

The background of the slide is a photograph of an industrial facility, likely a refinery or chemical plant, at night. The facility is illuminated by numerous lights, creating a complex pattern of bright spots against the dark sky. A large, tall distillation column is visible in the center. The entire image is overlaid with a semi-transparent red filter, which gives it a dramatic and industrial feel.

LIGHTING SYSTEM COURSE

Enppi

Engineering for the Petroleum and Process Industries

CONTENTS:

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6. LIGHTING CIRCUITS
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7. PANEL SCHEDULE



1. INTRODUCTION

1. INTRODUCTION:

The purpose of the lighting is to serve the needs of persons.

Quality of illumination implies that all luminances are designed to contribute favorably to visual performance, visual comfort, ease of seeing and safety for specific visual task involved.

Glare, diffusion, direction, shadows, uniformity, color, luminance and lumenance ratios have significant effects of visibility & should be considered during lighting design

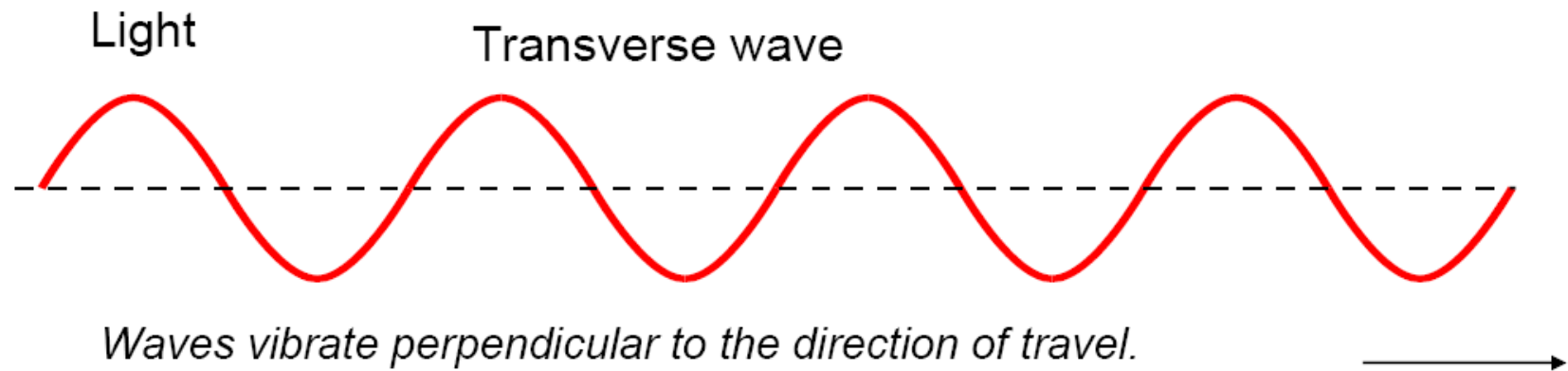
A large industrial refinery at night, illuminated by numerous lights. The scene is dominated by a strong red color overlay, giving it a dramatic and somewhat ominous appearance. The refinery features complex piping, storage tanks, and a tall distillation column. The sky is dark with some clouds, and the overall atmosphere is industrial and intense.

2. BASIC DEFINITIONS

2.1. WHAT IS LIGHT?

Light is the medium through which we can recognize the world surrounding us

In physical words: Light is a kind of electromagnetic radiation that consists of ripples or waves that are propagated in an omnipresent electric and magnetic field, and travelling away from its source uniformly in all directions, unless intercepted.

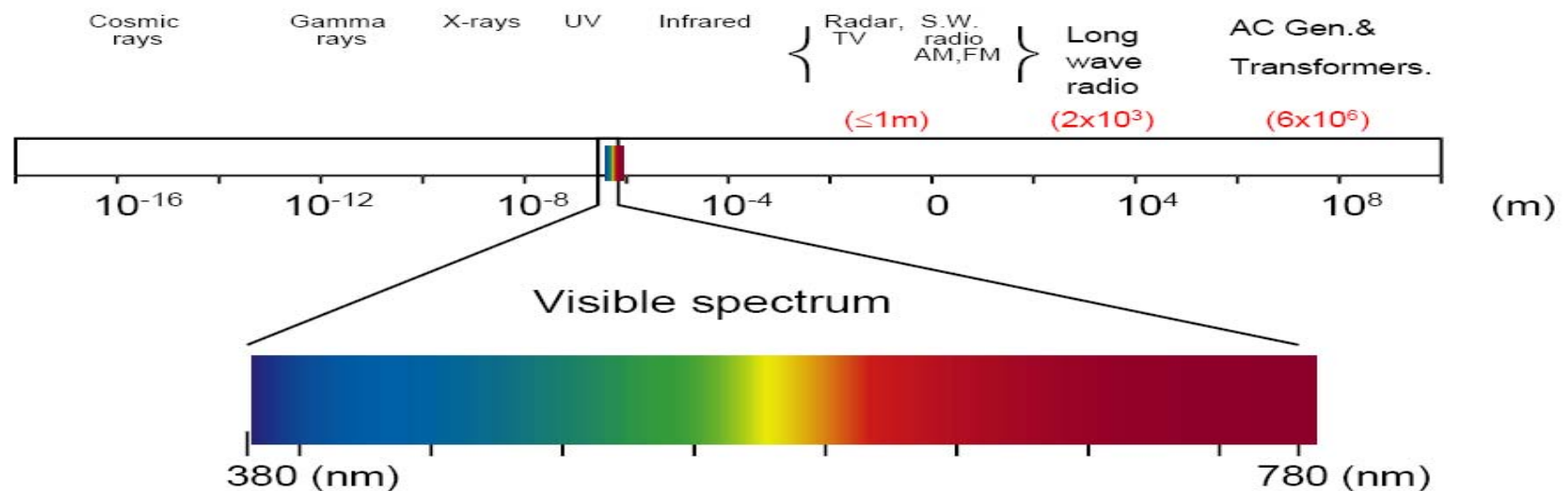


2.2. NATURE OF LIGHT



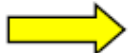



Various forms of incandescent bodies are the source of light, and the light emitted by such bodies depend upon its temperature.

As the temperature increases the wavelength of the radiated energy becomes smaller and smaller and enters into the range of the wavelength of light.

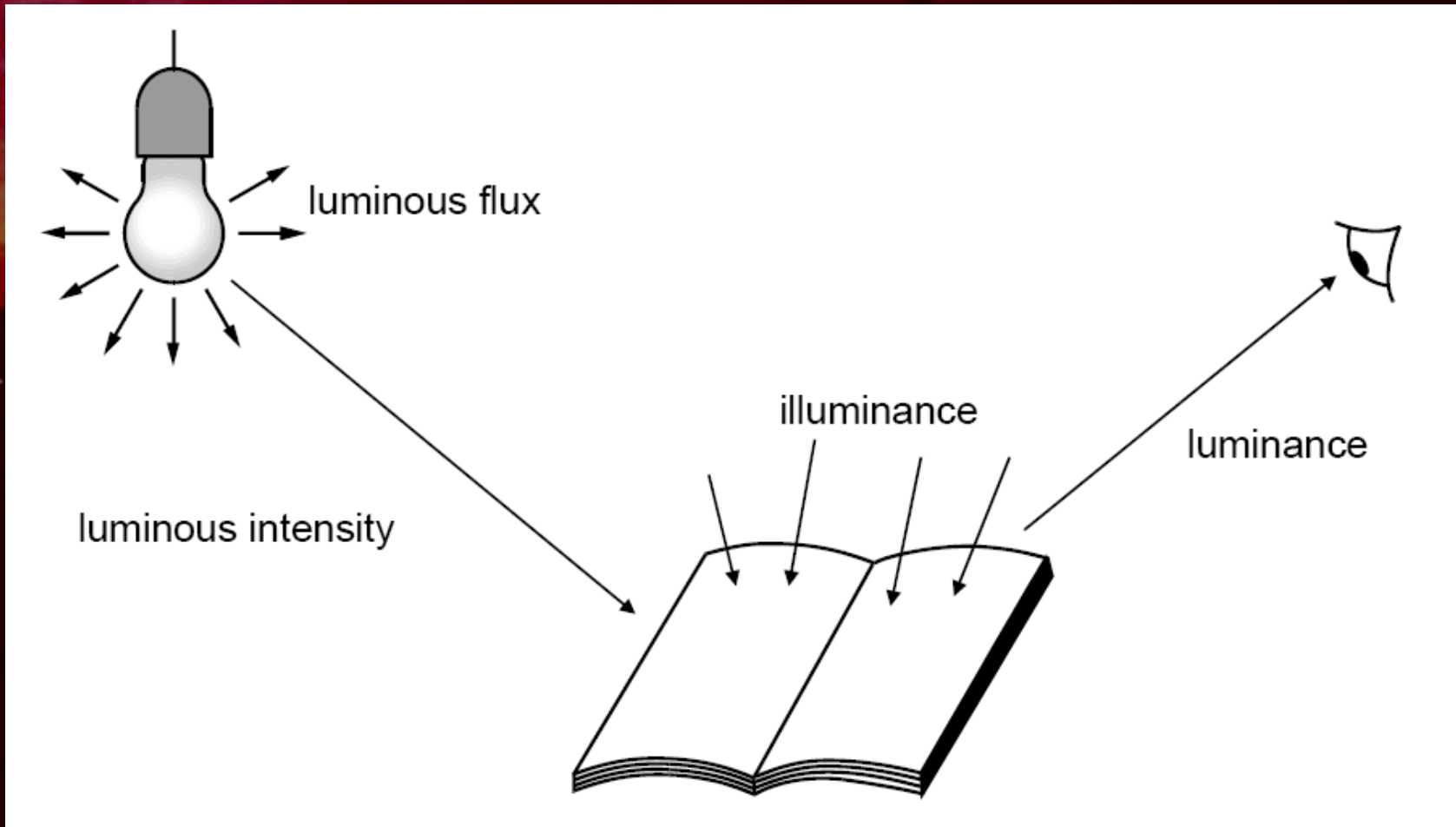
The wavelength which can produce the sensation of light varies from 380nm to 780nm



White light emitted by the sun consists of a mixture of various wavelengths in the visible spectrum:

Red		630 - 780 nm	} + IR and UV radiation
Orange		600 - 630 nm	
Yellow		565 - 600 nm	
Green		500 - 565 nm	
Blue		435 - 500 nm	
Violet		380 - 435 nm	

2.3. THE FOUR BASIC LIGHTING QUANTITIES

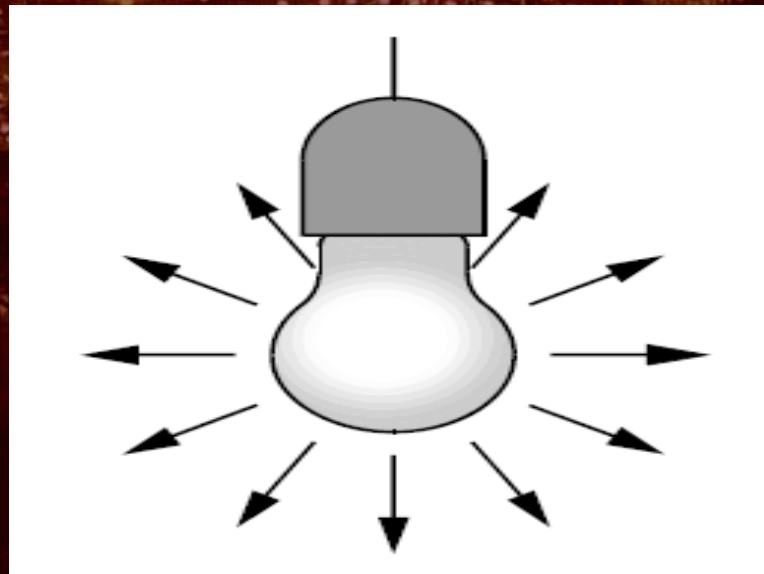


2.3.1. luminous flux :

The amount of light radiated per second by a light source

Unit: lumen (lm)

symbol : (Φ)

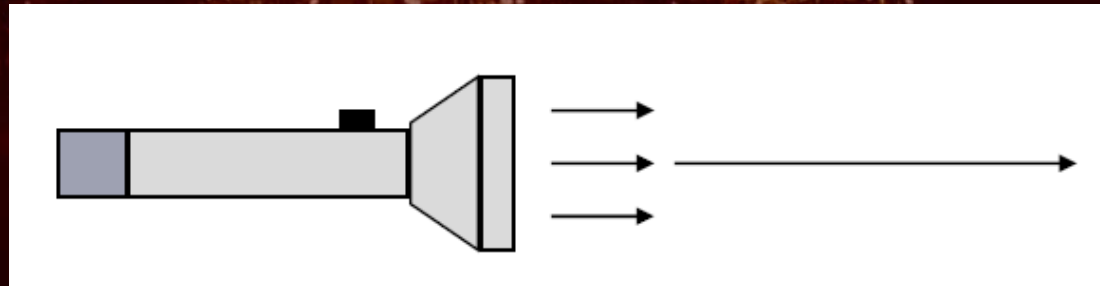


2.3.2. luminous Intensity :

The amount of light radiated by a light source in a given direction

Unit: candela (cd) or (lumen/steradian)

symbol : (I)



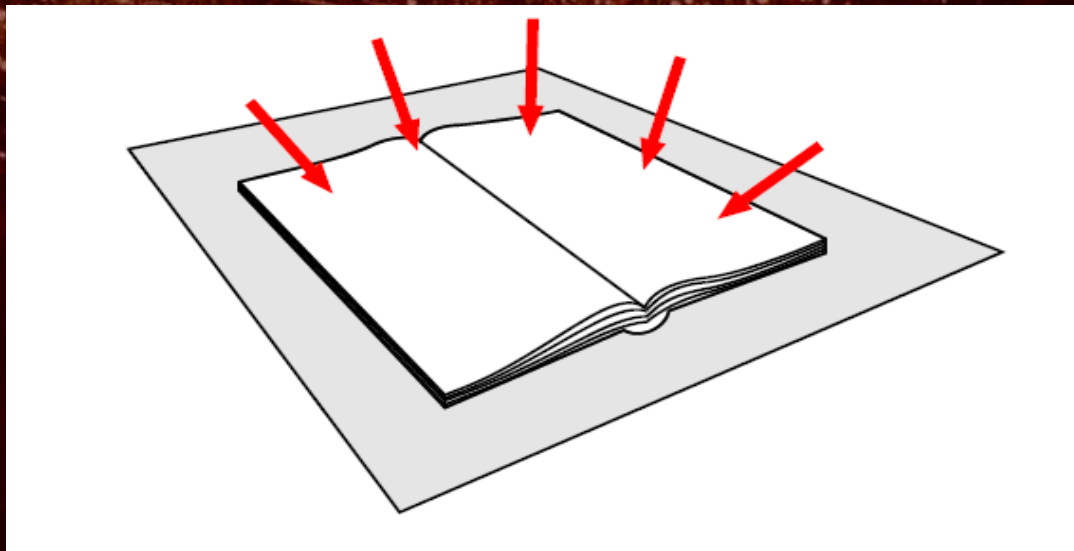
2.3.3. Illuminance:

The amount of light falling on a unit of surface

Unit: lux ($\text{lux} = \text{lm}/\text{m}^2$)

symbol : (E)

Illuminance is independent of the direction from which the luminous flux reaches the surface

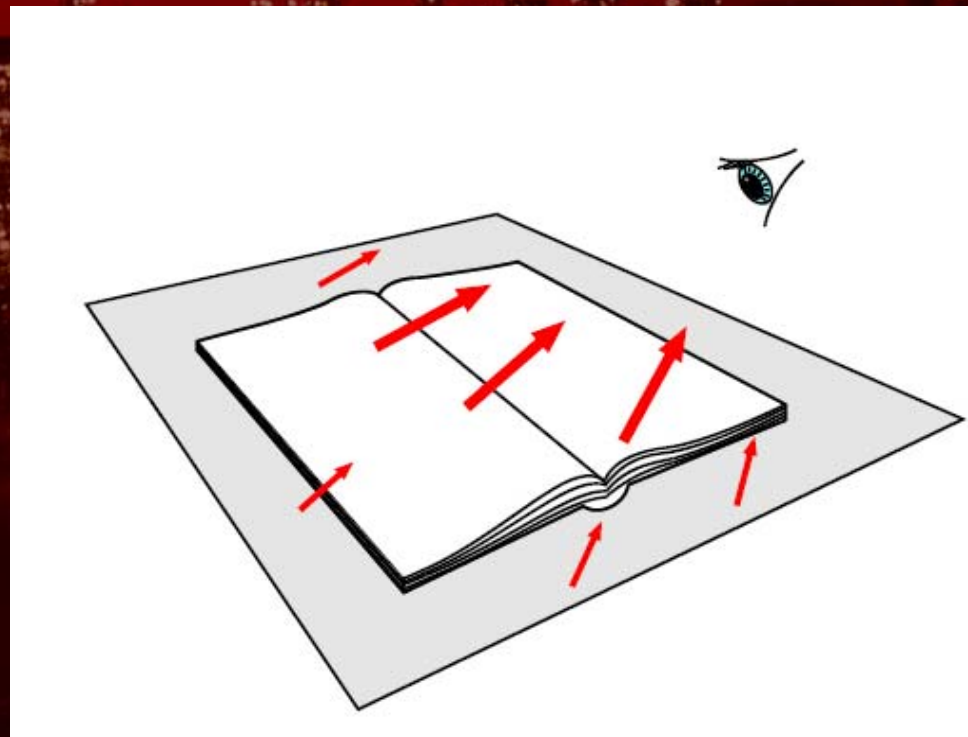


2.3.4. luminance:

The amount of light radiated by a unit of apparent surface in a given direction

Unit: candela per m² (cd/m²)

symbol : (L)



2.4. LAMP EFFICACY OR LUMINOUS EFFECACY:

Luminous efficacy (lm/W) = Luminous flux

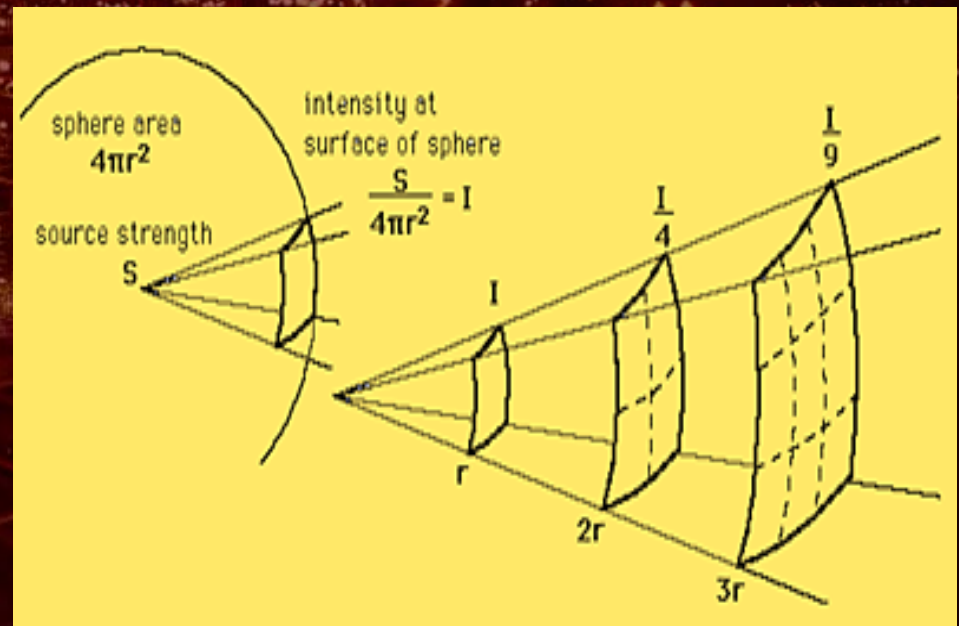
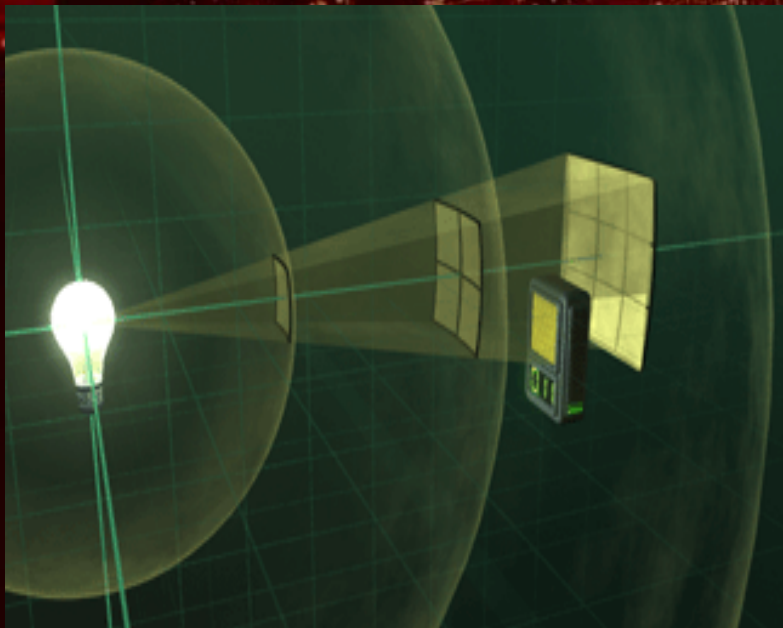
Electric power dissipated

LAMP	APPROX. LUMENS PER WATT
Candle (Luminous Efficiency Equivalent)	0.1
Oil lamp (Luminous Efficiency Equivalent)	0.3
60-Watt Coiled Coil Tungsten Filament	12
100-Watt Coiled Coil Tungsten Filament	13.8
40-Watt Fluorescent Lamp	60
125-Watt Mercury Vapor Lamp	40
250-Watt Mercury Vapor Lamp	47
400-Watt Mercury Vapor Lamp	49
1000-Watt Mercury Vapor Lamp	49
400-Watt Metal Halide Lamp	85
1000-Watt Metal Halide Lamp	100
150-Watt High Pressure Sodium Lamp	108
400-Watt High Pressure Sodium Lamp	125
1000-Watt High Pressure Sodium Lamp	130
180-Watt Low Pressure Sodium Lamp	180

2.5. LIGHT LAWS:

2.5.1. INVERSE SQUARE LAW :

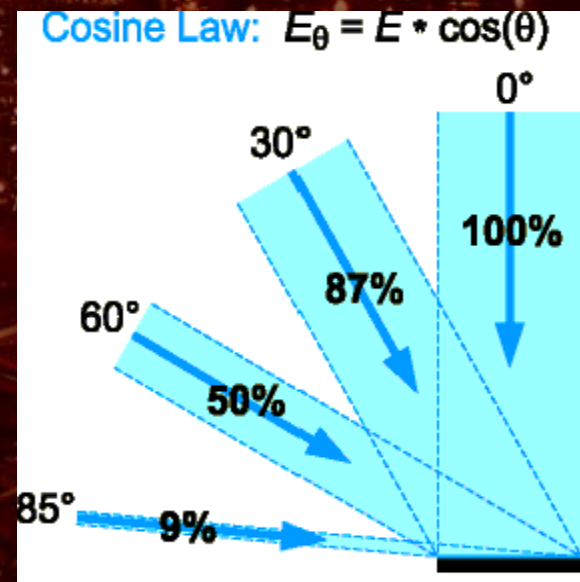
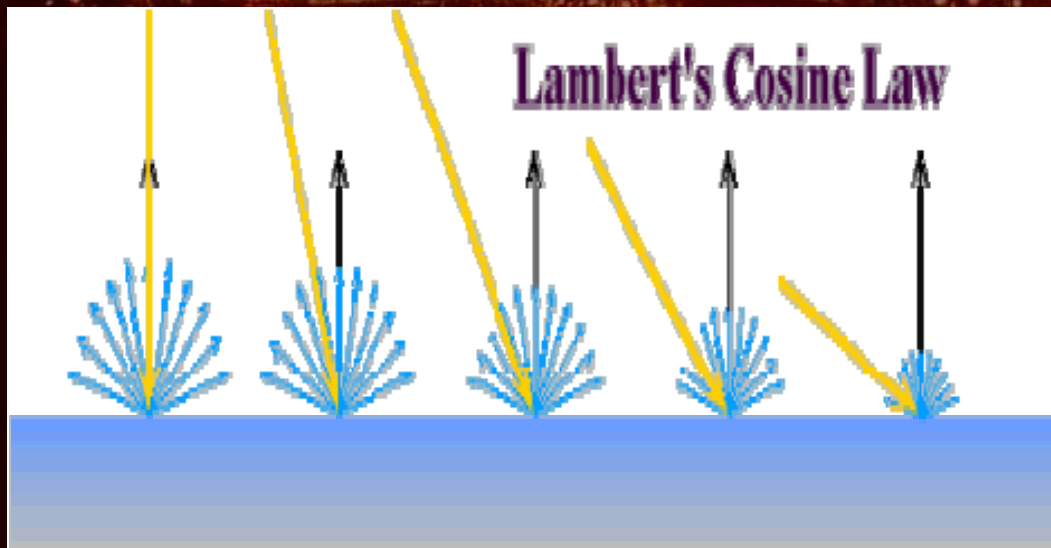
Illumination is inversely proportional to the square of the distance between the source & the surface



2.5.2. COSINE LAW OF INCIDENCE :

Illumination is proportional to the cosine of the angle of incidence

$$E \propto \cos(\theta)$$



So, from the previous two laws we will find that :

$$E = E_{\max} \cos (\Theta)$$

hence,

$$E = \frac{I \cos^3 (\Theta)}{h^2}$$

where :

E : Illumination at any point

I : luminous intensity of a given source

h : the vertical distance between source & surface

Θ : the angle of incidence

2.6. CO-EFFICIENT OF UTILIZATION (C.U.):

It is the ratio of the lumen actually received by the working plane to the total lumens emitted by the source

$$\text{C.U.} = \frac{\Phi_{\text{received by the working plane}}}{\Phi_{\text{emitted by the source}}}$$


2.7. MAINTENANCE FACTOR (M.F.):

The effective candle power of all lamps due to accumulation of dust or dirt on the lamps globes, reflectors, walls & ceiling is taken into account by including the maintenance factor.

$$\text{M.F.} = \text{L.L.D (Lumen Lamp Deprecation)} \times \text{L.D.D (Lumen Dirt Deprecation)}$$

MF ~ 0.8 for indoor lighting

MF ~ 0.6 → 0.7 for outdoor lighting

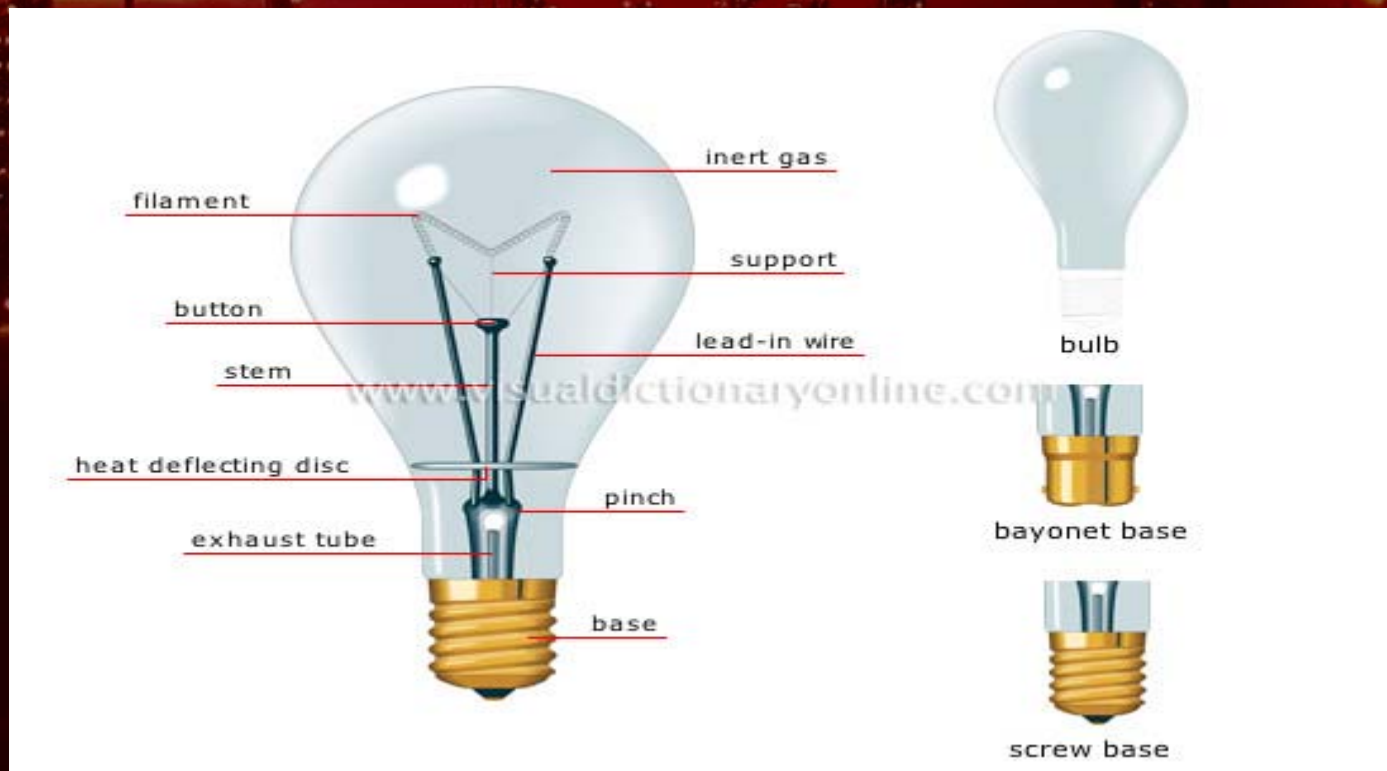
The background image shows a large industrial complex, possibly a refinery or chemical plant, at night. The facility is illuminated by numerous lights, creating a complex pattern of bright spots against the dark sky. A prominent tall distillation column is visible in the center. The entire image is overlaid with a semi-transparent red filter, giving it a monochromatic, dramatic appearance. The title text is centered over the middle of the image.

3. LIGHTING SOURCES & **SCHEMES**

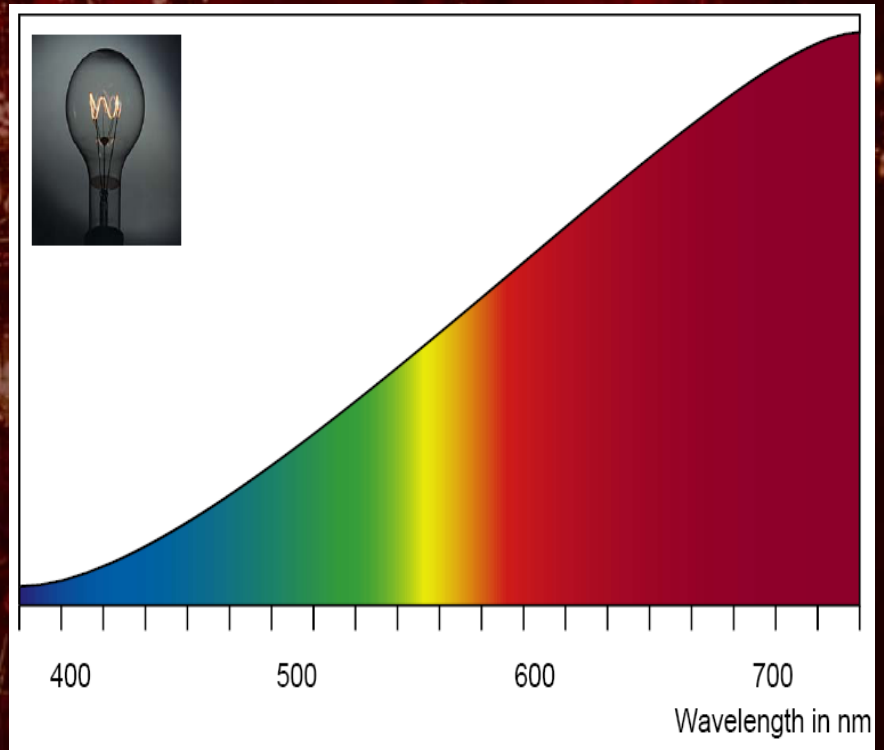
3.1. LIGHTING SOURCES :

There are three (3) basic types of light sources used today; incandescent, fluorescent and high-intensity discharge lamps.

3.1.1 INCANDESCENT LAMPS :



- Incandescent lamps produce light by electrically heating high-resistance tungsten filaments to intense brightness.
- Overall efficacy ranges from about 15 to 23 lumens per watt.
- Lamp life ranges from 750 to 1000 hours for standard general purpose lamps.
- It is important that incandescent lamps conform to the supply voltage a change of only a few volts seriously affects both life and light output.
- Incandescent lamps emit the majority of the energy in the red and infrared area

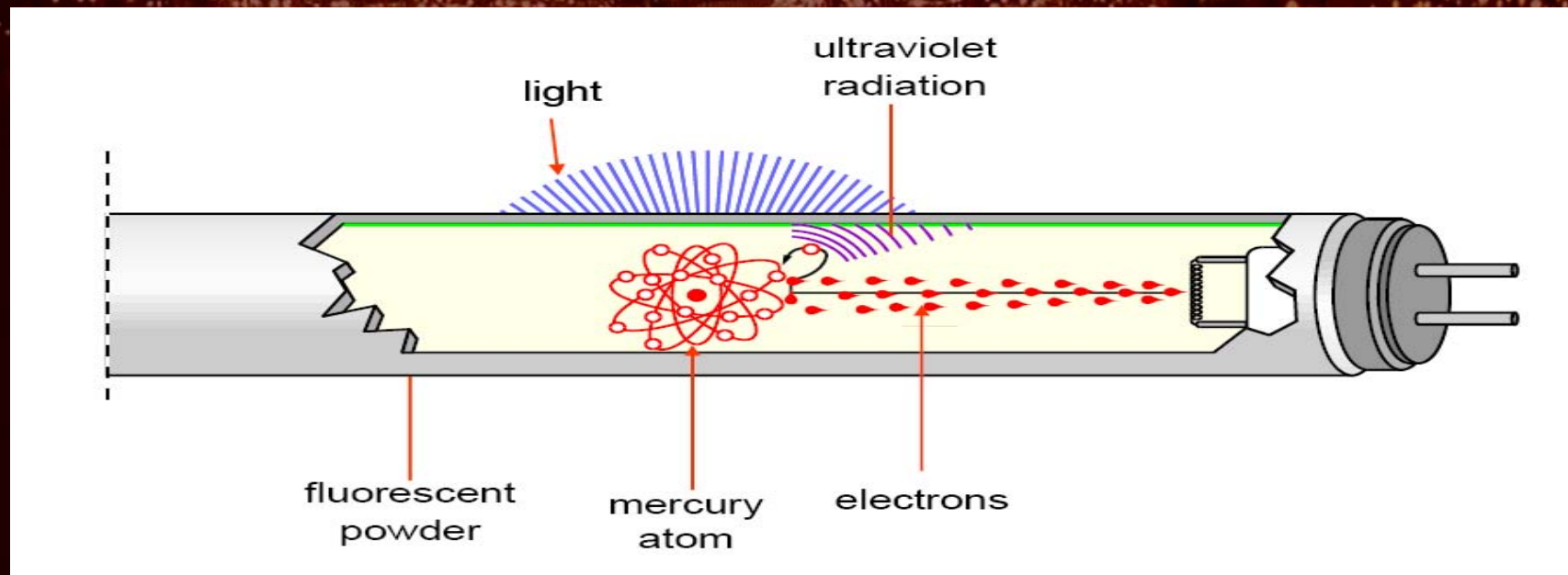


- Different types of incandescent lamps:


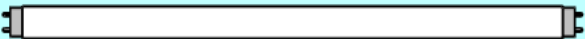
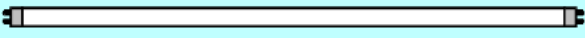

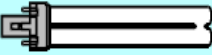

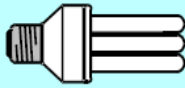


3.1.2. FLUORESCENT LAMPS :

- Fluorescent lamps produce light by establishing an arc between two (2) electrodes in an atmosphere of very low pressure mercury vapor in a chamber (the glass tube). This low pressure discharge produces Ultraviolet radiation at wave lengths which excite crystals of phosphor (the white powder) lining the tube wall. The fluorescent phosphor powder convert the ultraviolet energy into visible (light) energy.

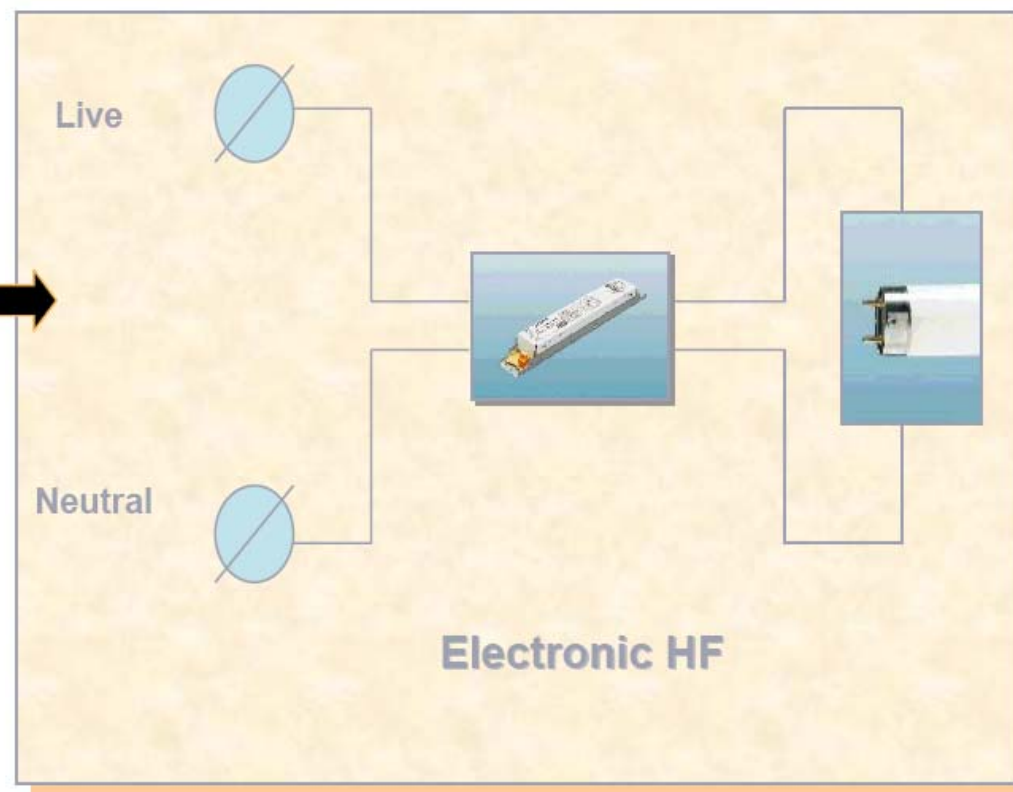
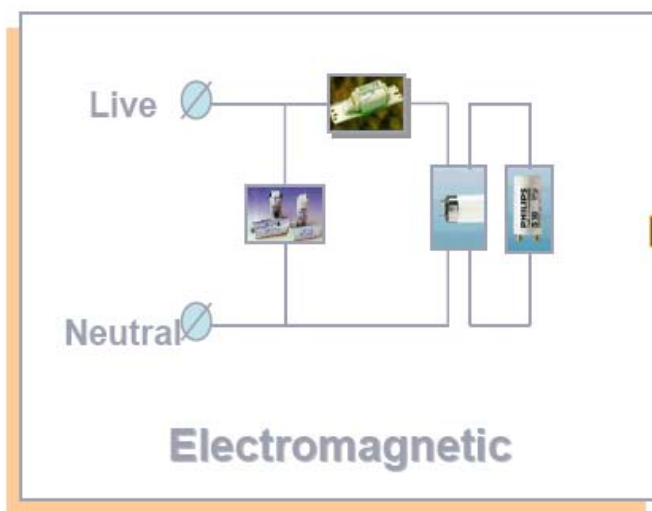


- Efficiency ranges from about 45 to 80 lumens per watt.
- Rated life ranges from about 7500 hours to 30,000 hours.
- Lamp performance is influenced by the character of the ballast and luminaire, line voltage, ambient temperature, burning hours per start and air movement.

T12	
TLD = T8	
TL5	
PL-L	
PL-S / PL-C / PL-T	
PLE-C / PLE-T	 

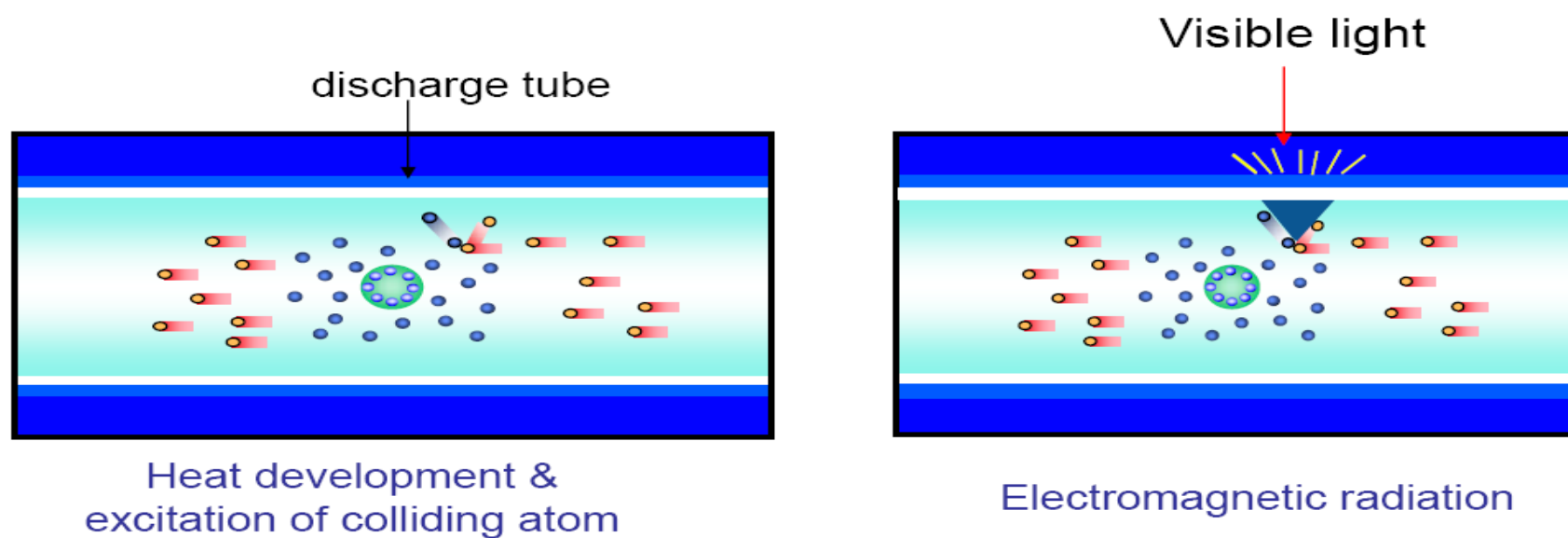


- Control gear for fluorescent lamps



3.1.3. HIGH INTENSITY DISCHARGE LAMPS :

- High-intensity electrical discharge lamps produce light when a high pressure arc is passed through a gas vapor



- Three (3) types of lamps are of the high-intensity discharge type; mercury, metal halide and high-pressure sodium.

3.1.3.1 MERCURY LAMPS:

- The early mercury vapor lamps emitted a characteristically blue-green color of light, which was practical only for industrial areas, street lighting, and general outdoor applications where color quality of the light was not too important.
- General lighting mercury lamps are now available in wattages from 50 to 1000 watts
- Typical efficiencies range from 30 to 63 lumens per watt, not including ballast power loss.
- "Clear" mercury lamps produce light rich in yellow and green tones but almost entirely lacking in red. Phosphor coated lamps provide improved color and have been popular.

- TYPES OF MERCURY VAPOUR LAMPS :



3.1.3.2. METAL HALIDE LAMPS:

- This lamp employs iodides of sodium, thallium and indium, in addition to mercury, and results in a lamp design, which generates more than 50% more light than mercury lamps, and with a much better color quality.
- Metal halide lamps are similar in construction to mercury lamps. They differ in that the arc tube contains various metal halides in addition to mercury.
- They are available with either clear or phosphor coated bulbs from 175 to 1500 W.
- Present efficiencies range from 70 to 125 lumens per watt, not including ballast power loss

-Compared to a clear mercury lamps, the metal halide additives improve the efficiency and color. Further color improvement is achieved with phosphor coatings

- Types of metal halide lamps :



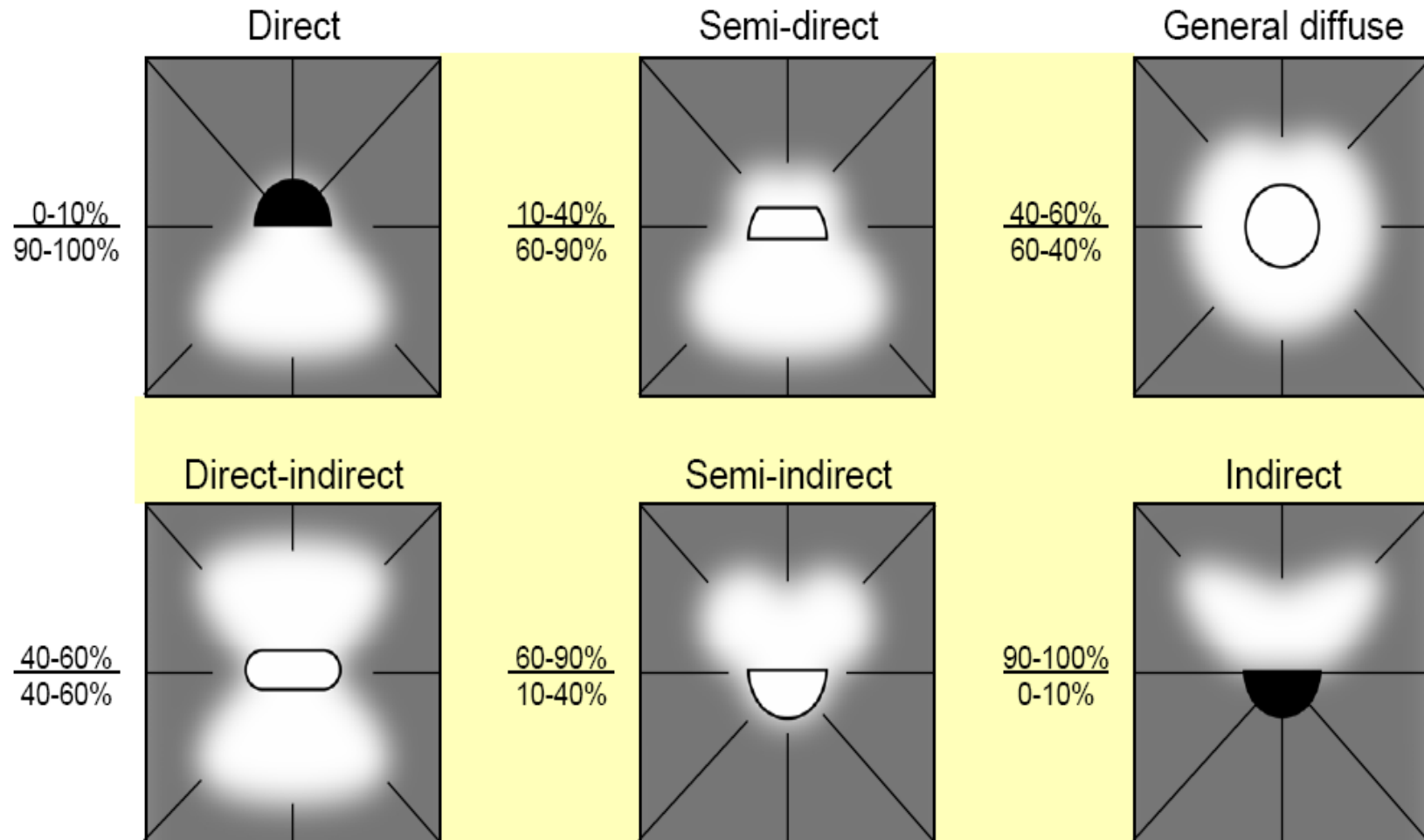
3.1.3.3. HIGH PRESSURE SODIUM LAMPS:

- The high pressure sodium lamp has the highest light producing efficiency of any commercial source of white light.
- High pressure sodium lamps produce light by electricity passing through sodium vapor.
- They are presently available in sizes of 50 to 1000 W.
- Typical initial efficiencies are about twice that of mercury vapor: from 80 to 140 lumens per watt, not including ballast power loss.
- The color of light produced by this lamp is golden white.

- Types of high pressure sodium lamps :



3.2. LIGHTING SCHEMES :



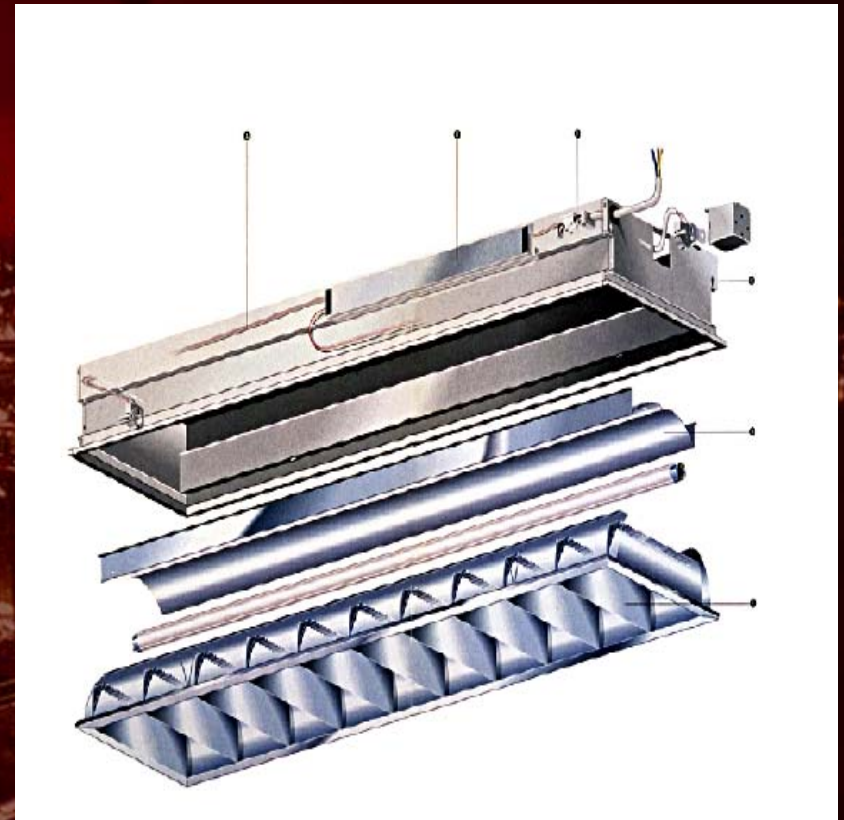


4. LIGHTING LUMENAIRES IN OIL **& GAS FIELD & LIGHTNG** **INTSALLTION DETAILS**

What is a luminaire :

It is a complete lighting unit with the following functions:

- Contains lamps
- Contains gear
- Supply energy to lamp(s)
- Distribute light
- Withstand ambient conditions
- Permit safe/ easy installation
- Permit safe/ easy maintenance



A luminaire may be classified by its application to :

- Outdoor applications

Local lighting



Street lighting



Area lighting



- Indoor applications

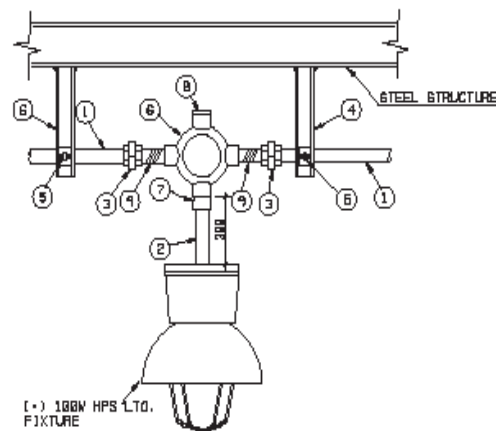


2. Pendant mounted fixture :



L3A STEEL STRUCTURE MOUNTED (TOP ENTRY)

PLAN SYMBOL



ITEM NO.	DESCRIPTION	MATERIAL	UNITS	QTY	SUPPLIED BY
1	RIGID STEEL CONDUIT (1.5" NPT THREAD)	STEEL, HDG. PVC FACTORY-COATED	METER	A.R.	EL. CONTR.
2	RIGID STEEL CONDUIT (1" NPT THREAD)	STEEL, HDG. PVC FACTORY-COATED	METER	A.R.	EL. CONTR.
3	UNION COUPLING (1.5" NPT THREAD)	C. IRON HDG. PVC FACTORY-COATED	EACH	1	SEE NOTE 19
4	UNISTRUT CHANNEL	STEEL, HDG. PVC FACTORY-COATED	METER	A.R.	EL. CONTR.
5	UNISTRUT CLAMP	STAINLESS STEEL	SET	A.R.	EL. CONTR.
6	CONDUIT BOX 4 ENTRY (1.5" NPT THREAD) WITH THERMAL BLOCK	C. IRON HDG. PVC FACTORY-COATED	EACH	1	EL. CONTR.
7	REDUCER (1.5" MALE X 1" FEMALE) NPT THREAD	C. IRON HDG. PVC FACTORY-COATED	EACH	1	SEE NOTE 19
8	BLIND PLUG (1.5" NPT THREAD)	C. IRON HDG. PVC FACTORY-COATED	EACH	2	SEE NOTE 19
9	SHORT NIPPLE (1.5" NPT THREAD)	C. IRON HDG. PVC FACTORY-COATED	EACH	1	SEE NOTE 19

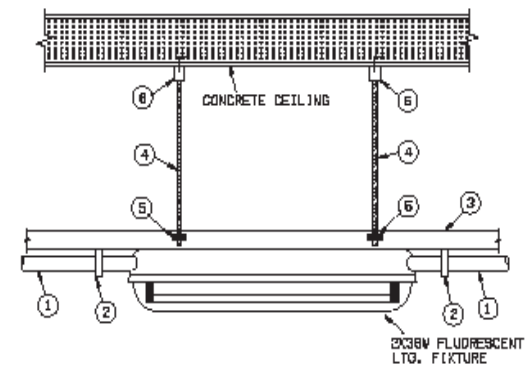
(*) SUITABLE FOR CLASS 1, DIV 2, GAS GROUP D; TEMP. CLASS TO HAZARDOUS AREA

DETAIL- 3

PENDANT MOUNTED H.P.S./FLUORESCENT LIGHTING FIXTURE

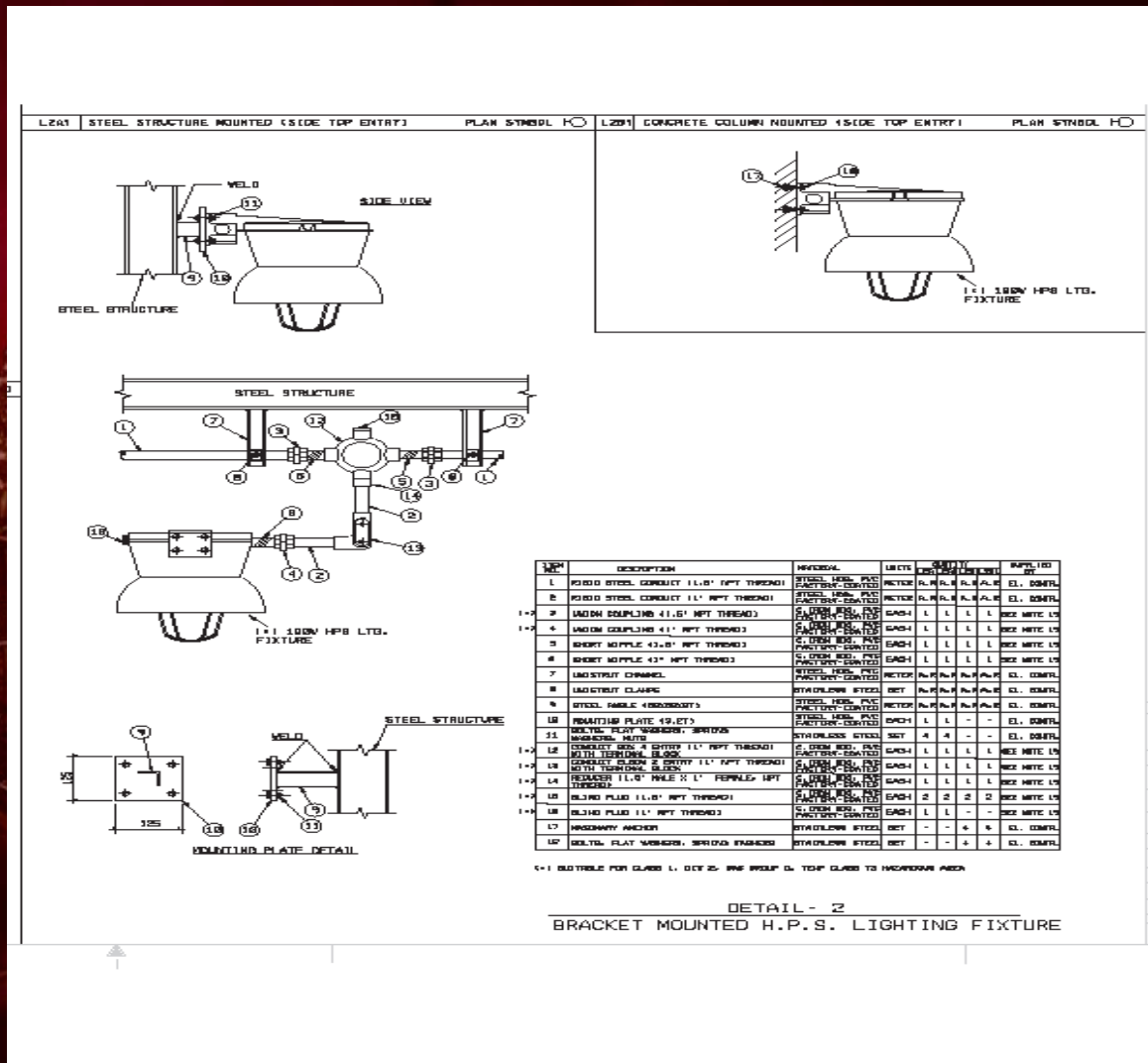
L3B CONCRETE STRUCTURE MOUNTED

PLAN SYMBOL



ITEM NO.	DESCRIPTION	MATERIAL	UNITS	QTY	SUPPLIED BY
1	RIGID STEEL CONDUIT (1.5" NPT THREAD)	STEEL, HDG.	METER	A.R.	EL. CONTR.
2	CONDUITS CLAMP	STAINLESS STEEL	SET	A.R.	EL. CONTR.
3	UNISTRUT CHANNEL	STEEL, HDG.	METER	A.R.	EL. CONTR.
4	THREADED ROD	STAINLESS STEEL	METER	A.R.	EL. CONTR.
5	WASHERS, NUTS	STAINLESS STEEL	SET	A.R.	EL. CONTR.
6	ANCHOR WEDGEKIT	STAINLESS STEEL	SET	A.R.	EL. CONTR.

3. Bracket mounted fixture :



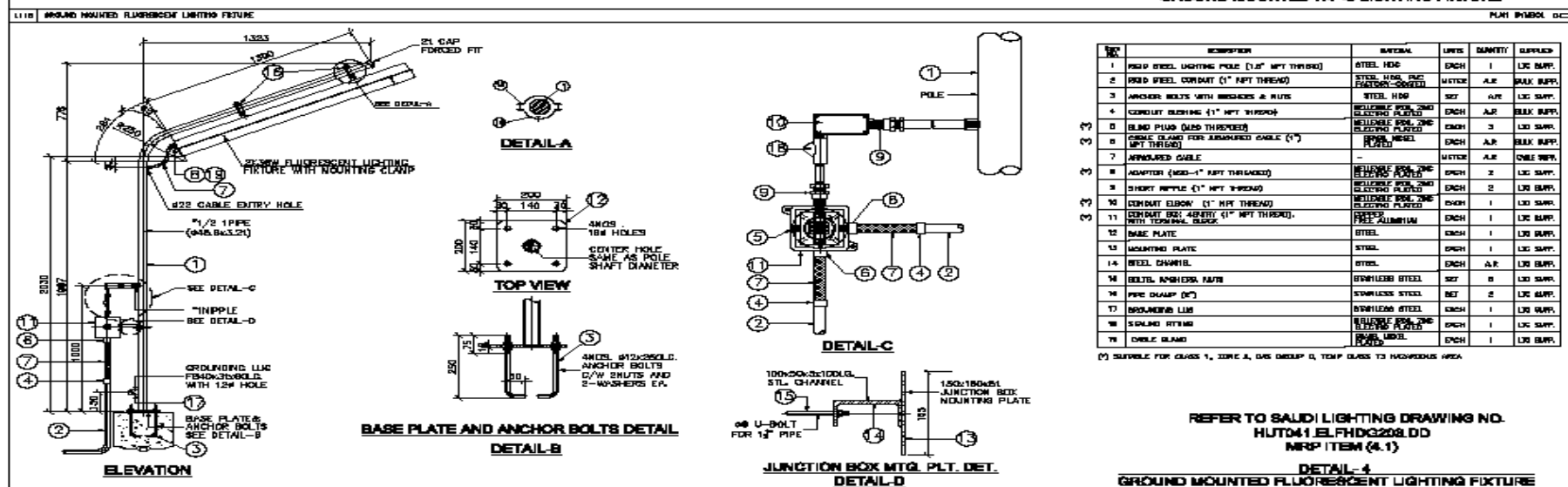
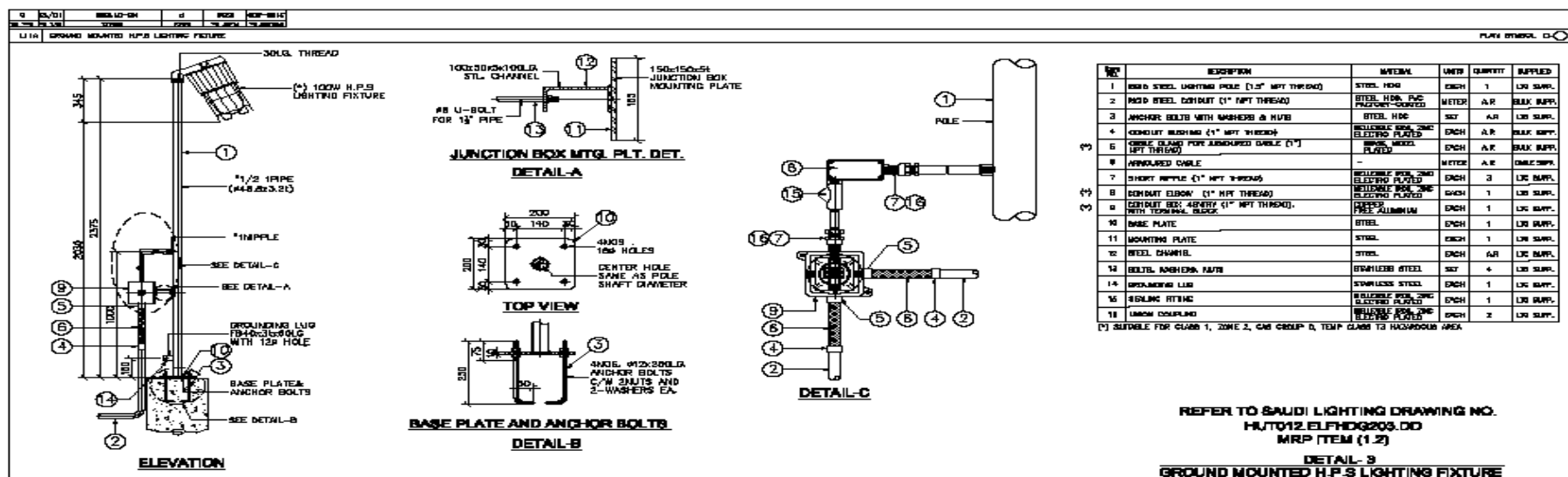
4. Platform mounted fixture :



5. Ground mounted fixture :



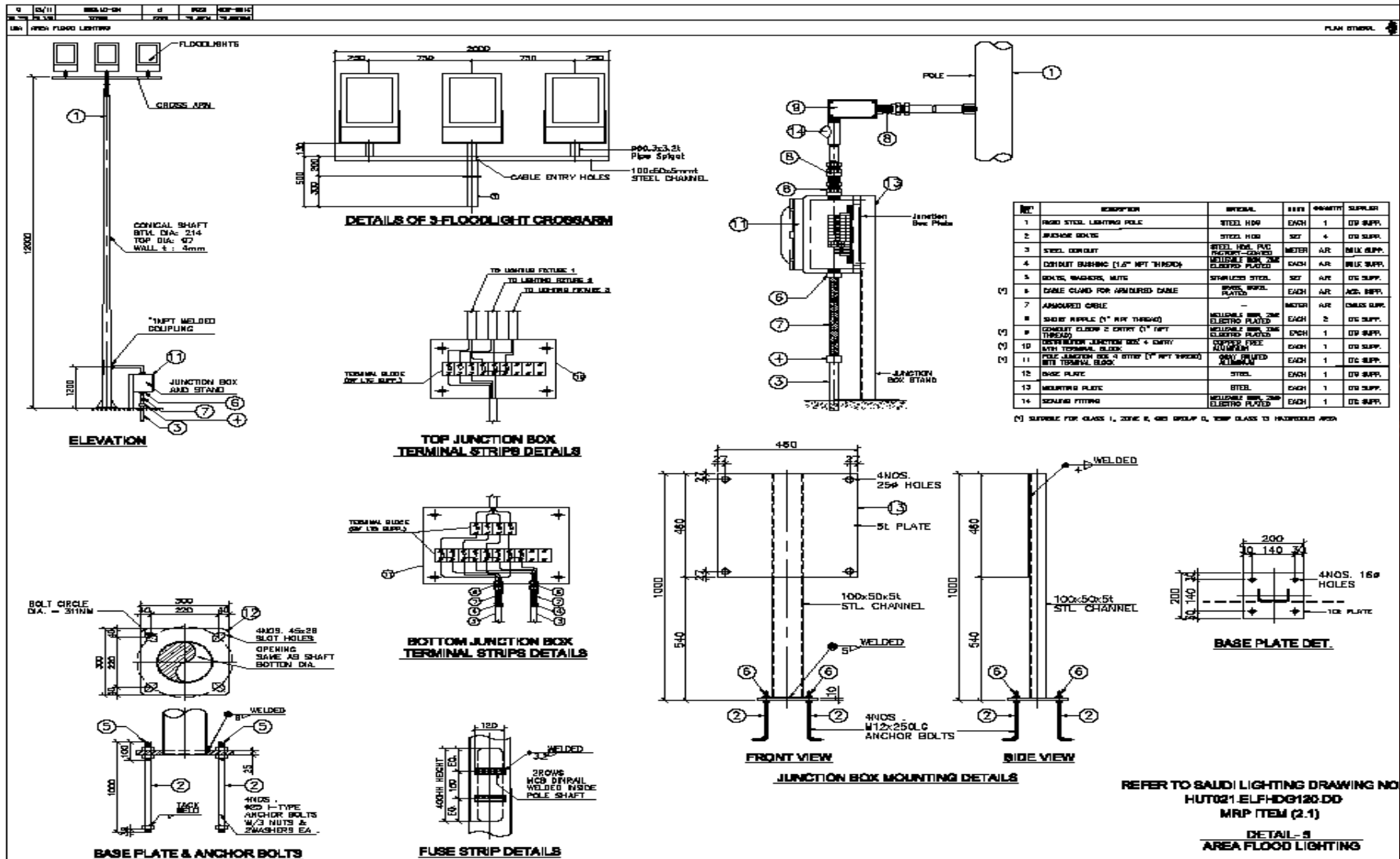
5. Ground mounted fixture, Cont. :



6. Flood lighting fixture :



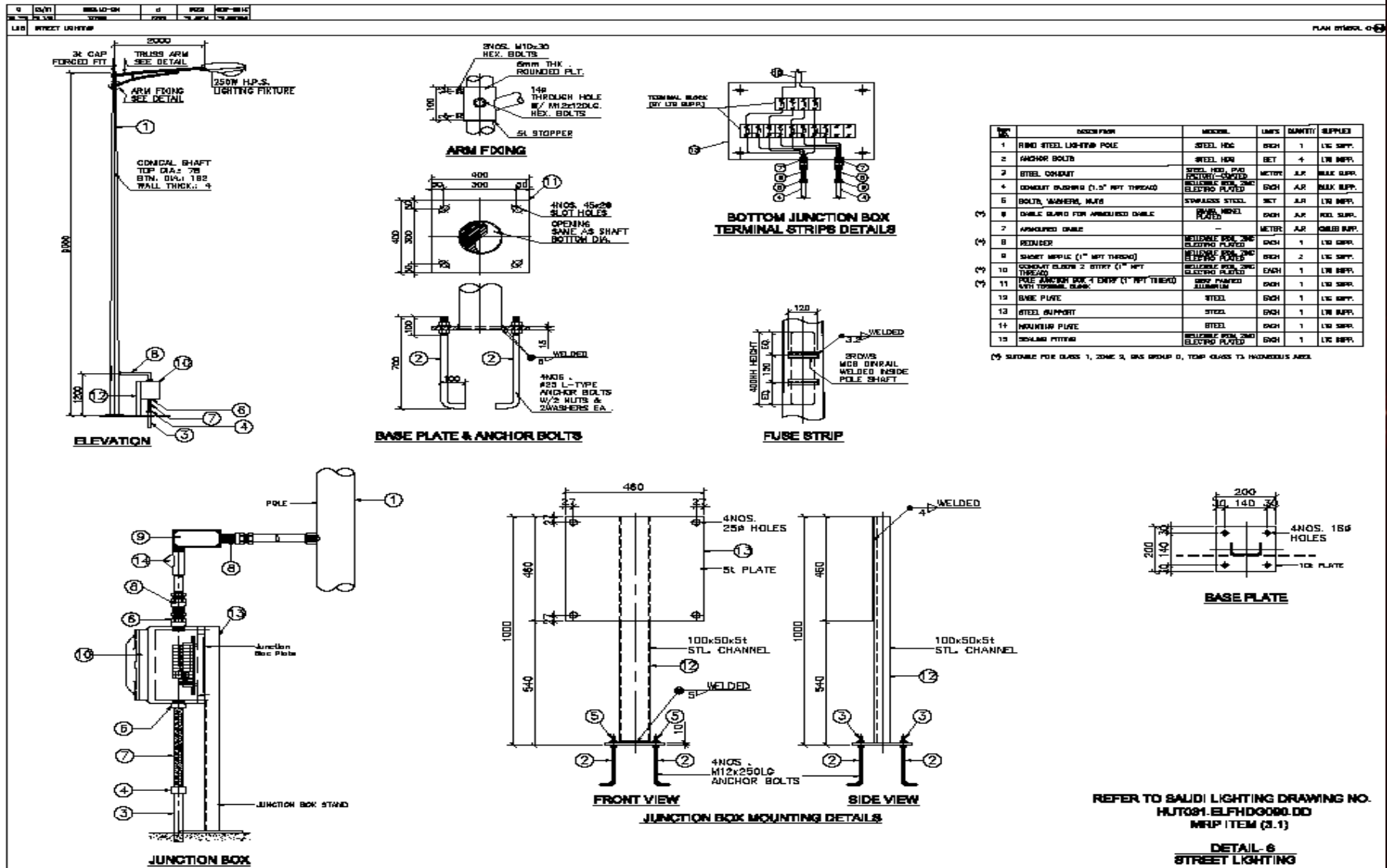
6. Flood lighting fixture, Cont. :



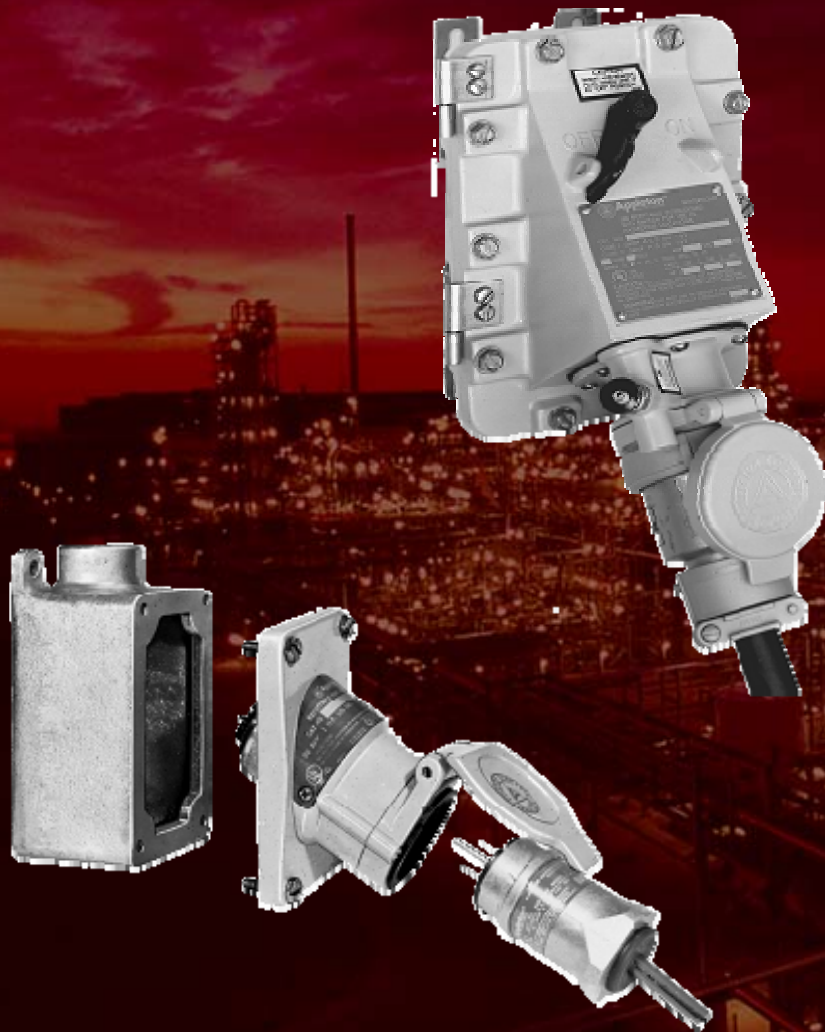
7. Street lighting fixture :



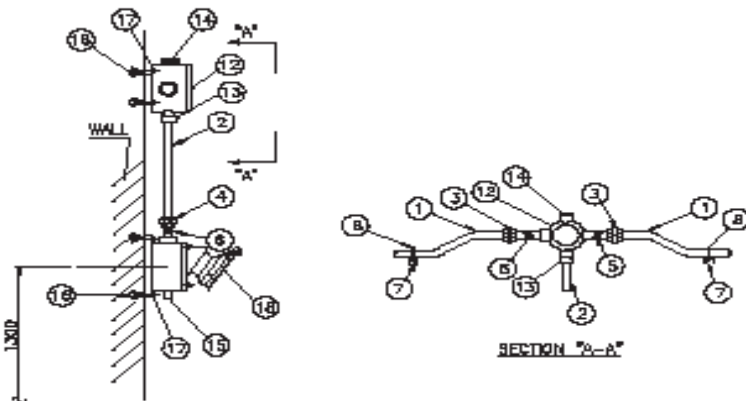
7. Street lighting fixture, Cont. :



8. Convenience outlet :



8. Convenience outlet, Cont. :

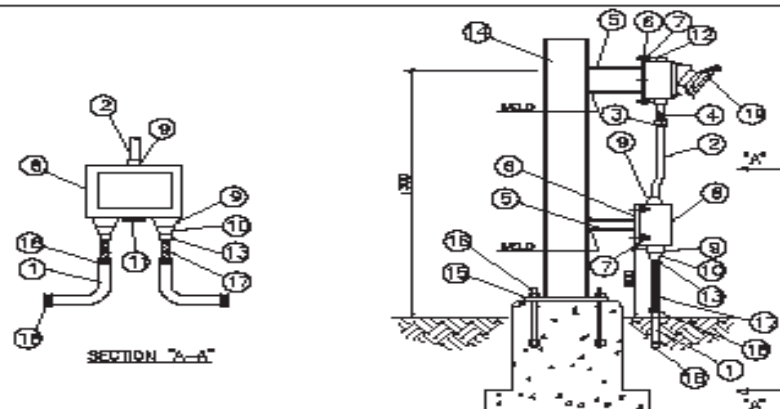


NO.	DESCRIPTION	MATERIAL	UNITS	QUANTITY	SUPPLIER
1	RIGID STEEL CONDUIT (1" NPT THREAD)	STEEL HDG. PIG FACTORY-COATED	METER	A/R	BAUX SUPP.
2	RIGID STEEL CONDUIT (1" NPT THREAD)	STEEL HDG. PIG FACTORY-COATED	METER	A/R	BAUX SUPP.
3	UNION COUPLING (1" NPT T-THREAD)	WELDEABLE BRON. ZINC ELECTRO PLATED	EACH	2	BAUX SUPP.
4	UNION COUPLING (1" NPT T-THREAD)	WELDEABLE BRON. ZINC ELECTRO PLATED	EACH	1	LTD SUPP.
5	SHORT RIFPLE (1" NPT THREAD)	WELDEABLE BRON. ZINC ELECTRO PLATED	EACH	2	LTD SUPP.
6	SHORT RIFPLE (1" NPT THREAD)	WELDEABLE BRON. ZINC ELECTRO PLATED	EACH	1	LTD SUPP.
7	UNIBRITUL CHANNEL	WELDEABLE BRON. ZINC ELECTRO PLATED	METER	A/R	EL. CONTR.
8	UNIBRITUL CLAMPS	STAINLESS STEEL	SET	A/R	EL. CONTR.
9	"6" CHANNEL	STEEL	METER	—	EL. CONTR.
10	MOUNTING PLATE	STEEL	METER	—	EL. CONTR.
11	BOLTS, FLAT WASHERS, SPRING WASHERS, NUTS	STAINLESS STEEL	SET	—	LTD SUPP.
12	CONDUIT BOX & ENTRY (1.5" NPT THREAD) WITH TERMINAL BLOCK	COPPER FREE ALUMINUM	EACH	1	LTD SUPP.
13	REDUCER (1.5" MALE X 1" FEMALE, NPT THREAD)	WELDEABLE BRON. ZINC ELECTRO PLATED	EACH	1	LTD SUPP.
14	BLIND PLUG (1.5" NPT THREAD)	WELDEABLE BRON. ZINC ELECTRO PLATED	EACH	2	LTD SUPP.
15	BLIND PLUG (1" NPT THREAD)	WELDEABLE BRON. ZINC ELECTRO PLATED	EACH	1	LTD SUPP.
16	MACHINERY ANCHOR	STAINLESS STEEL	SET	8	EL. CONTR.
17	BOLT, FLAT WASHER, SPRING WASHER	STAINLESS STEEL	SET	8	EL. CONTR.
18	CONVENIENCE OUTLET BOX, 150MM x 100 x 50 (L-W-H)	COPPER FREE ALUMINUM	EACH	1	LTD SUPP.

(*) SUITABLE FOR CLASS 1, ZONE 2, GAS GROUP D, TEMP CLASS T3 HAZARDOUS AREA

DETAIL- 8

WALL MOUNTED CONVENIENCE OUTLET



NO.	DESCRIPTION	MATERIAL	UNITS	QUANTITY	SUPPLIER
1	RIGID STEEL CONDUIT (1" NPT THREAD)	STEEL HDG. PIG FACTORY-COATED	METER	A/R	BAUX SUPP.
2	RIGID STEEL CONDUIT (1" NPT THREAD)	STEEL HDG. PIG FACTORY-COATED	METER	A/R	BAUX SUPP.
3	UNION COUPLING (1" NPT THREAD)	WELDEABLE BRON. ZINC ELECTRO PLATED	EACH	1	LTD SUPP.
4	BEARING FITTING	WELDEABLE BRON. ZINC ELECTRO PLATED	EACH	1	LTD SUPP.
5	"6" CHANNEL 350X50X5	STEEL	METER	A/R	EL. CONTR.
6	MOUNTING PLATE	STEEL	EACH	2	EL. CONTR.
7	BOLTS, FLAT WASHERS, SPRING WASHERS, NUTS	STAINLESS STEEL	SET	4	EL. CONTR.
8	CONDUIT BODY & ENTRY (1.5" NPT THREAD) WITH TERMINAL BLOCK	COPPER FREE ALUMINUM	EACH	1	LTD SUPP.
9	REDUCER (1.5" MALE X 1" FEMALE, NPT THREAD)	WELDEABLE BRON. ZINC ELECTRO PLATED	EACH	4	LTD SUPP.
10	REDUCER (1" MALE X (3/4") FEMALE, NPT THREAD)	WELDEABLE BRON. ZINC ELECTRO PLATED	EACH	3	LTD SUPP.
11	BLIND PLUG (1" NPT THREAD)	WELDEABLE BRON. ZINC ELECTRO PLATED	EACH	2	LTD SUPP.
12	BLIND PLUG (1" NPT THREAD)	WELDEABLE BRON. ZINC ELECTRO PLATED	EACH	1	LTD SUPP.
13	CABLE CLAMP (1" NPT THREAD)	WELDEABLE BRON. ZINC ELECTRO PLATED	EACH	2	CABLE SUPP.
14	STEEL SUPPORT	STEEL	METER	A/R	EL. CONTR.
15	BASE PLATE	STEEL	EACH	1	EL. CONTR.
16	ANCHOR BOLTS WITH WASHER & NUTS	STAINLESS STEEL	SET	4	LTD SUPP.
17	ARMoured CABLE	—	—	1	CABLE SUPP.
18	CONDUIT BURNING (1" NPT T-THREAD)	WELDEABLE BRON. ZINC ELECTRO PLATED	EACH	4	LTD SUPP.
19	CONVENIENCE OUTLET BOX, 150MM x 100 x 50 (L-W-H)	COPPER FREE ALUMINUM	EACH	1	BAUX SUPP.

(*) SUITABLE FOR CLASS 1, ZONE 2, GAS GROUP D, TEMP CLASS T3 HAZARDOUS AREA

DETAIL- 9

GROUND MOUNTED CONVENIENCE OUTLET

A photograph of an industrial facility, possibly a refinery or chemical plant, at night. The scene is filled with complex piping, structural steel, and various industrial vessels. Numerous lights are visible throughout the facility, creating a bright, glowing effect against the dark background. A prominent tall distillation column stands out in the center-right. The sky is dark with some clouds, and a bright light source, likely the moon or a distant star, is visible on the right side. The entire image has a strong red color overlay, giving it a dramatic and somewhat ominous appearance.

5. LIGHTING SYSTEM DESIGN

Lighting system design steps :

1. Project analysis:

- Read project lighting specification**
- project plot plan analysis**
- Model viewing**

2. Lamp selection

3. Luminaire selection

4. Determination of number of fixtures by lighting software

5. Implementation of the number & types of luminaires in a layout

6. Applying lighting distribution criteria to determine the no. of circuits & the feeding cable size

7. Add the distribution information in the layout

In this section we will discuss steps no. 4 & 5 in details while steps no. 6 & 7 will be discussed in the next section

4. Determination of number of fixtures by lighting software :

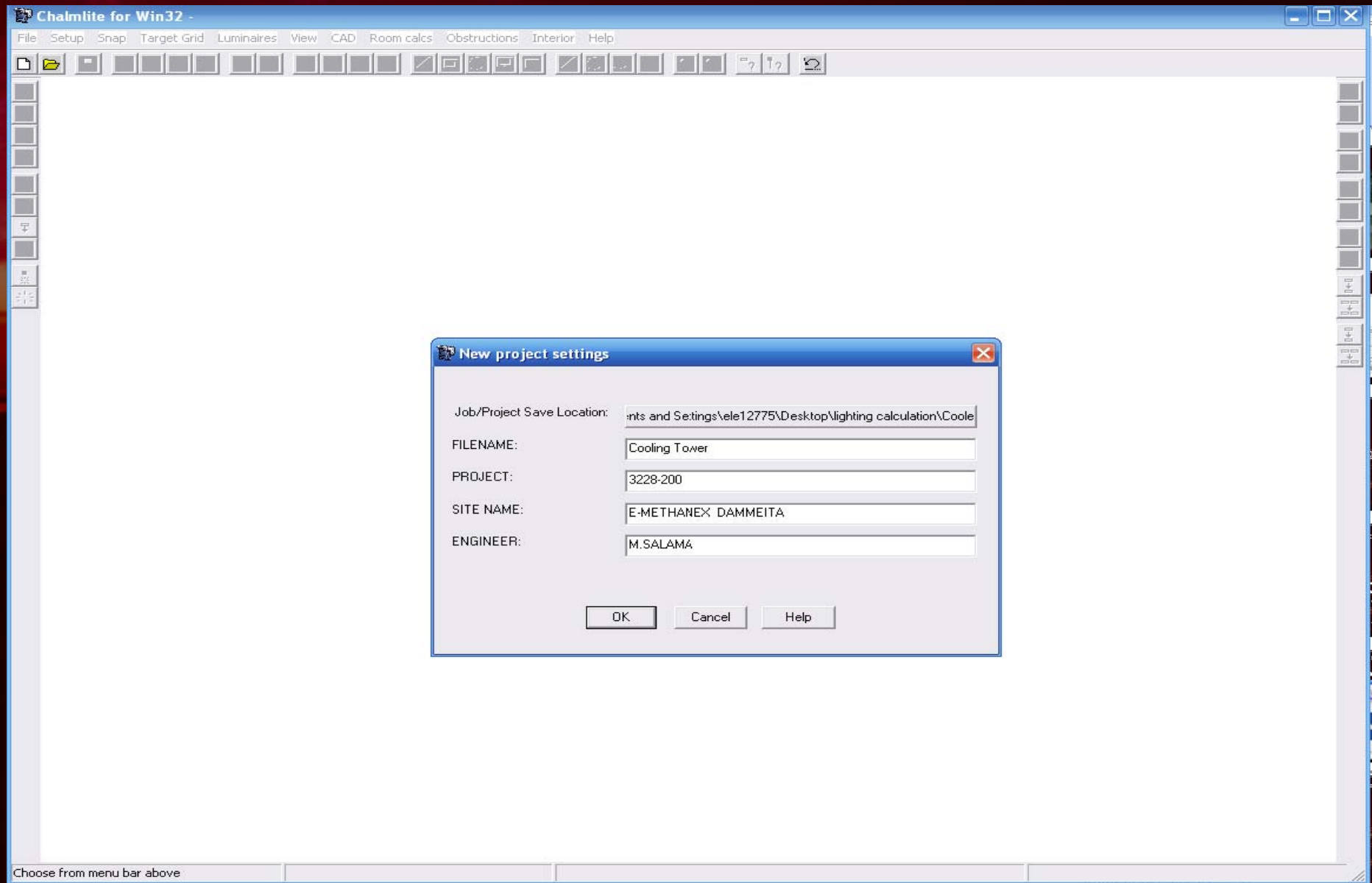
In our calculations we will use the chalmlite software

Getting started



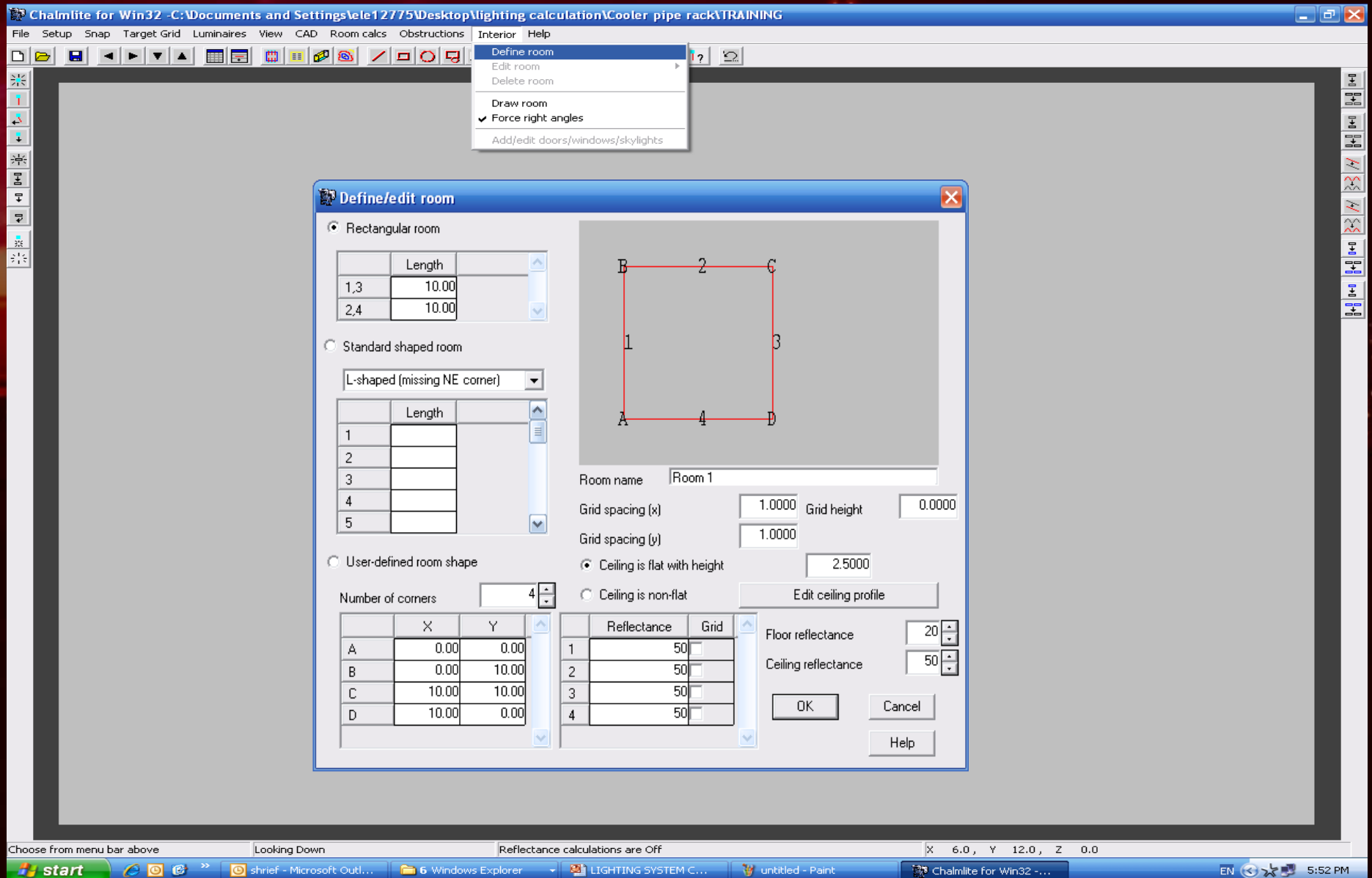
CHALMLITE SOFTWARE

Working Environment



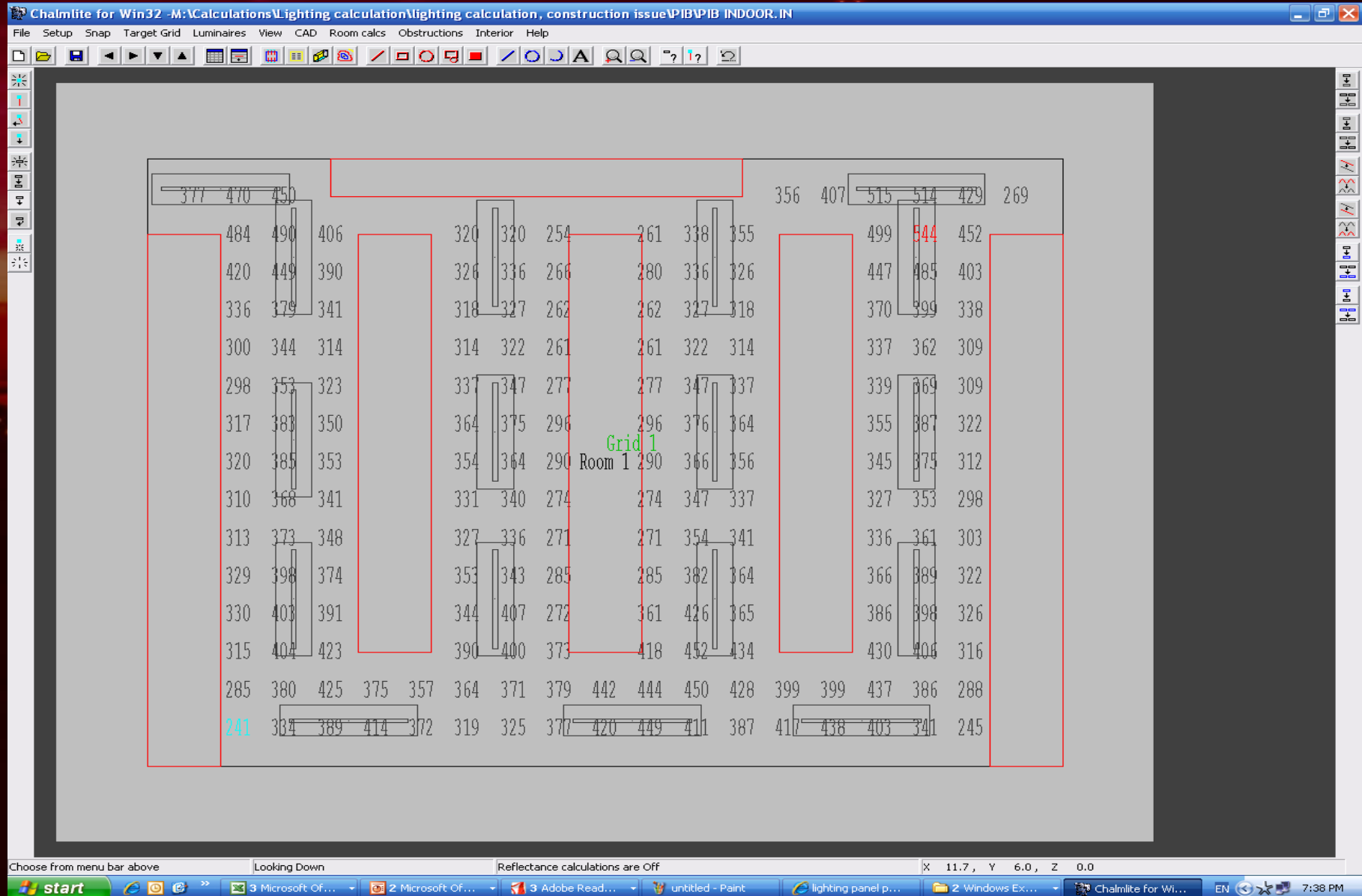
CHALMLITE SOFTWARE

Indoor Calculation



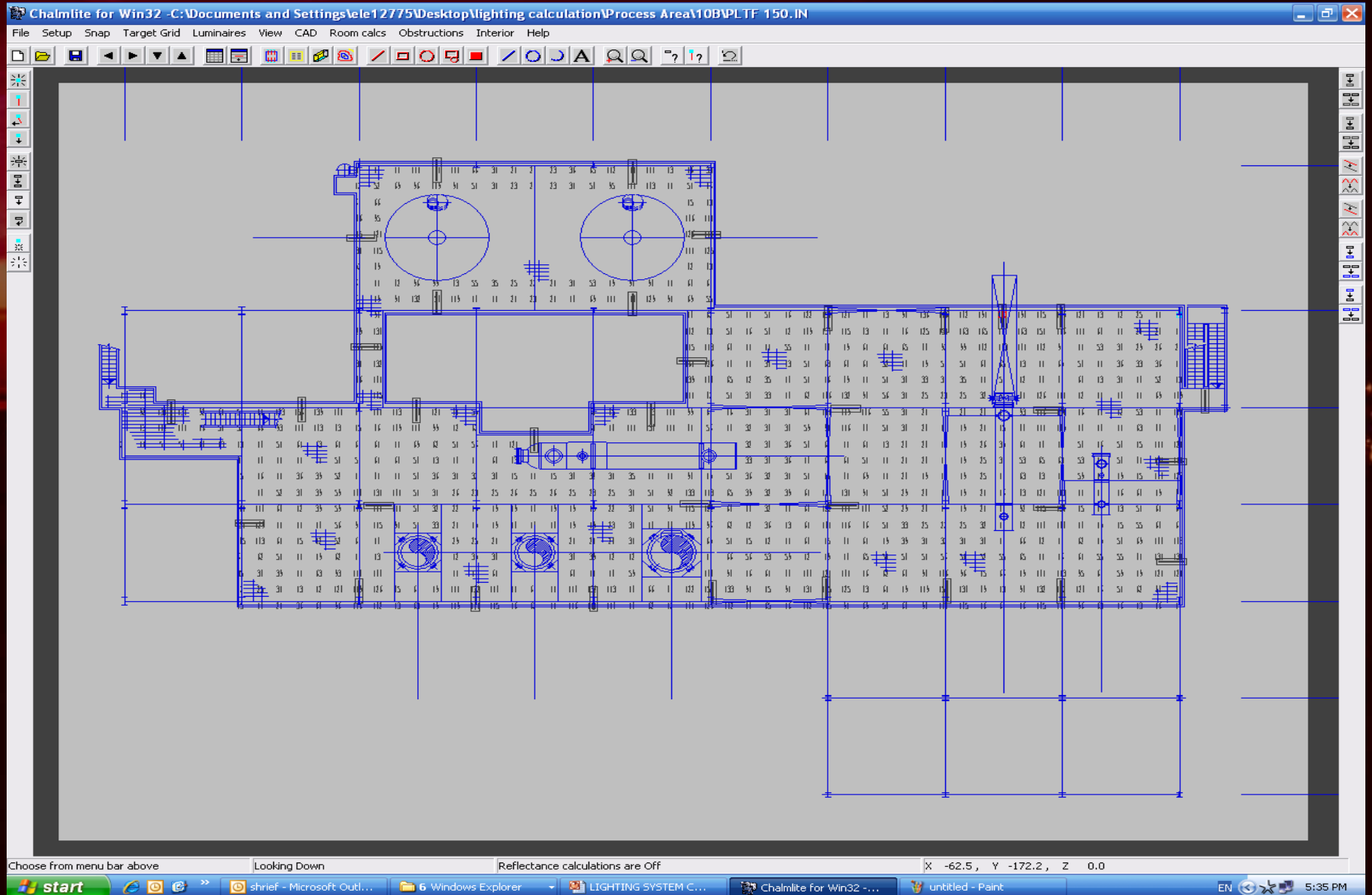
CHALMLITE SOFTWARE

Indoor Calculation



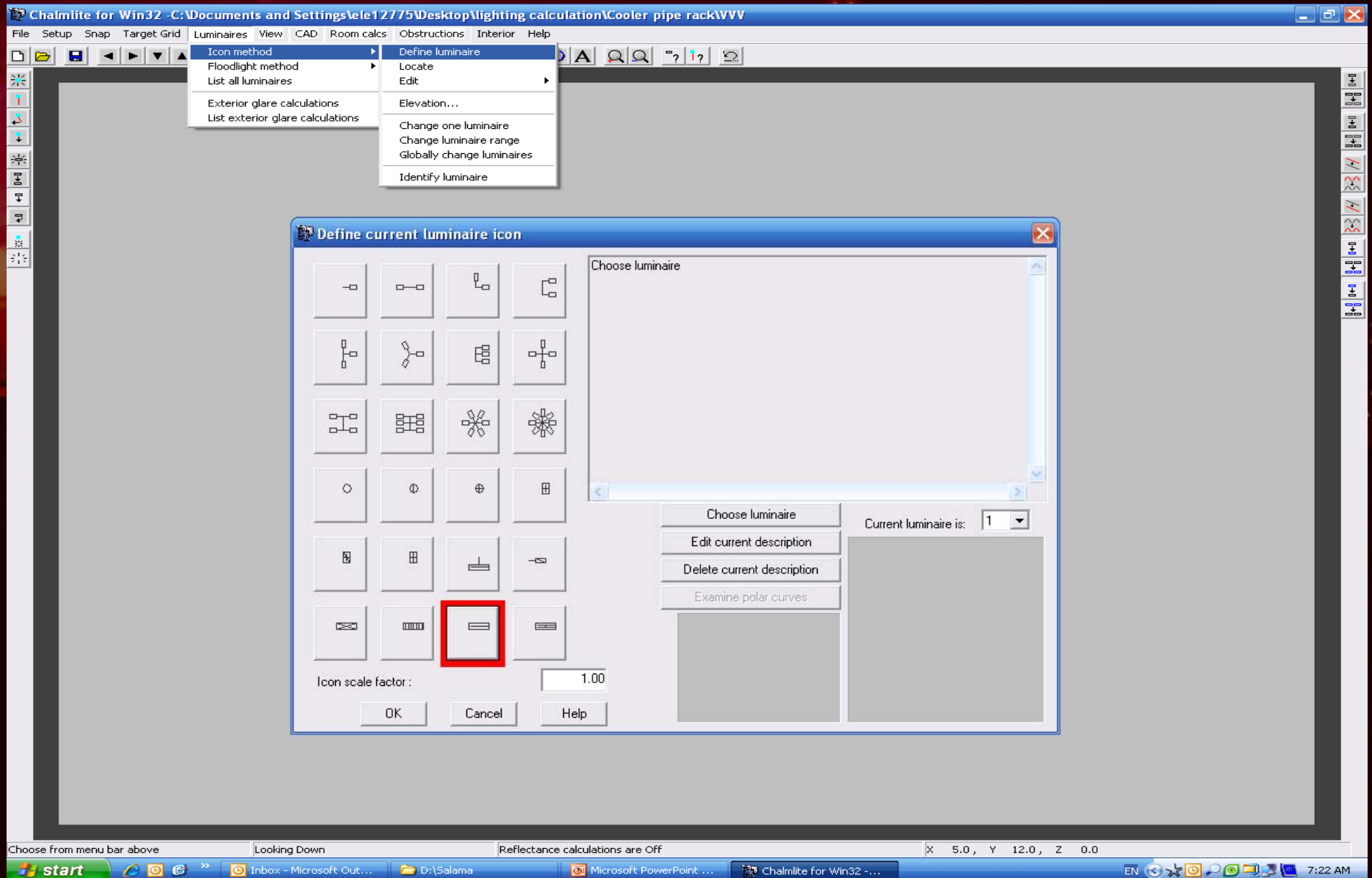
CHALMLITE SOFTWARE

Outdoor Calculation



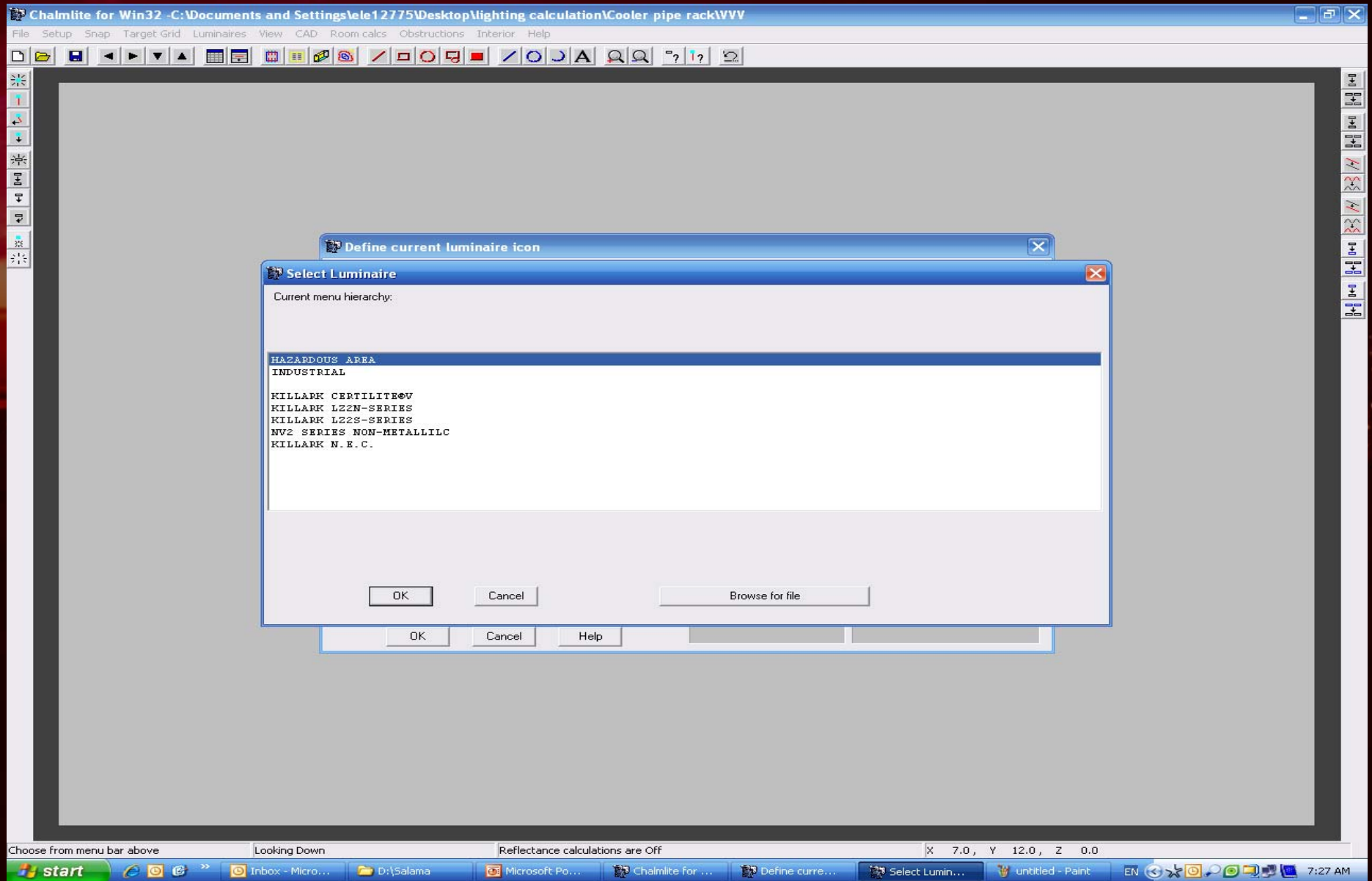
CHALMLITE SOFTWARE

Luminaire Selection



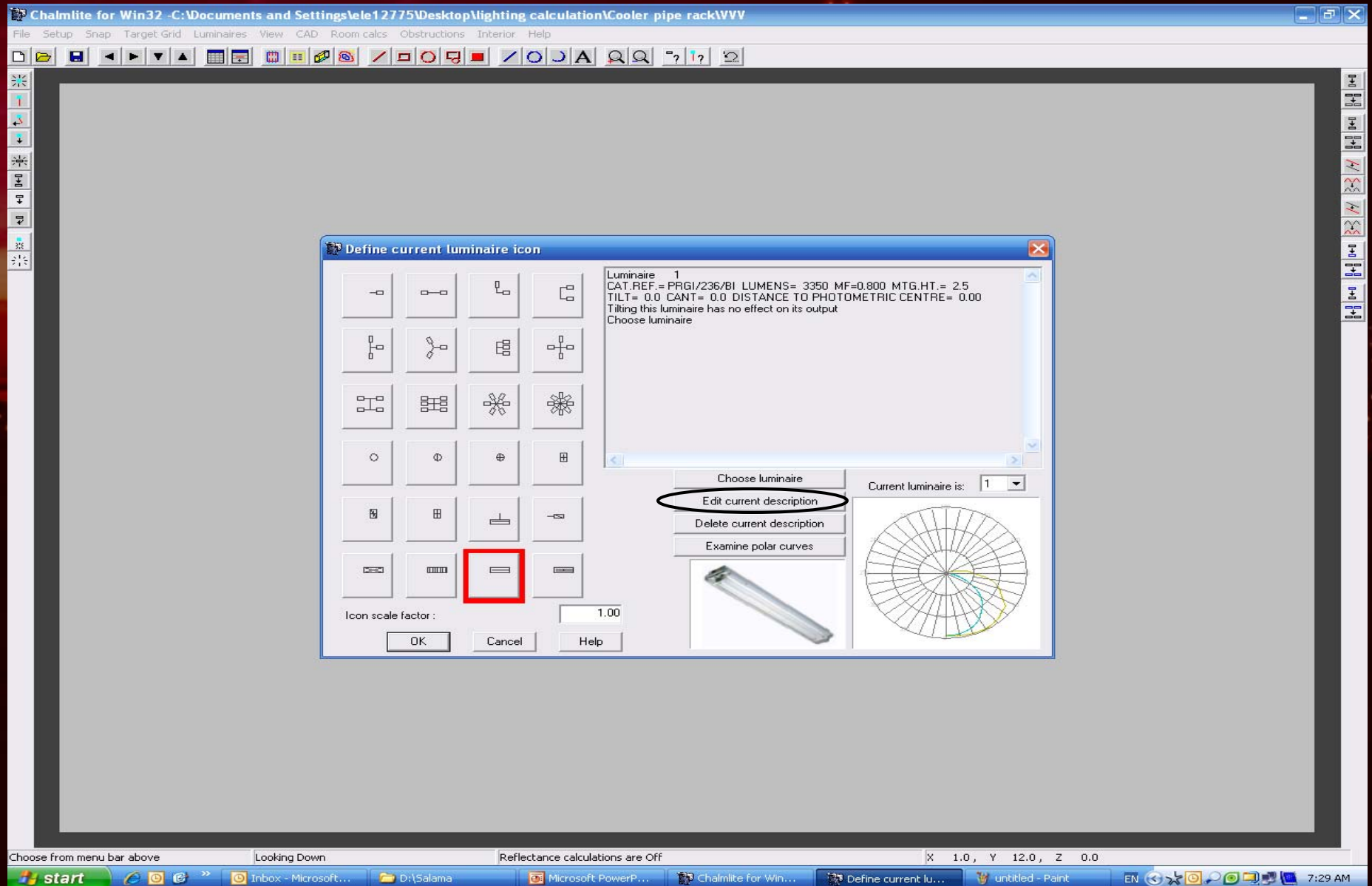
CHALMLITE SOFTWARE

Luminaire Selection



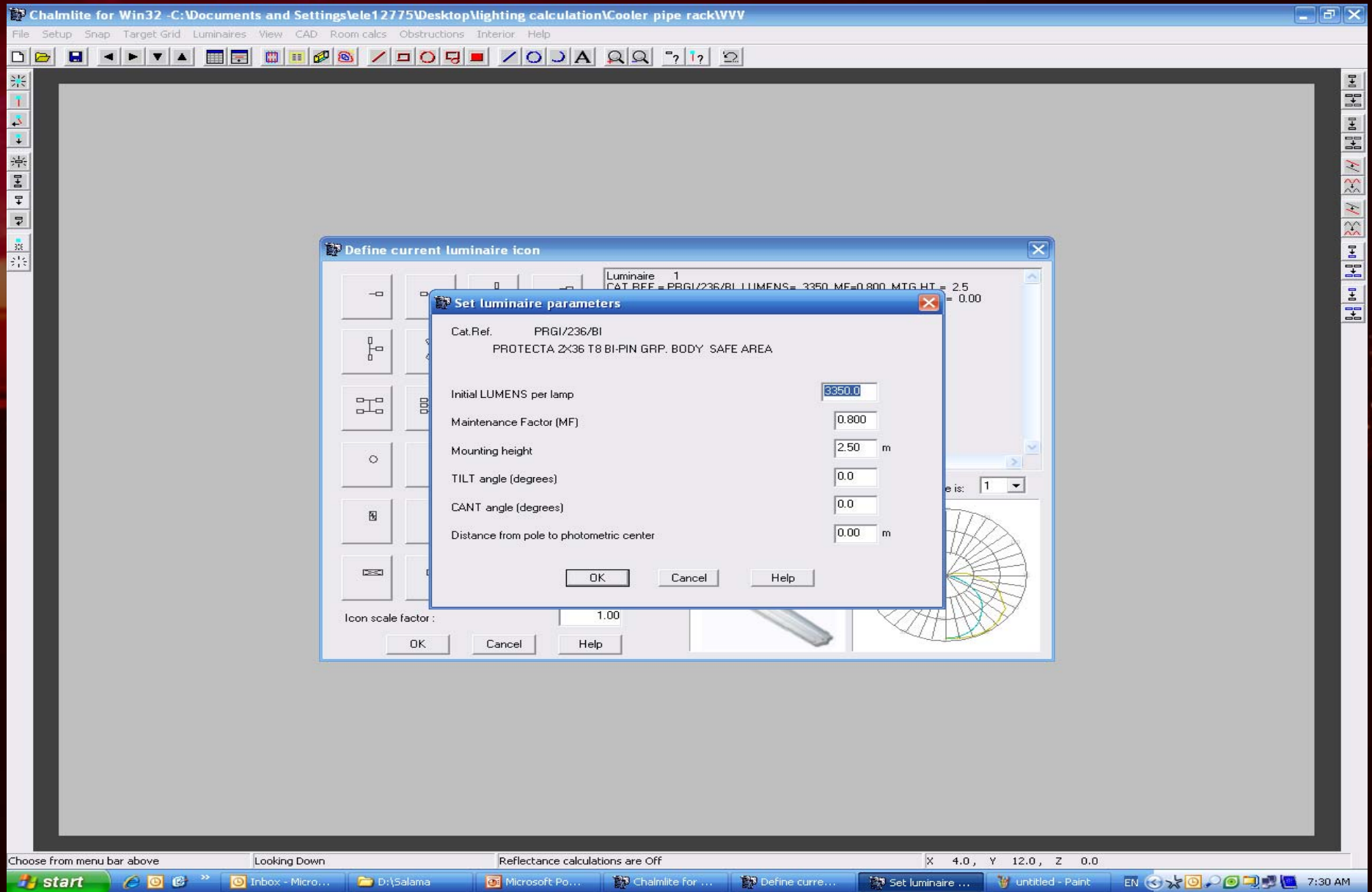
CHALMLITE SOFTWARE

Luminaire Selection



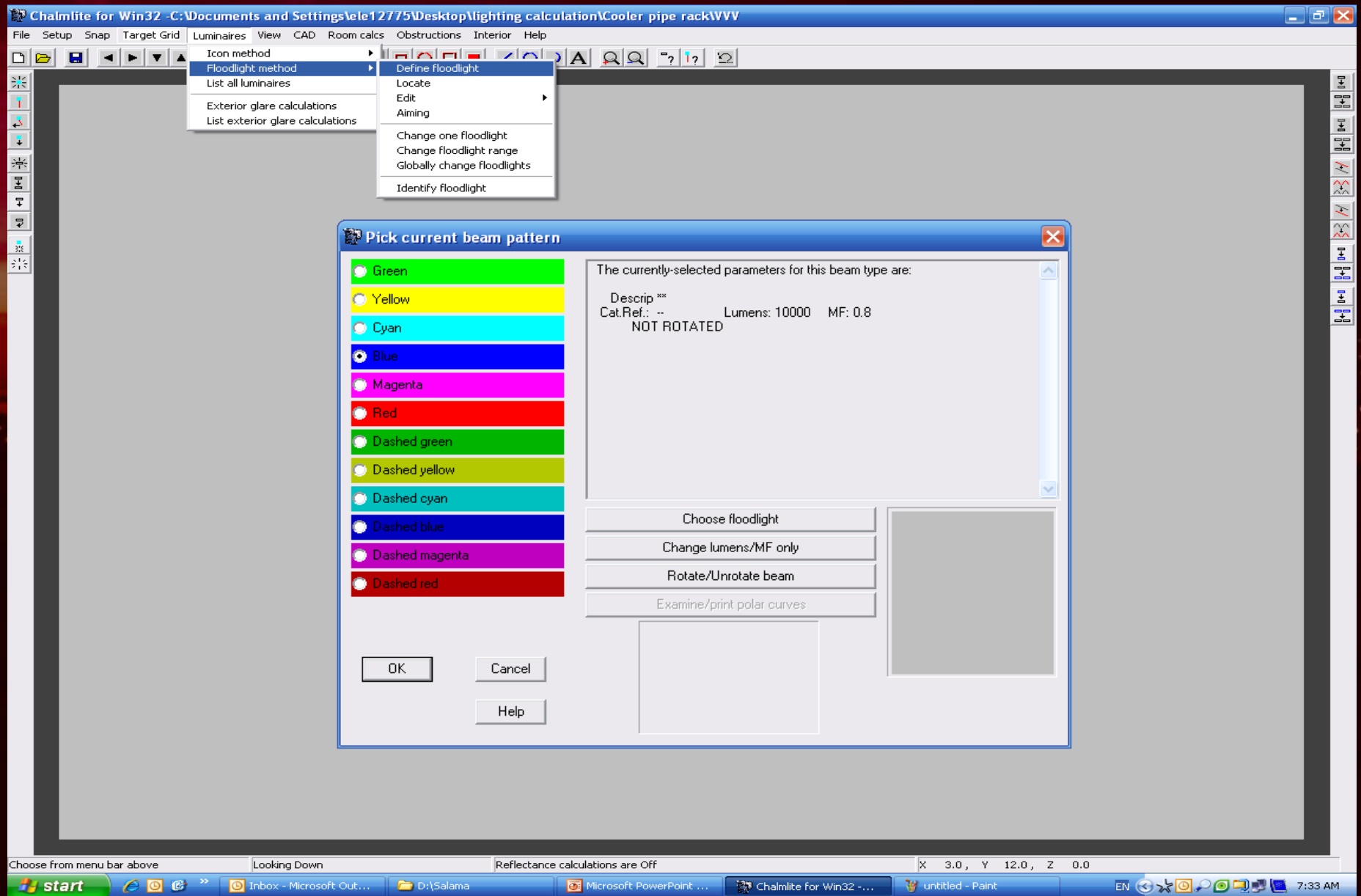
CHALMLITE SOFTWARE

Luminaire Selection



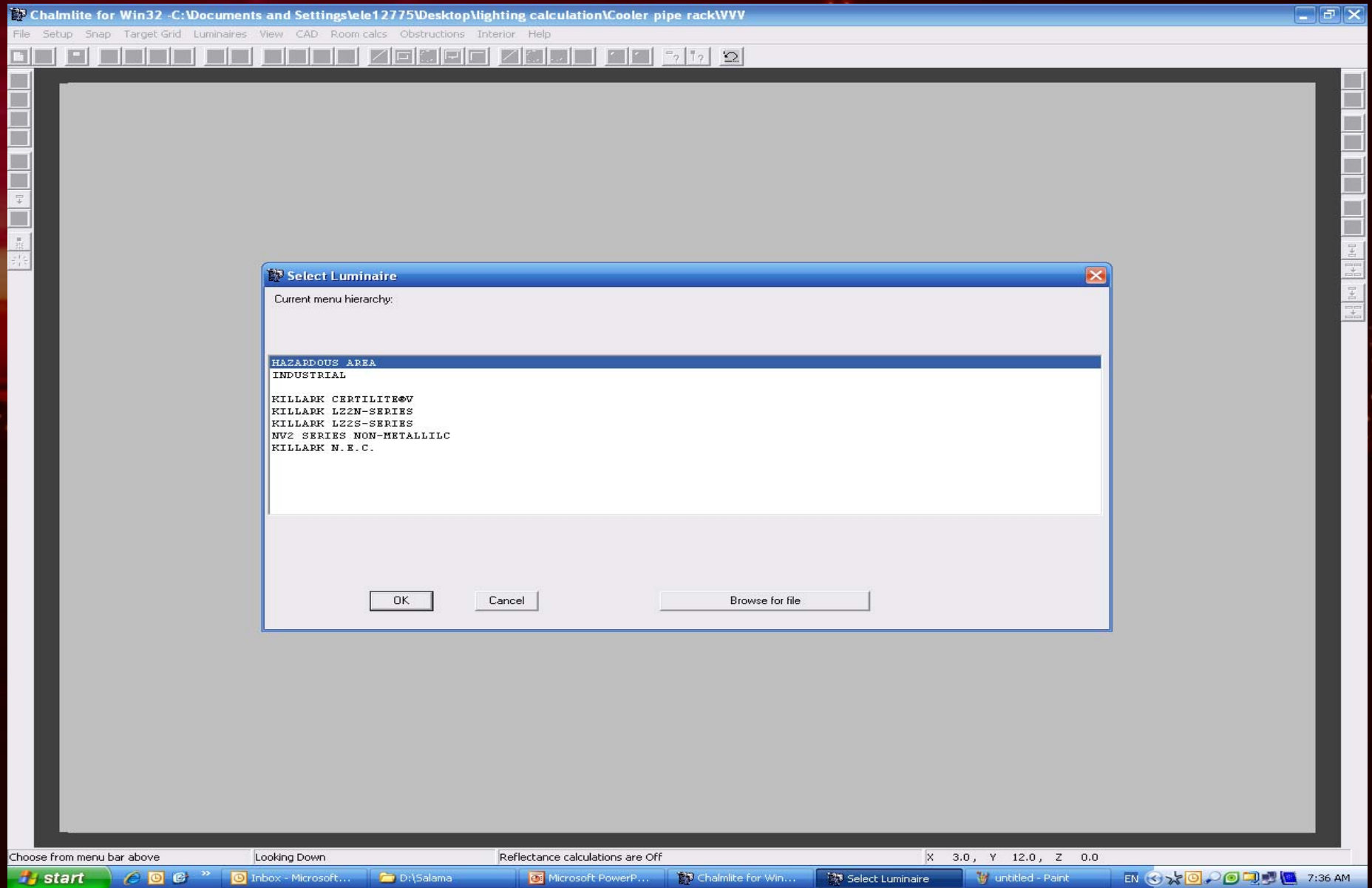
CHALMLITE SOFTWARE

Flood Light Method



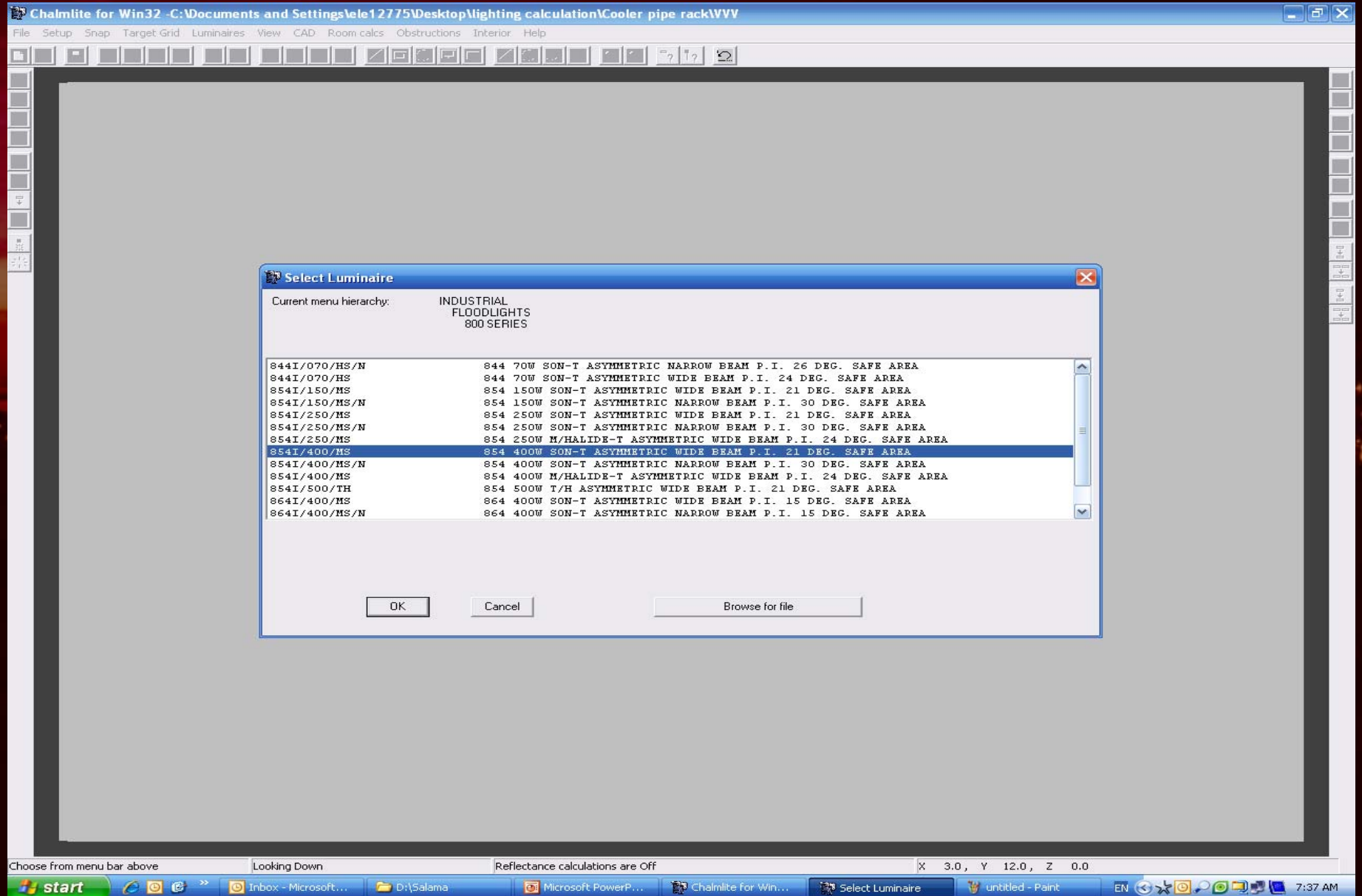
CHALMLITE SOFTWARE

Flood Light Method



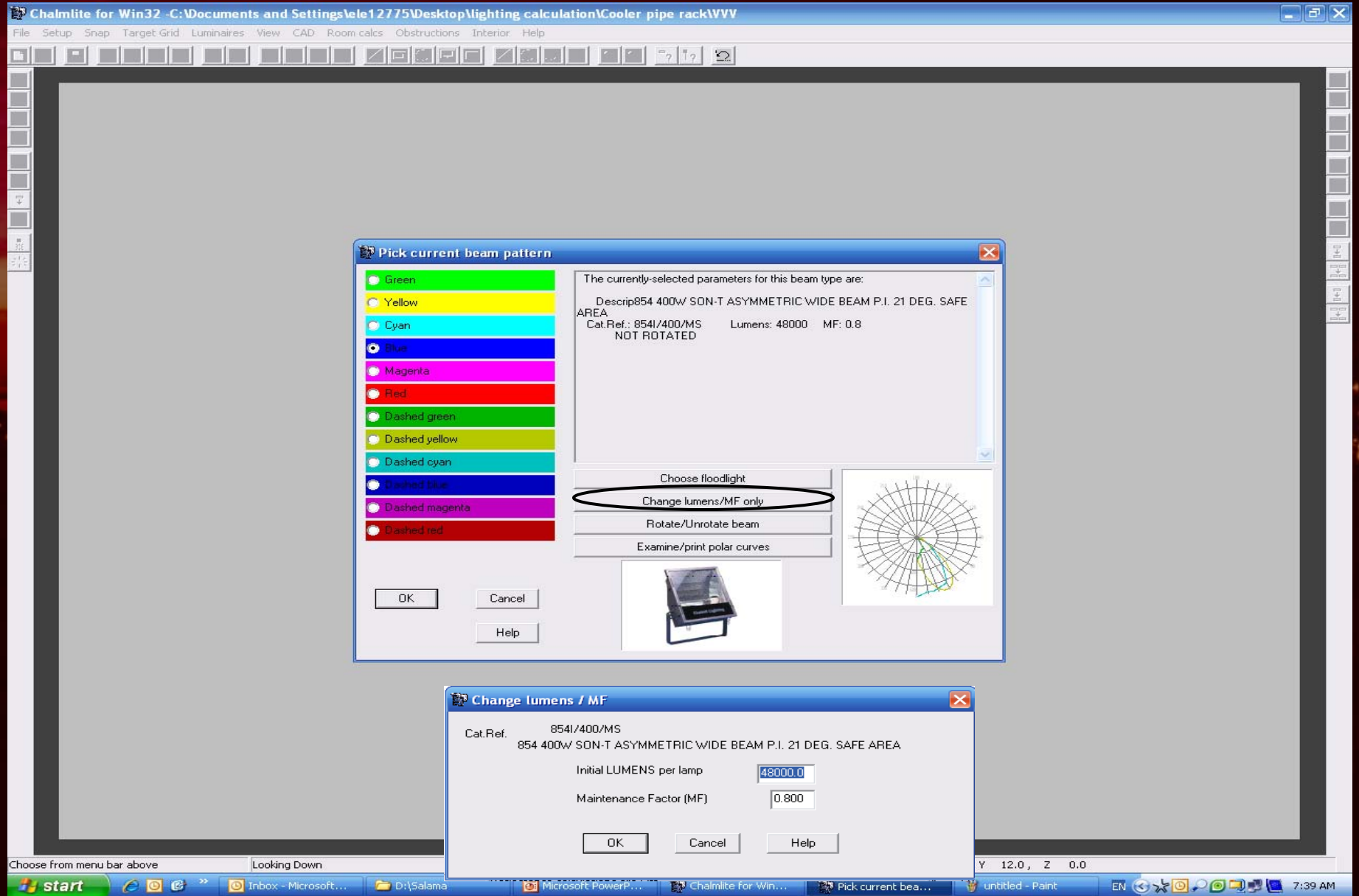
CHALMLITE SOFTWARE

Flood Light Method



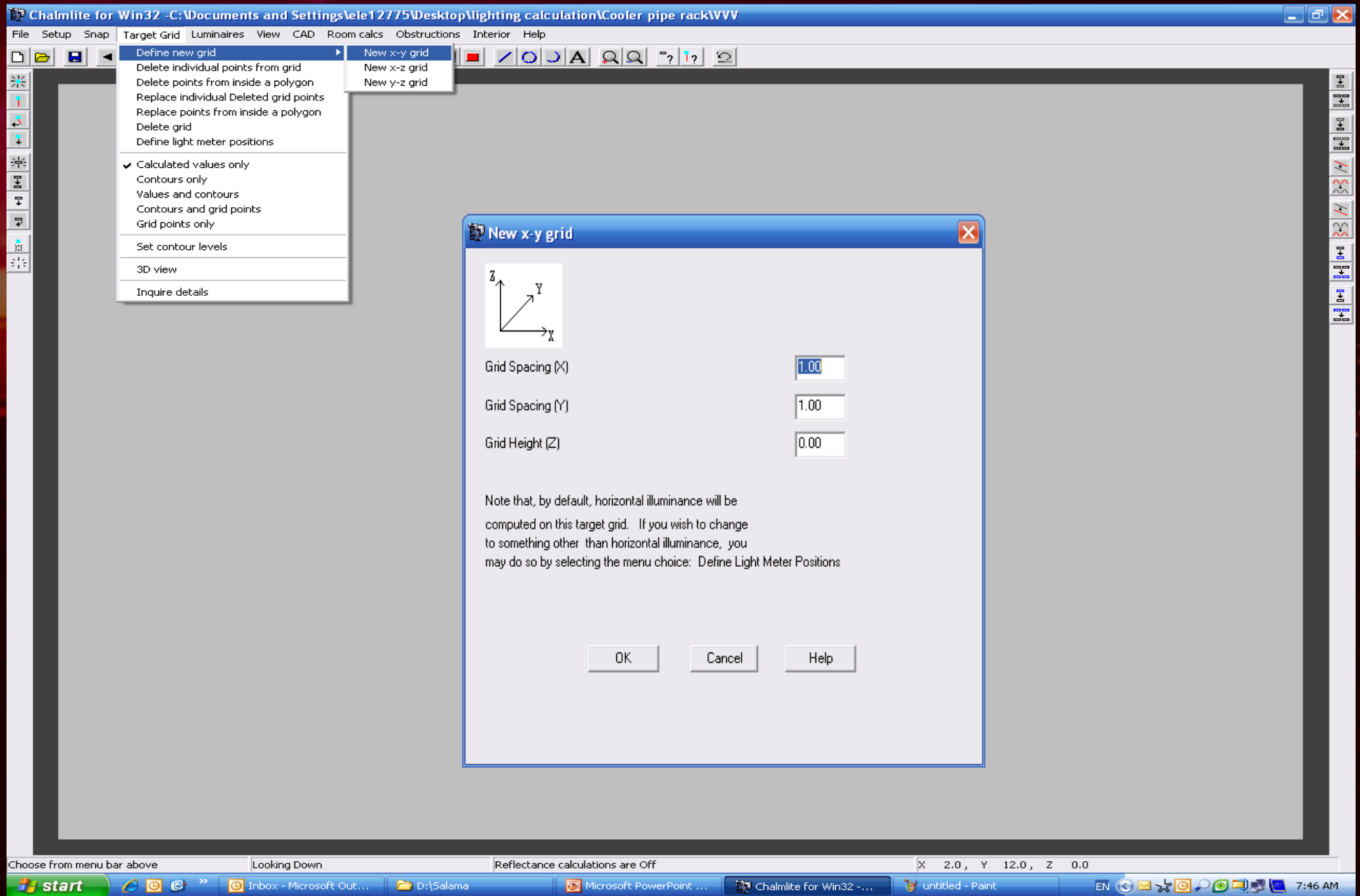
CHALMLITE SOFTWARE

Flood light method



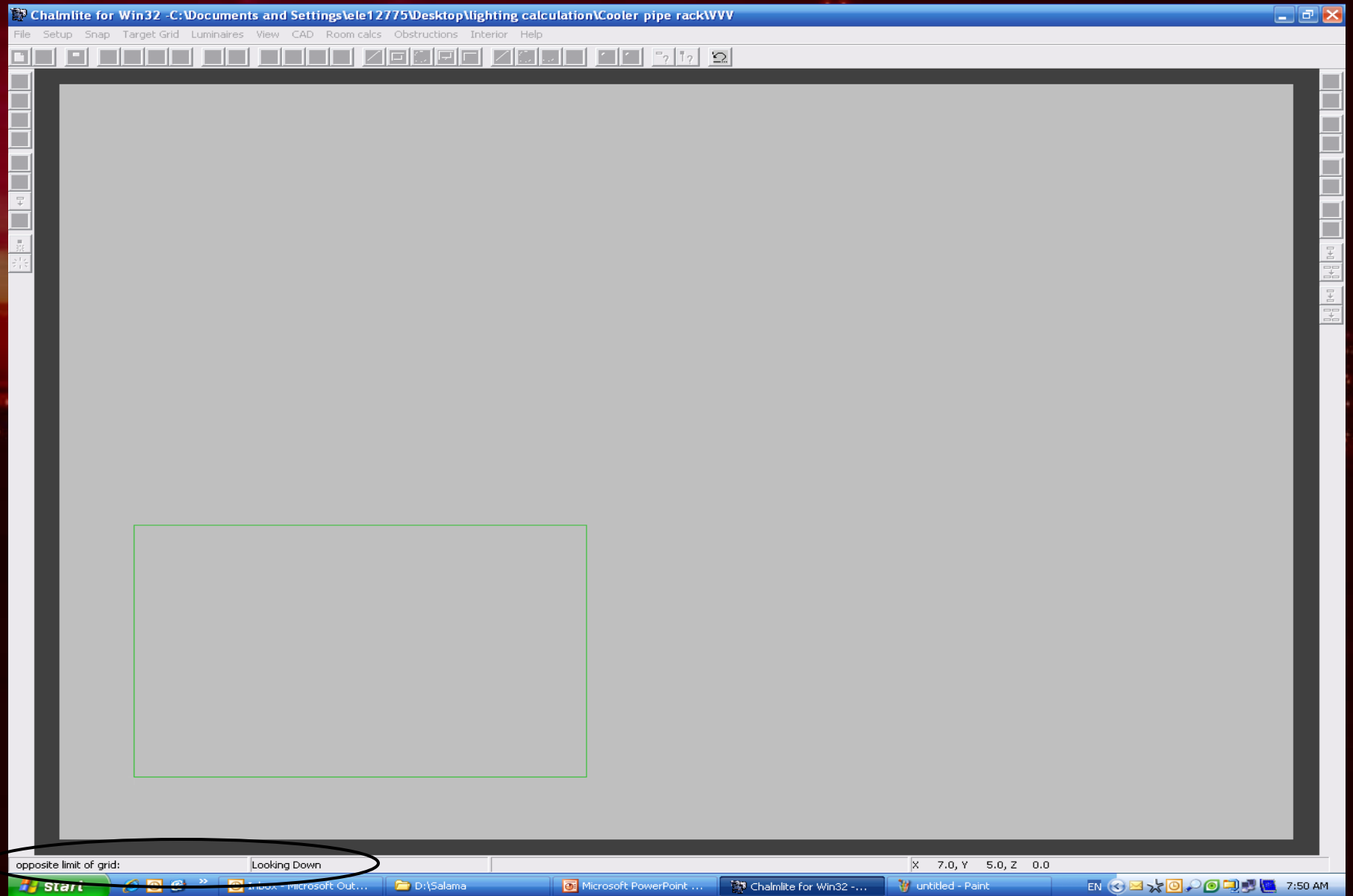
CHALMLITE SOFTWARE

Grid Definition



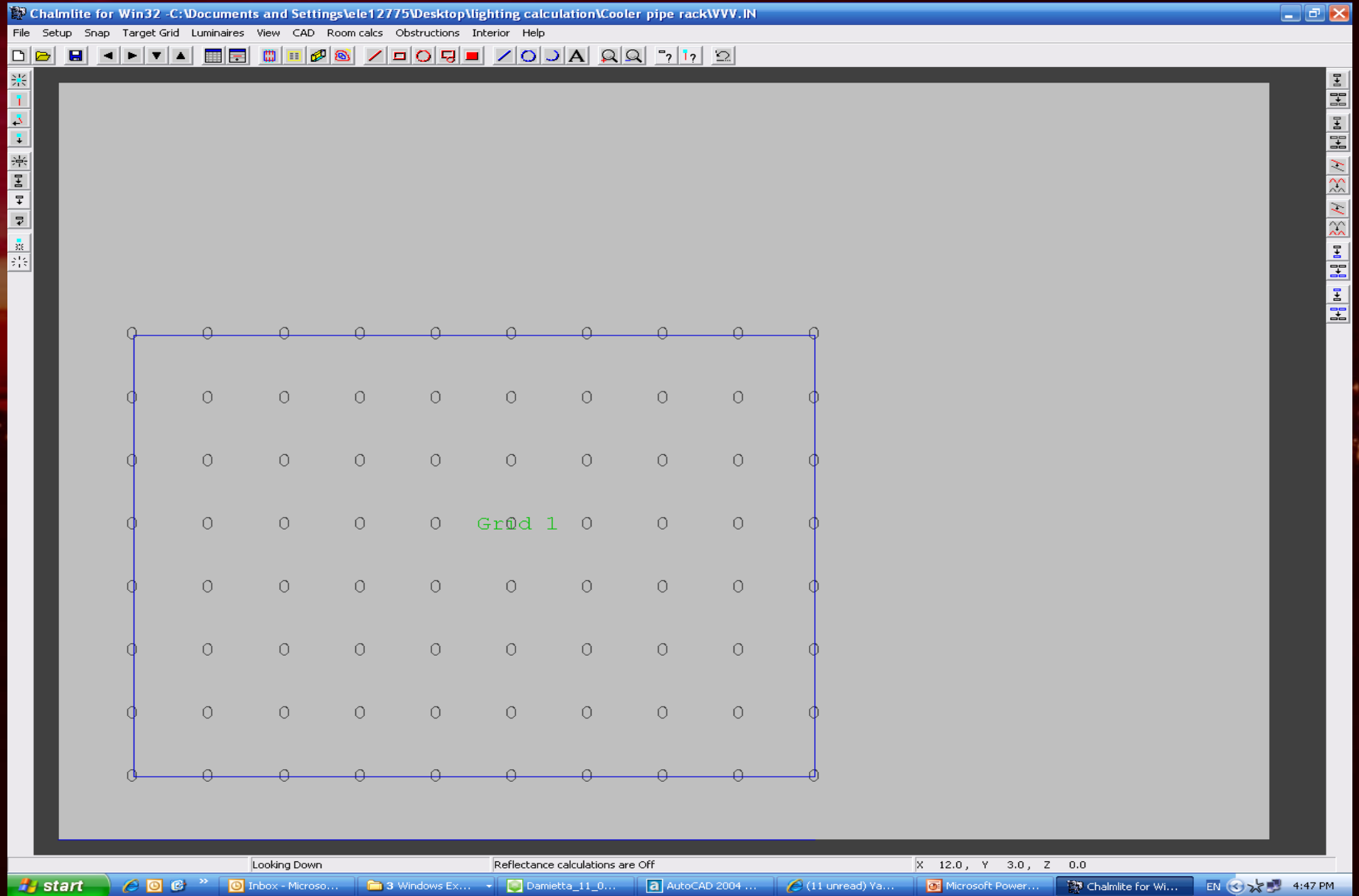
CHALMLITE SOFTWARE

Grid Definition



CHALMLITE SOFTWARE

Grid Definition



CHALMLITE SOFTWARE

Results Presentation

Chalmlite for Win32 - C:\Documents and Settings\lele12775\Desktop\lighting calculation\Cooler pipe rack\WVV.IN

File Setup Snap Target Grid Luminaires View CAD Room calcs Obstructions Interior Help

Selected luminaires

Number of luminaires used: 2

Floodlights

Line colour and pattern

Cat.Ref. -- View/edit details

Icons

Cat.Ref. PRGI/236/BI View/edit details

Mounting Height = 2.5m

Grid Details

Lux											
	Min	Avg	Mi/A	Max	N	S	E	W	Z	Vis	Room
1	10	43	.235	144					0.00	✓	

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X 12.6, Y 4.5, Z 0.0

start

Inbox - Microso...

3 Windows Ex...

Damietta_11_0...

AutoCAD 2004 ...

(11 unread) Ya...

Microsoft Power...

Chalmlite for Wi...

EN

4:51 PM

CHALMLITE SOFTWARE

Calculation Report

KILLARK



399 Hillington Road
Glasgow G52 4BL Scotland
Tel: +44(0)141 882 5555
Fax: +44(0)141 883 3704
E-Mail: info@chalmit.com

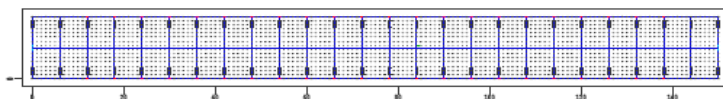
A division of Hubbell (HEP)
Chalmit Version 4.04
Nov 2007

Date: 02-04-08
Filename: COOLER PLTF 1
Project: 3228-200
Site: EMATHANEX
Engineer: M.SALAMA

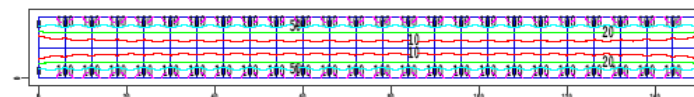
Scale 1: 900

Page 1 of 5

HORIZONTAL LUX



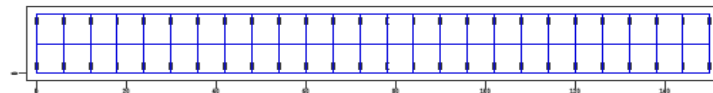
C:\Documents and Settings\ele12775\Desktop\lighting\HORIZONTAL Lux\Cooler pipe rack\COOLER PLTF21 of 5



CHALMLITE SOFTWARE

Calculation Report

C:\Documents and Settings\ele12775\Desktop\lighting calculation\Cooler pipe rack\COOLER FLTIF 5



C:\Documents and Settings\ele12775\Desktop\lighting calculation\Cooler pipe rack\COOLER FLTIF 5
TARGET GRID SUMMARIES Page 4 of 5

Grid 1 is x-y plane at Z= 0.0 Horizontal Lux
Limits: from x=0.0 to x=168.0 ,from y=0.0 to y=15.0
Average= 45.598 Minimum/Average=0.110
Maximum= 182.000 Minimum/Maximum=0.027
Minimum= 5.000 Number of Points= 2416

FLOODLIGHT/LUMINAIRE SUMMARY

PROTECTA 2X36 T8 BI-PIN GRP. BODY Ex n ATEX 3
Cat Ref. PRGN/236/BI Lumens per lamp= 3350.0 MF= 0.800
Mounting Height= 2.35m
Number Luminaires= 52 Number Locations= 52

Total Number Luminaires= 52

LUMINAIRE LOCATIONS AND ORIENTATION ANGLES

CAT. REF.	SEQUENCE NO.	(X,Y,Z) LOCATION			ANGLES		
		X	Y	Z	TILT	CANT	AZIMUTH STATUS
PRGN/236/BI	1	150	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	2	144	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	3	138	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	4	132	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	5	126	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	6	120	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	7	114	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	8	108	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	9	102	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	10	96	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	11	90	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	12	84	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	13	78	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	14	72	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	15	66	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	16	60	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	17	54	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	18	48	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	19	42	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	20	36	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	21	30	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	22	24	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	23	18	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	24	12	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	25	6	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	26	0	15	2.3	0.0	0.0	180.0 ON
PRGN/236/BI	27	150	0	2.3	0.0	0.0	0.0 ON
PRGN/236/BI	28	144	0	2.3	0.0	0.0	0.0 ON
PRGN/236/BI	29	138	0	2.3	0.0	0.0	0.0 ON
PRGN/236/BI	30	132	0	2.3	0.0	0.0	0.0 ON
PRGN/236/BI	31	126	0	2.3	0.0	0.0	0.0 ON
PRGN/236/BI	32	120	0	2.3	0.0	0.0	0.0 ON
PRGN/236/BI	33	114	0	2.3	0.0	0.0	0.0 ON
PRGN/236/BI	34	108	0	2.3	0.0	0.0	0.0 ON
PRGN/236/BI	35	102	0	2.3	0.0	0.0	0.0 ON
PRGN/236/BI	36	96	0	2.3	0.0	0.0	0.0 ON
PRGN/236/BI	37	90	0	2.3	0.0	0.0	0.0 ON
PRGN/236/BI	38	84	0	2.3	0.0	0.0	0.0 ON
PRGN/236/BI	39	78	0	2.3	0.0	0.0	0.0 ON
PRGN/236/BI	40	72	0	2.3	0.0	0.0	0.0 ON
PRGN/236/BI	41	66	0	2.3	0.0	0.0	0.0 ON
PRGN/236/BI	42	60	0	2.3	0.0	0.0	0.0 ON
PRGN/236/BI	43	54	0	2.3	0.0	0.0	0.0 ON
PRGN/236/BI	44	48	0	2.3	0.0	0.0	0.0 ON
PRGN/236/BI	45	42	0	2.3	0.0	0.0	0.0 ON
PRGN/236/BI	46	36	0	2.3	0.0	0.0	0.0 ON
PRGN/236/BI	47	30	0	2.3	0.0	0.0	0.0 ON
PRGN/236/BI	48	24	0	2.3	0.0	0.0	0.0 ON

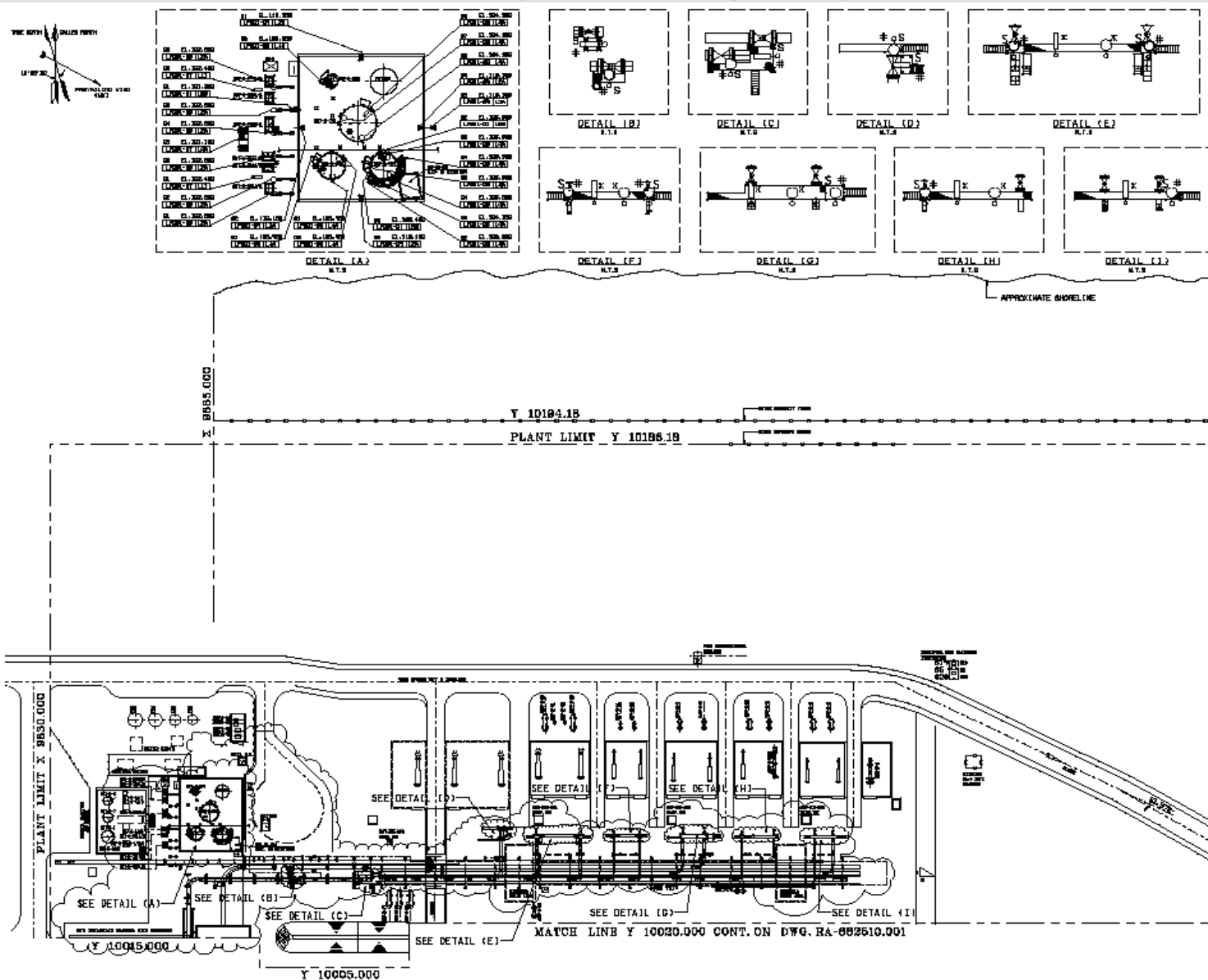
5. Implementation of the number & types of luminaires in a layout :

In this step the calculated luminaires number & types in the previous step will be presented in the layout .

Contents of the lighting layout:

1. Reference drawings
2. Notes
3. Legend
4. Fixture identification number
5. Panel identification number
6. Scale bar
7. Selected area plot plan
8. Fixtures & sockets distribution
9. lighting details if needed

LIGHTING LAYOUT



- [illegible]

LEGEND

- 0 LUMINANT PICTURE WITH LOW-LEVEL MAGNETIC REMANENT TYPE, SUITABLE FOR SLIDE 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 83

REFERENCE DRAWINGS

REFERENCE DRAWINGS	
NA-484201	PLAT PLAN
EE-484204	LIGHTING SYSTEM MOUNTING DETAILS
NA-484203	SEA-BOARD LIGHTING PLAN

KEY PLAN



10-2010-1000-1000-1000

11/15/07 11/15/07	11/15/07 11/15/07	11/15/07 11/15/07	11/15/07 11/15/07	11/15/07 11/15/07
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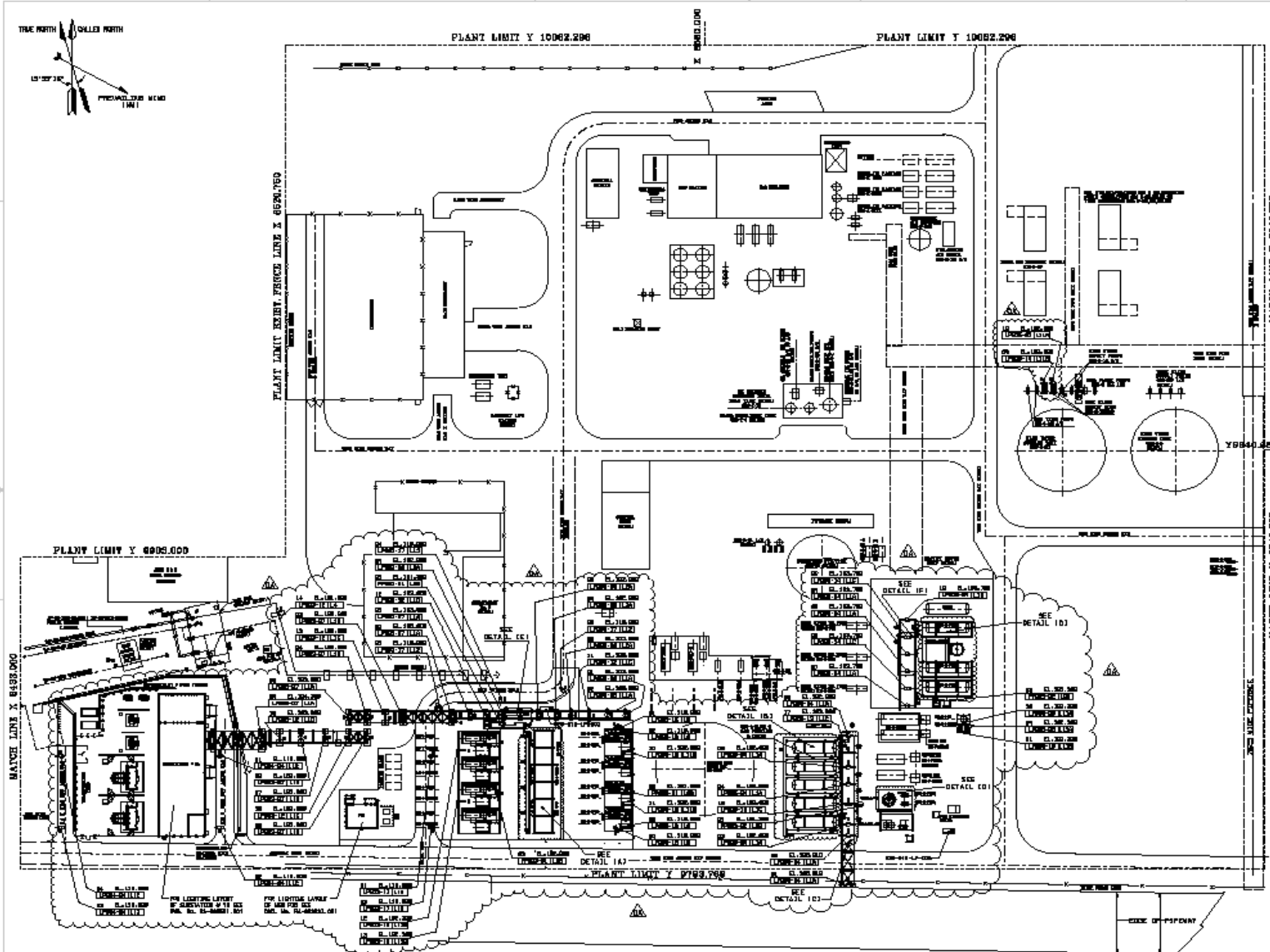
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00-000000 00-000000	THIS PERSON IS NOT TO BE USED FOR INFORMATION ONLY. CONTACT THE
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LIGHTING LAYOUT	LT
WATER DISPOSAL SYSTEM UPGRADE	
MONITORING AREA PERUSE	

MANIFOLD AREA CODE				
SAFANIYAH			BALDI ARAB	
PLANT NO.	CODE	MANIFOLD NUMBER	RT. NO.	SEC.
G97	P	Rd-002509	001	0

RESTRICTED

LIGHTING LAYOUT



1. **FILE NUMBER:** **100-100000000** **TO WHOM IT MAY CONCERN:**

LEGEND

- [illegible]

[illegible]

REFERENCE DRAWINGS

	REFERENCE DRAWINGS
RA-000021	PLOT PLAN
RA-000038	LIGHTING SYSTEM MONITOR DETAILS
RA-000066 RH - Q02	LIGHTING DETAIL
RA-000060	PANEL SCHEDULE, LIGHTING PANEL 2 OUTDOOR G10-G19-LF-Q02
RA-000054	PANEL SCHEDULE, LIGHTING PANEL 2 OUTDOOR BEE-G19-LF-Q04
RA-000067	PANEL SCHEDULE, LIGHTING PANEL CHOOX BEE-G19-LF-Q04
RA-000066	PANEL SCHEDULE, POWER PAUL.

KEY PLAN



THIS PERIODICAL MAY BE USED FOR ALL SYSTEMS AND INFORMATION MANAGEMENT, FOR MICROFILM, TAPES, AND OTHER INFORMATION STORAGE AND RETRIEVAL.

[illegible][illegible]

SAUDI ARABIAN OIL COMPANY

LIGHTING LAYOUT	LTD
WATER DRAINAGE SYSTEM UPGRADE	

WATER SUPPLY AND DISPOSAL AREA

SAFANIYAH		SALDI ARABIA	
FLY IN	DATE	FROM AIRPORT	TO AIRPORT

028	P	RA-682522	001	DA
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RESTRICTED VECTOR

The background image shows a large industrial complex, possibly a refinery or chemical plant, at night. The facility is illuminated by numerous lights, creating a complex network of bright points against the dark sky. A prominent tall distillation column is visible in the center. The entire image is overlaid with a semi-transparent red filter. The title text is centered over the image.

6. LIGHTIGN CIRCUITS DISTRIBUTION CRITIRIA

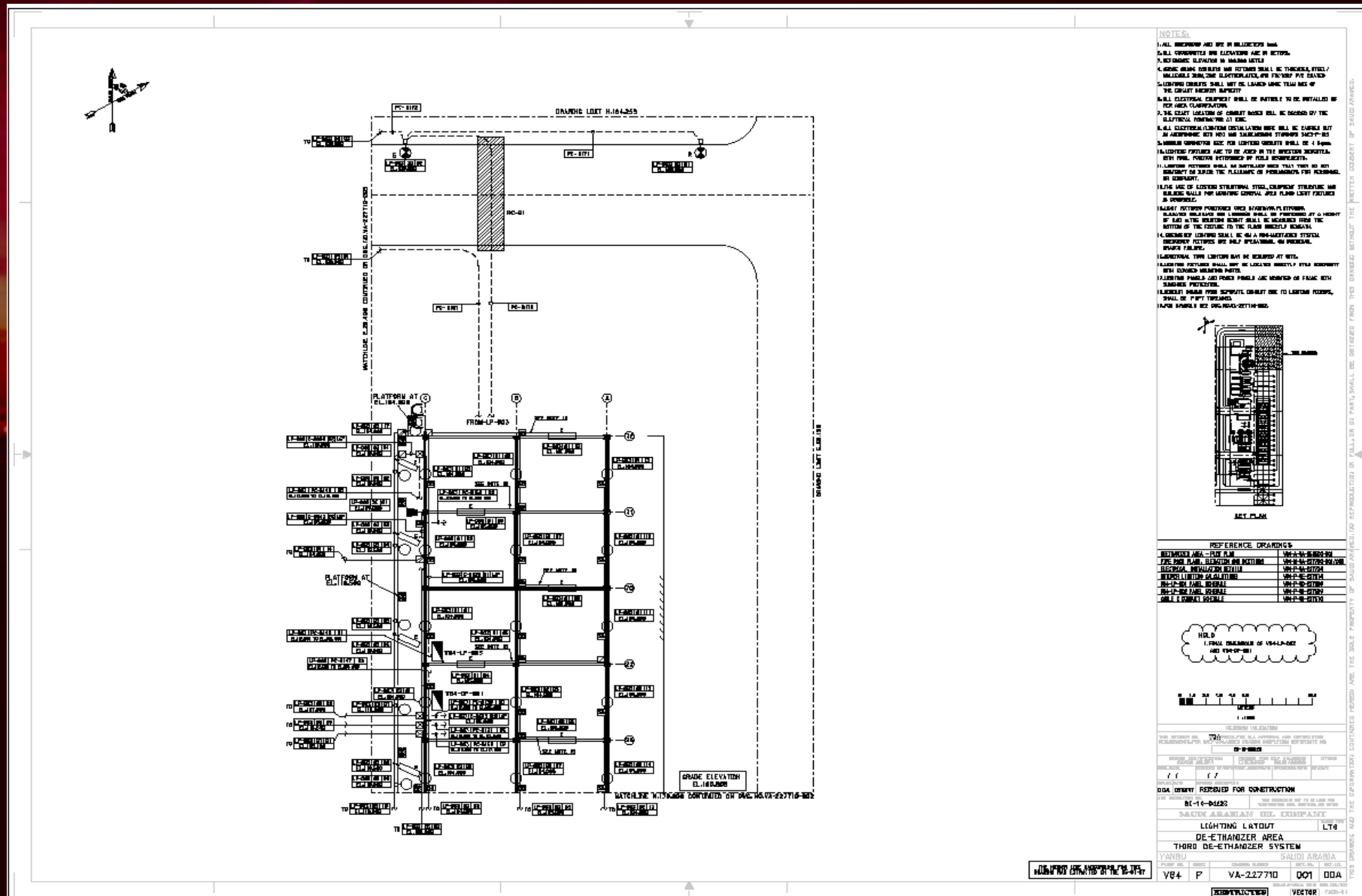
IMPORTANT INFORMATION :

1. Normal lighting circuits should be separated from Emergency lighting circuits
2. Normal lighting circuits & Emergency lighting circuits may be fed from 1ph or 3ph circuits
3. Street lighting, Flood lighting & high mast lighting should be fed from 3ph circuits
4. Normally, lighting circuits breaker rating is 20A for 1ph & 3ph ct.
5. Don't load the breaker with more than 80% of its rating
6. Don't use the max loading capacity of the breaker
7. Follow the required distribution philosophy in the specification
8. For sockets, no more than 6 socket per circuit

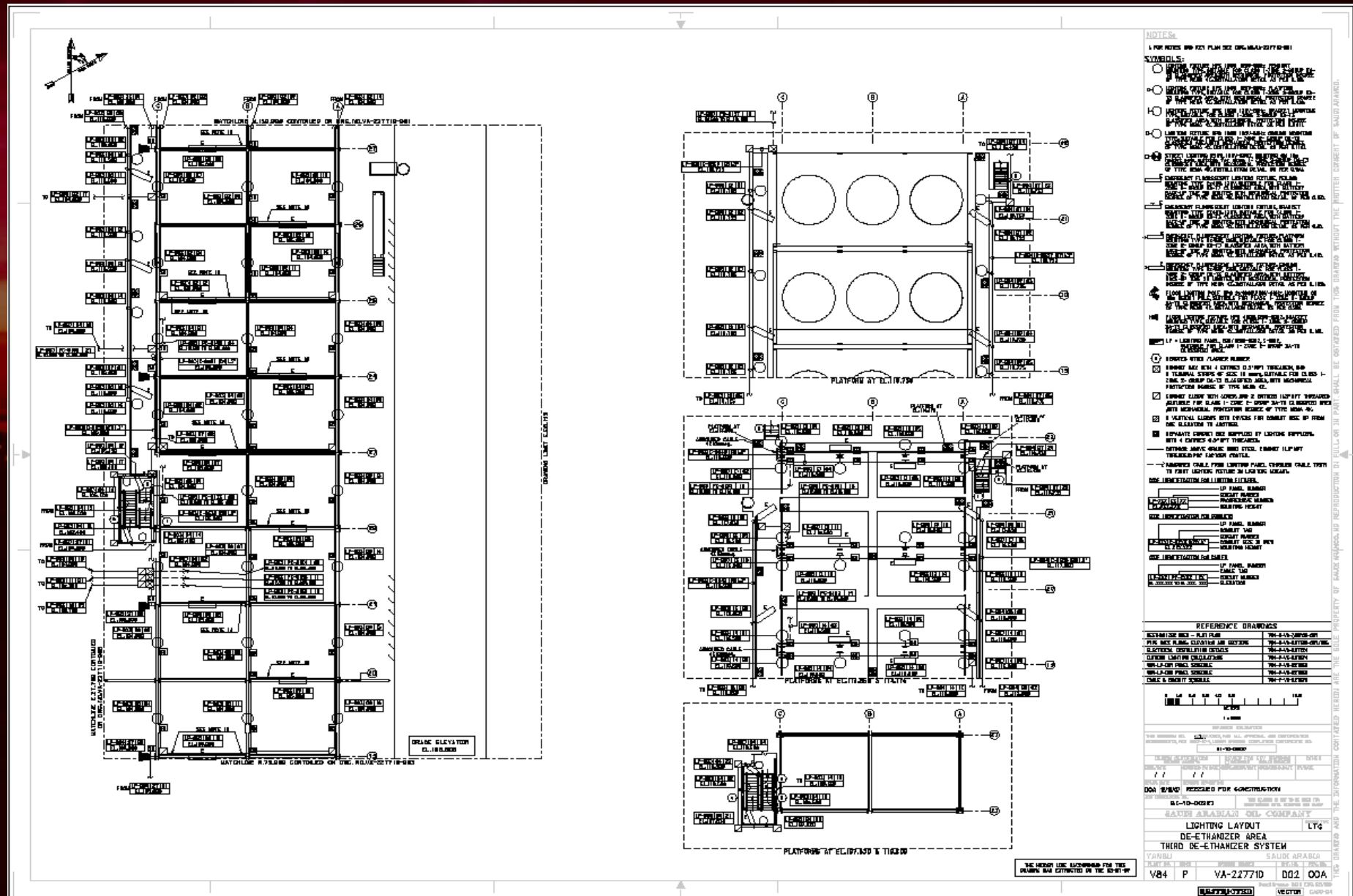
LIGHTING CIRCUITS DISTRIBUTION STEPS :

1. Count all types of lighting fixtures (Normal, Emergency & flood)
2. Determine the max no. of fixture per circuit
3. Keep a spare in the loading capacity of the breaker
4. Apply the distribution philosophy for the selected area
5. Try to equalize the loads between the 3phases
6. Size the circuit cable based on the circuit length & the voltage drop
7. Size the conduit based on the calculated cable size
8. Implement your data on the layout to get what we call detailed lighting layout

Detailed Lighting layout



Detailed Lighting layout



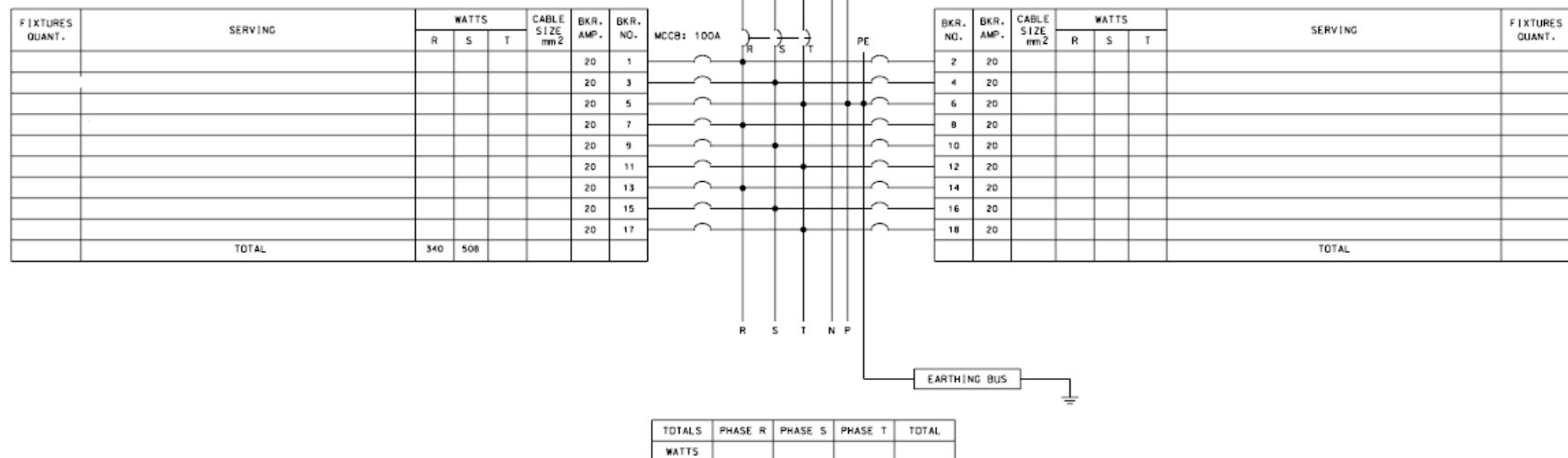
A photograph of an industrial facility, likely a refinery or chemical plant, at night. The scene is filled with numerous lights, pipes, and structures, creating a complex and busy appearance. A prominent tall smokestack is visible in the background. The entire image is overlaid with a semi-transparent red filter, giving it a dramatic and somewhat ominous feel. The text "7. PANEL SCHEDULE" is centered over the image in a white, bold, sans-serif font, with a thin white underline beneath the text.

7. PANEL SCHEDULE

WHAT IS PANEL SCHEDULE?

Panel schedule is a data arrangement captured from the detailed lighting layout

PANEL NUMBER:
SERVICE:
LOCATION:
ENCLOSURE TYPE:



PANEL SCHEDULE STEPS :

1. Determine the type of the panel (indoor lighting, outdoor lighting, power)

2. Get the number of circuits determined in the previous section

3. Provide 10% spare of the used circuits

4. Provide 10% space of the used circuits

5. Determine the nature of the feeding supply during the emergency cases (for lighting panel)

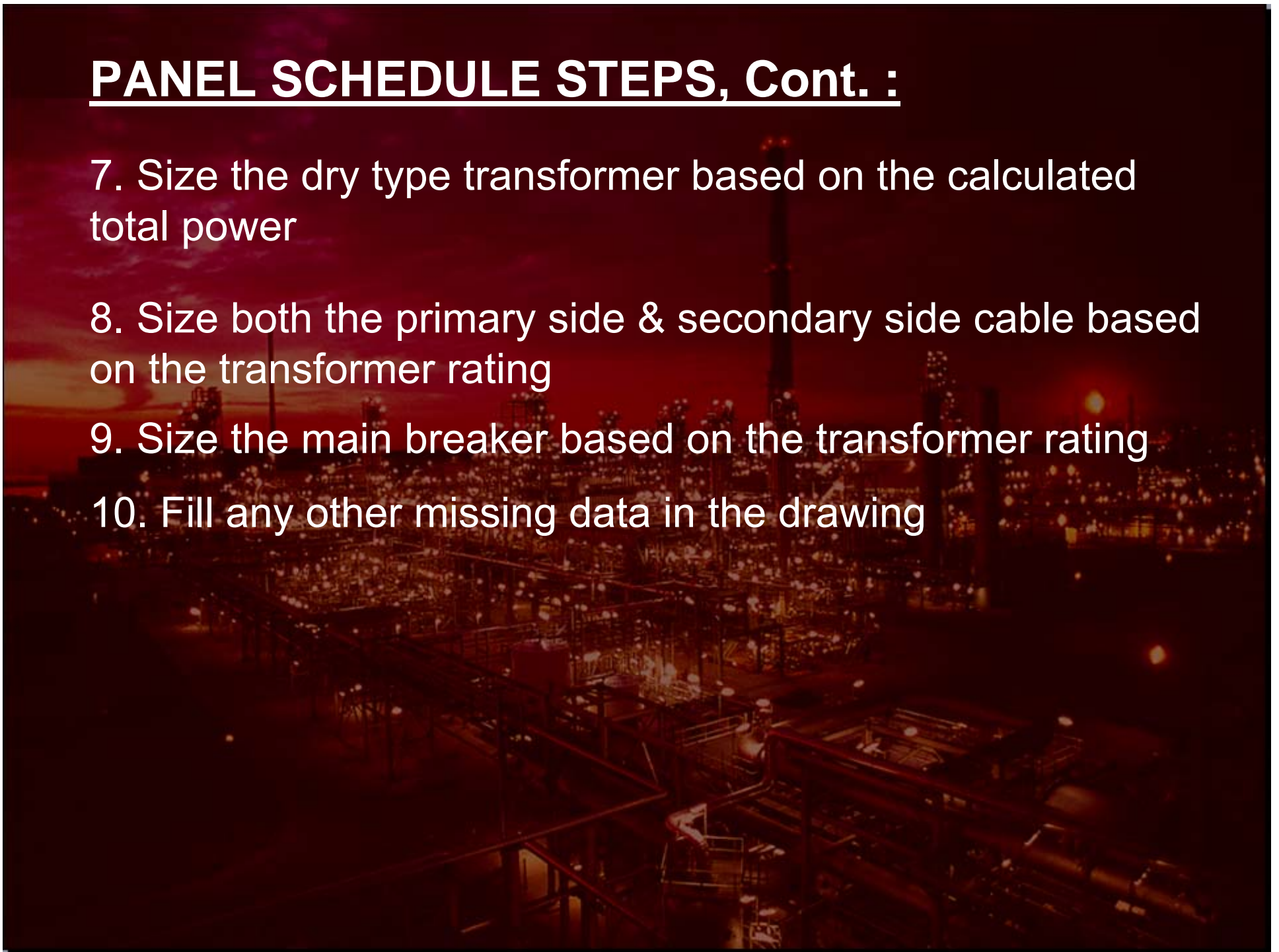
If Diesel Generator → use separate emergency bus bars

if Back up Batteries → use pilot wire

6. Arrange your data the schedule keeping balancing between phases in your mind

PANEL SCHEDULE STEPS, Cont. :

7. Size the dry type transformer based on the calculated total power
8. Size both the primary side & secondary side cable based on the transformer rating
9. Size the main breaker based on the transformer rating
10. Fill any other missing data in the drawing



Dry Type Transformer sizing :

1. Get the transformer connected load from panel schedule in (kVA)
2. Determine the demand factor (= 100%)
3. Determine the demand load in (KVA)

$$\text{Demand load} = \text{Tr. Connected load} / \text{Demand factor}$$

4. Determine the percentage of spare capacity (= 20%)
5. Determine the spare capacity in (KVA)

$$\text{Spare capacity} = 20\% * \text{Demand load (KVA)}$$

6. Determine the transformer load factor (= 0.8)

Dry Type Transformer sizing, Cont. :

7. Determine the min transformer capacity (KVA)

$$\text{Min Tr. Capacity} = \frac{\text{Demand load} + \text{spare capacity}}{\text{Tr. Load factor}}$$

8. Determine the nearest upper standard transformer rating (KVA)

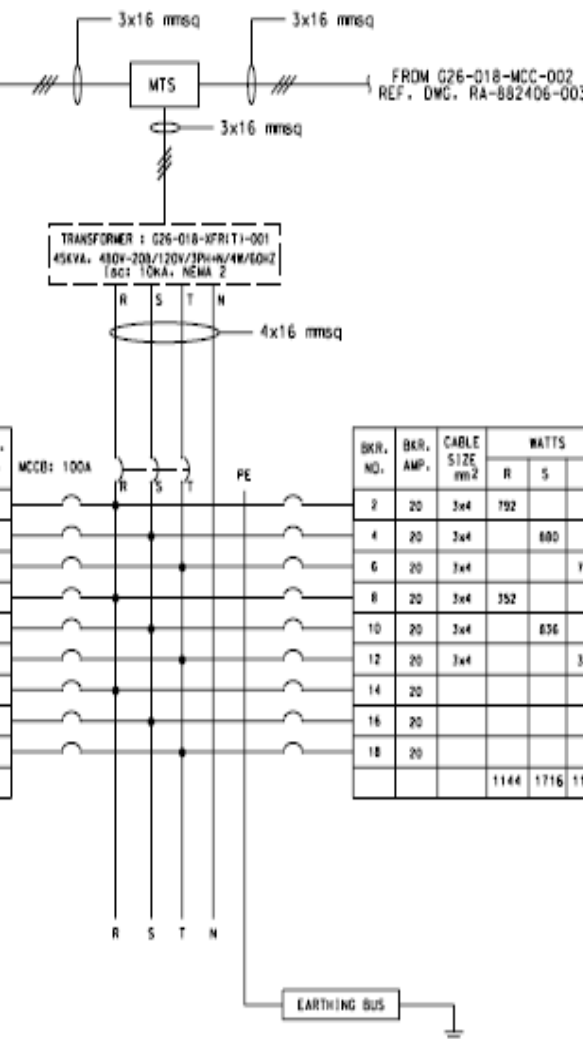
Standard Rating of Dry Type Transformer :

kVA	Full Cap. Taps		Type	°C Temp. Rise	Dimensions (Inches)			Wt. Lbs.	Dimensions (mm)			Wt. kg	Frame	Wiring Diagram Number	Weathershield		Style Number	Price U.S. \$
	FCAN	FCBN			H	W	D		H	W	D				Catalog Number	Price U.S. \$		
480 Δ Volts to 208Y/120 Volts																		
3	—	2@-5%	EPT	115	13-3/8	15-15/16	8-5/16	116	340	405	211	52	FR201	70A	Indoor- Outdoor	—	Y48G28T03N ①	1,345.
6	—	2@-5%	EPT	115	15-7/8	16-1/2	9-7/8	165	403	419	251	75	FR200	70A		—	Y48G28T06N ①	1,635.
6	2@+2.5%	2@-2.5%	EPT	115	15-7/8	16-1/2	9-7/8	165	403	419	251	75	FR200	72B		—	Y48D28T06N ①	1,635.
9	—	2@-5%	EPT	115	15-7/8	16-1/2	9-7/8	166	403	419	251	75	FR103	70A	Indoor- Outdoor	—	Y48G28T09N ①	2,120.
9	—	4@-2.5%	EPT	115	15-7/8	16-1/2	9-7/8	185	403	419	251	84	FR103	503A		—	Y48J28T09N ①	2,120.
9	2@+2.5%	2@-2.5%	EPT	115	15-7/8	16-1/2	9-7/8	185	403	419	251	84	FR103	72B		—	Y48D28T09N ①	2,120.
15	—	2@-5%	EPT	115	17-3/8	20	10-9/16	275	441	508	267	125	FR95	70A	Indoor- Outdoor	—	Y48G28T15N ①	2,660.
15	—	4@-2.5%	EPT	115	17-3/8	20	10-9/16	275	441	508	267	125	FR95	503A		—	Y48J28T15N ①	2,660.
15	2@+2.5%	2@-2.5%	EPT	115	17-3/8	20	10-9/16	275	441	508	267	125	FR95	72B		—	Y48D28T15N ①	2,660.
30	2@+2.5%	4@-2.5%	EPT	115	26-5/8	25-1/4	12-3/4	422	676	638	324	191	FR243	84A	Indoor- Outdoor	—	Y48M28T30N	5,060.
45	2@+2.5%	4@-2.5%	EPT	115	26-5/8	28-1/2	14-5/8	720	676	715	372	327	FR244	84A		—	Y48M28T45N	6,330.
75	2@+2.5%	4@-2.5%	EPT	115	32-1/8	30-1/4	15-5/8	1275	814	769	397	580	FR245	84A		—	Y48M28T75N ②	8,610.
15	2@+2.5%	4@-2.5%	DT-3	150	30	20-1/8	14-1/8	185	635	511	359	84	FR908	280B	WS31	424.	V48M28T15	1,940.
30	2@+2.5%	4@-2.5%	DT-3	150	30	20-1/8	14-1/8	230	762	511	359	104	FR910A	280B		424.	V48M28T30	2,475.
37.5	2@+2.5%	4@-2.5%	DT-3	150	30	20-1/8	14-3/8	310	762	511	364	140	FR912A	280B		424.	V48M28T37K	2,940.
45	2@+2.5%	4@-2.5%	DT-3	150	30	20-1/8	14-3/8	310	762	511	364	140	FR912A	280B	WS31	424.	V48M28T45	3,015.
50	2@+2.5%	4@-2.5%	DT-3	150	39-1/4	26-1/8	19-1/8	480	995	663	486	218	FR913B	280B		424.	V48M28T50J	4,200.
75	2@+2.5%	4@-2.5%	DT-3	150	39-1/4	26-1/8	19-1/8	480	995	663	486	218	FR914B	280B		424.	V48M28T75	4,250.
112.5	2@+2.5%	4@-2.5%	DT-3	150	39-1/4	26-1/8	19-1/8	600	995	663	486	272	FR915B	280B	WS33	424.	V48M28T12	6,170.
150	2@+2.5%	4@-2.5%	DT-3	150	44-1/2	28	23	870	1130	710	584	395	FR916B	280B		424.	V48M28T49	7,750.
225	2@+2.5%	4@-2.5%	DT-3	150	56-1/4	31-1/4	24-1/4	1200	1427	790	616	545	FR917	275A		970.	V48M28T22	11,320.
300	2@+2.5%	4@-2.5%	DT-3	150	57-1/2	36-1/4	32-1/4	1710	1460	921	817	776	FR923	275A	WS37	970.	V48M28T33	13,750.
500	2@+2.5%	4@-2.5%	DT-3	150	75	44-1/2	36	2400	1905	1130	914	1088	FR919	275A		1,645.	V48M28T55G	23,000.
750	2@+2.5%	4@-2.5%	DT-3	150	75	44-1/2	36	2900	1905	1130	914	1315	FR920	275A		1,645.	V48M28T77F	36,250.
1000	1@+3.5%	1@-3.5%	DT-3	150	68	64	45	4350	1727	1625	1143	1972	③	③	③	—	V48W28T11G ④	62,440.

Indoor Lighting Panel schedule

PANEL NUMBER: G26-018-LP-001
 SERVICE: INDOOR LIGHTING
 PANEL FOR SUBSTATION #18
 LOCATION: SUBSTATION #18
 ENCLOSURE TYPE: NEMA 1

FIXTURES QUANT.	SERVING	WATTS			CABLE SIZE mm ²	BKR. AMP.	BKR. NO.
		R	S	T			
10	NORMAL LIGHTING FOR SWITCHGEAR ROOM	880			3x4	20	1
10	NORMAL LIGHTING FOR SWITCHGEAR ROOM		880		3x4	20	3
10	NORMAL LIGHTING FOR SWITCHGEAR ROOM			880	3x4	20	5
12	NORMAL LIGHTING FOR MECHANICAL ROOM	1056			3x4	20	7
11	EMERGENCY LIGHTING FOR SWITCHGEAR ROOM		968		3x4	20	9
10	EMERGENCY LIGHTING FOR SWITCHGEAR ROOM			880	3x4	20	11
3	EMERGENCY LIGHTING FOR BATTERY ROOM	198			3x4	20	13
	SPARE					20	15
	SPARE					20	17
	TOTAL	2134	1848	1760			



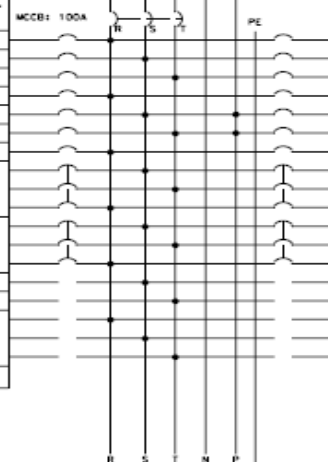
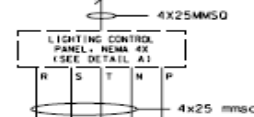
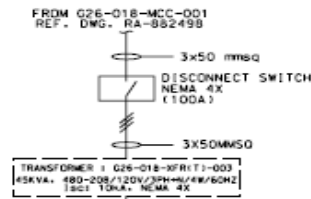
BKR. NO.	BKR. AMP.	CABLE SIZE mm ²	WATTS			SERVING	FIXTURES QUANT.
			R	S	T		
2	20	3x4	792			NORMAL LIGHTING FOR SWITCHGEAR ROOM	9
4	20	3x4		880		NORMAL LIGHTING FOR SWITCHGEAR ROOM	10
6	20	3x4			792	NORMAL LIGHTING FOR SWITCHGEAR ROOM	9
8	20	3x4	352			NORMAL LIGHTING FOR BATTERY ROOM	4
10	20	3x4		836		EMERGENCY LIGHTING FOR SWITCHGEAR ROOM	11
12	20	3x4			374	EMERGENCY LIGHTING FOR MECHANICAL ROOM	5
14	20					SPARE	
16	20					SPARE	
18	20					SPARE	
			1144	1716	1166	TOTAL	

TOTALS	PHASE R	PHASE S	PHASE T	TOTAL
WATTS	3278	3564	2926	9768

Outdoor Lighting Panel schedule

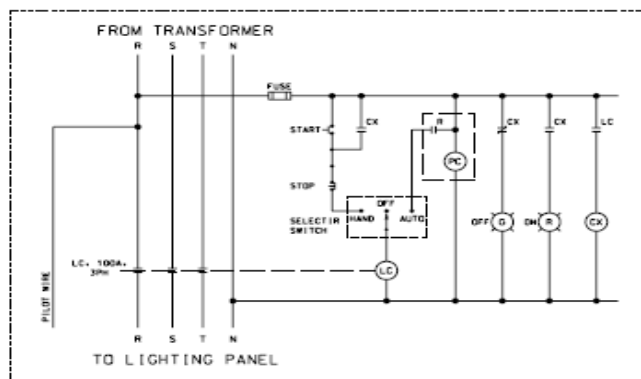
PANEL NUMBER: G26-018-LP-003
 SERVICE: OUTDOOR LIGHTING PANEL FOR AREA G26
 LOCATION: BESIDE RACK FROM N TO O
 ENCLOSURE TYPE: NEMA 4X

FIXTURES QUANT.	SERVING	WATTS			CABLE SIZE mm ²	BKR. AMP.	BKR. NO.
		R	S	T			
10	NORMAL LTD UNDER RACK FROM K1 TO K2	1350			3x10	20	1
10	NORMAL LTD ON COOLER PLATFORMS		1350		3x10	20	3
10	NORMAL LTD ON COOLER PLATFORMS			1350	3x10	20	5
5	NORMAL LTD UNDER RACK FROM B TO K	1215			3x10	20	7
	SPARE					20	9
	SPARE					20	11
	SPARE					20	13
7	FLOOD LIGHTING ON RACK FROM K1 TO K2		950				
				1425	4x16	20	15
		950					
5	STREET LIGHTING BESIDE INJECTION PUMPS		275				
			550		4x16	20	17
				550			
	SPACE						19
	SPACE						21
	SPACE						23
	TOTAL	3790	2850	3325			



BKR. NO.	BKR. AMP.	CABLE SIZE mm ²	WATTS			SERVING	FIXTURES QUANT.
			R	S	T		
2	20	3x10	1350			NORMAL LTD ON PLATFORMS ABOVE RACK FROM K1 TO K2	10
4	20	3x10		1350		NORMAL LTD ON COOLER PLATFORMS	10
6	20	3x10			1215	NORMAL LTD UNDER RACK FROM L TO S	5
8	20	3x10				SPARE	
10	20	4x10			1144	EMERGENCY LTD AT PUMP ROWS & RACK FROM K1 TO K2	17
12	20	4x10			1408	EMERGENCY LTD ON COOLER PLATFORMS & RACK FROM B TO S	16
14	20					SPARE	
				950			
16	20	4x16			475	FLOOD LIGHTING AT BOOSTER PUMPS	4
			950				
18	20					SPARE	
20						SPACE	
22						SPACE	
24						SPACE	
			2300	3444	3058	TOTAL	

DETAIL A



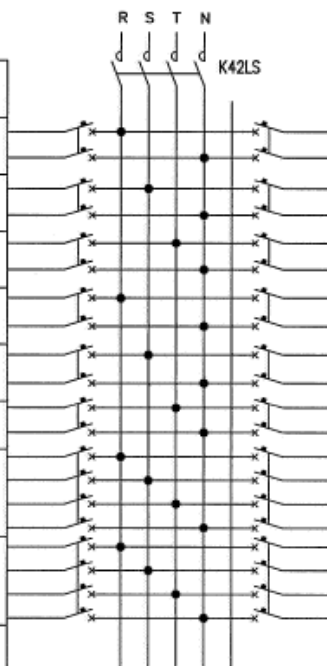
TOTALS	PHASE R	PHASE S	PHASE T	TOTAL
WATTS	6090	6294	6423	18807

Outdoor Lighting Panel schedule

PANEL NUMBER: LP001
SERVICE: 0.38/0.23KV 50HZ 75KVA

PLAN DRAWING: 2386-5000-E0-E-32-5203
LOCATION: ON RACK AT P3-8

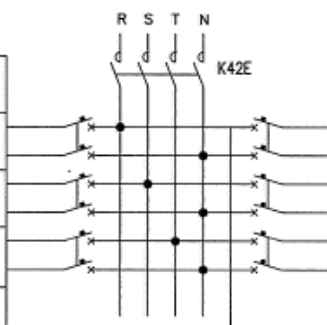
FIXTURE QUANT.	LOAD		WATT			CABLE SIZE mm2	BKR AMP	CKT NO.
			R	S	T			
3	NORMAL LTG. INSIDE WATER TREATMENT SHELTER (1BL-3701) 01,02,03		1320			3G6	20	1
4	NORMAL LTG. INSIDE WATER TREATMENT SHELTER (1BL-3701) 01,02,03,04			1760		3G6	20	3
8	NORMAL LTG. UNDER RACKS FROM P1-1 TO P1-9 & P3-1 TO P3-8, ON 1V-4701 & AT 1TK-2702 01,02,03,04,05,06,07,08				1221	3G6	20	5
	SPARE (NORMAL)						20	7
	SPARE (NORMAL)						20	9
	SPARE (NORMAL)						20	11
6	HIGH MAST LTG. EAST OF 1BL-7206	01,04 02,05 03,06	2200			5G25	20	13
24	STREET LTG. WEST & SOUTH OF AREA 50A	01,04,07,10,13,16,19,22 02,05,08,11,14,17,20,23 03,06,09,12,15,18,21,24	1320			5G25	20	15
TOTAL			4840	5280	4741			



CKT NO.	BKR AMP	CABLE SIZE mm2	WATT			LOAD		FIXTURE QUANT.
			R	S	T			
2	20					SPARE (NORMAL)		
4	20	3G6		1177		NORMAL LTG. UNDER RACKS FROM P1-1 TO P1-9 & P3-1 TO P3-8, ON 1V-4701 & AT 1TK-2702 01,02,03,04,05,06,07		7
6	20					SPARE (NORMAL)		
8	20					SPARE (NORMAL)		
10	20					SPARE (NORMAL)		
12	20					SPARE (NORMAL)		
14	20	5G25	990			01,04,07,10,13,16	STREET LTG. SOUTH WEST & SOUTH OF FUTURE ASU UNITS 3 & 4	18
				990		02,05,08,11,14,17		
					990	03,06,09,12,15,18		
16	20						SPARE (NORMAL)	
			990	2167	990	TOTAL		



FIXTURE QUANT.	LOAD	WATT			CABLE SIZE mm2	BKR AMP	CKT NO.
		R	S	T			
	SPARE (EMERGENCY)					20	17
	SPARE (EMERGENCY)					20	19
	SPARE (EMERGENCY)					20	21
	TOTAL	-	-	-			

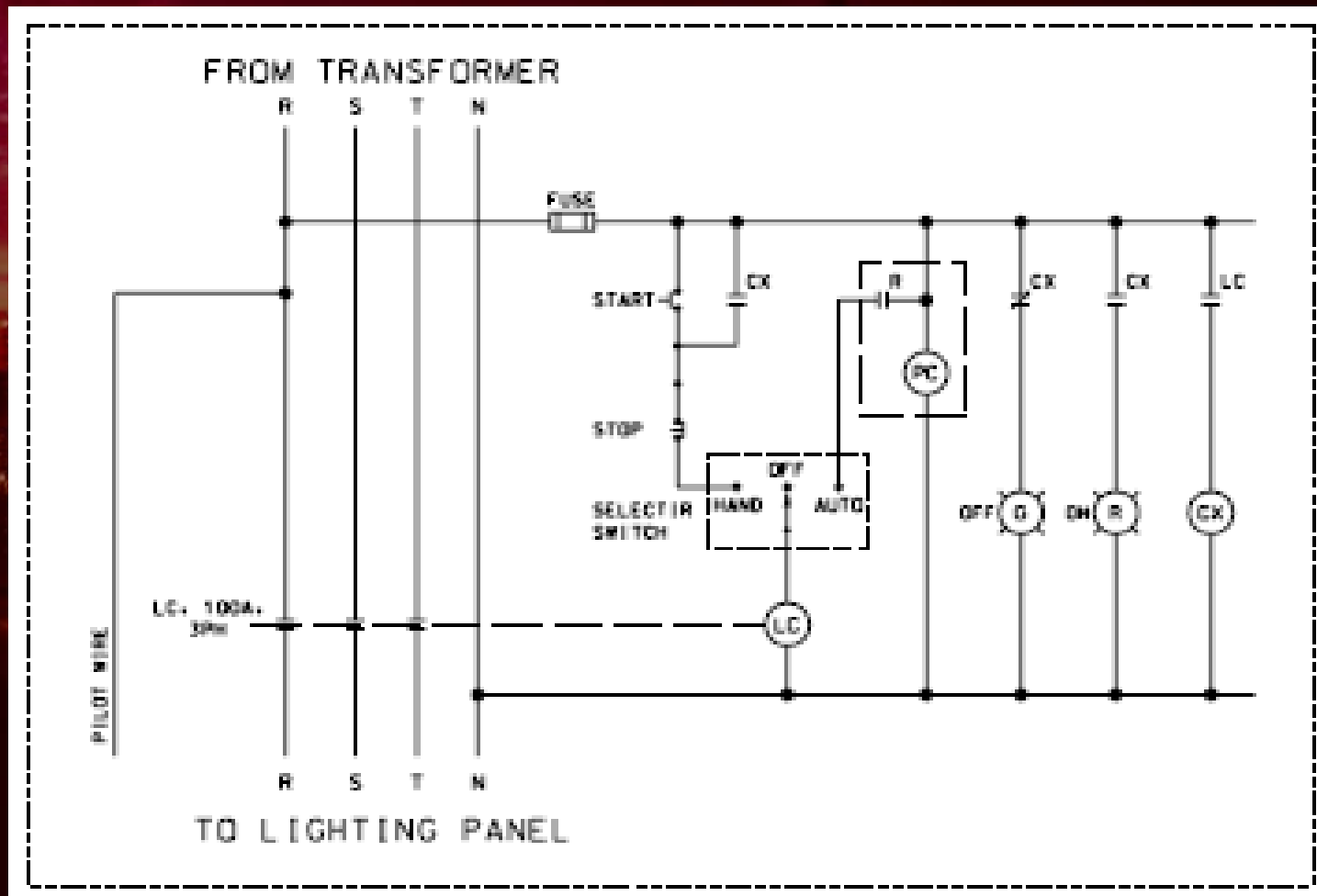


CKT NO.	BKR AMP	CABLE SIZE	WATT		LOAD	FIXTURE QUANT.
			R	S		
18	20	3G6	1265		EMERGENCY LTG. UNDER RACKS FROM P1-1 TO P1-9 & P3-1 TO P3-8, ON 1V-4701 & AT 1TK-2702 01,02,03,04,05,06,07,08,09	9
20	20				SPARE (EMERGENCY)	
22	20	3G6		1320	EMERGENCY LTG. INSIDE WATER TREATMENT SHELTER (1BL-370 01,02,03	3
			1265	-	1320	TOTAL



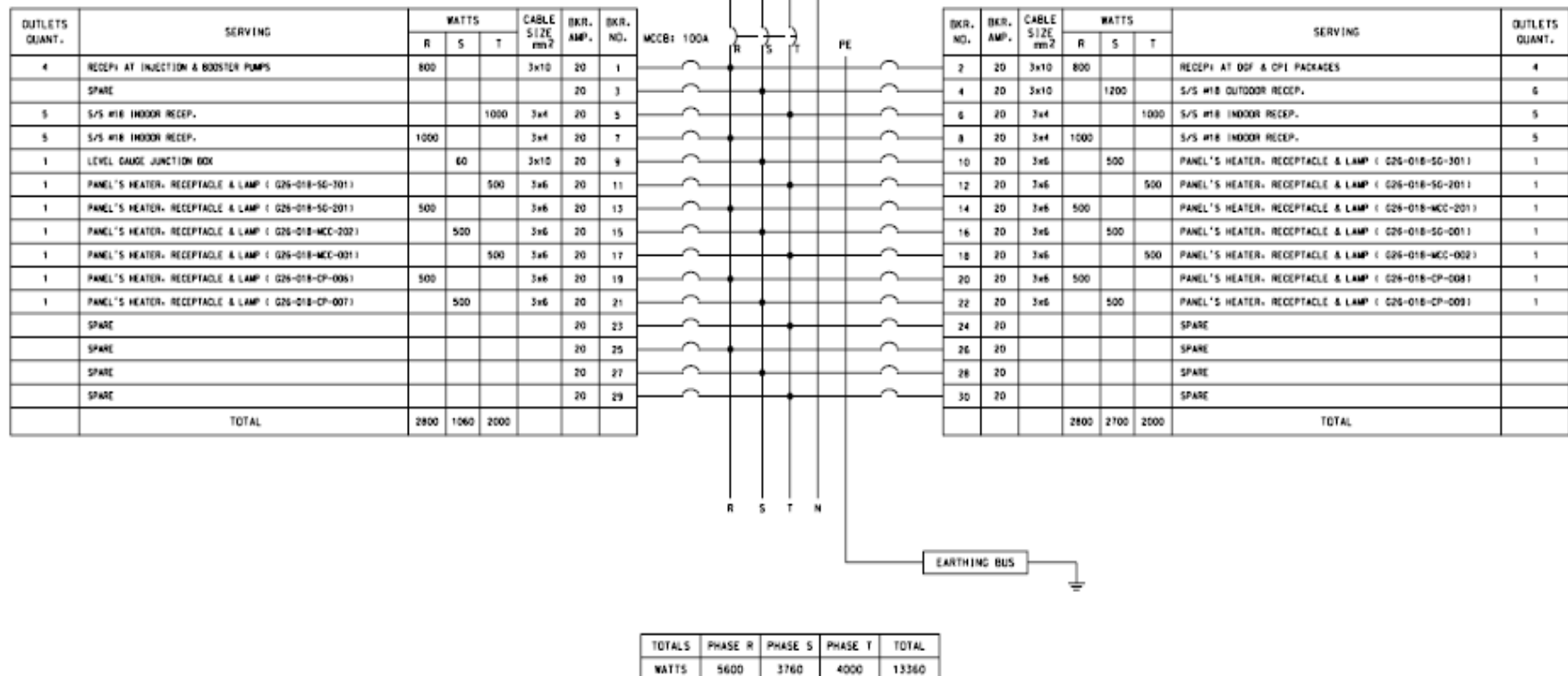
TOTAL	PHASE R	PHASE S	PHASE T	TOTAL
WATTS	7095	7447	7051	21593

Schematic Diagram of the Photo Cell

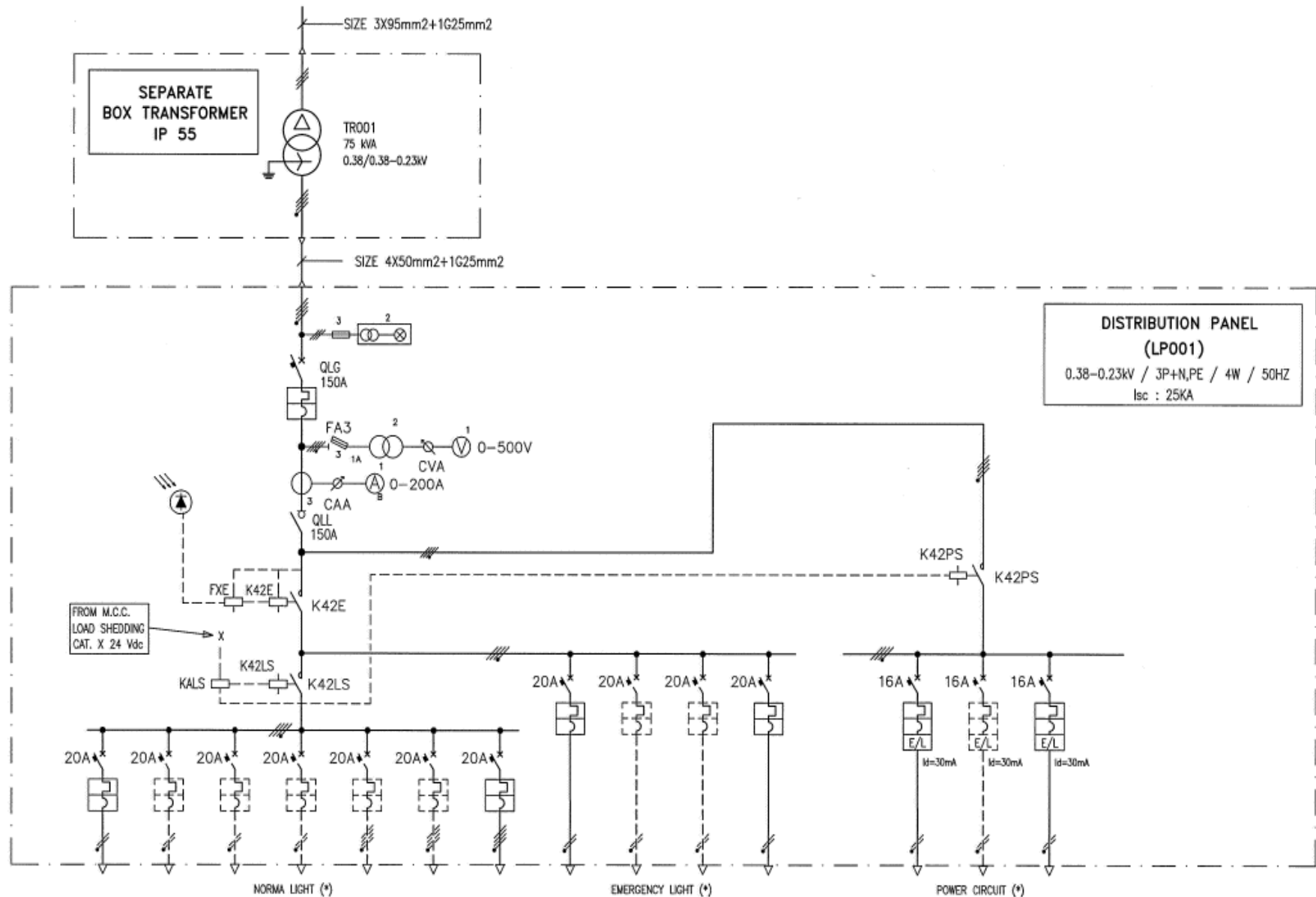


Power Panel schedule

PANEL NUMBER: G26-018-PP-003
 SERVICE: POWER PANEL FOR SUBSTATION #18 & AREA G26
 LOCATION: SUBSTATION #18
 ENCLOSURE TYPE: NEMA 1

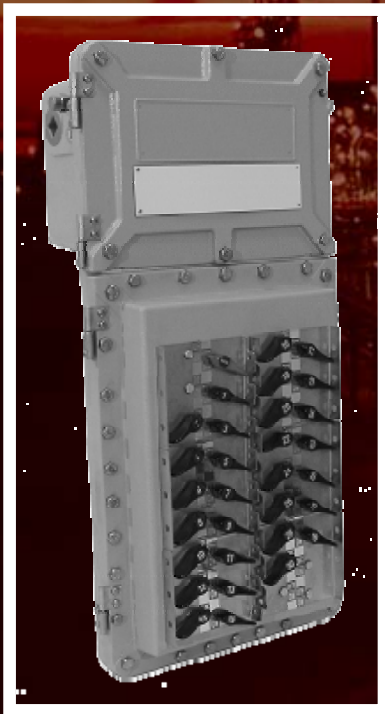


Single Line Diagram of Distribution Panel



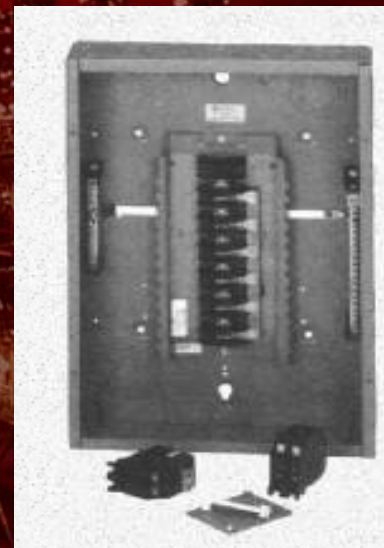
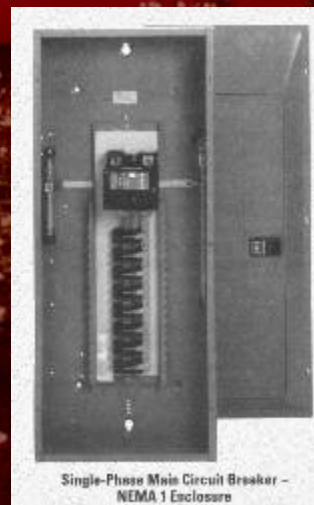
Deferent Types of Distribution panels :

Outdoor Panels



Deferent Types of Distribution panels :

Indoor Panels



Deferent Types of Dry Type Transformers :



Dry-Type Transformer Family



Thank You