

ENGINEERING AND ELECTROMECHANICAL SYSTEMS DESIGN (DESIGN/DRAFTING/DRAWING)

PRESENTED BY :

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MAJOR: **ELECTROMECHANICAL ENGINEERING**

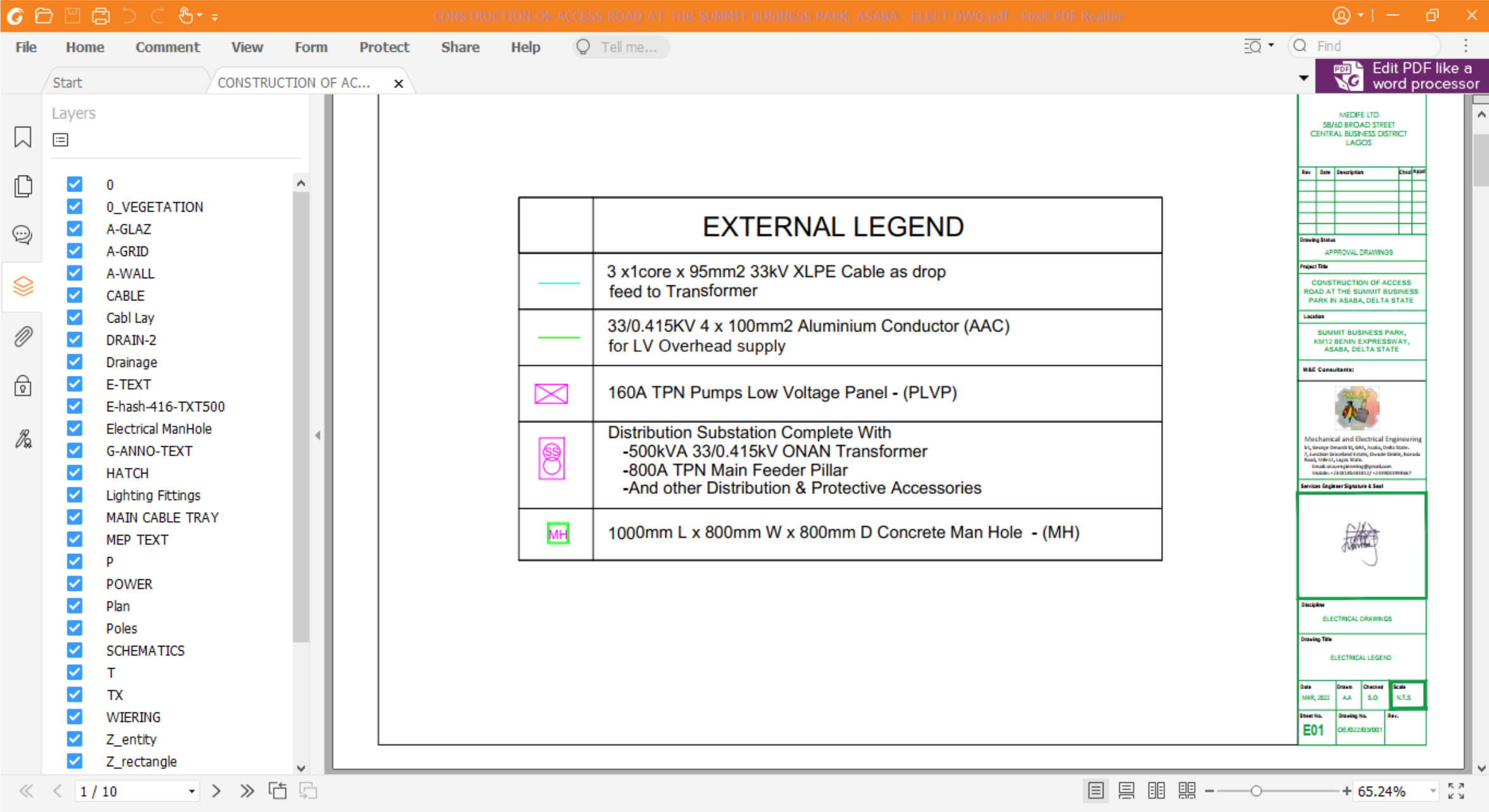
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INTRODUCTION



- The term engineering drawing is also known as drafting and design, engineering drafting, mechanical drawing, mechanical drafting, technical drawing and drafting.
- Drafting is a graphical language using lines, symbols and notes to describe objects for manufacturing or construction.
- Almost all technical disciplines use drafting, engineering drawing is the common language of engineering and it describe the process of creating drawings for any engineering or architectural applications.
- Engineering drawing and design produced according to accepted standards and formats, provides an effective and efficient way to communicate specific information about design intent.
- Engineering drawings are not opened to interpretation like other drawings such as decoration drawings and artistic painting.
- Drafting, drawing and design has moved from manual, the traditional drafting practice using pencil or ink on a medium such as paper or polyester film with the support of drafting instruments and equipment to the use of computer aided drafting or design (**CAD or CADD**).
- Engineering drawings communicates a variety of concepts, such as engineering requirements, data proposals, suggestions, instructions, information etc. to variety of concerned people or stakeholders involved in the projects.
- Drafting in general has one basic description, but specific drafting areas have specific and unique conceptual and skills characteristics such as electrical drafting, mechanical drafting and plumbing drafting.
- Engineering drawing, drafting and design pioneers were artists and inventors, most of the best-known early engineering drawings and designs are the works of the great Italian Leonardo da vinci.



- Layers
- 0
 - 0_VEGETATION
 - A-ANNO-TTLB
 - AC PIPING
 - ACTEXT
 - C-ANNO-DIMS
 - C-ANNO-SYMS
 - C-ANNO-TEXT
 - C-DETL
 - CENTRO
 - CORTE
 - COTA-01
 - COTA-02
 - CPP text
 - CWS
 - Cold water pipe
 - DES-01
 - DES-02
 - DES-03
 - DES-04
 - DES-05
 - DES-08
 - DIMEXT
 - DIMINT
 - DRAIN-2
 - Door 2
 - FHR

MECHANICAL LEGEND			
SYMBOLS			
	COLD WATER SUPPLY PIPES MAINS LINE	R.W.S.T	RAW WATER STORAGE TANK
	FIRE WATER PIPES	E.W.T	ELEVATED WATER TANK
	CONTROL VALVE	T.W.P	TRANSFER WATER PUMP
	NON RETURN VALVE	B.P.S	BOOSTER PUMP SET
	DIRECTION OF FLOW	IC	INSPECTION CHAMBER 400X400mm
	WATER METER/ VALVE PIT	MH	MAN HOLE 600X600mm
	FIRE HYDRANT	MH	MAN HOLE 800X800mm
	FIRE HOSE REEL WITH TAMPER PROOF	MH	MAN HOLE 1200X1200mm
P.W.T	PORTABLE WATER TANK	BH	BORE HOLE
W.T.P	WATER TREATMENT PLANT		

R.W.S.T
 RAW WATER STORAGE TANK
 SIZE: 6x6x3.66m DEEP
 CAPACITY:130,000 LITERS

P.W.S.T
 POTABLE WATER STORAGE TANK
 SIZE: 9.66 x 7.32 x 3.66m DEEP
 CAPACITY: 250,000 LITERS

E.W.T
 ELEVATED WATER TANK
 SIZE: 6 x 6 x2.44m DEEP
 CAPACITY:86,000 LITERS
 MOUNTED ON A 15METER HEIGHT

W.T.P
 WATER TREATMENT PLANT

PUMPS:
 PUMP DUTY / STANDBY
 CAPACITY 25.5W/s @ H 15m
 P1: POWER: 9.8 Kw ELECTRIC WATER PUMP
 P2: POWER: 8.1 Kw ELECTRIC WATER PUMP
 BOOSTERT / TRANSFER PUMP SET.

PROPOSED WATER BOREHOLE
 APPROX. DEPTH 150m MIN. COMPLETE
 WITH SUBMERSIBLE PUMP, 100mm dia UPVC
 CASING AND SCREEN [FINAL LOCATION TO BE
 DECIDED ON SITE] AFTER
 GEOPHYSICAL INVESTIGATION

GENERAL NOTES

Client

MEDIFE LTD
 58/60 BROAD STREET
 CENTRAL BUSINESS DISTRICT
 LAGOS

Rev	Date	Description	Drawn	Appr

Drawing Status
 APPROVAL DRAWINGS

Project Title
 CONSTRUCTION OF ACCESS ROAD AT THE SUMMIT BUSINESS PARK IN ASABA, DELTA STATE

Location
 SUMMIT BUSINESS PARK, KM12 BENIN EXPRESSWAY, ASABA, DELTA STATE

MSE Consultant:



Mechanical and Electrical Engineering
 Mr. George Olanrewaju, Olanrewaju, Asaba, Delta State.
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Services Engineer Signature & Seal

Discipline
 MECHANICAL DRAWINGS

ENGINEERING DRAWING, DRAFTING AND DESIGNS FUNDAMENTALS

- The overall success of any project begins with the layout and planning stage. The drawing planning process is universal and applicable to design discipline.
- Avoid the temptation to begin working on new designs, drawings or models without having a plan. In stead take time to plan the drawing process sufficiently using these outlines:
 1. The problem solving process
 2. Research techniques
 3. Preparing the drawing

Drawing scale: drawing are scaled so that the object can be illustrated clearly on standard size paper. Selected scale depends largely on the amount of details to be shown, the actual size of the object drawn and the amount of dimensioning and notes required.

To convert inches to millimeters, just multiply inches by 25.4

All Engineering drawings, drafting and designs shall have a general notes stating “ unless otherwise specified, all dimensions are in millimeters or inches as applicable”

Mechanical Engineer’s scale is commonly use for mechanical drafting when drawing are in fractional or decimal. The mechanical engineers scale typically has full scale division that are divided into 1/16, 10, and 50. the 1/16 division are the same as the 16 Architect’s scale where there 12” and each inch is divided into 1/16” while the 10 scale is the same with the civil engineers’ scale where each inch is divided into 10 parts with each division being 10 inch. And the 50 scale is for scaling dimensions that required additional accuracy because each inch has 50 divisions.

- Computer-Aided Engineering (**CAE**) is the method of using computers in design, drawing and drafting, analysis and manufacturing of a product, process or project. While Computer-Aided Design and Drafting (**CADD**) is the process of using computer with CADD software for design and drafting application.
- CAE relates to most element of **CADD** in industry, CAE is the umbrella discipline that involves several computer aided technologies including and not limited to Computer Aided Design(**CAD**), Computer Aided Industrial Design(**CAID**), Computer Aided Manufacturing(**CAM**), Computer Numerical Control(**CNC**), Computer Integrated Manufacturing(**CIM**) and Product Development Manufacturing(**PDM**).
- Computer Integrated Manufacturing(**CIM**) brings together all the technologies and management system, coordinating CADD, CAM, CNC, robotics and materials handling from the beginning of the design process through the packaging and shipment of the products.
- There are 4 basic scales shapes which are surface, solid models, 2-D and 3-D.
- Drawing are scaled so that the object can be illustrated clearly on standard size paper.
- Some factors to considered for choice of drafting and design media(materials on which you create drawings such as paper or polyester film) are: durability, dimensional stability, transparency, eras-ability and smoothness.
- The ability to communicate ideas through sketches is a fundamental tools for engineers and drafters.
- A product should be design to meet market demands, quality and be economical.

DESIGN, DRAWING AND DRAFTING TOOLS AND SOFTWARES

- Because Computer-Aided Drafting and Design (CADD) has replaced manual drafting, some information here serves as historical reference of where we are coming from. And both the **CADD** (Computer-Aided Drafting and Design) and manual drafting required the understanding of the basis of drafting and design concept such as sheet size, scale and sheet format.
- Manual drafting equipment and tools includes: Compass, Dividers, Triangles(8 in 30° – 60°), T-square, Templates(circle, arrow head, etc.), irregular curves Pencils(2H,H,F,HB,4H etc.),eraser, sharpener and scales (triangular architects' scale, triangular civil engineers' scale, triangular metric scale), lettering guide, drawing board/table.
- Several factors influence CADD software and format selection such as design and drafting practice, specific project requirement.
- Computer Numerical Control(CNC): Also known as NC for Numerical Control, is the control of process or machines by encoded commands that are commonly prepared by a computer programmer/ program-mist. CNC is a critical aspect of Computer Aided Manufacturing(CAM) in which a computerized controller uses motors to drive each axis of a machine such as a mill to manufacture parts in a production environment.
- Examples of CNC programming includes G-codes which are primary functions such as tool moves and M-codes which are miscellaneous functions such as tools changes and coolant settings.
- CNC is a major innovation in manufacturing.
- Basic CADD techniques includes: Drawing & Editing, Reuse of contents, Line standards & layers, Plotting, File templates, Storing and Managing Files.
- **AutoCAD** is a drawing and drafting design software that allows you to add GD&T symbols to drawings and designs using M-leader, Q-leader command.

CADD STANDARDS

- Most industries, schools, companies and or organizations establish CADD standards that specify design and drafting requirements, appearance, operating procedures, techniques and records keeping methods.
 1. File storage, naming and back-up.
 2. File templates.
 3. Units of measurements.
 4. Layout characteristics.
 5. Symbols.
 6. Borders and tittle blocks.
 7. Layers and text.
 8. Table and dimensions styles.
 9. Plot styles and plotting.

Electronic Design Automation(EDA) or Electronic Computer Aided Design(ECAD) is a group of software tools for designing electronic systems such as printed circuit board(PCB) and integrated circuits(IC).

EDA software tools provide for variety of applications from design, simulation, analysis, verification and manufacturing preparation.

ELECTROMECHANICAL DESIGN DRAWING AND DRAFTING

STEPS AND STAGES

- Engineering Design Process steps are: Problem Statement, Initial Sketch, Initial CADD Model, Finite Element Analysis(**FEA**), Design Optimization, Final FEA, Design Deliverables.
- Design stages are :
 1. Prepare a sketch the way you think it should look on the final drawing, takes into account correct drafting standards.
 2. Evaluate the size of the object so that you can determine the scale and sheet size for final CADD layout.
 3. Layout the drawing very lightly using construction lines
 4. Complete the final drawing to proper ASME standard line weights.
 5. After completion, a check plot should be made on the plotter or printer to check your work on paper or ask someone else check and review it for you.

ELECTROMECHANICAL SYSTEMS BUILDING AND MANUFACTURING

- The following are stages of products (electromechanical systems) building and or manufacturing process and or stages.
 1. Product development: this comprises of research and development of prototype drawings, materials selection, prototype construction or building, assembly and configuration, analysis of the prototype, engineering drawing and documents etc.
 2. Manufacturing Process: this comprises of casting, forging, machining processes. These are use extensively in the manufacturing industries. The machining process includes drilling, burring, knurling, tapping etc.

For example, the manufacturing of plastic product takes the following processes such as injection molding, extrusion process, blow molding process, calendaring process, rotational molding process, sintering process, vulcanization process and layering process.

In drawings, drafting and designs, documents is a general term that refers to all drawings and written information related to a project.

Shop drawings are drawings used to break each individual components of engineering drawing down into fabrication parts. It is also referred to as fabrication drawing.

The lines used in structural drafting are generally the same as those used in mechanical drawing and drafting design.

ELECTROMECHANICAL SYSTEMS DESIGNS RULES AND REGULATIONS

- When designing and drafting an electromechanical systems like electrical panels, refrigeration system, motor and pumps just to mention a few, the following common rules applied:
 1. The application or the area of application of the equipment(electromechanical system) to be design must be known
 2. Proper sizing must be adhere to for many reasons like efficiency and capacity in order for design to meet standard requirement and also sellable.
 3. Environmental factors must also be considered while drafting and designing.
 4. Such designs must conform to international standards such as rating, patterns and shapes among others.
 5. Manufacturing materials must be of standard and highly recommended with industrial practices.
 6. Proper mathematical operation and functions analysis must be done and inculcated in the design and drafting.
 7. Ensure that your designs and drafting are complete, detailed and easy to interpret using conventional legends to aid interpretations.
 8. Material condition and boundary symbols are used in conjunction with the geometry tolerance or datum reference in the feature control frame.
 9. Drafting and design drawing must have standardized symbols.
 10. Ensure the placement of identification numbers, it is a standard .

FUNDAMENTALS OF ELECTRICAL DIAGRAMS

- Electrical drawing diagram are generally not drawn to scale, it is the responsibility of the drafter is to organize the information in a logical and orderly manner without crowding and large variations in spacing layout.
- The following are the common electrical diagrams: Pictorial diagram, Schematic diagram, Highway wiring diagram, Wireless diagram, Block diagram, Wiring diagram
- Cable diagram usually provide circuit destination conductor size, number of leads, conductor types and power rating.
- Electrical power substation design drawing: is an important part of any power supply system. It is the part of the electrical transmission system where electricity is switched or transformed from a very high voltage to a conveniently usable form for distribution to homes or businesses.
- One-line diagram is a simple and technical way for electrical engineers and drafters or designers to communicate the design of an electrical power substations.
- The preparation of electrical diagram should use symbols in accordance with IEEE 315, Graphic symbols for electrical and electronic diagrams.
- Entire layout of a power substation are usually shown by a plot plan drawing, which is also known as site plan. And the scale used for plot plan generally ranges from $1'' = 20'$ to $1'' = 50'$ and also note that the customer equipment are shown with dash lines on plot plan drawing.
- Electrical symbol lettering height is 3mm or 4mm
- On a simple circuit, the number of sequence flows from left to right.

ELECTRICAL AND ELECTRONICS DESIGN DRAFTING

- Electrical drafting deals with concept and symbols that relates to high-voltage applications from the production of electricity in power plants through distribution to industries and homes.
- The key to effective communication on electrical and electronics drawings is the use of standardized symbols so that anyone who uses the diagram make the same interpretation.
- To ensure proper standardization, engineering drawings and related documents should be prepared in accordance with appropriate electrical and electronics drawing standards.
- The preparation of electrical diagram should use symbols in accordance with IEEE 315, Graphic symbols for electrical and electronic diagrams.
- Electrical circuit switch legs for commercial applications are generally drawn as solid lines rather than as dash lines as used in residential electrical plans.
- Generally, the conductor widths of 0.050 in (1.27mm) or 0.062 in (1.57mm) and minimum spacing between conductors from 0.031 in (0.97mm) to 0.050 in (1.27mm) are recommended for low-voltage application.
- The IEC standards specified master pattern grid increments of 0.1mm and 0.5 mm

Electronic Design Automation(**EDA**) or Electronic Computer Aided Design(**ECAD**) is a group of software tools for designing electronic systems such as printed circuit board(**PCB**) and integrated circuits(**IC**).

EDA software tools provide for variety of applications from design, simulation, analysis, verification and manufacturing preparation.

PIPE/PLUMBING SYSTEM DRAFTING, DRAWING AND DESIGN

Pipe drafting is a specialized field that calls on the drafter's skills of visualization and the ability to see pipes and fittings in several planes or depths in an orthographic view.

Pipe can be drawn into two forms which are single line and double lines.

Pipe drawing is referred to as the general arrangement drawings which provides plan, elevation and section view with equipment, fittings, dimensions and notes shown. And like every other type of drawing that required the use of standard symbols.

Pipe selection consideration includes: temperature, pressure, corrosion, safety, and cost.

Piping isometric drawing is a pictorial view of a piping system representing fittings, valves, dimensions, notes and instrumentation. This type of drawing are usually done after the plans and elevations are completed.

HEATING, VENTILATION AND AIR- CONDITIONING(HVAC) DRAWING, DRAFTING AND DESIGN

Drawing for the Heating, Ventilation and Air-Conditioning(**HVAC**) systems shows the size and general location of all equipment, duct works and components with accurate symbols, specifications, notes and schedules that form the basis of contract requirements for construction or manufacturing.

The HVAC engineers and or drafters also determines all of the specifications for units and duct size based on calculation of structure volume, exterior surface areas, construction materials, rate of air flow and pressure for drafting and design.

Air duct sizing formula

$$\text{CFM} = \text{Area} \times \text{FPM}$$

For instance: 12 x 12 duct at 750 FPM,

$$12 \times 12 = 1 \text{ sq ft.}$$

$$1 \text{ sq. ft} \times 750 \text{ FPM} = 750 \text{ CFM.}$$

Round Duct to Square Duct

$$\text{Area of a circle} = \text{pie} \times r^2$$

$$\text{Area} / \text{length} = \text{width.}$$

SOME DRAFTING DRAWING AND DESIGN PROJECTS.

CONSTRUCTION OF ACCESS ROAD AT THE SUMMIT BUSINESS PARK, ASABA - ELECT DWG.pdf - Foxit PDF Reader

File Home Comment View Form Protect Share Help Tell me...

Start CONSTRUCTION OF AC... x

Layers

- 0
- 0_VEGETATION
- A-GLAZ
- A-GRID
- A-WALL
- CABLE
- Cabl Lay
- DRAIN-2
- Drainage
- E-TEXT
- E-hash-416-TXT500
- Electrical ManHole
- G-ANNO-TEXT
- HATCH
- Lighting Fittings
- MAIN CABLE TRAY
- MEP TEXT
- P
- POWER
- Plan
- Poles
- SCHEMATICS
- T
- TX
- WIERING
- Z_entity
- Z_rectangle

NOTE:

- ALL DISTRIBUTION PANEL ENCLOSURES SHALL BE FORM 4B TYPE S
- ENCLOSURE TYPE SHALL BE "PRISMAR" OR APPROVED EQUAL
- ALL LOW VOLTAGE PANELS SHALL BE PSC4-ABBATED WITH DIGITAL METER TO MONITOR:
 - VOLTAGE (V)
 - ENERGY (KWH)
 - CURRENT (A)
 - FREQUENCY (Hz)
 - POWER (KW)

SCHEMATIC DIAGRAM FOR PUMPS LOW VOLTAGE PANEL (PLVP)

The diagram shows a low voltage panel (PLVP) with the following components and connections:

- Inputs:** FIRE PUMP (41.25kVA), BOREHOLE PUMP (1.02kVA), WATER PUMP (10.13kVA), WATER BOOSTER PUMP (12.28kVA).
- Protection:** 32A DP SWITCH, 32A TPN MCCB, 32A TPN MCCB, 32A TPN MCCB, 32A TPN MCCB.
- Panel Components:** DIGITAL METER, 180A TPN MCCB, 180A TPN MCCB, 180A TPN MCCB, MECHANICAL INTERLOCK FOR MANUAL CHANGE OVER, SURGE ARRESTOR (30KA).
- Output:** 180A 4P MCCB BREAKER FOR ISOLATION, 180A 4P MCCB BREAKER FOR ISOLATION, 30kVA 1500V/1150V PERFORMS UTILITY GENERATOR SET.
- Other:** SPARE, INCOMER FROM PACKAGED SUBSTATION 800A TPN TRANSFORMER FEEDER PILLAR 2.

ABBREVIATION

ABBREVIATION	DESCRIPTION
kVA	KILOVOLT - AMPERE
MCCB	MOLDED CASE CIRCUIT BREAKER
TPN	THREE POLES AND NEUTRAL
TPN + E	THREE POLES AND NEUTRAL + EARTH
SLVP	SUB LOW VOLTAGE PANEL
A	AMPERE
SYMBOL	DESCRIPTION
⚡	SURGE PROTECTOR

CONNECTED LOAD

FORM:	CONNECTED LOAD	84.64kVA
4B	CONNECTED CURRENT @ 70%	53.30kVA

DIVERSIFIED LOAD

CABLE ENTRY:	DIVERSIFIED LOAD	45.25A
BOTTOM	DIVERSIFIED CURRENT @ 70%	85.31A

CABLE SCHEDULE

- (A) 3C x 4mm² PVC/PVC SHEATHED CU CABLE
- (B) 4C x 6mm² PVC/SWAPVC ARMoured CU CABLE + 1c x 4mm² PVC SHEATHED CU CABLE FOR EARTHING
- (C) 4C x 16mm² PVC/SWAPVC ARMoured CU CABLE + 1c x 16mm² PVC SHEATHED CU CABLE FOR EARTHING
- (D) 4C x 25mm² PVC/SWAPVC ARMoured CU CABLE + 1c x 16mm² PVC SHEATHED CU CABLE FOR EARTHING
- (E) 4C x 35mm² PVC/SWAPVC ARMoured CU CABLE + 1c x 16mm² PVC SHEATHED CU CABLE FOR EARTHING

LOCATION: SERVICES AREA

Client: MEDIFE LTD
58/60 BROAD STREET
CENTRAL BUSINESS DISTRICT
LAGOS

Project Title: CONSTRUCTION OF ACCESS ROAD AT THE SUMMIT BUSINESS PARK IN ASABA, DELTA STATE

Location: SUMMIT BUSINESS PARK, 3517 BENIN EXPRESSWAY, ASABA, DELTA STATE

M&E Consultants: Mechanical and Electrical Engineering
15, George Oduduwa St, Oshodi, Lagos State, Nigeria
7, London Boulevard 1, Lagos State, Nigeria
Email: info@meengineering.com
Mobile: +234 818818127 / +234 818818127

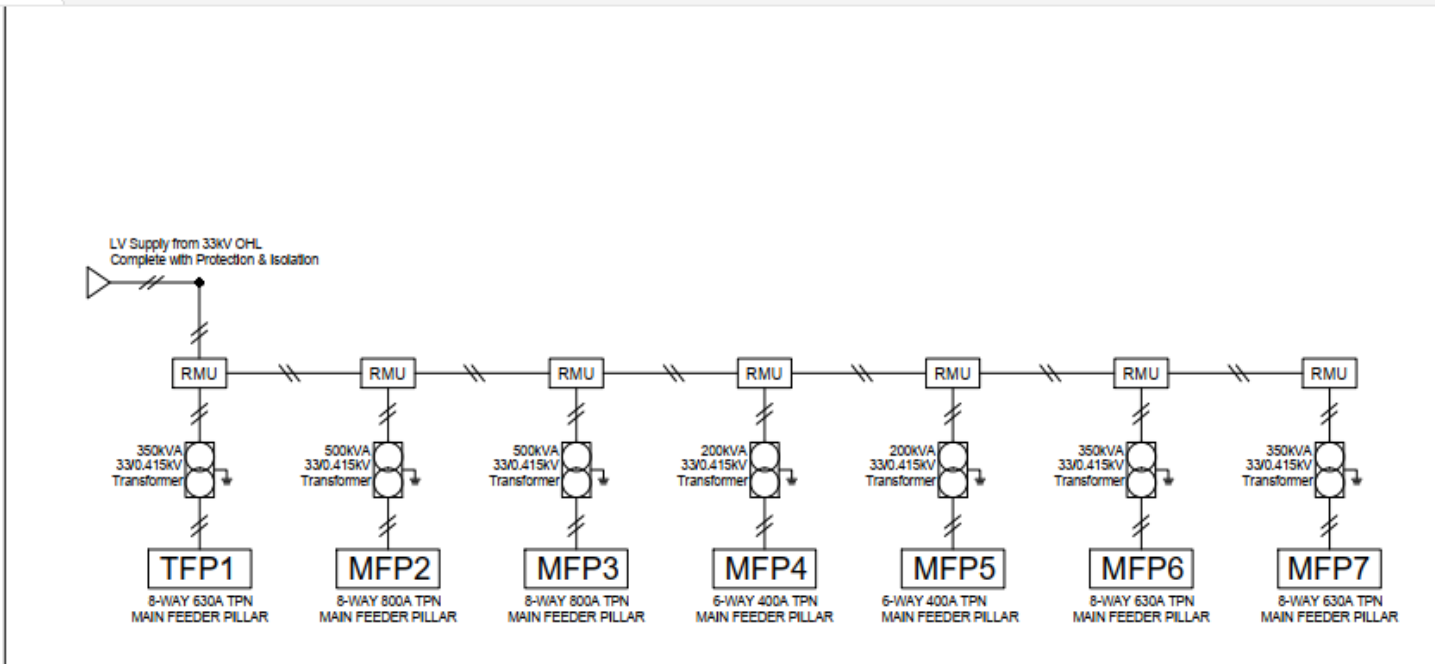
Service Engineer Signature & Seal:

Discipline: ELECTRICAL DRAWINGS

Drawing Title: OUTDOOR PUMP LOW VOLTAGE PANEL SCHEMATIC DIAGRAM

4 / 10 65.24%

- Start CONSTRUCTION OF AC... x
- Layers
- 0
 - 0_VEGETATION
 - A-GLAZ
 - A-GRID
 - A-WALL
 - CABLE
 - Cabl Lay
 - DRAIN-2
 - Drainage
 - E-TEXT
 - E-hash-416-TXT500
 - Electrical ManHole
 - G-ANNO-TEXT
 - HATCH
 - Lighting Fittings
 - MAIN CABLE TRAY
 - MEP TEXT
 - P
 - POWER
 - Plan
 - Poles
 - SCHEMATICS
 - T
 - TX
 - WIERING
 - Z_entity
 - Z_rectangle



OVERALL SCHEMATIC DIAGRAM

Client

MEDFE LTD
58/60 BROAD STREET
CENTRAL BUSINESS DISTRICT
LAGOS

Rev	Date	Description	Drawn/By

Drawing Status

APPROVAL DRAWINGS

Project Title

CONSTRUCTION OF ACCESS ROAD AT THE SUMMIT BUSINESS PARK IN ASABA, DELTA STATE

Location

SUMMIT BUSINESS PARK,
KMT12 BENIN EXPRESSWAY,
ASABA, DELTA STATE

M&E Consultants:

Mechanical and Electrical Engineering
11, George Oweh St, Oshodi, Lagos, Delta State,
7, Junction Okunribido Estate, Okunribido, Ikorodu,
Rivers, Lagos, Lagos State.
Email: oshodiengineering@gmail.com
Mobile: +234805333127 +234903299947

Services Engineer Signature & Seal

Discipline

ELECTRICAL DRAWINGS

Drawing Title

POWER DISTRIBUTION SCHEMATIC DIAGRAM

Date	Drawn	Checked	Scale
MARCH 2023	AA	S.O	1/1.5

Sheet No.	Drawing No.	Rev.
E06	DE/02/2023/001	

Start CONSTRUCTION OF AC... x

Layers

- 0
- 0_VEGETATION
- A-ANNO-TTLB
- AC PIPING
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- C-ANNO-DIMS
- C-ANNO-SYMS
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- DES-05
- DES-08
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- DIMINT
- DRAIN-2
- Door 2
- FHR

FIRE PUMP CALCULATION & HYDRAULIC CALCULATION

HYDRANT: Flow rate per external hydrant = 500gpm = 31.5 l/s = 1890 l/min

CALCULATION ASSUMPTIONS

Assuming two hydrants will work at same time

$$2(1890) = 3780 \text{ l/min}$$

TOTAL DESIGN FLOW RATE = 3780 l/min

HEAD LOSS

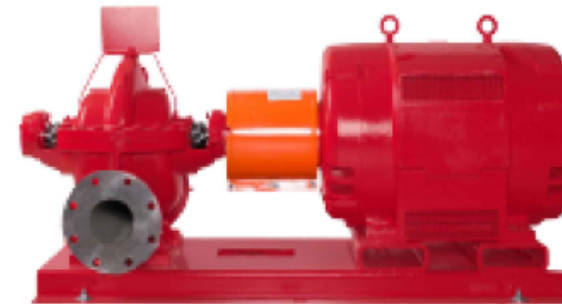
1. Static head = 14.5 m (Approximately 15m)
2. Frictional head = straight pipes and the actual lengths
100mm dia = 40m
3. Velocity head loss = +10% of static Head = 2m

$$\text{Total HEAD Loss} = 15\text{m} + 40\text{m} + 2\text{m} = 57\text{m}$$

$$\text{Total Head 15 Approximate) = 60m}$$

FIRE PUMP SHALL BE SELECTED FROM THE FOLLOWING PRODUCTS

1. GRUNDFOS PUMPS
2. LOWARA PUMPS



eSign PDF Docs PDF

Client

MEDFE LTD
58/60 BROAD STREET
CENTRAL BUSINESS DISTRICT
LAGOS

Rev	Date	Description	Chkd	Appd

Drawing Status
APPROVAL DRAWINGS

Project Title
CONSTRUCTION OF ACCESS
ROAD AT THE SUMMIT BUSINESS
PARK IN ASABA, DELTA STATE

Location
SUMMIT BUSINESS PARK,
KM12 BENIN EXPRESSWAY,
ASABA, DELTA STATE

M&E Consultants:



Mechanical and Electrical Engineering
14, George Okonkwo St, Asaba, Delta State,
7, Junction Okonkwo Street, Okonkwo, Okonkwo
Road, Mile 12, Lagos State.
Email: m&eengineering@gmail.com
Phone: +2349030000227 +234903000027

Services Engineer Signature & Seal

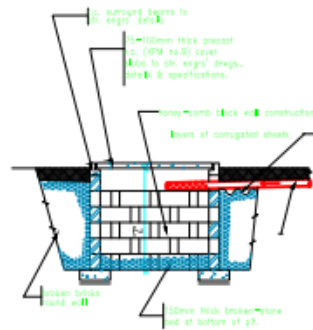
Discipline
MECHANICAL DRAWINGS

Drawing Title
FIRE PUMP DATA SHEET

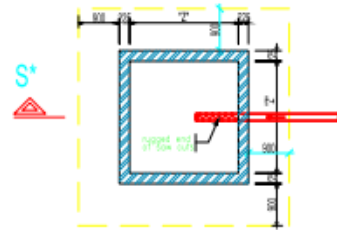
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Layers

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- 0_VEGETATION
- A-ANNO-TTLB
- AC PIPING
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- C-ANNO-SYMS
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- Door 2
- FHR



SOAK-AWAY PIT (SECTION S - S)

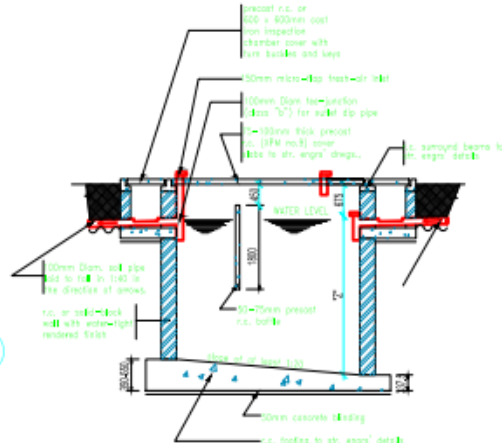


SOAK-AWAY PIT PLAN

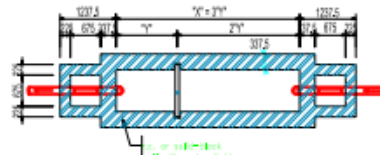
SCHEDULES						
1	2	3	4	5	6	7
NO. BELOW THE THRESHOLD RECOMMENDED FOR PROJECT	TYPE OF SEPTIC TANK	NUMBER OF LAMBS	VOLUME OF SEPTIC TANK (LITRES)	LENGTH OF SEPTIC TANK (MILLIMETRES)	WIDTH OF SEPTIC TANK (MILLIMETRES)	TANK AT RILET
A	1-50	2-100	2100	700	1500	
B	11-20	4-200	3600	1030	1500	
C	21-30	7-200	3500	2500	1800	
D1	31-50	6-200	3150	1050	1800	
D2	31-50	12-200	4500	1500	1800	
E1	51-75	8-200	3600	1300	1800	
E2	51-75	18-200	5100	1750	2000	
F1	76-100	12-200	4200	1410	1410	
F2	76-100	18-200	5100	1750	1750	
G1	101-120	14-200	4650	1550	1550	
G2	101-120	21-200	5700	1900	1900	

NOTE

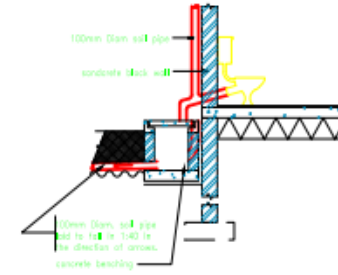
* 62" IS RECOMMENDED FOR THIS PROJECT



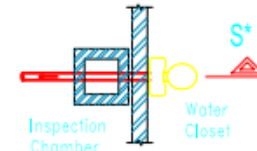
SEPTIC TANK (SECTION S - S)



SEPTIC TANK PLAN



INSPECTION CHAMBER (SECTION S - S)



INSPECTION CHAMBER PLAN

DETAILS

Client
MEDFE LTD
58/60 BROAD STREET
CENTRAL BUSINESS DISTRICT
LAGOS


Rev	Date	Description	Chkd/ Appd

Drawing Status
APPROVAL DRAWINGS

Project Title
CONSTRUCTION OF ACCESS ROAD AT THE SUMMIT BUSINESS PARK IN ASABA, DELTA STATE

Location
SUMMIT BUSINESS PARK,
KM12 BENIN EXPRESSWAY,
ASABA, DELTA STATE

M&E Consultants:



Mechanical and Electrical Engineering
45, George Odionuwa St, GRA, Ibeju-Lekki, Lagos State,
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Mobile: +2348185488127 / +234818599847

Services Engineer Signature & Seal

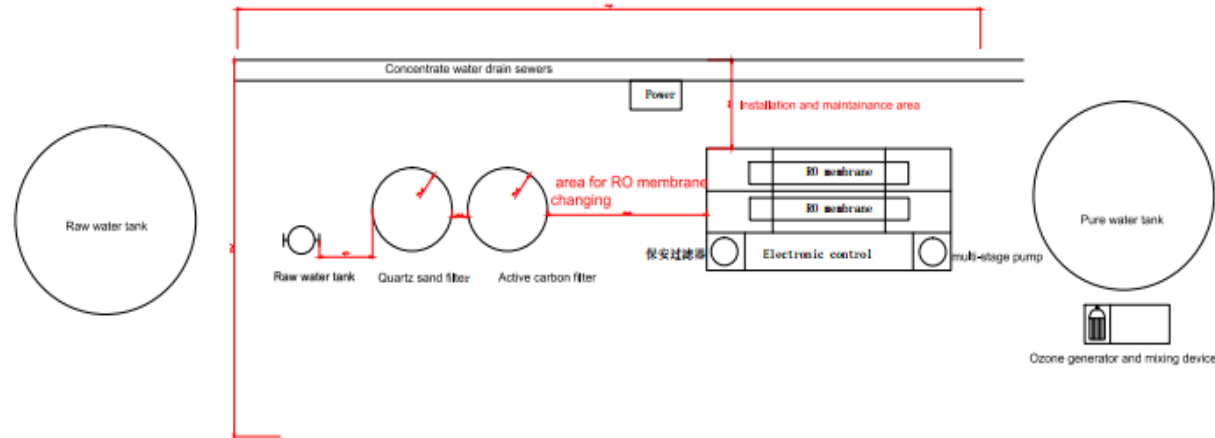
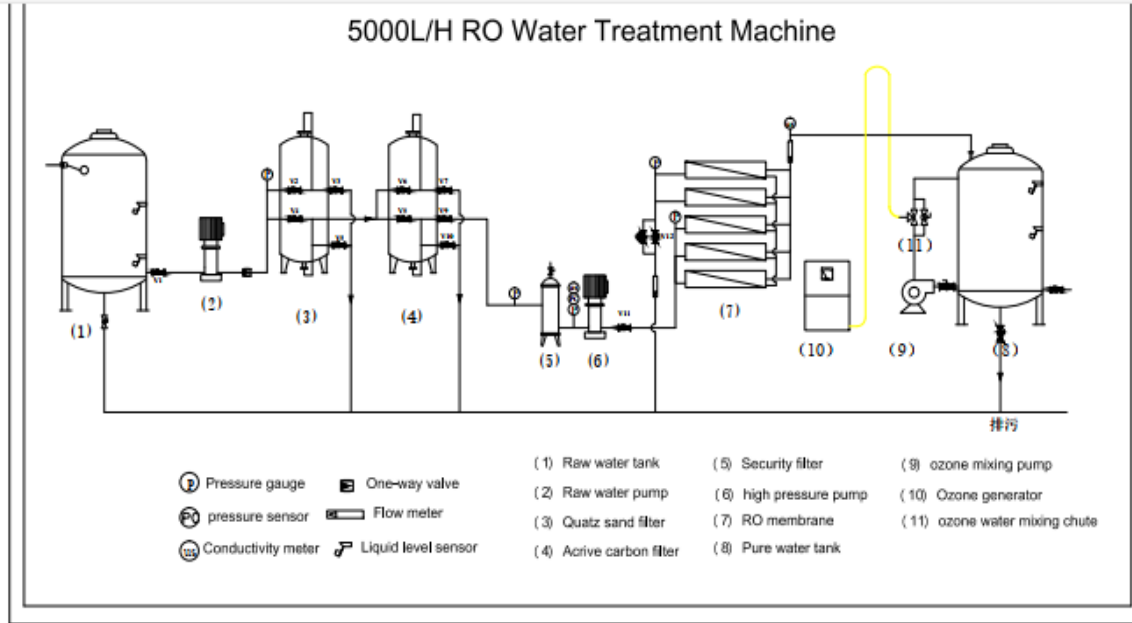
Discipline
MECHANICAL DRAWINGS

Drawing Title
SEPTIC TANK CONSTRUCTION DETAILS

Start CONSTRUCTION OF AC... x

Layers

- 0
- 0_VEGETATION
- A-ANNO-TTLB
- AC PIPING
- ACTEXT
- C-ANNO-DIMS
- C-ANNO-SYMS
- C-ANNO-TEXT
- C-DETL
- CENTRO
- CORTE
- COTA-01
- COTA-02
- CPP text
- CWS
- Cold water pipe
- DES-01
- DES-02
- DES-03
- DES-04
- DES-05
- DES-08
- DIMEXT
- DIMINT
- DRAIN-2
- Door 2
- FHR



Convert To and From PDF

Client
MEDIFE LTD
58/60 BROAD STREET
CENTRAL BUSINESS DISTRICT
LAGOS

Rev	Date	Description	Chd/Appd

Drawing Status
APPROVAL DRAWINGS

Project Title
CONSTRUCTION OF ACCESS ROAD AT THE SUMMIT BUSINESS PARK IN ASABA, DELTA STATE

Location
SUMMIT BUSINESS PARK, KM12 BENIN EXPRESSWAY, ASABA, DELTA STATE

M&E Consultant:

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Services Engineer Signature & Seal

Discipline
MECHANICAL DRAWINGS

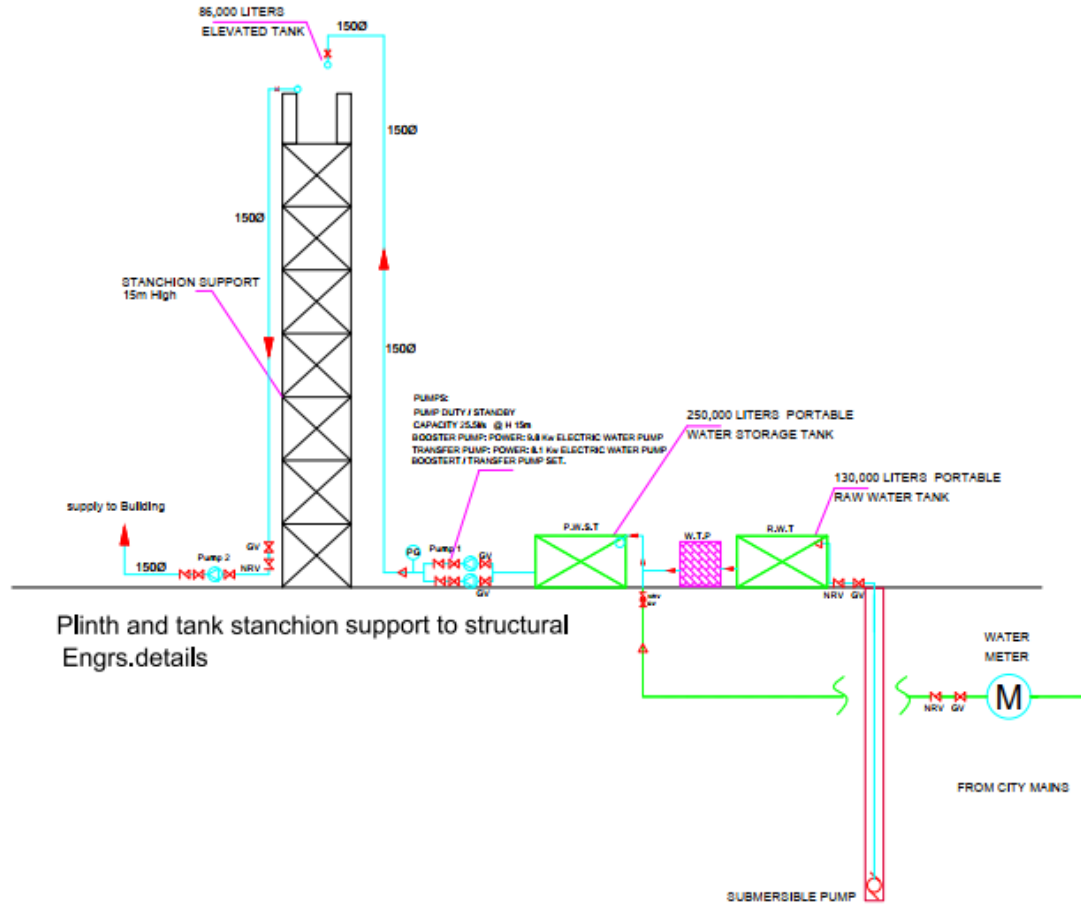
Drawing Title
WATER TREATMENT PLANT INSTALLATION DETAILS

Date	Drawn	Checked	Scale
MAR, 2022	E.S	LA	N.T.S

Start CONSTRUCTION OF AC... x

Layers

- 0
- 0_VEGETATION
- A-ANNO-TTLB
- AC PIPING
- ACTEXT
- C-ANNO-DIMS
- C-ANNO-SYMS
- C-ANNO-TEXT
- C-DETL
- CENTRO
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- COTA-01
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- DES-03
- DES-04
- DES-05
- DES-08
- DIMEXT
- DIMINT
- DRAIN-2
- Door 2
- FHR



Plinth and tank stanchion support to structural Engrs.details

Merge and split PDFs

Client

MEDIFE LTD
58/60 BROAD STREET
CENTRAL BUSINESS DISTRICT
LAGOS

Rev	Date	Description	Chd Appr

Drawing Status

APPROVAL DRAWINGS

Project Title

CONSTRUCTION OF ACCESS ROAD AT THE SUMMIT BUSINESS PARK IN ASABA, DELTA STATE

Location

SUMMIT BUSINESS PARK, KM12 BENIN EXPRESSWAY, ASABA, DELTA STATE

M&E Consultants:

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Services Engineer Signature & Seal

Discipline

MECHANICAL DRAWINGS

Drawing Title

WATER TANK SCHEMATIC

Date: _____ Drawn: _____ Checked: _____ Scale: _____

CONCLUSIONS, DISCOVERIES AND RECOMMENDATIONS

- The triangular architect's scale contains all different scales.
- The mechanical engineer's scale is commonly use for mechanical drafting when drawings are in fractional or decimal inches.
- The 1/16 division are the same as the 16 architect's scale where there 12'' and each inch divided into 1/16''.
- We have different kinds of scales associated with all kinds of design and drafting professions such as civil scale, architect scale, electrical scale and mechanical scale.
- A 3-D representation of a design can help over come visualization problems and produce a realistic and testable product model.
- 3-D drawing describe with width, height and depth dimensions(3 sides of the object) while 2-D shows only 2 sides but it is often required because it's the standard for manufacturing and construction.
- There are 4 basic scales shapes which are surface, solid models, 2-D and 3-D.
- Drawing are scaled so that the object can be illustrated clearly on standard size paper.
- Some factors to considered for choice of drafting and design media are: durability, dimensional stability, transparency, eras ability and smoothness.
- Several factors influences **CADD** software and format selection such as design and drafting practice, specific project requirement.
- Computer Aided Engineering(**CAE**) often focus on mechanical design and product development automation.
- Accuracy and close attention to details in preparations of schematic and printed circuit board(**PCB**) are very essential because everything depends on the accuracy of the two items. The schematic and PCB can not have a single mistake, because any mistake affects the master plan, art work, the drilling drawing, the assembly and bill of materials or quantity.
- Careful consideration must be given to conductor trace width and spacing during printed circuit board (PCB), these two are small thing that can cause service problem in the circuitry. And otherwise i.e. increase space leads to waste of space and increase production or manufacturing cost.

- Computer Integrated Manufacturing(**CIM**) brings together all the technologies and management system, coordinating CADD, CAM, CNC, robotics and materials handling from the beginning of the design process through the packaging and shipment of the products.
- **CNC** is a major innovation in manufacturing.
- With CAD or CADD the effects of changes can be seen quickly and analyzed.
- Drafting with the computer has increased productivity over manual techniques.
- Mechanical drafting and manufacturing are very closely allied and therefore, a mechanical drafter should have a general knowledge of manufacturing process and machines and or manufacturing methods and machine process.
- Part of design problem solving is to create a design that is functional and that can also be manufactured using available technologies at a cost that justify the product.
- One of the most powerful features of CADD is the ability to reverse drawing and model content. And also CADD software are extremely beneficial especially for precision sheet metals design and drafting applications.
- Some gear design terminology and formulas relate specifically to the construction of bevel gear. And likewise the drawing for bevel gear is similar to spur gear.
- Standardized symbols on drawings ensures that anyone who uses the diagram make the same interpretation.
- Specific methods are used to establish the accuracy of un-dimensioned drawings which are grid lines, dimensional accuracy points and registration marks.
- The preparation of electrical diagram should use symbols in accordance with IEEE 315, Graphic symbols for electrical and electronic diagrams.
- As electrical equipment design becomes increasingly smaller, the internal connections between electronic devices must also take lesser spaces, easier to install and extremely be accurate. And as a result printed circuit board(**PCB**) is required.
- Grounding layout are often drawn at a scale of 1'' = 10' (1:50 metric).

- The Printed Circuit Board (**PCB**) assembling drawing is a complete engineering drawing including components, assembly, fastening and soldering specifications and parts list or bill of materials.
- Drilling drawings are drawings prepared after the master layout is complete, which provides sizes, location and dimension for components and chassis mounting holes and the final dimensions for trimming the PCB board.
- The use computers where **CADD** function is taken further into the complete design, engineering and functional analysis of the products (electromechanical equipment, machines and devices).
- The Computer Aided Engineering (**CAE**) can :1. Simulate the circuit operation. 2. Test the system for possible problems. 3. Evaluate thermal characteristics of the circuitry to identify possible over heating situation, where heat sinks may be needed or mechanical cooling is required. 4. Design component location along with trace routing. 5. Performs printed circuit conductor routing automatically with completion on success in most board of 97%- 100%. 6. Identify and analyzed design complexity to help reduce manufacturing cost.

Electronic Design Automation (**EDA**) or Electronic Computer Aided Design (**ECAD**) is a group of software tools for designing electronic systems such as printed circuit board (PCB) and integrated circuits (IC).

EDA software tools provide for variety of applications from design, simulation, analysis, verification and manufacturing preparation.

Drawing revision: this occur for number of reasons and it's applicable to all types of drawing, such as changes required by clients, job site correction, correcting errors and code changes.

Pipe should be run in such a way that a minimum number of turns or bends are required.

Piping system should be designed by $3 \times O.D = \text{length of pipe}$.

Shop drawings are drawings used to break each individual components of engineering drawing down into fabrication part and it is also referred to as fabrication drawing.

The HVAC engineers and or drafters also determines all of the specifications for units and duct size based on calculation of structure volume, exterior surface areas, construction materials, rate of air flow and pressure for drafting and design.

REFERENCES AND CITATIONS

- Electrical Power System LLC (www.elecpowersystems.com), www.astcad.com.au , www.allpipefittings.org
- Engineering drawing and design by David A Madsen and David P Madsen. 5th ed.
- According to the American Society of Mechanical Engineers(ASME) document ASME 114.5-2009, Dimensioning and Tolerance, the commonly used international systems of units(SI) linear unit used on engineering drawings is the millimeters (mm)

All Engineering drawings, drafting and designs shall have a general notes stating “ unless otherwise specified, all dimensions are in millimeters or inches as applicable”

According to ASME: Notes are placed on drawing using upper case text and the notes read from the bottom of the sheet.

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ASME Y14.5M-2009, Dimensioning and tolerance standard.

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IEC 60617, Graphical symbols for diagrams.

MIL-HDBK-454A, Standard general requirements for electronic equipment.

MIL-STD-681E, Identification coding and application.

www.cadence.com , www.procad.com , www.seek.autodesk.com

IPC, the association connecting electronics industries. IPC document IPC2221A Generic standard in printed circuit board design, it provides generic requirement for organic printed circuit board design and specifies a master pattern grid spacing or any multiple of 0.005 in (0.127mm)

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 - Ch 21: Industrial Process Piping

David A. Madsen David P. Madsen

fifth edition

Engineering Drawing & Design



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Electrical Power Systems LLC

CERTIFICATE OF COMPLETION

THIS CERTIFIES THAT

OGUNLADE KEHINDE SAMUEL

HAS SUCCESSFULLY COMPLETED

**23 HOURS OF ELECTRICAL POWER SYSTEMS
DESIGN AND PROTECTION ONLINE DIPLOMA**

JULY 30, 2021

DATE



INSTRUCTOR
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