REPORT ON THE ACTIVITIES DURING INDUSTRIAL ATTACHMENT

MOUNT KENYA UNIVERSITY MAIN CAMPUS.

SCHOOL: ENGINEERING, ENERGY AND BUILT ENVIRONMENT.

DEPARTMENT: ELECTRICAL AND ELECTRONICS ENGINEERING.

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REG NO: BTCES/2018/84003

ATTACHMENT COMPANY: DATACORE SYSTEMS.

DURATION: FEBRUARY 15 2021 – APRIL 1 2021

SUPERVISOR: JOE MAHIUHA.

DECLARATION

This document contains a report of the activities that were undertaken during the industrial attachment session from Monday 15nt February to Tuesday 1st April 2021, by Victor Mwangi Wairimu supervised by Joe Mahiuha.

ACKNOWLEDGEMENTS

This success of the period was attributed to the fine blend of constructive needs by the school’s engineering department and Datacore’s management. The school’s requirement that the student should not only have the necessary educational skills but also practical knowledge from a typical real world production environment.

Also the supervisor Joe Mahiuha who made sure that not only did the student in context complete all assigned tasks diligently but also made sure that the student obtained full understanding of the task and the working of the underlying systems.

Final regards goes to the attachment coordinator and the assessor for providing a chance to the student in accordance to the requirements of the school of engineering. Your dedication, commitment and the hard work and great planning to ensure every aspect of the industrial attachment went smoothly.

EXECUTIVE SUMMARY

This report is a compilation of the happenings during the industrial attachment period in its entirety in accordance to the curriculum of Bachelor of Technology in Computer and Electronics Systems. It entails the work done during this period, the challenges encountered during this period and the lessons learnt from every challenge. It contains highlights - with a little detail – of the specific tasks performed on a daily basis according to the requirements of the attachment in relation to the curriculum.

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CHAPTER 1: INTRODUCTION

1.1 BACKGROUND INFORMATION

Datacore systems is a contract based company which operates on contracts received from other companies or individuals.

Due to this, there will be rare cases of task monotony as the attachment was more inclined to completion of contracted projects.

1.2 VISION AND MISSION

Mission: To light up the country with electrical energy.

Vision: A lit tomorrow connected to the national grid or solar panels.

1.2 DUTIES AND RESPONSIBILITIES

The responsibilities of the attached students involved:

- Installing of PV modules.
- Electrical wiring.
- Dc power batteries.

Among other numerous responsibilities related to the electrical and electronics engineering field.

CHAPTER 2: DEPARTMENT OVERVIEW

As stated earlier Datacore Systems is a contractor company dealing with electrical installation, repair, upgrade, audits and timely maintenance.

At the top of the chain is the Operations Manager, in charge of taking contracts and assigning tasks to the engineering team.

Further, they are followed by the finance and engineering departments who conduct financial and engineering duties respectively.

The engineering department is comprised of the senior engineers, entry level engineers and learners who are on their industrial attachment or those in the internship period.

At the end of the chain are other subordinate employees who are hired on task basis for non-technical tasks e.g cleaning, transporting equipment e.t.c.

As a student in their attachment period, the student on the context of this report was under the learners section of the engineering department.

CHAPTER 3: EVALUATION OF THE ATTACHMENT

The attachment period was very educative to the student, not only due to guidance from the supervisor an the colleagues but also due to presence of challenges which required the right mindset and abilities for the solution to be found.

3.1 FIRST PROJECT

The first task was to install PV modules which would help the host company to utilise natural cheaper energy as compared to the national grid thus leveraging against the cost of production.

To the student this was initially a challenging task since he had to join the operation while the project was underway. He had to study the circuits and get acquainted in a speedy manner in order to catch up with the rest of the group.

However, the experience provided a lot learning experience to the student as he had to indulge his skills of observation analyse circuit diagrams and listen to the instructions from the supervisor.

I commend the supervisor for providing a great environment for the student, the colleagues for being supportive and the student for his dedication and commitment.

Here I'll also include an overview technical details of the project, however most of the details of the day to day activities will be included in the student's logbook.

The project overview is shown below:

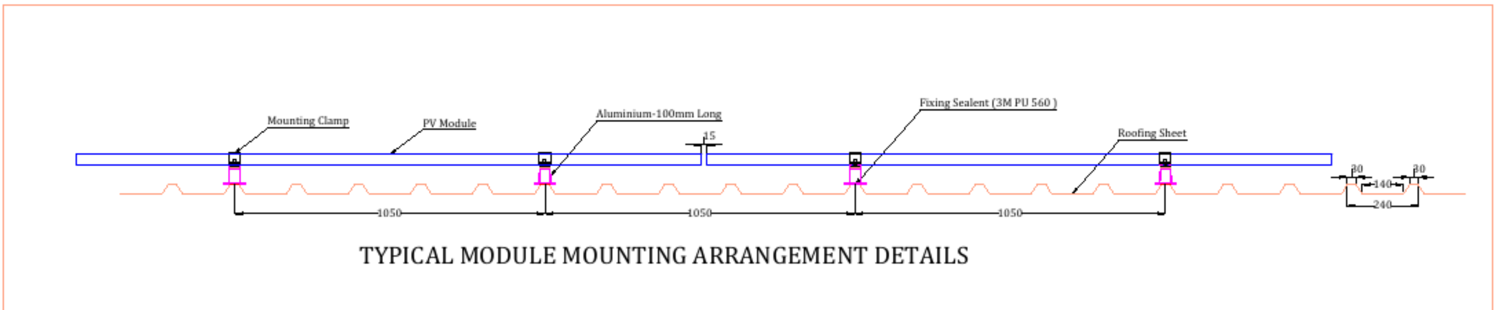
TOTAL PROJECT	
Description	Qty
PV Modules (445Wp)	840 Nos
Module per Strings	18 Nos /17 Nos
Total Strings	24 Nos /24 Nos.
Inverter SHP-75	4 Nos
Total KWp (DC)	375 KWp
Total KW (AC)	300 KW

As shown above, the objective was to provide an AC supply of 300KW to the load (industry machinery).

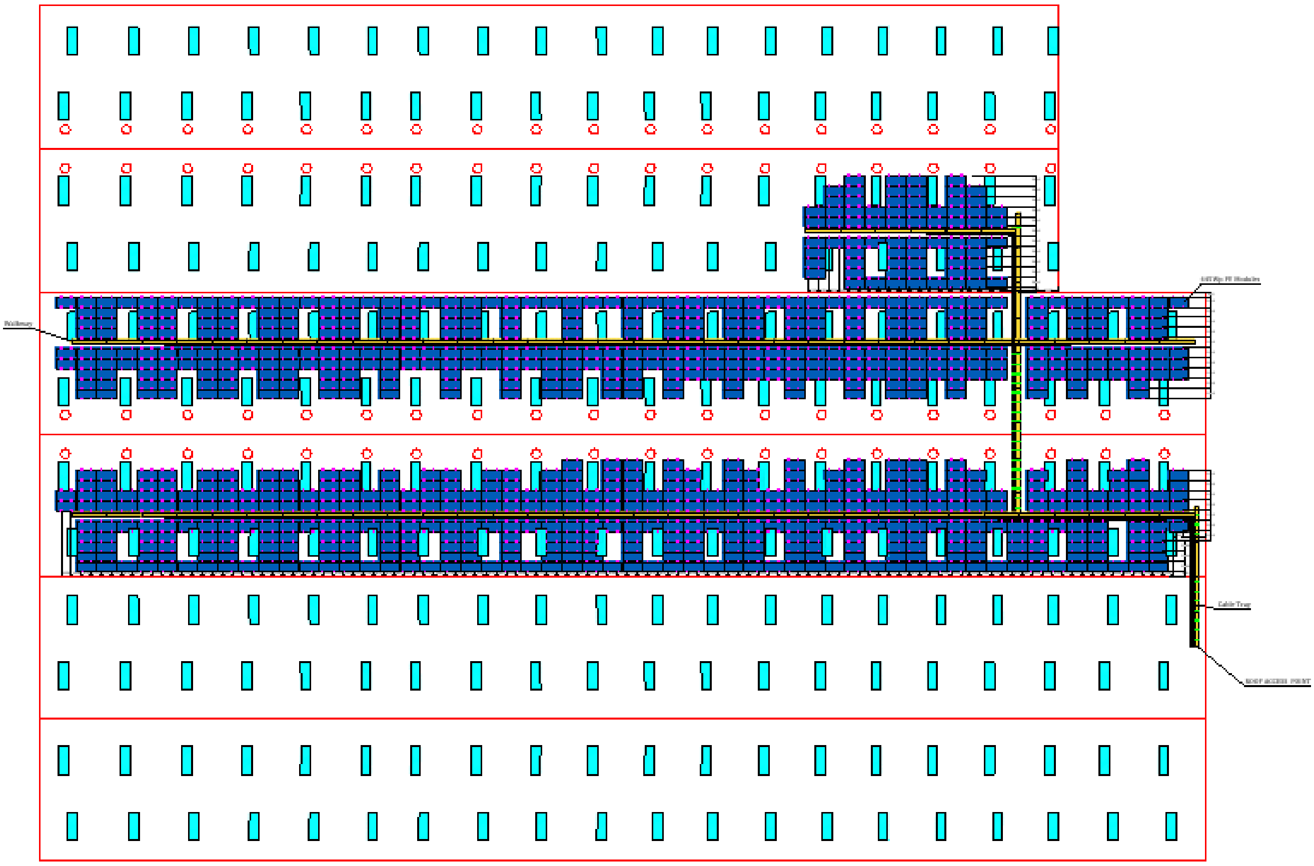
This could be achieved through the production of 375KW DC power before conversion to AC.

The number of PV modules in a string, the capacity of each module and the number of strings are provided above.

The specification of arrangement of the modules by the company is provided below:



the side view design of the arrangement



the aerial view design of the proposed arrangement

This arrangement was however installed by a different task force and the task assigned to the team comprising of the student was to make all the necessary electrical connections including earthing, testing and managing the electrical cables as a safety measure. None technical maintenance practices e.g cleaning was to be handled by the host company.

The task of technical monitoring, troubleshooting and maintenance of the system was however delegated to the company providing the solar panels.

In order for this to be achieved, data had to be transmitted from the clients to the remote monitoring systems through Ethernet links.

The PV modules were also to be used interchangeably with power from the national grid for support during the night and during weather conditions that did not favour harvesting solar energy. The modules also had to interoperate with the existing generators which acted as power back up systems.

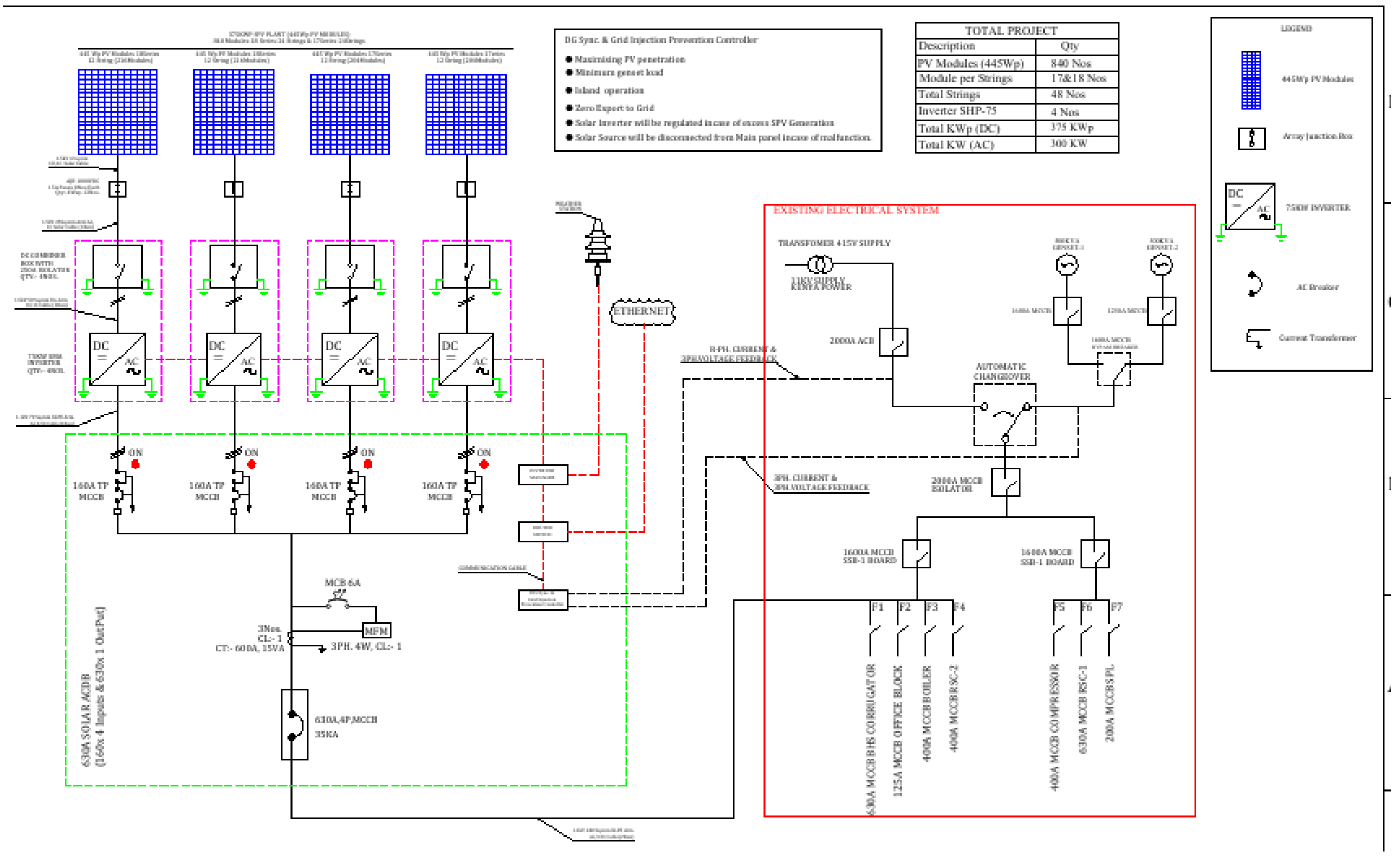
To achieve this, a DG synchronisation panel and The Grid Injection Controller had to be connected to the systems and the change over circuitry.

The needs of the DG synchronisation panel and The Grid Injection Controller was provided by the company as follows:

DG Sync. & Grid Injection Prevention Controller

- Maximising PV penetration
- Minimum genset load
- Island operation
- Zero Export to Grid
- Solar Inverter will be regulated incase of excess SPV Generation
- Solar Source will be disconnected from Main panel incase of malfunction.

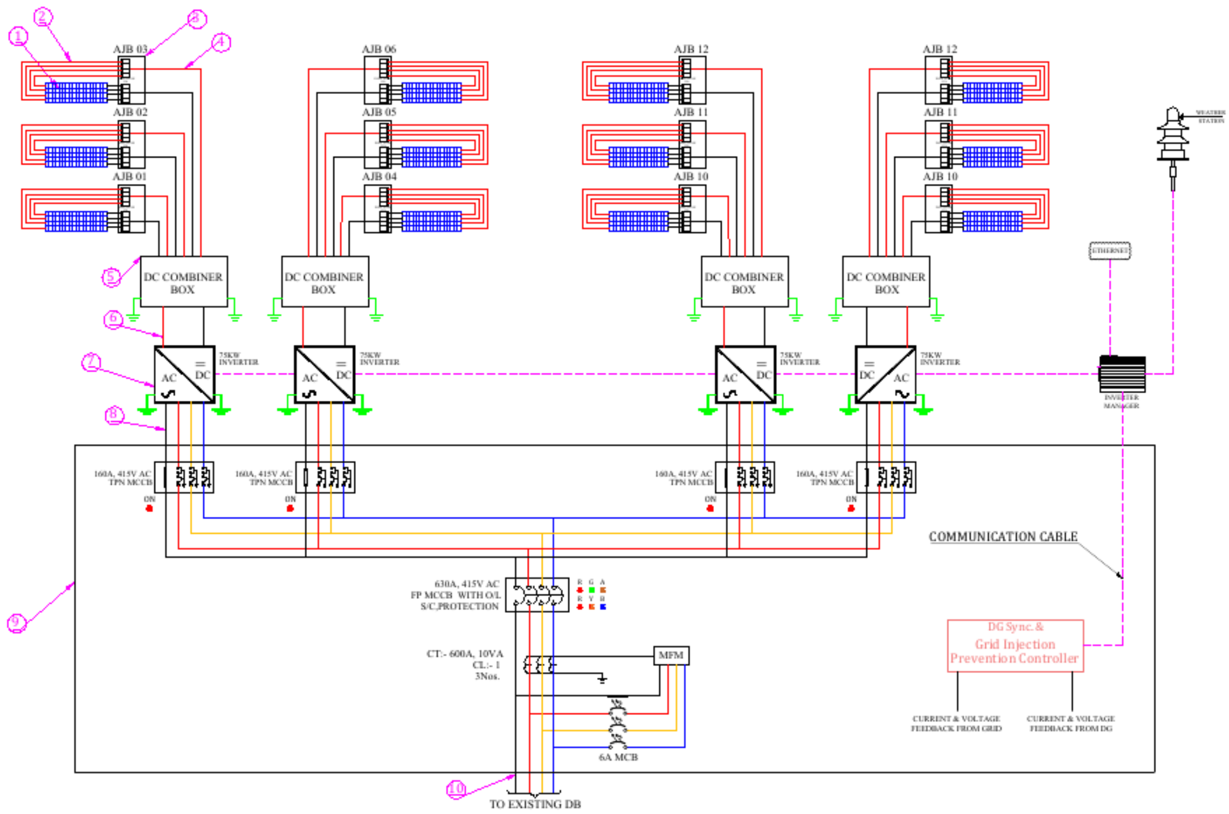
The project summary cam be shown in the following circuit diagram.



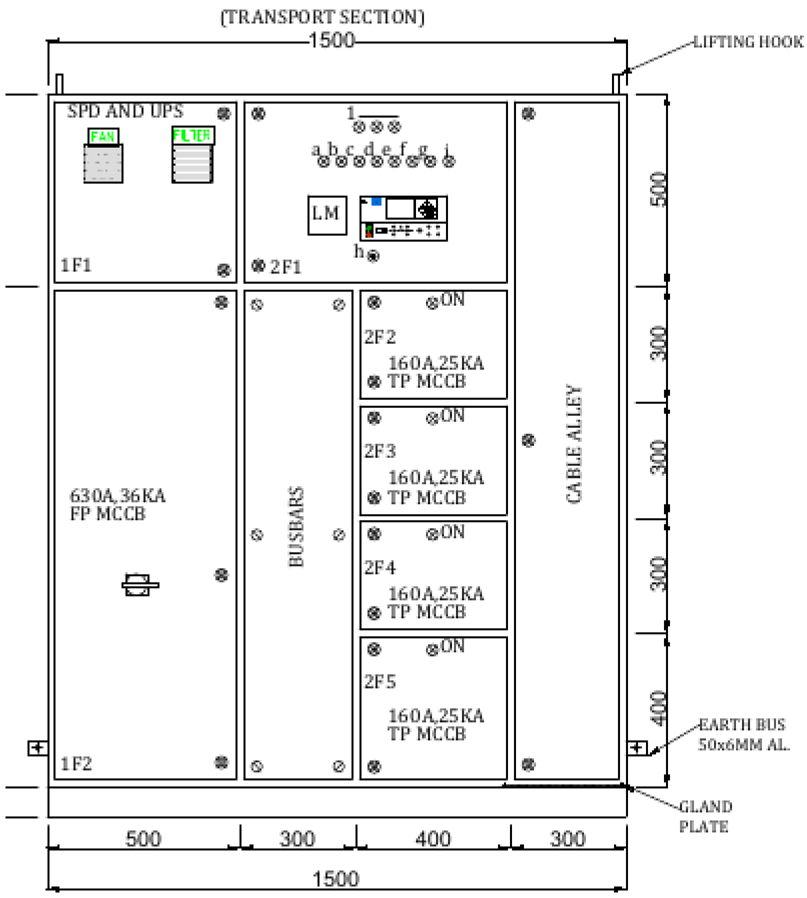
The diagram shows, PV module connectivity circuiting on the left, followed by the networking bit towards the middle with the right side showing the existing connection (power from national grid).

The change over circuit and the DG synchronisation panel and The Grid Injection Controller are also shown in the diagram.

A schematic drawing of the diagram is also included below.

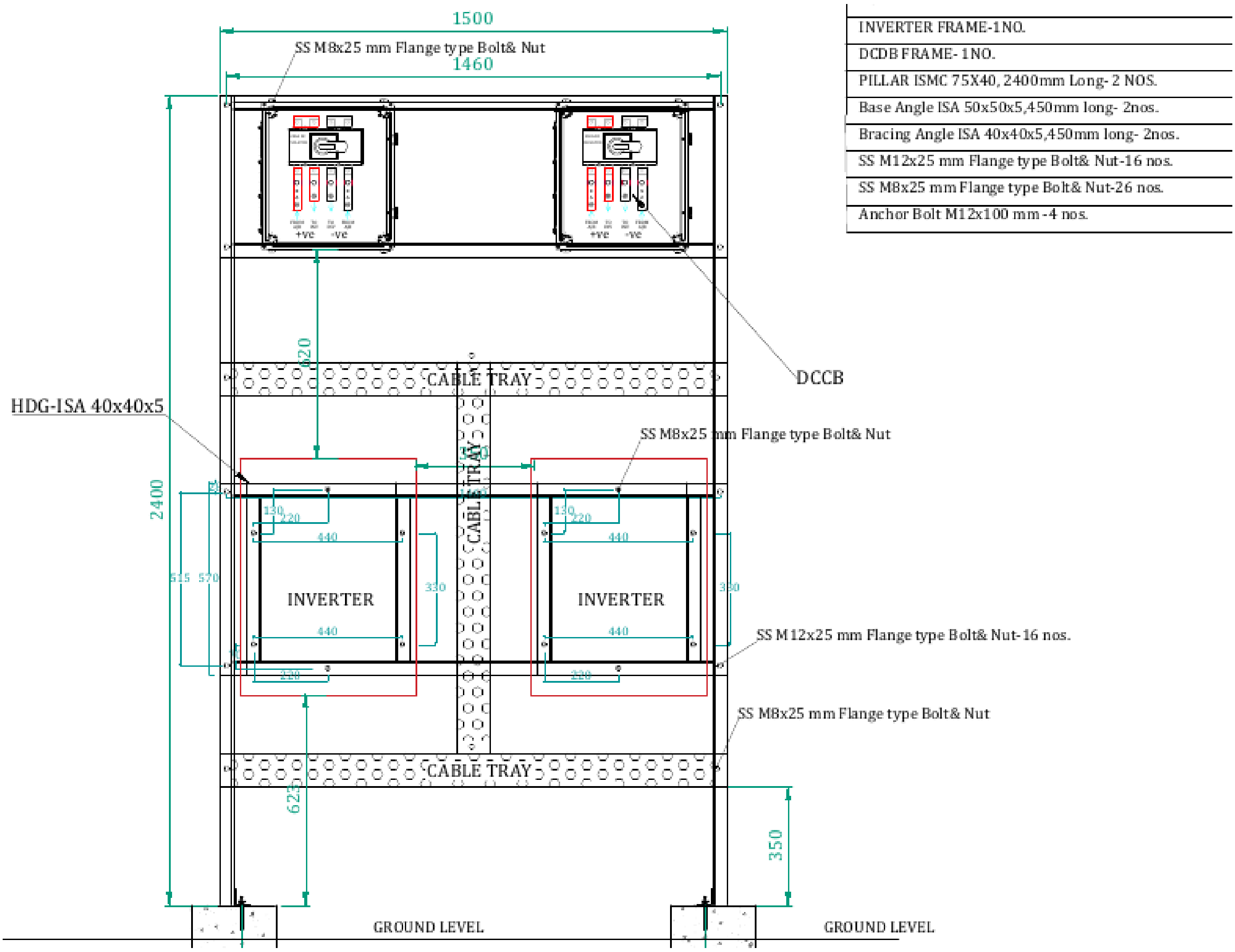


The AC distribution board of the project is shown below:



FRONT VIEW

Below is also a diagram of the inverter structure with DCCB assembly and the foundation arrangement.



3.1.1 LESSONS LEARNT IN THE COURSE OF THE PROJECT

- Electrical safety measures → Bearing in mind the huge power involved in the project, maximum care had to be observed to prevent damage to property and life. Some of the safety measures learned were:
  1. Self positioning during team operation on large currents.
  2. Cable management and its importance.
  3. Proper attire when carrying out electrical tasks.
  4. Careful handling of working equipment.
- Cable specification → I learnt the various types of electrical cables and the predominant areas and purposes of use of those cables. The power ratings and load was also a very important factor when selecting the cable types.
- Device arrangement and home →I learnt how to arrange an electrical workspace both for aesthetic and ease of accessibility. Other than that, I became familiar with the connection of various types of electrical devices e.g Current Transformers, Array Junction Box, Main Switching Board, Inverters and DC Combiner boxes.

3.1.2 CHALLENGES FACED IN THE PROJECT

- Linking among the teams → Poor specification of interfaces was an issue encountered leading to poor connections on the interfaces. This were however detected and fixed during troubleshooting and testing before the final commissioning.
- Weather conditions → Terminating PV modules during some hot hours during the day proved troublesome due to heat from the sun and the surfaces of the iron sheets. The former was solved through shifts while the latter was solved through protective clothing.

3.2 SECOND PROJECT

The second project was a domestic wiring task to residence. The connection was then to be terminated to the power supply from the national grid. We did not have to fix the meter box as we found an existing meter box in proper working conditions.

- Fixing the Consumer Control Unit → A CCU is the main control center for an average to larger domestic electrical supply. The CCU consist the main switch and the array circuit breakers. Owing to the size of the building and the capacity of power that it required to run, three CCUs were installed. Explanation of the CCU components is as follows:
    1. The main switch → The main switch is the device responsible for opening the circuit thus disconnecting the load from the national grid. In the setup, the three CCUs shared one main switch. The main switch is only connected to the live wire. It is a safety measure to make sure the switch in in 'OFF' mode when working on the electrical connections.
    2. The Circuit Breakers → Circuit breakers are meant to disconnect a particular circuitry due to overload. Circuit breakers are rated in terms of the current in Amperes that can pass through them. In order to determine the Circuit breaker to use, you check the cable that is used e.g a 1.5mm cable can be connected to a 6A breaker.
- Connecting electrical cables → Cables are path ways of power supply to the electrical component. Cable size is proportional to the load and is used to determine the breaker size e.g a 1.5 mm cable can be used for a normal lighting circuit and should be connected to a 6A breaker, a 2mm cable can also be used for higher load lighting circuits and lower load socket circuits while a 2.5mm cable is the standard cable for sockets.

3.3 MAINTAINING AND FIXING SYSTEMS

Due to the Covid 19 pandemic, most contracts that were obtained involved maintenance and system repair and not completely new projects.

Some of the projects worth putting down include:

- Replacing a relay card and fixing control systems.
- Replacing power back up systems.
- Replacing current transformers damaged due to higher than anticipated magnetic fields.
- Assigning IP addresses to control system interfaces.

CONCLUSION

The external experience was educative and allowed the named student to relate whatever is learnt in class with actual implementation in the real world production setups and also how to deal with all the various challenges encountered along the way.

NOTABLE SOURCES OF DATA IN THIS TEXT

Circuit diagrams and other circuit demonstrations have been obtained from the Installation instruction manual for the PV installation project by Spenomatic Solar and Datacore Systems in Carton Manufacturers ltd, KENYA.