NEAR EAST UNIVERSITY

Faculty of Engineering

Department of Electrical Electronic Engineering

EE400
Illumination of Hospital Project

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ABSTRACT

The subject of my Project is the ilimunation. Ilumination is in general consists of generation, distribution, economy and measurement of light. The benefits of good ilimunation are good sight, helping to keep eyes healthy, less accidents, increase productivity, increase economic potential, increase security, increase convertibility.

The main objective of this thesis is to make ilumination calculations of a building according to architectural plan that I have. While doing these calculations I tried to use the best methods in order to get the true results. My aim was to make the most suitable design according to these calculations. Efficiency and cost were very important.

Introduction

The purpose of the work explained in this text is to do the installation illumination and power distribution project of a building. It is the insallation Project of the architectural plan of a hospital in Turkey. In this project, all the necessary illumunation and power equipments are calculated. Also their communication equipments are calculated. Like Cable and other connected equipments.

At the illumination part, all of armatures are calculated then choosed according to the calculations per room. Also the power equipments calculated depending on the loads. All of installation designed in safety standards (IEC Standards). In this Project, there are too many different loads. So, their design must be balanced. For example, this Project has operating room, aniograph etc. We choosed for this rooms three phase sockets for specially machine. These are working by three phase.

The second important point is grounding process. The grounding equipmens are selected with respect to demand. Also all of these equipments have a relationship with the safety. They must be sensetive and fast. All of building equipment from ground to ceiling with those equipments.

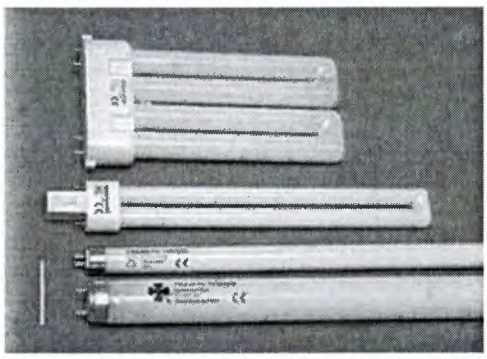
Finally, this project shows a real installation details. Which are voltage drop in the wire illumaination calculation low voltage distribution, grounding etc. It was an experince for us for the future engineering life.

4. LAMPS

Commonly called 'light bulbs', lamps are the removable and replaceable part of a light fixture, which converts electrical energy into electromagnetic radiation. While lamps have traditionally been rated and marketed primarily in terms of their power consumption, expressed in watts, proliferation of lighting technology beyond the incandescent light bulb has eliminated the correspondence of wattage to the amount of light produced. For example, a 60 W incandescent light bulb produces about the same amount of light as a 13 W compact fluorescent lamp. Each of these technologies has a differentefficacy in converting electrical energy to visible light. Visible light output is typically measured in lumens. This unit only quantifies the visible radiation, and excludes invisible infrared and ultraviolet light. A wax candle produces on the close order of 13 lumens, a 60 watt incandescent lamp makes around 700 lumens, and a 15-watt compact fluorescent lamp produces about 800 lumens, but actual output varies by specific design. Rating and marketing emphasis is shifting away from wattage and towards lumen output, to give the purchaser a directly applicable basis upon which to select a lamp

4.1 Fluorescent lamps

A **fluorescent lamp** or **fluorescent tube** is a low pressure mercury-vapor gas-discharge lamp that uses fluorescence to produce visible light. An electric current in the gas excites mercury vapor which produces short-wave ultraviolet light that then causes a phosphor coating on the inside of the bulb to glow. A fluorescent lamp converts electrical energy into useful light much more efficiently than incandescent lamps. The luminous efficacy of a fluorescent light bulb can exceed 100 lumens per watt, several times the efficacy of an incandescent bulb with comparable light output



4.2 Halogen lamp

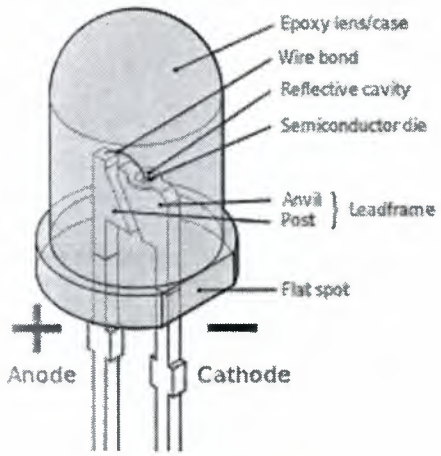
A **halogen lamp**, also known as a **tungsten halogen**, **quartz-halogen** or **quartz iodine lamp**, is an incandescent lamp that has a small amount of a halogen such asiodine or bromine added. The combination of the halogen gas and the tungstenfilament produces a **halogen cycle** chemical reaction which redeposits evaporated tungsten back onto the filament, increasing its life and maintaining the clarity of the envelope. Because of this, a halogen lamp can be operated at a higher temperature than a standard gas-filled lamp of similar power and operating life, producing light of a higher luminous efficacy and color temperature. The small size of halogen lamps permits their use in compact optical systems for projectors and illumination.

4.3 Neon lamps

A **neon lamp** (also **neon glow lamp**) is a miniature gas discharge lamp. The lamp typically consists of a small glass capsule that contains a mixture of neon and other gases at a low pressure and two electrodes (an anode and a cathode). When sufficient voltage and an appropriate current is applied between the electrodes, the lamp produces an orange glow discharge. The glowing portion in the lamp is a thin region near the cathode; the larger and much longer neon signs are also glow discharges, but they use the positive column which is not present in the ordinary neon lamp. Neon glow lamps are widely used as indicator lamps in the displays of electronic instruments and appliances.

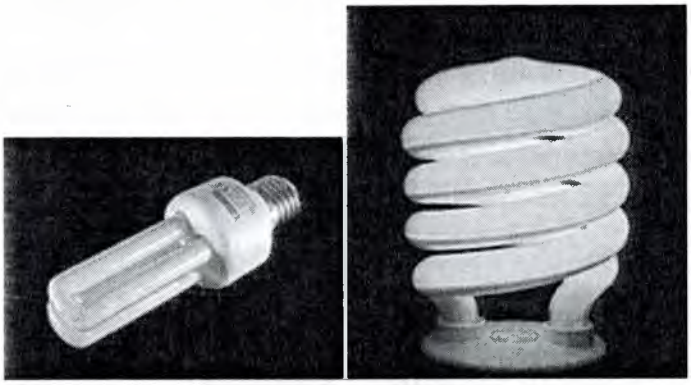
4.4 Light-Emitting Diode

A **light-emitting diode (LED)** is a two-lead semiconductor light source that resembles a basic pn-junction diode, except that an LED also emits light.[7]When an LED's anode lead has a voltage that is more positive than its cathode lead by at least the LED's forward voltage drop, current flows. Electrons are able to recombine with holes within the device, releasing energy in the form ofphotons. This effect is called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor.



4.5 Compact fluorescent lamps

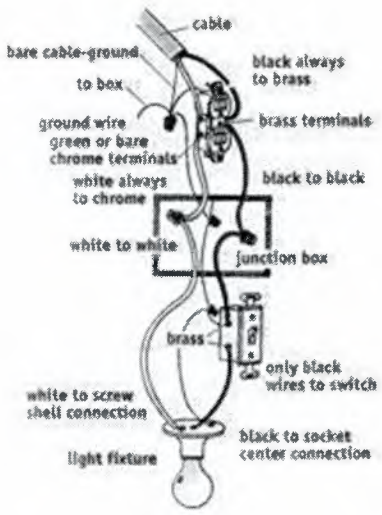
A **compact fluorescent lamp (CFL)**, also called **compact fluorescent light**, **energy-saving light**, and **compact fluorescent tube**, is a fluorescent lamp designed to replace an incandescent lamp; some types fit into light fixtures formerly used for incandescent lamps. The lamps use a tube which is curved or folded to fit into the space of an incandescent bulb, and a compact electronic ballast in the base of the lamp.



How to Install Electrical Wiring

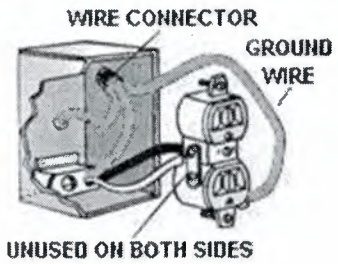
BASIC PRINCIPLES OF GOOD WIRING

Before beginning any electrical repair, shut off the power. Remove the fuse or trip the breaker for the circuit you will be working on in your service panel. Use a neon tester to be sure the power is off. If there is any doubt, you can remove the main fuse or trip the main breaker. Remember: Removing the main fuse or tripping the main breaker will usually shut off the power to the entire house.



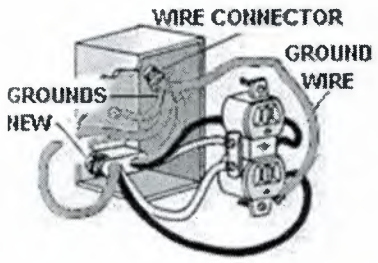
CONNECT NEW WIRING TO LAST OUTLET IN CABLE

New wiring should be connected to the last outlet in a run of cable. To locate the last outlet in the run, shut off the current. Remove the cover plates from each outlet on the circuit. The last outlet in the run has wires connected to only two of the four terminal screws. The two unused terminal screws on the last receptacle serve as a starting point for wiring to a new outlet.



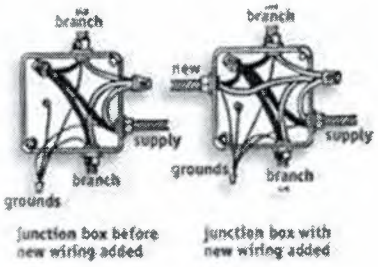
ATTACHING CABLE FOR NEW WIRING

Shut off the power to the circuit you will be working on at the service panel. Loosen the screws holding the receptacle in the box and remove it, as shown. Attach the the earth wire (the bare or green) to the chrome terminal. The yellow (or green in some instances) wire should be connected to the receptacle and the box maintaining the equipotential bonding on the earth system.



ADDING NEW WIRING FROM A JUNCTION BOX

New wiring can also be tied into a junction box, unless the wiring in the junction box is already at maximum capacity. Before tying in at a junction box, always trace the cables leading to the box to check the voltage. Be sure you are not connecting a 120-volt outlet to a run of wire providing 240 volts for larger appliances. To tie in new wiring at a junction box, first shut off the current at the service panel. Locate the main supply cable coming into the junction box from the service panel. Locate the supply wire by tracing the white wires. All white wires in the junction box will be attached to the white wire on the supply line. Knock out the unused plug on the junction box and run the new line from the box as illustrated. Be sure to use a cable clamp to secure the cable to the junction box.



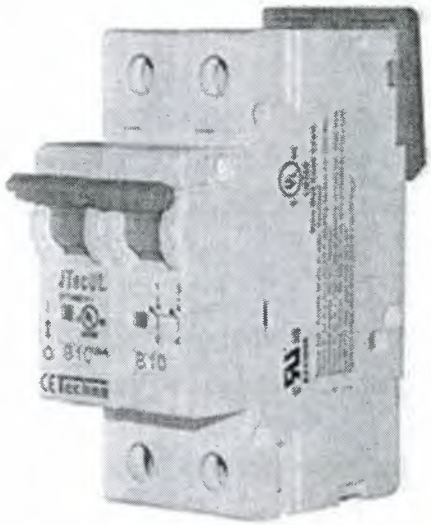
NYY POWER CABLE 0.6/1Kv CABLE APPLICATIONS

NYY is used as a power cable for energy supply in static installations, indoors, outdoors, underground, in concrete and in water where mechanical damages are not to be expected.

STRUCTURE: 1.5-10 mm2 up to 300 mm2 to 10 mm2 single wired, from so many strings. Insulating sheath insulated and sheath. 2-4 wirings from 10 mm2 to 10 mm2 very large cross-sections up to single wire, Wired. Each other on a common sheath wires and harnesses on the Black-colored sheath.

CIRCUIT BREAKERS

A **circuit breaker** is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by overload or short circuit. Its basic function is to detect a fault condition and interrupt current flow. Unlike afuse, which operates once and then must be replaced, a circuit breaker can be reset (either manually or automatically) to resume normal operation. Circuit breakers are made in varying sizes, from small devices that protect an individual household appliance up to large switchgear designed to protect high voltage circuits feeding an entire city



Type	Instantaneous Tripping Current
B	above 3 I_n up to and including 5 I_n
C	above 5 I_n up to and including 10 I_n
D	above 10 I_n up to and including 20 I_n
K	above 8 I_n up to and including 12 I_n For the protection of loads that cause frequent short duration (approximately 400 ms to 2 s) current peaks in normal operation.
Z	above 2 I_n up to and including 3 I_n for periods in the order of tens of seconds. For the protection of loads such as semiconductor devices or measuring circuits using current transformers.

Types of Circuit Breakers

Low-voltage circuit breakers

Low-voltage (less than 1,000 V_{AC}) types are common in domestic, commercial and industrial application, and include:

- MCB (Miniature Circuit Breaker)—rated current not more than 100 A. Trip characteristics normally not adjustable. Thermal or thermal-magnetic operation. Breakers illustrated above are in this category.

There are three main types of MCBs: 1. Type B - trips between 3 and 5 times full load current; 2. Type C - trips between 5 and 10 times full load current; 3. Type D - trips between 10 and 20 times full load current. In the UK all MCBs *must* be selected in accordance with BS 7671.

- MCCB (Molded Case Circuit Breaker)—rated current up to 2,500 A. Thermal or thermal-magnetic operation. Trip current may be adjustable in larger ratings.

- Low-voltage power circuit breakers can be mounted in multi-tiers in low-voltage switchboards or switchgear cabinets.

Other Types of Circuit Breakers

Magnetic circuit breakers

Thermal magnetic circuit breakers

Common trip breakers

Medium-voltage circuit breakers

High-voltage circuit breakers

Sulfur hexafluoride (SF_6) high-voltage circuit breakers

Disconnecting circuit breaker (DCB)

Carbon dioxide (CO_2) high-voltage circuit breakers

ILLUMİNATİON

The luminous flux reaching a surface, per unit area of that surface. One lumen per square meter is termed as one lux. Also

Illumination = Flux / Area = Lumens / Area
= (Candle power x Solid angle) / Area

where R is the distance between the surface and a point where the solid angle is formed.

PROPERTIES OF GOOD ILLUMINATION:

1. Illuminating source should have sufficient light.
2. It should not strike the eyes.
3. It should have suitable shades and reflectors.
4. It should be installed at such a place so as to give uniform light.

Defination:

Luminous flux:

Luminous flux is the rate of energy radiation in the form of light waves. The unit is lumen.

Lumen:

Lumen is the unit of luminous flux. It represents the flux emitted in unit solid angle of one steradian by a point source having a uniform intensity of one candela. Thus a uniform point source of one candle power emits 4π lumens.

TAVAN	0.80				0.50				0.30	
DUVAR	0.50		0.30		0.50		0.30		0.10	0.30
ZEMİN	0.30	0.10	0.30	0.10	0.30	0.10	0.30	0.10	0.10	0.10
Oda İndeksi $k = \frac{a \times b}{h \times (a+b)}$	ODA VERİMİ (η)									
0.60	0.24	0.23	0.18	0.18	0.20	0.19	0.15	0.15	0.12	0.15
0.80	0.31	0.29	0.24	0.23	0.25	0.24	0.20	0.19	0.16	0.17
1.00	0.36	0.33	0.29	0.28	0.29	0.28	0.24	0.23	0.20	0.20
1.25	0.41	0.38	0.34	0.32	0.33	0.31	0.28	0.27	0.24	0.24
1.50	0.45	0.41	0.38	0.36	0.36	0.34	0.32	0.30	0.27	0.26
2.00	0.51	0.46	0.45	0.41	0.41	0.38	0.37	0.35	0.31	0.30
2.50	0.56	0.49	0.50	0.45	0.45	0.41	0.41	0.38	0.35	0.34
3.00	0.59	0.52	0.54	0.48	0.47	0.43	0.43	0.40	0.38	0.36
4.00	0.63	0.55	0.58	0.51	0.50	0.46	0.47	0.44	0.41	0.39
5.00	0.66	0.57	0.62	0.54	0.53	0.48	0.50	0.46	0.44	0.40

Tablo 1.14- Oda aydınlatma verimi

ILLUMINATION CALCULATIONS

BASEMENT FLOOR

PARKING

Parking service area

a+b=28.7m
a*b=194.8 m2
H=2.79 m
h1=0 m
h2=0.8 m
m=0.8
E0=50 lx
h=H-(h1+h2)=2.79-(0+0.8)=1.99m
k=a*b/((a+b)*h)=194.8/((28.7)*1.99=3.41
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.59+(((3.41-3)/(4-3))*(0.63-0.59)) n2=0.606
Øa =430 lm (A60 40W) (SENSOR)
Øt=E0*S/(m*n2), Øt= 20,090lm
z=2
N= Øt/(Øa*z), N=20090/(430*2)=23.3 Assuming 20

SHELTER

a+b=22.7m
a*b=123.4 m2
H=2.79 m
h1=0 m
h2=0.8 m
m=0.8
E0=50 lx
h=H-(h1+h2)=2.79-(0+0.8)=1.99m
k=a*b/((a+b)*h)=123.4/((22.7)*1.99=2.73
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.56+(((2.73-2.50)/(3-2.5))*(0.59-0.56)) n2=0.574
Øa =960 lm (A60 75W)
Øt=E0*S/(m*n2), Øt= 13,436lm
z=2
N= Øt/(Øa*z), N=13436/(960*2)=6.99 Assuming 8

SHELTER WC

a+b=4.06m
a*b=3.64 m2
H=2.79 m
h1=0 m
h2=0.8 m
m=0.8
E0=50 lx
h=H-(h1+h2)=2.79-(0+0.8)=1.99m
k=a*b/((a+b)*h)=3.64/((4.06)*1.99=0.45 (from the table) n2=0.24
Øa =730 lm (A60 60W)
Øt=E0*S/(m*n2), Øt= 947lm
z=1
N= Øt/(Øa*z), N=947/(730*1)=1.3 Assuming 2

PARKING (2)

a+b=41.38m
a*b=160.04 m2
H=2.79 m
h1=0 m
h2=0.8 m
m=0.8
E0=50 lx
h=H-(h1+h2)=2.79-(0+0.8)=1.99m
k=a*b/((a+b)*h)=111.2/((33.64)*1.99=1.94 n2=0.49
Øa =430 lm (A60 40W) (SENSOR)
Øt=E0*S/(m*n2), Øt= 20,413lm
z=2
N= Øt/(Øa*z), N=20413/(430*2)=23 Assuming 20

PARKING (3)

a+b=19.85m
a*b=80.12 m2
H=2.79 m
h1=0 m
h2=0.8 m
m=0.8
E0=50 lx
h=H-(h1+h2)=2.79-(0+0.8)=1.99m
k=a*b/((a+b)*h)=111.2/((33.64)*1.99=2.02 Assumıng k=2 n2=0.51
Øa =430 lm (A60 40W) (SENSOR)
Øt=E0*S/(m*n2), Øt= 9,818lm
z=2
N= Øt/(Øa*z), N=9818/(430*2)=11.4 Assuming 15

PARKING ENTRANCE

a+b=21.1m
a*b=68.4 m2
H=2.79 m
h1=0 m
h2=0 m
m=0.8
E0=50 lx
h=H-(h1+h2)=2.79-(0+0)=2.79m
k=a*b/((a+b)*h)=68.4/((21.1)*2.79=1.16
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.36+(((1.16-1)/(1.25-1))*(0.41-0.36)) n2=0.392
Øa =730 lm (A60 60W) (SENSOR)
Øt=E0*S/(m*n2), Øt= 10,905lm
z=2
N= Øt/(Øa*z), N=10905/(730*2)=7.41 Assuming 6

PARKING BUILDING ENTRANCE

a+b=11.05m
a*b=31.14 m2
H=2.70 m
h1=0 m
h2=0 m
m=0.8
E0=50 lx
h=H-(h1+h2)=2.70-(0+0)=2.70m
k=a*b/((a+b)*h)=31.14/((11.05)*2.70=1.04 k=1 n2=0.36
Øa =730 lm (A60 60W)
Øt=E0*S/(m*n2), Øt= 5,406lm
z=2
N= Øt/(Øa*z), N=5406/(730*2)=3.7 Assuming 4

GROUND FLOOR

OBSERVATION ROOM

a+b=9.4 m.

a*b=S=20.15m²

H=3.09 m.

H2=0.8 m.

H1=0 m.

m=0.8 (dirty factor)

E0=200 lx

H=H-(h1+h2)=3.09-(0+0.8)=2.29m.

k=a*b/((a+b)*h) k=20.15/((9.4)*2.29)=0.94 k2=0.94

n2=n1+(((k2-k1)/(k3-k1))(n3-n1)), n2=0.31+(((0.94-0.80)/(1.0-0.80))(0.36-0.31))=0.35

Øa=1000lux (T26 18W)

Øt=E0*S/(m*n2), Øt=200*20.15/(0.8*0.35)=14,393 lm.

Z=4

N=Øt/(Øa*z), N=14,394/(1000*4)=3.59, Assuming 4

EXAMINATION ROOM

a+b=8.2m.

a*b=15.95 m²

H=3.09m.

H2=0.8m.

H1=0m.

m=0.8m.

E0=1000lx

H=H-(h1+h2)=3.09-(0+0.8)=2.29m.

k=a*b/((a+b)*h) k=15.95/((8.2)*2.29)=0.85 k2=0.85

n2=n1+(((k2-k1)/(k3-k1))(n3-n1)), n2=0.31+(((0.85-0.80)/(1.00-0.80))(0.36-0.31))=0.32

Øa=2350lux(T26 36W)

Øt=E0*S/(m*n2), Øt=1000*15.95/(0.8*0.32)=62,304 lm

Z=4

N=Øt/(Øa*z), N=62,304/(2350*4)=6.62 Assuming 6

INTERVENTION ROOM

a+b=7.8 m.
a*b=13.45 m²
H=3.09 m.
H2=0.8 m.
H1=0 m.
m=0.8
E0=500lx
H=H-(h1+h2)=3.09-(0+0.8)=2.29m.
k=a*b/((a+b)*h) k=13.45/((7.8)*2.29)=0.75
n2=n1+(((k2-k1)/(k3-k1))(n3-n1)), n2=0.24+(((0.75-0.6)/(0.8-0.6))(0.31-0.24))=0.292
Øa=2350lm(T26 36W)
Øt=E0*S/(m*n2), Øt=500*13.45/(0.8*0.292)=28,788 lm.
Z=4
N=Øt/(Øa*z), N=28788/(2350*4)=3.06 Assuming 4

DOCTOR ROOM

a+b=9.3 m.
a*b=20.50 m²
H=3.09m.
H1=0m.
H2=0.8m.
m=0.8
E0=200lx
H=H-(h1+h2)=3.09-(0+0.8)=2.29m.
k=a*b/((a+b)*h) k=20.50/((9.3)*2.29)=0.96 k2=0.96
n2=n1+(((k2-k1)/(k3-k1))(n3-n1)), n2=0.31+(((0.96-0.80)/(1-0.80))*(0.36-0.31))=0.35
Øa=1000lm(T26 18W)
Øt=E0*S/(m*n2), Øt=200*20.50/(0.8*0.35)=14,642lm
Z=4
N=Øt/(Øa*z), N=14642/(1000*4)=3.66 Assumming 4

TOMOGRAPH ROOM

a+b=20.9m.
a*b=76.14 m²
H=3.09m.
H1=0m.
H2=0.8m.
m=0.8
E0=500lx
H=H-(h1+h2)=3.09-(0+0.8)=2.29m.
k=a*b/((a+b)*h) k=76.14/((20.9)*2.29=1.60 k2=1.60
n2=n1+(((k2-k1)/(k3-k1))(n3-n1)), n2=0.45+(((1.60-1.50)/(2-1.50))(0.51-0.45))=0.462
Øa=3750lm(T26 58W)
Øt=E0*S/(m*n2), Øt=500*76.14/(0.8*0.462)=103,003lm
Z=2
N=Øt/(Øa*z), N=103003/(3750*2)=13.7 Assumming 14

BIG CORIDOR

a+b=18.8m.
a*b=42.12 m²
H=3.09m.
H1=0m.
H2=0m.
m=0.8
E0=100lx
H=H-(h1+h2)=3.09-(0+0)=3.09m.
k=a*b/((a+b)*h) k=42.12/((18.8)*3.09=0.725 k2=0.725
n2=n1+(((k2-k1)/(k3-k1))(n3-n1)), n2=0.24+(((0.725-0.60)/(0.80-0.60)((0.31-0.24))=0.283
Øa=2350lux(T26 36W)
Øt=E0*S/(m*n2), Øt=100*42.12/(0.8*0.283)=18,604lm
Z=2
N=Øt/(Øa*z), N=18604/(2350*2)=3.95 Assumming 4

X-RAY ROOM

a+b=20.7m.
a*b=72.9m²
H=3.09m.
H1=0m.
H2=0.8m.
m=0.8
E0=500lx
H=H-(h1+h2)=3.09-(0+0.8)=2.29m.
k=a*b/((a+b)*h) k=72.9/((20.7)*2.29=1.53 k2=1.50
n2=0.45
Øa=3750lm(T26 58W)
Øt=E0*S/(m*n2), Øt=500*72.9/(0.8*0.45)=101,250lm
Z=2
N=Øt/(Øa*z), N=101250/(3750*2)=13.5 Assumming 14

EMAR ROOM

a+b=16.8m.
a*b=56.12m²
H=3.09m.
H1=0m.
H2=0.8m.
m=0.8
E0=500lx
H=H-(h1+h2)=3.09-(0+0.8)=2.29m.
k=a*b/((a+b)*h) k=56.12/((16.8)*2.29=1.46 k2=1.46
n2=n1+(((k2-k1)/(k3-k1))(n3-n1)), n2=0.41+(((1.45-1.25)/(1.50-1.25)((0.45-0.41))=0.44
Øa=3750lux(T26 58W)
Øt=E0*S/(m*n2), Øt=500*56.12/(0.8*0.44)=79,715lm
Z=2
N=Øt/(Øa*z), N=79715/(3750*2)=10.62 Assumming 10

HOSPITAL ENTRANCE

(a+b+c+d)/2=10.135m.
S=35.8 m²
H=3.09m
H1=0m.
H2=0m.
m=0.8
E0=100lx
H=H-(h1+h2)=3.09-(0+0)=3.09m.
k=S/((a+b+c+d/2)*h) k=35.8/((10.135)*3.09=1.14 k2=1.14
n2=n1+(((k2-k1)/(k3-k1))(n3-n1)), n2=0.36+(((1.14-1)/(1.25-1)((0.41-0.36))=0.38
Øa=1000lm(T26 18W)
Øt=E0*S/(m*n2), Øt=100*35.8/(0.8*0.38)=11,776lm
Z=4
N=Øt/(Øa*z), N=11776/(1000*4), N=2.94 Assumming 3

CONSULTATION

a*b=70.847 m^2
a+b=19.05m.
H=3.09m
H1=0m.
H2=0.8m
m=0.8
E0=100lx
H=H-(h1+h2)=3.09-(0+0.8)=2.29m.
k=a*b/((a+b)*h) k=70.847/((19.05)*2.29)=1.62 k2=1.62
n2=n1+(((k2-k1)/(k3-k1))(n3-n1)), n2=0.45+(((1.62-1.50)/(2-1.5))*(0.51-0.45))=0.46
Øa=1000lm(T26 18W)
Øt=E0*S/(m*n2), Øt=100*70.847/(0.8*0.46)=19.251 lm
Z=4
N=Øt/(Øa*z), N=19251/(1000*4),N=4.81 Assuming 5

INFORMATION

a*b=10.50 m^2
a+b=5.8m.
H=3.09m
H1=0m.
H2=0.8m
m=0.8
E0=100lx
H=H-(h1+h2)=3.09-(0+0.8)=2.29m.
k=a*b/((a+b)*h) k=10.50/((5.8)*2.29)=0.79 k2=0.79
n2=n1+(((k2-k1)/(k3-k1))(n3-n1)), n2=0.24+(((0.79-0.60)/(0.80-0.6))*(0.31-0.24))=0.3065
Øa=1000lm(T26 18W)
Øt=E0*S/(m*n2), Øt=100*10.50/(0.8*0.3065)=4.282 lm
Z=2
N=Øt/(Øa*z), N=4282/(1000*2),N=2.141 Assuming 2

WC-1

a+b=4.8m.
a*b=S=5.4m²
H=3.09m.
H1=0m.
H2=0.8m.
m=0.8
E0=200lx
H=H-(h1+h2)=3.09-(0+0.8)=2.29m.
k=a*b/((a+b)*h) =5.4/((4.8)*2.29)=0.49 k2=0.49
n2=0.24 (from the table)
Øa=960lm(A60 75W)
Øt=E0*S/(m*n2), Øt=200*5.4/(0.8*0.24)=5625lm
Z=2
N=Øt/(Øa*z), N=5625/(960*2)=2.92 N= Assumming 3

WC-2

a+b=4.8m.
a*b=S=5.4m²
H=3.09m.
H1=0m.
H2=0.8m.
m=0.8
E0=200lx
H=H-(h1+h2)=3.09-(0+0.8)=2.29m.
k=a*b/((a+b)*h) =5.4/((4.8)*2.29)=0.49 k2=0.49
n2=0.24 (from the table)
Øa=960lm(A60 75W)
Øt=E0*S/(m*n2), Øt=200*5.4/(0.8*0.24)=5625lm
Z=2

EMERGENCY ROOM

a*b=47.675 m²
a+b=20.2m.
H=3.09m
H1=0m.
H2=0.8m
m=0.8
E0=500lx
H=H-(h1+h2)=3.09-(0+0.8)=2.29m.
k=a*b/((a+b)*h) k=47.675/((20.02)*2.29)=1.03 k2=1.03
n2=n1+(((k2-k1)/(k3-k1))(n3-n1)), n2=0.36+(((1.03-1.00)/(1.25-1))*(0.41-0.36))=0.366
Øa=5200lm(T26 58W OSRAM)
Øt=E0*S/(m*n2), Øt=500*47.675/(0.8*0.366)=81.412 lm
Z=2
N=Øt/(Øa*z), N=81412/(5200*2),N=7.82 Assuming 8

STAIRS

a*b=9.9 m²
a+b=6.65m.
H=3.09m
H1=0m.
H2=0.m
m=0.8
E0=100lx
H=H-(h1+h2)=3.09-(0+0)=3.09m.
k=a*b/((a+b)*h) k=9.9/((6.65)*3.09)=0.48 k2=0.48
n2=0.24 (from the table)
Øa=1000lm(T26 18W)
Øt=E0*S/(m*n2), Øt=100*9.9/(0.8*0.24)=5.156 lm
Z=2
N=Øt/(Øa*z), N=5156/(1000*2),N=2.578 Assuming 3

First Floor

POLYCLINIC 1

a= 4.2 m.

b=3.5m.

S=14m.^{2}

H= 3.09m.

E0= 200 lux (For policlinics) (*)

m=0.8 (dirty factor)

h1=0, h2=0.85m.

h=H – (h1+h2), h=3.09-0.85=2.4m.

k=a*b/((a+b)*h) k=(4.2*3.5)/((4.2+3.5)*2.4)=0.76, k2=0.76

n2=n1+(((k2-k1)/(k3-k1))(n3-n1)), n2=0.24+(((0.76-0.6)/(0.8-0.6))(0.31-0.24))

n2=0.296 (**)

Øa=1000lux (T26 18W)

Øt=E0*S/(m*η), Øt=(200*14)/(0.8*0.296)=11824 lm.

z=2

N=Øt/(Øa*z), N=11824/(1000*2)= 5.9 Assuming 6 lamps.

POLYCLINIC 2

a= 4.7 m.

b=4.8m.

S=20.7m.²

H= 3.09m.

E0= 200 lux (For policlinics) (*)

h1=0, h2=0.85m.

h=H – (h1+h2), h=3.09-0.85=2.4m.

k=a*b/((a+b)*h) k=(4.7*4.8)/((4.7+4.8)*2.4)=0.99,

n2=0.36 (**)

Øa=1000lux (T26 18W)

Øt=E0*S/(m*n2), Øt=(200*20.7)/(0.8*0.36)=14375 lm.

z=2

N=Øt/(Øa*z), N=14375/(1000*2)=7.2 Assuming 7 lamps.

CABINS

a= 1.8 m.

B=1.25m.

S=2.25m.²

H= 3.09m.

E0= 500 lux (For that rooms) (*)

h1=0, h2=0.85m.

h=H – (h1+h2), h=3.09-0.85=2.4m.

k=a*b/((a+b)*h) k=(1.8*1.25)/((1.8+1.25)*2.4)=0.31 Assuming 0.6

n2=0.36 (**)

Øa=900 lux (TC 11W)

Øt=E0*S/(m*n2), Øt=(500*2.25)/(0.8*0.36)=3906 lm.

z=2

N=Øt/(Øa*z), N=3906/(900*2)=2.17 Assuming 2 lamps.

POLYCLİNİC 3

a= 4.4 m.

b=4.8m.

S=19.3m.²

H= 3.09m.

E0= 200 lux (For policlinics) (*)

h1=0, h2=0.85m.

h=H – (h1+h2), h=3.09-0.85=2.4m.

k=a*b/((a+b)*h) k=(4.4*4.8)/((4.4+4.8)*2.4)=0.96, k2=0.96

n2=n1+(((k2-k1)/(k3-k1))(n3-n1)), n2=0.31+(((0.96-0.8)/(1-0.8))(0.36-0.31))

n2=0.35 (**)

Øa=1000lux (T26 18W)

Øt=E0*S/(m*n2), Øt=(200*19.3)/(0.8*0.35)=13786 lm

z=2

N=Øt/(Øa*z), N=13786/(1000*2)=6.9 Assuming 7 lamps

CAFETERIA

a+b=14.3m

a*b=S=19.3m.²

H= 3.09m.

E_o= 200 lux (For cafeterias) (*)

h1=0, h2=0.85m.

h=H – (h1+h2), h=3.09-0.85=2.4m.

k=a*b/((a+b)*h) k=(19.3)/((14.3)*2.4)=0.56 Assuming 0.6

η2=0.36 (**)

Øa=600 lux (PAR38-12°/30°)

Øt=E_o*S/(m*η), Øt=(200*19.3)/(0.8*0.36)=13403 lm

z=3

N=Øt/(Øa*z), N=13403/(600*3)=7.4 Assuming 7 lamps.

LABORATORY

a= 12.86 m.

B=7.5m.

S=92.35m.^{2}

H= 3.09m.

E_o= 500 lux (For Labrotory) (*)

h1=0, h2=0.85m.

h=H – (h1+h2), h=3.09-0.85=2.4m.

k=S/((a+b)*h) k=(92.35)/((12.86+7.5)*2.4)=1.89, k2=1.89

η2=η1+(((k2-k1)/(k3-k1))(η3-η1)), η2=0.45+(((1.89-1.5)/(2-1.5))(0.51-0.45))

η2=0.5 (**)

Øa=1000lux (T26 18W)

Øt=E_o*S/(m*η2), Øt=(500*92.35)/(0.8*0.5)=115,438 lm

z=4

N=Øt/(Øa*z), N=115,438/(1000*4)=28.9 Assuming 30 lamps

SAMPLING ROOM

a= 4.1 m.

B=4.8m.

S=18.0m.^{2}

H= 3.09m.

E_o= 500 lux (For that rooms) (*)

h1=0, h2=0.85m.

h=H – (h1+h2), h=3.09-0.85=2.4m.

k=S/((a+b)*h) k=(18.0)/((4.1+4.8)*2.4)=0.85, k2=0.85

η2=η1+(((k2-k1)/(k3-k1))(η3-η1)), η2=0.31+(((0.85-0.8)/(1-0.8))(0.41-0.36))

η2=0.33 (**)

Øa=1380lux

Øt=E_o*S/(m*η2), Øt=(500*18.0)/(0.8*0.33)=34,091 lm , z=2

N=Øt/(Øa*z), N=34,091/(1380*2)=12.35 Assuming 12 lamps

MAIN ROOM

a+b=15.5m

a*b=S=46.35m.²

H= 3.09m.

E_o= 200 lux (For that place) (*)

h1=0, h2=0.

h=H – (h1+h2), h=3.09 m.

k=a*b/((a+b)*h) k=(46.35)/((15.5)*3.09)=0.97 assuming 1

η2=0.36 (**)

Øa=1000 lux (T26 18W)

Øt=E_o*S/(m*η), Øt=(200*46.35)/(0.8*0.36)=32,187 lm

z=2

N=Øt/(Øa*z), N=32,187/(1000*2)=16.01 Assuming 16 lamps

MAIN STAIR

a+b=9.03m

a*b=S=11.63m.²

H= 3.09m.

E_o= 100 lux (For the stairs) (*)

h1=0, h2=0.85m.

h=H – (h1+h2), h=3.09m.

k=a*b/((a+b)*h) k=(11.63)/((9.03)*3.09)=0.41 assuming 0.6

η2=0.24 (**)

Øa=1380 lux

Øt=E_o*S/(m*η), Øt=(100*11.63)/(0.8*0.24)=6,058 lm

z=1

N=Øt/(Øa*z), N=6,058/(1380*1)=4.39 Assuming 4 lamps.

STAFF STAIRS

a+b=6.64m

a*b=S=11.03m.^{2}

H= 3.09m.

E_o= 100 lux (For the stairs) (*)

h1=0, h2=0.85m.

h=H – (h1+h2), h=3.09m.

k=a*b/((a+b)*h) k=(11.03)/((6.64)*3.09)=0.54 assuming 0.6

η2=0.24 (**)

Øa=1380 lux

Øt=E_o*S/(m*η), Øt=(100*11.03)/(0.8*0.24)=5,745 lm.

z=1

N=Øt/(Øa*z), N=5,745/(1380*1)=4.16 Assuming 4 lamps.

BIG CORIDOR

a+b=21.7 m

a*b=S=92.82 m.^{2}

H= 3.09m.

E_o= 100 lux (For the coridors) (*) (At night it should be 50)

h1=0, h2=0.85m.

h=H – (h1+h2), h=3.09m.

k=a*b/((a+b)*h) k=(92.82)/((21.7)*3.09)=1.38 k2=1.38

η2=η1+(((k2-k1)/(k3-k1))(η3-η1)), η2=0.41+(((1.38-1.25)/(1.5-1.25))(0.45-0.41))

η2=0.43 (**)

Øa=2350 lux (T26 36W)

Øt=E_o*S/(m*η), Øt=(100*92.82)/(0.8*0.43)=26,983 lm

z=2

N=Øt/(Øa*z), N=26,983/(2350*2)=5.7 Assuming 6 lamps

SMALL CORIDOR

a+b=10.8m

a*b=S=19.55 m.^{2}

H= 3.09m.

E_o= 100 lux (For the coridors) (*) (At night it should be 50)

h1=0, h2=0.85m.

h=H – (h1+h2), h=3.09m.

k=a*b/((a+b)*h) k=(19.55)/((10.8)*3.09)=0.59 assuming k=0.6

η2=0.24 (**)

Øa=2350lux (T26 26W)

Øt=E_o*S/(m*η), Øt=(100*19.55)/(0.8*0.24)=10,182 lm

z=2

N=Øt/(Øa*z), N=10,182/(2350*2)=2.17 Assuming 2 lamps

TOULETS

a+b=4.31m

a*b=S=4.65 m.^{2}

H= 3.09m.

E_o= 200 lux (For the touletss) (*) (At night it should be 50)

h1=0, h2=0

h=H – (h1+h2), h=3.09m.

k=a*b/((a+b)*h) k=(4.65)/((4.31)*3.09)=0.35 assuming k=0.6

η2=0.24 (**)

Øa=1380 lux

Øt=E_o*S/(m*η), Øt=(200*4.65)/(0.8*0.24)=4,844 lm

z=1

N=Øt/(Øa*z), N=4,844/(1380*1)=3.51 Assuming 4 lamps

SECOND FLOOR

ANGIOGRAPH BED

a+b=12.70 m
a*b=35.75 m2
H=3.09 m
h1=0 m
h2=0.8 m
m=0.8
E0=500 lx
h=H-(h1+h2)=3.09-(0+0.8)=2.29m
k=a*b/((a+b)*h)=35.75/((12.70)*2.29=1.22
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.40
Øa =5200 lm (T26 36W OSRAM)
Øt=E0*S/(m*n2), Øt=55,859 lm.
z=2
N= Øt/(Øa*z), N=5.37 Assuming 6

INTENSIVE CARE(1)

a+b=12.9 m
a*b=37.25 m2
H=3.09 m
h1=0 m
h2=0.8 m
m=0.8
E0=1000 lx
h=H-(h1+h2)=3.09-(0+0.8)=2.29m
k=a*b/((a+b)*h)=37.25/((12.9)*2.29=1.26 asumming 1.25
n2=0.41 (from the table)
Øa =5200 lm (T26 58W OSRAM)
Øt=E0*S/(m*n2), Øt=113,567 lm.
z=2
N= Øt/(Øa*z), N=10.9 Assuming 10

SEMI-STERILE CORRIDOR (1)

a+b=8.95 m
a*b=16.51 m2
H=3.09 m
h1=0 m
h2=0 m
m=0.8
E0=100 lx
h=H-(h1+h2)=3.09-(0+0)=3.09m
k=a*b/((a+b)*h)=16.51/((8.95)*3.09=0.596 asumming 0.6
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.24
Øa =2350 lm (T26 36W)
Øt=E0*S/(m*n2), Øt=8599 lm.
z=1
N= Øt/(Øa*z), N=3.66 asumming 4

ANGIOGRAPH ROOM

a+b=14.05 m
a*b=41.63 m2
H=3.09 m
h1=0 m
h2=0.8 m
m=0.8
E0=500 lx
h=H-(h1+h2)=3.09-(0+0.8)=2.29m
k=a*b/((a+b)*h)=41.63/((14.05)*2.29=1.29
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.41+(((1.29-1.25)/(1.50-1.25))*(0.45-0.41))=0.4164
Øa =2350 lm (T26 36W)
Øt=E0*S/(m*n2), Øt=500*41.63/(0.8*0.4164)=62,484 lm.
z=4
N= Øt/(Øa*z), N=62484/(2350*4)=6.64 Assuming 6

SEMI-STERILE CORRIDOR (2)

a+b=10.95 m
a*b=21.71 m2
H=3.09 m
h1=0 m
h2=0 m
m=0.8
E0=100 lx
h=H-(h1+h2)=3.09-(0+0)=3.09m
k=a*b/((a+b)*h)=21.71/((10.95)*3.09=0.642
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.24+(((0.642-0.60)/(0.80-0.60))*(0.31-0.24))
n2=0.2547
Øa =2350 lm (T26 36W)
Øt=E0*S/(m*n2), Øt=10,654 lm.
z=1
N= Øt/(Øa*z), N=10654/(2350*1)=4.53 Assuming 4

INTENSIVE CARE (2)

(a+b+c+d)/2=(8.38+6.22+6.60+6.22)/2=13.71m
a*b*c*d=50.30m2
H=3.09 m
h1=0 m
h2=0.8 m
m=0.8
E0=1000lx
h=H-(h1+h2)=3.09-(0+0.8)=2.29m
k=a*b/((a+b+c+d/2)*h)=50.30/((13.71)*2.29=1.60
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.45+(((1.60-1.50)/(2-1.50))*(0.51-0.45)) n2=0.462
Øa =3750 lm (T26 58W)
Øt=E0*S/(m*n2), Øt=1000*50.30/(0.8*0.462)=136,093lm
z=4
N= Øt/(Øa*z), N=136093/(3750*4)=9.07 Assuming 9

AUTOCLAVE ROOM

a+b=7.6 m
a*b=12.90 m2
H=3.09 m
h1=0 m
h2=0.8 m
m=0.8
E0=500 lx
h=H-(h1+h2)=3.09-(0+0.8)=2.29m
k=a*b/((a+b)*h)=12.90/((7.6)*2.29=0.74
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.24+(((0.74-0.60)/(0.80-0.60))*(0.31-0.24)) n2=0.29
Øa =1000 lm (T26 18W)
Øt=E0*S/(m*n2), Øt=27,802 lm.
z=4
N= Øt/(Øa*z), N=27802/(1000*4)=6.95 Assuming 6

PATIENT PREPATION

a+b=7.5 m
a*b=12.96 m2
H=3.09 m
h1=0 m
h2=0.8 m
m=0.8
E0=500 lx
h=H-(h1+h2)=3.09-(0+0.8)=2.29m
k=a*b/((a+b)*h)=12.96/((7.5)*2.29=0.75
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.24+(((0.75-0.60)/(0.80-0.60))*(0.31-0.24))
n2=0.2925
Øa =2350 lm (T26 36W)
Øt=E0*S/(m*n2), Øt=27,692 lm.
z=4
N= Øt/(Øa*z), N=27692/(2350*2)=5.89 Assuming 4

PATIENT RESUSCITATION

a+b=7.5 m
a*b=12.96 m2
H=3.09 m
h1=0 m
h2=0.8 m
m=0.8
E0=500 lx
h=H-(h1+h2)=3.09-(0+0.8)=2.29m
k=a*b/((a+b)*h)=12.96/((7.5)*2.29=0.75
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.24+(((0.75-0.60)/(0.80-0.60))*(0.31-0.24))
n2=0.2925
Øa =2350 lm (T26 36W)
Øt=E0*S/(m*n2), Øt=27,692 lm.
z=4
N= Øt/(Øa*z), N=27692/(2350*2)=5.89 Assuming 4

OPERATING ROOM (1)

a+b=11.3 m
a*b=30 m2
H=3.09 m
h1=0 m
h2=0.8 m
m=0.8
E0=1000 lx
h=H-(h1+h2)=3.09-(0+0.8)=2.29m
k=a*b/((a+b)*h)=30/((11.3)*2.29=1.16
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.36+(((1.16-1)/(1.25-1))*(0.41-0.36)) n2=0.39
Øa =3750 lm (T26 58W)
Øt=E0*S/(m*n2), Øt=96,154 lm.
z=4
N= Øt/(Øa*z), N=96154/(3750*4)=6.41 Assuming 6

OPERATING ROOM (2)

a+b=14.05 m
a*b=46.35 m2
H=3.09 m
h1=0 m
h2=0.8 m
m=0.8
E0=1000 lx
h=H-(h1+h2)=3.09-(0+0.8)=2.29m
k=a*b/((a+b)*h)=46.35/((14.05)*2.29=1.44
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.41+(((1.44-1.25)/(1.50-1.25))*(0.45-0.41)) n2=0.44
Øa =3750 lm (T26 58W)
Øt=E0*S/(m*n2), Øt=131,676 lm.
z=4
N= Øt/(Øa*z), N=131676/(3750*4)=8.77 Assuming 8

OPERATING ROOM (3)

a+b= 12.80m
a*b=35.80 m2
H=3.09 m
h1=0 m
h2=0.8 m
m=0.8
E0=1000 lx
h=H-(h1+h2)=3.09-(0+0.8)=2.29m
k=a*b/((a+b)*h)=46.35/((14.05)*2.29=1.22
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.36+(((1.22-1)/(1.25-1))*(0.41-0.36)) n2=0.404
Øa =3750 lm (T26 58W)
Øt=E0*S/(m*n2), Øt=110,767 lm.
z=4
N= Øt/(Øa*z), N=131676/(3750*4)=7.38 Assuming 6

WOMEN'S LOCKER ROOM

a+b= 6.95m
a*b=9.90 m2
H=3.09 m
h1=0 m
h2=0.8 m
m=0.8
E0=100 lx
h=H-(h1+h2)=3.09-(0+0.8)=2.29m
k=a*b/((a+b)*h)=9.90/((6.95)*2.29=0.62
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.24+(((0.62-0.60)/(0.80-0.60))*(0.31-0.24))
n2=0.247
Øa =1000 lm (T26 18W)
Øt=E0*S/(m*n2), Øt=5,010 lm.
z=4
N= Øt/(Øa*z), N=5010/(1000*4)=1.25 Assuming 2

MEN'S LOCKER ROOM

a+b= 5.75m
a*b=7.65 m2
H=3.09 m
h1=0 m
h2=0.8 m
m=0.8
E0=100 lx
h=H-(h1+h2)=3.09-(0+0.8)=2.29m
k=a*b/((a+b)*h)=7.65/((5.75)*2.29=0.60, n2=0.24
Øa =1000 lm (T26 18W)
Øt=E0*S/(m*n2), Øt=3984 lm.
z=2
N= Øt/(Øa*z), N=3984/(1000*2)=1.9 Assuming 2

DOCTOR ROOM

a+b= 7.2m
a*b=12 m2
H=3.09 m
h1=0 m
h2=0.8 m
m=0.8
E0=100 lx
h=H-(h1+h2)=3.09-(0+0.8)=2.29m
k=a*b/((a+b)*h)=12/((7.2)*2.29=0.73
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.24+(((0.73-0.60)/(0.80-0.60))*(0.31-0.24)) n2=0.28
Øa =1000 lm (T26 18W)
Øt=E0*S/(m*n2), Øt=5357 lm.
z=2
N= Øt/(Øa*z), N=3984/(1000*2)=2.67 Assuming 3

WAITING(1)

a+b= 8.7m
a*b=18.72 m2
H=3.09 m
h1=0 m
h2=0.8 m
m=0.8
E0=100 lx
h=H-(h1+h2)=3.09-(0+0.8)=2.29m
k=a*b/((a+b)*h)=18.72/((8.7)*2.29=0.93
n2=0.31+(((0.93-0.80)/(1-0.80))*(0.36-0.31)), n2=0.24+(((0.73-0.60)/(0.80-0.60))*(0.31-0.24)) n2=0.3425
Øa =1000 lm (T26 18W)
Øt=E0*S/(m*n2), Øt= 6832lm.
z=2
N= Øt/(Øa*z), N=3984/(1000*2)=3.41 Assuming 4

WAITING HALL

a+b= 8.15m
a*b=9.97 m2
H=3.09 m
h1=0 m
h2=0 m
m=0.8
E0=100 lx
h=H-(h1+h2)=3.09-(0+0)=3.09m
k=a*b/((a+b)*h)=9.97/((8.15)*3.09=0.396, n2=0.24(from the table)
Øa =1000 lm (T26 18W)
Øt=E0*S/(m*n2), Øt= 5192lm.
z=2
N= Øt/(Øa*z), N=3984/(1000*2)=2.59 Assuming 4

STERILE CORRIDOR

a+b= 9.1m
a*b=16.9 m2
H=3.09 m
h1=0 m
h2=0 m
m=0.8
E0=100 lx
h=H-(h1+h2)=3.09-(0+0)=3.09m
k=a*b/((a+b)*h)=16.9/((9.1)*3.09=0.60, n2=0.24(from the table)
Øa =1000 lm (T26 18W)
Øt=E0*S/(m*n2), Øt= 8802lm.
z=2
N= Øt/(Øa*z), N=8802/(1000*2)=4.4 Assuming 4

SEMI-STERILE CORRIDOR (3)

a+b= 11.03m
a*b=21.918 m2
H=3.09 m
h1=0 m
h2=0 m
m=0.8
E0=100 lx
h=H-(h1+h2)=3.09-(0+0)=3.09m
k=a*b/((a+b)*h)=21.918/((11.03)*3.09=0.64,
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.24+(((0.64-0.60)/(0.80-0.60))*(0.31-0.24))
n2=0.254
Øa =1000 lm (T26 18W)
Øt=E0*S/(m*n2), Øt= 10786lm.
z=2
N= Øt/(Øa*z), N=8802/(1000*2)=5.4 Assuming 5

WAITING (2)

a+b= 16.4m
a*b=27.23 m2
H=3.09 m
h1=0 m
h2=0 m
m=0.8
E0=100 lx
h=H-(h1+h2)=3.09-(0+0)=3.09m
k=a*b/((a+b)*h)=27.23/((16.4)*3.09=0.53 n2=0.24 (from the table)
Øa =1000 lm (T26 18W)
Øt=E0*S/(m*n2), Øt= 14182lm.
z=2
N= Øt/(Øa*z), N=8802/(1000*2)=7.09 Assuming 7

PATIENT ROOM (1)

(a+b+c+d)/2= 8.72m
a*b=12.24 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=150 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=27.23/((16.4)*3.09=0.597 assuming n2=0.24 (from the table)
Øa =840 lm (QT18 60W)
Øt=E0*S/(m*n2), Øt= 9562lm.
z=2
N= Øt/(Øa*z), N=9562/(840*2)=5.7 Assuming 5

PATIENT ROOM (1) -TOILET

a+b=4.25m
a*b=3.90 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=200 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=3.90/((4.25)*2.35=0.40 assuming n2=0.24 (from the table)
Øa =960 lm (A60 75W)
Øt=E0*S/(m*n2), Øt= 4062lm.
z=2
N= Øt /(Øa*z), N=4062/(960*2)=2.11 Assuming 2

PATIENT ROOM (2)

(a+b+c+d)/2= 8.72m
a*b=12.24 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=150 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=27.23/((16.4)*3.09=0.597 assuming n2=0.24 (from the table)
Øa =840 lm (QT18 60W)
Øt=E0*S/(m*n2), Øt= 9562lm.
z=2
N= Øt/(Øa*z), N=9562/(840*2)=5.7 Assuming 5

PATIENT ROOM (2) -TOILET

a+b=4.25m
a*b=3.90 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=200 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=3.90/((4.25)*2.35=0.40 assuming n2=0.24 (from the table)
Øa =960 lm (A60 75W)
Øt=E0*S/(m*n2), Øt= 4062lm.
z=2
N= Øt /(Øa*z), N=4062/(960*2)=2.11 Assuming 2

PATIENT ROOM (3)

a+b=9.1m
a*b=15.6 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=150 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=15.6/((9.1)*2.35=0.72
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.24+(((0.72-0.6)/(0.80-0.60))*(0.31-0.24)) n2=0.282
Øa =840 lm (QT18 60W)
Øt=E0*S/(m*n2), Øt= 10,372lm
z=2
N= Øt/(Øa*z), N=10372/(840*2)=6.17 Assuming 6

PATIENT ROOM (3) -TOILET

a+b=4.1m
a*b=3.4 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=200 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=3.90/((4.25)*2.35=0.35 assuming n2=0.24 (from the table)
Øa =960 lm (A60 75W)
Øt=E0*S/(m*n2), Øt= 3542lm.
z=2
N= Øt /(Øa*z), N=3542/(960*2)=1.84 Assuming 2

PATIENT ROOM (4)

a+b=9.1m
a*b=15.6 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=150 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=15.6/((9.1)*2.35=0.72
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.24+(((0.72-0.6)/(0.80-0.60))*(0.31-0.24)) n2=0.282
Øa =840 lm (QT18 60W)
Øt=E0*S/(m*n2), Øt= 10,372lm
z=2
N= Øt/(Øa*z), N=10372/(840*2)=6.17 Assuming 6

PATIENT ROOM (4) -TOILET

a+b=4.1m
a*b=3.4 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=200 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=3.90/((4.25)*2.35=0.35 assuming n2=0.24 (from the table)
Øa =960 lm (A60 75W)
Øt=E0*S/(m*n2), Øt= 3542lm.
z=2
N= Øt /(Øa*z), N=3542/(960*2)=1.84 Assuming 2

PATIENT ROOM (5)

a+b=9.1m
a*b=15.6 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=150 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=15.6/((9.1)*2.35=0.72
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.24+(((0.72-0.6)/(0.80-0.60))*(0.31-0.24)) n2=0.282
Øa =840 lm (QT18 60W)
Øt=E0*S/(m*n2), Øt= 10,372lm
z=2
N= Øt/(Øa*z), N=10372/(840*2)=6.17 Assuming 6

PATIENT ROOM(5) -TOILET

a+b=4.1m
a*b=3.4 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=200 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=3.90/((4.25)*2.35=0.35 assuming n2=0.24 (from the table)
Øa =960 lm (A60 75W)
Øt=E0*S/(m*n2), Øt= 3542lm.
z=2
N= Øt /(Øa*z), N=3542/(960*2)=1.84 Assuming 2

PATIENT ROOM (6)

a+b=10.5m

a*b=22.55 m2

H=3.15 m

h1=0 m

h2=0.8 m

m=0.8

E0=150 lx

h=H-(h1+h2)=3.15-(0+0.8)=2.35m

k=a*b/((a+b)*h)=22.55/((10.5)*2.35=0.72

n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.31+(((0.91-0.8)/(1-0.8))*(0.36-0.31)) n2=0.33

Øa =840 lm (QT18 60W)

Øt=E0*S/(m*n2), Øt= 12,812lm

z=2

N= Øt/(Øa*z), N=12812/(840*2)=7,62 Assuming 8

PATIENT ROOM (6) -TOILET

a+b=4.1m

a*b=3.4 m2

H=3.15 m

h1=0 m

h2=0.8 m

m=0.8

E0=200 lx

h=H-(h1+h2)=3.15-(0+0.8)=2.35m

k=a*b/((a+b)*h)=3.90/((4.25)*2.35=0.35 assuming n2=0.24 (from the table)

Øa =960 lm (A60 75W)

Øt=E0*S/(m*n2), Øt= 3542lm.

z=2

N= Øt /(Øa*z), N=3542/(960*2)=1.84 Assuming 2

PATIENT ROOM (7)

a+b=9.1m
a*b=15.6 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=150 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=15.6/((9.1)*2.35=0.72
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.24+(((0.72-0.6)/(0.80-0.60))*(0.31-0.24)) n2=0.282
Øa =840 lm (QT18 60W)
Øt=E0*S/(m*n2), Øt= 34574lm
z=2
N= Øt/(Øa*z), N=10372/(840*2)=6.17 Assuming 6

PATIENT ROOM (7) -TOILET

a+b=4.1m
a*b=3.4 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=200 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=3.90/((4.25)*2.35=0.35 assuming n2=0.24 (from the table)
Øa =960 lm (A60 75W)
Øt=E0*S/(m*n2), Øt= 3542lm.
z=2

PATIENT ROOM (8)

a+b=9.1m
a*b=15.6 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=150 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=15.6/((9.1)*2.35=0.72
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.24+(((0.72-0.6)/(0.80-0.60))*(0.31-0.24)) n2=0.282
Øa =840 lm (QT18 60W)
Øt=E0*S/(m*n2), Øt= 10,372lm
z=2
N= Øt/(Øa*z), N=10372/(840*2)=6.17 Assuming 6

4.8 PATIENT ROOM (8) -TOILET

a+b=4.1m
a*b=3.4 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=200 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=3.90/((4.25)*2.35=0.35 assuming n2=0.24 (from the table)
Øa =960 lm (A60 75W)
Øt=E0*S/(m*n2), Øt= 3542lm.
z=2
N= Øt /(Øa*z), N=3542/(960*2)=1.84 Assuming 2

PATIENT ROOM (9)

a+b=9.1m
a*b=15.6 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=150 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=15.6/((9.1)*2.35=0.72
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.24+(((0.72-0.6)/(0.80-0.60))*(0.31-0.24)) n2=0.282
Øa =840 lm (QT18 60W)
Øt=E0*S/(m*n2), Øt= 10,372lm
z=2
N= Øt/(Øa*z), N=10372/(840*2)=6.17 Assuming 6

PATIENT ROOM (9) –TOILET

a+b=4.1m
a*b=3.4 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=200 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=3.90/((4.25)*2.35=0.35 assuming n2=0.24 (from the table)
Øa =960 lm (A60 75W)
Øt=E0*S/(m*n2), Øt= 3542lm.
z=2
N= Øt /(Øa*z), N=3542/(960*2)=1.84 Assuming 2

PATIENT ROOM (10)

a+b=9.1m
a*b=15.6 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=150 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=15.6/((9.1)*2.35=0.72
n2=n1+(((k2-k1)/(k3-k1))*(n3-n1)), n2=0.24+(((0.72-0.6)/(0.80-0.60))*(0.31-0.24)) n2=0.282
Øa =840 lm (QT18 60W)
Øt=E0*S/(m*n2), Øt= 10,372lm
z=2
N= Øt/(Øa*z), N=10372/(840*2)=6.17 Assuming 6

PATIENT ROOM (10) -TOILET

a+b=4.1m
a*b=3.4 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=200 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=3.90/((4.25)*2.35=0.35 assuming n2=0.24 (from the table)
Øa =960 lm (A60 75W)
Øt=E0*S/(m*n2), Øt= 3542lm.
z=2
N= Øt /(Øa*z), N=3542/(960*2)=1.84 Assuming 2

NURSE ROOM

a+b=5.9m
a*b=6.75 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=500 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=6.75/((9.1)*2.35=0.48 n2=0.24
Øa =1000 lm (T26 18W)
Øt=E0*S/(m*n2), Øt= 17578lm
z=4
N= Øt/(Øa*z), N=/(1000*4)=4.35 Assuming 4

CORRIDOR

a+b=21.7m
a*b=49.66 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=100 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=49.66/((21.7)*2.35=0.48 k=0.98, n2=0.36
Øa =1000 lm (T26 18W)
Øt=E0*S/(m*n2), Øt= 17243lm
z=4
N= Øt/(Øa*z), N=17243/(1000*4)=4.35 Assuming 6

FLOOR OFFICE (1)

a+b=5.35m
a*b=6.14 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=100 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=49.66/((21.7)*2.35=0.49 k=0.49, n2=0.24
Øa =1000 lm (T26 18W)
Øt=E0*S/(m*n2), Øt= 3198lm
z=4
N= Øt/(Øa*z), N=3198/(1000*4)=0.8 Assuming 1

FLOOR OFFICE (2)

a+b=3.75m
a*b=3.44 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=100 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=3.44/((3.75)*2.35=0.40 k=0.40, n2=0.24
Øa =1000 lm (T26 18W)
Øt=E0*S/(m*n2), Øt= 1791lm z=2
N= Øt/(Øa*z), N=1791/(1000*)=0.9 Assuming 1

WC

a+b=3.95m
a*b=3.40 m2
H=3.15 m
h1=0 m
h2=0.8 m
m=0.8
E0=50 lx
h=H-(h1+h2)=3.15-(0+0.8)=2.35m
k=a*b/((a+b)*h)=3.40/((3.3.95)*2.35=0.37 k=0.37, n2=0.24
Øa =960 lm (A60 75W)
Øt=E0*S/(m*n2), Øt= 885lm z=1
N= Øt/(Øa*z), N=885/(960*1)=0.92 Assuming 2

STAIRWELL

a+b=18m
a*b=57.39 m2
H=3.15 m
h1=0 m
h2=0 m
m=0.8
E0=100 lx
h=H-(h1+h2)=3.15-(0+0)=3.15m
k=a*b/((a+b)*h)=57.39/((18)*3.15=1.01 k=1, n2=0.36
Øa =1000 lm (T26 18W)
Øt=E0*S/(m*n2), Øt= 19927lm
z=4
N= Øt/(Øa*z), N=19927/(1000*4)=4.9 Assuming 5

INSTALLATION FLOOR

IF.1

a+b=45.76m.

a*b=250.46m²

H=1.89m.

H1=0m.

H2=0.8m.

m=0.8

E0=100lx

H=H-(h1+h2)=1.89-(0+0.8)=1.09m.

k=a*b/((a+b)*h) k=250.46/((45.76)*1.09=5.02 k2=5

n2=0.66 (from the table)

Øa=1000lm(T26 18W)

Øt=E0*S/(m*n2), Øt=100*250.46/(0.8*0.66)=47,435lm

Z=2

N=Øt/(Øa*z), N=47435/(1000*2), N=23.71 Assumming 26

IF.2

a+b=38.45m.

a*b=162.77m²

H=1.89m.

H1=0m.

H2=0.8m.

m=0.8

E0=100lx

H=H-(h1+h2)=1.89-(0+0.8)=1.09m.

k=a*b/((a+b)*h) k=162.77/((38.45)*1.09=3.88 k2=3.88

n2=n1+(((k2-k1)/(k3-k1))(n3-n1)), n2=0.59+(((3.88-3.00)/(0.63-0.59))=0.6252

Øa=1000lm(T26 18W)

Øt=E0*S/(m*n2), Øt=100*162.77/(0.8*0.6252)=32,543lm

Z=2

N=Øt/(Øa*z), N=32543/(1000*2), N=16.27 Assumming 16

MEDİCAL GAS ROOM

a+b=11m.
a*b=S=21.32m²
H=1.89m.
H1=0m.
H2=0.8m.
m=0.8
E0=100lx
H=H-(h1+h2)=1.89-(0+0.8)=1.09m.
k=a*b/((a+b)*h) k=21.32/((11)*1.09=1.78 k2=1.78
n2=n1+(((k2-k1)/(k3-k1))(n3-n1)), n2=0.45+(((1.78-1.50)/(2.00-1.50))*(0.51-0.45))=0.4836
Øa=1000lm(T26 18W)
Øt=E0*S/(m*n2), Øt=100*21.32/(0.8*0.4836)=5552lm
Z=2
N=Øt/(Øa*z), N=5552/(1000*2), N=2.776 Assumming 3

IF.3

a+b=17.4 m.
a*b=S=51.065m²
H=1.89m.
H1=0m.
H2=0.8m.
m=0.8
E0=100lx
H=H-(h1+h2)=1.89-(0+0.8)=1.09m.
k=a*b/((a+b)*h) k=51.065/((17.4)*1.09=2.69 k2=2.69
n2=n1+(((k2-k1)/(k3-k1))(n3-n1)), n2=0.56+(((2.69-2.50)/(3.00-2.50))*(0.59-0.56))=0.57
Øa=1000lm(T26 18W)
Øt=E0*S/(m*n2), Øt=100*51.065/(0.8*0.57)=11198lm
Z=2
N=Øt/(Øa*z), N=11198/(1000*2), N=5.59 Assumming 6

MEDICAL GAS CORRIDOR

a+b=10 m.
a*b=S=14.76m²
H=1.89m.
H1=0m.
H2=0m.
m=0.8
E0=100lx
H=H-(h1+h2)=1.89-(0+0)=1.89m.
k=a*b/((a+b)*h) k=14.76/((10)*1.89=0.78 k2=0.78
n2=n1+(((k2-k1)/(k3-k1))(n3-n1)), n2=0.24+(((0.78-0.60)/(0.80-0.60))*(0.31-0.24))=0.30
Øa=1000lm(T26 18W)
Øt=E0*S/(m*n2), Øt=100*14.76/(0.8*0.30)=6150lm
Z=2
N=Øt/(Øa*z), N=6150/(1000*2)=3 N= Assumming 4

STAIRWELL

a+b=12.95m.
a*b=S=30.58m²
H=1.89m.
H1=0m.
H2=0m.
m=0.8
E0=100lx
H=H-(h1+h2)=1.89-(0+0)=1.89m.
k=a*b/((a+b)*h) k=30.58/((12.95)*1.89=1.249 k2=1.25
n2=0.41 (from the table)
Øa=1000lm(T26 18W)
Øt=E0*S/(m*n2), Øt=100*30.58/(0.8*0.41)=9323lm
Z=2
N=Øt/(Øa*z), N=9323/(1000*2)=4.68 N= Assumming 5

THIRD FLOOR

MAIN HALL

a+b=15.5m

a*b=S=46.35m.^{2}

H= 3.09m.

E_o= 200 lux (*)

h1=0, h2=0.

h=H – (h1+h2), h=3.09 m.

k=a*b/((a+b)*h) k=(46.35)/((15.5)*3.09)=0.97 assuming 1

η2=0.36 (**)

Øa=1000 lux (T26 18W)

Øt=E_o*S/(m*η), Øt=(200*46.35)/(0.8*0.36)=32,187 lm

z=2

N=Øt/(Øa*z), N=32,187/(1000*2)=16.01 Assuming 16 lamps

MAIN STAIRS

a+b=9.03m

a*b=S=11.63m.^{2}

H= 3.09m.

E_o= 100 lux (For the stairs) (*)

h1=0, h2=0.

h=H – (h1+h2), h=3.09m.

k=a*b/((a+b)*h) k=(11.63)/((9.03)*3.09)=0.41 assuming 0.6

η2=0.24 (**)

Øa=1380 lux

Øt=E_o*S/(m*η), Øt=(100*11.63)/(0.8*0.24)=6,058 lm

z=1

N=Øt/(Øa*z), N=6,058/(1380*1)=4.39 Assuming 4 lamps.

PATIENTS ROOM WC and BATHROOM

a+b=4.0 m

a*b=S=3.4 $m.^2$

H= 3.09m.

E_o= 200 lux (*)

h1=0, h2=0.80m.

h=H – (h1+h2), h=2.29m.

k=a*b/((a+b)*h) k=(3.4)/((4.0)*2.29)=0.37 Assuming 0.6

η2=0.24 (**)

Øa=960 lux (A60 75W)

Øt=E_o*S/(m*η), Øt=(200*3.09)/(0.8*0.24)=3.219 lm.

z=1

N=Øt/(Øa*z), N=3.219/(960*1)=3.3 Assuming 3 lamps.

PATIENT ROOM 2

a+b=5.6 m

a*b=S=6.75 $m.^2$

H= 3.09m.

E_o= 300 lux (*)

h1=0, h2=0.85m.

h=H – (h1+h2), h=2.24m.

k=a*b/((a+b)*h) k=(6.75)/((5.6)*2.24)=0.54 assuming k2=0.6

η2=0.24 (**)

Øa=840 lux (QT18 60W)

Øt=E_o*S/(m*η), Øt=(300*6.75)/(0.8*0.24)=11,807 lm

z=2

N=Øt/(Øa*z), N=11,807/(840*2)=7.03 Assuming 7 lamps.

NURSE ROOM

a+b=10.2 m

a*b=S=20.15 m.^{2}

H= 3.09m.

E_o= 150 lux (*)

h1=0, h2=0.75m. (Bed level)

h=H – (h1+h2), h=2.34m.

k=a*b/((a+b)*h) k=(20.15)/((10.2)*2.34)=0.72 k2=0.84

$\eta 2=\eta 1+(((k2-k1)/(k3-k1))(\eta 3-\eta 1))$, $\eta 2=0.31+(((0.84-0.8)/(1.0-0.8))(0.36-0.31))$

$\eta 2=0.32$ (**)

Øa=1050 lux (QT18 75W)

$Øt=E_o*S/(m*\eta)$, Øt=(150*20.15)/(0.8*0.32)=10,547 lm.

z=2

N=Øt/(Øa*z), N=10,547/(1050*2)=5.02 Assuming 5 lamps.

CORIDOR

a+b=21.7 m

a*b=S=49.66 m.^{2}

H= 3.09m.

E_o= 100 lux (For the coridors) (*) (At night it should be 50)

h1=0, h2=0

h=H – (h1+h2), h=3.09m.

k=a*b/((a+b)*h) k=(49.66)/((21.7)*3.09)=0.74

$\eta 2=\eta 1+(((k2-k1)/(k3-k1))(\eta 3-\eta 1))$, $\eta 2=0.24+(((0.74-0.6)/(0.8-0.6))(0.31-0.24))$

$\eta 2=0.29$ (**) Øa=2350 lux (T26 36W)

$Øt=E_o*S/(m*\eta)$, Øt=(100*49.66)/(0.8*0.29)=21,405 lm z=2

N=Øt/(Øa*z), N=21,405/(2350*2)=4.56 Assuming 5 lamps

INTENSICE ROOM

a+b=11.99 m

a*b=S=37.8 $m.^2$

H= 3.09m.

E_o= 1000 lux (*)

h1=0, h2=80

h=H – (h1+h2), h=2.29m.

k=a*b/((a+b)*h) k=(37.8)/((11.99)*2.29)=1.38

$\eta 2=\eta 1+(((k2-k1)/(k3-k1))(\eta 3-\eta 1))$, $\eta 2=0.41+(((1.38-1.25)/(1.5-1.25))(0.45-0.41))$

$\eta 2=0.43$ (**)

Øa=2350 lux (T26 36W)

$Øt=E_o*S/(m*\eta)$, Øt=(1000*37.8)/(0.8*0.43)=109,884 lm

z=4

N=Øt/(Øa*z), N=109,884/(2350*4)=11.67 Assuming 12 lamps

DOCTOR'S ROOM

a+b=7.2 m.

a*b=S=11.75$m.^2$

H= 3.09m.

E_o= 500 lux (*)

h1=0, h2=0.85m.

h=H – (h1+h2), h=3.09-0.85=2.4m.

k=S/((a+b)*h) k=(11.75)/((7.2)*2.4)=0.68, k2=0.68

$\eta 2=\eta 1+(((k2-k1)/(k3-k1))(\eta 3-\eta 1))$, $\eta 2=0.24+(((0.68-0.6)/(0.8-0.6))(0.31-0.24))$

$\eta 2=0.27$ (**) Øa=1050lux (QT18 5W)

$Øt=E_o*S/(m*\eta 2)$, Øt=(500*11.75)/(0.8*0.27)=27,245 lm z =3

N=Øt/(Øa*z), N=27,245/(1050*3)=8.65 Assuming 9 lamps

MIDWIES ROOM

a+b=6.7 m.

a*b=S=10.35m.^{2}

H= 3.09m.

E_o= 500 lux (*)

h1=0, h2=0.85m.

h=H – (h1+h2), h=3.09-0.85=2.4m.

k=S/((a+b)*h) k=(10.35)/((6.7)*2.4)=0.64, k2=0.64

$\eta 2=\eta 1+(((k2-k1)/(k3-k1))(\eta 3-\eta 1))$, $\eta 2=0.24+(((0.64-0.6)/(0.8-0.6))(0.31-0.24))$

$\eta 2=0.25$ (**)

Øa=1050lux (QT18 5W)

$Øt=E_o*S/(m*\eta 2)$, Øt=(500*10.35)/(0.8*0.25)=25,875 lm

z=4

N=Øt/(Øa*z), N=25,875/(1050*4)=6.16 Assuming 6 lamps

DELIVERY ROOM 1

a+b=10.1 m.

a*b=S=23.2 m.^{2}

H= 3.09m.

E_o= 100 lux (*)

h1=0, h2=0.80m.

h=H – (h1+h2), h=3.09-0.85=2.29m.

k=S/((a+b)*h) k=(23.2)/((10.1)*2.29)) k=1

$\eta 2=0.36$ (**)

Øa=900 lux (TC 5W)

$Øt=E_o*S/(m*\eta 2)$, Øt=(100*23.2)/(0.8*0.36)=8,056 lm z=1

N=Øt/(Øa*z), N=8,056/(900*1)=8.95 Assuming 9 lamps

DELIVERY ROOM 2

a+b=8.68 m.

a*b=S=15.65 $m.^2$

H= 3.09m.

E_o= 100 lux (*)

h1=0, h2=0.80m.

h=H – (h1+h2), h=3.09-0.85=2.29m.

k=S/((a+b)*h) k=(15.65)/((8.68)*2.29))=0.79 Assuming 0.8

η2=0.31 (**)

Øa=900 lux (TC 5W)

Øt=E_o*S/(m*η2), Øt=(100*15.65)/(0.8*0.31)=6,310 lm

z=1

N=Øt/(Øa*z), N=6,310/(900*1)=7.01 Assuming 7 lamps

DELIVERY

a+b=14.8 m.

a*b=S=44.1 m.²

H= 3.09m.

E_o= 1000 lux (*)

h1=0, h2=0.80m.

h=H – (h1+h2), h=3.09-0.85=2.29m.

k=S/((a+b)*h) k=(44.1)/((14.8)*2.29))=1.3

$\eta 2=\eta 1+(((k2-k1)/(k3-k1))(\eta 3-\eta 1))$, $\eta 2=0.41+(((1.3-1.25)/(1.5-1.25))(0.45-0.41))$

$\eta 2=0.42$ (**)

Øa=2350 lux (T26 36W)

$Øt=E_o*S/(m*\eta 2)$, Øt=(1000*44.1)/(0.8*0.42)=131,250 lm

z=4

N=Øt/(Øa*z), N=131,250/(2350*4)=13.97 Assuming 14 lamps

WC1

a+b=4.47 m

a*b=S=5.00 m.²

H= 3.09m.

E_o= 100 lux (For the touletss) (*)

h1=0, h2=0.

h=H – (h1+h2), h=3.09m.

k=a*b/((a+b)*h) k=(5.00)/((4.47)*3.09)=0.36 assuming k=0.6

$\eta 2=0.24$ (**) Øa=1380 lux

$Øt=E_o*S/(m*\eta)$, Øt=(100*5.00)/(0.8*0.24)=2,604 lm z=1

N=Øt/(Øa*z), N=2,604/(1380*1)=1.89 Assuming 2 lamps

WC2

a+b=4.22 m

a*b=S=4.40 m.^{2}

H= 3.09m.

E_o= 100 lux (For the touletss) (*)

h1=0, h2=0.

h=H – (h1+h2), h=3.09m.

k=a*b/((a+b)*h) k=(4.40)/((4.22)*3.09)=0.34 assuming k=0.6

η2=0.24 (**)

Øa=1380 lux

Øt=E_o*S/(m*η), Øt=(100*4.40)/(0.8*0.24)=2,292 lm

z=1

N=Øt/(Øa*z), N=2,292/(1380*1)=1.67 Assuming 2 lamps

NST ROOM

a+b=7.15 m.

a*b=S=10.45 m.^{2}

H= 3.09m.

E_o= 500 lux (*)

h1=0, h2=0.80m.

h=H – (h1+h2), h=3.09-0.85=2.29m.

k=S/((a+b)*h) k=(10.45)/((7.15)*2.29))=0.64

η2=η1+(((k2-k1)/(k3-k1))(η3-η1)), η2=0.24+(((0.64-0.6)/(0.8-0.6))(0.31-0.24))

η2=0.25 (**) Øa=1000 lux (T26 18W)

Øt=E_o*S/(m*η2), Øt=(500*10.45)/(0.8*0.25)=26,135 lm z=4

N=Øt/(Øa*z), N=131,250/(1000*4)=6.5 Assuming 6 lamps

PAINS ROOM

a+b=7.7 m.

a*b=S=13.86 m.^{2}

H= 3.09m.

E_o= 500 lux (*)

h1=0, h2=0.80m.

h=H – (h1+h2), h=3.09-0.85=2.29m.

k=S/((a+b)*h) k=(13.86)/((7.7)*2.29))=0.62 Assuming k=0.6

$\eta 2=\eta 1+(((k2-k1)/(k3-k1))(\eta 3-\eta 1))$, $\eta 2=0.24+(((0.64-0.6)/(0.8-0.6))(0.31-0.24))$

$\eta 2=0.24$ (**)

Øa=1000 lux (T26 18W)

$Øt=E_o*S/(m*\eta 2)$, Øt=(500*13.86)/(0.8*0.24)=36,094 lm

z=4

N=Øt/(Øa*z), N=136,094 /(1000*4)=9.02 Assuming 9 lamps

WC1

a+b=3.65m

a*b=S=4.65 m.^{2}

H= 3.09m.

E_o= 100 lux (For the touletss) (*)

h1=0, h2=0.

h=H – (h1+h2), h=3.09m.

k=a*b/((a+b)*h) k=(4.65)/((3.65)*3.09)=0.41 assuming k=0.6

$\eta 2=0.24$ (**) Øa=1380 lux

$Øt=E_o*S/(m*\eta)$, Øt=(200*4.65)/(0.8*0.24)=2,422 lm

z=1

N=Øt/(Øa*z), N=2,422/(1380*1)=1.75 Assuming 2 lamps

WC2

a+b=3.05m

a*b=S=2.22 m.^{2}

H= 3.09m.

E_o= 100 lux (For the touletss) (*)

h1=0, h2=0.

h=H – (h1+h2), h=3.09m.

k=a*b/((a+b)*h) k=(2.22)/((3.05)*3.09)=0.23 assuming k=0.6

η2=0.24 (**)

Øa=1380 lux

Øt=E_o*S/(m*η), Øt=(100*2.22)/(0.8*0.24)=1,156 lm

z=1

N=Øt/(Øa*z), N=1,156/(1380*1)=0.84 Assuming 1 lamps

CROSSING HALL

a+b=6.2m

a*b=S=7.65 m.^{2}

H= 3.09m.

E_o= 100 lux (For the coridors) (*) (At night it should be 50)

h1=0, h2=0

h=H – (h1+h2), h=3.09m.

k=a*b/((a+b)*h) k=(7.65)/((6.2)*3.09)=0.4 assuming k=0.6

η2=0.24 (**)

Øa=2350lux (T26 26W)

Øt=E_o*S/(m*η), Øt=(100*7.65)/(0.8*0.24)=3,984 lm

z=1

N=Øt/(Øa*z), N=3,984/(2350*1)=1.7 Assuming 2 lamps

FLOOR OFFICE

a+b=3.7m

a*b=S=3.4 $m.^2$

H= 3.09m.

E_o= 100 lux (For the coridors) (*) (At night it should be 50)

h1=0, h2=0

h=H – (h1+h2), h=3.09m.

k=a*b/((a+b)*h) k=(3.4)/((3.7)*3.09)=0.3 assuming k=0.6

η2=0.24 (**)

Øa=960lux (A60 75W)

Øt=E_o*S/(m*η), Øt=(100*3.4)/(0.8*0.24)=1,771 lm

z=1

N=Øt/(Øa*z), N=1,771/(960*1)=1.85 Assuming 2 lamps

FİFTH FLOOR

CHAIRMAN OF THE BOARD

a+b=13.59m.
a*b=S=37.25m²
H=3.34m.
H1=0m.
H2=0.8m.
m=0.8
E0=200lx
H=H-(h1+h2)=3.34-(0+0.8)=2.54m.
k=a*b/((a+b)*h) k=37.25/((13.59)*2.54=1.08 k2=1.08
n2=n1+(((k2-k1)/(k3-k1))(n3-n1)), n2=0.36+(((1.08-1.00)/(1.25-1))*(0.41-0.36))=0.37
n2=0.37
Øa=840lm(QT18 60W)
Øt=E0*S/(m*n2), Øt=200*37.25/(0.8*0.37)=25168lm
Z=4
N=Øt/(Øa*z), N=25168/(840*4)=7.49 N= Assumming 7

COMMON ROOM

a+b=4.71m.
a*b=S=6.10m²
H=3.34m.
H1=0m.
H2=0.8m.
m=0.8
E0=50lx
H=H-(h1+h2)=3.34-(0+0.8)=2.54m.
k=a*b/((a+b)*h) k=6.10/((4.71)*2.54=0.50 k2=0.60 n2=0.24 (from the table)
Øa=840lm(QT18 60W)
Øt=E0*S/(m*n2), Øt=50*6.10/(0.8*0.24)=1588lm
Z=2
N=Øt/(Øa*z), N=1588/(840*2)=0.945 N= Assumming 1

WC

a+b=4.12 m.

a*b=S=4.45m²

H=3.34m.

H1=0m.

H2=0.8m.

m=0.8

E0=200lx

H=H-(h1+h2)=3.34-(0+0.8)=2.54m.

k=a*b/((a+b)*h) =4.45/((4.12)*2.54)=0.42 k2=0.42

n2=0.24 (from the table)

Øa=960lm(A60 75W)

Øt=E0*S/(m*n2), Øt=200*4.45/(0.8*0.24)=4635lm

Z=2

N=Øt/(Øa*z), N=4635/(960*2)=2.41 N= Assumming 2

SECRETARIA

a+b=15.79m.

a*b=S=49.644m²

H=3.34m.

H1=0m.

H2=0.8m.

m=0.8

E0=200lx

H=H-(h1+h2)=3.34-(0+0.8)=2.54m.

k=a*b/((a+b)*h) =49.644/((15.79)*2.54)=1.24 k2=1.24

n2=0.41 (from the table)

Øa=840lm(QT18 60W)

Øt=E0*S/(m*n2), Øt=200*49.64/(0.8*0.41)=30268lm

Z=4

N=Øt/(Øa*z), N=30268/(840*2)=9 N= Assumming 7

POWER CALCULATIONS

VOLTAGE DROPS(for Illuminations and Power cable)

BASEMENT FLOOR

For illuminations line

4.line; %e=(0.074)*(P*L)/S <1.5

%e=(0.074)*(0.8*27.4)/1.5=1.08<1.5 acceptable

For power lines

1.line; %e=(0.074)*(P*L)/S <1.5

%e=(0.074)*((2.1*23.7))/2.5=1.47<1.5 acceptable

GROUND FLOOR

For illumination line

1. Line

%e=0.074*(P*L)/S (for mono phase)

%e=0.074*(1.8*33.8)/4=1.12<1.5 Acceptable

For power line

1.Line; %e=0.074*(P*L)/S (for mono phase)

%e=0.074*(2.1*37.69)/4=1.46<1.5 Acceptable

8.Line; %e=0.0124*(P*L)/S (for three phase)

%e=0.0124*(1.8*32.64)/4=0.18<3.0 Acceptable

FIRST FLOOR

For illuminations line

9. Line; %e=0.074(P*L)/S (For monophase)

%e=0.074((14*0.018)*22.91)/1.5)=0.28 (<1.5 accecptable)

For Power line

12. Line; %e=0.074(P*L)/S (For monophase)

%e=0.074((5*0.3)*35.45)/(4)=0.98 (<1.5 accecptable)

3. Line; %e=0.0124(P*L)/S (For therephase)

%e=0.0124((6*0.6)*23.45)/(4)=0.26 (<3.0 accecptable)

SECOND FLOOR

For illuminations line

3.line; %e=(0.074)*(P*L)/S <1.5

%e=(0.074)*((80*0.058)*17.67)/6=1.01<1.5 acceptable

For power lines

14.line; %e=(0.074)*(P*L)/S <1.5 (mono phase)

%e=(0.074)*((0.3*7)*17.67)/2.5=1.1<1.5 acceptable

11.line; %e=(0.0124)*(P*L)/S <3 (three phase)

%e=(0.0124)*((0.6*5)*25)/4=0.23 <3 acceptable

INSTALLATION FLOOR

For illumination Line

3.Line; %e=0.074*(P*L)/S (for mono phase)

%e=0.074*(0.828*31.43)/1.5=1.28<1.5 Acceptable

For power Line

1.Line; %e=0.074*(P*L)/S (for mono phase)

%e=0.074*(1.2*36.82)/2.5=1.30<1.5 Acceptable

THIRD FLOOR

For illuminations line

1.Line; %e=0.074(P*L)/S (For monophase)
%e=0.074((2200)*23.0)/2.5)=1.49 (<1.5 accecptable)

For power line

13.Line; %e=0.074(P*L)/S (For monophase)
%e=0.074((7*0.3)*23.0/2.5=1.43 (<1.5 accecptable)

3. Line; %e=0.0124(P*L)/S (For therephase)

%e=0.0124((3*0.6)*23.45)/(4)=0.13 (<3.0 accecptable)

FOURT FLOOR

For illuminations line

3.line; %e=(0.074)*(P*L)/S <1.5

%e=(0.074)*(1.98*25)/2.5=1.4<1.5 acceptable

For power lines

7.line; %e=(0.074)*(P*L)/S <1.5 (mono phase)

%e=(0.074)*((0.3*7)*25)/4=0.97<1.5 acceptable

FIFTH FLOOR

For illumination Line

1.Line; %e=0.074*(P*L)/S (for mono phase)

%e=0.074*(1.95*14.56)/2.5=0.84<1.50 Acceptable

For power Line

1.Line; %e=0.074*(P*L)/S (for mono phase)

%e=0.074*(1.5*14.86)/2.5=0.66<1.50 Acceptable

General Voltage Drop

		Length (m)	I (A) Line	
1. Basement Floor	Power (KW) 12,1	3	18.38	**4x4**

Dvd=g*L*I
Dvd=6*3*18.38
331mV (<9500 Acceptable)

2. Ground Floor	Power (KW) 2,4	6,5	3,64	**4x4**

Dvd=g*L*I
Dvd=6*6.5*3.64
142mV (<9500 Acceptable)

3. First Floor	Power (KW) 11,95	10	18,15	**4x6**

Dvd=g*L*I
Dvd=3.6*10*18.15
653mV (<9500 Acceptable)

4. Second Floor	Power (KW) 23,63	13,5	35,9	**4x10**

Dvd=g*L*I
Dvd=2.2*13.5*35.9
1066mV (<9500 Acceptable)

5. Installation Floor	Power (KW) 2	15,8	3,03	**4x4**

Dvd=g*L*I
Dvd=6*15.8*3.03
288mV (<9500 Acceptable)

6. Thirdh Floor	Power (KW) 23,14	19,3	35.15	**4x10**

Dvd=g*L*I
Dvd=2.2*19.3*35.15
1492 mV (<9500 Acceptable)

7. Fourth Floor	Power (KW) 10,3	22,8	15,64	**4x6**

Dvd=g*L*I
Dvd=3.6*22.8*15.64
1284 mV (<9500 Acceptable)

8. Fifth Floor	Power (KW) 2,27	26,3	3,44	**4x2.5**

Dvd=g*L*I
Dvd=9.1*26.3*3.4
823mV (<9500 Acceptable)

8.1 AC Dvd=g*L*I	Power (KW) 10	45.71	15,02	**4x6**

Dvd=3.6*45.71*15.02
2478mV (<9500 Acceptable)

8.2 Elevators Dvd=g*L*I	Power (KW) 8	45.2	12,15	**4x6**

Dvd=3.6*45.2*12.15
1977mV (<9500 Acceptable)

Main Cable	105,2	25	159.8	**3x70+35**

Dvd=g*L*I
Dvd=0.57*25*1

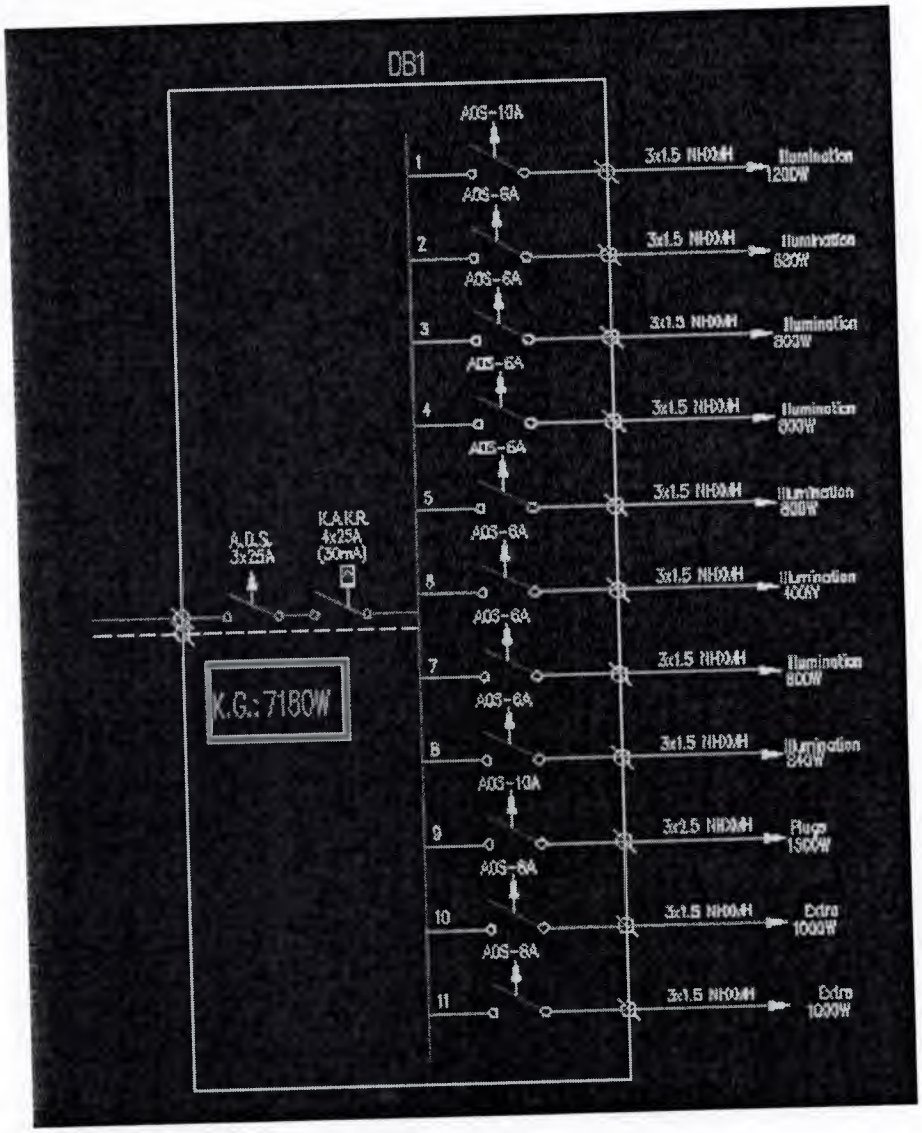
Main Circuit Breaker Calculation;
I=P/[U*1.73*cosQ)
I=105200/(220*1.73*0.8)
I=345A (350A is acceptable)

* Acceptable Voltage Drop 380*0.025=9,5V
=9500mV

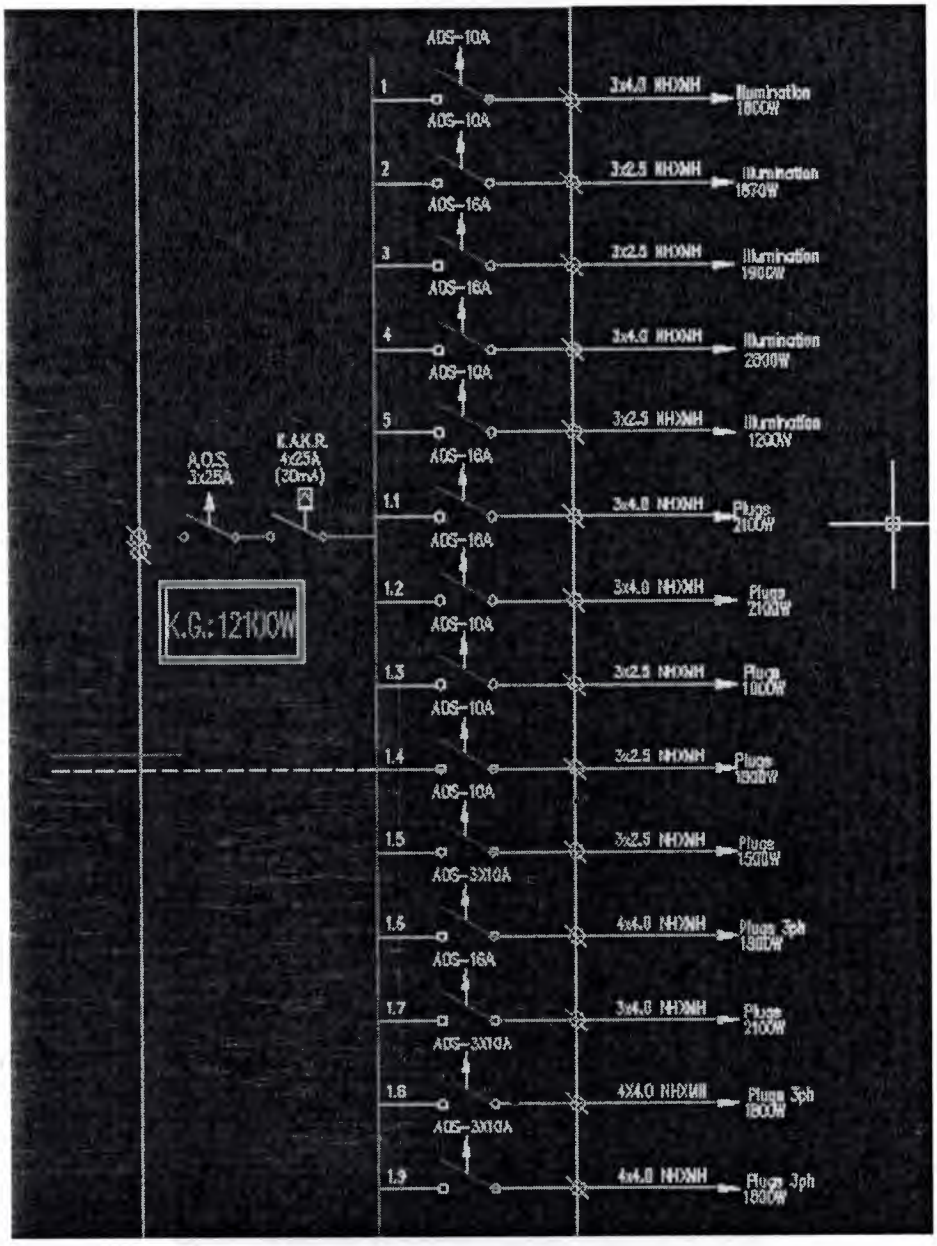
** From the Croos Sectional Area Tables

Total Power and Voltage Drop Distribution Boxes

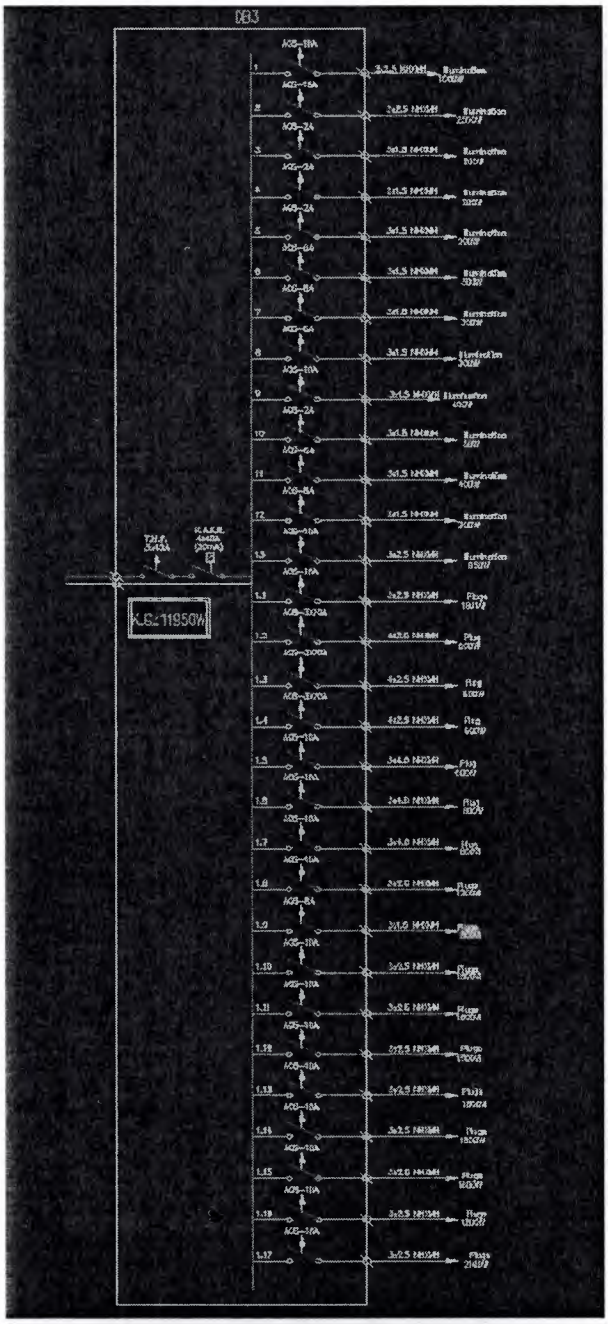
BASEMENT FLOOR;



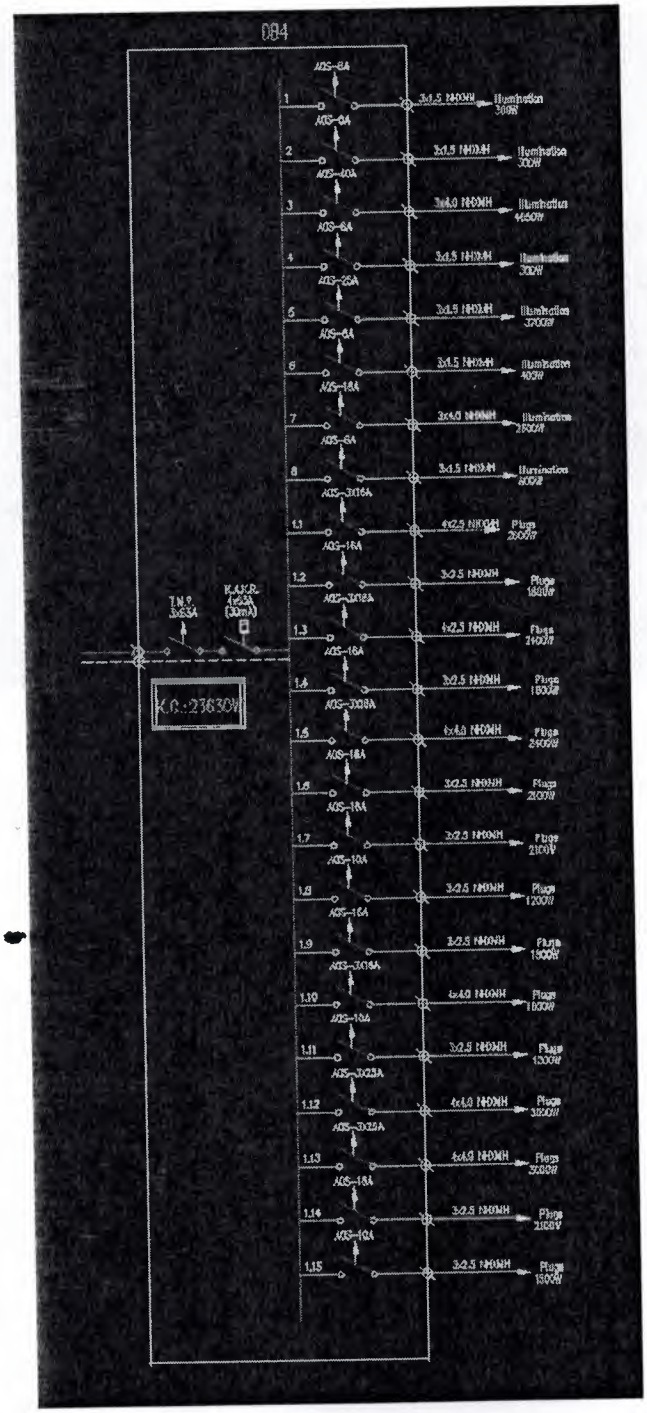
GROUND FLOOR;



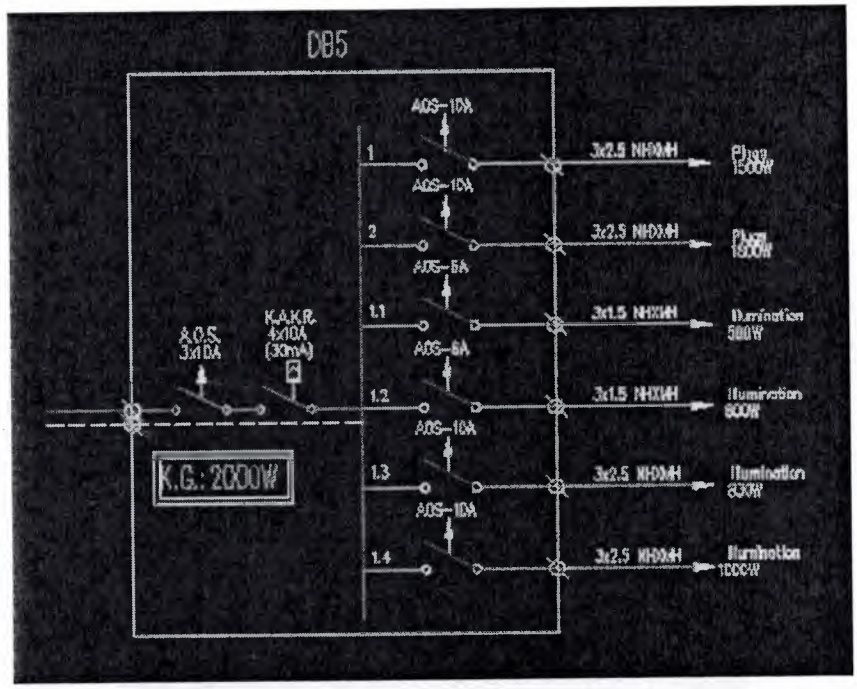
FIRST FLOOR;



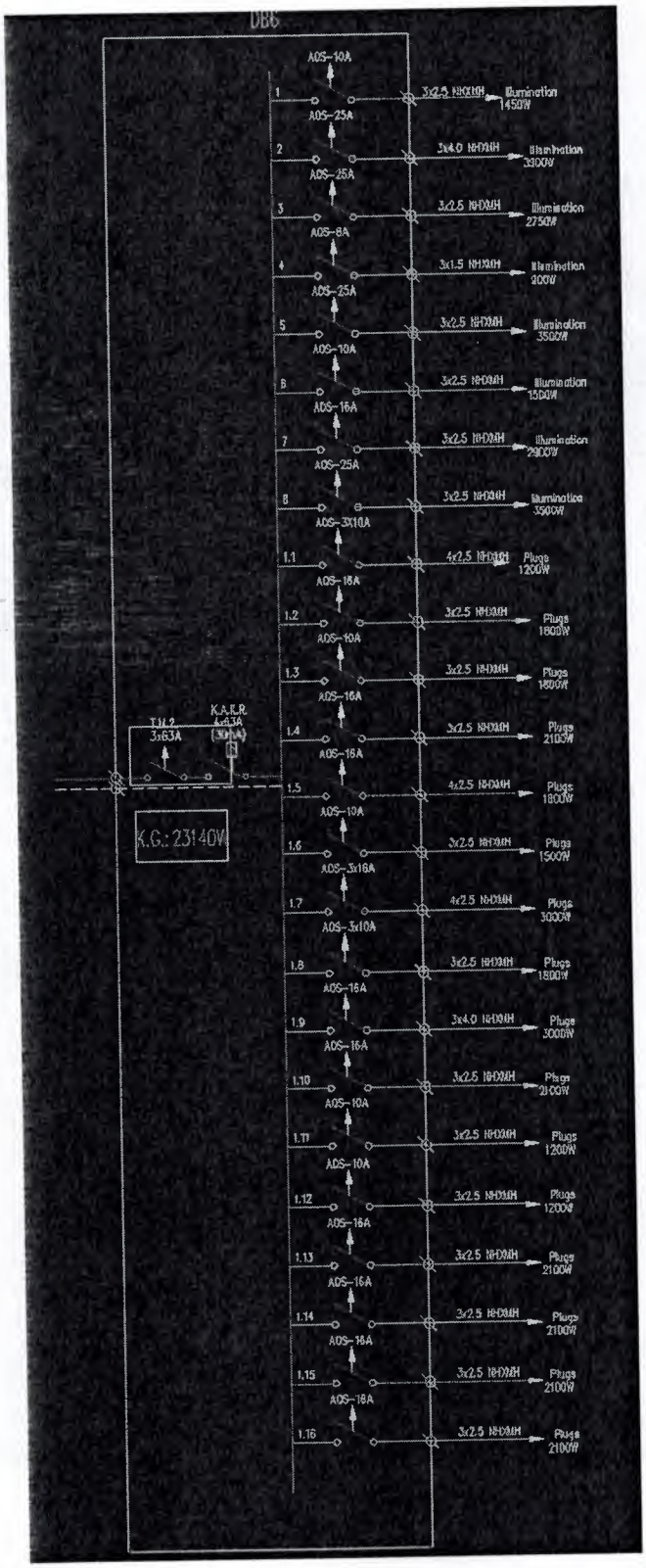
SECOND FLOOR;



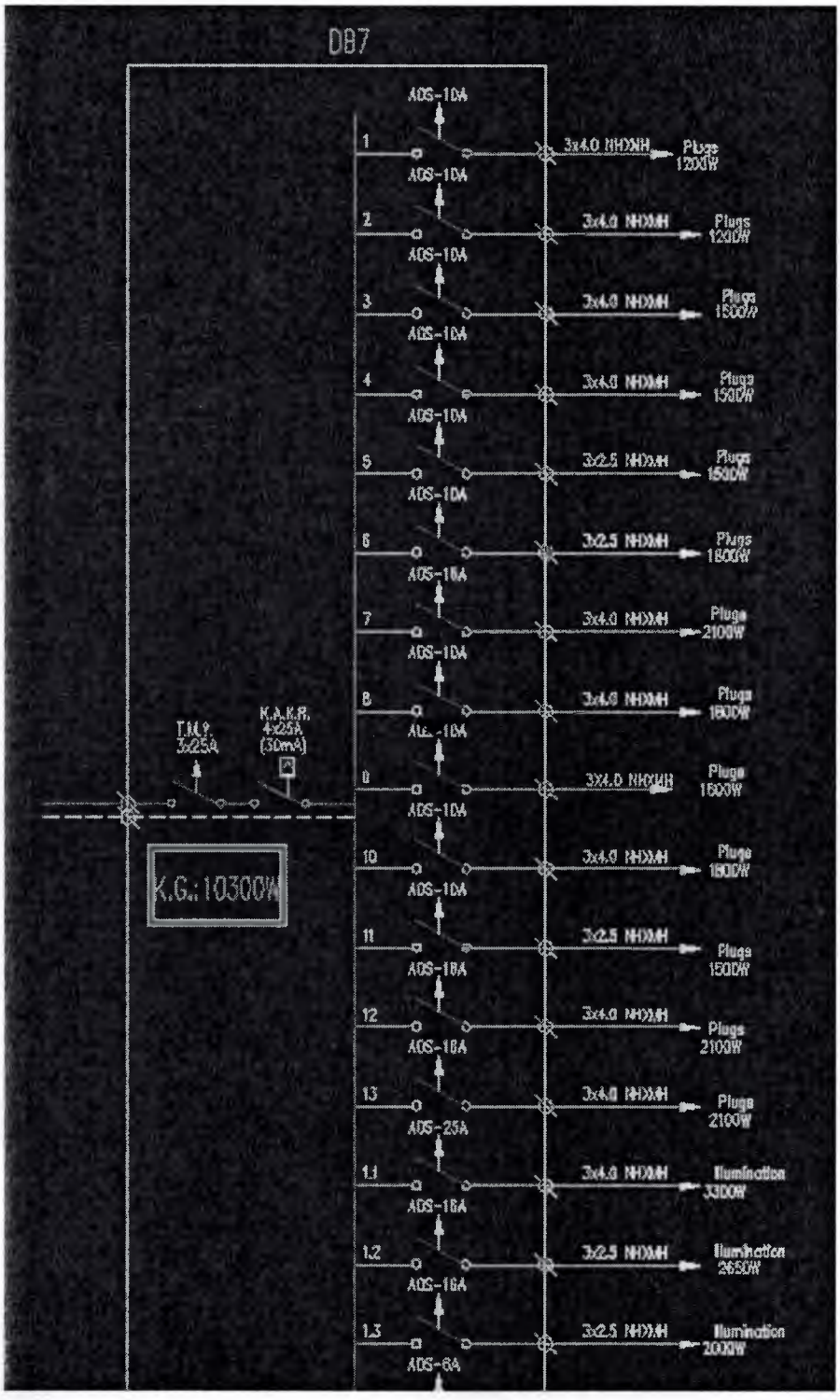
INSTALLATION FLOOR;



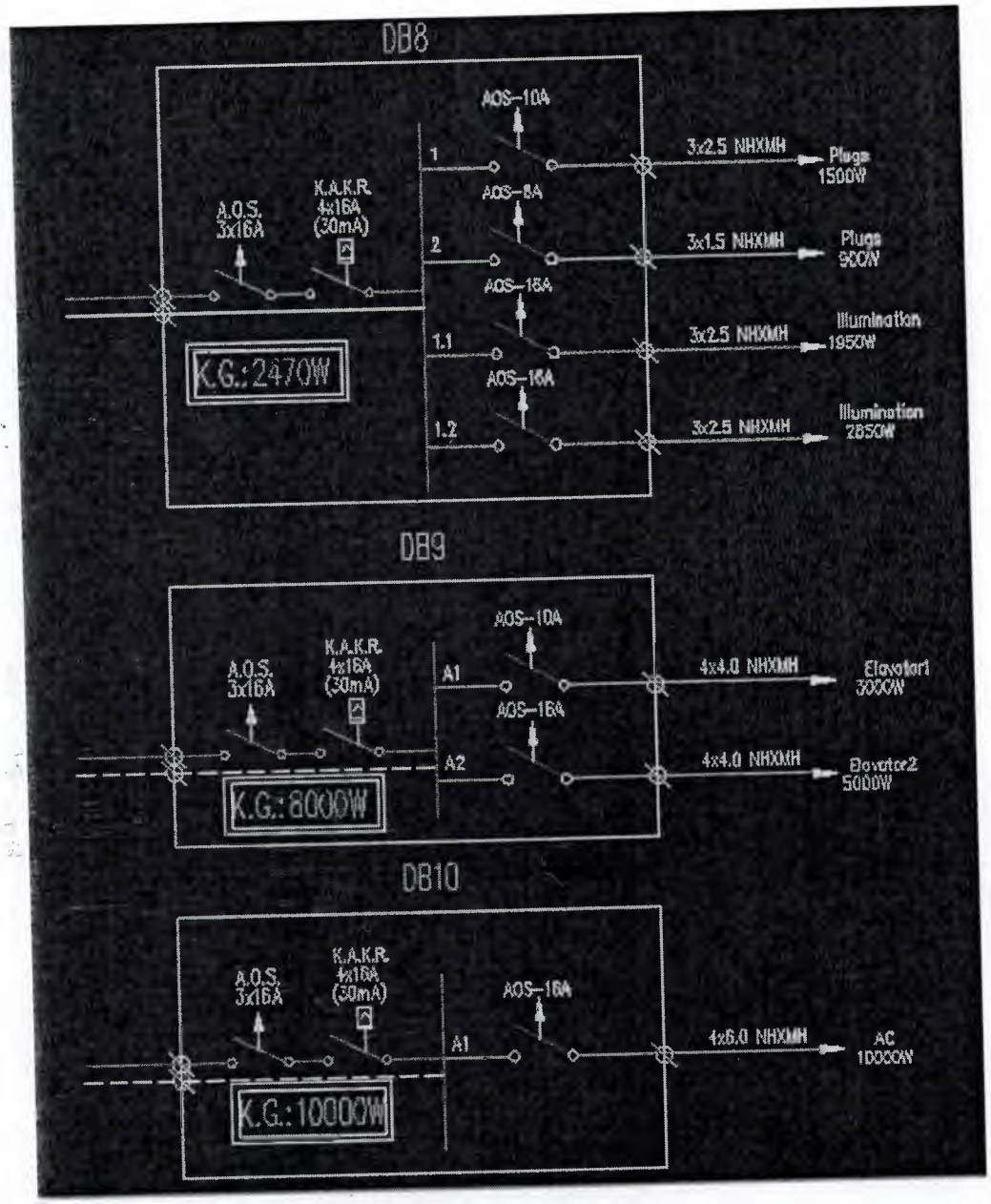
THIRD FLOOR;


DBB
AOS-10A
1
3x2.5 NHXMH
Illumination
1450W
AOS-25A
2
3x4.0 NHXMH
Illumination
3300W
AOS-25A
3
3x2.5 NHXMH
Illumination
2750W
AOS-8A
4
3x1.5 NHXMH
Illumination
200W
AOS-25A
5
3x2.5 NHXMH
Illumination
3500W
AOS-10A
6
3x2.5 NHXMH
Illumination
1300W
AOS-16A
7
3x2.5 NHXMH
Illumination
2900W
AOS-25A
8
3x2.5 NHXMH
Illumination
350OW
AOS-3X10A
1.1
4x2.5 NHXMH
Plugs
1200W
AOS-16A
1.2
3x2.5 NHXMH
Plugs
1800W
AOS-10A
1.3
3x2.5 NHXMH
Plugs
1800W
AOS-16A
T.M.2
3x63A
K.A.R.
4x63A
(30mA)
1.4
3x2.5 NHXMH
Plugs
2100W
AOS-16A
1.5
4x2.5 NHXMH
Plugs
1800W
AOS-10A
K.G.: 2314OW
1.6
3x2.5 NHXMH
Plugs
1500W
AOS-3x16A
1.7
4x2.5 NHXMH
Plugs
3000W
AOS-3x10A
1.8
3x2.5 NHXMH
Plugs
1800W
AOS-16A
1.9
3x4.0 NHXMH
Plugs
3000W
AOS-16A
1.10
3x2.5 NHXMH
Plugs
2100W
AOS-10A
1.11
3x2.5 NHXMH
Plugs
1200W
AOS-10A
1.12
3x2.5 NHXMH
Plugs
1200W
AOS-16A
1.13
3x2.5 NHXMH
Plugs
2100W
AOS-16A
1.14
3x2.5 NHXMH
Plugs
2100W
AOS-16A
1.15
3x2.5 NHXMH
Plugs
2100W
AOS-16A
1.16
3x2.5 NHXMH
Plugs
2100W

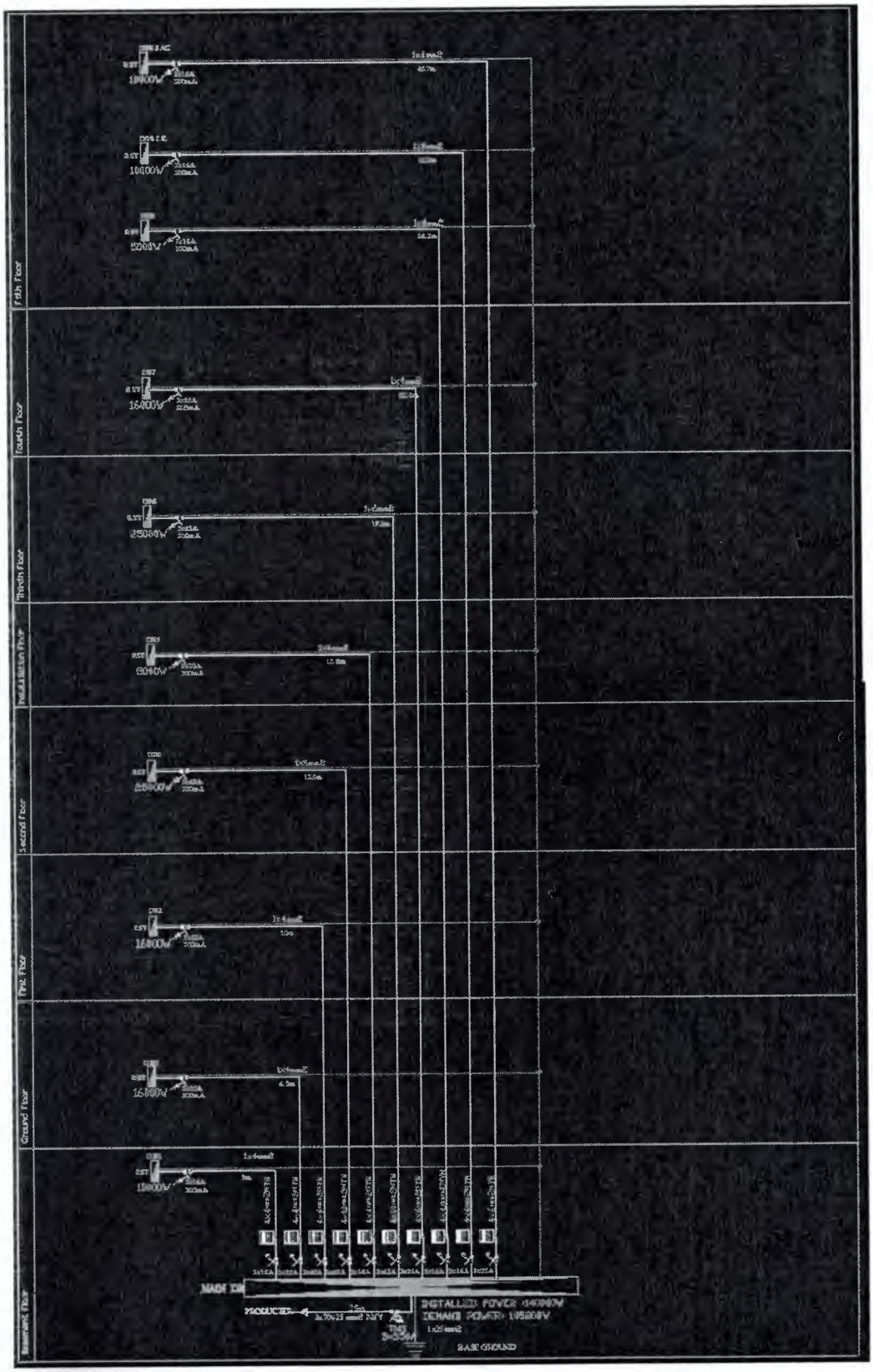
FOURTH FLOOR;



FIFTH FLOOR;


DB8
AOS-10A
1
3x2.5 NHXMH
Plugs
1500W
A.O.S.
3x16A
K.A.K.R
4x16A
(30mA)
AOS-8A
2
3x1.5 NHXMH
Plugs
900W
AOS-16A
1.1
3x2.5 NHXMH
Illumination
1950W
K.G.:2470W
AOS-16A
1.2
3x2.5 NHXMH
Illumination
2850W
DB9
AOS-10A
A1
4x4.0 NHXMH
Elevator1
3000W
A.O.S.
3x16A
K.A.K.R
4x16A
(30mA)
AOS-16A
A2
4x4.0 NHXMH
Elevator2
5000W
K.G.:8000W
DB10
A.O.S.
3x16A
K.A.K.R
4x16A
(30mA)
AOS-16A
A1
4x6.0 NHXMH
AC
10000W
K.G.:10000W

GENERAL DISTRIBUTION DIAGRAM;



CONCLUSION

This project's experience about electrical engineering is valuable for the future. We can see it's diffucpoint at the application. For example, safety of people is very important. It must be a perfect design and keep the people safety and peaceful. Beacuse any mistake may result with a big problem about life of the people and installation. Which are caused by poor design of the safety equipments. For example a too large circuit breaker can be result to a fire. Also a thin cable selecting can get same result. Another detail is about illumanition design. All of illumination equipments are selected as aresult of calculation. These depend on the area and demand illuminating light level.

REFERANCES

1.www.doityourself.com

2. www.projecim.com

3.Jump up^ Robert Friedel and Paul Israel, *Edison's Electric Light: Biography of an Invention*, Rutgers University Press, New Brunswick New Jersey USA,1986 ISBN 0-8135-1118-6 pp.65-66

4.Jump up^ "1920-1929 Stotz miniature circuit breaker and domestic appliances", ABB, 2006-01-09, accessed 4 July 2011

5.Jump up^ Charles H. Flurscheim (ed), *Power Circuit Breaker Theory and Design, SecondEdition* IET, 1982 ISBN 0906048702 Chapter 1

6.Jump up^ B. M. Weedy, *Electric Power Systems Second Edition*, John Wiley and Sons, London, 1972, ISBN 0-471-92445-8 pp. 428-430

7.Jumpup^ http://bonle.en.alibaba.com/product/50348671/51680889/Switch/MCB___MCCB.html

8.Jumpup^ http://www.claytonengineering.com/training/myweb6/Module11/Output/ImportantConcepts.html

9.Jump up^ "Circuit Breaker Speed Explained". *Blue Sea Systems*. Retrieved 2 April 2014.

10.Jump up^ A few manufacturers now offer a single-bottle vacuum breaker rated up to72.5 kV and even 145 kV. Seehttp://www3.interscience.wiley.com/journal/113307491/abstract?CRETRY=1&SRETRY=0 Electrical Engineering in Japan, vol 157 issue 4 pages 13-23

11. http://www.ecy.wa.gov/mercury/mercury_light_bulbs.html

12.Jump up^ M. A. Laughton *Electrical Engineer's Reference Book Sixteenth Edition*, Newnes, 2003 ISBN 0-7506-4637-3, page 21-12

13Jump up^http://www.epa.gov/waste/hazard/wastetypes/universal/lamps/index.htm

14.Jump up^ Gribben, John; "The Scientists; A History of Science Told Through the Lives of Its Greatest Inventors"; Random House; 2004; pp 424–432; ISBN 978-0-8129-6788-3

15.Jump up^ US 865367 *Fluorescent Electric Lamp*

16.Jump up^ "Mr. Moore's Etheric Light. The Young Newark Electrician's New And Successful Device.". New York Times. October 2, 1896. Retrieved 2008-05-26. Paid access.