

(e) SS535 Installation, Operation, Maintenance Performance and Constructional Requirements of Main Failure Standby Generating Systems

(f) SS538 Code of Practice for Maintenance of Electrical Equipment of Electrical Installations

(g) SS546 Code of Practice for Emergency Voice Communication Systems in Buildings

(h) SS550 Code of Practice for Installation, operation and maintenance of electric passenger and goods lifts

(i) SS551 Code of Practice for Earthing

(j) SS555 Code of Practice for Protection against lightning

(k) SS563 Code of Practice for The Design installation and maintenance of emergency lighting and power supply systems in buildings

(l) Handbook on Application for Electricity Supply

(m) Code of Practice for Info-communications Facilities in Building (COPIF)

(n) Electricity Act and Regulations

2.3 DESIGN CRITERIA

a. PowerGrid Substation

A new 22kV/LV PowerGrid Substation with 4 nos of 1000 kVA transformer will be taking supply from the nearest Main is required within the proposed site. The supply will then be fed directly from the Substation to the Consumer LT Switchroom.

b. Low Voltage (400V) System
The distribution voltage level is at 400V/230V

i. General

Consumer LT Switchroom is proposed at the 1st storey of the building where the load centre is located. The supply from the main switchboard will be distributed to the respective Administration, Library, Gym and Class Room blocks by a combination of overhead cables, underground pipes, busbars, risers and tap off units.

Supply to the common facilities such as swimming pool, external lighting and mechanical pumps will be taken from the main switchboard via submains cabling and distribution boards

Submain feeders in the form of cables and / or busbar will originate from the main switchboard and terminate at sub-boards or distribution boards. Final circuits wiring in conduits/trunkings will run from distribution boards to serve lighting, switch socket outlets and isolators, etc.

In general, the distribution boards will be provided with the following spare capacity for future load growth:-

a)	Main Switchboards	20%
b)	Major Sub-boards	20%
c)	Intermediate/Final Distribution Boards	20%

ii. Distribution Scheme

A master-metering scheme will be provided for the school. The electricity supply will be metered at the incoming and will be billed monthly by the Service Provider based on the power consumption.

Distribution from sub-boards to classrooms and office areas will be by cable tray/trunking and terminated in the rooms.

Distribution to common areas such as corridors and plant rooms will be by cable trays, trunkings or conduits. All wiring within the teaching and common areas will be run in conceal conduits, whereas for Gym/Theatre/Library, a mixture of floor service outlet box (SOB) and conceal conduit. Conduits in the plant rooms and those run within false ceiling spaces however will be surface run.

iii. Sub-boards & DB

Lighting and power for common areas such as corridors and plant rooms will be served by common sub-board on every floor.

The lighting and power for classrooms for each school shall be served by a localised distribution board in the classroom.

Designated spaces such as office, library, kitchen, gymnasium and the multi-sports complex will have localised distribution boards.

Ideally these sub-boards shall either be located in the risers and designated areas on every floor. Purposed sub-boards shall be co-located in the designated areas.

c. Standby Power Supply

In the event of power failure, 1 no. 600 kVA standby generator set will automatically start-up to cater for the following essential services of the office building:-

i. Fire Protection Pumps and Alarm System

ii. Fire Lifts

iii. Essential Mechanical Ventilation System for protected fire lobbies, bus bay, generator rooms, etc.

iv. Emergency Lighting including all Exit Signs

v. Public Address & Bell System

vi. IT Server Room & Wire Centres including air-conditioning.

vii. Security System

viii. A/C and Power Supply of Fire Command Centre

ix. BMS Services associated with Essential systems as stated above.

d. Lighting

General, the use of artificial lighting can be divided into areas below:-

i. General lighting

Spaces such as staircases, corridors with no false ceiling, plant rooms, bus bays, car parks, exterior and circulation will have fully enclosed fluorescent T5 luminaires designed for its intended use.

The luminaries in all common areas, swimming pool, and exterior and circulation areas will be controlled by timer using BMS.

The fluorescent T5 luminaries in staircases and corridors will be fitted with electronic high frequency (HF) ballasts and photocells. In addition to that, motion sensors will provide control to the lighting in these areas. Toilets will be fitted with motion detectors as well as this provision will help to reduce electrical consumption.

ii. Offices/Library/Classrooms/Pods/Labs

Highly efficient fluorescent T5 Labs utilising parabolic reflectors will be used in the office, library, classrooms, laboratories and the pod areas. These luminaries will be fitted with electronic high frequency (HF) ballasts to ensure maximum energy efficiency is achieved.

Lighting in Offices and Libraries will be grouped in zones and controlled by separated switches so that the staff can have maximum flexibility when selecting a particular zone to turn on. Rooms/spaces within these spaces will be controlled with a localised On/Off switch.

The lighting controls for classrooms and pods will be control row by row and with respect to the projector screens and exterior façade.

iii. Gym and Sports Hall

Lighting in the Sport Hall will be group by zones and controlled by separate switches to ensure courts are correctly illuminated during practise and competition. Whereas the luminaires will be selected in order to prevent excessive glare to the users in both gym and sports hall.

The sports hall lightings will be controlled by timing through the BMS network and localised On/Off switch within the control room.

iv. Football Field and Indoor Swimming Pool

High mast floodlights on steel poles will be provided to illuminate the football field. Indoor swimming pool areas will be illuminated by using suitable floodlight. The sports field lighting shall be designed by lighting specialist to be engaged by the contractor hence the cost shall be included in the M&E works.

General lighting will be provided for the grandstand and general circulation areas of the outdoor sports field and swimming pool areas. The lighting will be designed to provide sufficient levels suitable for security around these areas.

v. Auditorium

The Auditorium will have a combination of dimmable, fixed output and performance lighting which will be control by a lighting control system. The control system will be complete with pre-set scene and dimming features suitable for the intended usage and lighting control of the auditorium.

vi. Emergency lighting

Non-maintained emergency lightings and maintained illuminated exit signs will be strategically located throughout the building to illuminate the escape paths – as determined by the architect during a power failure.

vii. External lighting

Bus bays, car-park will be zoned in alternate circuits to cater for peak and non-peak periods in a day. The driveways will be in alternate circuit as keeping the lanes lighted will help increase awareness of road safety to pedestrians and road users. These can be controlled from the guard house.

The street lighting around the perimeter of the building will be controlled by timer of BMS.

In general, lighting control for the entire building will be controlled by time zones set within the BMS network. The BMS highly recommended to be used to monitor common areas namely, corridors, driveways, lift lobbies and car-park areas.

Table 3.1 shows the lighting illuminating levels for the various areas of interests.

Table 3.1

Location Areas	Recommended Design Value of Illuminance (lux)
Staircases, circulation areas, corridors and drop off areas	150
M&E Plant Rooms	200
Car parks, bus bays	75
Driveways	75
Offices, Classrooms[#], Conference and Meeting Rooms, Pods, Library	300-500
Gym and Sports Hall	300
Outdoor Football Field and Swimming Pool (Leisure)	300
Auditorium	300

RECOMMENDED ILLUMINANCE

Except otherwise stated, all lighting levels are designed with SS531 as the minimum requirement.

 # Following the Vision Care Specification from MOE

Table 3.2 shows the maximum permissible lighting load as stipulated in SS530:2006 which the lighting design must comply with.

Table 3.2

Location/Areas	Maximum Permissible Lighting Load (W/m^2)	Target Lighting Power Budget (W/m^2)	Savings (%)
Staircases	6	5	17
Corridors	10	7	30
Offices	15	9	40
Classrooms and Pods	15	10	33
Auditoriums	10	7	30
Car parks	5	3.5	30

e. Small Power

In general, each designated area such as classrooms, offices will be completed with provisions of switches socket outlets (SSO), as per table 3.3.

Table 3.3

Location Areas	Recommended Number of SSO
Offices	2 nos. 2x13A SSO per workstation
Staff Rooms	1 no. 2x13A SSO per 8 sq. m
Study Areas	2 nos. 2x13A SSO per 20 sq. m
Classrooms	5 nos. 2x13A SSO 5 nos. 1x13A SSO for AV equipment
Canteen	1 nos. 2x13A SSO per 15m (radius)
Circulation Areas, Corridors, Lobbies	1 no. 1x13A SSO per 10m (radius) 1 no. 1x15A SSO per 10m (radius) 1 no. 20A Isolator for water cooler
Gymnasium	1 no. 1x13A SSO per gym equipment 1 no. 2x13A SSO per 15 sq. m
Sports Hall	1 no. 2x13A SSO per 15 sq. m
Plant Rooms	2 nos. 2x13A SSO
Toilets	1 no. 1x13A SSO per circulation fan 1 no. 1x13A SSO per hand dryer
Auditorium	1 no. 1x13A SSO per 10m (radius) 1 no. 1x15A SSO per 10m (radius)

f. Lightning Protection System

The lightning protection system will consist of a network of parallel horizontal conductors on the roof and these will be connected to the air termination through down conductors within the building structure.

Design will be carried out in accordance with SS555:Part 1 to 4 Code of Practice against Lightning and to protect the occupants within the building.

A lightning early warning system will be installed to provide early warning to the users at the open field areas.

g. Sub-metering

Electrical sub-metering will be provided to the SB/DB which is above 100kVA (approximately 150A, 3phase) in various parts of the building to facilitate energy monitoring through BAS / BMS.

Electrical sub-metering shall be designed to facilitate BCA Greenmark verification after TOP and completion.

h. Electrical Earthing System

There should be no sharing at earth pits between the electrical earthing system and clean earth.

The earthing of the entire electrical installation will be designed in accordance with SS551:2009. The system will comprise of earth continuity conductors, earth leads and earth electrodes. The electrodes will be of deep-driven copper cladded earth rods and the resistance to earth will be lesser than one ohm.

Individual clean earth shall be provided for Server and LAN rooms to ensure the integrity of the earthing system is not compromised.

A separate clean earth system for AV systems at the Auditorium upon confirmation of the AV equipments.

i. Telephone Wiring System

This project is designed using IP telephony system.

The works scopes of Telephone Wiring System will cover the following:-

i. Cable trays, trunking and conduits will be provided for the installation of the structured cabling system connection the Data Centre on Storey 3 through the Wire Centre located at each block/floor.

ii. Telephone Distribution

Distribution of telephone lines in the building will be through vertical riser shaft. Cable trays will be provided for cable distribution.

The telephone lines will be distributed via concealed conduits.

j. Integrated School Communication System

The System will be integrated and interface with the PA system via overriding switches for emergency announcements over the PA speakers. The integrated system will operate as a duplex, handsfree loudspeaker system (via PA speakers for general announcements).

The Public Address & Bell System will be microprocessor based communication system consisting of: Control Console – to be located at the general office. The system will enable the operator to communicate with each zone via condenser microphone fixed at the console. A Compact Disc Player is integrated into the system to provide background music, taped messages, alarm tone or bell chime. A three (3) tone chime will precede every announcement and an All Call/Emergency Paging key will enable the Principal to have easy access for all the zones in case of announcements such as Emergency. Provision of jacks for PA system will be provided at gym.

Separated PA system dedicated to bus bay area only will be provided to make announcement for all the bus crews only for instance.

Speakers – Ceiling or Wall mounted speaker will be provided for every room and evenly distributed located in the library, offices, canteen and common areas. Outdoor weatherproof horn speakers will be evenly located at the open field, swimming pool areas, carpark, busbay and M&E plant rooms.

The main PA/EVC equipment rack will be located inside the FCC room. Microphone station c/w zone selector switches will be provided at the main Admin office for general announcement purposes.

k. Security System

i. Access Control System

The access control system (ACS) will be provided to assist in the control and monitoring of authorised access to selected areas. The ACS will allow the access and egress through controlled doors.

Using the access control card, authorised personnel can be managed and logged. The card technology to be applied will be based on a contactless smart card system which will serve all access control functions. Electromagnetic Lock will be incorporated to the doors of the protected rooms.

Generally Offices, Library and restricted rooms are provided with ACS.

ii. CCTV System

The CCTV and DVR system will provide the video surveillance and recording functions, as well as the video switching functions to manage all closed circuit television. This includes fixed and Pan/Tilt/Zoom cameras. The CCTV Surveillance and Recording System will be housed in Security Room/FCC room at 1st storey. Additional LCD monitors will be provided at Guard House for remote monitoring.

All cameras will be strategically located in visible dome housings to acts as a deterrent as well as provide good all round visibility and recording in locations as follow:

- Ingress, Egress and Driveway
- Drop Off
- Bus Bay
- Gym
- Library
- Canteen and Kitchen
- Lift Lobbies

l. IT Structured Cabling System

The Structured Cabling System (SCS) shall be used for data telephone and BMS applications and shall also be capable of fully integrated all voice, data and video application for future integration purposes.

A Main Server Room shall be located within Administration Office to connect the cabling infrastructure for the whole campus. There will be two other Distribution Server Room located on Storey 3 to distribute to various wire centres on every floor. They will be connected via fibre optical cable. Active main IT equipment such as Electronics communications equipment, hardware and software, computer server equipment and the transmission media required to terminate this equipment on distribution hardware in the Server Room will be provided by the school IT.

Uninterruptible Power Supply (UPS) will be provided by the school IT to all servers in the Server Room to prevent data loss in the event of power failure.

Wire centres shall be wall mounted in various strategic locations in the education blocks and sports hall. It consists of cabinets and rack-mountable patch panels for termination of copper and fibre optic cables.

The data transmission links between the Main Server Room and Distribution Server Room and between the Distribution Server Room to the wire centres one every floor will be by fibre optic cable which is capable of data transfer rate at up to 1 Gbps (Gigabytes per second).

Subsequently, the data transmission link between the wire centres and Data Outlet (RJ45) will be of CAT 6A, Foiled Twisted Pair (FTP) copper cables which is capable at data transfer rate at 100Mbps (Megabytes per second).

m. Cable Management System

For horizontal distribution of power, communication/data cables, a common services support for cable tray/trunking will be implemented along the corridors. Consequently, vertical distribution will be by cable tray/trunking on the dedicated communication and data risers.

3 VERTICAL TRANSPORTATION

3.1 SCOPE OF WORKS

Passenger / Service/ Handicap Lift

3.2 CODES AND STANDARDS

The design and construction of the installation will be based on the current edition of the following Codes of Practice:-

Singapore Standard SS550:2009 – Code of Practice for Installation, Operation and Maintenance of Electric Passenger and Goods Lifts.

3.3 LIFT

a. Design Criteria for Lifts

The building will be served by the following lifts

- 1 no. at passenger / Evacuation lift, located at the Auditorium block
- 1 no. at passenger / service lift, located at the canteen.
- 1 no. at service lift, located at the Sports Hall.

The lifts are AC variable voltage variable frequency (VVVF) type.

Machine roomless lift's (for service lift located at sport Hall & Canteen) traction motors and the associated control panels will be housed at the top of the lift shaft and lift landing.

The lift car will have standard provision of car operating panels, intercoms, sound system, lighting and ventilation.

Standard car and car door safety equipment such as flexible guide clamp safety gear, speed governor, limit switches, car load weighing devices, EBOPS, retractable door edge, photo-electric cell, etc. will be installed for all lifts.

The homing sequence and the operation of the lift under fire and power failure conditions will be in accordance with Singapore Standard SS550:2009. During the power outage, Automatic Rescue Device (ARD) will be sufficiently designed to bring the lift to the next landing floor. In the event of a fire alarm activation, the lift will be homed to 1st storey.

Lift Supervisory Panel will be installed in the FCC/Security Room (1st storey of Admin Block to provide remote display and control of the fire operation under both normal and emergency situation. In general, the lift supervisory panel will comprise the following:-

i. Car position indicator with up and down arrows to indicate the position and travel direction of the lift.

ii. Key switches for maintenance and resetting of lift operation after fire or emergency situation.

iii. Indicating lights for showing the status of power lift operation after fire or emergency situation, etc.

b. Lift Provision

Auditorium Block

3000Kg , Speed 1.0 m/s, stops (1st to 5th Storey)

Car door size – 1100 (W) x 2300 (H) mm

Sport Hall

24 person, Speed 1.5 m/s, 2 stops (1st to 2nd Storey)

Car door size –1000 (W) x 2300 (H) mm

Canteen

13 person, speed 1.0m/s, 2 stops (1st to 2nd Storey)

Car door size – 900 (W) x 2100 (H) mm

c. The lift will operate in 'sleep mode' that is the lighting and ventilation of the lift car will be switched-off when the lift is at idling mode to meet Green Mark requirement.

4 AIRCONDITIONING & MECHANICAL VENTILATION SERVICES

4.1 SCOPES OF WORKS

The scope of this service will include:-

a. Air conditioning system complete with water- cooled chillers, chilled/ condenser water pumps, cooling towers, fan coil units, air handling units and single/multi split unit.

b. Pre-cooled Air Handling Units (PAU) for fresh air supply.

c. Mechanical Ventilation system for toilets, Kitchen, plantrooms, service corridors and aboveground car park where natural ventilation is not possible

4.2 CODES AND STANDARDS

The design and construction of the above services will be based on the following Standards.

a. The Building Control (Environmental Sustainability) Regulations 2008.

b. Singapore Standard SS553:2009
Code of Practice for Mechanical Ventilation and Air Conditioning in Buildings.

c. Singapore Standard SS530:2006
Code of Practice for Energy Efficiency Standard for Building Services and Equipment

d. ASHRAE (American Society of Heating, Refrigeration and Air Cond itioning Engineers) Handbooks

e. Ductwork Construction-To SMACNA (Sheet Metal and Air Conditioning Contractors' National Association, USA) Low/Medium Velocity Construction Standards.

4.3 DESIGN BASIS

a. Air Conditioned Areas

The air-conditioning system will be designed to provide comfort levels in the intended air-conditioned spaces as identified on the architects drawings under the following design conditions.

i. Outdoor Design Conditions

The following ambient conditions have been taken as the basis for plant capacity:-

- Design Ambient Dry Bulb Temperature 32°C
- Design Ambient Wet Bulb Temperature 26°C

ii. Indoor Design Conditions

Indoor design conditions for air-conditioned spaces are indicated in the table below.

Area	Design Target Temperature (No RH Control)	Design Allowance			Outdoor Air Supply (L/s per person)
		Lighting (W/m²)	Equipment (W/m²)	Occupancy (m² / person)	
Classroom	24˚C ± 1˚C	9	20	30 People/Classroom	4.2
Office/Teacher's Space	24˚C ± 1˚C	9	20	10	5.5
Meeting Room/MPH	24˚C ± 1˚C	9	20	Based on seating capacity	3.8
Library	24˚C ± 1˚C	9	20	7.5	5.5
Auditorium Stage	24˚C ± 1˚C	200	300	3	3.0
Auditorium Seating Area	24˚C ± 1˚C	7	5	Based on seating capacity	3.0
Music Room/Art Room	24˚C ± 1˚C	10	5	1.5	4.2
Science Room	24˚C ± 1˚C	10	Based on electrical and lab equipment heating dissipation	5	5 Or Make-up air supply for local exhaust air [1]
Dance Studio/Rehearsal Room with Stage	24˚C ± 1˚C	10	20	3	10.5
Indoor Sport Hall	24˚C ± 1˚C	12	15	3	3.8
Data/ Server /LAN	22˚C ± 1˚C	Lighting (w/m²) 9	Equipment (w/m²)500	Occupancy	NA
Security office	24˚C ± 1˚C	9	300	10	5.5

b. Mechanical Ventilated Areas

The mechanical ventilation system will be designed to give the following performance:-

	Location	Type of Ventilation	Air Quantity
1.	Toilets	Exhaust with make-up air through door grilles and/or operable windows.	15 air changes per hour in accordance with regulatory authority minimum requirement
2.	M&E Rooms	Exhaust and/or supply air or make up through external wall louvers/windows	According to equipment loads, To limit temp to 5°C above ambient (but not less than 6 air changes per hour)
3.	Kitchen areas	Kitchen exhaust and fresh air system.	Based on size of cooking hood To comply with SS553:2009
4.	School Bus Bay/ Carpark	Mechanical Ventilation with supply	To comply with SS553:2009

(Edited the Lighting power budget based on M&E targets)

c. Acoustic Objective

Air conditioning and mechanical ventilation systems will be designed to meet the recommended ambient sound level in accordance to SS553:2009.

Acoustic requirement for auditorium, musical room, dance studio, major equipment plant room is not covered under this scope of works and shall be under Acoustic consultant scope of work. The design of the ventilation systems will include the acoustic and noise isolation requirements (as provided and confirmed by the acoustic consultant).

d. Schedule of Operation

To determine appropriate selection and sizing of the ACMV systems, the following schedule of school operation hours has been established:

Hours of Operation	Description
8:00 AM – 5:00 PM (Monday – Friday) 8:00 AM – 1:00 PM (Saturday) Sunday / public holiday – No Operation	Classrooms, Admin Office, Library, Auditorium, Multi-Purpose Hall, labs, Indoor Sports hall
After School Operation Hours	Admin office, library, Auditorium, Indoor Sports Hall
24 Hour Operation Hours	FCC, Security Room

4.4 SYSTEMS DESCRIPTIONS

a. Central Chilled water Air-conditioning Plant

The air-conditioning system will be served by a central chilled-water system. Variable primary flow system will be designed for the chilled water circulation. Cooling tower fans and chilled water pumps shall be complete with Variable Speed Drives (VSD) to ensure better part load efficiency.

The peak cooling load is calculated to be 1600RT. The off peak/ night load is estimated to be 120 RT. The chillers shall be configured as close to the air-conditioning demand. The chiller configuration recommended is 3 nos 750RT (2 Duty & 1 Standby) and 1 no VSD 250RT.

The chillers would be operated with refrigerant with ozone depletion potential (ODP) of zero or with global warming potential (GWP) of less than 100.

Two nos. 750RT & 1 no. VSD 250 RT chillers will work to meet cooling demanding plus one unit 750RT set as standby. One unit of 250RT chiller will be designed to cater for the sport hall, library, admin & auditorium to be operated during vacation or after school operation hours to serve other function. Piping connection provisions will be provided in the chilled water system for 1 no additional chiller (up to 250RT) to cater for future expansion..

The operating temperature for chilled water system as follows:-

Chilled Water Supply – 8 °C

Chilled Water Return – 15 °C

The targeted chilled water plant designed system efficiency shall meet 0.64 kW/RT. Provision of permanent M&V instruments for monitoring of water-cooled chilled water plant efficiency shall comply with the Green Mark Gold Plus and SS591:2013 requirements. Verification of chilled water plant instrumentation using the heat balance-substantiating test in accordance with AHRI 550/590 will also be conducted.

The chillers will be located in the 1st floor plantroom of Academic Building , and cooling towers will be located at the roof deck of the same Building.

The start/stop and sequencing of each chiller system will be automatic according to the building load to conserve energy and obtain equal run hours for each machine.

Cooling tower water treatment with water treatment system that can achieve 7 or better cycles of concentration will be provided.

Refer to Drawing No. 5810508/AV-SK1 for the chilled water schematic.

b. Air Conditioning Systems

VARIABLE AIR VOLUME (VAV) Air handling units will serve the admin's office areas and library at every storey. Air handling units will be provided with VSD to reduce fan speed during low occupancy and installed with CO_2 sensors c/w motorized dampers to vary fresh air intake to the conditioned spaces and UVC Lamps to improve indoor air quality. Chilled water to the AHU is modulated by means of a 2-way valve and is controlled by room space temperature sensor / thermostat.

All Classrooms, Pod areas, internal corridors will be Air-Con using concealed ceiling ducted fan coil units.

The air distribution system efficiency is targeted to meet the baseline in SS553:2009. All air handling units and pre-cooled air handling units will have the provision of filtration media and differential pressure monitoring equipment in accordance with SS554:2009

The Security room, IT server room, MDF room and FCC room will be provided with wall mounted 24 hr. air-conditioning using both Chilled water FCU and Air Cooled Direct Expansion system. The system will be complete with duty and standby units to provide 100 % redundancy. The following rooms will be provided with 24hrs A/C: -

a) LAN Rooms

b) FCC

c) Security Office

d) Arts Room (1)

e) Arts Store (1)

f) Kindergarden Art and Craft Room (1)

g) Music Room (1)

h) Music Store (1)

i) Music VIP Room (1)

j) Kindergarden Music Room (1)

k) Drama Room / Black Box (1)

l) Guard House

m) Science Prep Room (1)

NOTE1: Subject further review & confirmation with GESS on actual system requirements such as redundancy, essential supply, etc.

Outdoor air to the classrooms will be pre-cooled and ducted to each room, c/w motorised dampers to modulate pre-treated outdoor air supply based on CO2 Sensors in each class room.

Spill air from the classrooms will be allowed to flow into the common corridors, provided cooling effect to these corridors while reducing the air conditioning load.

The auditorium will be served by one chilled water outdoor air handing unit, which is located at the roof top of the auditorium and distribute treated air through displacement ventilation system from low level ducted diffusers located below the seats. Outdoor air handler shall be suitable for Singapore weather without condensation on FCU unit.

The indoor sport hall will be served by 3 nos of air handling units (based on 3 basketball court layout). All these units will be installed on the mezzanine floor slab of Indoor Sports Hall. Air distribution within the sports hall will be via high-level exposed.

All other rooms will be air-conditioned using concealed ceiling ducted-type fan coil units (FCU). Each fan coil unit will be controlled by a wall mounted thermostat. The thermostat unit controls power on/off, temperature and fan speeds.

Condensate drain pipe from fan coil units will be copper pipes insulated to prevent condensation and will run to the nearest floor traps/wastes. Waste pipe carrying the condensate water will be be externally insulated to prevent condensation.

c. Ventilation Systems

i. Toilets / Changing Rooms

The vertical riser duct will be connected to toilet exhaust fans which will be located at the roof.

Make-up air will be via door grilles and/or operable windows from the

Corridor/external wall.

ii. Mechanical and Electrical Equipment Rooms

These rooms will be ventilated with exhaust and make-up air systems sized to maintain internal conditions within the manufacturer's specifications and/or in accordance with the code requirements.

iii. Kitchen Exhaust System

Kitchen hoods will be provided above the cooking areas and kitchen exhaust will discharge directly to the exterior at the roof and away from the habitable areas of the building, and will not be less than 5 m from any air intake openings.

The exhaust hood dimension & quantity to be advised by kitchen specialist engaged by GESS.

The kitchen exhaust duct will be provided with separate compartments and/or masonry shafts.

iv. School Bus Bay and Carpark Mechanical Ventilation System

As the one side of the school bus bay is open, so part of the school bus bay which is within the 12 meters of the openings will be natural ventilated. This will be incorporated into the architecture design. When smoke purging system is required, it shall comply with Fire Code 2013.

For school bus bay areas beyond 12 meters of the opening areas, a mechanical ventilation system without supply will be designed with the assumption that natural ventilation opening equivalent to not less than 2% of the mechanically ventilated areas is provided. CO sensors will be used to regulate demand for mechanical ventilation fans via VSD. Ductless jet fans will also be provided at school bus bay and carpark.

(Refer to Drawing No. 5810508/AV –SK2)

v. Natural Ventilation

Canteen open area, common corridors and exit staircase will be natural ventilated, this will be incorporated into the architecture, design & landscape.

vi. Science Rooms

These rooms will be provided with exhaust while precooled air acts as make-up air.

4.5 MATERIALS, EQUIPMENTS AND OTHER REQUIREMENTS

a. Central Plant

i. Chillers

Chiller efficiency shall be 0.51 KW/RT or better.

Chillers will be water-cooled centrifugal type running on refrigerant R134a. They will be selected on the basis of ARI 550.

Each chiller will be completed with proprietary control and start sequencing to give stable operation down to 25% of rated load.

ii. Pumps

Chilled water and condenser water pumps will be horizontal suction and horizontal discharge pumps operating not more than 1500Rpm. Pumps will be mounted on inertia blocks and provided with flexible connections, non-return valves and isolating valves.

Pumps efficiency shall be 0.042 KW/RT for chilled water pumps and 0.052 KW/RT to a condenser water pumps respectively or better.

b. Piping, Insulation, Valves and Fittings

i. Chilled Water and Condenser Water

	Diameter	Material & Joint
1)	25mm to 150mm	Black carbon steel to BS 1387 Class B. Fully welded fittings with flanged valve, strainer and accessories
2)	Above 150mm	ASTM 53 Schedule 40. Fully welded. Valves and accessories to be flanged.
3)	Condenser water pipe will be same as chilled water pipe but will be factory galvanized.	

ii. Condensate

1)	All sizes	Copper to BS EN 1057 Table Y

iii. Fittings

iv. Steel pipe fittings will be ERW type of similar of the jointing method specified above.

v. Balancing and Control Values

Pressure independent balancing and control value shall be provided on each main branch and AHU/PAHU/FCU pipes.

vi. Insulation

In general, closed cell insulation will be used to cover all components of pipelines and fittings for diameters less than 50mm and equipment where the surface temperature is lower than the ambient air dew point temperature, such that the surface temperature of the insulation will not be lower than the ambient dew point.

The integrity of the vapour barrier will be ensured. In additional, polished aluminium cladding (0.8mm) will be provided where such pipework is exposed such as plantrooms, air handling rooms and the like.

At each support, insulation will be packed using rigid polyurethane packer over which the vapour barrier shall pass without interruption.

For pipe and fittings diameters greater than 50mm, pre-insulated pipe work will be used.

c. Ductwork/Accessories

i. Rigid Ducting

Generally ducting will be designed to SMACNA “HVAC Duct Construction Metal and Flexible Second Edition 1995”, to seal Class B and 750Pa static pressure for all AHU, kitchen extract ducting. All other ducting will be to seal Class C and 500Pa static pressure.

ii. Flexible Ducting

Flexible ducting will be to the above standard. Semi-rigid aluminium sidewinder will be used in all cases and will not exceed 3m length of run. External insulation will be provided.

Attachment shall be by mechanically fastened bands.

iii. Fire Dampers

Will be provided at all ductwork penetrations of fire rated walls/fire compartment and shall have a similar rating to the wall.

iv. Volume Control Dampers

Balancing VCDs are required on each branch other than index duct run.

1)	Opposed and parallel bade volume control dampers	Stainless steel shaft, roller bearing and position indication with blade lip seal.
2)	Single blade	Permitted on final branch outlet only

v. VAV Terminals

All the variable air volume (VAV) terminals shall be of pressure independent type.

vi. Turning Vanes

Generally double bladed turning vanes at all 90° bends. Splitter at all radiused bends where shown on the drawings.

vii. Insulation

1)	Internal	Internal acoustic insulation will be provided where shown on the drawings. This shall consist 25 or 50mm of 32kg/m^3 density fibreglass with facing to prevent fibre carry-over.
2)	External	Minimum 25mm 48kg/m^3 fibreglass complete with aluminium foil vapour barrier.

4.6 BUILDING AUTOMATION (BAS) SYSTEM

The BAS will provide remote monitoring, control and time scheduling.

The system will be able to monitor and/or control chillers, cooling towers, ventilation fans, pumpsets, water tank level (monitor only), air-handling units and fan coil units, DX units.

Lightings at the common circulation areas will be integrated with the building automation system (BAS). The ON/OFF timing of the lightings shall be pre-programmed into the BAS.

The electrical and water sub-meters will also be linked to BAS for monitoring purposes.

The BAS Servers & Primary workstation will be located at the FCC.

Refer to Drawing No. 5810508/BMS-SK1

5 FIRE PROTECTION SERVICES

5.1 SCOPE OF WORKS

The scope of works will include the following:-

a. Fire Hosereel System

b. Portable Fire Extinguishers

c. Fire Hydrant

d. Dry Riser System

e. Manual Call Points and Automatic Fire Alarm System

f. Automatic Sprinkler System

5.2 CODES AND REGULATIONS

The design and installation of the complete fire protection services will be in accordance with the following local codes.

a.	Code of Practice for Fire Hydrant, Rising Mains and Hose Reel Systems	SS 575:2012
b.	Code of Practice for Use and Maintenance of Portable Fire Extinguishers	SS CP55:1991
c.	Code of Practice for the Installation and Servicing of Electrical Fire Alarm Systems	SS CP10:2005
d.	Code of Practice for Automatic Fire Sprinkler System	SS CP 52:2004
e.	Code of Practice for Fire Precautions in Buildings 2013	

5.3 FIRE HOSEREEL SYSTEM

a. Design Basis

The hosereel system will be designed according to the codes and regulations, viz. the number of hosereels will be such that all portions of each storey of the building will be within 6m of nozzle attached to not more than 30m of hose the distance being measured along a route suitable for the hoseline, locations as determined by the Architect.

b. System Description

i. Water Supply

For all the blocks (Classrooms and Admin Block and Sport Hall), the hosereels will be provided with pressured water supply from the sprinkler/hosereel storage tank located on the roof. The water supply is transferred from low level sprinkler/hosereel transfer tank and pump room located at storey 1 where PUB water supply incoming from.

Minimum water supply will be provided to ensure a jet of 10m in length and at least 0.4 litres/sec to the most hydraulically remote hosereel.

c. Materials of Construction

The hosereel system will be provided to the common areas and strategic locations.

The hosereel pipework connected directly from the main water supply pipe will be copper pipes to BS EN 1057 (heavy-duty); the hosereel pipework connected from the hosereel tank will be medium grade galvanized steel tube to BS1387.

(Refer to Drawing No. 5810508/FP-SK1)

5.4 PORTABLE FIRE EXTINGUISHERS

Portable fire extinguishers of appropriate types will be installed at strategic locations of the buildings and in the plant rooms, as determined by the Architect.

5.5 EXTERNAL FIRE HYDRANTS

The external private fire hydrants will be located along the fire engine access and spaced not more than 100m apart, as determined by the Architect.

They will be served from a separate water line off the PUB water bulk meter. The fire hydrants will be provided with pressured water supply from the fire hydrant tank located on the storey 1.

The underground pipework for the external private fire-hydrant system will be cement-lined ductile iron to BS EN 545: 1995.

All pipework shall be leak-tested and flow-tested prior to being concealed and/or buried.

All pipework shall be painted. Fire-rated material shall be painted with non-water based paint in accordance to manufacturer's requirement.

5.6 DRY RISERS

The buildings where the habitable height is more than 10m in height will be provided with a 100mm diameter dry riser. No portion of any room will be more than 38m from the dry riser.

Each dry riser will be connected to a 4-way fire brigade breeching inlet located within 18m of the fire engine access.

The dry riser pipework will be of Class C, heavy grade galvanised steel pipe to BS 1387.

5.7 MANUAL CALL POINTS AND AUTOMATIC FIRE ALARM SYSTEM

a. Design Basis

The manual fire alarm system, in the form of manual call points, will be provided to the common area and strategic locations so that no person needs to travel more than 30m from any position within the building in order to activate the alarm.

There will be a break glass call station and an alarm bell adjacent to each hosereel. The break glass call stations will be wired to a fire alarm indicator board located at the Security Office. Manual detection of a fire in the building will be accomplished by the manual activation of the call points.

Automatic fire alarm system, in the form of smoke detectors, will be provided for the electrical plantrooms/risers, for early detection and warning of a fire in these spaces according to the client's requirement. The provision of automatic fire alarm system is over and above the existing manual fire alarm requirement stipulated in the Code of Practice for Fire Precautions in Buildings 2013 (Purpose Group III-Institutional).

b. System Description

The alarm system will be monitored at the Main Fire Alarm Panel located at the Fire Command Centre at 1st Storey.

Once a fire has been detected either manually by manual call points or automatically by smoke detectors, a general alarm condition will be activated whereby all the alarm bells will sound. Upon receipt of any fire alarm, lift homing sequence and fire emergency fans, if any, will be activated.

The alarm signal will be connected to Singapore Civil Defence Forces via an approved fire alarm monitoring company.

A mimic panel will be provided at the Guard post near the main entrance.

(Refer to Drawing No. 5810508/FP-SK2)

5.8 SPRINKLER SYSTEM

Sprinklers will be designed to Ordinary Hazard Group II – 30m Class shall be provided to all areas except electrical plant rooms and risers. Full extent of sprinklers would be confirmed and coordinated with the architect. Pre-action sprinklers for certain high-value rooms and equipment will be included as an option as required by the client

A sprinkler/hosereel transfer tank located at storey 1 to serve and transfer the water to high level sprinkler/hosereel storage tank. Electric duty/standby sprinkler and jockey pumps shall be provided.

A 4-way sprinkler breeching inlet shall be provided at the storey one near to the fire engine access way to supply the water from SCDF tanker to the control valve.

(Refer to Drawing No. 5810508/FP-SK1)

6 PLUMBING, SANITARY & DRAINAGE SERVICES

6.1 SCOPE OF WORKS

The scope of works for the Plumbing and Sanitary Systems will include the following:-

a. Cold Water System

b. Sanitary Plumbing and Drainage System

c. Hot water system (for kitchen and changing rooms).

6.2 CODES AND REGULATIONS

The design and construction of the Plumbing and Sanitary Systems will comply with the following codes.

a. Code of Practice for Water Services CP 48:2005

b. Code of Practice on Sewerage and Sanitary Works (1st Edition March 2000)

Including Addendum No. 1 (Feb 2001) and Addendum No. 2 (Nov 2004)

c. Other Codes, Standards, Regulations referred to by the above codes.

6.3 MATERIALS AND EQUIPMENT

a. Plumbing System

i. Domestic Water

1)	Pipe diameter greater than 80mm below or above ground	Cement lined heavy duty ductile iron pipe to BS EN 545:1995
2)	Diameter equal or less than 65mm and below ground	Copper to BS EN 1057:1996 (Heavy Duty)
3)	Diameter equal or less than 65mm and above ground	Copper to BS EN 1057:1996 (Light Duty)
4)	Valves – 50 and below	Threaded gate bronze body
5)	Above 65 and less than or equal to 100mm	Flanged gate bronze body
6)	Above 100mm	Rising stem gate valve CI body

b. Sanitary & Drainage

1) Soil and vent stack and fittings diameter less than or equal to 150mm

▪ Aboveground	Unplasticised polyvinyl chloride (UPVC)
▪ Underground	Heavy Duty Ductile iron pipe (BS EN 598:1995)
▪ Science Laboratories	Polypropylene

2) Inspection covers — Cast iron

3) Floor trap cover

▪ Toilet	UPVC
▪ Pantry	Stainless steel
▪ Plantrooms	Stainless steel

4) Last IC sanitary drain pipe connection to manhole 225mm — Vitrified clay pipe

5) Canteen waste — Grease trap & screen chamber

6.4 DESIGN BASIS

a. Cold Water System Storage

Storage capacity allowed will be provided for 1 day consumption of water supply based on PUB Water Department's guideline.

The design criteria for daily water consumption are based on the following:

- 15 litres per student per day
- 15 litres per staff per day
- 1000 litres per day per canteen stall or 80 litres per day per seat
- 80 litres per tap per day for washing/gardening
- 160 litres per tap per day for bin centre washing
- A 70m³ potable water tank will be located on the roof.

b. Pressure at Outlets/Fittings

The system will be designed such that the pressure at entry to water fittings outlets shall not be less than 1.0 bar and not greater than 3.7 bars.

In general, hydropneumatic pumpsets will be used to boost pressure at outlets and fittings.

6.5 PLUMBING SYSTEM DESCRIPTION

Water supply incoming from PUB water main will go direct to the low level cold water transfer tank and pumps room located storey 1. Water supply will be pumped up to high level water storage tank located at the roof to serve the classrooms and admin building and sport hall.

Similarly, water supply incoming from PUB water main will go direct to the low level cooling tower make up water transfer tank and pumps room located storey 1. Water supply will be pumped up to high level cooling tower make up water storage tank located at the roof to serve cooling tower water make-up tank, AC expansion tank and domestic water storage tank located at the roof.

Water supply will be fed by booster pump feed (hydropneumatic system) to the top 3 storeys (5th to Roof Storey). 1st Storey to 4th Storey will be fed through gravity feed from the water tank.

Water sub-meters will be provided for the canteen kitchen, swimming pool balancing tank, cooling towers, AC expansion tank, landscape irrigation).

Variable-speed drive (VSD) pumping system shall be provided for the roof top booster systems. Monitoring panels shall be provided at the Security Office to monitor the status of all pumps, tank overflow alarms or faults.

Provision of digital private meters to monitor major water usage such as irrigation, cooling tower will be provided. These meters will be linked to BAS and trigger an alarm upon leak detection.

(Refer to Drawing No. 5810508/P-SK1)

6.6 SANITARY SYSTEM DESCRIPTION

The Sanitary Drainage System will be of the fully ventilated system. All sanitary waste lines shall be connected to gravity drain network comprising pipes and inspection chambers (IC). The IC network shall discharge to the external sewer manhole through a minimum 225mm vitrified clay pipe (VCP).

All underground drain lines and ICs shall be tested for leaks based on the requirements of National Environment Agency (NEA). Soil waste pipes shall not be installed above any potable water tanks and potable water pumps. All floor traps c/w mosquito device shall be inspected prior to handover to ensure that all debris is removed.

The sewage and wastewater from the toilets at each floor will discharge into the soil and waste stacks. These vertical stacks will discharge into inspection chambers at 1st Storey. The wastewater from the canteen kitchen at 1st Storey will be discharged to the grease trap and then to the inspection chamber.

The waste water generated from the science preparation rooms and science laboratories at 6th storey will be discharged into sewer via a dilution tank located at storey 1 sunken area.

(Refer to Drawing No. 5810508/D-SK1)

6.7 HOT WATER SYSTEM

The hot water for Shower rooms at level 1 (sport hall changing rooms, swimming pool changing rooms, one male and one female toilets) will be served by instant gas water heaters. The canteen kitchen is estimated to prepare 500 meals at peak period and therefore, three units of 1100 liter hot water storage tanks will be provided that requires heating capacity of 75kW.

7 GAS SERVICES

7.1 CODES AND REGULATIONS

Code of Practice for Manufactured Gas Pipe Installation CP 51:2004

7.2 MATERIALS AND EQUIPMENT

Gas pipe work buried underground from the boundary line up to the building line will be ductile iron to BS 4772 Class K9.

Aboveground gas mains will be Class “B” medium grade galvanised steel pipe to BS 1387. Where the gas pipe work has to transverse into false ceiling space, then pipe work will be of API-5L Sch 40 black steel with welded joints which will be subject to 100% radiographic test to satisfy Power Gas Department’s requirements.

7.3 GAS SYSTEM DESCRIPTION

Gas will be supplied from Power Gas mains to the domestic hot water systems, canteen kitchen, food lab and storey 2 classroom kitchen by means of underground gas pipe work using the shortest possible route. The gas risers shall be housed in a well-ventilated external gas shaft.

Gas meters shall be installed at locations that are easy to access. Gas leakage detection system shall be provided at the canteen kitchen.

Gas point will be provided for each lab desk.

(Refer to Drawing No. 5810508/G-SK1)

8 SWIMMING POOL SERVICES

8.1 CODES AND REGULATIONS

SS 556:2010 Code of Practice for The Design and Management of Aquatic facilities

8.2 MATERIALS AND EQUIPMENT

A complete set of pool cleaning equipment including brushes, poles, nets, skimmers, etc shall be provided and adequate for daily maintenance of the pool.

A complete set of Water Testing Kits shall be provided to facilitate water quality testing and recording.

A complete set of Life Safety Equipment including life buoys, rescue poles, signage, etc shall be provided in compliance with the requirements for Licensing.

8.3 SWIMMING POOL FILTRATION SYSTEM DESCRIPTION

Water quality shall meet the requirements of the National Environment Agency (Environment Health Department). Appropriate type circulation, filtration and chemical treatment systems shall be provided for the pool.

Turn-over rate for the pool shall be 6 hours. At least one standby pump and one standby filter shall be provided.

Monitoring panels shall be provided at the Security Office to monitor the status of pool filtration pumps and balancing tank overflow alarms or faults.

(Refer to Drawing No. 5810508/SP-SK1)

8.4 HEAT PUMP

Pool heating system comprises with 4x145 kW heat pumps (3 duty plus 1 standby at peak load) to maintain the two swimming pools (learn-to-swim, main and pools) at average temperature of 26 deg C to 28 deg C.

9 PRELIMINARY SCHEMATICS OF PROPOSED M&E SYSTEMS

9.1 ELECTRICAL SERVICES

S/No.	Drawing No.	Description
1	5810508/E-SK1	Main Single Line Diagram
2	5810508/E-SK1A	Main Single Line Diagram
3	5810508/E-SK5	Schematic Diagram for Public Address System
4	5810508/E-SK6	Schematic Diagram for Firemen Intercom System
5	5810508/E-SK7	Schematic Diagram for CCTV System (IP System)
6	5810508/E-SK8	Schematic Diagram for Card Access System
7	5810508/E-SK9	Schematic Diagram for VOIP Telephone System & iT Infrastructure

9.2 AIRCONDITIONING & MECHANICAL VENTILATION SERVICES

S/No.	Drawing No.	Description
1	5810508/AV-SK1	Chilled Water Schematic
2	5810508/BAS-SK1	Building Automation System Schematic

9.3 FIRE PROTECTION SERVICES

S/No.	Drawing No.	Description
1	5810508/FP-SK1	Sprinkler Dry Riser / Hosereel Schematic
2	5810508/FP-SK2	Fire Alarm Schematic

9.4 PLUMBING, SANITARY AND GAS SERVICES

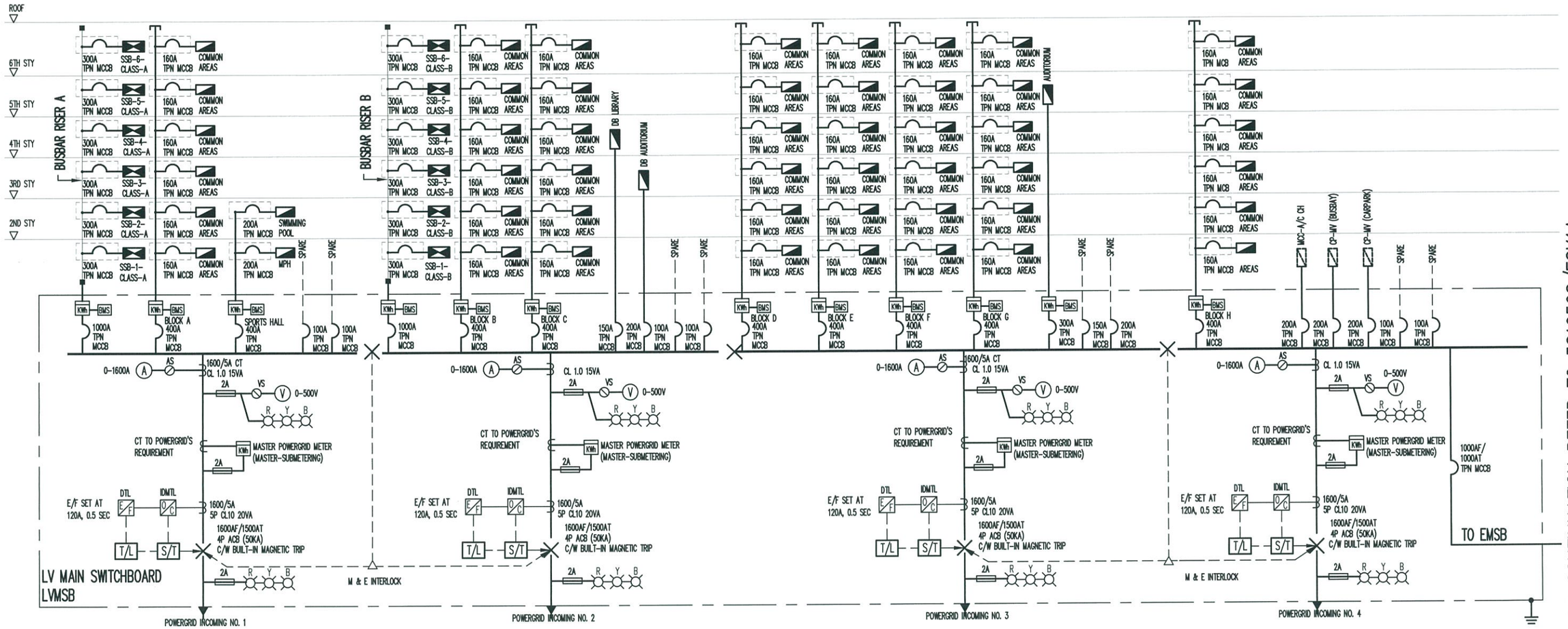
S/No.	Drawing No.	Description
1	5810508/P-SK1	Plumbing Schematic
2	5810508/D-SK1	Sanitary Schematic
3	5810508/G-SK1	Gas Schematic

9.5 SWIMMING POOL SERVICES

S/No.	Drawing No.	Description
1	5810508/SP-SK1	Swimming Pool Schematic

Electrical Services

Drawing Plotted:



FOR CONTINUATION REFER TO 5810508/ESK1A

Rev. No.	Description Revision	Date	Drawn By	Checked by
C	FOR DETAIL DESIGN	MAY '15	MIM1	KTEY
B	FOR CONCEPT DESIGN	NOV '14	MIM1	KTEY
A	FOR CONCEPT DESIGN	AUG '14	MIM1	KTEY

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Scale	N.T.S	Checked	KTEY
Date	AUG '14	Job Manager	LPH
Drawn	MIM	Job Director	KBW
File Name :	5810508-ESK1	QP	DTSY

Client:
GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)
72 Bukit Timah Road
Singapore 288760

Project:
PROPOSED EDUCATIONAL INSTITUTION BUILDING COMPRISING OF 6 STOREY EDUCATIONAL BLOCK, 2 STOREY AMENITIES BLOCK WITH CARPARK AND COMMUNAL FACILITIES

Title:
MAIN SINGLE LINE DIAGRAM PART A

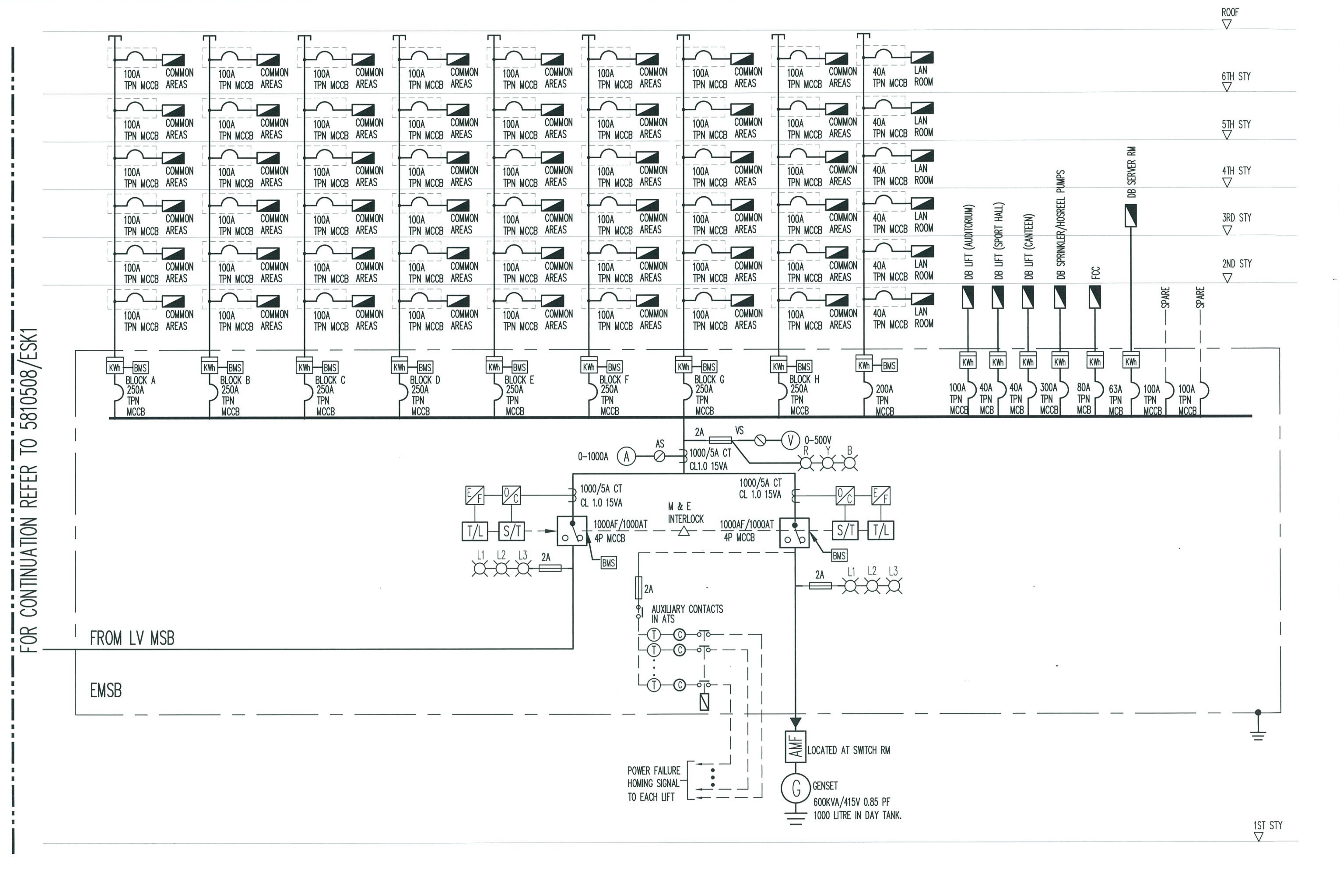
Service: ELECTRICAL SERVICES
Drawing No. 5810508/E-SK1
Rev. C

Document No.

DO NOT SCALE

IF IN DOUBT ASK.

Drawing Plotted:



ROOF
6TH STY
5TH STY
4TH STY
3RD STY
2ND STY
1ST STY
100A TPN MCCB
COMMON AREAS
40A TPN MCCB
LAN ROOM
DB LIFT (AUDITORIUM)
DB LIFT (SPORT HALL)
DB LIFT (CANTEEN)
DB SPRINKLER/HOSREEL PUMPS
FCC
DB SERVER RM
SPARE
SPARE
KWh
BMS
BLOCK A 250A TPN MCCB
BLOCK B 250A TPN MCCB
BLOCK C 250A TPN MCCB
BLOCK D 250A TPN MCCB
BLOCK E 250A TPN MCCB
BLOCK F 250A TPN MCCB
BLOCK G 250A TPN MCCB
BLOCK H 250A TPN MCCB
200A TPN MCCB
100A TPN MCCB
40A TPN MCB
40A TPN MCB
300A TPN MCCB
80A TPN MCB
63A TPN MCB
100A TPN MCCB
100A TPN MCCB
2A
VS
0-500V
R Y B
0-1000A
AS
1000/5A CT CL1.0 15VA
1000/5A CT CL 1.0 15VA
M & E INTERLOCK
1000AF/1000AT 4P MCCB
E/F
O/C
T/L
S/T
L1 L2 L3
AUXILIARY CONTACTS IN ATS
T
C
POWER FAILURE HOMING SIGNAL TO EACH LIFT
FROM LV MSB
EMSB
AMF
LOCATED AT SWITCH RM
G
GENSET
600KVA/415V 0.85 PF
1000 LITRE IN DAY TANK.
FOR CONTINUATION REFER TO 5810508/ESK1

Rev. No.	Description Revision	Date	Drawn By	Checked by
C	FOR DETAIL DESIGN	MAY' 15	MIM1	KTEY
B	FOR CONCEPT DESIGN	NOV' 14	MIM1	KTEY
A	FOR CONCEPT DESIGN	AUG' 14	MIM1	KTEY

Beca

Beca Carter Hollings & Ferner (S.E. Asia) Pte Ltd.
51 Anson Road, #12-51, Anson Centre. Singapore 079904
Tel : 6220 7588 Fax : 6225 6937

Scale	N.T.S	Checked	KTEY
Date	AUG '14	Job Manager	LPH
Drawn	MIM	Job Director	KBW
File Name :	5810508-ESK1	QP	DTSY

Client: GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)
72 Bukit Tinggi Road
Singapore 289760

Project: PROPOSED EDUCATIONAL INSTITUTION BUILDING COMPRISING OF 6 STOREY EDUCATIONAL BLOCK, 2 STOREY AMENITIES BLOCK WITH CARPARK AND COMMUNAL FACILITIES

Title: MAIN SINGLE LINE DIAGRAM PART B

Service: ELECTRICAL SERVICES

Drawing No. 5810508/E-SK1A

Rev. C

Document No.

DO NOT SCALE

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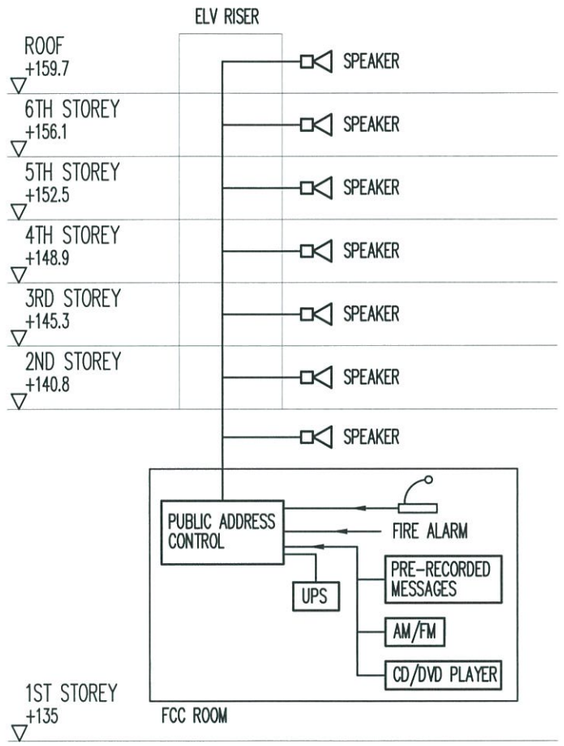

SCHEMATIC DIAGRAM FOR PUBLIC ADDRESS SYSTEM

SCALE N.T.S

Rev. No.	Description Revision	Date	Drawn By	Checked by
A	FOR CONCEPT DESIGN	AUG '14	MMH	KTEY

Beca Carter Hollings & Ferner (S.E. Asia) Pte Ltd.
51 Anson Road, #12-51, Anson Centre, Singapore 079904
Tel : 6220 7588 Fax : 6225 6937

Scale		Checked	KTEY
Date	AUG '14	Job Manager	LPH
Drawn		Job Director	KBW
File Name :		QP	DTSY

Client: GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)
72 Bukit Timah Road
Singapore 259709

Project: PROPOSED EDUCATIONAL INSTITUTION BUILDING COMPRISING OF 6 STOREY EDUCATIONAL BLOCK, 2 STOREY AMENITIES BLOCK WITH CARPARK AND COMMUNAL FACILITIES

Title: SCHEMATIC DIAGRAM FOR PUBLIC ADDRESS SYSTEM

Service: ELECTRICAL SERVICES

Drawing No. 5810508/E-SK5

Rev. A

Document No. 5810508-esk5.dwg

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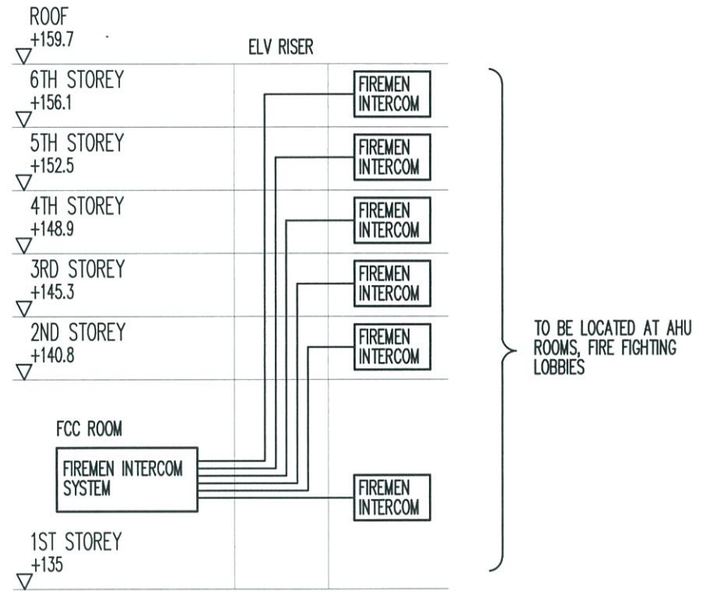


SCHEMATIC DIAGRAM FOR FIREMEN INTERCOM SYSTEM

SCALE N.T.S

Rev. No.	Description Revision	Date	Drawn By	Checked by
A	FOR CONCEPT DESIGN	AUG' 14	MIM1	KTEY

Beca Carter Hollings & Ferner (S.E. Asia) Pte Ltd.
51 Anson Road, #12-51, Anson Centre, Singapore 079904
Tel : 6220 7588 Fax : 6225 6937

Scale		Checked	KTEY
Date	AUG '14	Job Manager	LPH
Drawn		Job Director	KBW
File Name :		QP	DTSY

Client:
GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)
72 Bukit Timah Road
Singapore 259709

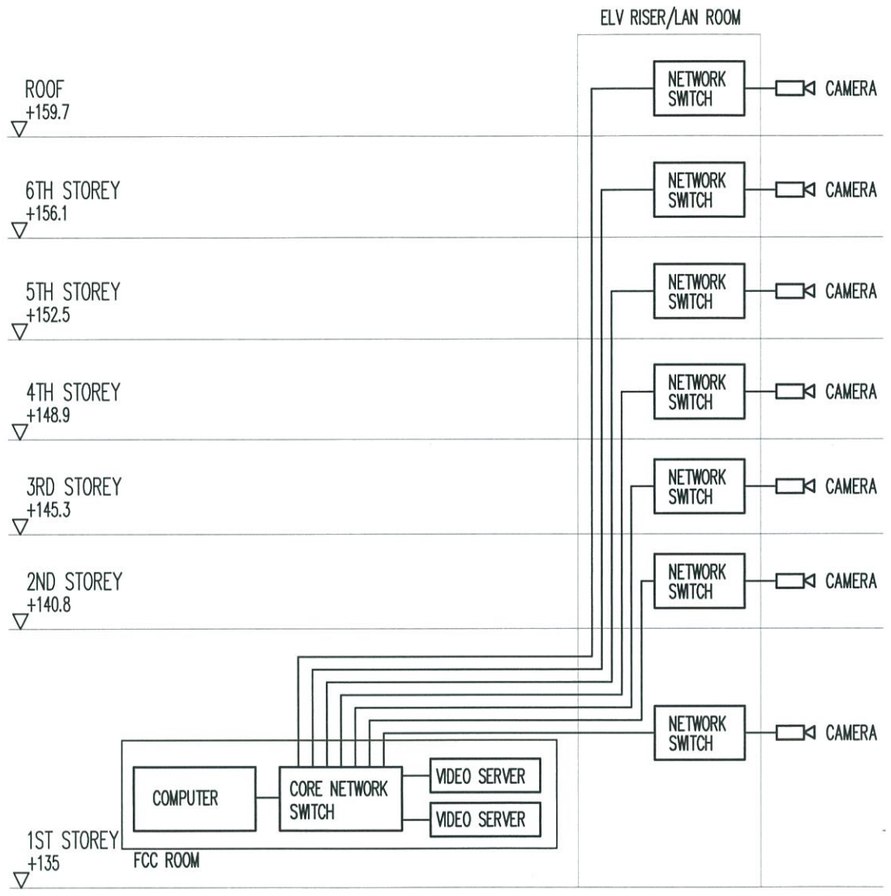
Project:
PROPOSED EDUCATIONAL INSTITUTION BUILDING COMPRISING OF 6 STOREY EDUCATIONAL BLOCK, 2 STOREY AMENITIES BLOCK WITH CARPARK AND COMMUNAL FACILITIES

Title:
SCHEMATIC DIAGRAM FOR FIREMEN INTERCOM SYSTEM

Service: ELECTRICAL SERVICES

Drawing No. 5810508/E-SK6

Rev. A



SCHEMATIC DIAGRAM FOR CCTV SYSTEM (IP SYSTEM)

SCALE N.T.S

Rev. No.	Description Revision	Date	Drawn By	Checked by
A	FOR CONCEPT DESIGN	AUG' 14	MM1	KTEY

Beca Carter Hollings & Ferner (S.E. Asia) Pte Ltd.
51 Anson Road, #12-51, Anson Centre. Singapore 079904
Tel : 6220 7588 Fax : 6225 6937

Scale		Checked	KTEY
Date	AUG '14	Job Manager	LPH
Drawn		Job Director	KBW
File Name :		QP	DTSY

Client:
GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)
72 Dover Road
Singapore 259769

Project:
PROPOSED EDUCATIONAL INSTITUTION BUILDING COMPRISING OF 6 STOREY EDUCATIONAL BLOCK, 2 STOREY AMENITIES BLOCK WITH CARPARK AND COMMUNAL FACILITIES

Title:
SCHEMATIC DIAGRAM FOR CCTV SYSTEM (IP SYSTEM)

Service: ELECTRICAL SERVICES

Drawing No. 5810508/E-SK7

Rev. A

Document No. 5810508-esk7.dwg

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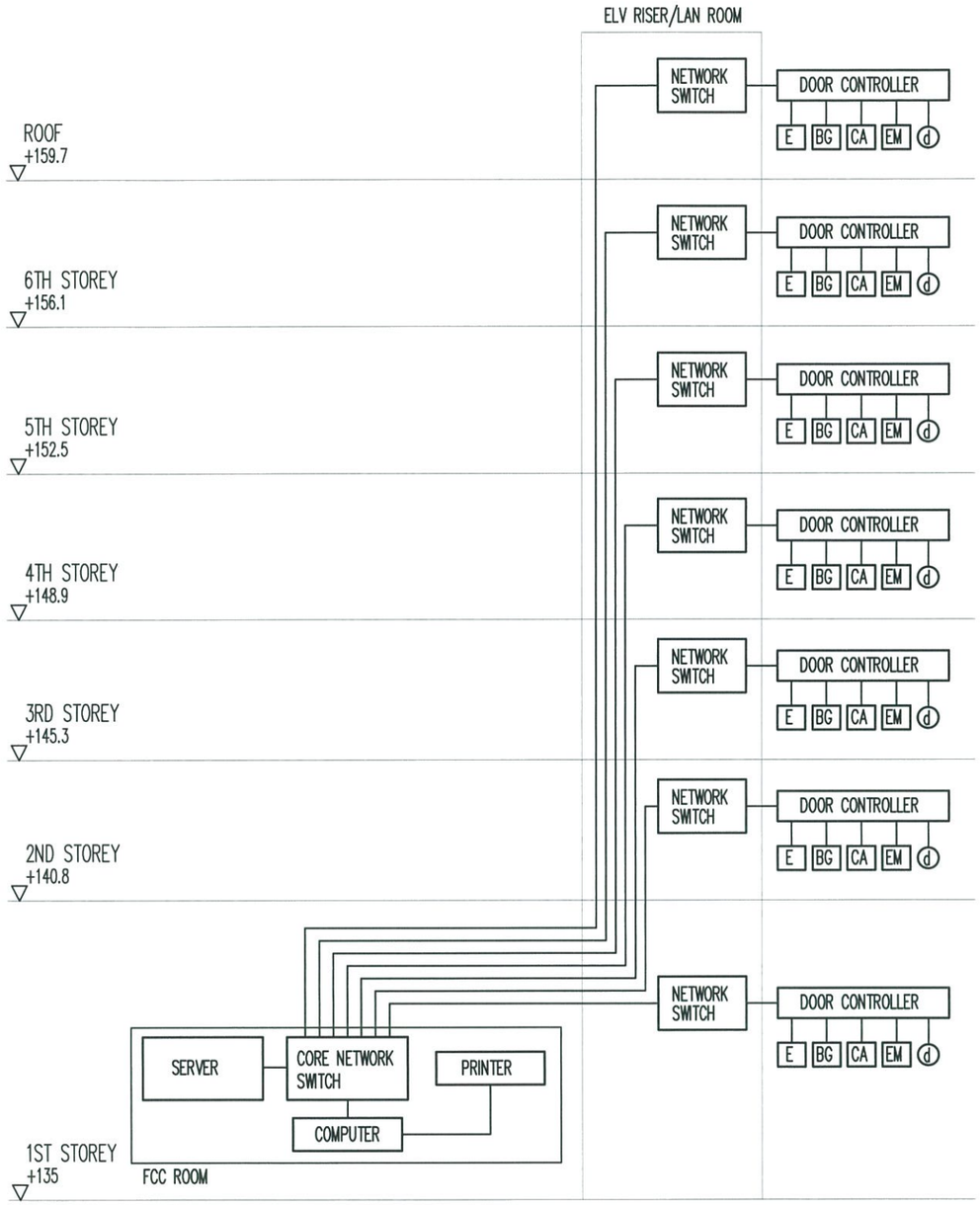

LEGEND

- E — EXIT PUSH BUTTON
- BG — BREAK GLASS
- CA — CARD ACCESS READER
- EM — ELECTROMAGNETIC LOCK
- d — DOOR CONTACT

SCHEMATIC DIAGRAM FOR CARD ACCESS SYSTEM

SCALE N.T.S

Rev. No.	Description Revision	Date	Drawn By	Checked by
A	FOR CONCEPT DESIGN	AUG' 14	MMH	KTEY

Beca Carter Hollings & Ferner (S.E. Asia) Pte Ltd.
51 Anson Road, #12-51, Anson Centre, Singapore 079904
Tel : 6220 7588 Fax : 6225 6937

Scale		Checked	KTEY
Date	AUG '14	Job Manager	LPH
Drawn		Job Director	KBW
File Name :		GP	DTSY

Client: GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)
22 Bukit Timah Road Singapore 259750

Project: PROPOSED EDUCATIONAL INSTITUTION BUILDING COMPRISING OF 6 STOREY EDUCATIONAL BLOCK, 2 STOREY AMENITIES BLOCK WITH CARPARK AND COMMUNAL FACILITIES

Title: SCHEMATIC DIAGRAM FOR CARD ACCESS SYSTEM

Service: ELECTRICAL SERVICES

Drawing No. 5810508/E-SK8

Rev. A

Document No. 5810508-esk8.dwg

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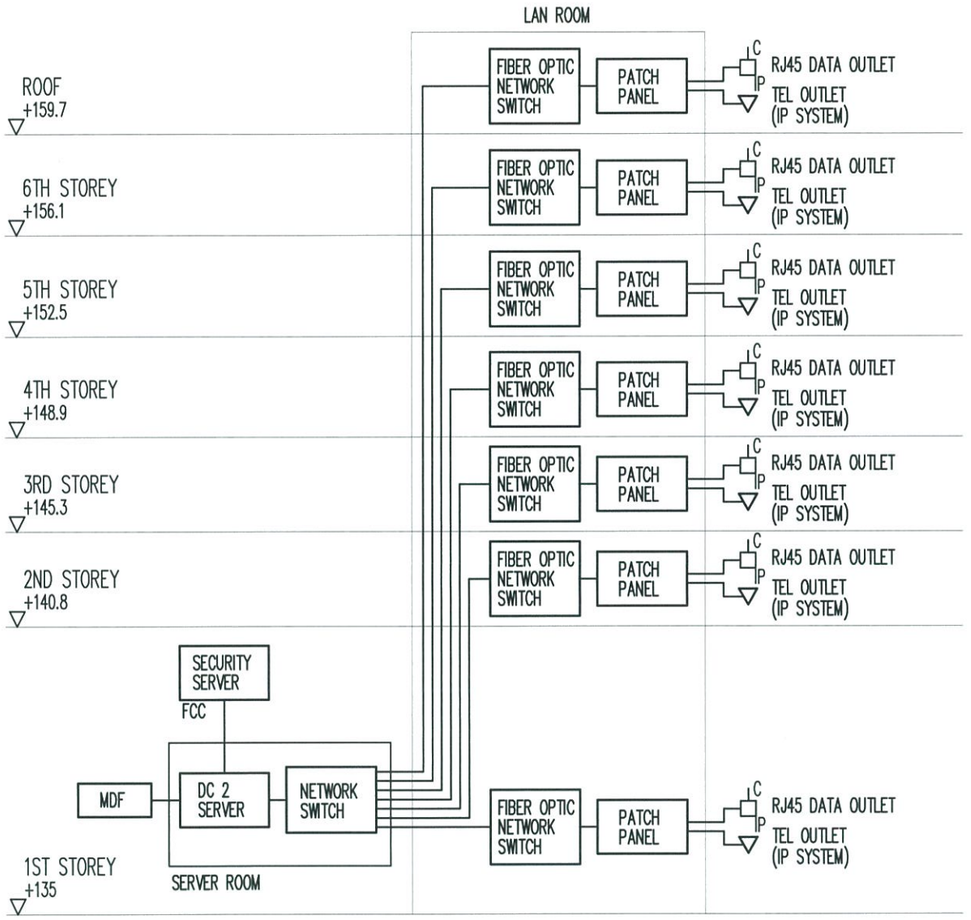


SCHEMATIC DIAGRAM FOR VOIP TELEPHONE SYSTEM & IT INFRASTRUCTURE

SCALE N.T.S

Rev. No.	Description Revision	Date	Drawn By	Checked by
A	FOR CONCEPT DESIGN	AUG' 14	MIM1	KTEY

Beca Carter Hollings & Ferner (S.E. Asia) Pte Ltd.
51 Anson Road, #12-51, Anson Centre, Singapore 079904
Tel : 6220 7588 Fax : 6225 6937

Scale		Checked	KTEY
Date	AUG '14	Job Manager	LPH
Drawn		Job Director	KBW
File Name :		GP	DTSY

Client: GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)
72 Bukit Timah Road
Singapore 288709

Project: PROPOSED EDUCATIONAL INSTITUTION BUILDING COMPRISING OF 6 STOREY EDUCATIONAL BLOCK, 2 STOREY AMENITIES BLOCK WITH CARPARK AND COMMUNAL FACILITIES

Title: SCHEMATIC DIAGRAM FOR VOIP TELEPHONE SYSTEM & IT INFRASTRUCTURE

Service: ELECTRICAL SERVICES

Drawing No. 5810508/E-SK8

Rev. A

Document No. 5810508-esk9.dwg

DO NOT SCALE

IF IN DOUBT ASK.

ACMV Services

ACMV SCHEMATIC DIAGRAM

CHILLER RISER 1 | CHILLER RISER 2 | CHILLER RISER 3 | CHILLER RISER 4 | CHILLER RISER 5 | CHILLER RISER 6

CT-1 (VSD) 625 RT | CT-2 (VSD) 625 RT | CT-3 (VSD) 625 RT | CT-4 (VSD) 625 RT | CT-(FUTURE) 313 RT | MAKE UP WATER PIP

ROOF LEVEL

AHU 4.5 L/S — L5+L6 AUDITORIUM

CONDENSATE DRAIN PIPE

6TH STOREY
- FAD, PAHU, FA, DX, FCU
- PAHU OUTDOOR TYPE (3.0L/S)
- 14NOS. x 0.54L/S — CLASS ROOM
- 2NOS. x 0.26L/S — LAN RM
- 2NOS. x 0.13L/S
- Ø100 CHWS/ CHWR

5TH STOREY
- PAHU OUTDOOR TYPE (2.6L/S)
- 13NOS. x 0.4L/S — CLASS ROOM
- 2NOS. x 0.2L/S — LAN RM
- Ø125 CHWS/ CHWR

4TH STOREY
- PAHU OUTDOOR TYPE (2.6L/S)
- 13NOS. x 0.4L/S — CLASS ROOM
- 2NOS. x 0.2L/S — LAN RM
- Ø125 CHWS/ CHWR

3RD STOREY
- PAHU OUTDOOR TYPE (2.6L/S)
- 13NOS. x 0.4L/S — CLASS ROOM
- 2NOS. x 0.2L/S — LAN RM
- Ø150 CHWS/ CHWR

2ND STOREY
- Ø200 CHWS / CHWR
- PAHU OUTDOOR TYPE (1.3L/S), 4MPH — GYM
- 2.0L/S — GYM
- 2.7L/S — ISH
- 3NOS. x 10.0L/S — INDOOR SPORTS HALL
- Ø150 CHWS/ CHWR

1ST STOREY
- Ø50 CHWS/ CHWR
- 0.4L/S — SERVER ROOM
- 0.4L/S — SERVER ROOM
- 2NOS.x 0.4L/S — STORE ROOM
- 0.4L/S — CENTRAL ROOM
- 0.26L/S — PE OFFICE

CLASS RISER 1 (LAN RM)
- PAHU OUTDOOR TYPE (3.0L/S)
- 13NOS. x0.54L/S — CLASS ROOM
- 2NOS. x0.3L/S — LAN RM
- Ø100 CHWS/ CHWR
- 13NOS. x0.48L/S — CLASS ROOM
- 2NOS. x0.3L/S — LAN RM
- Ø125 CHWS/ CHWR
- 13NOS. x0.48L/S — CLASS ROOM
- 2NOS. x0.3L/S — LAN RM
- 13NOS. x0.48L/S — CLASS ROOM
- 2NOS. x0.3L/S — LAN RM
- Ø150 CHWS/ CHWR
- 10NOS. x0.48L/S — CLASS ROOM
- 9NOS. x0.3L/S — LAN RM
- Ø200 CHWS/ CHWR
- 11NOS. x0.48L/S — CLASS ROOM
- 2NOS. x0.3L/S — LAN RM

CLASS RISER 2 (LAN RM)
- PAHU OUTDOOR TYPE (3.0L/S)
- 15NOS. x0.54L/S — CLASS ROOM
- 4NOS. x0.3L/S — LAN RM
- Ø100 CHWS/ CHWR
- 13NOS. x0.4L/S — CLASS ROOM
- 2NOS. x0.2L/S — LAN RM
- Ø125 CHWS/ CHWR
- 13NOS. x0.4L/S — CLASS ROOM
- 2NOS. x0.2L/S — LAN RM
- 13NOS. x0.4L/S — CLASS ROOM
- 2NOS. x0.2L/S — LAN RM
- Ø150 CHWS/ CHWR
- 10NOS. x0.4L/S — CLASS ROOM
- 9NOS. x0.2L/S — LAN RM
- Ø200 CHWS/ CHWR
- 11NOS. x0.4L/S — CLASS ROOM
- 2NOS. x0.2L/S — LAN RM

CLASS RISER 3
- AHU-5 L/S — ADMIN RM
- Ø100 CHWS/ CHWR
- AHU-2.6 L/S — LIBRARY
- Ø125 CHWS/ CHWR
- 8NOS. 0.4L/S x0.2L/S — 6NOS. x0.13L/S
- PAHU OUTDOOR TYPE (2.6L/S)
- Ø150 CHWS/ CHWR
- 3NOS. x0.4L/S — 3NOS. x0.26L/S
- PAHU OUTDOOR TYPE (2.6L/S)
- Ø150 CHWS/ CHWR
- 8NOS. x 0.4L/S
- Ø200 CHWS/ CHWR

CLASS RISER 4
- Ø100 CHWS/ CHWR
- AHU-2.6 L/S — ADMIN RM
- Ø125 CHWS/ CHWR
- AHU-2.6 L/S — ADMIN RM
- Ø150 CHWS/ CHWR
- 0.4L/S — BUS OFFICE
- 0.4L/S — LOBBY

CLASS RISER 5
- PAHU OUTDOOR TYPE (2.6L/S)
- 13NOS. x 0.4L/S — CLASS ROOM
- 2NOS. x 0.2L/S — LAN RM
- Ø100 CHWS/ CHWR
- 13NOS. x 0.4L/S — CLASS ROOM
- 2NOS. x 0.2L/S — LAN RM
- Ø125 CHWS/ CHWR
- 13NOS. x 0.4L/S — CLASS ROOM
- 2NOS. x 0.2L/S — LAN RM
- Ø125 CHWS/ CHWR
- 13NOS. x 0.4L/S — CLASS ROOM
- 2NOS. x 0.2L/S — LAN RM
- Ø150 CHWS/ CHWR
- 8NOS. x 0.4L/S — KITCHEN
- 17NOS. x 0.13L/S — CLASS ROOM
- 5NOS. x 0.4L/S
- 2NOS. x 0.26L/S — LAN RM
- Ø200 CHWS/ CHWR
- 8NOS. x 0.4L/S
- CH 750 RT
- CH 750 RT
- CH 750 RT
- CH 250 RT
- FUTURE 250 RT

Rev. No.	Description Revision	Date	Drawn By	Checked By
A	FOR CONCEPT DESIGN	JUN' 15	CWL1	MKMS

Beca Carter Hollings & Ferner (S.E. Asia) Pte Ltd.
51 Anson Road, #12-51, Anson Centre, Singapore 079904
Tel : 6220 7588 Fax : 6225 6937

Scale	N.T.S	Checked	MKMS
Date	JUN '15	Job Manager	LPH
Drawn	CWL1	Job Director	KBW
File Name :	5810508-AV-SK1	QP	NHS

Client: GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)
72 Bukit Tinggi Road
Singapore 289760

Project: PROPOSED EDUCATIONAL INSTITUTION BUILDING COMPRISING OF 6 STOREY EDUCATIONAL BLOCK, 2 STOREY AMENITIES BLOCK WITH CARPARK AND COMMUNAL FACILITIES

Title: ACMV SCHEMATIC DIAGRAM

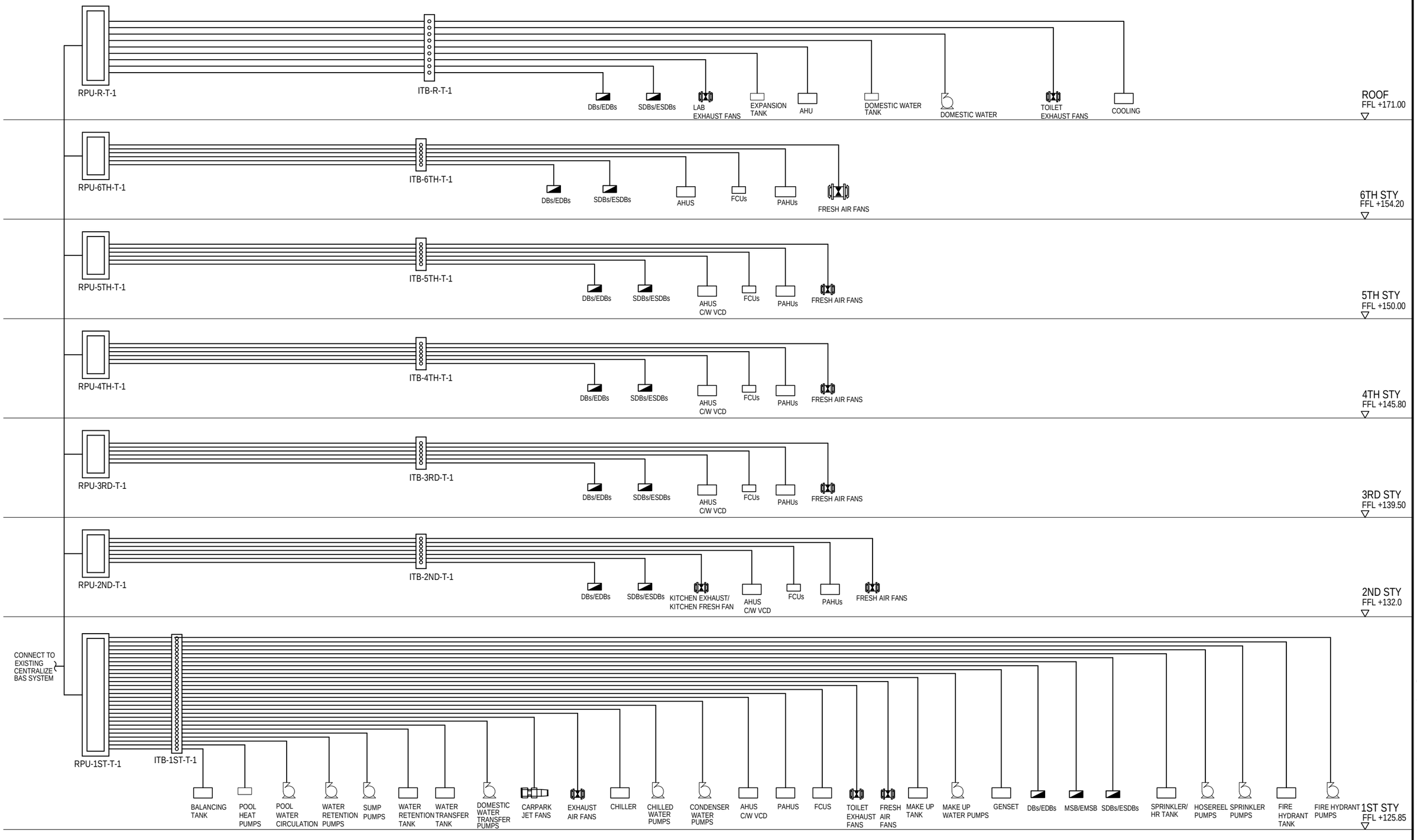
Service: AIR-CONDITIONING & MECHANICAL VENTILATION SERVICES

Drawing No. 5810508/AV/SK-1 Rev. A

Document No. 5810508-vsk1.dwg

DO NOT SCALE

IF IN DOUBT ASK.



BMS SCHEMATIC DIAGRAM

Rev. No.	Description Revision	Date	Drawn By	Checked by
A	FOR CONCEPT DESIGN	JUN' 15	CWL1	MKMS

Beca Carter Hollings & Ferner (S.E. Asia) Pte Ltd.
51 Anson Road, #12-51, Anson Centre, Singapore 079904
Tel : 6220 7588 Fax : 6225 6937

Scale	N.T.S	Checked	MKMS
Date	JUN '15	Job Manager	LPH
Drawn	CWL1	Job Director	KBW
File Name :	5810508-BMS-SK1	QP	NHS

Client: GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)
72 Bukit Tinggi Road
Singapore 289760

Project: PROPOSED EDUCATIONAL INSTITUTION BUILDING COMPRISING OF 6 STOREY EDUCATIONAL BLOCK, 2 STOREY AMENITIES BLOCK WITH CARPARK AND COMMUNAL FACILITIES

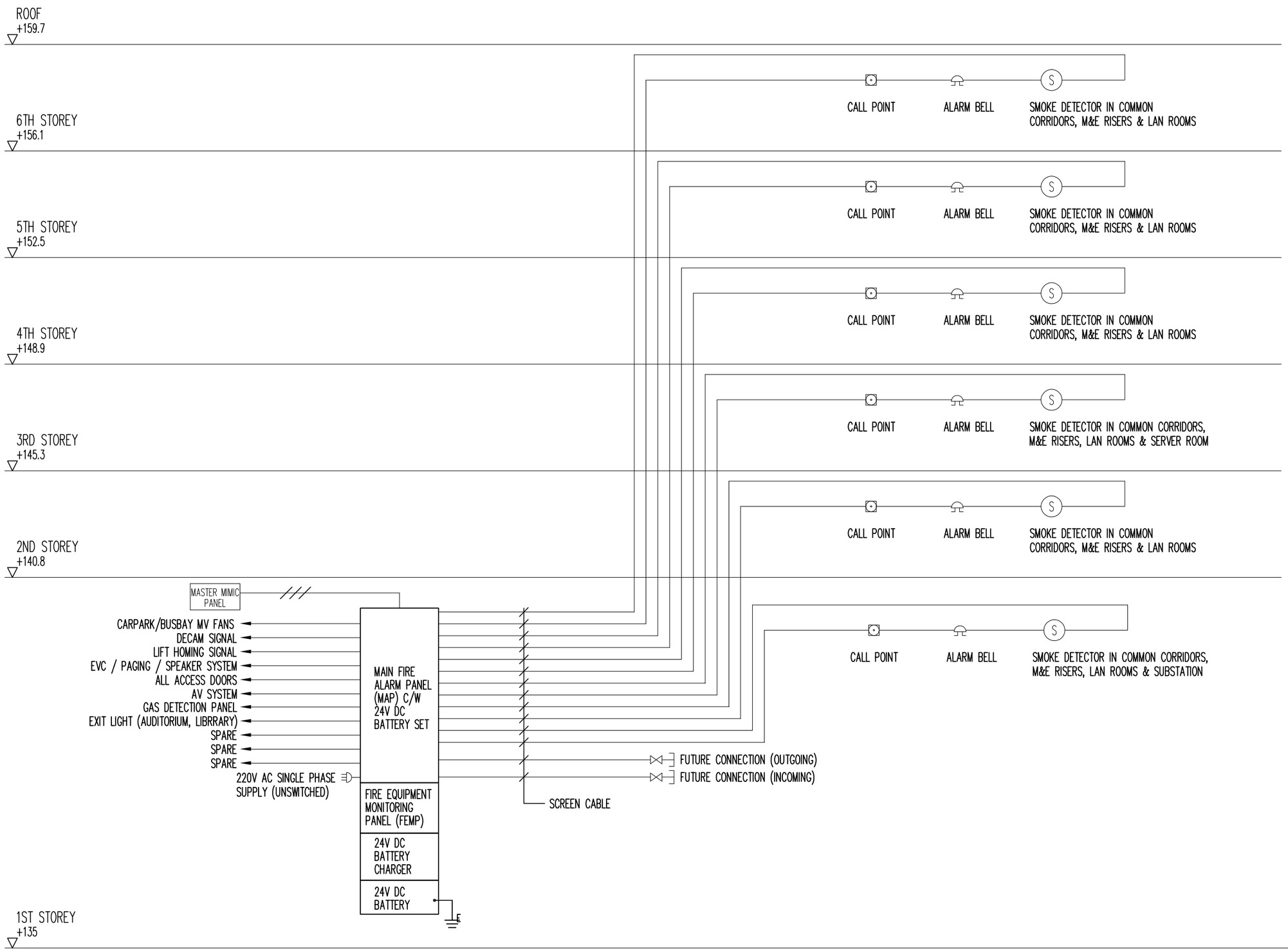
Title: BMS SCHEMATIC DIAGRAM

Service: BMS SERVICES

Drawing No. 5810508/BMS/SK-1

Rev. A

Fire Protection Services



LEGEND:

- MANUAL CALL POINT
- ALARM BELL
- SMOKE DETECTOR
- BONDED TO EARTH

NOTE:

THE SUPPLY DESIGN & INSTALLATION OF FIRE ALARM SYSTEM TO COMPLY WITH SS???.

FIRE ALARM SCHEMATIC DIAGRAM (GESS)

SCALE : N.T.S

Rev. No.	Description Revision	Date	Drawn By	Checked by
A	FOR CONCEPT DESIGN	JUN' 15	HSM	MKMS

Beca Carter Hollings & Ferner (S.E. Asia) Pte Ltd.
51 Anson Road, #12-51, Anson Centre, Singapore 079904
Tel : 6220 7588 Fax : 6225 6937

Scale	N.T.S	Checked	MKMS
Date	JUN '15	Job Manager	LPH
Drawn	AMH	Job Director	KBW
File Name :	5810508/FP-SK2	QP	NHS

Client: GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)
72 Bukit Tinggi Road
Singapore 289760

Project: PROPOSED EDUCATIONAL INSTITUTION BUILDING COMPRISING OF 6 STOREY EDUCATIONAL BLOCK, 2 STOREY AMENITIES BLOCK WITH CARPARK AND COMMUNAL FACILITIES

Title: FIRE ALARM SCHEMATIC DIAGRAM

Service: FIRE PROTECTION SERVICES

Drawing No. 5810508/FP-SK2

Rev. A

DRY RISER 1 | DRY RISER 2 | DRY RISER 3 | DRY RISER 4 | DRY RISER 5 | DRY RISER 6

ROOF LEVEL

6TH STOREY — CV-6-1 — CLASSROOMS/LABS/ AUDITORIUM

5TH STOREY — CV-5-1 — CLASSROOMS/LIBRARY

4TH STOREY — CV-4-1 — CLASSROOMS/ADMIN/ LIBRARY

3RD STOREY — CV-3-1 — CLASSROOMS/ADMIN — SPORT HALL

2ND STOREY — CV-2-1, CV-2-2 — CLASSROOMS

1ST STOREY — CV-1-1, CV-1-2 — CLASSROOMS/ CARPARK/ BUSBAY — CARPARK/ BUSBAY/ M&E PLANTS

LEGEND:

- CONCEALED SPRINKLER HEAD (PLAN/ SCH)
- EXPOSED SPRINKLER HEAD (PLAN/ SCH)
- FLOW SWITCH
- SUBSIDIARY VALVE (MONITORED STOP VALVE)
- DRAIN OFF VALVE
- HOSEREEL (SCH)
- DRY RISER LANDING VALVE (SCH)
- PRESSURE GAUGE C/W STOP COCK
- 2 WAY BREECHING INLET FOR DRY RISER SYSTEM (PLAN/ SCH)
- FLEXIBLE CONNECTION
- REDUCER (CONCENTRIC)
- REDUCER (ECCENTRIC)
- BALL FLOAT VALVE
- AUTOMATIC AIR RELIEF VALVE

#100 DRAIN | #150 | #100

PUB BULK METER CHAMBER

FROM PUB INCOMING PIPE

NEWATER

PUB NEWATER BULK METER

TO DOMESTIC WATER

TO FIRE HYDRANT

TO COOLING TOWER MAKE-UP

TO NEAREST DRAIN

2-WAY BREECHING INLET (TO BE DETERMINED BY ARCHITECT)

2-WAY BREECHING INLET (TO BE DETERMINED BY ARCHITECT)

SPRINKLER/HR STORAGE TANK(RC)
TANK SIZE: 56.1 SQ.M x 2.85M(H)
EFF CAP: 125 CU.M + 1.1 CU.M

SPRINKLER PUMPS & JOCKEY PUMP

HOSEREEL PUMPS

TO NEAREST DRAIN

GESS-SPRINKLER, HOSEREEL AND DRY RISER SYSTEM SCHEMATIC DIAGRAM

SCALE N.T.S.

Rev. No.	Description Revision	Date	Drawn By	Checked by
A	FOR CONCEPT DESIGN	JUN' 15	HSM	MKMS

Beca Carter Hollings & Ferner (S.E. Asia) Pte Ltd.
51 Anson Road, #12-51, Anson Centre. Singapore 079904
Tel : 6220 7588 Fax : 6225 6937

Scale	N.T.S	Checked	MKMS
Date	JUN '15	Job Manager	LPH
Drawn	AMH	Job Director	KBW
File Name :	5810508/FP-SK1	QP	NHS

Client: GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)
72 Bukit Tinggi Road
Singapore 289760

Project: PROPOSED EDUCATIONAL INSTITUTION BUILDING COMPRISING OF 6 STOREY EDUCATIONAL BLOCK, 2 STOREY AMENITIES BLOCK WITH CARPARK AND COMMUNAL FACILITIES

Title: SPRINKLER, HOSEREEL & DR SYSTEM SCHEMATIC DIAGRAM

Service: FIRE PROTECTION SERVICES

Drawing No. 5810508/FP-SK1

Rev. A

Document No. 5810508-fsk1.dwg

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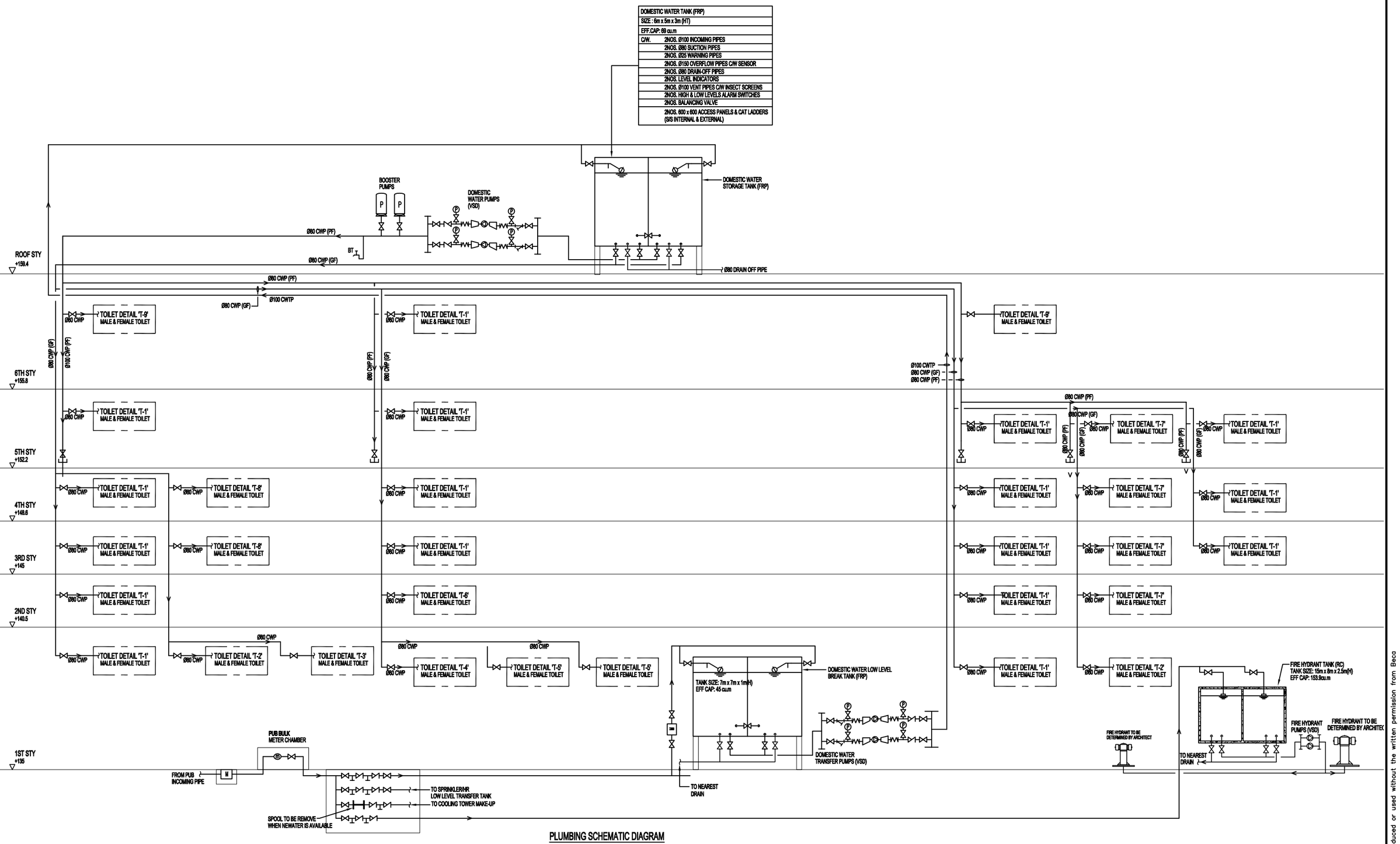
Plumbing, Sanitary & Gas Services

DOMESTIC WATER TANK (FRP)	
SIZE : 6m x 5m x 3m (HT)	
EFF.CAP: 69 cu.m	
C/W.	2NOS. Ø100 INCOMING PIPES
	2NOS. Ø80 SUCTION PIPES
	2NOS. Ø25 WARNING PIPES
	2NOS. Ø150 OVERFLOW PIPES C/W SENSOR
	2NOS. Ø80 DRAIN-OFF PIPES
	2NOS. LEVEL INDICATORS
	2NOS. Ø100 VENT PIPES C/W INSECT SCREENS
	2NOS. HIGH & LOW LEVELS ALARM SWITCHES
	2NOS. BALANCING VALVE
	2NOS. 600 x 600 ACCESS PANELS & CAT LADDERS (S/S INTERNAL & EXTERNAL)



PLUMBING SCHEMATIC DIAGRAM

Rev. No.	Description Revision	Date	Drawn By	Checked by
A	FOR CONCEPT DESIGN	JUN '15	KTTA	MKMS

Beca Carter Hollings & Ferner (S.E. Asia) Pte Ltd.
51 Anson Road, #12-51, Anson Centre, Singapore 079904
Tel : 6220 7588 Fax : 6225 6937

Scale	N.T.S	Checked	MKMS
Date	JUN '15	Job Manager	LPH
Drawn	KTTA	Job Director	KBW
File Name :	5810508-P-SK1	QP	NHS

Client: GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)
72 Bukit Tinggi Road
Singapore 289760

Project: PROPOSED EDUCATIONAL INSTITUTION BUILDING COMPRISING OF 6 STOREY EDUCATIONAL BLOCK, 2 STOREY AMENITIES BLOCK WITH CARPARK AND COMMUNAL FACILITIES

Title: PLUMBING SCHEMATIC DIAGRAM

Service: PLUMBING SERVICES

Drawing No. 5810508/P/SK-1

Rev. A

Document No. 5810508-psk1.dwg

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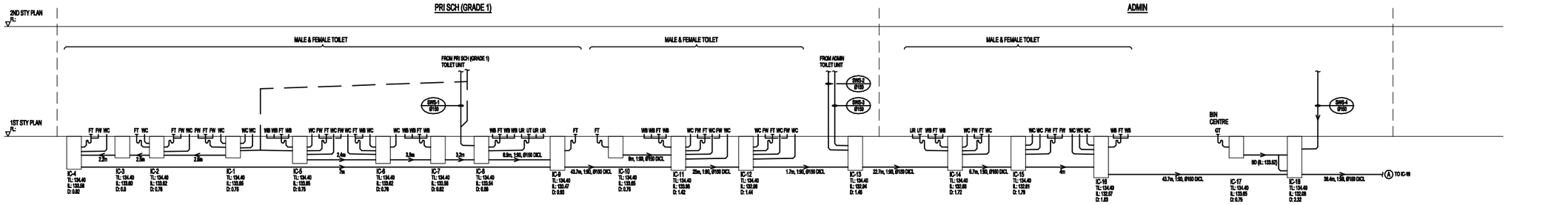
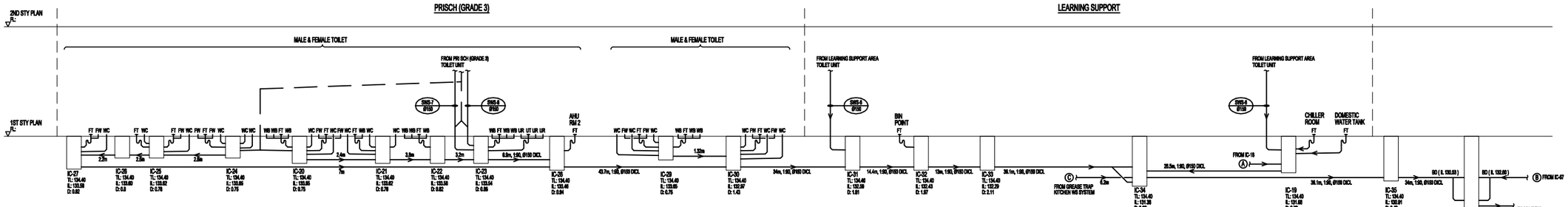
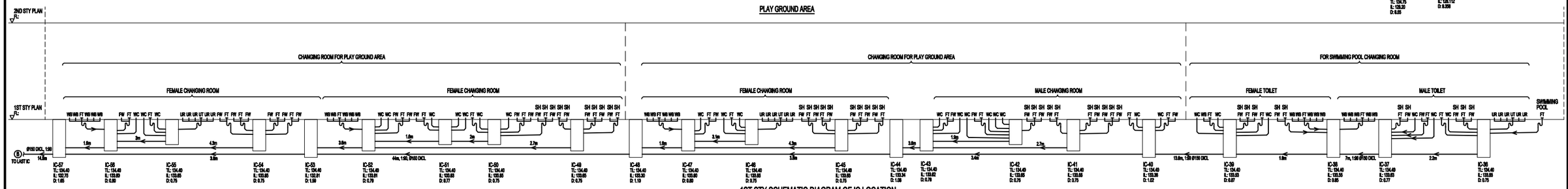
IF IN DOUBT ASK.

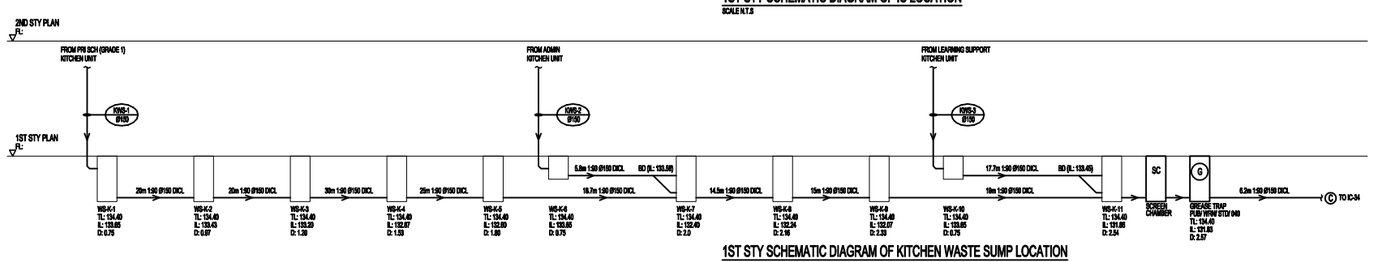






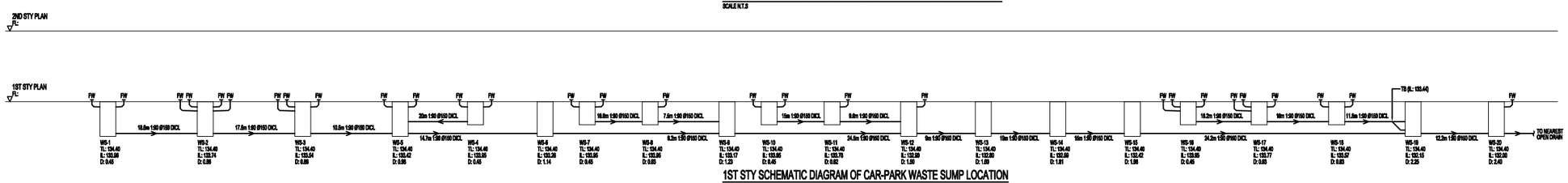
1ST STY SCHEMATIC DIAGRAM OF IC LOCATION

SCALE N.T.S



1ST STY SCHEMATIC DIAGRAM OF KITCHEN WASTE SUMP LOCATION

SCALE N.T.S



1ST STY SCHEMATIC DIAGRAM OF CAR-PARK WASTE SUMP LOCATION

SCALE N.T.S

A	FOR CONCEPT DESIGN	JUN '15	AAP	MKMS
Rev. No.	Description Revision	Date	Drawn By	Checked by

Beca Carter Hollings & Ferner (S.E. Asia) Pte Ltd.
51 Anson Road, #12-51, Anson Centre, Singapore 079904
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Scale	N.T.S	Checked	MKMS
Date	JUN '15	Job Manager	LPH
Drawn	AAP	Job Director	KBW
File Name :	5810508/DSK-2	QP	NHS

Client:
GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)
72 Bukit Tinggi Road
Singapore 289760

Project:
PROPOSED EDUCATIONAL INSTITUTION BUILDING COMPRISING OF 6 STOREY EDUCATIONAL BLOCK, 2 STOREY AMENITIES BLOCK WITH CARPARK AND COMMUNAL FACILITIES

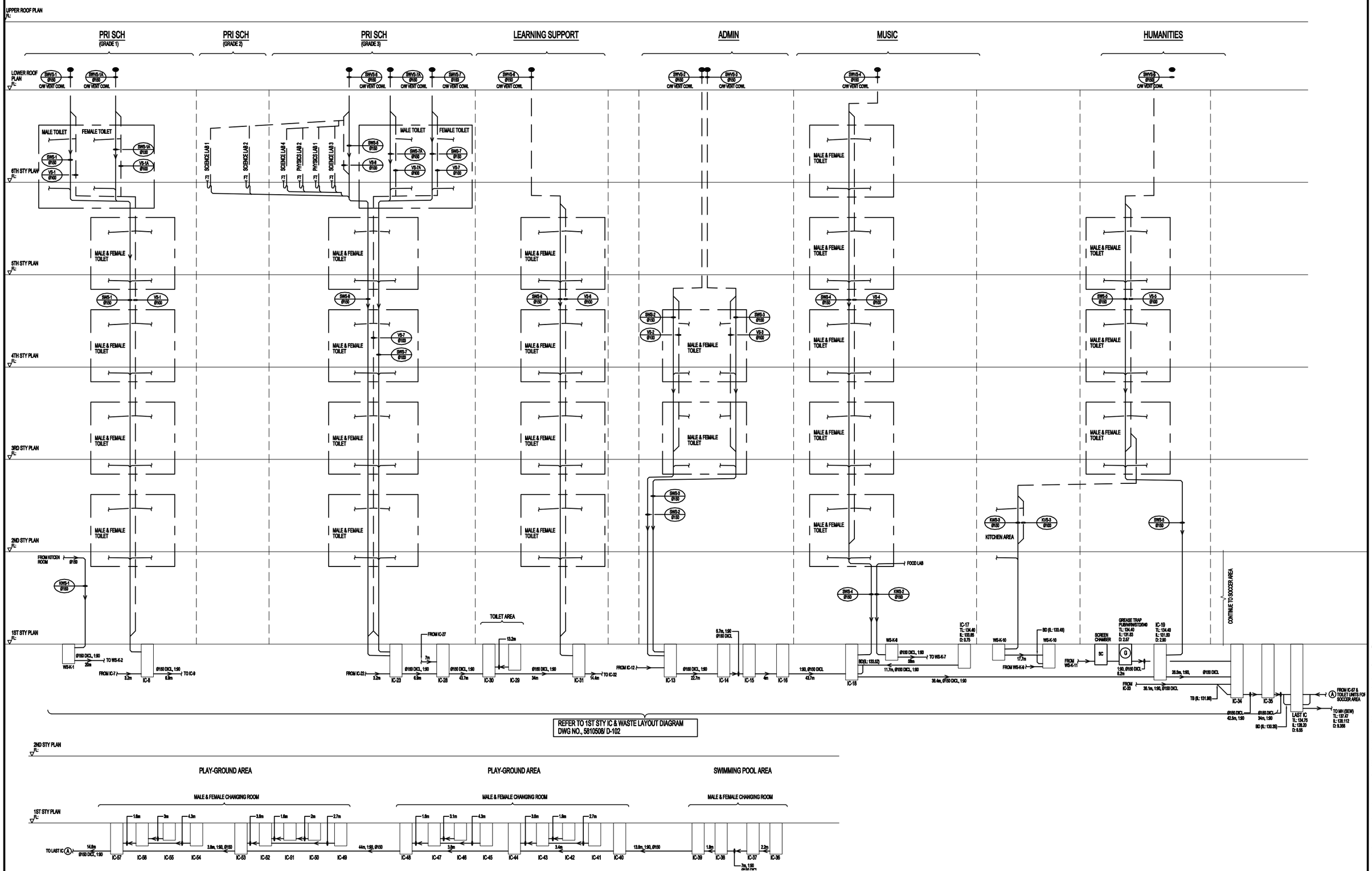
Title:
SCHEMATIC DIAGRAM FOR IC AND WS LAYOUT

Service: SANITARY & DRAINAGE SERVICES
Drawing No. 5810508/D-SK2
Rev. A

Document No. 5810508-dsk2.dwg

DO NOT SCALE

IF IN DOUBT ASK.



Rev. No.	Description Revision	Date	Drawn By	Checked by
A	FOR CONCEPT DESIGN	JUN' 15	AAP	MKMS

Beca Carter Hollings & Ferner (S.E. Asia) Pte Ltd.
51 Anson Road, #12-51, Anson Centre. Singapore 079904
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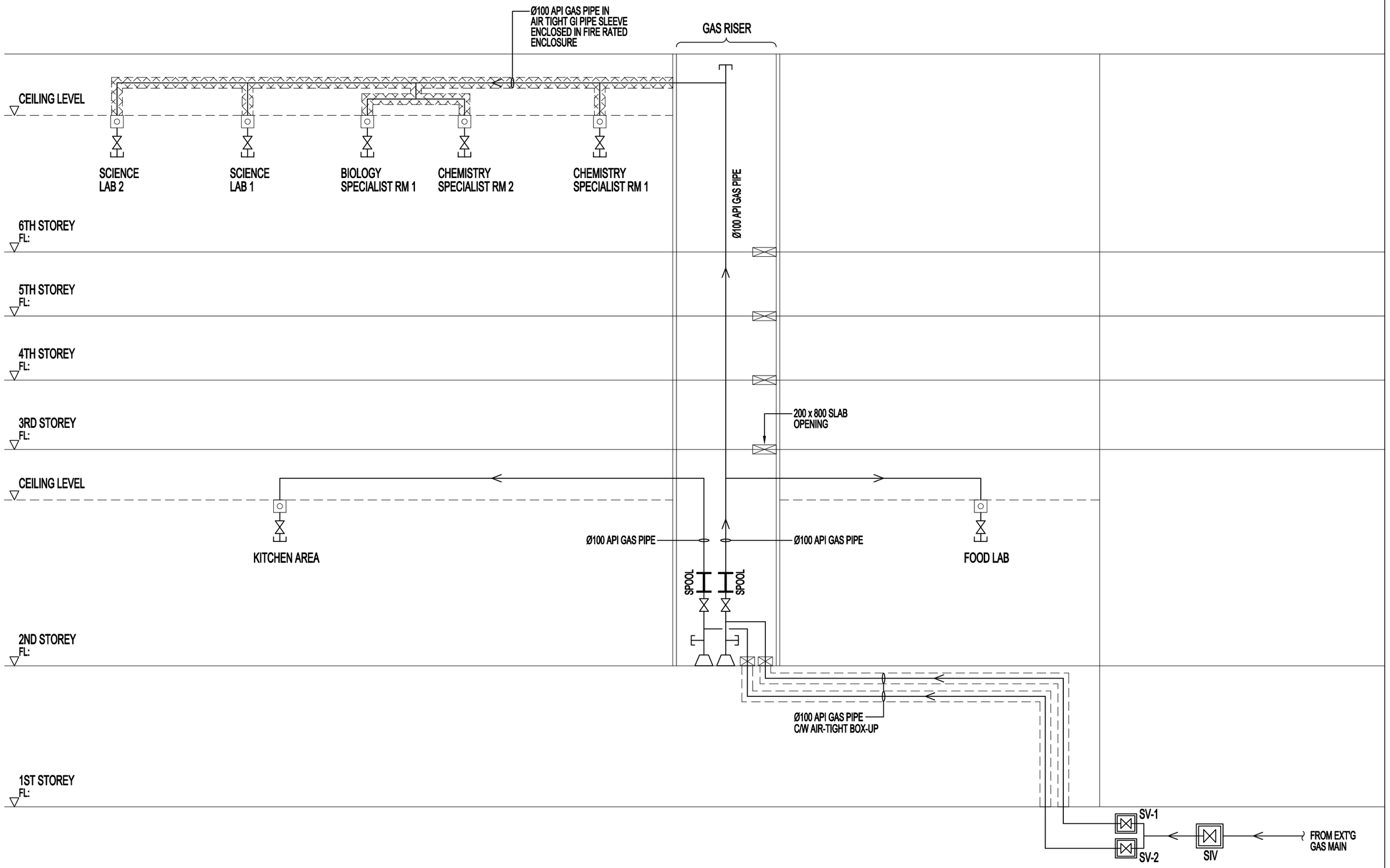
Scale	N.T.S	Checked	MKMS
Date	JUN '15	Job Manager	LPH
Drawn	AAP	Job Director	KBW
File Name :	5810508/D-SK1	QP	NHS

Client: GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)
72 Bukit Tinggi Road Singapore 289760

Project: PROPOSED EDUCATIONAL INSTITUTION BUILDING COMPRISING OF 6 STOREY EDUCATIONAL BLOCK, 2 STOREY AMENITIES BLOCK WITH CARPARK AND COMMUNAL FACILITIES

Title: SANITARY SCHEMATIC DIAGRAM

Service: SANITARY & DRAINAGE SERVICES
Drawing No. 5810508/D-SK1
Rev. A



Rev. No.	Description Revision	Date	Drawn By	Checked by
A	FOR CONCEPT DESIGN	JUN' 15	AAP	MKMS

Beca Carter Hollings & Ferner (S.E. Asia) Pte Ltd.
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Scale	N.T.S	Checked	MKMS
Date	JUN '15	Job Manager	LPH
Drawn	AAP	Job Director	KBW
File Name :	5810508/G-SK1	QP	NHS

Client:
GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)
72 Bukit Tinggi Road
Singapore 289760

Project:
PROPOSED EDUCATIONAL INSTITUTION BUILDING COMPRISING OF 6 STOREY EDUCATIONAL BLOCK, 2 STOREY AMENITIES BLOCK WITH CARPARK AND COMMUNAL FACILITIES

Title:
GAS SCHEMATIC DIAGRAM

Service: GAS SERVICES
Drawing No. 5810508/G-SK1
Rev. A

Document No. 5810508-gsk1.dwg

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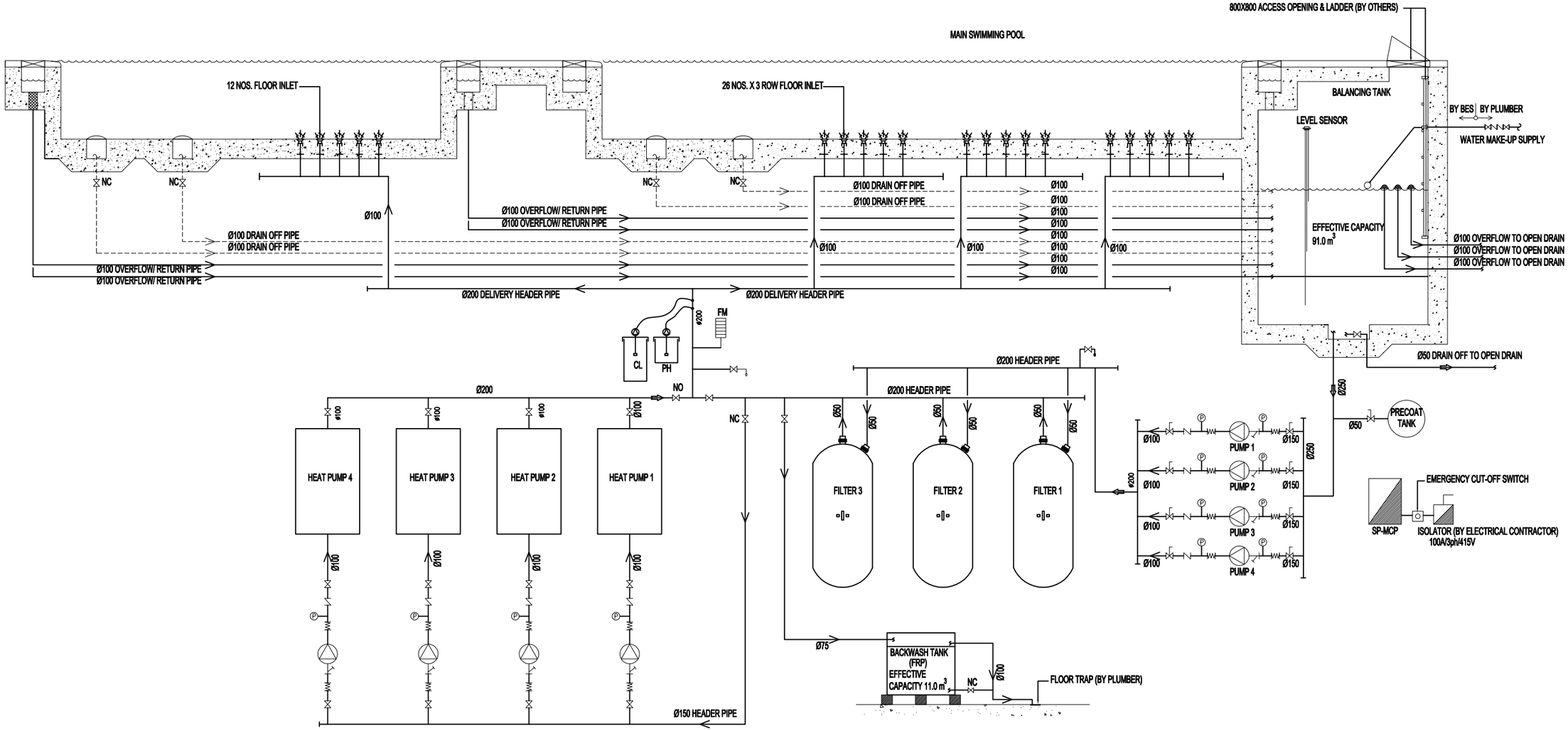
Swimming Pool Services



Rev. No.	Description Revision	Date	Drawn By	Checked by
A	FOR CONCEPT DESIGN	JUN' 15	AAP	MKMS

Beca Carter Hollings & Ferner (S.E. Asia) Pte Ltd.
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Scale	N.T.S	Checked	MKMS
Date	JUN '15	Job Manager	LPH
Drawn	KTTA	Job Director	KBW
File Name :	5810508/SP-SK1	QP	NHS

Client: GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)
72 Bukit Tinggi Road
Singapore 289760

Project: PROPOSED EDUCATIONAL INSTITUTION BUILDING COMPRISING OF 6 STOREY EDUCATIONAL BLOCK, 2 STOREY AMENITIES BLOCK WITH CARPARK AND COMMUNAL FACILITIES

Title: SWIMMING POOL SCHEMATIC DIAGRAM

Service: SWIMMING POOL SERVICES

Drawing No. 5810508/SP-SK1

Rev. A

Document No. 5810508-spsk1.dwg

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Appendix A

Schedule of M&E Provisions

Preliminary GFA Tabulation

	GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)	SCHEDULE FINISHES		
		M&E		
		Lighting	Small Power	IT/Data
1.0	**- PRE SCHOOL FACILITIES -**			
	PRE SCHOOL -			
1.1	Pre-Primary (PS) Classroom	300 lux	5 nos. 2x13A SSO 5 nos. 13A SSO for AV	min 2 nos. RJ45 data/tel pt.
1.1.1	PP Lockers	N.A.	N.A.	N.A.
1.1.2	PP Pod	200	4 nos. 2x13A for Computer 2 nos. 2x13A for maintenance 1 nos. 13A SSO for Wireless Access Point	8 nos. RJ45 data/tel pt. 1 nos. RJ45 data/tel pt for Wireless Access Point
1.1.3	PP Storage	100 lux	2 nos. 13A SSO	N.A.
1.2	Toddler Classroom	300	5 nos. 2x13A SSO 5 nos. 13A SSO for AV	min 2 nos. RJ45 data/tel pt.
1.3	Child Group Classroom	300	5 nos. 2x13A SSO 5 nos. 13A SSO for AV	min 2 nos. RJ45 data/tel pt.
	KINDERGARTEN - K1, K2			
1.4	K1 Classroom	300 lux	5 nos. 2x13A SSO 5 nos. 13A SSO for AV	min 2 nos. RJ45 data/tel pt.
1.4.1	K1 Lockers	N.A.	N.A.	N.A.
1.4.2	K1 Pod	200 lux	1 nos. 2x13A SSO per computer 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance 1 nos. 13A SSO for Wireless Access Point	2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 data/tel pt for Wireless Access Point
1.4.3	K1 Storage	100 lux	min 2 nos. 13A SSO for maintenance	N.A.
1.5	K2 Classroom	300 lux	5 nos. 2x13A SSO 5 nos. 13A SSO for AV	2 nos. RJ45 data/tel pt.
1.5.1	K2 Lockers	N.A.	N.A.	N.A.
1.5.2	K2 Pod	200 lux	1 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance 1 nos. 13A SSO for Wireless Access Point	2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 data/tel pt for Wireless Access Point
1.5.3	K2 Storage	100 lux	N.A.	N.A.
1.6	Learning Support and Languages	300 lux	4 nos. 2x13A SSO	2 nos. RJ45 data/tel pt.
1.7	Music Classroom	300 lux	8 nos. 2x13A SSO 5 nos. 13A SSO for AV	2 nos. RJ45 data/tel pt.
1.8	Arts Classroom	500 lux	8 nos. 2x13A SSO 5 nos. 13A SSO for AV	2 nos. RJ45 data/tel pt.
1.8b	Arts Classroom Store	100 lux	min 2 nos. 13A SSO for maintenance	
1.9	Library	300-500 lux	1 nos. 2x13A for desks with task light. 1 nos. 15A SSO for maintenance every 20m diameter 1 nos. 13A SSO for Wireless Access Point	2 nos. RJ45 data/tel pt. per office table 1 nos. RJ45 data/tel pt. for Photocopier 1 nos. RJ45 data/tel pt for Wireless Access Point
1.10	Head Teacher's Office	300 - 500 lux	2 nos. 2x13A SSO for desk 1 nos. 2x13A SSO for general use	2 nos. RJ45 data/tel pt.
1.11	Infants Secretary / Waiting / Receptionist	300 lux	2 nos. 2x13A SSO for desk 1 nos. 2x13A SSO for general use 1 nos. 13A SSO for Wireless Access Point	2 nos. RJ45 data/tel pt. per office table 1 nos. RJ45 data/tel pt. for Photocopier 1 nos. RJ45 data/tel pt for Wireless Access Point
1.12	Staff Room / Lounge (56 pax)	200 lux	2 nos. 2x13A SSO per desk 1 nos. 2x13A SSO for general use 1 nos. 13A SSO for Wireless Access Point	2 nos. RJ45 data/tel pt. per office table 1 nos. RJ45 data/tel pt. for Photocopier 1 nos. RJ45 data/tel pt for Wireless Access Point
1.13	Multi Purpose Hall	200 lux (doesn't include special effects lighting)	min 4 nos. 2x13A SSO for backstage area. 1 nos. 15A SSO for maintenance every 20m diameter	2 nos. RJ45 data/tel pt.
1.14	Contained Outdoor Play Space (from 18months to 6 years old)	200 lux	min. 2 nos. 2x13A SSO c/w pad-lockable min. 2 nos. 15A SSO c/w pad-lockable for maintenance 1 nos. 13A SSO for Wireless Access Point	min. 1 nos. RJ45 data/tel pt for Wireless Access Point
1.15	Space for Push Chair / Tricycles	N.A.	N.A.	N.A.
1.16	Softplay Room	200 lux	1 nos. 13A SSO for Wireless Access Point min. 2 nos. 2x13A SSO c/w pad-lockable min. 2 nos. 15A SSO c/w pad-lockable for maintenance	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
1.17	Meeting Room cum Parents' Room (upfront near Admin/reception area)	300 lux	1 nos. 2x13A SSO for general usage	2 nos. RJ45 data/tel pt.
1.18	Multi Purpose Hall Storage	100 lux	2 nos. 13A SSO for general	N.A.
1.19	German Speech Therapist	300 lux	2 nos. 2x13A SSO	2 nos. RJ45 data/tel pt.
1.2	Pre-School Kitchen (17pax)	300 lux	80A 3ph Isolator	2 nos. RJ45 data/tel pt.
2.0	**PRIMARY SCHOOL**			
	HOMEROOM TEACHING SPACE			
2.1	Classrooms	300 lux	5 nos. 2x13A SSO 5 nos. 13A SSO for AV	2 nos. RJ45 data/tel pt. per room
2.2	Foundation classroom including a small study room			
2.3	Specialist Teacher work area w/o homeroom (i.e. English/ German/ Language teachers)		2 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance	2 nos. RJ45 data/tel pt.
	Lockers - AS FITTED FURNITURE - NOT SEPARATE	N.A.	N.A.	N.A.
2.4	Enlarged Pod - as shared space for six language classes	300 lux	min. 2 nos. 2x13A SSO underside of table 1 nos. SSO for Wireless Access Pt.	1 nos. RJ45 for Wireless Access Pt.
2.5	Storage - IN CLASSROOM - NOT SEPARATE		N.A.	N.A.
2.6	Storage per grade level, for laptop cart, presentation equipment	100 lux	min. 2 nos. 13A SSO for maintenance	

Preliminary GFA Tabulation

	GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)	M&E		
2.0	**PRIMARY SCHOOL**			
	SPECIALIST / SHARED SPACE			
2.8	Reception area and multipurpose room	**200 lux**	**1 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance**	**2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 for Wireless Access Pt.**
2.9	Storage for the multipurpose room (exhibition material, presentation etc)	**100 lux**	**min. 2 nos. 13A SSO**	**N.A.**
2.10	Art Room, including storage and consumables	**300 lux**	**8 nos. 2x13A SSO**	**2 nos. RJ45 data/tel pt.**
2.11	Specialist rooms (4 per language)	**300 lux**	**min. 3 nos. 2x13A SSO**	**2 nos. RJ45 data/tel pt.**
2.12	Primary teacher work area	**300 lux**	**2 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance**	**2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 for Wireless Access Pt.**
2.13	IT Space - Located as part of the shared space in 1 x POD area	**300 lux**	**2 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance**	**2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 for Wireless Access Pt.**
	OUTDOOR AND PLAY			
2.14	External Playstore	**100 lux**	**min. 2 nos. 15A WP SSO c/w pad-lockable for maintenance 1 nos. 13A SSO for Wiresless Access Pt.**	**1 nos. RJ45 for Wireless Access Pt.**
2.15	Bicycle storage	**50 lux**		
2.16	Play Area (Middle School)	**100 lux**		
2.17	Play Area (High School)			
2.18	Outdoor Ball Play Area			
3.0	**SECONDARY SCHOOL (Students nos. - Refer to Brief)**			
	MIDDLE SCHOOL (G6 - G10)			
3.1	Classrooms (Homerooms for Grade 6)	**300 lux**	**5 nos. 2x13A SSO 5 nos. 13A SSO for AV**	**2 nos. RJ45 data/tel pt.**
3.2	Pod	**200 lux**	**1 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance 1 nos. 13A SSO for Wireless Access Point**	**2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 for Wireless Access Pt.**
3.3	Teacher Work Area & Storage	**300 lux**	**2 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance 1 nos. 13A SSO for Wireless Access Point**	**2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 for Wireless Access Pt.**
	HIGH SCHOOL (G11 - G12) (Students nos. - Refer to Brief)			
3.4	High School Centre Classrooms (large)	**300 lux**	**7 nos. 2x13A SSO 5 nos. 13A SSO for AV**	**2 nos. RJ45 data/tel pt.**
3.5	Pod	**200 lux**	**1 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance 1 nos. 13A SSO for Wireless Access Pt.**	**2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 for Wireless Access Pt.**
3.6	High School Centre Classrooms (medium)	**300 lux**	**5 nos. 2x13A SSO 5 nos. 13A SSO for AV**	**2 nos. RJ45 data/tel pt.**
3.7	Student Welfare Manager Office	**300 lux**	**2 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance 1 nos. 13A SSO for Wireless Access Point**	**2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 for Wireless Access Pt.**
	- SHARED FACILITIES, SECONDARY SCHOOL -			
4.0	**ENGLISH LANGUAGE**			
4.1	English Classrooms	**300 lux**	**5 nos. 2x13A SSO 5 nos. 13A SSO for AV**	**2 nos. RJ45 data/tel pt.**
4.2	English Pods	**200 lux**	**1 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance 1 nos. 13A SSO for Wireless Access Pt.**	**2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 for Wireless Access Pt.**
4.3	Teacher Work Area Plus Resources Space (12- 15 pax)	**300 lux**	**2 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance 1 nos. 13A SSO for Wireless Access Pt.**	**2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 for Wireless Access Pt.**
4.4	English Four Oral Exam Rooms, 2 persons, carrels (Also, MT Support)	**300 lux**	**5 nos. 2x13A SSO 5 nos. 13A SSO for AV**	**2 nos. RJ45 data/tel pt.**
5.0	**GERMAN LANGUAGE**			
5.1	German Classrooms	**300 lux**	**5 nos. 2x13A SSO 5 nos. 13A SSO for AV**	**2 nos. RJ45 data/tel pt.**
5.2	German Pod	**200 lux**	**1 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance 1 nos. 13A SSO for Wireless Access Pt.**	**2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 for Wireless Access Pt.**
5.3	Teacher Work Area Plus Resources Space	**300 lux**	**2 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance 1 nos. 13A SSO for Wireless Access Pt.**	**2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 for Wireless Access Pt.**
5.4	German Four Oral Exam Rooms, 2 persons, Carrels (Also, MT Support)	**300 lux**	**3 nos. 2x13A SSO 1 nos. 13A SSO for AV**	**2 nos. RJ45 data/tel pt.**
6.0	**EUROPEAN AND ASIAN LANGUAGES**			
6.1	European & Asian Lang Classrooms (French, Spanish, Dutch, Danish, Latin, Mandarin)	**300 lux**	**5 nos. 2x13A SSO 5 nos. 13A SSO for AV**	**2 nos. RJ45 data/tel pt.**
6.2	European & Asian Language Pods	**200 lux**	**1 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance 1 nos. 13A SSO for Wireless Access Pt.**	**2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 for Wireless Access Pt.**
6.3	Teacher Work Area	**300 lux**	**2 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance 1 nos. 13A SSO for Wireless Access Pt.**	**2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 for Wireless Access Pt.**
6.4	Teacher Resources Space / Storage	**300 lux for Work Area 100 lux for Storage**	**2 nos. 2x13A SSO on each end of the room**	**N.A.**
6.5	Learning Support Language classrooms (medium)	**300 lux**	**5 nos. 2x13A SSO 5 nos. 13A SSO for AV**	**2 nos. RJ45 data/tel pt.**

	GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)	M&E		
7.0	**MATHS**			
7.1	Maths Classroom	300 lux	5 nos. 2x13A SSO 5 nos. 13A SSO for AV	2 nos. RJ45 data/tel pt.
7.2	Maths Pods	200 lux	1 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance 1 nos. 13A SSO for Wireless Access Pt.	2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 for Wireless Access Pt.
7.3	Teacher Work Area	300 lux	2 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance 1 nos. 13A SSO for Wireless Access Pt.	2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 for Wireless Access Pt.
7.4	Teacher Work Resources Space/ Storage	300 lux for Work Area 100 lux for Storage	2 nos. 2x13A SSO on each end of the room	N.A.
8.0	**HUMANITIES, GEOGRAPHY/ECONOMICS, HISTORY**			
8.1	Geography/Economics Classroom	300 lux	5 nos. 2x13A SSO 5 nos. 13A SSO for AV	2 nos. RJ45 data/tel pt.
8.2	History Classroom	300 lux	5 nos. 2x13A SSO 5 nos. 13A SSO for AV	2 nos. RJ45 data/tel pt.
8.3	Humanities / Geography/ Economic/ History Pods	200 lux	1 nos. 2x13A SSO per desk min. 2 nos. 2x13A SSO for maintenance 1 nos. 13A SSO for Wireless Access Pt.	1 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 for Wireless Access Pt.
8.4	Teacher Work Area	300 lux	2 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance 1 nos. 13A SSO for Wireless Access Pt.	2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 for Wireless Access Pt.
8.5	Teacher Work Resource Space / Storage	300 lux for Work Area 100 lux for Storage	2 nos. 2x13A SSO on each end of the room	N.A.
9.0	**SCIENCE**			
9.1	Shared Lab - E Section MS MYP Science Classes + G Section MS Classes (2 labs to double as Pri Sch Labs)	500 lux	3 nos. 2x13A SSO per table 1 nos. 13A SSO for Wireless Access Pt.	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
9.2	Biology Specialty Room - DP, ABI, G SEC MS	500 lux	3 nos. 2x13A SSO per table 1 nos. 13A SSO for Wireless Access Pt.	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
9.3	Chemistry Speciality Room- DP, ABI, G Sec MS	500 lux	3 nos. 2x13A SSO per table 1 nos. 13A SSO for Wireless Access Pt.	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
9.4	Physics Speciality Room - DP, ABI, G SEC MS	500 lux	3 nos. 2x13A SSO per table 1 nos. 13A SSO for Wireless Access Pt.	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
9.5	One Common Prep Room for all Science Subjects	300 lux	3 nos. 2x13A SSO per table 1 nos. 13A SSO for Wireless Access Pt.	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
9.6	Chemical Store	100 lux	min 2 nos. 13A SSO for maintenance on each end of the room	N.A.
9.7	Science Project Work Room - Collaboration area (Adjoining rooms)	300 lux	min. 2 nos. 2x13A SSO for table cluster	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
9.8	Science teacher work area (15 + 2 Teachers)	500 lux	2 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance 1 nos. 13A SSO for Wireless Access Pt.	2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 for Wireless Access Pt.
9.9	Science Greenhouse	N.A		
9.10	Student POD	200 lux	1 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance 1 nos. 13A SSO for Wireless Access Pt.	2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 for Wireless Access Pt.
10.0	**VISUAL ARTS**			
10.1	Art Classroom	500 lux	8 nos. 2x13A SSO 5 nos. 13A SSO for AV	2 nos. RJ45 data/tel pt.
10.2	Art Storage (2 for each Art Classroom) - INSIDE CLASSROOM 10SQM	100 lux	2 nos. 13A Sso for maintenance on each end of the room	N.A.
10.3	Art Kiln Plus Drying Room (Balcony-like with maximum ventilation)	200 lux	63A 3ph isolator for Kiln 2 nos. 13A SSO for maintenance	N.A.
10.4	Art DP Studio Space, including Photography	max 500 lux	min 2 nos. 2x13A SSO for each workstation	min. 4 nos. RJ45 data/tel pt 1 nos. RJ45 pt. for Wireless Access Pt.
10.5	Art Pod (Outside making space shared with DT)	200 lux	1 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance 1 nos. 13A SSO for Wireless Access Pt.	2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 for Wireless Access Pt.
10.6	Art Office (3 Teachers)	500 lux	2 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance 1 nos. 13A SSO for Wireless Access Pt.	2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 for Wireless Access Pt.
11.0	**DRAMA - THEATRES (To be co-located with Drama/Music to make Performing Arts Centre)**			
11.1	Auditorium 450 seats, to include orchestra pit (approx 3m width)	Depends on architectural, ID and AV conceptual design		
11.2	Black Box Classroom	300 lux	1 nos. 2x13A SSO every 10m along the permeter of the classroom 1 nos. 13A SSO for Wireless Access Pt.	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
11.3	Drama Classroom / Studio	300 lux	1 nos. 2x13A SSO every 10m along the permeter of the classroom 1 nos. 13A SSO for Wireless Access Pt.	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
11.4	Drama Collection, small mops	200 lux	N.A.	N.A.
11.5	Theatre Storage (for Props and Costumes)	100 lux	2 nos. 13A SSO for maintenance	N.A.
11.6	Auditorium Control Room	300 lux	Depends on AV equipments	
11.7	Auditorium Lobby - to accommodate 350 standing people	200 lux	1 nos. 13A SSO for Wireless Access Pt 1 nos. 13A SSO c/w pad-lockable for maintenance every 25m diameter	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
11.8	Changing rooms with attached toilet	300 lux	1 nos. 13A SSO for osc. Fan 1 nos. 15A SSO for Hand dryer	N.A.
11.9	Multi-Purpose Hall 1 (200 persons retractable seating, flat wooden floor, end stage)	300 lux	1 nos. 2x13A SSO c/w pad-lockable for maintenance every 30m diameter. 1 nos. 13A SSO for Wireless Access Pt.	1 nos. RJ45 data/tel pt. for Wireless Access Pt.

	GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)	M&E		
11.0	**DRAMA - THEATRES (To be co-located with Drama/Music to make Performing Arts Centre)**			
11.10	Multi-Purpose Hall 2 (one area with flooring suitable for PE dance)	300 lux	1 nos. 2x13A SSO c/w pad-lockable for maintenance every 20m diameter. 1 nos. 13A SSO for Wireless Access Pt.	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
11.11	Multi-Purpose Halls Storage (chairs, tables, e.g. exams)	100 lux		
11.12	Teacher Work Space for Music, VIP and Drama (for 6 pax)	500 lux	2 nos. 2x13A SSO per workstation 1 nos. 13A SSO for Wireless Access Pt. 1 nos. 13A SSO for maintenance every 20m diameter	2 nos. RJ45 data/tel pt. per workstation 1 nos. RJ45 data/tel for Wireless Access Pt.
12.0	**DESIGN TECHNOLOGY**			
12.1	Design Technology Workshops	500 lux	Power Outlets for individual machine depends on the final design. However, we will provide a separate 300A sub-board for entire DT. 1 nos. 13A SSO for Wireless Access Pt.	1 nos. RJ45 data/tel for Wireless Access Pt. 2 nos. RJ45 data/tel pt per workstation
12.2	Design Technology for Computer-Aided Design, Drafting and Electronics	500 lux	2 nos. 2x13A SSO per workstation	2 nos. RJ45 data/tel pt per workstation
12.3	Design Technology Prep Room / Storage	min. 100 lux max. 300 lux	Depends on equipment	N.A.
12.4	Design Technology Storage for On-going Projects	100 lux	N.A.	N.A.
12.5	Design Technology Office (3 Teachers)	500 lux	2 nos. 2x13A SSO per workstation	2 nos. RJ45 data/tel pt. per workstation
12.6	Design Technology POD	300 lux	2 nos. 2x13A SSO per workstation 1 nos. 13A SSO for Wireless Access Pt. 1 nos. 13A SSO c/w pad-lockable for maintenance every 25m diameter	2 nos. RJ45 data/tel pt. per workstation 1 nos. RJ45 data/tel pt. for Wireless Access pt.
13.0	**LEARNING SUPPORT & SOCIAL COUNSELLING**			
13.1	Learning Support Classroom for Primary (dividable into two rooms for the students)	500 lux	5 nos. 2x13A SSO 5 nos. 13A SSO for AV	2 nos. RJ45 data/tel pt. per workstation 1 nos. RJ45 data/tel pt. for Wireless Access pt.
13.2	Learning Support Classroom (for German Speech Therapist)	500 lux	5 nos. 2x13A SSO 5 nos. 13A SSO for AV	2 nos. RJ45 data/tel pt. per workstation 1 nos. RJ45 data/tel pt. for Wireless Access pt.
13.3	Work Room / Office (including University Counsellor/ Euro & German Counsellors)	500 lux	2 nos. 2x13A SSO per workstation 1 nos. 13A SSO for maintenance every 15m diameter	2 nos. RJ45 data/tel pt. per workstation
13.4	Learning Support for Secondary (small room)	500 lux	2 nos. 2x13A SSO per workstation 2 nos. 2x13A SSO for general usage	2 nos. RJ45 data/tel pt. per workstation
13.5	Other Support Services	N.A.		
13.5a	Meeting Room	300 lux	min 1 nos. Service Outlet Box c/w 2x13A SSO on table 1 nos. 2x13A SSO for general usage	2 nos. RJ45 data/tel pt. per workstation 1 nos. RJ45 data/tel pt. for Wireless Access pt.
13.5b	Social Counselor Area	500 lux	2 nos. 2x13A SSO per workstation 2 nos. 2x13A SSO for general usage	2 nos. RJ45 data/tel pt. per workstation 1 nos. RJ45 data/tel pt. for Wireless Access pt.
14.0	**PHYSICAL EDUCATION**			
14.1	Gymnasium (25*65*9m)	300 lux	1 nos. 2x13A SSO c/w pad-lockable every 10m 1 nos. 13A SSO for Wireless Access Pt.	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
14.2	Gymnasium II (25*50*9m)	300 lux	1 nos. 2x13A SSO c/w pad-lockable every 10m 1 nos. 13A SSO for Wireless Access Pt.	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
14.3	PE Offices Junior/High School/Outdoor Ed (8 Teachers)	500 lux	2 nos. 2x13A SSO per workstation	2 nos. RJ45 data/tel pt. per workstation
14.4	PE Teacher Changing Shower Rooms (Male and Female)	300 lux	1 nos. 13A SSO for osc. Fan 1 nos. 15A SSO for Hand dryer	N.A.
14.5	PE Grounds Machinery and Equipment Storage (other facilties for archive elsewhere on site)	100 lux	1 nos. 13A SSO for maintenance every 25m diameter	N.A.
14.6	PE Pool Machinery and Pump Room (near pool)	200 lux	2 nos. 13A SSO WP	N.A.
14.7	PE Pool Equipment store (level with pool deck)	100 lux	2 nos. 13A SSO WP	N.A.
14.8	PE Boys Changing Rooms	300 lux	1 nos. 13A SSO for osc. Fan 1 nos. 15A SSO for Hand dryer	N.A.
14.9	PE Girls Changing Rooms			
14.10	PE Boys Changing Room, Pool			
14.11	PE Girls Changing Room, Pool			
14.12	PE Resource Room / Control Room	300 lux	2 nos. 2x13A SSO per workstation	2 nos. RJ45 data/tel pt. per workstation
14.13	PE Lobby, Senior Hall	300 lux	1 nos. 2x13A SSO c/w pad-lockable every 25m diameter	N.A.
14.14	PE Equipment Storage	100 lux	2 nos. 13A SSO for maintenance	N.A.
14.15	Dance Studio/ MPH	300 lux	1 nos. 2x13A SSO every 10m along the permeter of the classroom 1 nos. 13A SSO for Wireless Access Pt.	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
14.16	PE Office (for 4 pax)	500 lux	2 nos. 2x13A SSO per desk 1 nos. 13A SSO per photocopier min. 2 nos. 2x13A SSO for maintenance 1 nos. 13A SSO for Wireless Access Pt.	2 nos. RJ45 data/tel pt. per computer 1 nos. RJ45 data/tel pt. per photocopier 1 nos. RJ45 for Wireless Access Pt.
14.16 a	Gym Fitness		1 nos. 1x13A SSO per equipment min. 2 nos. 2x13A SSO for maintenance 1 nos. 13A SSO for Wireless Access Pt.	2 nos. RJ45 data/tel pt. per equipment 1 nos. RJ45 for Wireless Access Pt.
14.17	Soccer field	200 lux	min 2 nos. 13A WP SSO at grand stand	1 nos. WP RJ45 for Wireless Access Pt. at Grand Stand
15.0	**MUSIC & VIP**			
15.1	Music Classroom Secondary	300 lux	1 nos. 2x13A SSO every 10m along the permeter of the classroom 1 nos. 13A SSO for Wireless Access Pt.	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
15.2	Music Keyboard Room	300 lux	1 nos. 2x13A SSO	N.A.
15.3	Music Recording Studio / Film Studio (Green Screen, etc..) cum Media Studio	300 lux	2 nos. 2x13A SSO per workstation	2 nos. RJ45 data/tel pt. per workstation
15.4	Music Ensemble Room	300 lux	1 nos. 2x13A SSO	N.A.
15.5	Music Practice Studio	300 lux	1 nos. 2x13A SSO every 10m along the permeter of the classroom 1 nos. 13A SSO for Wireless Access Pt.	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
15.6	Music Instrument Storage	100 lux	1 nos. 2x13A SSO every 10m along the permeter of the room	N.A.
15.7	Music Office (6 Teachers)	500 lux	2 nos. 2x13A SSO per workstation	2 nos. RJ45 data/tel pt. per workstation
15.8	VIP Backoffice		2 nos. 2x13A SSO per workstation	2 nos. RJ45 data/tel pt. per workstation

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	GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)	M&E		
15.0	**MUSIC & VIP**			
15.9	VIP Teacher Lounge	300 lux	1 nos. 13A SSO c/w pad-lockable every 25m diameter 1 nos. 13A SSO for Wireless Access Pt.	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
15.10	VIP Music Studio Practice Rooms		1 nos. 2x13A SSO	N.A.
15.11	VIP Drum Practice Studio		1 nos. 2x13A SSO	N.A.
15.12	Student Band Room		1 nos. 2x13A SSO	N.A.
15.13	Music Classroom Primary		1 nos. 2x13A SSO every 10m along the permeter of the classroom 1 nos. 13A SSO for Wireless Access Pt.	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
16.0	**CANTEEN**			
16.1	Primary School Canteen 500 Seats	200 lux	1 nos. 13A SSO for maintenance every 20m diameter 1 nos. 13A SSO for Wireless Access Pt.	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
16.2	Central Kitchen	300 lux	400A 3-ph isolator	2 nos. RJ45 data/tel pt.
16.3	Secondary School Canteen 500 Seats	200 lux	1 nos. 13A SSO for maintenance every 20m diameter 1 nos. 13A SSO for Wireless Access Pt.	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
16.4	Storage	100 lux	1 nos. 13A SSO for maintenance	N.A.
16.5	Cafeteria can be with mezzanine deck (Teachers' Dining Area)	200 lux	32A 3ph isolator for stall	N.A.
16.6	Food Lab	500 lux	4 nos. 2x13A SSO per table 1 nos. 13A SSO for Wiresless Access Pt.	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
16.6	Storage - Dry	100 lux	1 nos. 13A SSO for maintenance	N.A.
16.7	Canteen Pavilion Servery	200 lux	1 nos. 13A SSO for maintenance	N.A.
16.8	Canteen Operations Office	300 lux	2 nos. 2x13A SSO per workstation	2 nos. RJ45 data/tel pt. per workstation
16.9	Canteen Changing, Lockers and Toilets	300 lux	1 nos. 13A SSO for osc. Fan 1 nos. 15A SSO for Hand dryer	N.A.
17.0	**LIBRARY**			
17.1	Library Centre (to house both Pri and Sec libraries)	500 lux for reading area 200 lux for shelving area & circulation 300 lux for notice /announcement areas	1 nos. 2x13A SSO c/w pad-lockable every 30m diameter 1 nos. 13A SSO for Wireless Access Pt.	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
17.2	Senior School Resource Center	300 lux	2 nos. 2x13A SSO per workstation	2 nos. RJ45 data/tel pt. per workstation
17.3	Career Counselling / Student Confidante Teachers			
17.4	Library Storage for laptop carts and equipment	100 lux	2 nos. 13A SSO for maintenance	N.A.
18.0	**- ADMINISTRATIVE FUNCTIONS -**			
18.1	**ADMINISTRATION OFFICE**			
18.2	Admin - CFO	500 lux	2 nos. 2x13A SSO per workstation	2 nos. RJ45 data/tel pt. per workstation
18.3	Admin - COO			
18.4	Admin - COO and CFO PAs			
18.5	Admin - Human Resource Office (includes space for HR files)	500 lux	2 nos. 2x13A SSO per workstation 1 nos. 13A SSO per photocopier machine	2 nos. RJ45 data/tel pt. per workstation 1 nos. RJ45 data/tel pt. per photocopier machine
18.6	Admin - HR file storage	100 lux	N.A.	N.A.
18.7	Admin - Head of HR office	500 lux	2 nos. 2x13A SSO per workstation	2 nos. RJ45 data/tel pt. per workstation
18.8	Admin - Spare office with docking stations for guests - KMK, CIS etc.	500 lux	2 nos. 2x13A SSO per workstation 1 nos. 13A SSO per photocopier machine	2 nos. RJ45 data/tel pt. per workstation 1 nos. RJ45 data/tel pt. per photocopier machine
18.9	Admin - Accounts office			
18.10	Admin - File storage	100 lux	N.A.	N.A.
18.11	Admin - Head of Accounting	500 lux	2 nos. 2x13A SSO per workstation	2 nos. RJ45 data/tel pt. per workstation
18.12	Admin - Secure Auditor office			
18.13	Admin - Financial controller			
18.14	Admin - Workstation / computer booth			
18.15	Admin - Marcom (4 workstations, cupboard storage)			
18.16	Admin - Foundation Director / ROB			
18.17	Admin - Secure room with safe for exams etc (Adjacent to Heads of Middle and High Sch)	200 lux	N.A.	N.A.
18.18	Admin - Copy/Print room (3x fast B/W copiers, 1x colour, franking, basic stationary, paper cutting	500 lux	1 nos. 13A SSO per machine	1 nos. RJ45 data/tel pt. per machine
18.19	Admin - Pantry for providing for guests of Board and SMT (adjacent to PAs)	200 lux	2 nos. 2x13A SSO	N.A.
18.20	Admin - Building Manager office - next to Design studios	500 lux	2 nos. 2x13A SSO per workstation	2 nos. RJ45 data/tel pt. per workstation
18.21	Admin - Building workshop - next to Design	500 lux	Nos. of power outlet depends on kW rating of equipment	1 nos. RJ45 data/tel pt. for Wireless Access Point
18.22	Admin - Building storage - next to Design	100 lux	2 nos. 13A SSO for maintenance	N.A.
18.23	Admin - Entrance lobby with reception incorporated, surrounded by the testing rooms etc.	200 lux	1 nos. 13A SSO for wireless access pt. 1 nos. 13A SSO c/w pad-lockable for maintenance every 20m diameter	1 nos. RJ45 data/tel pt. for Wireless Access Point
18.24	Admin - Parent meeting room	300 lux	2 nos. 2x13A SSO per table	1 nos. RJ45 data/tel pt. for Wireless Access Point
18.25	Admin - Admissions (4 pax, 6 workstations, plus storage)		2 nos. 2x13A SSO per workstation	2 nos. RJ45 data/tel pt. per workstation
18.26	Admin - Parent committee (no storage)			
18.27	Admin - Parent committee storage for events team (not in admin building)	100 lux	1 nos. 13A SSO for maintenance	N.A.
18.28	Admin - Shop display area (including ticket office)	200 lux	2 nos. 2x13A SSO per workstation	2 nos. RJ45 data/tel pt. per workstation

	GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)	M&E		
18.0	**- ADMINISTRATIVE FUNCTIONS -**			
18.29	Admin - Purchasing Office	500 lux	2 nos. 2x13A SSO per workstation	2 nos. RJ45 data/tel pt. per workstation
18.30	Admin - Shop storage and changing	100 lux	1 nos. 13A SSO for maintenance	N.A.
18.31	Admin - CCA and VIP	500 lux	1 nos. 2x13A SSO for general usage every 10m diameter	N.A.
18.32	Admin - CCA and VIP Storage	100 lux	1 nos. 13A SSO for maintenance	N.A.
18.33	Admin - Principal	500 lux	2 nos. 2x13A SSO per workstation	2 nos. RJ45 data/tel pt. per workstation
18.34	Admin - PAs to Principal and Head of Learning Resouces			
18.35	Admin - Heads of Section			
18.36	Admin - PAs to Heads of Section			
18.37	Admin - Head of Pre-school			
18.38	Admin - PA to Pre-school			
18.39	Admin - Head of Learning Resources			
18.40	Admin - Heads of Primary (First floor under staff social area with stair case)			
18.41	Admin - Meeting rooms for Educational Middle Management (e.g Head of Primary)			
18.42	Admin - Board Conference room		1 nos. 2x13A SSO every 4 sq.m 1 nos. 13A SSO for Wireless Access Pt.	2 nos. RJ45 data/tel pt. every 4 sq.m 1 nos. RJ45 data/tel pt. for Wireless Access Pt.
18.43	Admin - Programme Coordinators office		2 nos. 2x13A SSO per workstation	2 nos. RJ45 data/tel pt. per workstation
18.44	Admin - Heads of Middle School / High School (adjacent to Programme Coordinators)			
18.45	Admin - Timetable Manager / Cover planner office			
18.46	Admin - Staff Social Area	300 lux	1 nos. 2x13A for general usage every 15m diameter	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
18.47	Admin - Staff Social Area Pantry	200 lux	2 nos. 2x13A SSO	N.A.
18.48	Admin - Cafeteria for staff - not for parents etc. Green space and covered area		1 nos. 13A SSO for Wireless Access Pt.	1 nos. RJ45 data/tel pt. for Wireless Access Pt.
18.49	Admin - Copy/Print room (3x fast B/W copiers, 1xcolour, franking, basic stationery, paper cutting	300 lux	1 nos. 13A SSO per machine	1 nos. RJ45 data/tel pt. per machine
18.50	Admin - Multipurpose Meeting Rooms / Conference Rooms	500 lux	1 nos. 2x13A SSO every 4 sq.m 1 nos. 13A SSO for Wireless Access Pt.	2 nos. RJ45 data/tel pt. every 4 sq.m 1 nos. RJ45 data/tel pt. for Wireless Access Pt.
19.0	**IT OFFICE**			
19.1	Admin - Main Data Centre / Server	300 lux	min 2 nos. 13A SSO for maintenance	N.A.
19.2	Admin - ICT Office	500 lux	2 nos 2x13A SSO per workstation min 2 nos. 13A SSO for maintenance	2 nos. RJ45 data/tel per workstation
19.3	Admin - ICT Store	100 lux	min 2 nos. 13A SSO for maintenance	N.A.
19.4	Admin - ICT Server Room Wire Counters	200 lux	min 2 nos. 13A SSO for maintenance	
19.5	Admin - ICT Support Office	500 lux	2 nos 2x13A SSO per workstation min 2 nos. 13A SSO for maintenance	2 nos. RJ45 data/tel per workstation
	- SERVICES -			
20.0	**BUS TRANSPORT OFFICE - Near bus drop-off area**			
20.1	Bus Bay	100 lux	N.A.	N.A.
20.2	Bus Transport Office (Semi-Public Area)	300 lux	2 nos 2x13A SSO per workstation	2 nos. RJ45 data/tel per workstation
20.3	Bus Transport Restrooms / Toilets - Male	300 lux	1 nos. 13A SSO for osc. Fan 1 nos. 15A SSO for Hand dryer	N.A.
20.4	Bus Transport Restrooms / Toilets - Female	300 lux	1 nos. 13A SSO for osc. Fan 1 nos. 15A SSO for Hand dryer	N.A.
20.5	Bus Drivers Rest Area - outside - no room allocated	N.A.	N.A.	N.A.
20.6	Students Waiting Area	200 lux	min 1 nos. 13A SSO for maintenance	N.A.
21.0	**MAINTENANCE - Try and locate near plant nursery to keep department together / Near to DT Studio too**			
21.1	Admin - Maintenance office (not workshop)	500 lux	2 nos. 2x13A SSO per workstation	2 nos. RJ45 data/tel pt. per workstation
21.2	Admin - Maintenance storage - not in admin building	100 lux	min 2 nos. 13A SSO for maintenance	N.A.
21.3	Admin - Social area for cleaners / maintenance	200 lux	min 2 nos. 13A SSO for maintenance	N.A.
21.4	Admin - Changing facilities / toilet / shower / lockers for cleaners / maintenance	300 lux	1 nos. 13A SSO for osc. Fan 1 nos. 15A SSO for Hand dryer	N.A.
21.5	Maintenance Workshop - wood, storage of tables and chairs and other furniture	500 lux	min 2 nos. 13A SSO for maintenance	N.A.
21.6	Maintenance Workshop (One for Ahmad, one for Carlos)	500 lux	2 nos. 2x13A SSO	2 nos. RJ45 data/tel pt.
21.7	Maintenance Cleaning Storage	100 lux	1 nos. 13A SSO for maintenance	N.A.
22.0	**PARKING**			
22.1	Vehicular Parking Nos. (to be based on LTA requirements: 83)	100 lux	N.A.	N.A.
22.2	Buses: 20 mini buses / 29 med buses / 8 coaches	100 lux	N.A.	N.A.
22.3	Covered Bus Park	100 lux	N.A.	N.A.
22.4	Covered Drop Off, driveway, and linkways to Buildings	100 lux	N.A.	N.A.
23.0	**SECURITY OFFICES - Near front of school**			
23.1	Security Guard House at Entry, with Restroom	300 lux	2 nos. 2x13A SSO per workstation 1 nos. 13A SSO for photocopier	2 nos. RJ45 data/tel pt. per workstation 1 nos. RJ45 data/tel pt. for photocopier
23.2	Security PBX Security Camera Monitoring Room	300 lux	2 nos. 2x13A SSO per workstation 1 nos. 13A SSO for photocopier	2 nos. RJ45 data/tel pt. per workstation 1 nos. RJ45 data/tel pt. for photocopier

Preliminary GFA Tabulation

	GERMAN EUROPEAN SCHOOL SINGAPORE (GESS)	M&E		
24.0	**SUPPORT FUNCTIONS**			
	Nurse Station (Primary School - Ground Level)	**500 lux**	**2 nos. 2x13A SSO per workstation 1 nos. 13A SSO for photocopier**	**2 nos. RJ45 data/tel pt. per workstation 1 nos. RJ45 data/tel pt. for photocopier**
24.1	Nurse Station (Secondary School - Ground Level) Counselling - Social + Emotional	**500 lux**	**2 nos. 2x13A SSO per workstation 1 nos. 13A SSO for photocopier**	**2 nos. RJ45 data/tel pt. per workstation 1 nos. RJ45 data/tel pt. for photocopier**
24.2	Social Room Nurse Office, 2 Workstations, Meeting Table	**200 lux**	**2 nos. 2x13A SSO per workstation 1 nos. 13A SSO for photocopier**	**2 nos. RJ45 data/tel pt. per workstation 1 nos. RJ45 data/tel pt. for photocopier**
24.3	Swimming Pool 50m by 25m including seating (Open to sky)	**150 lux**	**N.A.**	**N.A.**
24.4	Learn to Swim Pool	**200 lux**	**N.A.**	**N.A.**
24.5	Playing Fields (60m x 90m pitch)	**300 lux**	**N.A.**	**N.A.**
24.5	Grand Stand (Open to Sky)	**50 lux**	**1 nos. SSO WP for Wireless Access Pt.**	**1 nos. RJ45 data/tel pt. for Wireless Access Pt.**
24.6	Document Archive Storage In Admin Concept	**100 lux**	**min. 2 nos. 13A SSO for maintenance**	**N.A.**
24.7	Plant Nursery - For Growing of Plants Rooftop	**N.A**		
24.8	Bin Centre (with compactor, to NEA requirements)	**200 lux**	**2 nos. 13A SSO WP for maintenance**	
24.9	ACMV Chiller Plant room	**200 lux**	**2 nos. 13A SSO WP for maintenance**	**N.A.**
24.10	ACMV AHU Rooms	**200 lux**	**2 nos. 13A SSO WP for maintenance**	**N.A.**
24.11	Domestic and Sprinkler Tank / Pump rooms	**200 lux**	**2 nos. 13A SSO WP for maintenance**	**N.A.**
24.12	Electrical Sub-station and Consumer Switch Room	**200 lux**	**2 nos. 2x13A metal-clad SSO**	**N.A.**

Appendix B

Proposed Light Fittings

Light Fitting Cut Sheet

Art Area

Prospector LED

96107962 PROSPECTOR 1x12W LED L927 MT3 SP GRY

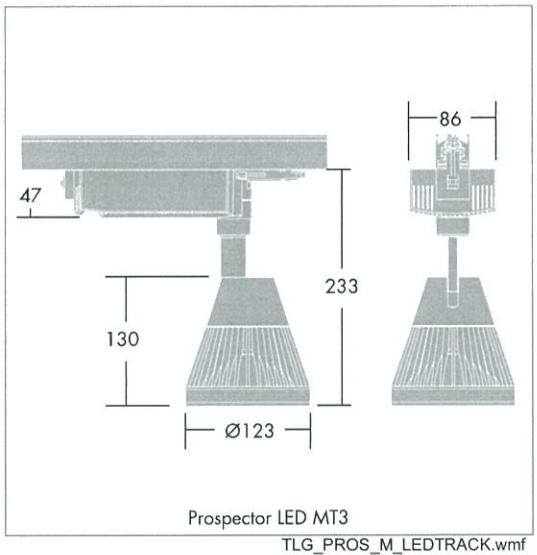
LED 12W LED_600	1,0m	CE	IP20		850°C

Display lighting at its best, with the latest LED technology

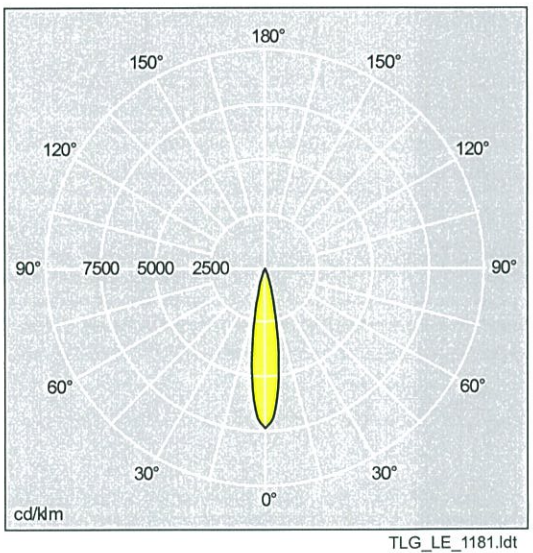
A track mounted spotlight for 1 x 12W LED_600 lamp with integral LED converter ballast. Housing of die-cast Aluminium painted silver-grey. Class I electrical, IP20. For 3-circuit track mounting on Thorn SuperTrack, 365° rotation and 90° tilt adjustment, lockable with allen key. Featuring Cree "True Light"™ technology delivering precise, uniform display lighting with CRI>90. Complete with 2700K LED

Dimensions: Ø123 x 130 mm
Total power: 11.5 W
Weight: 1.2 kg

TLG_PROS_F_LEDLR3827KGY2.jpg



TLG_PROS_M_LEDTRACK.wmf



TLG_LE_1181.ldt

- Lamps: 1 x LED_600/12 W
- Total luminous flux: 600 lm
- Luminaire efficacy: 52 lm/W
- Ballast: LED_Con
- Connected Load: 11.5 W
- LOR: 1.00 ULOR: 0.00 DLOR: 1.00

D-CO LED Downlight

96107436 D-CO LED DL 3x1,2W 4K 35° 350mA GRY

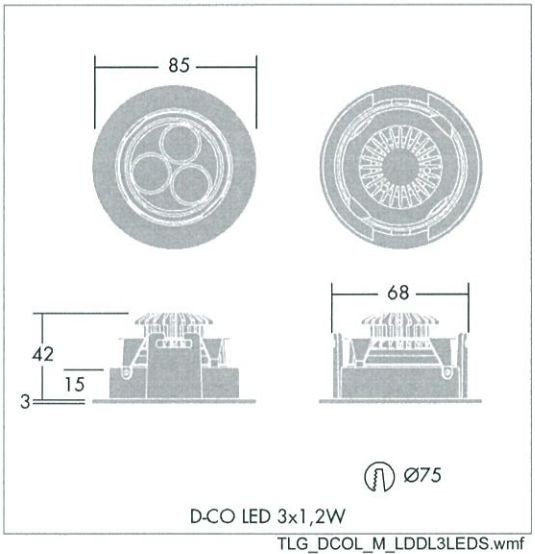
LED 1W LED_58	LED CE	IP20	

A range of stylish, high performance and long lasting LED downlights

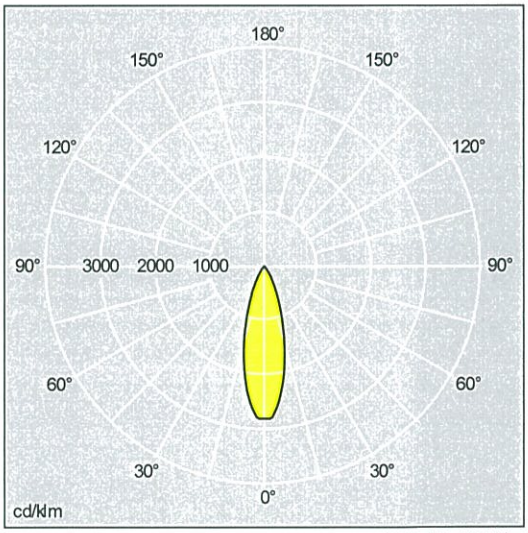
An LED downlight with 3 x 1.2W LEDs, as a 20W halogen replacement, 700mm halogen-free cable with plug for connection to suitable LED converter (see accessories). Tiltable by 20°. Manufactured from Aluminium, painted Titan-grey. Suitable for ceiling thicknesses 1-25mm with a minimum void depth of 50mm, cut-out Ø75mm. Class III electrical. IP20. Complete with 4000K LED, beam angle 35°.

Dimensions: Ø85 x 45 mm
Total power: 3.6 W (excluding driver losses)
Weight: 0.14 kg

TLG_DCOL_F_DL3LEDS1.jpg



TLG_DCOL_M_LDDL3LEDS.wmf



TLG_LE_1155.ldt

- Lamps: 3 x LED_58/1 W
- Total luminous flux: 174 lm
- Luminaire efficacy: 48 lm/W
- Connected Load: 3.6 W
- LOR: 1.00 ULOR: 0.00 DLOR: 1.00

Prospector LED

96107964 PROSPECTOR 1x12W LED L927 PEND SP GRY

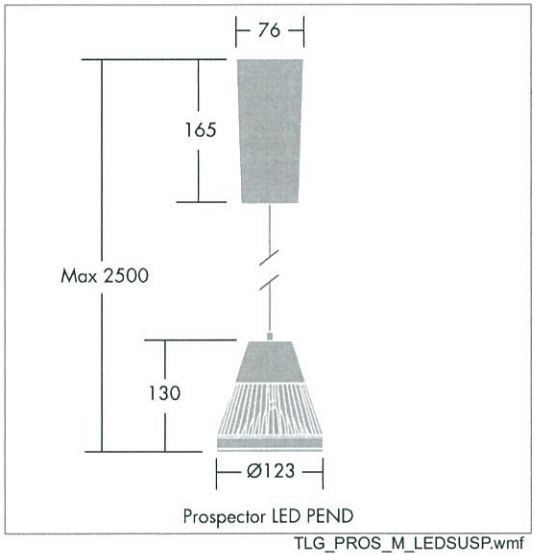
LED 12W LED_600	1,0m	CE	IP20		850°C

Display lighting at its best, with the latest LED technology

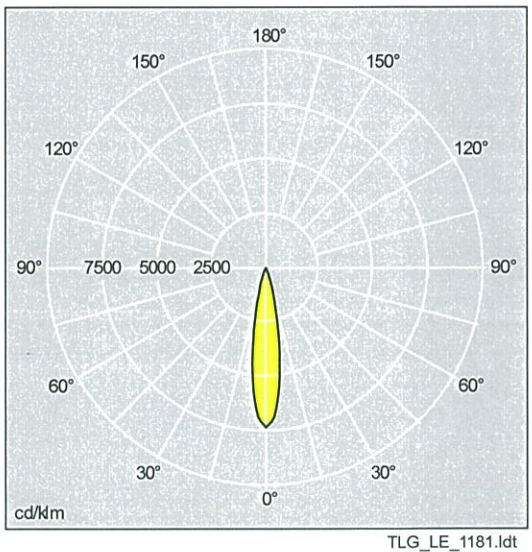
A suspended spotlight for 1 x 12W LED_600 lamp with integral LED converter ballast. Housing of die-cast Aluminium painted silver-grey. Class I electrical, IP20. Suspended via cable from conical canopy, suspension cable can be shortened on site. Featuring Cree "True Light"™ technology delivering precise, uniform display lighting with CRI>90. Complete with 2700K LED

Dimensions: Ø123 x 130 mm
Total power: 11.5 W
Weight: 1.2 kg

TLG_PROS_F_LEDPEN1.jpg



TLG_PROS_M_LEDSUSP.wmf



TLG_LE_1181.ldt

- Lamps: 1 x LED_600/12 W
- Total luminous flux: 600 lm
- Luminaire efficacy: 52 lm/W
- Ballast: LED_Con
- Connected Load: 11.5 W
- LOR: 1.00 ULOR: 0.00 DLOR: 1.00

Tidon

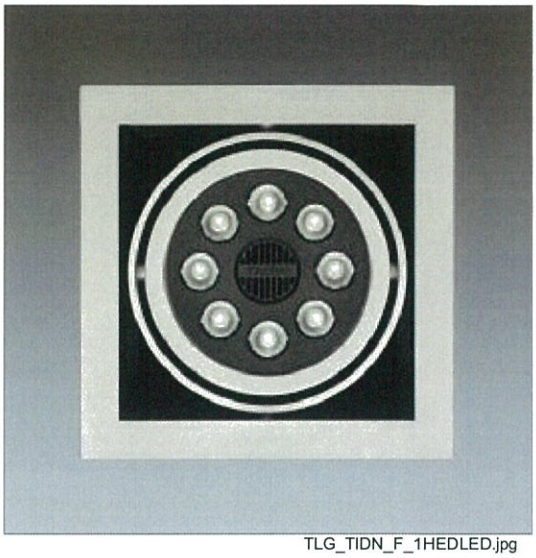
96107410 TIDON-S1 1x20W LED FL L840 GRY

LED 20W LED_872	LED	CE		IP20	

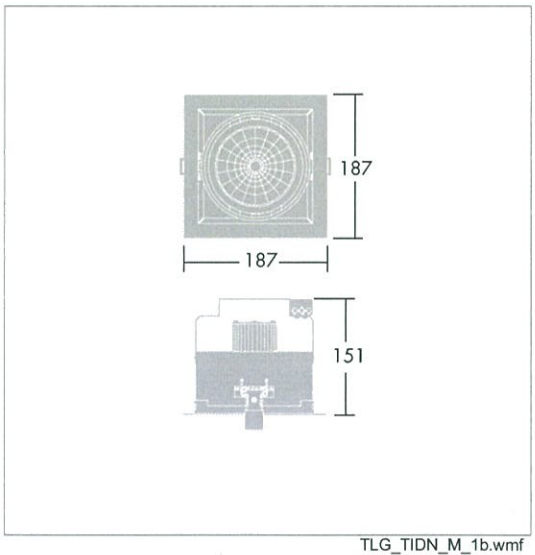
A range of recessed LED/HID gimbal spotlights with single, twin or triple lighting heads offering different beam angles

Single ceiling recessed gimbal head luminaire for 20W LED. Frame housing in seamless welded Aluminium with shallow appearance finished grey, recessed housing finished in black. Tool-free mounting via rubber sleeved spring clips. IP20, Class III electrical. Drivers to be ordered separately (see matrix under installation instructions). Distribution: flood. Adjustable 30° in all directions from the vertical. Complete with 4000K LED

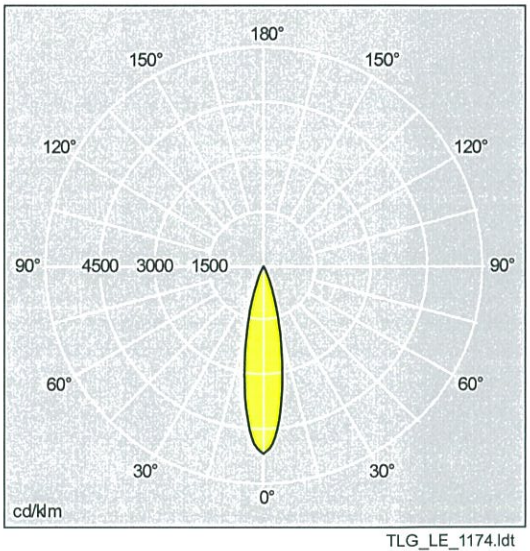
Dimensions: 187 x 187 x 151 mm
Minimum void depth: 149mm
Total power: 20 W
Weight: 1.5 kg



TLG_TIDN_F_1HEDLED.jpg



TLG_TIDN_M_1b.wmf



TLG_LE_1174.ldt

- Lamps: 1 x LED_872/20 W
- Total luminous flux: 872 lm
- Luminaire efficacy: 44 lm/W
- Connected Load: 20.0 W
- LOR: 1.00 ULOR: 0.00 DLOR: 1.00

Tidon

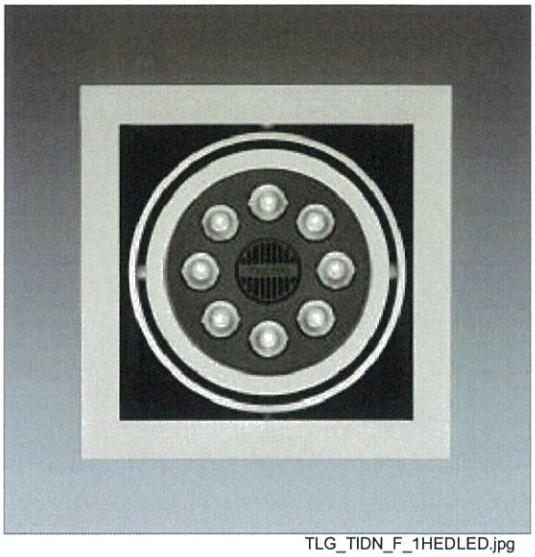
96107409 TIDON-S1 1x20W LED SP L840 GRY

LED 20W LED_Tidon1	LED	CE		IP20	

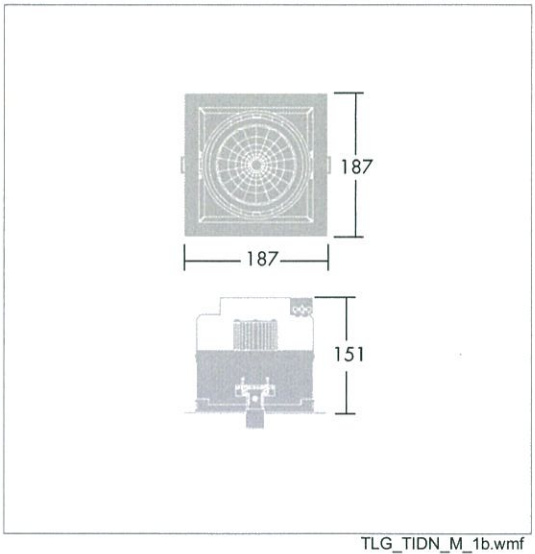
A range of recessed LED/HID gimbal spotlights with single, twin or triple lighting heads offering different beam angles

Single ceiling recessed gimbal head luminaire for 20W LED. Frame housing in seamless welded Aluminium with shallow appearance finished grey, recessed housing finished in black. Tool-free mounting via rubber sleeved spring clips. IP20, Class III electrical. Drivers to be ordered separately (see matrix under installation instructions). Distribution: spot. Adjustable 30° in all directions from the vertical. Complete with 4000K LED

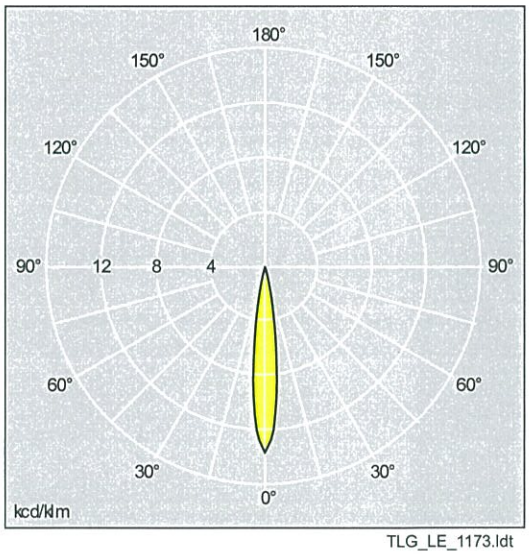
Dimensions: 187 x 187 x 151 mm
Minimum void depth: 149mm
Total power: 20 W
Weight: 1.5 kg



TLG_TIDN_F_1HEDLED.jpg



TLG_TIDN_M_1b.wmf



TLG_LE_1173.ldt

- Lamps: 1 x LED_Tidon1/20 W
- Total luminous flux: 918 lm
- Luminaire efficacy: 46 lm/W
- Connected Load: 20.0 W
- LOR: 1.00 ULOR: 0.00 DLOR: 1.00

Light Fitting Cut Sheet

Classrooms, Offices and Library

Quattro T5

96535984 QUATROT5 3x14W T16 HF E3 WL4 DSB L840

G5	14W T16	CE		T_a25	EN 60598 -2-22	IP20		850°C

Ultra shallow recessed modular T16 (T5) luminaires for exposed grid and concealed fix ceilings with choice of optic

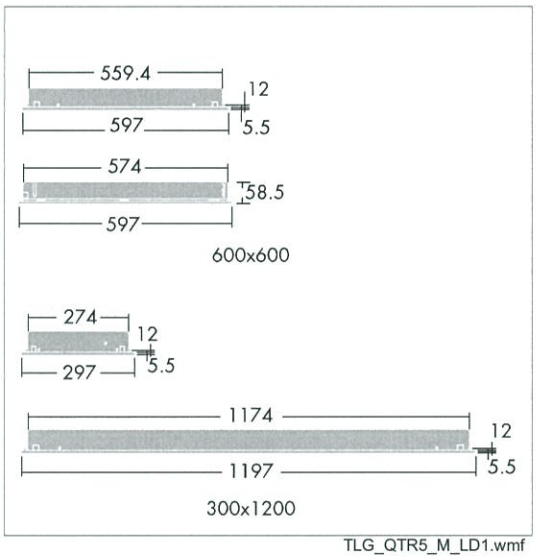
Recessed modular luminaire, with emergency function, for 3 x 14 T16 lamps. With Combined HF & EM SC circuit and Self contained luminaire, manual test (3 hours) emergency operation. White painted steel body with mirrorbrite aluminium louvre and white infill panels. Lays into most exposed grid ceiling systems and can be installed into concealed fix ceilings using "wedge" suspension brackets (supplied). Electrical connection via factory fitted 4 pole GST male connector. Supplied with T connector and 840 lamps.

Dimensions 597 x 597 x 59mm

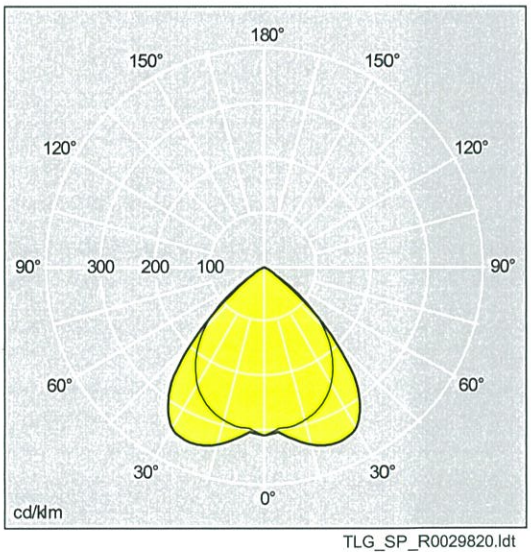
Total power: 52 W

Weight: 5.4 kg

TLG_QTR5_F_P2.jpg



TLG_QTR5_M_LD1.wmf



TLG_SP_R0029820.ldt

- Lamps: 3 x T16/14 W
- Total luminous flux: 3600 lm
- Luminaire efficacy: 45 lm/W
- Colour Rendering Index min.: 80
- Ballast: COM HF EM SC Tridonic PC Combo
- Connected Load: 52.0 W
- Inverter: 3.00 h
- LOR: 0.65 ULOR: 0.00 DLOR: 0.65

Quattro T5

96549528 QUATROT5 4X14W T16 HFIX WL6 DSB AH L840

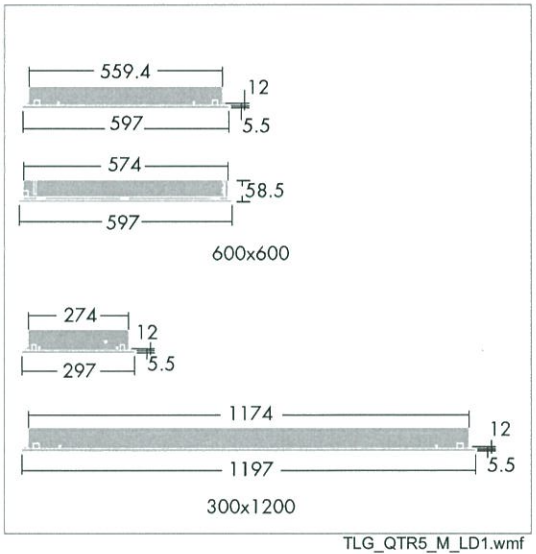
G5	14W T16	CE	T_a25	EN 60598	IP20		850°C

Ultra shallow recessed modular T16 (T5) luminaires for exposed grid and concealed fix ceilings with choice of optic

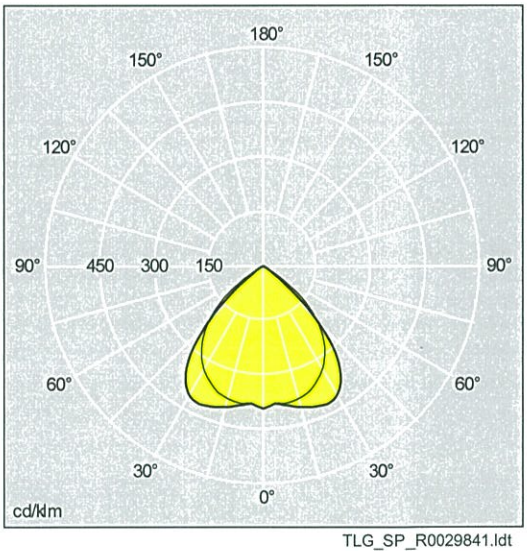
Recessed modular luminaire, with air handling facility, for 4 x 14W T16 lamps with Electronic, circuit DALI dimmable control gear. Body in white painted steel. Louvre in satinbrite Aluminium with white micro perforated infill panels. Lays into most exposed grid ceiling systems and can be installed into concealed fix ceilings with mini-wedge suspension brackets (supplied). Electrical connection via factory fitted 6 pole GST "T" connector. Complete with 840 lamp(s)..

Dimensions: 597 x 597 x 59 mm
Total power: 60.5 W
Weight: 5.2 kg

TLG_QRT5_F_MB.jpg



TLG_QTR5_M_LD1.wmf



TLG_SP_R0029841.ldt

- Lamps: 4 x T16/14 W
- Total luminous flux: 4800 lm
- Luminaire efficacy: 64 lm/W
- Colour Rendering Index min.: 80
- Ballast: HFI* Tridonic PCA T5 EXCITE
- Connected Load: 60.5 W
- CELMA EEI: A1 BAT
- LOR: 0.81 ULOR: 0.00 DLOR: 0.81

Light Fitting Cut Sheet

Corridor

Quattro T5

96535984 QUATROT5 3x14W T16 HF E3 WL4 DSB L840

G5	14W T16	CE		T_a25	EN 60598 -2-22	IP20		850°C

Ultra shallow recessed modular T16 (T5) luminaires for exposed grid and concealed fix ceilings with choice of optic

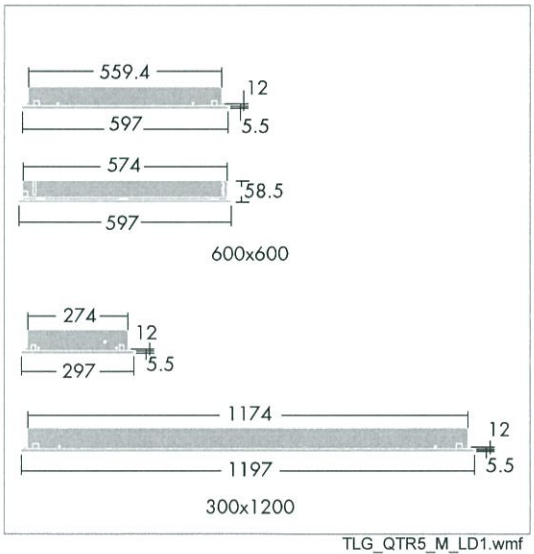
Recessed modular luminaire, with emergency function, for 3 x 14 T16 lamps. With Combined HF & EM SC circuit and Self contained luminaire, manual test (3 hours) emergency operation. White painted steel body with mirrorbrite aluminium louvre and white infill panels. Lays into most exposed grid ceiling systems and can be installed into concealed fix ceilings using "wedge" suspension brackets (supplied). Electrical connection via factory fitted 4 pole GST male connector. Supplied with T connector and 840 lamps.

Dimensions 597 x 597 x 59mm

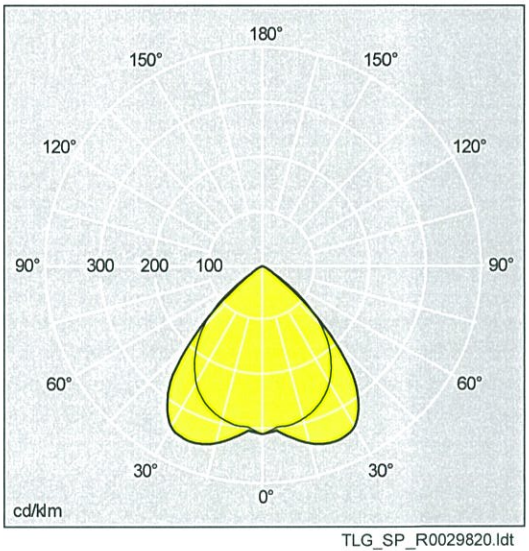
Total power: 52 W

Weight: 5.4 kg

TLG_QTR5_F_P2.jpg



TLG_QTR5_M_LD1.wmf



TLG_SP_R0029820.ldt

- Lamps: 3 x T16/14 W
- Total luminous flux: 3600 lm
- Luminaire efficacy: 45 lm/W
- Colour Rendering Index min.: 80
- Ballast: COM HF EM SC Tridonic PC Combo
- Connected Load: 52.0 W
- Inverter: 3.00 h
- LOR: 0.65 ULOR: 0.00 DLOR: 0.65

Light Fitting Cut Sheet

Laboratories and Preparation Rooms

Quattro T5

96535988 QUATROT5 4x14W T16 HF E3 WL4 FEFL L840

THORN

G5	14W T16	CE		T_a25	EN 60598 -2-22	IP20		850°C

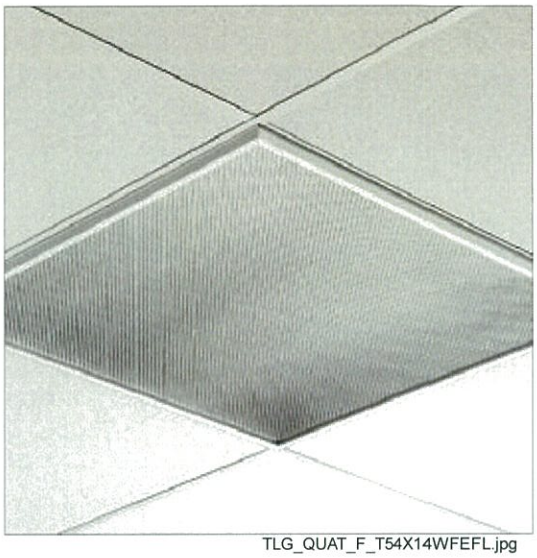
Ultra shallow recessed modular T16 (T5) luminaires for exposed grid and concealed fix ceilings with choice of optic

Recessed modular luminaire, with emergency lighting function, for 4 x 14W T16 lamps. With Combined HF & EM SC circuit and Self contained luminaire, manual test (3 hours) emergency operation. White painted steel body with clear prismatic polyethylene terephthalate glycol diffuser panel in fabricated white pvc frame (UK Building Regs Part B2 class TP[a] - 850°C). Lays into most exposed grid ceiling systems and can be installed into concealed fix ceilings using "wedge" suspension brackets (supplied). Complete with 840 lamp.

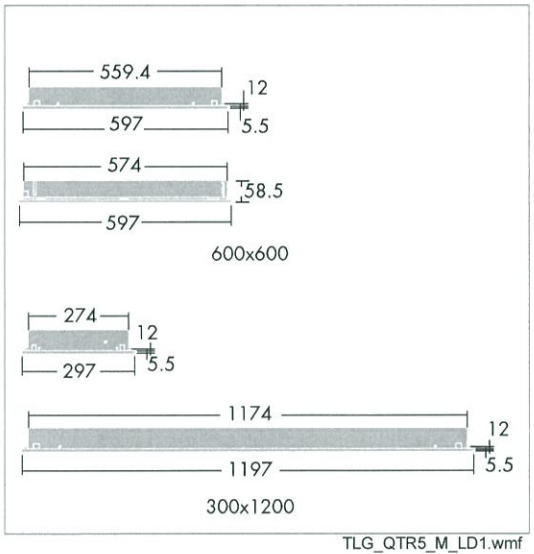
Dimensions 597 x 597 x 59mm

Total power: 67 W

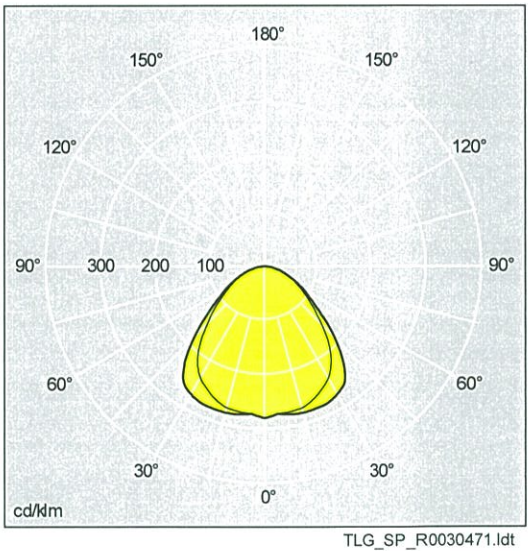
Weight: 5.9 kg



TLG_QUAT_F_T54X14WFEFL.jpg



TLG_QTR5_M_LD1.wmf



TLG_SP_R0030471.ldt

- Lamps: 4 x T16/14 W
- Total luminous flux: 4800 lm
- Luminaire efficacy: 49 lm/W
- Colour Rendering Index min.: 80
- Ballast: COM HF EM SC Tridonic PC Combo
- Connected Load: 67.0 W
- Inverter: 3.00 h
- LOR: 0.68 ULOR: 0.00 DLOR: 0.68

Light Fitting Cut Sheet

Electrical and Mechanical Plant Rooms

Arrowslim T5

96211416 ARROSLM 2x54W L840

+ 96218673 ARROSLM REFLECTOR 1/2x54

G5	54W T16			T_a25	EN 60598	IP20		850°C

T16

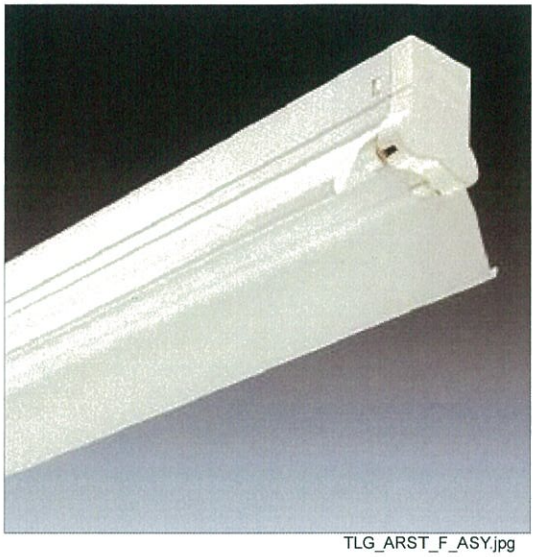
A slim profile T16 (T5) batten with simple design aesthetic and a choice of diffusers, reflectors and connect versions

Slim section batten luminaire for 2 x 54W T16 lamp. electronic - fixed output circuit. Three position lampholder gives maximum mounting flexibility. Body steel with white finish

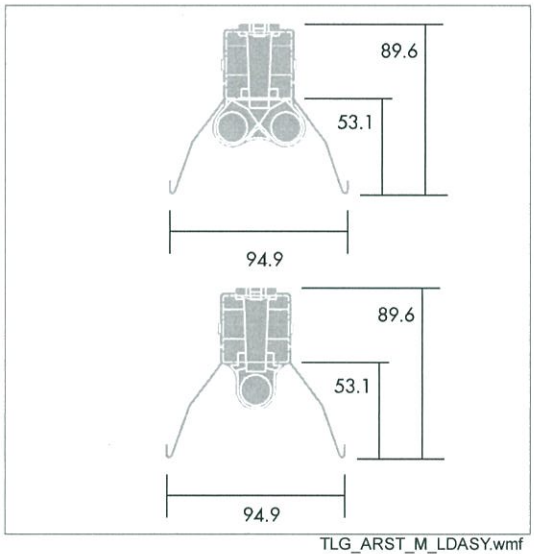
Dimensions: 1172 x 50 x 65 mm
Total power: 116 W
Weight: 1.6 kg -

Equipped with: Reflector attachment for use with Arrowslim T16 luminaires, including emergency and Connect variants. Symmetric distribution. Material steel with white finish.

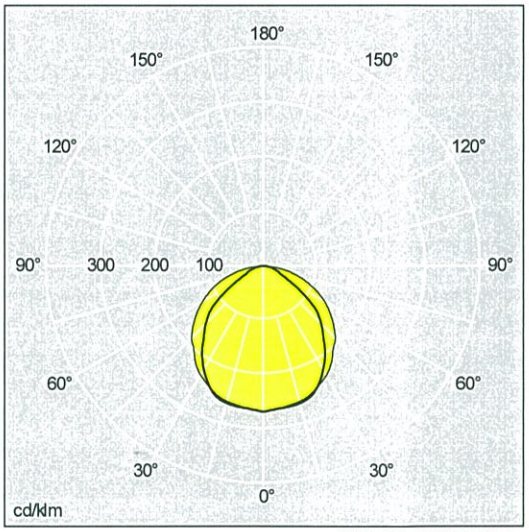
Weight: 0.8 kg



TLG_ARST_F_ASY.jpg



TLG_ARST_M_LDASY.wmf



TLG_SP_R0030762.ldt

- Lamps: 2 x T16/54 W
- Total luminous flux: 8900 lm
- Luminaire efficacy: 52 lm/W
- Colour Rendering Index min.: 80
- Ballast: HF EL s
- Connected Load: 116.0 W
- CELMA EEI: A2
- LOR: 0.68 ULOR: 0.00 DLOR: 0.68

ImpactForce II

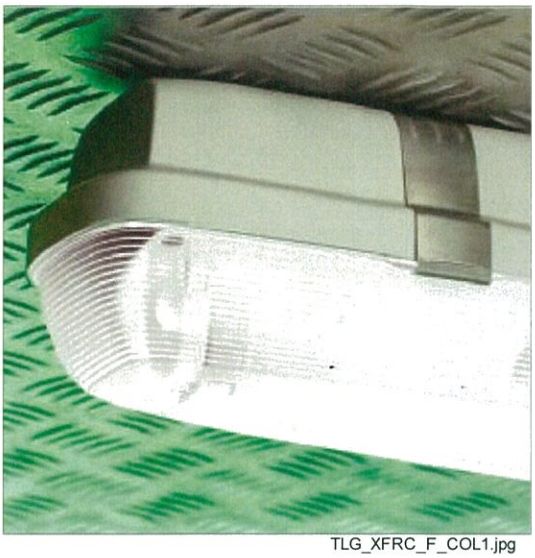
96234439 IMPACTF2 2X28W T16 HF E3 L840

G5	28W T16	CE		IP65		850°C

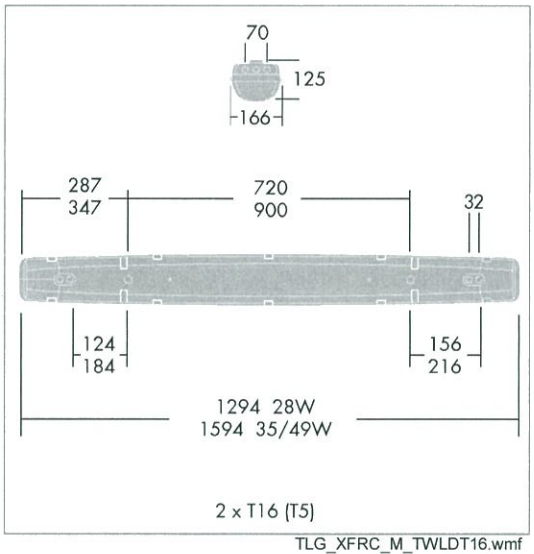
A high performance impact resistant, IP65 proof fluorescent range

A high performance IP65 dust and moisture resistant luminaire with a high impact resistance. For 2 x 28W T16 lamp(s) with electronic - fixed output circuit and integral 3 hour manual test emergency lighting function. Class I electrical. Canopy in light grey glass fibre reinforced polyester. Diffuser in Polycarbonate (PC) with internal prisms. For surface or suspended mounting. Quick-fix installation brackets are supplied for surface mounting, optional accessory kits are avalable to help with other mounting options. Complete with 840 lamp(s).

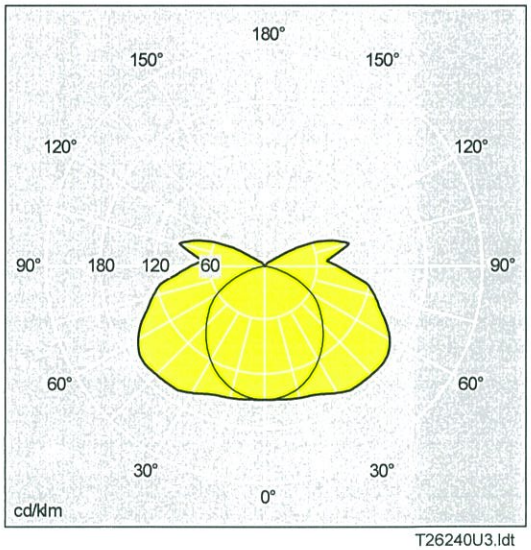
Dimensions: 1294 x 167 x 125 mm
Total power: 62 W
Weight: 3.37 kg



TLG_XFRC_F_COL1.jpg



TLG_XFRC_M_TWLDT16.wmf



T26240U3.ldt

- Lamps: 2 x T16/28 W
- Total luminous flux: 5200 lm
- Luminaire efficacy: 65 lm/W
- Colour Rendering Index min.: 80
- Ballast: HF Tridonic PC PRO Lp
- Connected Load: 62.0 W
- CELMA EEI: A2
- LOR: 0.78 ULOR: 0.14 DLOR: 0.64

Light Fitting Cut Sheet

Perimeter Lighting

Avenue D² LED

96261402 AVENUE D2 LED 18L50 BP 740 CL1 STR RS

LED 30W LED_1765	IK08	CE	IP66	

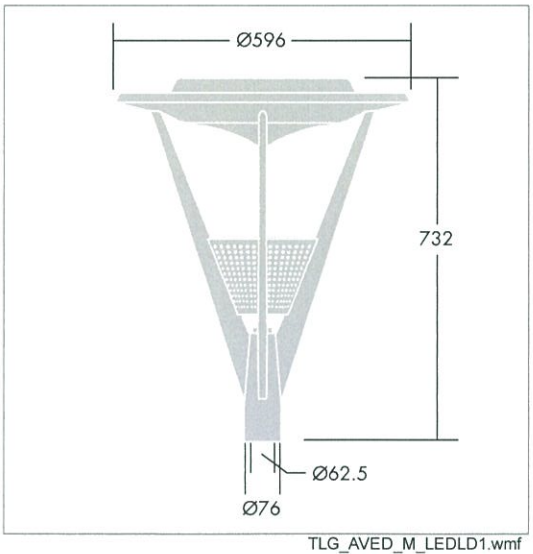
An elegant and efficient LED lantern with a prismatic enclosure to prevent glare and provide a unique, comfortable light

An elegant LED amenity lantern. Electronic, bi-power control gear. Light distribution: asymmetrical. Class I electrical, IP66, IK08. Base and arms: die-cast Aluminium, powder coated dark sandy grey 900. Canopy: spun Aluminium, powder coated dark sandy grey 900. Lampshield: metallised Polycarbonate (PC) with stainless steel. Diffuser: clear UV stabilised Polycarbonate (PC) with anti glare prisms.

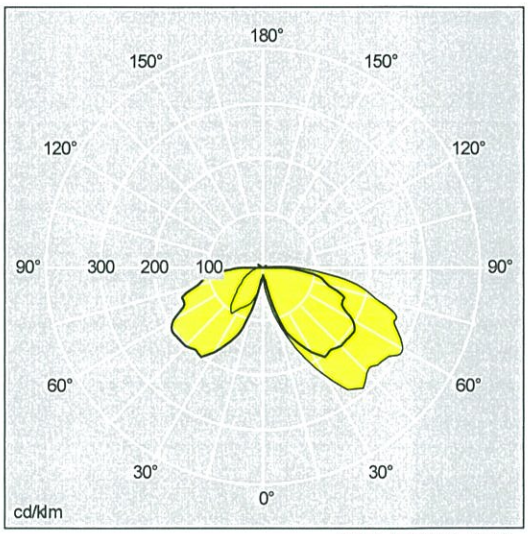
Equipped with power reduction circuit, effective 3 hours before and 5 hours after a calculated midnight. It can be deactivated at installation with an easily accessible internal switch. Complete with 4100K LED

Dimensions: Ø596 x 732 mm
Total power: 30 W
Weight: 8.6 kg
Scx: 0.134 m²

TLG_AVED_F_LEDRSPDBLIT.jpg



TLG_AVED_M_LEDLD1.wmf



TLLA_AD2O5D_DC.ldt

- Lamps: 1 x LED_1765/30 W
- Total luminous flux: 1765 lm
- Luminaire efficacy: 59 lm/W
- Ballast: EL2
- Connected Load: 30.0 W
- LOR: 1.00 ULOR: 0.05 DLOR: 0.96

D-CO LED Bollard

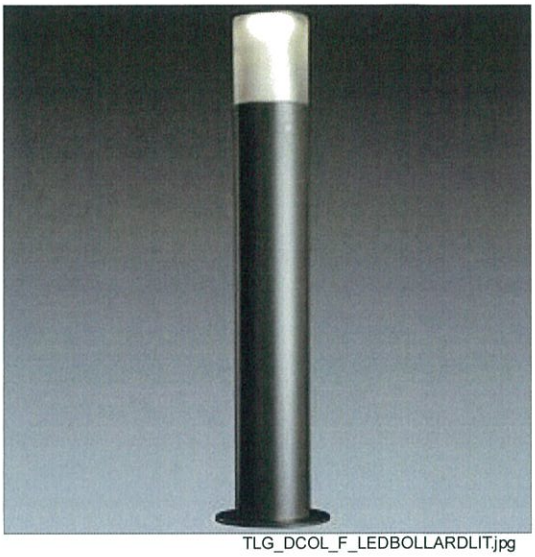
96262145 D-CO LED BOLLARD 1000 30L50 840 CL1

LED 14W LED_583	IK10	CE	T_a50	IP65	

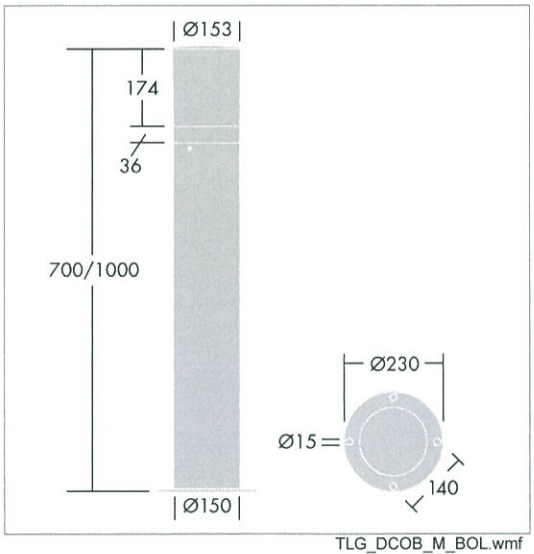
A timeless bollard offering comfortable visual guidance

A timeless LED bollard. Electronic, fixed output control gear. Class I electrical, IP65. Top and body: Aluminium powder coated grey 900. Diffuser: semi-opal anti-UV Polycarbonate (PC). Suitable for flange mounting or with root spike (available separately). Complete with 4000K LED

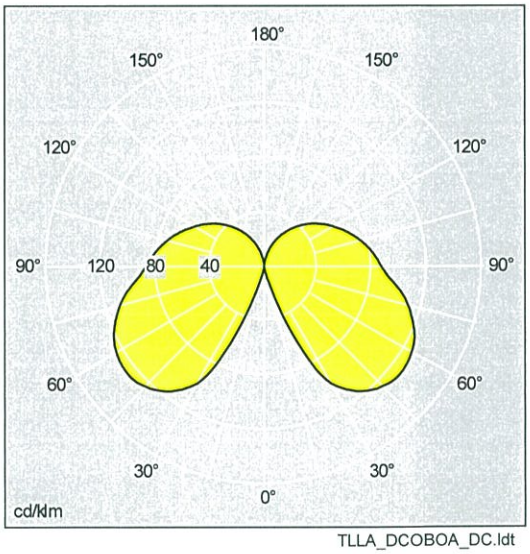
Dimensions: Ø150 x 1000 mm
Total power: 14 W
Weight: 5.45 kg



TLG_DCOL_F_LEDBOLLARDLIT.jpg



TLG_DCOB_M_BOL.wmf



TLLA_DCOBOA_DC.ldt

- Lamps: 1 x LED_583/14 W
- Total luminous flux: 583 lm
- Luminaire efficacy: 42 lm/W
- Ballast: EL2
- Connected Load: 14.0 W
- LOR: 1.00 ULOR: 0.35 DLOR: 0.65

Light Fitting Cut Sheet

Soccer Field

Altis

96263382 ALTIS HR 1KW R1 HQITS-S CL1 WI

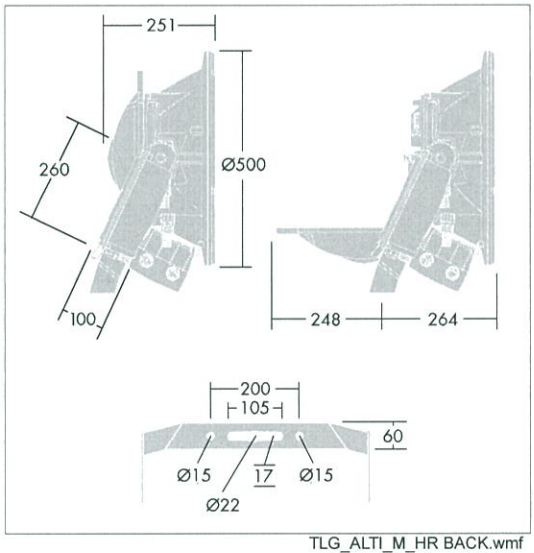
Cable HIT-DE	1000W HIT-DE	IK08	CE	IP66	

High performance discharge floodlight suitable for international sports TV broadcasting

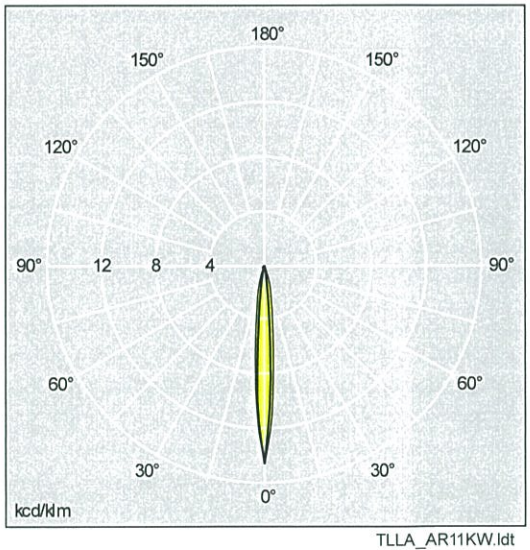
A high performance discharge floodlight for 1 x 1000W HIT-DE lamp. magnetic. Class I electrical, IP66. Body and frame: die-cast Aluminium unpainted. Enclosure: 4mm thermally toughened glass. Stirrup fixed by single bolt through Ø22mm hole, or 105x17mm oblong hole, or by twin bolts through Ø15mm holes. Cable gland for 8 to 12mm cable. Aiming via integrated sights. Ideal for sports field and stadium lighting. Complete with hot restrike ignitor box. Gear tray to be ordered separately. Lamp to be ordered separately.

Total power: 1051 W
Dimensions: 566 x 626 x 285 mm
Weight: 16.7 kg
Scx: 0.21 m²

TLG_ALTI_F_STANDPDB.jpg



TLG_ALTI_M_HR BACK.wmf



TLLA_AR11KW.ldt

- Lamps: 1 x HIT-DE/1000 W
- Total luminous flux: 90000 lm
- Luminaire efficacy: 64 lm/W
- Colour Rendering Index min.: 90
- Ballast: MAG
- Connected Load: 1051.0 W
- LOR: 0.75 ULOR: 0.00 DLOR: 0.75

Light Fitting Cut Sheet

Sports Hall

THORN

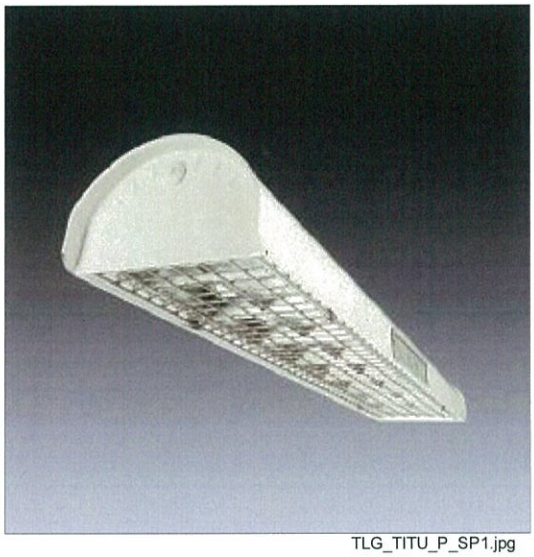
TITUS SPORT 3X54W L840 — 96547445

Surface luminaire for 3 x 54W T16 lamp with high frequency ballast circuit. White powder painted galvanised steel body with Miro finish specular aluminium reflector and hinged galvanised steel wire guard. Side access hatch for electrical connection. Suitable for surface or catenary mounting, and tilting up to 50 degrees without rotational torque. Robust construction satisfies DIN 18032.3 standard for Sports Halls. Optional louvre attachments are available.

Dimensions 1232 x 231 x 157mm
Total power: 178 W
Weight: 7.1 kg

Louvre/diffuser/cover: TITUS LOUVRE L 28W/54W LL — 96190691

Louvre with satin cross vanes



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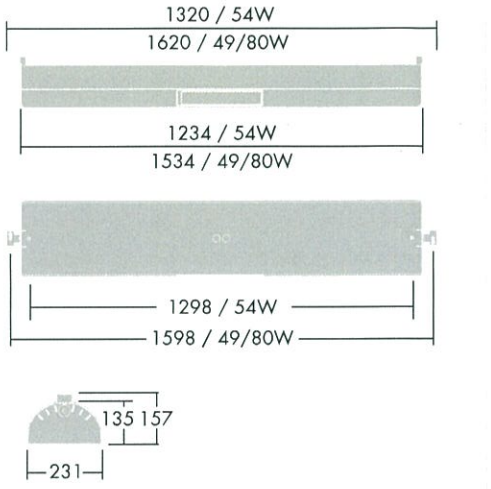

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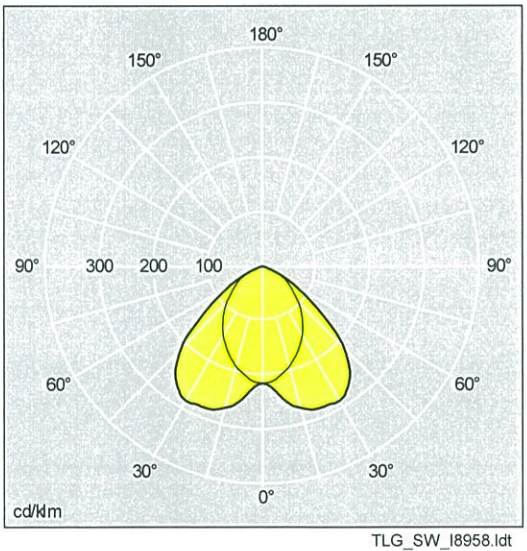
Light distribution — STD - standard



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