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# **OPERATION & MAINTENANCE OF THE LEBANESE UNIVERSITY CAMPUS - HADATH**



## **VOLUME 2: TECHNICAL DOCUMENTS**

### **Section 2.4 – Work Package 3 – Networks**

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## **Lebanese University Campus - Hadath**

### **3.1 - Work Parcel 3 - Technical Description**

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#### **Chilled Water System**

Five centrifugal chillers of total capacity 10,000 T.R (2,000 T.R each) water cooled by means of cooling towers (5 cells) are located in thermal plant area (building T) . Chilled Water at 5.5 °C is distributed to buildings by means of primary pumps via pre-insulated pipes loop running inside the utility tunnel then connected to secondary pumps located in the basement of each building.

Condenser water is also pumped to the cooling towers by means of condenser water pumps.

Make-up water for cooling towers, chilled water, and hot water is produced by means of water softners and collected in concrete water tank where two submersible pumps are installed to distribute the soft water to cooling towers and to the expansion tanks of chilled water and hot water system.

The schematic diagram illustrating this system can be found in section 3.2.1. The complete list of main equipment making up this system can be found in section 3.3.

#### **Hot Water System**

Four hot water boilers of total capacity 4,000 BHP (1,000 BHP each) are located in thermal plant area. Hot Water at 90 °C is distributed to buildings by means of primary pumps via pre-insulated pipes loop running inside the utility tunnel then connected to secondary pumps located in the basement of each building.

Fuel oil is provided to the boilers by means of fuel pumps connected to four underground fuel tanks capacity of 35,000 liters, located next to the technical area (building T).

The schematic diagram illustrating this system can be found in section 3.2.2. The complete list of main equipment making up this system can be found in section 3.3.

#### **Water Supply System**

Five water wells, with submersible pumps, distributed on site area will produce domestic water which will be collected in underground water tanks located in the main pumping station (V3).

In normal conditions, water will be pumped to two elevated water tanks ( Bottom and Mid) of water tower (V2) in order to be discharged by gravity to buildings via ductile iron pipes loops ( domestic, fire and irrigation) running inside the utility tunnel then connected to buildings or to external networks.

In case of emergency where elevated water tanks are stopped, water will be directly boosted to the water loops inside the utility tunnel and the switch over of the water routing will be achieved by means of motorized valves.

In both cases, domestic water is treated and disinfected prior to the connection to the loop inside the utility tunnel by means of two chlorination systems (one as standby) located in the main pumping station.

Potable water will be produced by means of Reverse Osmosis system located in the main pumping station, and collected in underground drinking water tanks located also inside the main pumping station.

After treatment and disinfection by means of two another chlorination systems (one as standby) located in the main pumping station, potable water will be also distributed to buildings via ductile iron pipes loop inside the utility tunnel, and fed either from the top elevated water tank by gravity or from direct boosting pumps in case of failure of the elevated tank.

The schematic diagram illustrating this system can be found in section 3.2.3.a and 3.2.3.b. The complete list of main equipment making up this system can be found in section 3.3.

#### **Gas Supply System**

Six gas tanks distributed on site area (refer to key plan for location) will provide the liquified petroleum gas to buildings via black steel pipes network connected to a main gas box at the entrance of each served building (kitchens or laboratories).

The schematic diagram illustrating this system can be found in section 3.2.4. The complete list of main equipment making up this system can be found in section 3.3.

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## **Lebanese University Campus - Hadath**

### **3.1 - Work Parcel 3 - Technical Description**

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#### **Storm Water Pumping Station**

About 65 % of the storm water of the project is collected inside an underground retention water tank (V6) where four large submersible pumps are installed to discharge the water via glass reinforced pipes (GRP) into the main municipality storm water network.

Their start, shut down and the sequence of operation of the pumps will be provided by means of level regulators installed at different pre-determined levels in the reservoir connected to a control system incorporated within the control panel of the pumps.

#### **Steam Supply System**

One 50 BHP steam boiler located in the maintenance building (T3) will generate steam via black steel schedule 80 pipes to be connected to the laundry equipment located also in building T3.

Fuel oil is provided to the boiler by means of two fuel pumps (one as standby) connected to the same underground fuel tanks feeding the hot water boilers.

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## **Lebanese University Campus - Hadath**

### **3.1 - Work Parcel 3 - Technical Description**

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#### **Medium Voltage Network**

**(Excluding Faculty of Science Main Building, Library, & Old Cafeteria)**

Two separate EDL incoming feeders 20kV, indirectly provided to the campus via 11/20kV transformers, supply the MV switchgear in building T whilst being also supplied by 4 gensets through a bus coupler. Four outgoing feeders configure the power supply from these feeders to the building's RMU's at a collecting RMU in building M.

Two outgoing feeders for mechanical plant supply are feeding power to two separate MV distribution switchgear supplying the 5.6kV chillers as well as the MDB of related LV mechanical heating and cooling equipment.

#### **Emergency Power Plant**

**(Excluding Faculty of Science Main Building, Library, & Old Cafeteria)**

An underground fuel tank located outside building T delivers fuel to four daytanks related to the four gensets. The daily fuel tank supplies fuel to the corresponding genset conceived with remote radiator(s) and a central air compressor system with star configured air pipes network.

The LV output of each genset is transformer stepped up and connected, after proper synchronization, to the MV switchgear of building T.

Generators are diesel type each with a rated output power of 1500 kVA installed in the generator area of building T.

#### **Emergency Power Plant**

**Faculty of Science Main Building, Library, & Old Cafeteria**

Fuel tank located outside FOS Main Building delivers fuel to two daytanks related to the three gensets. The daily fuel tank supplies fuel to the corresponding genset .

Only one generator is connected to to main ATS system.

The Generators are diesel type two with a rated output power of 1000 kVA and one with a rated output power of 250 kVA installed in the generator area of building FOS.

#### **Telephone Distribution Network**

**(Excluding Faculty of Science Main Building, Library, & Old Cafeteria)**

The main PABX located in building T, linked to the local center of PTT, ensures vehiculation of communication between the buildings PABX's of the campus and the outside world as well as between the buildings themselves by means of a star configured network of F.O. cables. The components of the system are described in section 3.3 while the schematic diagram of the system is shown in section 3.2

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## Lebanese University Campus - Hadath

### 3.1 - Work Parcel 3 - Technical Description

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#### MAIN PABX SYSTEM DESCRIPTION

Manufacturer: PHILIPS Business Communication Systems, the Netherlands. Model: SOPHO JS3090

The SOPHO JS3090 is a modular system designed for large size of business, and classified as a full digital Integrated Services Private Branch Exchange (ISPBX), or simply an ISDN PABX as defined by the CCITT, and capable of switching voice, data and image.

The maximum system capacity is 10,000 ports housed in 8 cabinets, 31 shelves and up to 140,000 extensions in network configuration.

The central processor module (CM) is based on PHILIPS patented 4/2 fault-tolerant concept. It consists of four identical and independently operating processor slices (CPU card) and two shared memory banks. Via a majority voting mechanism-processing errors

The switching network module (SM) also incorporates a fault-tolerant design. It consists of multiple independent operating network slices. Each slice is connected to multiple (up to 8) peripheral module (PM) and each PM is connected to 2-8 network slices.

The switching network can be configured to requirements. The minimum size is 2 slices delivering 16 2Mbps connections. The maximum size is 8 slices providing a switching matrix for 64 2 Mbps connections.

The switching network is always non-blocking.

The mean time to fatal failure (MTTFF) for the CM and SM is 16 years.

The peripheral module (PM) shelf supports and offers the following:

- 256 ports distributed over card position 1 to 16.
- One peripheral module controller (PMC) in position 17.
- 2 x 32 ports on card positions 19 and 18.
- One power supply unit (PSU).

The central processor module (CPU) and all the mains components in the system are of low voltage family series, with low power dissipation, thus there is no need for a forced ventilation for the system or any conditioned environment for up to 70 C.

The proposed main system for building T is composed of:

- Three cabinets.
- One CSM shelf.
- Nine PM1100 shelves.

One of the main system characteristics is that it can accept 7 or 15 channels 2B+D, basic rate access, ISDN card and each channel can be configured as an ISDN trunk or ISDN extension, and on the extension level you can connect up to 8 parallel sets of differe

The SOPHO system software accommodates a set of standard features and provides a uniform platform for additional applications and open platform to third party equipment.

The applications can be added to the platform according to specific user needs and include:

- Private and Multi-Vendor Networking.
- Video Conferencing
- Computer Telephony Integration (ECMA CSTA and TAPI)
- Announcement Services.
- Voice Manager.
- Automatic Call Distribution.
- DECT Cordless Communications.
- System Manager (Accounting, Configuration, Security, Performance, Fault, Patrol & Hotel

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## **Lebanese University Campus - Hadath**

### **3.1 - Work Parcel 3 - Technical Description**

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#### **Telephone Distribution Network Faculty of Science Main Building, Library, & Old Cafeteria**

The main PABX located in FOS Main Building, linked to Ogero through 100 Trunks and Linked to campus through a 25 Pair 3M Cable tied with Building J PABX, which ensures the vehiculation of communication between the building PABX's of the FOS and the outside world as well as between the FOS and other buildings. 6 out of 100 Trunks are feeding the Second and Ground Floor of the FOS Library while the remaing floors in the FOS Library and the FOS Cafeteria are connected by the mean of telephone extensions from the Main PABX installed in the FOS building. The components of the system are described in section 3.3 while the schematic diagram of the system is shown in section 3.2

#### **Data Distribution Network (Excluding Faculty of Science Main Building, Library, & Old Cafeteria)**

Two redundant core switches in building T are linked via fiber optic cables in star configuration network to individual faculty switches themselves similarly connected to floor switch(es) to which the individual end user outlets are driven. The components of the system are described in section 3.3 while the schematic diagram of the system is shown in section 3.2

#### **Data Distribution Network Faculty of Science Main Building, Library, & Old Cafeteria**

Two redundant core switches in FOS Main Building are linked via fiber optic cables in star configuration network to each floor and to the first floor of the FOS Library switch's to which the individual end user outlets are driven. The components of the system are described in section 3.3 while the schematic diagram of the system is shown in section 3.2

#### **Telephone and Data Systems Interconnectivity**

The building MWCC (main wiring communications cabinet), linked to the building PABX and building farm server, is regrouping the building MDF (main distribution frame), and the faculty and/or floor switches star connected to the floor WCC's via F.O./UTP cables. The floor WCC is collecting the end user data/telephone outlets cabling. The components of the system are described in section 3.3 while the schematic diagram of the system is shown in section 3.2

#### **Clock System**

The master clock station in building T connected to a global positioning system (GPS) antenna/receiver is linked in a loop configuration of data cables network to the building slave stations serving the building individual clocks.

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## **Lebanese University Campus - Hadath**

### **3.1 - Work Parcel 3 - Technical Description**

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#### **Building Management System (BMS)**

The purpose of the BMS is to control electro-mechanical equipment in order to optimize energy savings. The BMS is operated and monitored via operator workstations in the security room of each building and in the CSSC.

The standalone building BMS controllers are cascaded to a router(s) and fiber optic interface (FOI) there and then local system is linked in a loop configuration of fiber optic cables to the CSSC (central security and surveillance center).

The BMS monitors and controls all mechanical equipment in order to provide optimum energy saving measures and equipment status monitoring. It also monitors electrical equipment to ensure the normal operation of lifts, lighting circuits, and status of electrical installations. The BMS is responsible to operate the priorities of electrical distribution networks in buildings in case of power failures. This is in addition to other functions described in the O&M manuals.

#### **Access Control System**

The building access controllers are cascaded to a router(s) and fiber optic interface (FOI) there and then local system is linked in a loop configuration of fiber optic cables to the access control workstation via main FOI linking the access control and the BMS in building T.

The access control system monitors building doors by means of door contacts in order to generate an alarm signal in case of intrusion. The system also monitors and controls access systems for parkings. The building safety is also ensured by means of a watchman patrol tour system, monitored via the access control system, whereby the watchman in charge switches a keylock at visited and secured stations.



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**Lebanese University Campus - Hadath**

**3.2 - *Work Parcel 3 - Schematic Diagrams of Systems***

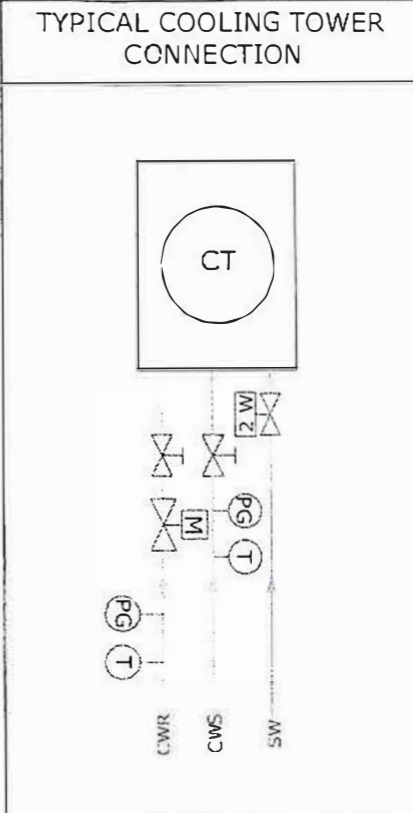
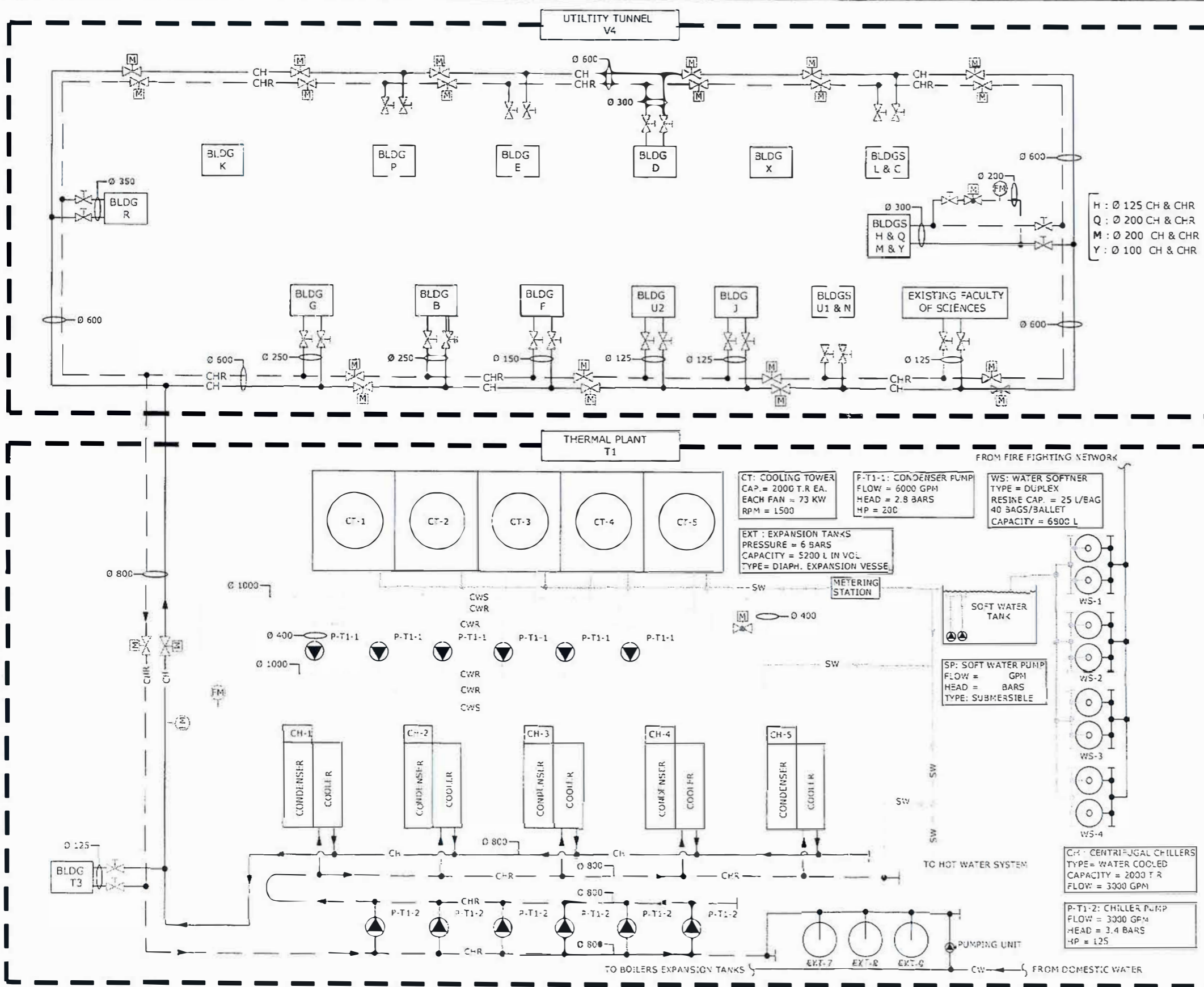
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# WORK PARCEL 3 : PLANTS AND NETWORKS

## 3.2 : SCHEMATIC DIAGRAM OF SYSTEMS

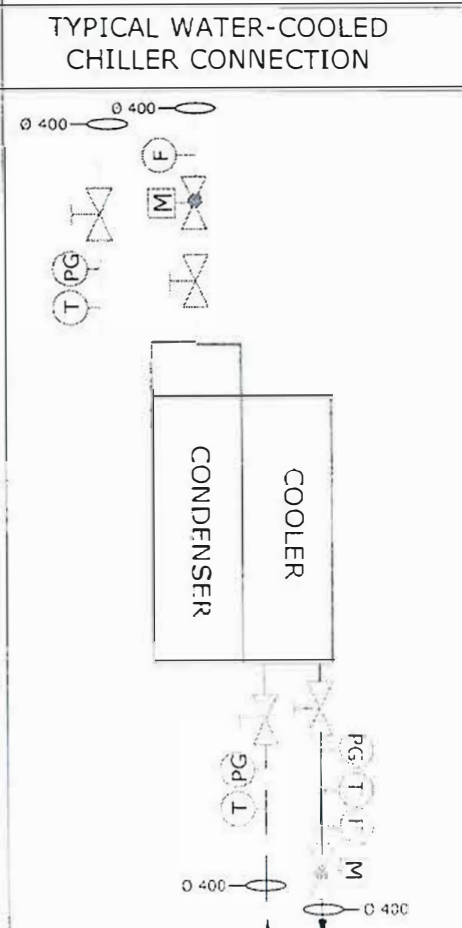
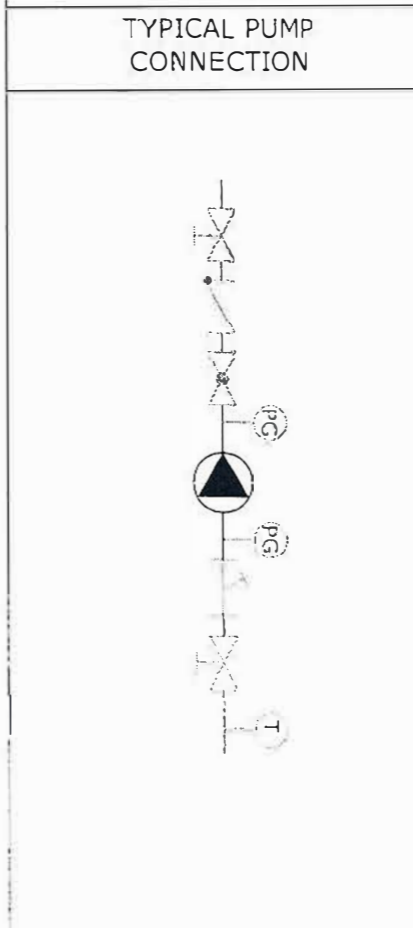
### 3.2.1 : CHILLED WATER SYSTEM

BUILDING: T & V4



**LEGEND AND ACCESSORIES**

- CH : CHILLED WATER SUPPLY PIPE
- CHR : CHILLED WATER RETURN PIPE
- CWS : CONDENSER WATER SUPPLY PIPE
- CWR : CONDENSER WATER RETURN PIPE
- SW : SOFT WATER PIPE
- CW : DOMESTIC COLD WATER PIPE
- Gate Valve
- Check Valve
- Globe Valve
- Strainer
- Motorized Butterfly Valve
- Motorized Modulating Valve
- Two-way On-Off Valve
- Pump
- Pressure Gauge
- Water Flow Switch
- Temperature Gauge



**CT: COOLING TOWER**  
CAP. = 2000 T.R EA.  
EACH FAN = 73 KW  
RPM = 1500

**P-T1-1: CONDENSER PUMP**  
FLOW = 6000 GPM  
HEAD = 2.8 BARS  
HP = 200

**WS: WATER SOFTNER**  
TYPE = DUPLEX  
RESINE CAP. = 25 L/BAG  
40 BAGS/BALLET  
CAPACITY = 6900 L

**EXT: EXPANSION TANKS**  
PRESSURE = 6 BARS  
CAPACITY = 5200 L IN VOL.  
TYPE = DIAPH. EXPANSION VESSE.

**METERING STATION**

**SOFT WATER TANK**

**SP: SOFT WATER PUMP**  
FLOW = GPM  
HEAD = BARS  
TYPE: SUBMERSIBLE

**CH: CENTRIFUGAL CHILLERS**  
TYPE = WATER COOLED  
CAPACITY = 2000 T.R  
FLOW = 3000 GPM

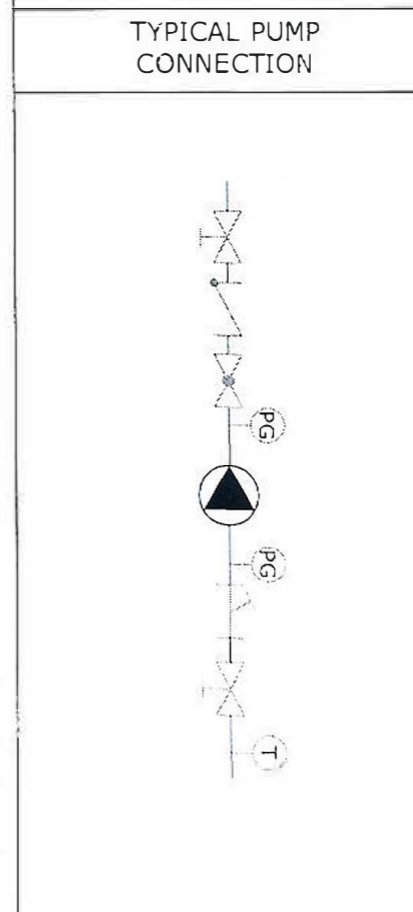
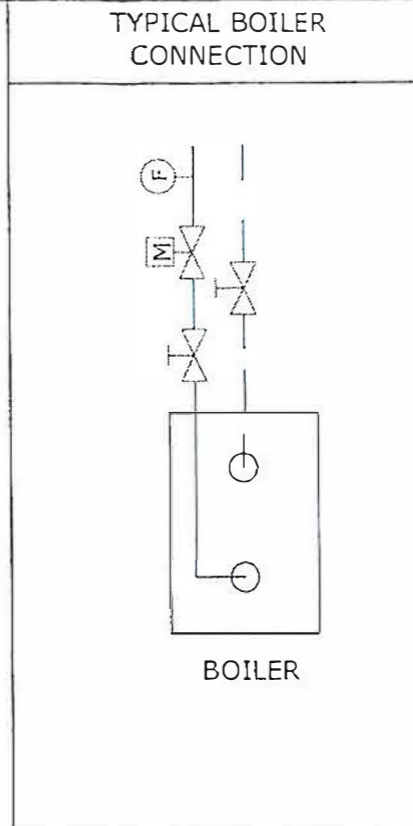
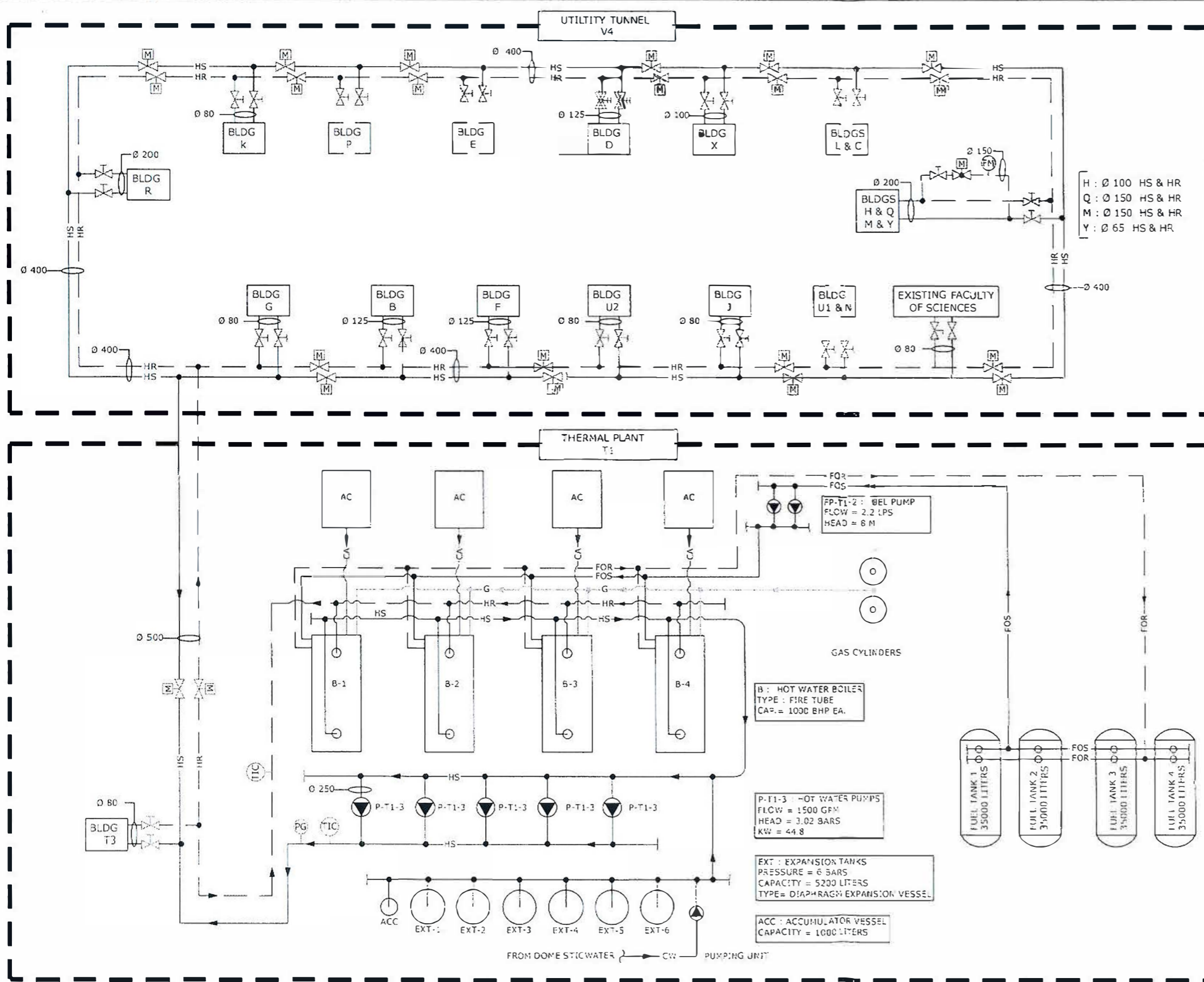
**P-T1-2: CHILLER PUMP**  
FLOW = 3000 GPM  
HEAD = 3.4 BARS  
HP = 125

# WORK PARCEL 3 : PLANTS AND NETWORKS

## 3.2 : SCHEMATIC DIAGRAM OF SYSTEMS

### 3.2.2 : HOT WATER SYSTEM

BUILDINGS: T & V4 DATE:



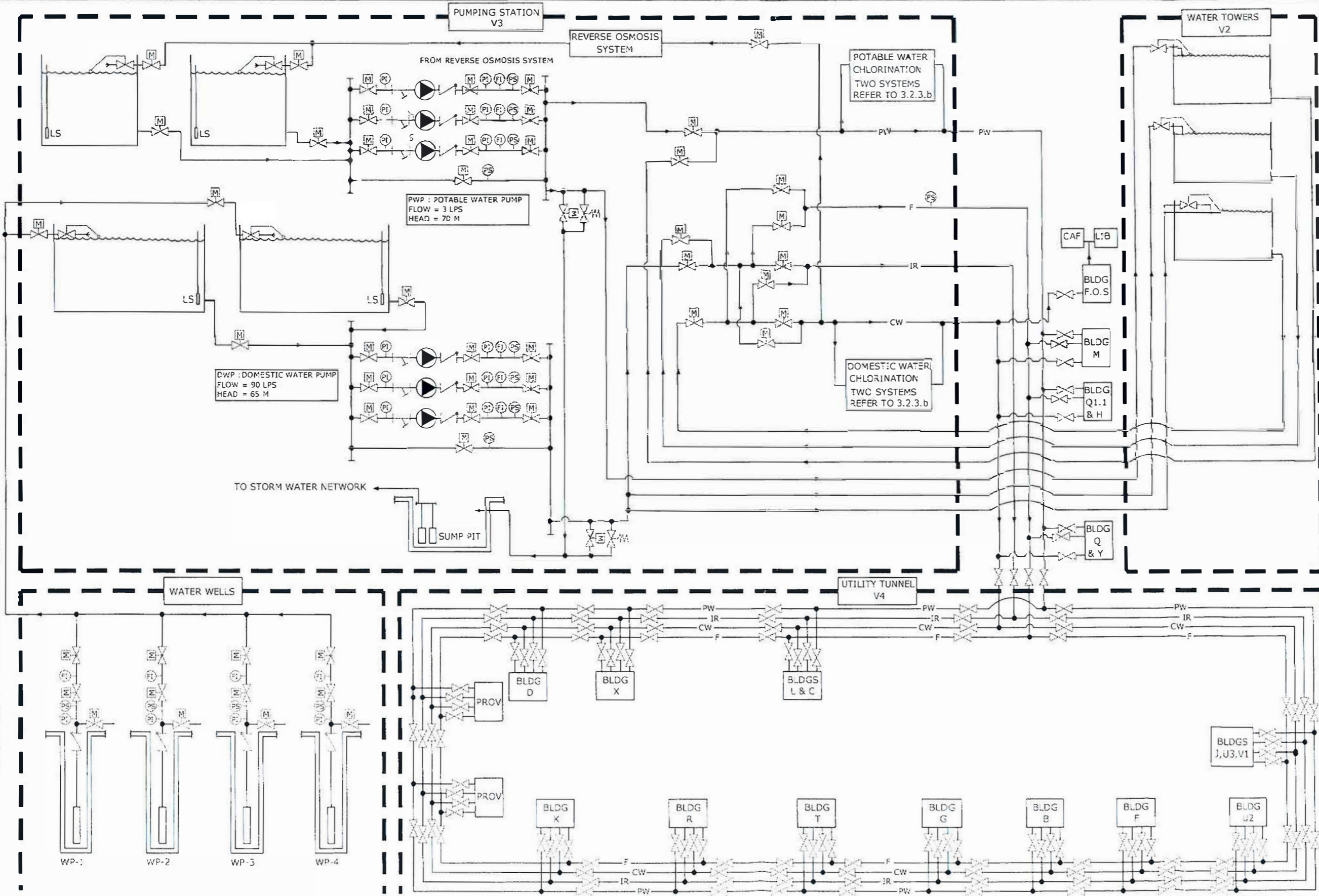
LEGEND AND ACCESSORIES	
HS	: HOT WATER SUPPLY PIPES
HR	: HOT WATER RETURN PIPES
G	: GAS PIPES
CA	: COMPRESSED AIR PIPES
AC	: AIR COMPRESSOR
FOS	: FUEL OIL SUPPLY PIPES
FOR	: FUEL OIL RETURN PIPES
EXT	: EXPANSION TANKS
	: GATE VALVE
	: CHECK VALVE
	: GLOBE VALVE
	: STRAINER
	: MOTORIZED BUTTERFLY VALVE
	: PUMP
	: PRESSURE GAUGE
	: WATER FLOW SWITCH
	: TEMPERATURE GAUGE
	: TEMPERATURE INDICATOR CONTROLLER
	: FLOW METER

# WORK PARCEL 3 : PLANTS AND NETWORKS

## 3.2 : SCHEMATIC DIAGRAM OF SYSTEMS

### 3.2.3.a : WATER SUPPLY SYSTEM

BUILDINGS: V3 & V4



#### LEGEND AND ACCESSORIES

- TIC : TEMP. INDICATION CONTROLLER
- DPS : DIFFERENTIAL PRESSURE SWITCH
- ORP : OXIDATION REDUCTION METER
- TDS : TOTAL DISSOLVED SOLIDS METERS
- LS : LEVEL SENSOR
- PH : PH METER
- FI : FLOW INDICATOR
- PI : PRESSURE INDICATOR
- PS : PRESSURE SENSOR
- FS : FLOW SWITCH
- Ball Valve
- Gate Valve
- Check Valve
- Globe Valve
- Strainer
- Pi:loTE CONTROL VALVE
- MOTORIZED VALVE
- MOTORIZED MODULATING VALVE
- SOLENOID OPERATED VALVE
- FLEXIBLE CONNECTOR
- HYDROPNEUMATIC DIAPHRAGM VALVE
- MANUAL DIAPHRAGM VALVE
- PRESSURE RELIEF VALVE
- PUMP
- GAS CHLORINE CYLINDERS

#### GENERAL NOTES

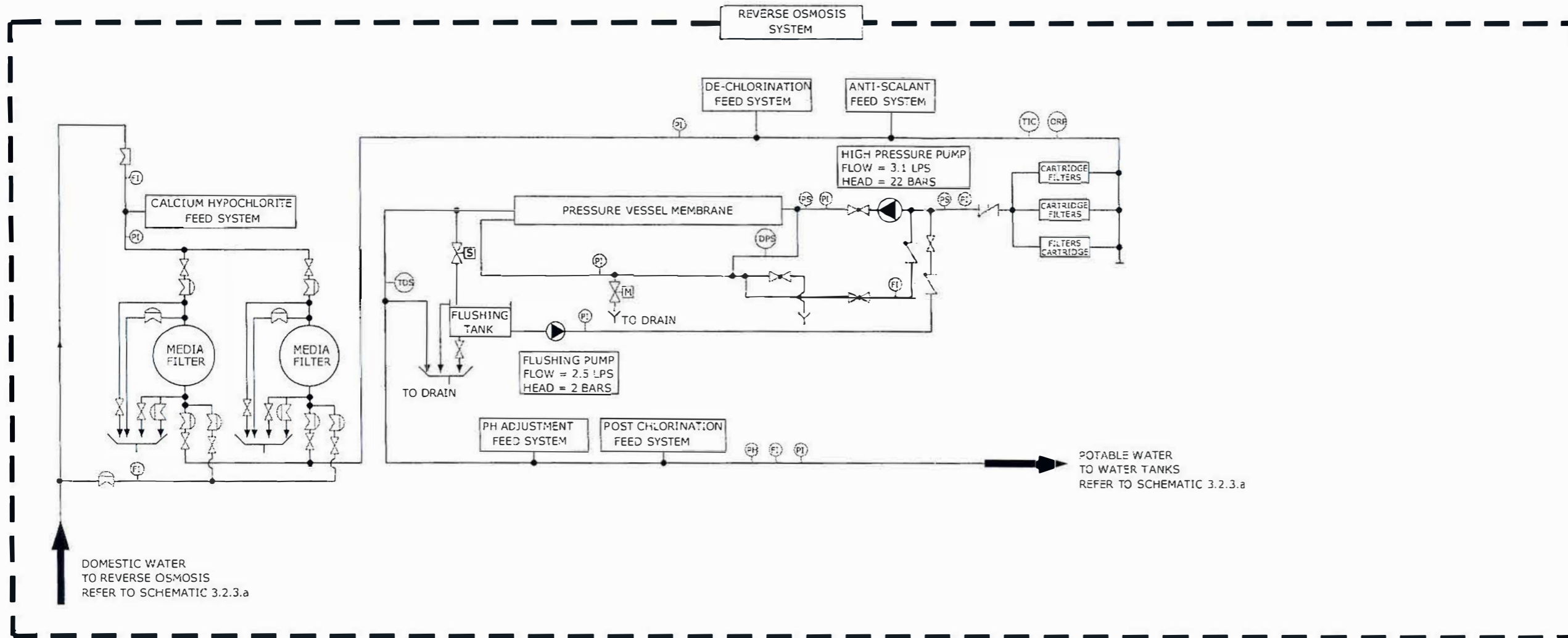
- 1- ALL PIPES INSIDE THE PUMPING STATION ARE BLACK STEEL EPOXY COATED
- 2- ALL PIPES GOING FROM OR TO THE WATER TOWER ARE DUCTILE IRON PIPES
- 3- ALL PIPES RUNNING INSIDE THE UTILITY TUNNEL ARE DUCTILE IRON PIPES

# WORK PARCEL 3 : PLANTS AND NETWORKS

## 3.2 : SCHEMATIC DIAGRAM OF SYSTEMS

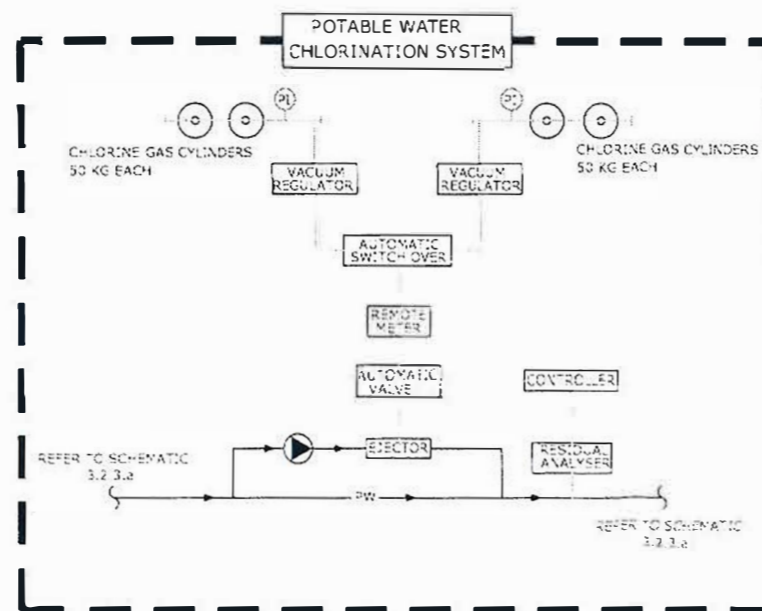
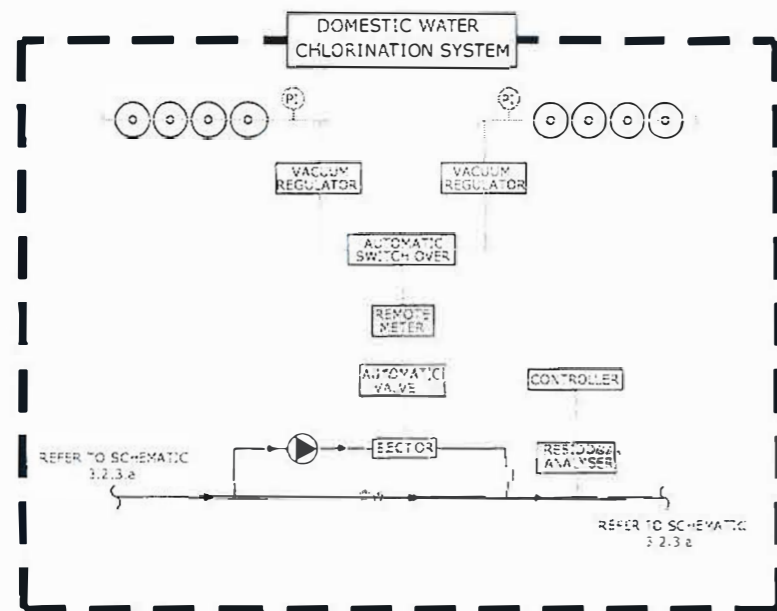
### 3.2.3.b : WATER SUPPLY SYSTEM-DETAILS

BUILDING: V3



#### LEGEND AND ACCESSORIES

- TIC : TEMP. INDICATION CONTROLLER
  - DPS : DIFFERENTIAL PRESSURE SWITCH
  - ORP : OXIDATION REDUCTION METER
  - TDS : TOTAL DISSOLVED SOLIDS METERS
  - LS : LEVEL SENSOR
  - PH : PH METER
  - FI : FLOW INDICATOR
  - PI : PRESSURE INDICATOR
  - PS : PRESSURE SENSOR
- 
- BALL VALVE
  - GATE VALVE
  - CHECK VALVE
  - GLOBE VALVE
  - STRAINER
  - PILOTE CONTROL VALVE
  - MOTORIZED VALVE
  - MOTORIZED MODULATING VALVE
  - SOLENOID OPERATED VALVE
  - FLEXIBLE CONNECTOR
  - HYDROPNEUMATIC DIAPHRAGM VALVE
  - MANUAL DIAPHRAGM VALVE
  - PRESSURE RELIEF VALVE
  - PUMP
  - GAS CYLINDERS

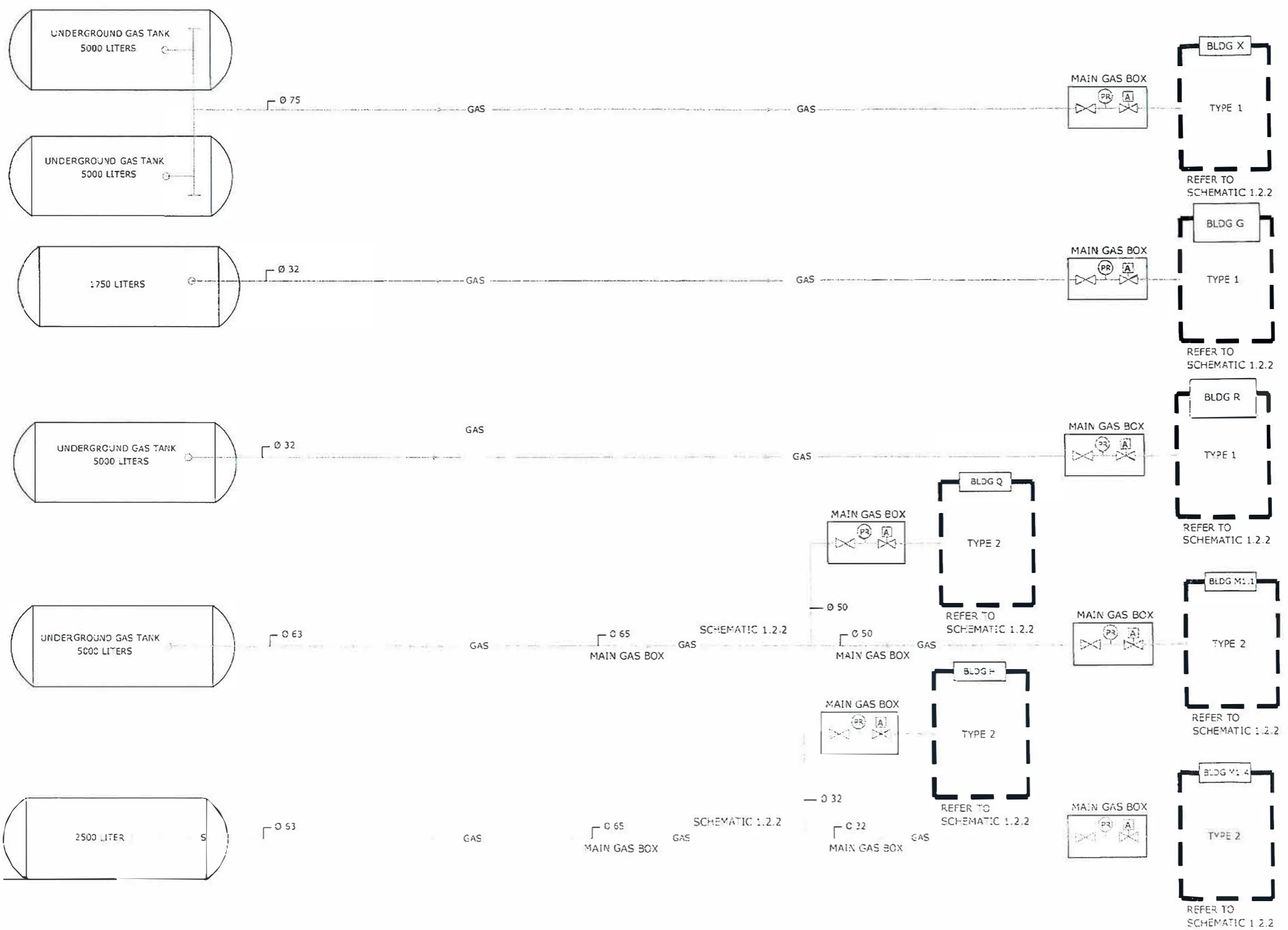


# WORK PARCEL 3 : PLANTS AND NETWORKS

## 3.2 : SCHEMATIC DIAGRAM OF SYSTEMS

### 3.2.4 : GAS SUPPLY SYSTEM

BUILDING: EXTERNAL



#### LEGEND AND ACCESSORIES

- PR : FIRST STAGE PRESSURE REGULATOR
- TYPE 1 : KITCHEN AND RESTAURANT
- TYPE 2 : LABORATORIES
- 1/4 SHUT OFF VALVE
- AUTOMATIC SHUT OFF VALVE

#### GENERAL NOTES

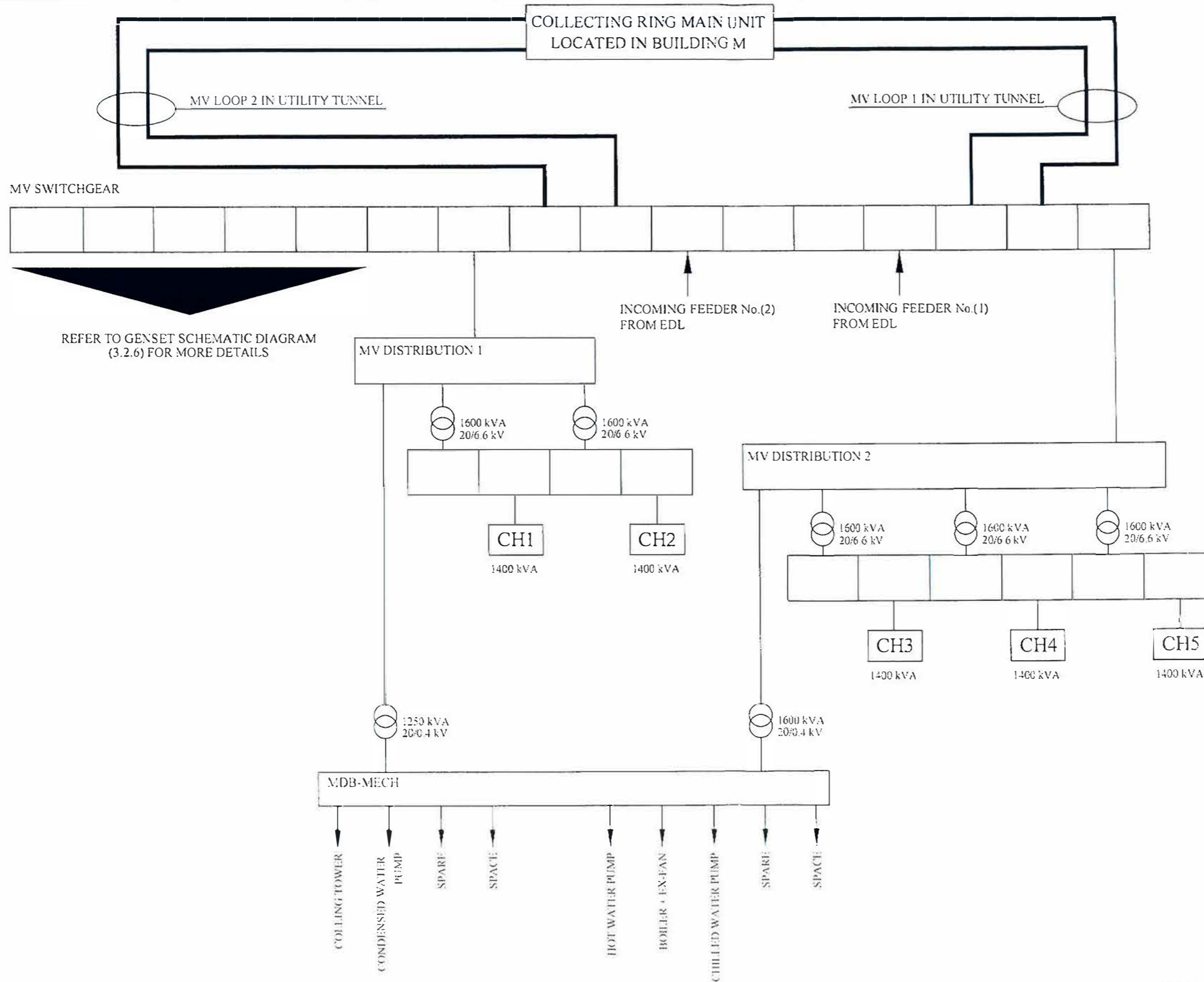
- 1- ALL GAS PIPES RUNNING OUTSIDE BUILDINGS BLACK STEEL EPOXY COATED PIPES
- 2- ALL GAS PIPES RUNNING INSIDE BUILDINGS ARE COPPER PIPES

# WORK PARCEL 3 : PLANTS AND NETWORKS

## 3.2 : SCHEMATIC DIAGRAM OF SYSTEMS

### 3.2.5: MEDIUM VOLTAGE NETWORK

BUILDING: EXTERNAL



REFER TO GENSET SCHEMATIC DIAGRAM (3.2.6) FOR MORE DETAILS

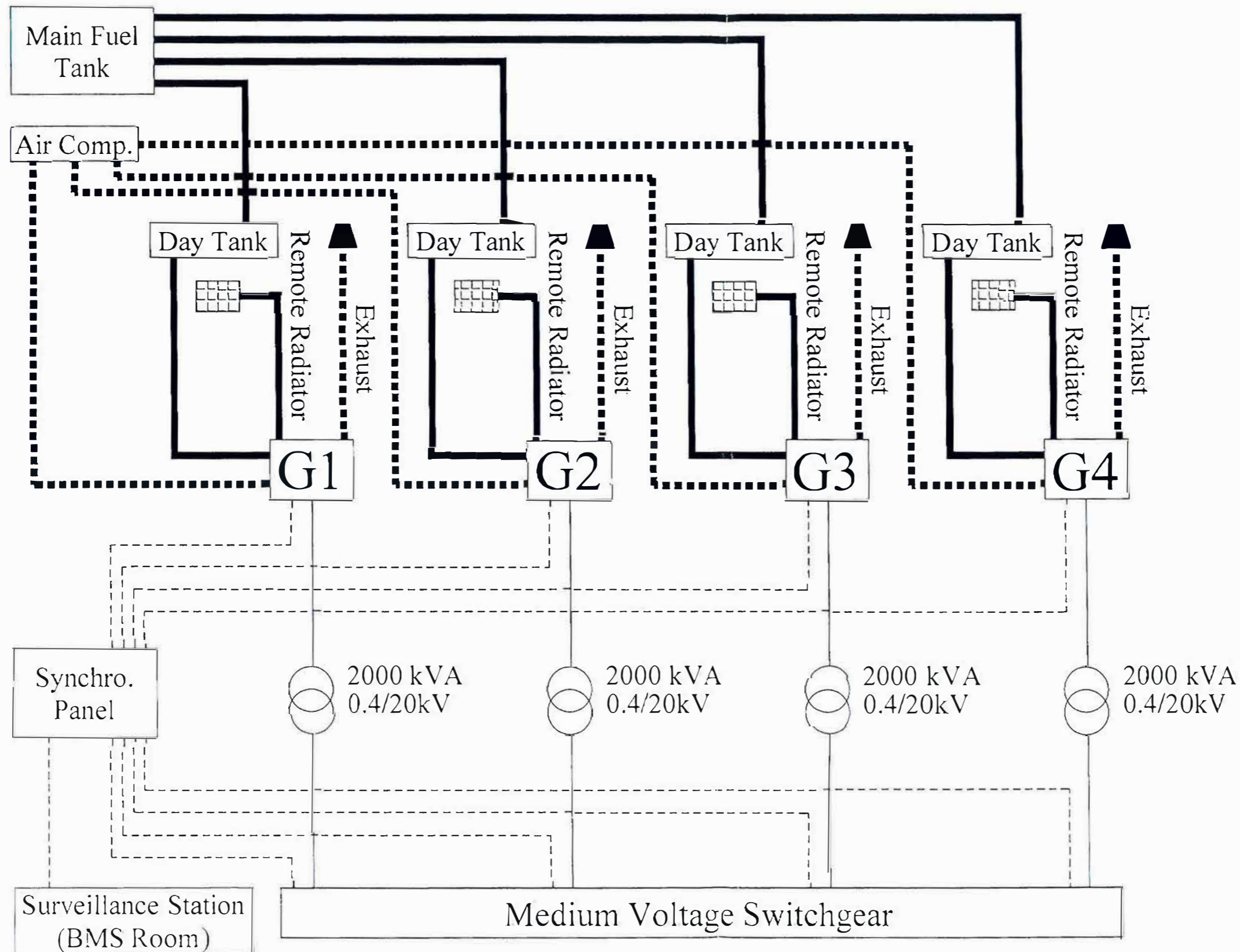
LEGEND AND ACCESSORIES

GENERAL NOTES

WORK PARCEL 3 : PLANTS AND NETWORKS  
 3.2 : SCHEMATIC DIAGRAM OF SYSTEMS  
 3.2.6-a: EMERGENCY POWER PLANT





EXCLUDING FACULTY OF SCIENCES MAIN BUILDING, LIBRARY, & OLD CAFETERIA

BUILDING: EXTERNAL



LEGEND AND ACCESSORIES

G1, G2, G3, G4: 1850 kVA Gensets

-  Control Cables
-  Power Cables
-  Air Pipes and Ducts
-  Fuel and Water Pipes

GENERAL NOTES



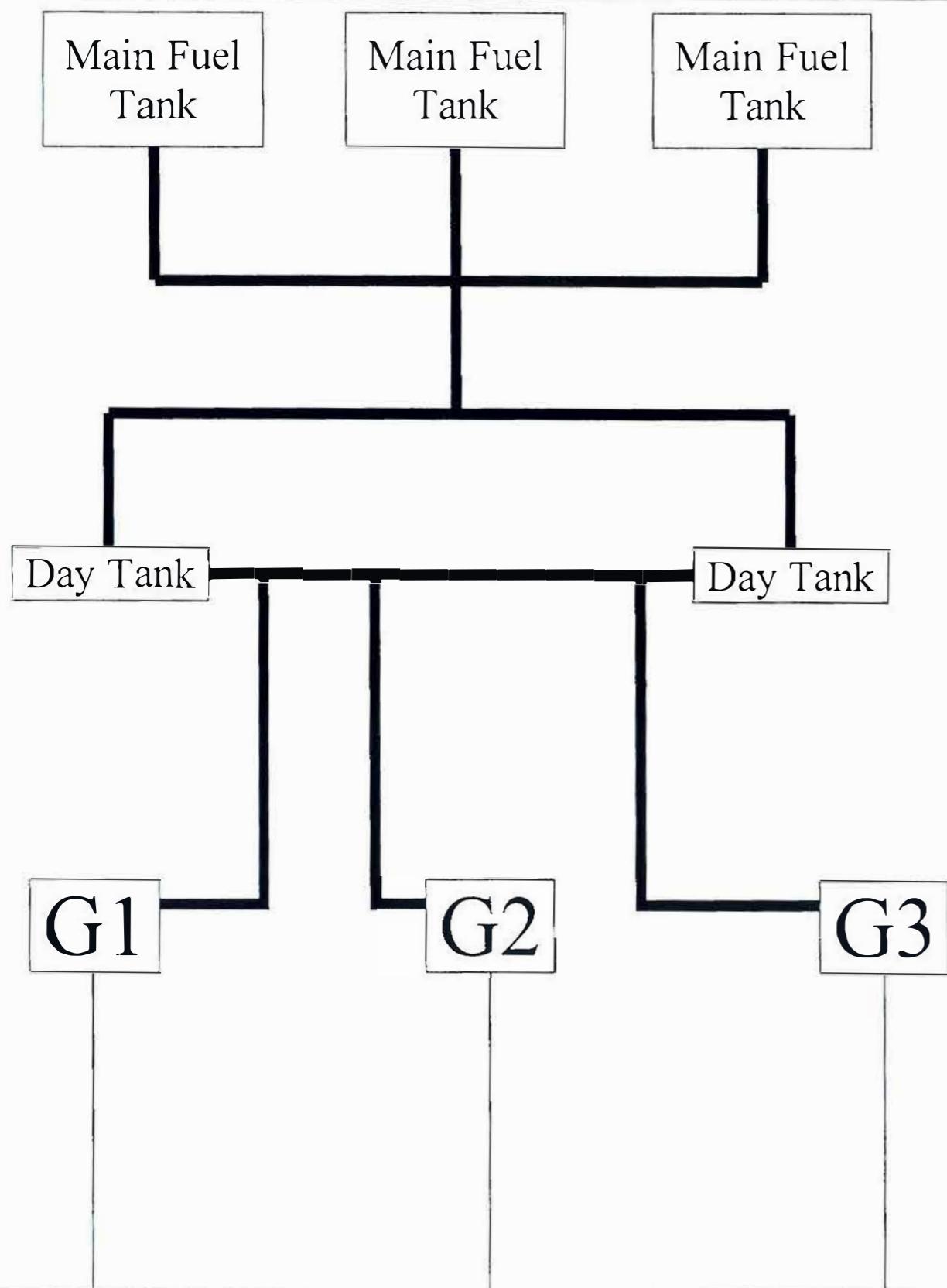
WORK PARCEL 3 : PLANTS AND NETWORKS

3.2 : SCHEMATIC DIAGRAM OF SYSTEMS

3.2.6-b: EMERGENCY POWER PLANT

FACULTY OF SCIENCES MAIN BUILDING, LIBRARY, & OLD CAFETERIA


BUILDING: EXTERNAL




LEGEND AND ACCESSORIES

G1, G2: 1000 kVA Gensets


G3: 250 kVA Gensets

 Power Cables

 Fuel and Water Pipes

G1, G2: 1000 kVA Gensets

G3: 250 kVA Gensets

 Power Cables

 Fuel and Water Pipes

GENERAL NOTES

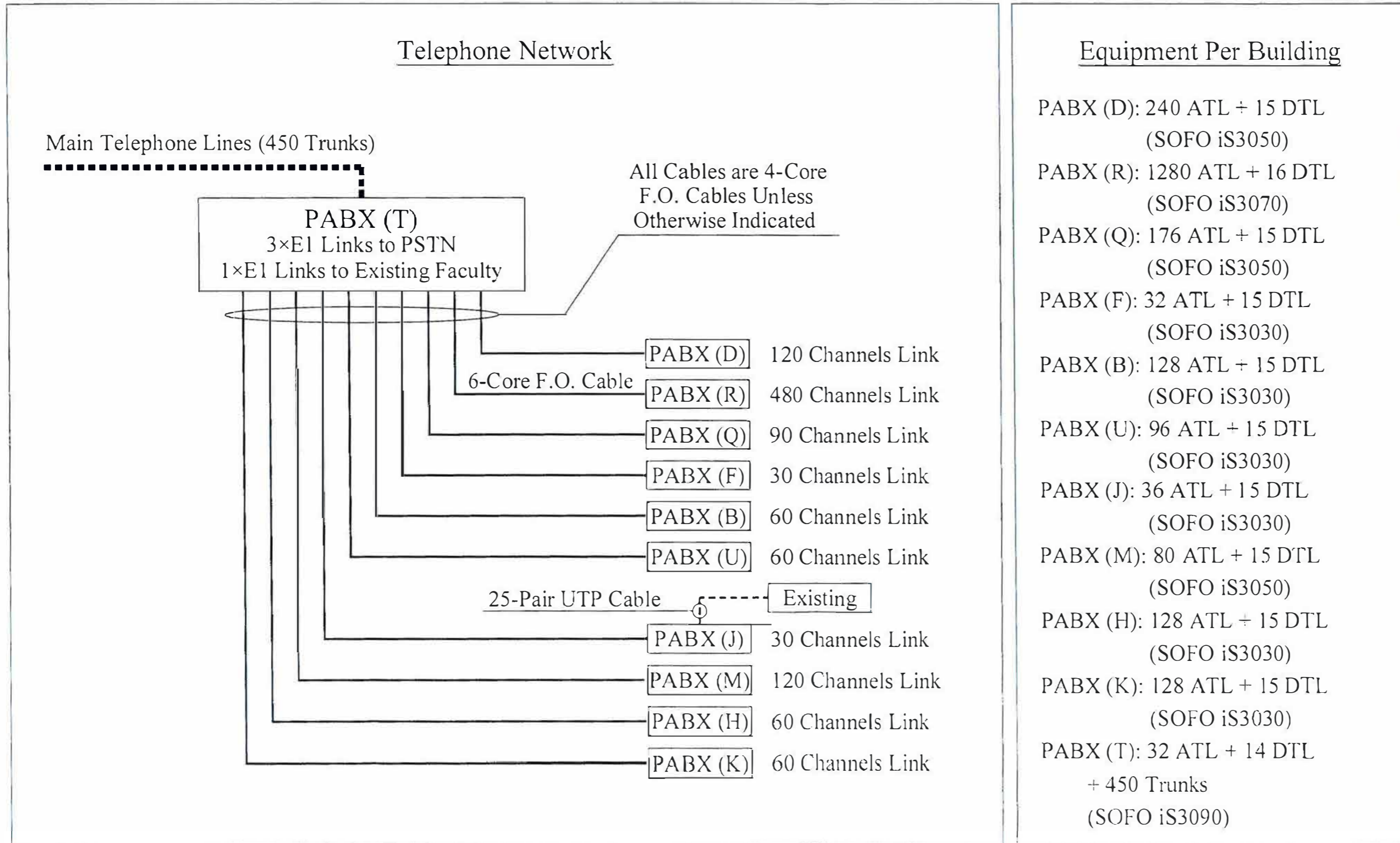
Automatic Transfer Switch

WORK PARCEL 3 : PLANTS AND NETWORKS  
 3.2 : SCHEMATIC DIAGRAM OF SYSTEMS  
 3.2.7-a TELEPHONE DISTRIBUTION NETWORK

EXCLUDING FACULTY OF SCIENCES MAIN BUILDING, LIBRARY, & OLD CAFETERIA

BUILDING: EXTERNAL

LEGEND AND ACCESSORIES

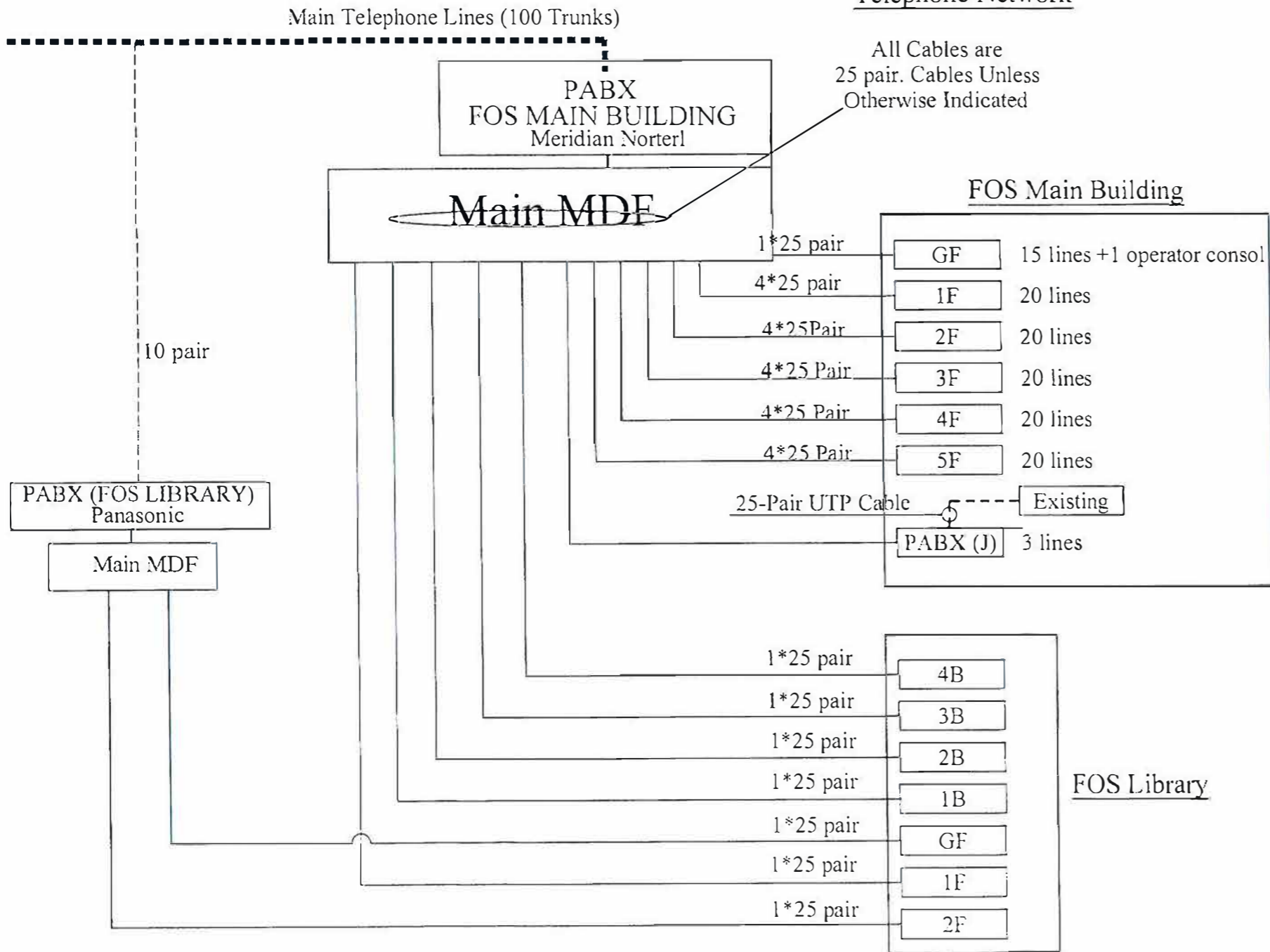


GENERAL NOTES

WORK PARCEL 3 : PLANTS AND NETWORKS  
 3.2 : SCHEMATIC DIAGRAM OF SYSTEMS  
 3.2.7-b: TELEPHONE DISTRIBUTION NETWORK  
 FACULTY OF SCIENCES MAIN BUILDING AND LIBRARY

BUILDING: EXTERNAL

Telephone Network



Equipment Per Building

+ 100 Trunks  
 PABX (FOS MAIN BUILDING): 160ATL + 16 DTL (SOFO iS3090)  
 PABX (FOS LIBRARY): 256 ATL + 16 DTL

LEGEND AND ACCESSORIES

GENERAL NOTES

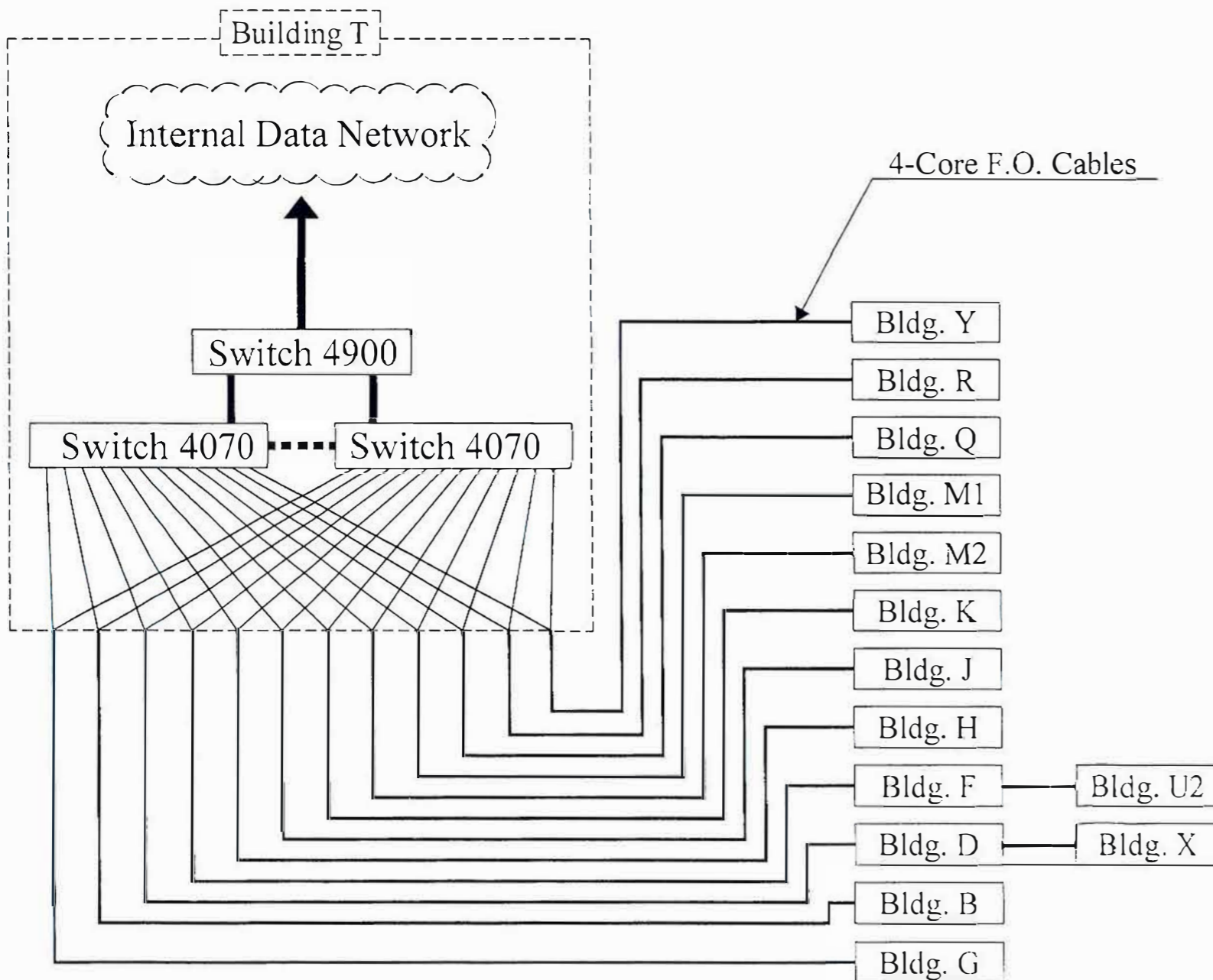
WORK PARCEL 3 : PLANTS AND NETWORKS  
 3.2 : SCHEMATIC DIAGRAM OF SYSTEMS  
 3.2.8-a: DATA DISTRIBUTION NETWORK

EXCLUDING FACULTY OF SCIENCES MAIN BUILDING, LIBRARY, & OLD CAFETERIA

BUILDING: EXTERNAL

LEGEND AND ACCESSORIES

Data Network



Equipment Per Building

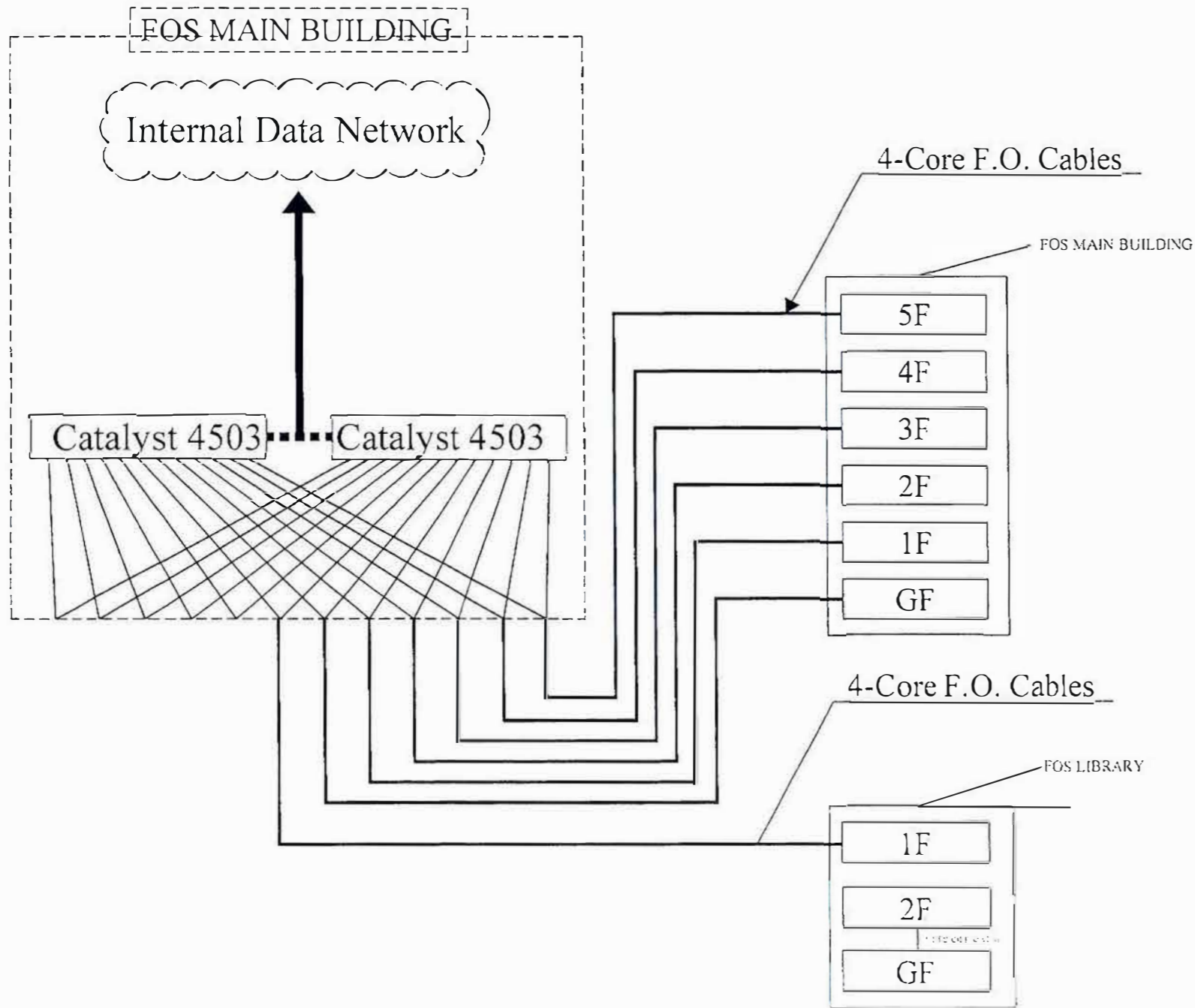
- Bldg Y: 1×(Switch 4900) + 4×(Switch 4400)
- Bldg X: 1×(Switch 4400)
- Bldg U2: 1×(Switch 4400)
- Bldg R: 1×(Switch 4400)
- Bldg Q: 1×(Switch 4900) + 8×(Switch 4400)
- Bldg M1: 1×(Switch 4900) + 7×(Switch 4400)
- Bldg M2: 1×(Switch 4900) + 5×(Switch 4400)
- Bldg K: 1×(Switch 4900) + 2×(Switch 4400)
- Bldg H: 1×(Switch 4900) + 4×(Switch 4400)
- Bldg F: 1×(Switch 4900) + 3×(Switch 4400)
- Bldg D: 1×(Switch 4900) + 16×(Switch 4400)
- Bldg J: 1×(Switch 4900) + 8×(Switch 4400)
- Bldg G: 1×(Switch 4900) + 20×(Switch 4400)
- Bldg B: 1×(Switch 4070) + 21×(Switch 4400)
- Bldg T: 2×(Switch 4070) + 1×(Switch 4900)  
+ 1×(Switch 4400)

GENERAL NOTES

WORK PARCEL 3 : PLANTS AND NETWORKS  
 3.2 : SCHEMATIC DIAGRAM OF SYSTEMS  
 3.2.8-b: DATA DISTRIBUTION NETWORK  
 FACULTY OF SCIENCES MAIN BUILDING AND LIBRARY

BUILDING: EXTERNAL

Data Network



Equipment Per Building

Bldg OFS: 12×(Switch 2950) + 1×(Switch 2960)

LEGEND AND ACCESSORIES

GENERAL NOTES

WORK PARCEL 3 : PLANTS AND NETWORKS

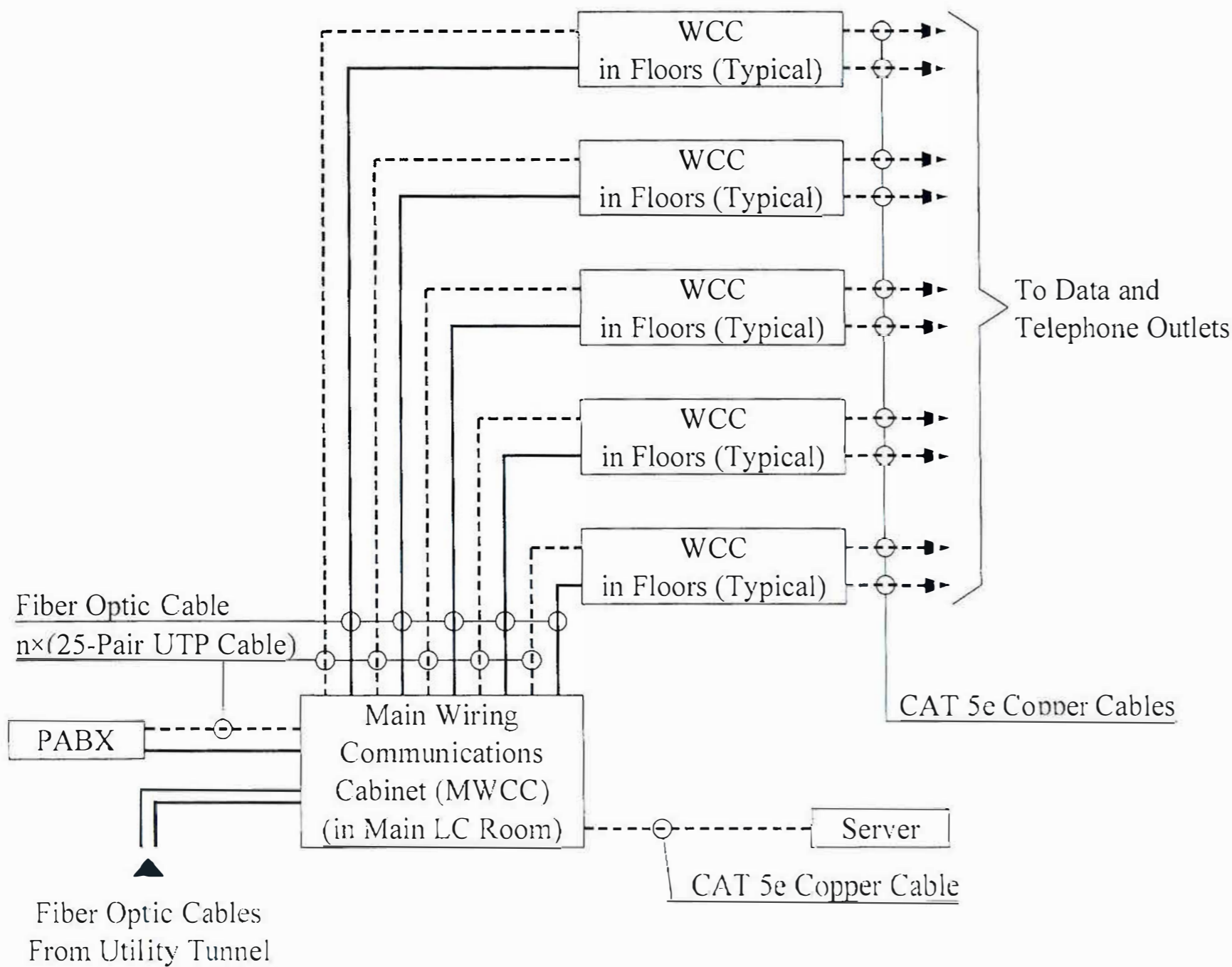
3.2 : SCHEMATIC DIAGRAM OF SYSTEMS

3.2.9: TELEPHONE AND DATA SYSTEMS INTERCONNECTIVITY

BUILDING: ALL

LEGEND AND ACCESSORIES

Access Control Network



Notes

MWCC Contains:

1. Faculty Switch
2. Floor Switch (if Applicable)
3. Fiber Optic Patch Panel
4. RJ45 Patch Panel

WCC Contains:

1. Floor Switch
2. Fiber Optic Patch Panel
3. RJ56 Patch Panel

Notes:

Refer to Telephone System and Data System Schematics for PABX and Data Switch Models in each Building.

GENERAL NOTES

WORK PARCEL 3 : PLANTS AND NETWORKS

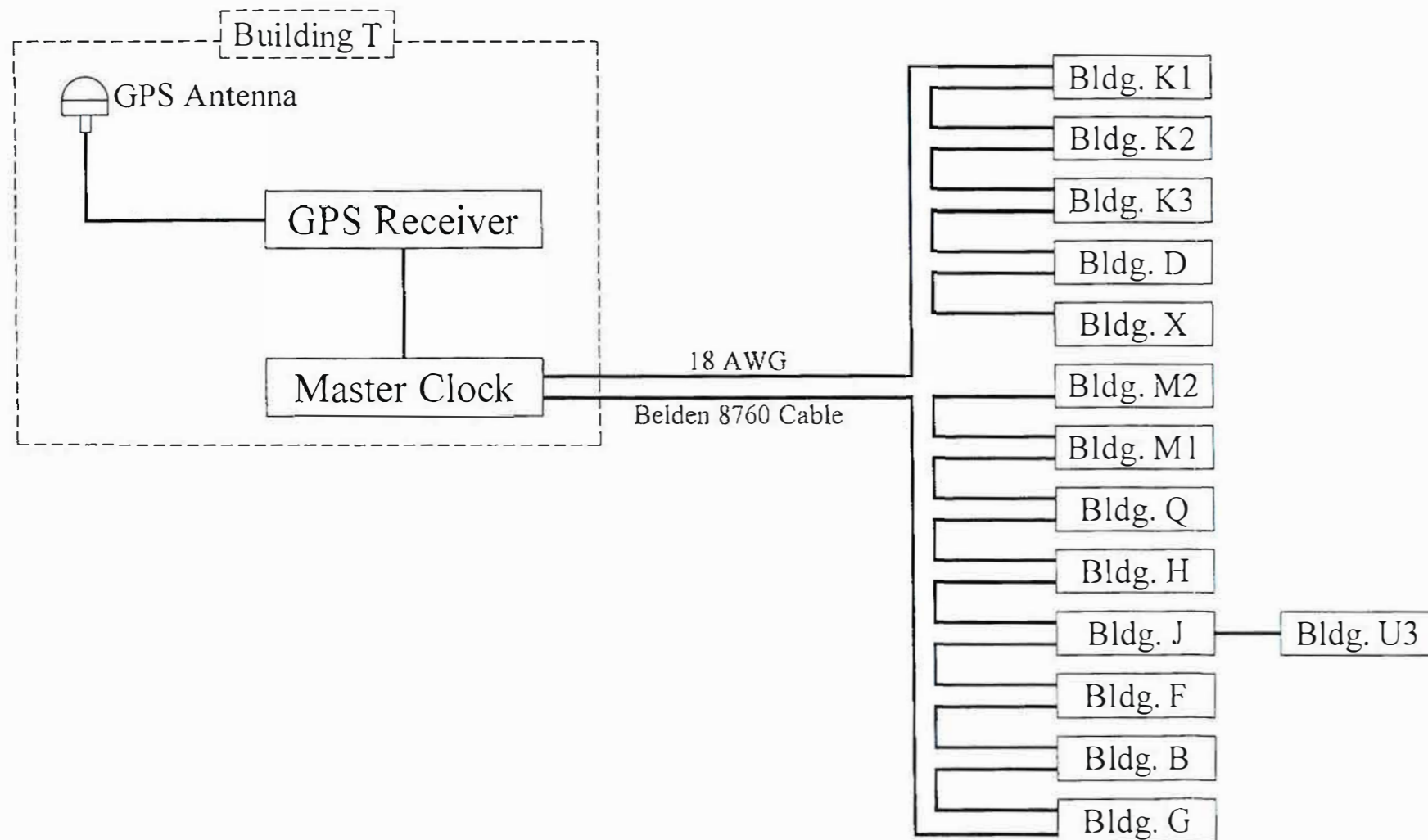
3.2 : SCHEMATIC DIAGRAM OF SYSTEMS

3.2.10: CLOCK SYSTEM

BUILDING: EXTERNAL

LEGEND AND ACCESSORIES

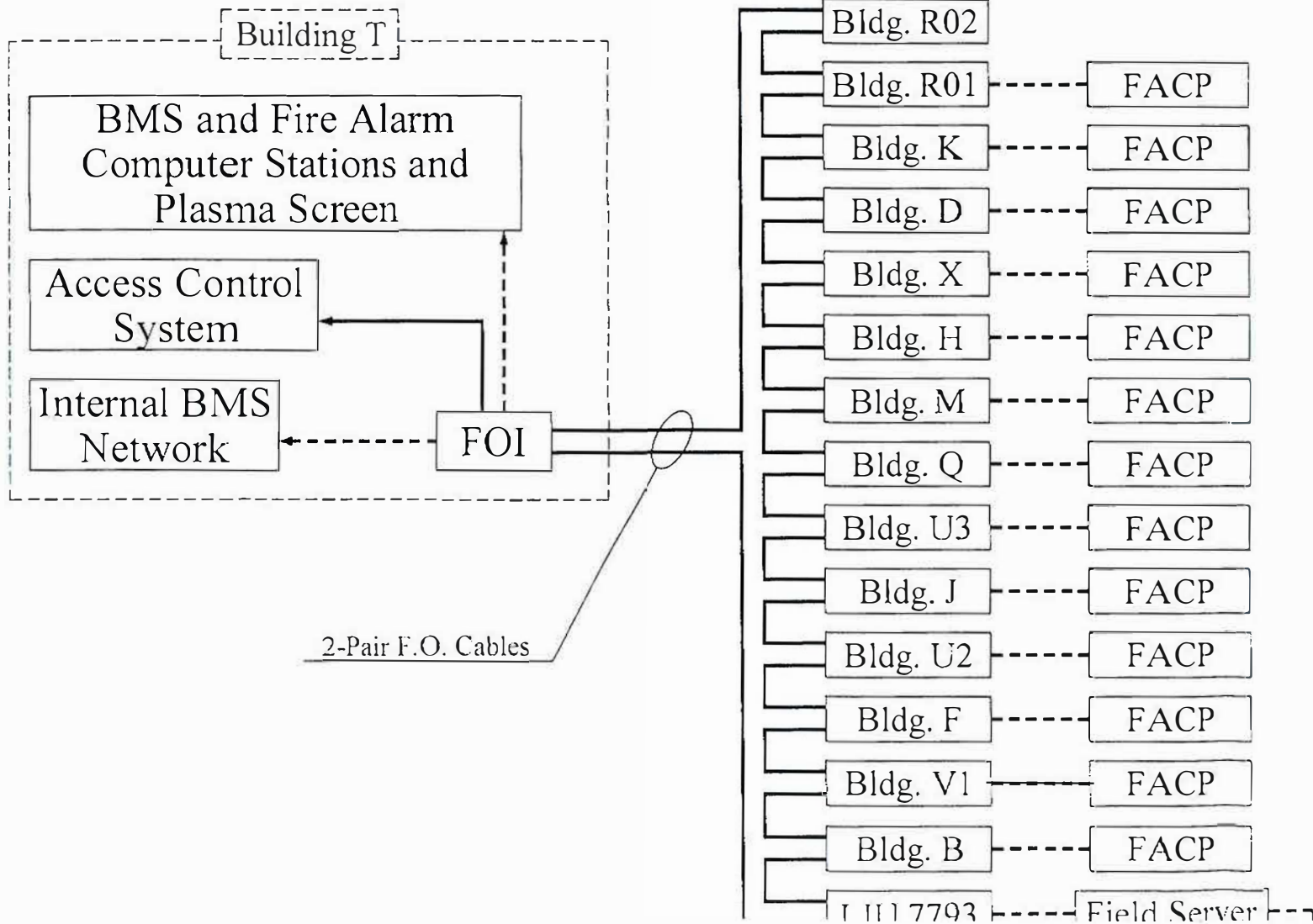
Clock System Network



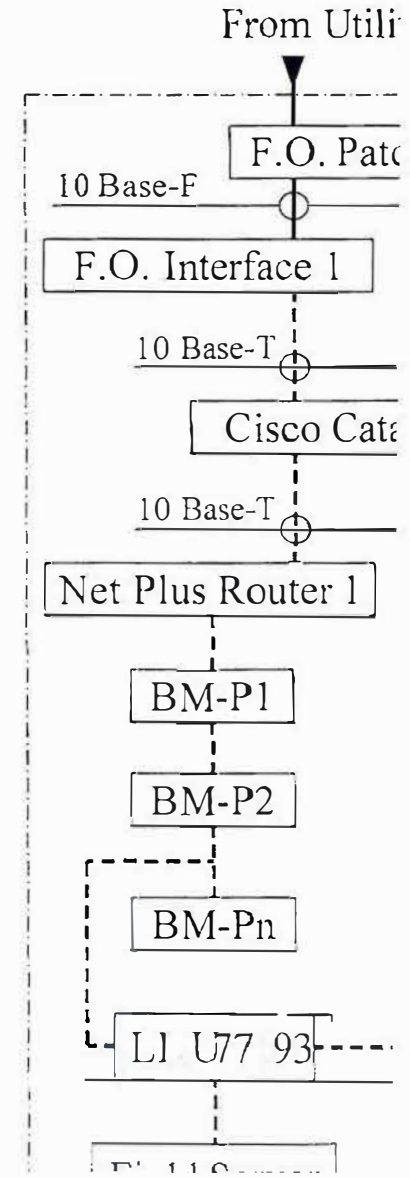
- Bldg. Q: Delta M/S Station (30 Clocks)
- Bldg. K: Alfa M/S Station (5 Clocks)
- Bldg. J: Alfa M/S Station (25 Clocks)
- Bldg. M2: Alfa M/S Station (10 Clocks)
- Bldg. M1: Alfa M/S Station (25 Clocks)
- Bldg. V1: Alfa M/S Station (1 Clock)
- Bldg. X: Alfa M/S Station (10 Clocks)
- Bldg. U3: Alfa M/S Station (25 Clocks)
- Bldg. H: Alfa M/S Station (15 Clocks)
- Bldg. F: Alfa M/S Station (15 Clocks)
- Bldg. D: Delta M/S Station (40 Clocks)
- Bldg. B: Alfa M/S Station (20 Clocks)
- Bldg. G: Alfa M/S Station (26 Clocks)
- Bldg. T: Microquartz Master Clock (15 Clocks)

GENERAL NOTES

### Building Management System Network

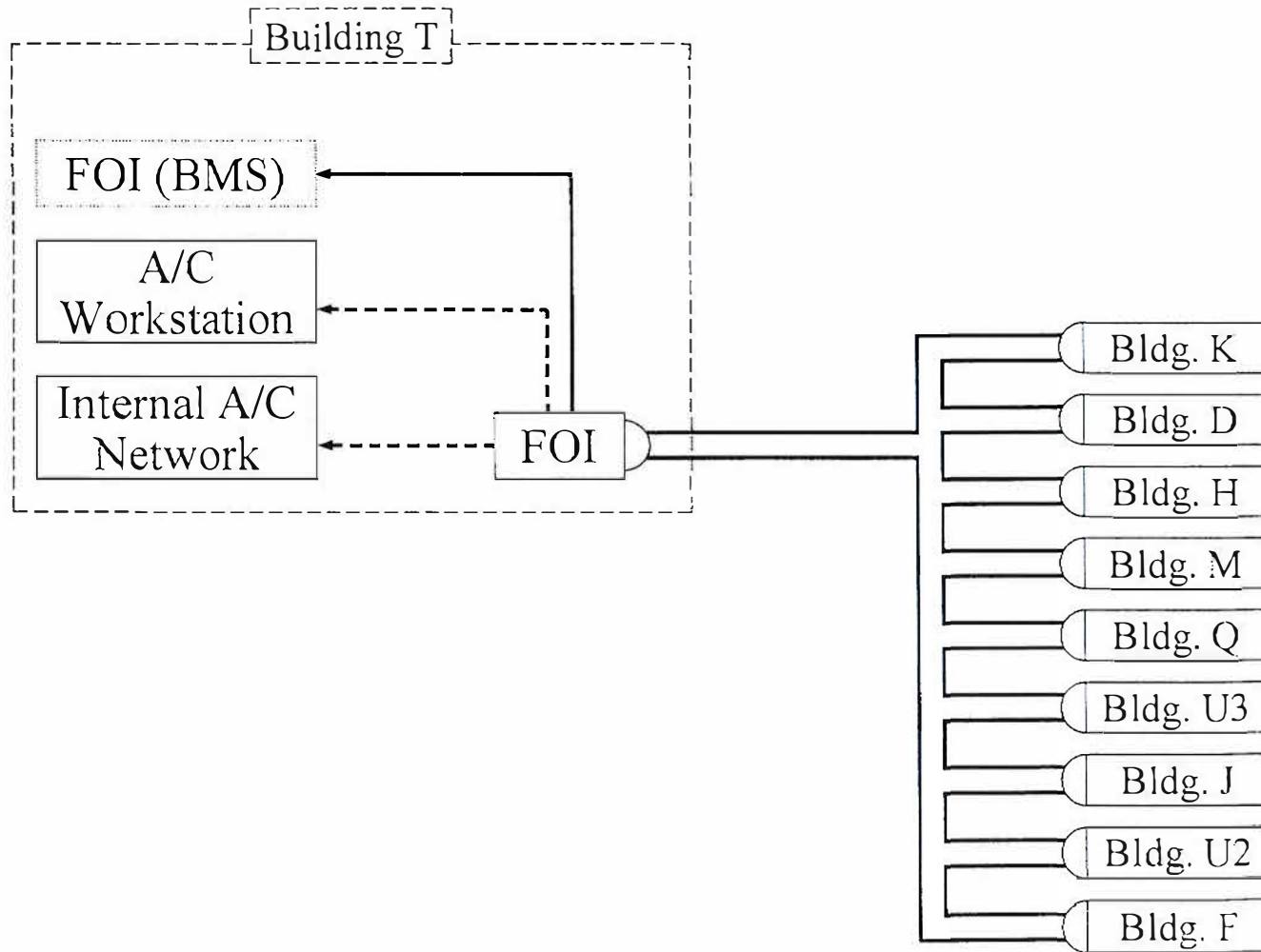


### Typical Configuration

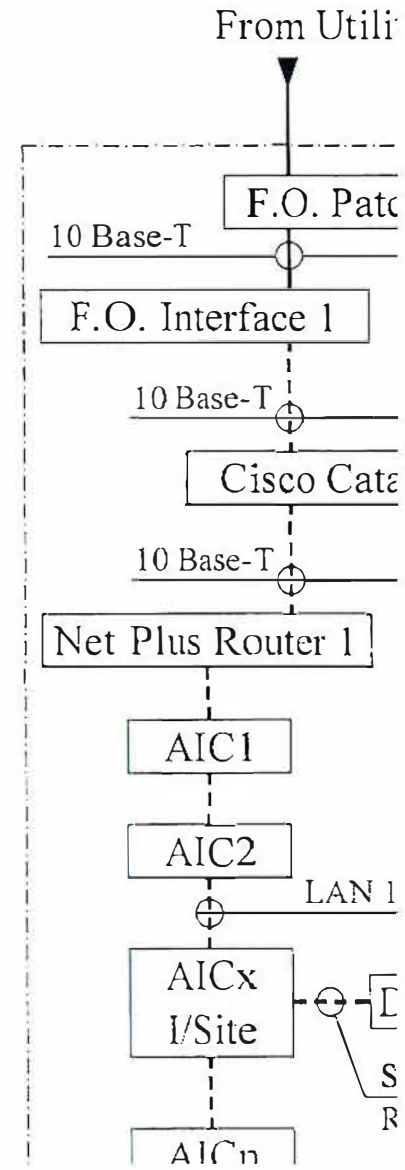




### Access Control Network



### Typical Configuration



## Lebanese University Campus - Hadath

### 3.3 - Work Parcel 3 - List of Equipment per System

#### 3.3.1 - Mechanical

##### Chilled Water System

	Items	Capacity	Qty	Technical Description	Maintenance Instructions In Operation and Maintenance Manuals Listed in Appendix 3.5.1
1	Chiller	2000 Tons	5	Centrifugal, water cooled type, R134 refrigerant Entering CHW temp: 14.4 C Leaving CHW temp: 5.5 c	✓
2	Cooling Tower	378.5 Lps @ 34.14 MWG	5	Induced draft crossflow vertical air discharge - Glass reinforced polyester- PVC mills Inlet water temp: 35 C Leaving water temp: 29.44 C Drift loss percent of circulation flow : 0.004%	✓
3	Chillers pumps P-T1-2	189.7 Lps @ 34.14 MWG	6	Horizontal Split case centrifugal	✓
4	Condensers pumps P-T1-1	378.6 Lps @ 28 MWG	6	Horizontal Split case centrifugal	✓
5	Water Softners	6800 liters	4	Duplex Type Resine cap. = 25 liters per bag 40 bags per ballet	✓
6	Make-up water pumps PM-T1-1	35.6 Lps @ 11.08 MWG	2	Submersible pumps	✓
7	Expansion Tanks	5000 liters	3	Diaphragm type complete with pumping unit	✓
8	Piping system and insulation			Preinsulated black steel pipes with Dia 125mm up to 1000 mm	✓
9	Valves and accessories			Gate valves from Dia. 125 mm up to Dia. 400 mm	✓
				Globe valves from Dia. 125 mm up to Dia. 400 mm	✓
				Check valves from Dia. 125 mm up to Dia. 400 mm	✓
				Motorized Butterfly valves from Dia. 250 mm up to Dia. 400 mm	✓
				Strainers from Dia. 125 mm up to Dia. 400 mm	✓

**Lebanese University Campus - Hadath**

**3.3 - Work Parcel 3 - List of Equipment per System**

**3.3.1 - Mechanical**

**Hot Water System**

	Items	Capacity	Qty	Technical Description	Maintenance Instructions In Operation and Maintenance Manuals Listed in Appendix 3.5.1
1	Boiler	1000 BHP	4	Fuel oil #2 operated boilers Entering water temp: 70C Leaving water temp: 95 C Complete with air compressors	✓
2	Boilers pumps P-T1-3	93.7 Lps @ 30.2 MWG	5	Horizontal Split case centrifugal	✓
3	Fuel oil pump for boilers FP-T1-2	2.2 Lps @ 8 MWG	2	End suction centrifugal	✓
4	Expansion Tanks	5000 LTr	6	Diaphragm type complete with pumping unit and accumulator vessel of 1000 liters in volume	✓
5	Gas Cylinders		2		✓
6	Piping system and insulation			Preinsulated black steel pipes with Dia 80 mm up to 400 mm	✓
7	Valves and accessories			Gate valves from Dia. 80 mm up to Dia. 250 mm	✓
				Globe valves from Dia. 80 mm up to Dia. 250 mm	
				Check valves from Dia. 80 mm up to Dia. 250 mm	
				Motorized Butterfly valves from Dia. 125 mm up to Dia. 250 mm	
				Strainers from Dia. 80 mm up to Dia. 250 mm	

**Lebanese University Campus - Hadath****3.3 - Work Parcel 3 - List of Equipment per System****3.3.1 - Mechanical****Water Supply System**

	Items	Capacity	Qty	Technical Description	Maintenance Instructions In Operation and Maintenance Manuals Listed in Appendix 3.5.1
1	Submersible Well Pumps		4		✓
2	Domestic Water Pumps	90 lps @ 65 mwg	3	Split case centrifugal	✓
3	Drinking Water Pumps	3 lps @ 65 mwg	3	Vertical Multistage	✓
4	Reverse Osmosis System (Potable Water System)	150 m <sup>3</sup> /day	1	Complete with calcium hypochlorite feed system, dual media filters, dechlorination system, antiscalant system, cartridge system, high pressure pumps, pressure vessel membrane, and all required accessories	✓
5	Reverse Osmosis System (Domestic & Irrigation Water System)	600 m <sup>3</sup> /day	2	Complete with calcium hypochlorite feed system, dual media filters, dechlorination system, antiscalant system, cartridge system, high pressure pumps, pressure vessel membrane, and all required accessories	✓
6	Chlorination System for domestic water system		2	Complete with chlorine cylinders, vacuum regulators, automatic switch over, Remote Meter, automatic valve, ejector, booster pumps and all required accessories	✓

**Lebanese University Campus - Hadath**

**3.3 - Work Parcel 3 - List of Equipment per System**

**3.3.1 - Mechanical**

**Water Supply System**

	Items	Capacity	Qty	Technical Description	Maintenance Instructions In Operation and Maintenance Manuals Listed in Appendix 3.5.1
7	Chlorination System for potable water system		2	Complete with chlorine cylinders, vacuum regulators, automatic switch over, Remote Meter, automatic valve, ejector, booster pumps and all required accessories	✓
8	Submersible Pumps for sump pit drainage		2		✓
9	Piping System			Black Steel Epoxy Coated pipes from Dia. 50 mm up to Dia. 350 mm	✓
10	Valves and Accessories			Ductile Iron Check valves from Dia. 80 mm up to Dia. 300 mm	✓
				Ductile Iron Motorized Butterfly valves from Dia. 80 mm up to Dia. 350 mm	
				Ductile Iron Pressure Relief Valves from Dia. 80 mm up to Dia. 150 mm	
				Ductile Iron Strainers from Dia. 80 mm up to Dia. 300 mm	
				Pilote Control Valves from Dia. 80 mm up to Dia. 300 mm	
				PVC Ball valves from Dia 50 mm up to Dia. 100 mm	
				PVC Check valves from Dia 50 mm up to Dia. 100 mm	
				PVC Strainers from Dia 50 mm up to Dia. 100 mm	

**Lebanese University Campus - Hadath**

**3.3 - Work Parcel 3 - List of Equipment per System**

**3.3.1 - Mechanical**

**Storm Water Pumping Station**

	Items	Capacity	Qty	Technical Description	Maintenance Instructions In Operation and Maintenance Manuals Listed in Appendix 3.5.1
1	Submersible Pumps	154 lps @ 14 mwg	4		✓
2	Piping system			PVC pipes Dia. 300 mm inside the pumping station	✓
				GRP pipes Dia. 500 mm discharge pipe from pumping station to the discharge manhole	
3	Valves and Accessories			Cast Iron Gate valve Dia. 300 mm	✓
				Cast Iron Check valve Dia. 300 mm	

**Gas Supply System**

	Items	Capacity	Qty	Technical Description	Maintenance Instructions In Operation and Maintenance Manuals Listed in Appendix 3.5.1
1	Gas tanks	5000 liters	4		✓
2	Piping system			Black Steel pipe from 25 mm up to 50 mm	✓

**Lebanese University Campus - Hadath**

**3.3 - Work Parcel 3 - List of Equipment per System**

**3.3.2 - Electrical**

**Medium Voltage  
(Building T)**

	Items	Capacity	Qty	Technical Description	Maintenance Instruction Provided in Operation and Maintenance Manuals Listed in Appendix No: 3.5.1
1	Transformer 20/6.6 kV	1600 kVA	5	20kV/6.6kV, D/D connection, 50HZ, oil type	✓
2	Transformer 11/20 kV	10 MVA	2	11kV/20kV, D/D connection, 50HZ, oil type	
3	Transformer 20/0.4 kV	1600 kVA 1250 kVA	1 1	20kV/0.4kV, D/Y connection, 50HZ, oil type	
4	Step-Up Transformer	2000 kVA	4	0.4/20kV, Y/D connection, 50HZ, oil type	
5	MV Switchgear	16 MV Cells	1	Including protection and metering devices	✓
6	RMU for Chillers	1 Inc. Cell 4 Out. Cells	1	Including Protection Devices	
7	RMU for Chillers	1 Inc. Cell 3 Out. Cells	1	Including Protection Devices	
8	Generator	1850 kVA	4	Diesel with Remote Radiator	✓
9	Synchronizing Panel	5 Generators	1	PLC Controlled	✓

**Emergency Power Supply  
Faculty of Science Main Building, Library, & Old Cafeteria**

	Items	Capacity	Qty	Technical Description	Maintenance Instruction Provided in Operation and Maintenance Manuals Listed in Appendix No: 3.5.1
1	Generator	1000 kva	2	Diesel Genset	✗
2	Generator	250 KVA	1	Diesel Genset	✗

## Lebanese University Campus - Hadath

### 3.3 - Work Parcel 3 - List of Equipment per System

#### 3.3.2 - Electrical

#### Telephone System (Excluding Faculty of Science Main Building, Library, & Old Cafeteria)

	Items	Capacity	Qty	Technical Description	Maintenance Instruction Provided in Operation and Maintenance Manuals Listed in Appendix No: 3.5.1
1	Main EPABX	3×E1 Links to PSTN 1×E1 Link to Existing	1	Main PABX of campus	✓
2	PABX Building D	240 A + 15 D	1	Building PABX	✓
3	PABX Building R	1280 A + 16 D	1		
4	PABX Building Q	176 A + 15 D	1		
5	PABX Building F	32 A + 15 D	1		
6	PABX Building B	128 A + 15 D	1		
7	PABX Building U	96 A + 15 D	1		
8	PABX Building J	36 A + 15 D	1		
9	PABX Building M1	40 A + 15 D	1		
10	PABX Building M2	40 A + 15 D	1		
11	PABX Building H	128 A + 15 D	1		
12	PABX Building K	128 A + 15 D	1		
13	PABX Building G	240 A + 15 D	1		
14	Telephone Outlets (D)		110		
15	Telephone Outlets (R01)		790		
16	Telephone Outlets (R02)		390		
17	Telephone Outlets (Q)		259		
18	Telephone Outlets (F)		82		
19	Telephone Outlets (B)		222		
20	Telephone Outlets (U2)		43		
21	Telephone Outlets (U3)		2		
22	Telephone Outlets (V1)		3		
23	Telephone Outlets (V3)		3		
24	Telephone Outlets (J)		57		
25	Telephone Outlets (M1)		81		
26	Telephone Outlets (M2)		28		
27	Telephone Outlets (M3)		116		
28	Telephone Outlets (H)		199		
29	Telephone Outlets (K)		15		
30	Telephone Outlets (X)		12		
31	Telephone Outlets (T)		67		
32	Telephone Outlets (G)		209		

#### Telephone System Faculty of Science Main Building, Library, & Old Cafeteria

	Items	Capacity	Qty	Technical Description	Maintenance Instruction Provided in Operation and Maintenance Manuals Listed in Appendix No: 3.5.1
1	FOS Main Building EPABX/Nortel NT8D09	160 A + 16 D	1	Main PABX of FOS(4 incoming lines, 4 outgoing lines)	✓
2	PABX FOS Library	256 A + 16 D	1	Building PABX	✘
3	Telephone Outlets (FOS)		384	RJ11 Outlets	✘



## Lebanese University Campus - Hadath

### 3.3 - Work Parcel 3 - List of Equipment per System

#### 3.3.2 - Electrical

#### Data System (Excluding Faculty of Science Main Building, Library, & Old Cafeteria)

	Items	Capacity	Qty	Technical Description	Maintenance Instruction Provided in Operation and Maintenance Manuals Listed in Appendix No: 3.5.1																								
1	Main Wiring Comm. Cabinet	2×4070 1×4900	1	Gigabit Ethernet Switches	✓																								
2	Wiring Communications Cabinets (R)	1×4400	1		Gigabit Ethernet Switches	✓																							
3	Wiring Communications Cabinets (Q)	1×4900 9×4400	2				Gigabit Ethernet Switches	✓																					
4	Wiring Communications Cabinets (M1)	8×4400	1						Gigabit Ethernet Switches	✓																			
5	Wiring Communications Cabinets (M2)	1×4900 5×4400	1								Gigabit Ethernet Switches	✓																	
6	Wiring Communications Cabinets (K)	1×4900 2×4400	1										Gigabit Ethernet Switches	✓															
7	Wiring Communications Cabinets (J)	1×4900 8×4400	1												Gigabit Ethernet Switches	✓													
8	Wiring Communications Cabinets (H)	1×4900 4×4400	1														Gigabit Ethernet Switches	✓											
9	Wiring Communications Cabinets (F)	1×4900 3×4400	1																Gigabit Ethernet Switches	✓									
10	Wiring Communications Cabinets (U2)	1×4400	1																		Gigabit Ethernet Switches	✓							
11	Wiring Communications Cabinets (D)	1×4900 16×4400	1																				Gigabit Ethernet Switches	✓					
12	Wiring Communications Cabinets (X)	1×4400	1																						Gigabit Ethernet Switches	✓			
13	Wiring Communications Cabinets (B)	1×4070 22×4400	2																								Gigabit Ethernet Switches	✓	
14	Wiring Communications Cabinets (G)	1×4900 20×4400	1																										Gigabit Ethernet Switches
15	Data Outlets (T)		29	RJ45 Outlets																									
16	Data Outlets (R01)		35		RJ45 Outlets	✓																							
17	Data Outlets (Q)		363				RJ45 Outlets	✓																					
18	Data Outlets (M1)		257						RJ45 Outlets	✓																			
19	Data Outlets (M2)		20								RJ45 Outlets	✓																	
20	Data Outlets (M3)		184										RJ45 Outlets	✓															
21	Data Outlets (K)		11												RJ45 Outlets	✓													
22	Data Outlets (J)		242														RJ45 Outlets	✓											
23	Data Outlets (H)		215																RJ45 Outlets	✓									
24	Data Outlets (F)		48																		RJ45 Outlets	✓							
25	Data Outlets (U2)		10																				RJ45 Outlets	✓					
26	Data Outlets (D)		137																						RJ45 Outlets	✓			
27	Data Outlets (X)		9																								RJ45 Outlets	✓	
28	Data Outlets (B)		424																										RJ45 Outlets
29	Data Outlets (G)		402	RJ45 Outlets																									
30	Data Outlets (V1)		3		RJ45 Outlets	✓																							
31	Data Outlets (V3)		1				RJ45 Outlets	✓																					

#### Data System Faculty of Science Main Building, Library, & Old Cafeteria

	Items	Capacity	Qty	Technical Description	Maintenance Instruction Provided in Operation and Maintenance Manuals Listed in Appendix No: 3.5.1
1	Wiring Communications Cabinets (FOS)	Catalyst 2950 1 x 24 Port	12	Gigabit Ethernet Switches	✘
2	Data Outlets (FOS)		490	RJ45 Outlets	✘

**Lebanese University Campus - Hadath**

**3.3 - Work Parcel 3 - List of Equipment per System**

**3.3.2 - Electrical**

**Clock System**

	Items	Capacity	Qty	Technical Description	Maintenance Instruction Provided in Operation and Maintenance Manuals Listed in Appendix No: 3.5.1
1	Central Station (T)	GPS Antenna GPS Receiver Master Clock	1	Microquartz Master Clock Synchronizes with all slave clocks in buildings	✓
2	M/S Station (Q)		1	Delta Type	✓
3	M/S Station (K)		1	Alfa Type	
4	M/S Station (J)		1	Alfa Type	
5	M/S Station (M2)		1	Alfa Type	
6	M/S Station (M1)		1	Alfa Type	
7	M/S Station (V1)		1	Alfa Type	
8	M/S Station (X)		1	Alfa Type	
9	M/S Station (U3)		1	Alfa Type	
10	M/S Station (H)		1	Alfa Type	
11	M/S Station (F)		1	Alfa Type	
12	M/S Station (D)		1	Delta Type	
13	M/S Station (B)		1	Alfa Type	
14	M/S Station (G)		1	Alfa Type	
15	Slave Clocks (T)		15	Dial Type Clock	
16	Slave Clocks (Q)		30		
17	Slave Clocks (K)		5		
18	Slave Clocks (J)		25		
19	Slave Clocks (M2)		10		
20	Slave Clocks (M1)		25		
21	Slave Clocks (V1)		1		
22	Slave Clocks (X)		10		
23	Slave Clocks (U3)		25		
24	Slave Clocks (H)		15		
25	Slave Clocks (F)		15		
26	Slave Clocks (D)		40		
27	Slave Clocks (G)		26		
28	Slave Clocks (B)		20		

## Lebanese University Campus - Hadath

### 3.3 - Work Parcel 3 - List of Equipment per System

#### 3.3.2 - Electrical

#### Access Control System

	Items	Capacity	Qty	Technical Description	Maintenance Instruction Provided in Operation and Maintenance Manuals Listed in Appendix No: 3.5.1
1	Central Station (T)		1	Includes Work Station	✓
2	A/C Controller (D)		5	Controls all Access Control Functions in Association with Points Obtained from Door Contact Units and Parking Barriers	✓
3	A/C Controller (H)		2		
4	A/C Controller (M)		7		
5	A/C Controller (Q)		16		
6	A/C Controller (J)		5		
7	A/C Controller (U2)		1		
8	A/C Controller (R01)		2		
9	A/C Controller (R02)		1		
10	A/C Controller (B)		10		
11	A/C Controller (F)		3		
12	A/C Controller (U3)		1		
13	Door Contact Unit (K)		2	Piezzo Electric Sensor installed on doors to initiate alarm upon intrusion detection	✓
14	Door Contact Unit (D)		7		
15	Door Contact Unit (H)		13		
16	Door Contact Unit (M)		52		
17	Door Contact Unit (Q)		31		
18	Door Contact Unit (J)		36		
19	Door Contact Unit (U2)		42		
20	Door Contact Unit (R01)		43		
21	Door Contact Unit (R02)		11		
22	Door Contact Unit (B)		108		
23	Door Contact Unit (F)		16	Includes barriers, card readers, detection loops.	✓
24	Parking Entry Sys. (D)		2		
25	Parking Entry Sys. (H)		2		
26	Parking Entry Sys. (M)		2		
27	Parking Entry Sys. (U3)		8		
28	Parking Entry Sys. (F)		1	Bells go off in case of intrusion.	✓
29	Parking Entry Sys. (G)		1		
30	Intrusion Bell (D)		2		
31	Intrusion Bell (H)		4		
32	Intrusion Bell (M)		3		
33	Intrusion Bell (Q)		6		
34	Intrusion Bell (J)		2		
35	Intrusion Bell (U2)		2		
36	Intrusion Bell (R01)		7	Keyed Station for Tour System	✓
37	Intrusion Bell (R02)		2		
38	Intrusion Bell (F)		1		
39	Watchman Pat. Station (D)		35		
40	Watchman Pat. Station (H)		18		
41	Watchman Pat. Station (M)		47		
42	Watchman Pat. Station (Q)		29		
43	Watchman Pat. Station (J)		10		
44	Watchman Pat. Station (U2)		6		
45	Watchman Pat. Station (B)		42		
46	Watchman Pat. Station (F)		18		
47	Watchman Pat. Station (G)		17		

**Lebanese University Campus - Hadath**

**3.3 - Work Parcel 3 - List of Equipment per System**

**3.3.2 - Electrical**

**Building Management System**

	Items	Capacity	Qty	Technical Description	Maintenance Instruction Provided in Operation and Maintenance Manuals Listed in Appendix No: 3.5.1
1	Central Station (T)		1	Includes Work Station	✓
2	BMS Controller (T)		13	Controls all Building Mangment Functions in Association with Points Obtained from Sensor Installed at Mechanical and Electrical Equipment	✓
3	BMS Controller (K)		11		
4	BMS Controller (D)		21		
5	BMS Controller (H)		7		
6	BMS Controller (M1)		11		
7	BMS Controller (M2)		5		
8	BMS Controller (M3)		10		
9	BMS Controller (Q)		15		
10	BMS Controller (U3)		2		
11	BMS Controller (J)		6		
12	BMS Controller (U2)		6		
13	BMS Controller (B)		30		
14	BMS Controller (R01)		28		
15	BMS Controller (R02)		12		
16	BMS Controller (V1)		3		
17	BMS Controller (V2)		6		
18	BMS Controller (V3)		2		
19	BMS Controller (V4)		10		
20	BMS Controller (X)		4		
21	BMS Controller (F)		4		
22	BMS Controller (G)		34		
23	Sensors (T)		237		
24	Sensors (K)		108		
25	Sensors (D)		336		
26	Sensors (H)		140		
27	Sensors (M1)		151		
28	Sensors (M2)		75		
29	Sensors (M3)		151		
30	Sensors (Q)		227		
31	Sensors (U3)		29		
32	Sensors (J)		205		
33	Sensors (U2)		127		
34	Sensors (B)		501		
35	Sensors (R01)		311		
36	Sensors (R02)		77		
37	Sensors (V1)		41		
38	Sensors (V2)		113		
39	Sensors (V3)		28		
40	Sensors (V4)		12		
41	Sensors (X)		94		
42	Sensors (F)		130		
43	Sensors (G)		298		

**Lebanese University Campus - Hadath**

**3.3 - Work Parcel 3 - List of Equipment per System**

**3.3.2 - Electrical**

**Building Management System**

	Items	Capacity	Qty	Technical Description	Maintenance Instruction Provided in Operation and Maintenance Manuals Listed in Appendix No: 3.5.1
44	Actuators (T)		60	Valve and Damper Actuators	✓
45	Actuators (K)		9		
46	Actuators (D)		99		
47	Actuators (H)		59		
48	Actuators (M1)		42		
49	Actuators (M2)		21		
50	Actuators (M3)		42		
51	Actuators (Q)		81		
52	Actuators (J)		73		
53	Actuators (U2)		19		
54	Actuators (B)		162		
55	Actuators (R01)		49		
56	Actuators (R02)		15		
57	Actuators (V2)		19		
58	Actuators (F)		29		
59	Actuators (G)		114	Dry Contacts installed at relays, contactors, breakers, etc...	✓
60	Dry Contacts (T)		594		
61	Dry Contacts (K)		332		
62	Dry Contacts (D)		671		
63	Dry Contacts (H)		367		
64	Dry Contacts (M1)		335		
65	Dry Contacts (M2)		167		
66	Dry Contacts (M3)		335		
67	Dry Contacts (Q)		555		
68	Dry Contacts (U3)		80		
69	Dry Contacts (J)		321		
70	Dry Contacts (U2)		350		
71	Dry Contacts (B)		872		
72	Dry Contacts (R01)		2494		
73	Dry Contacts (R02)		853		
74	Dry Contacts (V1)		125		
75	Dry Contacts (V2)		364		
76	Dry Contacts (V3)		82		
77	Dry Contacts (V4)		240		
78	Dry Contacts (X)		273		
79	Dry Contacts (F)		318		
80	Dry Contacts (G)		713		

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## **Lebanese University Campus - Hadath**

### **3.4 - Work Parcel 3 - Scope of Work**

#### **3.4.1 - GENERAL DESCRIPTION OF SCOPE**

##### **Technical Scope of Work: Operation**

- 1- Compliance with the requirements of the Contract Documents.
- 2- Ensuring that the systems operation as described in Section 3.1 takes place without any faults, defects, shortages or interruption.
- 3- Contractor shall be responsible for the coordination with the Lebanese University buildings managements in order to operate the systems described in Work Parcel 3 as per the academic time schedules planned for each buildings.
- 4- Providing the consumables necessary for the operation of all systems described in Section 3.1
- 5- Contractor shall be responsible for keeping systems running satisfactorily to perform their designed functions optimally such as:
  - a- Perfect attainment of temperatures with minimum noise and vibration levels and optimized consumption of power, fuel and water.
  - b- Control of priority contactors in case of emergency to provide maximum services to buildings using the available resources.
  - c- Monitoring and control of domestic and potable water quality, in order to comply with the given technical requirements.
  - d- Control of electro-mechanical equipment via the building management system by keeping the key parameters (equipment, load shedding, monitoring, etc...) effective.
  - e- Ensure that the emergency power plant comes on line automatically upon EDL power failure.
- 6- Contractor shall be responsible to provide regular reports (quarterly) showing the consumption of main consumables (such as chemicals, water, fuel, gas etc...), and to establish whether this consumption is optimized. If it is not, the Contractor is to identify causes and propose remedial actions.
- 7- Contractor shall be responsible to operate the systems taking into account the energy saving measures as for and non-restricted to the following:
  - a- Planning and updating the schedules for operation of systems according to the results of the reports mentioned in paragraph 5 above.
  - b- Other energy saving measures as for fuel, gas, and water consumptions, should be evaluated and implemented where approved by the Employer Representative for efficient operation.
- 8- The Contractor is responsible to coordinate with the local Authorities in case of power failure or loss of telephone lines.

##### **Technical Scope of Work: Maintenance**

- 1- Contractor is responsible to perform all the preventive (routine) and corrective maintenance (emergency), (as defined in the O&M manuals), cleaning and restoration (painting, welding, minor repairs, corrosion protection) of Electro-mechanical equipment which are defined in the Contract documents.
- 2- All works should be performed in accordance with the manufacturer's recommendations and /or as stipulated in the appendices.

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## **Lebanese University Campus - Hadath**

### **3.4 - Work Parcel 3 - Scope of Work**

- 3- Reporting:  
The contractor shall be responsible to provide regular (quarterly) reports showing the maintenance works executed, along with suggestions for future maintenance tasks, status of equipment, frequency and analysis of troubleshooting.
- The contractor shall be responsible to provide emergency reports for problems that may occur. These reports shall contain description of the problem, corrective studies all necessary corrective actions, and budgeting.
- 4- Refer to attached document overleaf for detailed description:

# **Lebanese University Campus-Hadath**

## **3.4 – Work Parcel 3 – Scope of Work**

### **3.4.2 SPECIFIC TASKS RELATED TO SPECIFIC EQUIPMENT**

#### List of sample tasks scheduling for maintenance

<b>3.4.2.1 Concrete, steel, PE Water Tanks.....</b>	<b>2</b>
<b>3.4.2.3 Deep Well Pumps .....</b>	<b>6</b>
<b>3.4.2.4 Chilled, Heating, Steam, Condensate Systems and Ancillaries .....</b>	<b>8</b>
<b>3.4.2.5 Fuel System.....</b>	<b>9</b>
<b>3.4.2.6 Fuel Oil Pump .....</b>	<b>10</b>
<b>3.4.2.7 Fuel Storage Tanks .....</b>	<b>12</b>
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# **Lebanese University Campus-Hadath**

## **3.4 – Work Parcel 3 – Scope of Work**

### **3.4.2.1 Concrete, steel, PE Water Tanks**

#### **Quarterly**

- Examine and ensure all lids and covers are correctly located.
- Examine overflows and vents for obstructions, leave in free condition, and ensure security of all fixings and supports.
- Examine tanks access ladder for corrosion. Repair and report on condition.
- Test and report on condition of the float valve assembly replace washers and float assembly as required.
- Examine operating water level, ensure correct operation of float valve.
- Examine tank and associated pipe work connections for leaks repair as required.
- Examine and ensure security of pipe supports, brackets and fixings, repair as necessary.

#### **Annually**

- Carry out tasks as detailed for Bi-annually.
  - Test all manually operated valves, ensure full and free travel and correct setting, check for leakage, adjust or repack valve glands as may be required, remove all deposits and lubricate valve stems.
  - Examine all associated pipe work, repairing any damaged sections.
-

# **Lebanese University Campus-Hadath**

## **3.4 – Work Parcel 3 – Scope of Work**

### **3.4.2.2 Water Softeners, Reverse Osmosis and Distiller Plant**

#### **Specific Precautions**

- Review the manual before you start the service process.
- Disconnect all electrical equipment as it applies in the System Manual. Also, in some cases, you may be spilling water on the floor surface area. To protect yourself from electrical shock, disconnect all electrical power.
- Follow the different procedures for depressurising the water treatment system. In some cases, the incoming water needs to be shut off. In other cases, it may be required to shut off the hard water inlet valve, soft water outlet valve and the manual brine valve to the injector. When draining the resin tank, be sure that an adequate drain facility is available for the water flow to prevent flooding or water damage.

#### **Weekly**

- Full inspection of entire plant
- Field measurement of operating conditions
- Checking and calibration of plant instruments.
- Checking performance of plant
- Testing and recording the major water parameter for adherence with processed water control limits.
- Adjusting chemicals for all systems
- Injection of sodium hypochlorite in the various systems.
- Injection of salt for softener.
- Adjusting PH for all systems

#### **Quarterly**

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## **Lebanese University Campus-Hadath**

### **3.4 – Work Parcel 3 – Scope of Work**

- Examine and ensure correct operation of the plant. Report any damage.
- Carry out an analysis of water conditions and adjust the chemical dosing as required to maintain water conditions within the water treatment specialists prescribed limits, record results.
- Report on the stock of the necessary treatment salts, advise on the necessity to re-order premises stock.
  
- Examine all control and isolating valves for full and free travel, check for leakage. Adjust or repack valve glands as may be required.
  
- Ensure correct operation of the timer assembly.

#### **Electrical**

- Ensure correct operation of the control assembly.

#### **Bi-annually**

- Carry out tasks as detailed for Quarterly.
  
- Examine the unit and ensure correct operation of back wash cycle. Adjust controls as per manufacturer's instructions.
  
- Examine all associated pipe work, nuts and olives. Repair replaces any damaged sections.

#### **Electrical**

- Test and ensure correct operation of controllers and associated components. Adjust or recalibrate as necessary.

#### **Annually**

- Carry out tasks as detailed for Bi-annually.
  
  - Examine tanks and vessels, report on their condition. Clean them thoroughly removing all chemical deposits from the unit.
  
  - Ensure the security of drains and overflows and that they are free from obstruction.
  
  - Remove and clean the pilot strainer. Replace if necessary.
-

## **Lebanese University Campus-Hadath**

### ***3.4 – Work Parcel 3 – Scope of Work***

- Remove and clean the brine injector nozzle. Replace if necessary.
  - Strip and clean the injector assembly and filter. Replace any faulty item.
  - Lubricate the controller brining and refill cam faces, all gear teeth, pivots and sliding faces. Report on their condition.
-

# **Lebanese University Campus-Hadath**

## **3.4 – Work Parcel 3 – Scope of Work**

### **3.4.2.3 Deep Well Pumps**

#### **Daily**

- Visually inspect the well and the quality of water. Report findings.
- Verify the perfect operation of the unit. Report any defect.
- Insure that the well is properly covered, Re-fix loose elements. Report as necessary.

#### **Monthly**

- Carry out tasks as detailed under Daily.
- Clean the well. Remove all debris and floating elements.
- Check the floating element. Insure that any object does not obstruct the floating element. (e.g. debris or electrical cable).
- Check the discharge line for any leakage or rust. Report findings.

#### **Electrical**

- Check the control panel for any defect.

#### **Annually**

- Carry out tasks as detailed under Monthly
  - Check pumps bearings. Replace as necessary.
  - Insure proper fixing of the suction bell and filter. Clean or replace as necessary.
  - Inspect the condition of well lines. Report findings. Fix or replace as necessary.
  - Clean the well in deep.
-

# **Lebanese University Campus-Hadath**

## **3.4 – Work Parcel 3 – Scope of Work**

### **Electrical**

- Check all power lines. Replace as necessary.
- Megger test motor windings. Report findings. Fix or replace as necessary.

### **2 yearly**

- Carry out tasks as detailed under Annually.
  - Overhaul the pump.
-

# **Lebanese University Campus-Hadath**

## **3.4 – Work Parcel 3 – Scope of Work**

### **3.4.2.4 Chilled, Heating, Steam, Condensate Systems and Ancillaries**

#### **Monthly**

- Check all exposed pipe work, joints, connections, etc. for leakage or corrosion. Report defect and repair as necessary.
- Check alignment of expansion bellows and lugs where applicable. Report any defects.
- Check guide points for wear and freedom of pipe movement, grease guide rollers as required.

#### **Quarterly**

- Carry out tasks as detailed for Monthly.
- Check all pipe support brackets, hangers, and anchors for security, and tighten as necessary. Report condition.
- Check condition of all insulation and covering, paying particular attention to the integrity of the vapour seal, repair and report any defects.
- Check operation of valves, stop cocks, drain cocks, etc. If operation of valve is stiff, lubricate as necessary, repeat opening and closing until clear, and return valve to its original position.
- Examine all valve gland packing for leakage and adjust or re-pack as required.
- Clean strainer(s).

#### **Annually**

- Carry out tasks as detailed for Quarterly.
  - Check pipe work identification tags remain secure, report any defects.
  - Check for integrity of fire stopping where pipes pass through walls etc. report any defects.
-

# **Lebanese University Campus-Hadath**

## **3.4 – Work Parcel 3 – Scope of Work**

- Re-calibrate pressure and temperature gauges

### **3.4.2.5 Fuel System**

#### **Bi-annually**

- Examine pipe work for leaks and rectify. Reporting any defects, cleaning spillage from premises.
  - Test all manually operated valves, ensure full and free travel, check for leakage, adjust or repack valve glands as may be required, remove all deposits and spillage, lubricating valve stems as necessary.
  - Check operation of solenoid valve. Repair as necessary
  - Examine and ensure security and integrity of all caps and chains, replacing any damaged or missing items.
  - Examine pipe supports where applicable. Check for loose nuts, and tighten as necessary. Report condition of supports and anchors.
-



# **Lebanese University Campus-Hadath**

## **3.4 – Work Parcel 3 – Scope of Work**

### **3.4.2.6 Fuel Oil Pump**

#### **Specific Precautions**

- If pump is dismantled provide warning signs and barriers to prevent injury to personnel.

#### **Monthly**

- Visually examine pump unit and adjacent pipe work together with associated connections for leaks or corrosion. Repair defects, and report findings. Clean spillage from premises.
- Clean flow meters, pressure gauges to make meters register legible.

#### **Quarterly**

- Carry out tasks as detailed for Monthly.
- Test unit operation for any excessive noise or vibration or rough operation. Report findings.
- Examine and record delivery pressure and temperature. Compare with commissioning results. Report any defects
- Examine and test all associated isolation and check valves for full and free travel, checking for leakage or corrosion. Adjust or repack valve glands as required. Lubricate valve stems as necessary, removing all deposits.
- Ensure security of all brackets, supports and fixings.

#### **Pump Bearings**

- Check for inadequate lubrication, or overheated bearings. Inspect lubrication system. Check for leaks or damage in the lubricating pipelines. Repair as necessary.

#### **Piping System**

- Check and ensure correct operation of all flexible connections, repairing or advising on the necessity to replace damaged components.

#### **Electrical**

---

## **Lebanese University Campus-Hadath**

### **3.4 – Work Parcel 3 – Scope of Work**

- Check and ensure correct operation of controls, controllers and switches.

#### **Annually**

- Carry out tasks as detailed for Quarterly.
- Check and tighten as required, report on condition of holding down bolts.

#### **Pump Impeller and Casing**

- Check and ensure that pump inlet is clear and free from obstruction. Thoroughly clean strainer and filter. Replace if necessary.
- Check for deterioration, or corrosion at suction end and filter. Report on condition.
- Clean impeller. Inspect for damage or cracks. Report on condition. Advise on the necessity of any remedial work.
- Check shaft column pipe for presence of liquid being pumped

#### **Electrical**

- Examine and report condition of all associated wiring facility and wiring, ensuring security of terminations.
  - Conduct an earth continuity test. Carry out an insulation resistance test on motor windings. Record data. Advise on necessity of any remedial work.
-

# Lebanese University Campus-Hadath

## **3.4 – Work Parcel 3 – Scope of Work**

### **3.4.2.7 Fuel Storage Tanks**

#### **Special Precaution**

Prior to inspection, make sure that the chamber of the fuel tanks is free from CO or CO<sub>2</sub> gases by using the proper sensing equipment. If such gases are present, report immediately. Do not start inspection until the above problems are solved.

#### **Bi-annually.**

- Examine and ensure all lids and covers are correctly located.
  - Examine overflows and vents for obstructions, leave in free condition; ensure security of all fixings and supports.
  - Examine liquid level; ensure correct operation of level cut-out switches or valves.
  - Examine tank and associated pipe work connections for leaks and repair as required.
  - Check access ladder. Ensure rigidity. Repair and report as necessary.
  - Examine internal conditions of tank. Inspect surfaces for signs of deposits. Report findings.
  - After inspection, replace manhole cover using new gaskets. Clean and grease bolts before replacement.
  - Cleaning is to be carried out when inspection reveals that this is necessary, in order to remove dirt, scale or sludge. This is also necessary to carry out repairs to the tank, fittings or lining.
  - Inspect fixings and linkages of level sensors. Check for damage or corrosion. Report and fix as necessary.
  - Inspect level sensors for damage, or fuel in the air ball. Repair or replace if necessary.
  - Clean any spillage of fuel in the premises.
-

## **Lebanese University Campus-Hadath**

### ***3.4 – Work Parcel 3 – Scope of Work***

#### **Annually**

- Carry out tasks as detailed for Bi-Annually.
  - Test all manually operated valves, ensure full and free travel and correct setting, check for leakage, adjust or repack valve glands as may be required, remove all deposits and lubricate valve stems.
  - Examine all pipe work and any tank insulation repairing any damaged sections.
-

# **Lebanese University Campus-Hadath**

## **3.4 – Work Parcel 3 – Scope of Work**

### **3.4.2.8 Chimney Flue Stack/Boilers/Generators/Incinerator**

#### **Precautions**

Inspection, cleaning and maintenance procedures for this item should not take place when the boiler/s are running. Make sure that the boilers are not running and that the duct is not "hot" prior to inspection.

#### **Weekly**

- Open the access door and clean the ashes accumulated on the access door and its surroundings.

#### **Quarterly**

- Carry out the tasks as detailed in Weekly
- Ensure all supports, brackets and suspension rods are secure. Tighten bolts as necessary.
- Inspect access door/s and ensure door fixings are secure.
- Check for damage and air tightness. Repair as necessary.
- Ensure that door handles, catches and locks are functioning correctly.
- Inspect insulation for any damage or deterioration. Report on condition.

#### **Annually**

- Carry out the tasks as detailed for Quarterly.
  - Clean the inside of the duct thoroughly.
  - Check internal condition of duct. Report findings.
  - Ensure that seals are intact and efficient. Replace seals if necessary.
-

## **Lebanese University Campus-Hadath**

### ***3.4 – Work Parcel 3 – Scope of Work***

- Ensure that the access doors are not damaged and that they make perfect contact all around with seal.
-

# **Lebanese University Campus-Hadath**

## **3.4 – Work Parcel 3 – Scope of Work**

### **3.4.2.9 Gas Pipe System, Tanks, Distribution Boxes.**

#### **Bi-annually**

- Examine pipe work for leaks and rectify. Reporting any defects, cleaning spillage from premises.
  - Test all manually operated valves, ensure full and free travel, check for leakage, adjust or repack valve glands as may be required, remove all deposits and spillage, lubricating valve stems as necessary.
  - Examine and ensure security and integrity of all caps and chains, replacing any damaged or missing items.
  - Examine pipe supports where applicable. Check for loose nuts, and tighten as necessary. Report condition of supports and anchors.
-

# **Lebanese University Campus-Hadath**

## **3.4 – Work Parcel 3 – Scope of Work**

### **3.4.2.10 Chillers**

#### **Safety Precautions**

- The Safety Code for Mechanical Refrigeration ANSI/ASHRAE 15-1978 contains the recognized standards to assure the safe installation, operation and inspection of refrigeration systems. The purpose of this Code is to establish reasonable safeguards to life, limb, health, and property.
- It is important that those responsible for the installation, operation and maintenance of this system be familiar with this Code.
- Only experienced, qualified personnel should install, operate or maintain refrigeration equipment. They should be familiar with and adhere to local safety regulations and procedures.
- Never discharge refrigerant into an area that does not have sufficient ventilation or where an open flame or electrical spark is present.
- Always have an observer nearby when working on any part of a refrigeration system so that help is available in an emergency.
- Refer to manufacturer's manual for any additional requirement

#### **Weekly**

- Read and report temperatures and pressures. Report any abnormal figure.
- Refer to manufacturer's manual for any additional requirement

#### **Monthly**

- Carry out tasks as detailed under Weekly
  - Check sight glass. Check for refrigerant leakage. Repair or adjust refrigerant level if necessary. Follow manufacturers recommendations in performing this process.
  - Check pressure relief valve, pressure gauges, flow indicators, temperature indicators. Report on condition.
  - Clean Exterior surface.
-



# Lebanese University Campus-Hadath

## **3.4 – Work Parcel 3 – Scope of Work**

- Clean Condensor surface.
- Refer to manufacturer's manual for any additional requirement

### **Electrical**

- Check pressure switches. Report on condition.
- Tighten all terminal connections and main cable.
- Refer to manufacturer's manual for any additional requirement

### **Quarterly**

- Carry out tasks as detailed for Monthly

### **Direct Expansion (shell and tube type) Liquid Cooler**

- Examine condition of thermal insulation and vapour seal. Renew any damaged item.
- Examine thermal element of the low temperature safety cut-out for corrosion. Clean and reposition.
- Check temperature difference between the refrigerant and the leaving chilled water. Compare with commissioning data. If significant increase is noted, report requiring inspection of cooler tubes for cleaning.

### **Associated Water Pipe work and Accessories**

- Check for any leakage. Repair as necessary.
  - Examine valves for leakage. Ensure full and free travel. Adjust or re-pack valve glands as required. Lubricate valve stem. Reset valves to their original position.
  - Examine insulation. Repair any defective section.
  - Examine strainer for leakage; clean strainer as necessary.
  - Observe pressure drop across strainer if gauges are provided. Record data.
-

# **Lebanese University Campus-Hadath**

## **3.4 – Work Parcel 3 – Scope of Work**

### **Electrical**

#### **Pressure and Temperature Safety Cut-outs**

- Ensure accuracy of cutouts. Adjust an incorrectly set cutout.

### **Annually**

- Carry out tasks as detailed for Quarterly.
- Examine and check all anti-vibration mountings. Repair or replace any damaged item.
- Check unit externally for corrosion. Brush clean and repaint as necessary.
- Ensure security of all guards, fixing and anchors. Tighten loose bolts. Ensure access doors can be securely closed. Repair as necessary.

### **Compressor**

- Test all compressor mounts.

### **Compressor Motor**

- Check foundation for settling and cracks. Report on condition.
- Check machine fixing for tightness. Tighten fixing elements as necessary.

### **Direct Expansion (shell and tube type) Liquid Cooler**

- Check end covers for refrigerant leaks. Check water connections for leaks. Rectify any leaking joint or connection.

### **Pressure and Temperature Gauges**

- Check validity of readings, re-calibrate or renew defective gauges.

### **Electrical**

- Isolate equipment from power supply. Ensure it can not be switched back ON again. Test that equipment is dead. Make earth and short circuit connections. Fence off or cover up adjacent life parts.
-

## **Lebanese University Campus-Hadath**

### **3.4 – Work Parcel 3 – Scope of Work**

- Check state and attachment of electric conductors. Attach conductors securely.

#### **Electrical Services**

- Check condition of electrical components. Service as necessary
  - Ensure security of fuse bases, carriers, circuit breakers and switches, replacing all spare fuses and lamps.
  - Examine fuse links and circuit breakers for correct rating, replace as necessary.
  - Check and ensure the mechanism of all circuit breakers and switches to operate correctly.
  - Replace all spare fuses that are blown down.
  - Examine and report on the condition of all associated wiring trucking, conduits, cable glands termination and test for security of termination, earth continuity and insulation resistance.
-

# **Lebanese University Campus-Hadath**

## **3.4 – Work Parcel 3 – Scope of Work**

### **3.4.2.11 Oil Fired Steam & Hot Water Boiler and Burner**

#### **Safety Precautions**

- Keep the boiler, burner and entire boiler room clean. A clean boiler room is essential to first class boiler operation.
- Keep the burner and boiler control covers in place. The electrical contacts in the controls are very sensitive to dust and dirt.
- Never close vents supplying air to the boiler room.
- If the burner is to be out of service for the summer, be sure to close all valves and break all power connections to the burner and auxiliaries.  

**CAUTION:** Humidity Effects: To protect against high resistance leakage in the electronic circuit resulting from high humidity, it is recommended that the Flame Safeguard Control be left powered continually even when not in operation. If it is necessary to shut down completely for an extended period, the control should be thoroughly cleaned, and power should be turned on for 48 hours before putting the control back in operation.
- Repair all leaks promptly. All piping connections to the boiler and burner should be maintained leak proof because even a minor leak, if neglected, may soon become serious.
- Refer to manufacturer's manual for any additional requirement

#### **Daily (Boilers in service)**

- Observe operating pressures and temperature and general conditions. Determine cause of any unusual noises or conditions and make necessary corrections.
  - Record parameters on logs at prescribed interval.
  - Observe the operation of the boiler limit and operating controls to determine that the burner is being cut off at the proper setting. Adjust per the manufacturer's instruction sheet as required.
  - Observe the operation of Air compressors according to the manufacturer's operation manual
  - Check temperatures and record.
-

## **Lebanese University Campus-Hadath**

### **3.4 – Work Parcel 3 – Scope of Work**

- a. Fuel
- b. Feed water
- c. Stack Economizer
- d. Air heater.
- Check pressures and records.
  - a. Boiler
  - b. Fuel
  - c. Feed water
- Inspect burner flame. Record any unusual sightings.
- Refer to manufacturer's manual for any additional requirement

#### **Weekly (Boilers in Service)**

- Carry out tasks as detailed under Daily.
- Observe condition of flame; correct if flame is Smokey or if burner starts with a puff.
- Check fuel supply.
- Observe operation of circulating pump(s). Ensure that the Boiler stalls when there is no flow of water.
- Check all burner linkages to be sure that there has been no change from its original marked position. Tighten, if necessary. Check to ensure linkage not binding. Lubricate, if necessary.
- Check flame safeguard. Ensure proper shutdown and re-light sequence by simulating a flame failure and supervising a re-light.
- Blow down boiler to remove rust and dirt from the boiler mud leg or drum.
- Check all phases of the operation of the control circuit for proper operation.
- Operate burner manual shutoff valves to determine that they are working freely and properly. Lubricate if necessary.
- Measure and record flame signal strength.
- Refer to manufacturer's manual for any additional requirement

#### **Monthly (Boilers in Service)**

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## **Lebanese University Campus-Hadath**

### **3.4 – Work Parcel 3 – Scope of Work**

- Carry out tasks as detailed under Weekly
- Test limit controls.
- Test operating controls.
- Check boiler room floor drains for proper functioning.
- Inspect fuel supply systems in boiler room area.
- Check condition of heating surfaces.
- Check ignition assembly and electrode. Clean, if necessary.
- Clean oil atomising nozzle. Never use a sharp instrument on the nozzle. If nozzle becomes damaged, replace it.
- Clean flame detector lens with a soft, clean, lint- free cloth. Check scanner cell and test.
- Check air dampers and blow wheel. Remove any accumulation of lint or dirt.
- Inspect condition of refractory.
- Inspect the oil strainer and clean, if necessary. The frequency of cleaning will depend upon the frequency of the burner operation and the quality of oil in use. Be sure the cap gasket is in good order and mating surfaces are clean. A light coat of clean oil will help secure a vacuum-tight joint. NOTE: Close the gate valve ahead of the strainer before removing the cap to prevent loss of oil prime.
- Lubricate motors in accordance with motor manufacturers instructions. (May be annual requirement.)
- Check safety valves by manually lifting with handle provided. Ensure they reseal.
- Check and record flue gas analysis. Compare with previous readings to detect any trends. Make appropriate adjustments if required.
- Lubricate all dampers and drive arm-bearing surfaces with a dry lubricant.

### **Annually**

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## **Lebanese University Campus-Hadath**

### **3.4 – Work Parcel 3 – Scope of Work**

NOTE: Annual maintenance should be conducted in the spring to afford ample time to repair serious problems.

- Carry out tasks as detailed under Monthly.
  - Check weight operated fuel valve for proper operation. Lubricate as necessary.
  - Check condition of oil tank. Clean and remove sludge, if necessary.
  - Perform a routine maintenance of entire combustion control equipment.
  - Inspect boiler piping for proper support and tightness.
  - Drain and clean sediment and accumulated carbon from electric oil heater and boiler mounted oil heater. (If applicable)
  - Check electric cables for cracks. Repair any defective wire,
  - Completely tear down boiler and thoroughly clean fireside and waterside. Inspect for deterioration, which could indicate an inadequate water treatment program.
  - Reassemble boiler using new gaskets. Perform hydrostatic test.
  - Clean and inspect all burner components. Perform tune up and record readings as a comparison base. Replace any defective components.
  - Check all operating and safety devices, including a pop test on safety relief valves, flame safeguard checks, and leak test of safety shutoff valves.
  - Check and clean all external systems including gauges, combustion air inlets, etc.
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Lebanese University Campus - Hadath

**3.5.1 - Work Parcel 3 - List of O & M Manuals**

DIVISION	DESCRIPTION	VOLUME No.
<b>SET NO.1 – CENTRAL SERVICES</b>		
0	FIRST AID INSTRUCTIONS STRUCTURE OF O&M MANUALS	1 of 1
1	CHILLED WATER SYSTEM	1 of 2 2 of 2
2	COOLING WATER SYSTEM	1 of 1
2A	CHEMICAL WATER TREATMENT	1 of 1
2B	NALCO Stress Management for Cooling System (3D TRASAR)	1 of 1
3	HOT WATER SYSTEM AND STEAM SYSTEM	1 of 2 2 of 2
4	GENERATOR SET	1 of 2 2 of 2
4A	FUEL OIL SYSTEM	1 of 1
5	LPG GAS SYSTEM	1 of 1
6	MAIN PUMPING STATION • WATER WELLS • DOMESTIC SYSTEM • POTABLE SYSTEM • RO SYSTEM • CHLORINATION SYSTEM	1 of 5
7	IRRIGATION SYSTEM	1 of 2 2 of 2
8	FIRE FIGHTING SYSTEM	1 of 1
9	DRAINAGE SYSTEM	1 of 1
10	POOLS AND FOUNTAINS	1 of 2 2 of 2
11	KITCHEN EQUIPMENT	1 of 2 2 of 2
12	LAUNDRY EQUIPMENT	1 of 1
13	MV SYSTEM	1 of 5 TO 5 of 5
14	TELEPHONE SYSTEM	1 of 1
15	SOUND SYSTEM	1 of 1
16	CLOCK SYSTEM	1 of 1
17	CCTV SYSTEM	1 of 1
18	BUILDING MANAGEMENT SYSTEM, SECURITY SYSTEM AND INTERFACE WITH FAS	1 of 13 TO 13 of 13
19	LIFTS	1 of 12 TO 12 of 12
20	THEATER LIGHTING AND DIMMING	1 of 1
<b>SET NO. 2 – NATIONAL SCHOOL OF FINE ARTS BUILDING B</b>		
1	PLUMBING/MECHANICAL SYSTEM	1 of 1
2	HVAC SYSTEM	1 of 2 2 of 2
3	ELECTRICAL SYSTEMS	1 of 3 TO 3 of 3



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**3.5.1 - Work Parcel 3 - List of O & M Manuals**

DIVISION	DESCRIPTION	VOLUME No.
<b>SET NO. 3 –FACULTY OF LAW AND POLITICAL SCIENCES BUILDING D</b>		
1	PLUMBING/MECHANICAL SYSTEM	1 of 1
2	HVAC SYSTEM	1 of 2
2	HVAC SYSTEM	2 of 2
3	ELECTRICAL SYSTEMS	1 of 3 TO 3 of 3
<b>SET NO. 4 –CONFERENCE CENTER – BUILDING F</b>		
1	PLUMBING/MECHANICAL SYSTEM	1 of 1
2	HVAC SYSTEM	1 of 2 2 of 2
3	ELECTRICAL SYSTEMS	1 of 3 TO 3 of 3
<b>SET NO. 5 –SCHOOL OF PHARMACY – BUILDING H</b>		
1	PLUMBING/MECHANICAL SYSTEM	1 of 1
2	HVAC SYSTEM	1 of 2 2 of 2
3	ELECTRICAL SYSTEMS	1 of 3 TO 3 of 3
<b>SET NO. 6- EXTENSION OF EXISTING FACULTY OF SCIENCES</b>		
1	PLUMBING/MECHANICAL SYSTEM	1 of 1
2	HVAC SYSTEM	1 of 2 2 of 2
3	ELECTRICAL SYSTEMS	1 of 2 2 of 2
<b>SET NO. 7- SPORTS COMPLEX BUILDINGS K1, K2,K3</b>		
1	PLUMBING/MECHANICAL SYSTEM	1 of 1
2	HVAC SYSTEM	1 of 1
3	ELECTRICAL SYSTEMS	1 of 3 TO 3 of 3
<b>SET NO. 8- FACULTY OF MEDICINE, BUILDING M1 SET NO.9- FACULTY OF DENTISTRY, BUILDING M2</b>		
1	PLUMBING/MECHANICAL SYSTEM	1 of 2 2 of 2
2	HVAC SYSTEM	1 of 2 2 of 2
3	ELECTRICAL SYSTEMS	1 of 3 TO 3 of 3
<b>SET NO. 10- FACULTY OF PUBLIC HEALTH – BUILDING Q</b>		
1	PLUMBING/MECHANICAL SYSTEM	1 of 1
2	HVAC SYSTEM	1 of 2 2 of 2
3	ELECTRICAL SYSTEMS	1 of 3 TO 3 of 3

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**3.5.1 - Work Parcel 3 - List of O & M Manuals**

DIVISION	DESCRIPTION	VOLUME No.
	<b>SET NO. 11- MALE DORMITORIES, BUILDING R1</b>	
	<b>SET NO.12- FEMALE DORMITORIES, BUILDING R2</b>	
1	PLUMBING/MECHANICAL SYSTEM	1 of 1
2	HVAC SYSTEM	1 of 2 2 of 2
3	ELECTRICAL SYSTEMS	1 of 3 TO 3 of 3
	<b>SET NO. 13- TECHNICAL BUILDINGS T1, T2&amp;T3</b>	
1	PLUMBING/MECHANICAL SYSTEM	1 of 1
2	HVAC SYSTEM	1 of 2 2 of 2
3	ELECTRICAL SYSTEMS	1 of 3 TO 3 of 3
	<b>SET NO. 14- UNDERGROUND PARKING, BUILDING U3</b>	
	<b>EASTERN PARKING, BUILDING V1</b>	
1	PLUMBING/MECHANICAL SYSTEM	1 of 1
2	HVAC SYSTEM	1 of 1
3	ELECTRICAL SYSTEMS	1 of 3 TO 3 of 3
	<b>SET NO. 15- RESTAURANT &amp; FUNCTIONAL HOUSING</b>	
	<b>BUILDING U2</b>	
1	PLUMBING/MECHANICAL SYSTEM	1 of 1
2	HVAC SYSTEM	1 of 2 2 of 2
3	ELECTRICAL SYSTEMS	1 of 3 TO 3 of 3
	<b>SET NO. 16- CENTRAL CATERING AND WESTERN</b>	
	<b>PARKING, BUILDING X</b>	
1	PLUMBING/MECHANICAL SYSTEM	1 of 1
2	HVAC SYSTEM	1 of 1
3	ELECTRICAL SYSTEMS	1 of 3 TO 3 of 3
	<b>SET NO. 17- FACULTY OF SCIENCES (FOS, LIBRARY &amp;</b>	
	<b>CAFETERIA)</b>	
1	HVAC SYSTEM	1 of 1
2	ELECTRICAL SYSTEMS	1 of 1

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### 3.5.2 - Work Parcel 3 - List of As-Built Drawings

IRN	Trades	Block/Zone	Subzone or Scale	Type of Document	Level of Plans	Running Number	Revision
02	B 0 1	R 2 1	1 3 2	B			
Internal Revision Number		Zone defining the Building Examples: R2: Female Dorm R1: Male Dorm TS: Type Spaces OO: Whole Project	0= (Whole Zone) 1,2,3,4,5,6 (Parts of zone or whole zone) 7= Miscellaneous 8=Typical Spaces	1= Plans 2=Sections 3=Elevations 4=Details on A0 5=General Details on A3 6=Particular Details on A3 7=Schedules 8=Miscellaneous	0=Foundation 1=2nd Basement 3=Ground Floor 4=1st Floor 5=2nd Floor 6=3rd Floor 7=4th Floor 8=5th Floor 9=Roof	To facilitate diff documents of the same type and the same location	A, B, C, D

#### Trades (As needed for Drawing Numbering)

Trade A		Trade B		Trade C		Trade D		Trade E	
Site Works		Structures & OutBoards		Technical Equipment		Technical Equipment		Finishes	
A05	Main Pumping Station	B00	General Structure Drawings	C00	General M+E Drawings	D02	Swimming Pool Treatment equipment & accessories	E00	Architectural Executive Drawings
A06	Water Supply	B01	Concrete Works	C10	HVAC	D04	Decorative Fountains		
A07	Waste Water	B02	Frame Works & Canopies	C20	Plumbing	D08	Scientific Lab Equipment		
A11	External Signs & Boards	B03	Waterproofing & Joints	C30	High Voltage Installation				
A13	Electrical Network	B05	External Aluminum & Glazing	C31	General Transformer Substat				
A14	Low Current (Refer to C04)	B09	Reinforcement	C32	Static UPS System				
A15	Chilled & Heating Water	B10	Precast Elements	C33	Lighting layout				
		B11	Concrete Drawings with Reinforcement	C34	Miscellaneous				
				C35	Earthing System & Lightning Project				
				C40	Low Current Installation				
				C41	General Telephone Systems				
				C42	Computer Network				
				C43	Sound System				
				C44	Fire Alarm System				
				C45	Clock System				

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**Lebanese University Campus - Hadath****3.5.3 - Work Parcel 3- List of Suppliers and Subcontractors**

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**Chilled Water System**

	<b>Equipment</b>	<b>Subcontractor/ Supplier</b>	<b>Contact</b>	<b>Manufacturer</b>	<b>Concerned Buildings</b>
1	Chillers	York Lebanon LTD	Tel : 961-1-427787	York	Thermal Plant (T)
2	Cooling Towers	WEBCO	Tel : 961-1-853047 Fax : 961-1-853711	Marley	Thermal Plant (T)
3	Split Case Pumps	SALMSON	Tel : 961-4-772280 Fax: 961-4-722285	Crane	Thermal Plant (T)
4	Water Softners	Progress Water Products	Tel : 961-3-324244	PWP	Thermal Plant (T)
5	Submersible pumps for soft water	SACOM	Tel : 961-1-255150 Fax : 961-1-255152	Flygt	Thermal Plant (T)
6	Motorized Butterfly Valves	Ahmad Knio	Tel : 961-1-790794 Fax : 961-1-790796	JMC	Thermal Plant (T)
7	Expansion Tanks with pumping units	WEBCO	Tel : 961-1-853047 Fax : 961-1-853711	Flamco	Thermal Plant (T)

**Hot Water System**

	<b>Equipment</b>	<b>Subcontractor/ Supplier</b>	<b>Contact</b>	<b>Manufacturer</b>	<b>Concerned Buildings</b>
1	Hot Water Boilers	Al-Salem Agencies & Services	Tel : 961-1-567115	Hurst	Thermal Plant (T)
2	Air Compressor for boilers ignition	Al-Salem Agencies & Services	Tel : 961-1-567115	Hurst	Thermal Plant (T)
3	Gas Cylinders	NATGAS	Tel : 961-1-888881 Fax : 961-1-877802	Local Made	Thermal Plant (T)
4	Fuel End Suction Pumps	Ibrahim Tabsh	Tel : 961-1-738598	IDP	Thermal Plant (T)
5	Split Case Pumps	SALMSON	Tel : 961-4-772280 Fax : 961-4-722285	Crane	Thermal Plant (T)
6	Motorized Butterfly Valves	Ahmad Knio	Tel : 961-1-790794 Fax : 961-1-790796	JMC	Thermal Plant (T)
7	Expansion Tanks with pumping units	WEBCO	Tel : 961-1-853047 Fax : 961- 853711	Flamco	Thermal Plant (T)

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**Lebanese University Campus - Hadath****3.5.3 - Work Parcel 3- List of Suppliers and Subcontractors**

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**Water Supply System**

	<b>Equipment</b>	<b>Subcontractor/ Supplier</b>	<b>Contact</b>	<b>Manufacturer</b>	<b>Concerned Buildings</b>
1	Submersible pumps for water wells	WATCO	Tel : 961-5-805010 Fax : 961-5-805012	GRUNDFOS	Pumping Station (V3)
2	Split Case Pumps	WATCO	Tel : 961-5-805010 Fax : 961-5-805012	PATTERSON	Pumping Station (V3)
3	Vertical Multistage Pumps	WATCO	Tel : 961-5-805010 Fax : 961-5-805012	LOWARA	Pumping Station (V3)
4	Motorized Butterfly valves	WATCO	Tel : 961-5-805010 Fax : 961-5-805012	BIMEX	Pumping Station (V3)
5	Reverse Osmosis System	WATCO	Tel : 961-5-805010 Fax : 961-5-805012	FILMTEC	Pumping Station (V3)
6	Chlorination System	WaterMaster	Tel : 961-1-422905 Fax : 961-1-424813	WaterMaster	Pumping Station (V3)
7	Submersible pumps	WATCO	Tel : 961-5-805010 Fax : 961-5-805012	SARLIN	Pumping Station (V3)

**Storm Water Pumping Station**

	<b>Equipment</b>	<b>Subcontractor/ Supplier</b>	<b>Contact</b>	<b>Manufacturer</b>	<b>Concerned Buildings</b>
1	Submersible pumps	Aquatreat Trading	Tel : 961-1-495612 Fax : 961-4-872387	Homa	N/A

**Gas Supply System**

	<b>Equipment</b>	<b>Subcontractor/ Supplier</b>	<b>Contact</b>	<b>Manufacturer</b>	<b>Concerned Buildings</b>
1	Gas Tanks and accessories	NATGAS	Tel : 961-1-888881 Fax : 961-1-877802	NATGAS	N/A

## Lebanese University Campus - Hadath

### 3.5.3 - Work Parcel 3- List of Suppliers and Subcontractors

#### Medium Voltage Network

(Excluding Faculty of Science Main Building, Library, & Old Cafeteria)

	Equipment	Subcontractor/ Supplier	Contact	Manufacturer	Concerned Buildings
1	Generator	Jallad	Tel : 961-9-212077	Caterpillar	Power Plant (T)
2	Synchronizing Panel	Jallad	Tel : 961-9-212077	Siemens	Power Plant (T)
3	MV Switchgear	ABB	Tel : 961-1-512830	ABB	Power Plant (T)
4	Step-up Transformers	Matelec	Tel : 961-9-620920	Mateltec	Power Plant (T)
5	MV/MV Step-down Transformers	ABB	Tel : 961-1-512830	ABB	All
6	MV/LV Step-down Transformers	ABB	Tel : 961-1-512830	ABB	All
7	MV Cables	Liban Cables	Tel : 961-1-350040	Liban Cables	Power Plant (T)

#### Emergency Power Supply

Faculty of Science Main Building, Library, & Old Cafeteria

	Equipment	Subcontractor/ Supplier	Contact	Manufacturer	Concerned Buildings
1	Generator	SAKR	Tel: 961-9-444666	Gumin \ Scania	FOS

#### Low Voltage Distribution

(Excluding Faculty of Science Main Building, Library, & Old Cafeteria)

	Equipment	Subcontractor/ Supplier	Contact	Manufacturer	Concerned Buildings
1	Circuit Breakers and Contactors	Harb Electric	Tel : 961-1-821625	ABB	All
2	Panel Board: EMDB	Hermes	Tel : 961-1-582223	Hiemel	Building T
3	Panel board:EMCC's	Al Bonian International	Tel: 961-6-410371	Cubic	Building T

#### Low Voltage Distribution

Faculty of Science Main Building, Library, & Old Cafeteria

	Equipment	Subcontractor/ Supplier	Contact	Manufacturer	Concerned Buildings
1	Circuit Breakers and Contactors	HARB SIMON ELECTRIC	Tel: 961-1-821625 Tel: 961-1-560222	ABB General Electric	FOS
2	Panel Board: EMDB	HARB SIMON ELECTRIC	Tel: 961-1-821625 Tel: 961-1-560222	ABB General Electric	FOS
3	Panel board:EMCC's	HARB SIMON ELECTRIC	Tel: 961-1-821625 Tel: 961-1-560222	ABB General Electric	FOS

**Lebanese University Campus - Hadath**

**3.5.3 - Work Parcel 3- List of Suppliers and Subcontractors**

**Low Current Systems**  
(Excluding Faculty of Science Main Building, Library, & Old Cafeteria)

	<b>Equipment</b>	<b>Subcontractor/ Supplier</b>	<b>Contact</b>	<b>Manufacturer</b>	<b>Concerned Buildings</b>
1	Telephone System	Comware	Tel: 961-9-210974	Philips	All
2	Data Network	Tetracom	Tel: 961-1-582000	3Com	All except G
		Comware	Tel: 961-9-210974	3Com	G
3	Clock System	Triacom	Tel: 961-1-362661	Bodet	All except G
4	Access Control	TAC	Tel: 961-5-801977	TAC	All except G
		Automation & Control	Tel: 961-4-487726	Landis & Staefa	G
5	Closed Circuit Television System	Comware	Tel: 961-9-210974	Baxall/Vista/ Ultrak	All except G
		Automation & Control	Tel: 961-4-487726	Vista	G
6	Building Management System	TAC	Tel: 961-5-801977	TAC	All except G
		Automation & Control	Tel: 961-4-487726	Landis & Staefa	G

**Low Current Systems**  
Faculty of Science Main Building, Library, & Old Cafeteria

	<b>Equipment</b>	<b>Subcontractor/ Supplier</b>	<b>Contact</b>	<b>Manufacturer</b>	<b>Concerned Buildings</b>
1	Telephone System	Tetracom	Tel: 961-1-582000	Meridian	FOS
2	Data Network	BMB	Tel: 961-1-582000	Cisco	FOS

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**Lebanese University Campus-Hadath****3.5.4 - Work Parcel 3 - List of Consummables**

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**Chilled Water System**

	<b>Consummable</b>	<b>Systems/Location</b>	<b>Form</b>	<b>Type</b>
1	Refrigerant	Chillers	Gas	R134-a
2	Anti-Scale-Anti-Corrosion	Cooling Towers	Liquid	Nalco 8513B
3	Biocide		Liquid	Nalco 2818
4	Biocide		Liquid	Nalco ST-70
5	Acid		Liquid	Nalco N/A
6	Anti-Scale Anti-Corrosion	Primary Cooling Loop	Liquid	Nalco Nalsil
7	Biocide		Liquid	Nalco 2593

**Hot Water System**

	<b>Consummable</b>	<b>Systems/Location</b>	<b>Form</b>	<b>Type</b>
1	Fuel Oil	Generators-Boilers	Liquid	# 2
2	Anti-Scale Anti-Corrosion	Primary Heating Loop	Liquid	Nalco Nalsil
3	Biocide		Liquid	Nalco 2593

**Water Supply System**

	<b>Consummable</b>	<b>Systems/Location</b>	<b>Form</b>	<b>Type</b>
1	Cartridge Filters	R-O system	Pieces	5 Microns
2	Hypochlorite		Powder/Liquid	N/A
3	Soda Ash		Powder	N/A
4	Anti-Scalant		Liquid	N/A
5	Sodium Bisulfite		Powder	N/A
6	Sand		Granular	N/A
7	Chlorine	Chlorination System	Gas	N/A

**Gas Supply System**

	<b>Consummable</b>	<b>Systems/Location</b>	<b>Form</b>	<b>Type</b>
1	Gas	Gas Tanks	Gas	Propane



**Lebanese University Campus-Hadath**

**3.5.4 - Work Parcel 3 - List of Consummables**

**Electrical**

	<b>Consummable</b>	<b>Systems/Location</b>	<b>Form</b>	<b>Type</b>
1	Signalling Lamps	Panel Boards	Pcs	N/A
2	MCB Circuit Breakers			N/A
3	MCCB Circuit Breakers			N/A
4	Relays			N/A
5	Contactors			N/A
6	Metering and Measuring			N/A
7	Fuses			N/A
8	Disconnecting Switches	Mechanical Equipment	Pcs	N/A
9	Batteries	Generator	Pcs	N/A
10	Fuel		Liquid	N/A
11	Oil		Liquid	N/A
12	Filter		Pcs	N/A
13	Sensors		Pcs	N/A
14	Actuators			N/A
15	Grease		Solid	N/A
16	MV Fuses	MV System	Pcs	N/A
17	Grease		Solid	N/A
18	Paint		Liquid	N/A
19	Oil	Transformers	Liquid	N/A
20	Slave Clocks	Clock System	Pcs	N/A
21	Door Contact Units	Access Control and Building Management System	Pcs	N/A
22	Sensors		Pcs	N/A
23	Actuators		Pcs	N/A
24	Intrusion Bells		Pcs	N/A