

APPOINTMENT OF A SERVICE PROVIDER TO MANUFACTURE, DELIVER AND COMMISSION RELOCATABLE MODULAR UNITS (ALTERNATIVE BUILDING TECHNOLOGY) FOR 5 SCHOOLS IN THE EASTERN CAPE WITHIN THE ACCELERATED SCHOOLS INFRASTRUCTURE DELIVERY INITIATIVE (ASIDI) 47 PROGRAMME ON BEHALF OF THE DEPARTMENT OF BASIC EDUCATION (DBE) – CLUSTER D2A

ADDITIONAL NOTES AND PROJECT SPECIFICATIONS:

1) Addendum to the Modular Project Specifications

The following to be read in conjunction with the project specification for modular structures of November 2020 contained in Annexure B:

CLAUSE NO	DESCRIPTION	ADDENDUM
11	FOUNDATIONS	<p>Tenderers to note that the raft foundations pertaining to this Contract was completed under a previous project phase. The status of each is indicated in the table below. Shop drawings indicating the initial design of the raft foundations per structure are annexed hereto for information purposes. The exact size and levels of as well as the positioning of the sleeves, etc in the raft foundations are to be checked and verified by the tenderer on site.</p> <p>The tenderer shall include in his tender price for any adjustments or additional items of foundation required to suit the modular system proposed by the tenderer. Any such changes to the foundations must be designed by a Registered Engineer, who must issue an approval certificate at completion.</p>

2) Status of the Foundations

No	Project Name	EMIS #	New Modular Structures	Foundation Status
1	Mnyaka PS	200300323	3 x Single Classroom 1 x Multi-purpose Classroom 1 x Grade R 1 x Admin Unit	Raft foundations are complete. Aprons are partially complete – provision is made in the BoQ for completion of the aprons in accordance with the initial shop drawing designs.
2	Ngweyesizwe JP	200300450	2 x Single Classroom 1 x Multi-purpose Classroom 1 x Grade R 1 x Admin Unit	Raft foundations are complete. Aprons are partially complete – provision is made in the BoQ for completion of the aprons in accordance with the initial shop drawing designs.

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3	Qhamile JPS	200300545	2 x Single Classroom 1 x Multi-purpose classroom 1 x Grade R 1 x Admin	Raft foundations are complete. Aprons are partially complete – provision is made in the BoQ for completion of the aprons in accordance with the initial shop drawing designs.
4	Vuyolwethu JPS	200300725	2 x Single Classroom 1 x Multi-purpose Classroom 1 x Grade R 1 x Admin Unit	Raft foundations are complete. The concrete walls for the MPC, Grade-R and Double Classroom walls are completed. Provision has been made in the BoQ under the building works section for completing the superstructure of these units conventionally. The combined admin and nutrition unit must be a modular structure and shall comply with the modular specifications. Aprons are partially complete – provision is made in the BoQ for completion of the aprons in accordance with the initial shop drawing designs.
5	Hokisi PS	200300139	Refurbishment of existing	No new construction is required. Provisional allowance has been included for repairs to the existing modular structures supplied and installed by others.

3) Annexures for Tender and Pricing Purposes:

Annexure No	Description	
A	Site Development Plans	A1) Mnyaka
		A2) Ngweyesizwe
		A3) Qhamile
		A4) Vuyolwethu
		A5) Hokisi PS

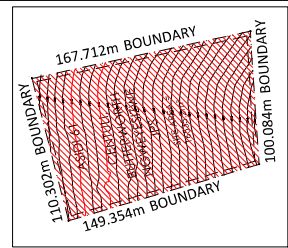
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B	Project Modular Specifications	
C	Proforma Modular Unit Layout Drawings	C1) Single Classroom
		C2) Two Classroom
		C3) Multi-Purpose Classroom
		C4) Grade-R Classroom
		C5) Admin and Nutrition Unit
D	Raft Foundation Shop Drawings (Previous Project Phase)	D1) Single Classroom
		D2) Two Classroom
		D3) Multi-Purpose Classroom
		D4) Grade-R Classroom
		D5) Admin and Nutrition Unit
E	Project Electrical Specifications	
Annexure No	Description	
F	Electrical Site Reticulation Drawings	A1) Mnyaka
		A2) Ngweyesizwe
		A3) Qhamile
		A4) Vuyolwethu

ANNEXURE A

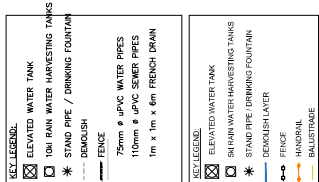
SITE DEVELOPMENT PLANS

THE CONTRACTOR SHALL BE RESPONSIBLE FOR ENSURING THE ACCURACY OF ALL DIMENSIONS AND LEVELS SHOWN ON THESE DRAWINGS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND APPROVALS FROM THE RELEVANT AUTHORITIES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND APPROVALS FROM THE RELEVANT AUTHORITIES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND APPROVALS FROM THE RELEVANT AUTHORITIES.



SITE LOCALITY PLAN
SCALE 1:2000 @ A1
EMIS : 200300697

TABLE 1: SUMMARY OF HUMAN CAPITAL									
TABLE 1A: GRADE ENROLLMENT FIGURES FOR 2017									
GRADE	BOYS	GIRLS	TOTAL	GRADE	BOYS	GIRLS	TOTAL	GRADE	BOYS
1	1	2	3	10	1	1	2	11	1
2	1	1	2	11	1	1	2	12	1
3	1	1	2	12	1	1	2	13	1
4	1	1	2	13	1	1	2	14	1
5	1	1	2	14	1	1	2	15	1
6	1	1	2	15	1	1	2	16	1
7	1	1	2	16	1	1	2	17	1
8	1	1	2	17	1	1	2	18	1
9	1	1	2	18	1	1	2	19	1
10	1	1	2	19	1	1	2	20	1
11	1	1	2	20	1	1	2	21	1
12	1	1	2	21	1	1	2	22	1
13	1	1	2	22	1	1	2	23	1
14	1	1	2	23	1	1	2	24	1
15	1	1	2	24	1	1	2	25	1
16	1	1	2	25	1	1	2	26	1
17	1	1	2	26	1	1	2	27	1
18	1	1	2	27	1	1	2	28	1
19	1	1	2	28	1	1	2	29	1
20	1	1	2	29	1	1	2	30	1
21	1	1	2	30	1	1	2	31	1
22	1	1	2	31	1	1	2	32	1
23	1	1	2	32	1	1	2	33	1
24	1	1	2	33	1	1	2	34	1
25	1	1	2	34	1	1	2	35	1
26	1	1	2	35	1	1	2	36	1
27	1	1	2	36	1	1	2	37	1
28	1	1	2	37	1	1	2	38	1
29	1	1	2	38	1	1	2	39	1
30	1	1	2	39	1	1	2	40	1
31	1	1	2	40	1	1	2	41	1
32	1	1	2	41	1	1	2	42	1
33	1	1	2	42	1	1	2	43	1
34	1	1	2	43	1	1	2	44	1
35	1	1	2	44	1	1	2	45	1
36	1	1	2	45	1	1	2	46	1
37	1	1	2	46	1	1	2	47	1
38	1	1	2	47	1	1	2	48	1
39	1	1	2	48	1	1	2	49	1
40	1	1	2	49	1	1	2	50	1
41	1	1	2	50	1	1	2	51	1
42	1	1	2	51	1	1	2	52	1
43	1	1	2	52	1	1	2	53	1
44	1	1	2	53	1	1	2	54	1
45	1	1	2	54	1	1	2	55	1
46	1	1	2	55	1	1	2	56	1
47	1	1	2	56	1	1	2	57	1
48	1	1	2	57	1	1	2	58	1
49	1	1	2	58	1	1	2	59	1
50	1	1	2	59	1	1	2	60	1
51	1	1	2	60	1	1	2	61	1
52	1	1	2	61	1	1	2	62	1
53	1	1	2	62	1	1	2	63	1
54	1	1	2	63	1	1	2	64	1
55	1	1	2	64	1	1	2	65	1
56	1	1	2	65	1	1	2	66	1
57	1	1	2	66	1	1	2	67	1
58	1	1	2	67	1	1	2	68	1
59	1	1	2	68	1	1	2	69	1
60	1	1	2	69	1	1	2	70	1
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62	1	1	2	71	1	1	2	72	1
63	1	1	2	72	1	1	2	73	1
64	1	1	2	73	1	1	2	74	1
65	1	1	2	74	1	1	2	75	1
66	1	1	2	75	1	1	2	76	1
67	1	1	2	76	1	1	2	77	1
68	1	1	2	77	1	1	2	78	1
69	1	1	2	78	1	1	2	79	1
70	1	1	2	79	1	1	2	80	1
71	1	1	2	80	1	1	2	81	1
72	1	1	2	81	1	1	2	82	1
73	1	1	2	82	1	1	2	83	1
74	1	1	2	83	1	1	2	84	1
75	1	1	2	84	1	1	2	85	1
76	1	1	2	85	1	1	2	86	1
77	1	1	2	86	1	1	2	87	1
78	1	1	2	87	1	1	2	88	1
79	1	1	2	88	1	1	2	89	1
80	1	1	2	89	1	1	2	90	1
81	1	1	2	90	1	1	2	91	1
82	1	1	2	91	1	1	2	92	1
83	1	1	2	92	1	1	2	93	1
84	1	1	2	93	1	1	2	94	1
85	1	1	2	94	1	1	2	95	1
86	1	1	2	95	1	1	2	96	1
87	1	1	2	96	1	1	2	97	1
88	1	1	2	97	1	1	2	98	1
89	1	1	2	98	1	1	2	99	1
90	1	1	2	99	1	1	2	100	1
91	1	1	2	100	1	1	2	101	1
92	1	1	2	101	1	1	2	102	1
93	1	1	2	102	1	1	2	103	1
94	1	1	2	103	1	1	2	104	1
95	1	1	2	104	1	1	2	105	1
96	1	1	2	105	1	1	2	106	1
97	1	1	2	106	1	1	2	107	1
98	1	1	2	107	1	1	2	108	1
99	1	1	2	108	1	1	2	109	1
100	1	1	2	109	1	1	2	110	1
101	1	1	2	110	1	1	2	111	1
102	1	1	2	111	1	1	2	112	1
103	1	1	2	112	1	1	2	113	1
104	1	1	2	113	1	1	2	114	1
105	1	1	2	114	1	1	2	115	1
106	1	1	2	115	1	1	2	116	1
107	1	1	2	116	1	1	2	117	1
108	1	1	2	117	1	1	2	118	1
109	1	1	2	118	1	1	2	119	1
110	1	1	2	119	1	1	2	120	1
111	1	1	2	120	1	1	2	121	1
112	1	1	2	121	1	1	2	122	1
113	1	1	2	122	1	1	2	123	1
114	1	1	2	123	1	1	2	124	1
115	1	1	2	124	1	1	2	125	1
116	1	1	2	125	1	1	2	126	1
117	1	1	2	126	1	1	2	127	1
118	1	1	2	127	1	1	2	128	1
119	1	1	2	128	1	1	2	129	1
120	1	1	2	129	1	1	2	130	1
121	1	1	2	130	1	1	2	131	1
122	1	1	2	131	1	1	2	132	1
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124	1	1	2	133	1	1	2	134	1
125	1	1	2	134	1	1	2	135	1
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128	1	1	2	137	1	1	2	138	1
129	1	1	2	138	1	1	2	139	1
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131	1	1	2	140	1	1	2	141	1
132	1	1	2	141	1	1	2	142	1
133	1	1	2	142	1	1	2	143	1
134	1	1	2	143	1	1	2	144	1
135	1	1	2	144	1	1	2	145	1
136	1	1	2	145	1	1	2	146	1
137	1	1	2	146	1	1	2	147	1
138	1	1	2	147	1	1	2	148	1
139	1	1	2	148	1	1	2	149	1
140	1	1	2	149	1	1	2	150	1
141	1	1	2	150	1	1	2	151	1
142	1	1	2	151	1	1	2	152	1
143	1	1	2	152	1	1	2	153	1
144	1	1	2	153	1	1	2	154	1
145	1	1	2	154	1	1	2	155	1
146	1	1	2	155	1	1	2	156	1
147	1	1	2	156	1	1	2	157	1
148	1	1	2	157	1	1	2	158	1
149	1	1	2	158	1	1	2	159	1
150	1	1	2	159	1	1	2	160	1
151	1	1	2	160	1	1	2	161	1
152	1	1	2	161	1	1	2	162	1
153	1	1	2	162	1	1	2	163	1
154	1	1	2	163	1	1	2	164	1
155	1	1	2	164	1	1	2	165	1
156	1	1	2	165	1	1	2	166	1
157	1	1	2	166	1	1	2	167	1
158	1	1	2	167	1	1	2	168	1
159	1	1	2	168	1	1	2	169	1
160	1	1	2	169	1	1	2	170	1
161	1	1	2	170	1	1	2	171	1
162	1	1	2	171	1	1	2	172	1
163	1	1	2	172	1	1	2	173	1
164	1	1	2	173	1	1	2	174	1
165	1	1	2	174	1	1	2	175	1
166	1	1	2	175	1	1	2	176	1
167	1	1	2	176	1	1	2	177	1
168	1	1	2	177	1	1	2	178	1
169	1	1	2	178	1	1	2	179	1
170	1	1	2	179	1	1	2	180	1
171	1	1	2	180	1	1	2	181	1
172	1	1	2	181	1	1	2	182	1</



NOTE
 -ALL FINISHED LEVELS FOR PLATFORMS AND BUILDINGS ARE TO BE TAKEN FROM ENGINEERS DRAWINGS.
 -RAMPS ARE TO BE CONCRETE WALKWAYS ON THE GROUND WHEREVER POSSIBLE.
 -BALUSTRADE WALLS ONLY REQUIRED WITH LEVEL DIFFERENCE GREATER THAN 500mm, i.e. AS PER SANS 10400

[illegible]

THE CONTRACTOR MUST CHECK AND VERIFY ALL LEVELS, DIMENSIONS, POSITIONS AND ELEVATIONS OF ALL BUILDINGS, STRUCTURES, SERVICES AND UTILITIES TO BE REPORTED TO THE ARCHITECT PRIOR TO PROCEEDING.

NO DIMENSIONS MAY BE SCALED FROM ANY DRAWINGS. GOLDEN RULE: "ASK WHEN IN DOUBT".

THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER CONTRACT DOCUMENTATION.

FOUNDATIONS, COLUMNS, REINFORCED CONCRETE BEAMS & SLABS AND STAIRS TO APPROVED ENGINEER'S DETAILS.

NEW PREMISES ARE NOT TO BE OCCUPIED UNTIL SERVICES ARE TAKEN OVER BY LOCAL AUTHORITY & OCCUPANCY CERTIFICATE ISSUED.

ELECTRICAL LAYOUT AND SPECIFICATIONS ARE TO BE AGREED UPON BEFORE ANY WORK COMMENCES. ALL ELECTRICAL WORKING TO BE DONE TO THE SATISFACTION OF THE ELECTRICAL CONTRACTOR TO PROVIDE WRITTEN CONFIRMATION BEFORE ANY WORK COMMENCES.

ALL WORK AND NEW DRAINAGE TO LOCAL AUTHORITY STANDARDS & REQUIREMENTS. WORK TO STRICTLY ADHERE TO RELEVANT EMB 1400 REGULATIONS.

THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR ENSURING THE STRUCTURAL STABILITY OF ALL COMPONENTS OF WORK & MUST OBTAIN THE NECESSARY APPROVALS FROM THE RELEVANT LOCAL AUTHORITY BEFORE COMMENCING WORK.

THE CONTRACTOR MUST OBTAIN A SITE SURVEY PRIOR TO COMMENCING WORK. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES TO THE ARCHITECT PRIOR TO COMMENCING WORK.

THE CONTRACTOR MUST OBTAIN A SITE SURVEY PRIOR TO COMMENCING WORK. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES TO THE ARCHITECT PRIOR TO COMMENCING WORK.

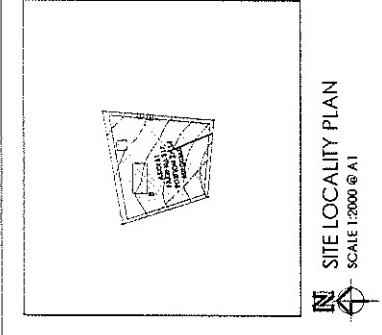


TABLE 1: SUMMARY OF HUMAN CAPITAL

GRADE	BOYS	GIRLS	TOTAL
1	11	11	22
2	11	11	22
3	11	11	22
4	11	11	22
5	11	11	22
6	11	11	22
7	11	11	22
8	11	11	22
9	11	11	22
10	11	11	22
11	11	11	22
12	11	11	22
TOTAL	132	132	264






TABLE 1b: NUMBER OF ADMINISTRATION STAFF		
	MALE	FEMALE
	0	2
	TOTAL	
	2	



TABLE 1b: NUMBER OF ADMINISTRATION STAFF			
	MALE	FEMALE	TOTAL
1	1	2	3

TABLE 24. DEMOLITION WORKS			
BUILDING USAGE	AREA	SIZE	TOTAL FOR ALL BLOCKS
ADMINISTRATION	AREA/IS	QUANTITIES	
	AREA/CLASSROOM	NO. OF CLASSROOMS	
	156m ²	4	2
CLASSROOMS			
LABORATORIES	18m ²	N/A	1

KEY LEGEND:

	10M ELEVATED WATER TANK
	5M RAIN WATER HARVESTING TANKS
	STAND PIPE / DRINKING FOUNTAIN
	DEMOLISH LAYER
	FENCE LAYER



NOTE
ALL FINISHED LEVELS FOR PLATFORMS AND BUILDINGS
ARE TO TAKEN FROM ENGINEERS DRAWINGS

ALL FINISHED LEVELS FOR PLATFORMS AND BUILDINGS ARE TO TAKEN FROM ENGINEERS DRAWINGS.

ANNEXURE B

**PROJECT MODULAR SPECIFICATIONS OF
NOVEMBER 2020**

PROJECT SPECIFICATION FOR MODULAR STRUCTURES

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DETAILED TECHNICAL SPECIFICATION

1. KNOWLEDGE

1.1. The construction of modular structures such as classrooms, administration buildings, toilets, general siteworks associated with the foundations, etc at various locations as described in the Scope of Works. The modular structures and associated equipment shall be complete and functional and shall be as a minimum according to this specification and the latest revisions of the following standards and specifications:

- i) SANS 10400: The Application of the National Building Regulations
- ii) SANS 10160: Basis for Structural Design and Actions for Buildings
- iii) Occupational Health and Safety Act and Regulations
- iv) Regulations Governing Hazardous chemical substances R1179 as amended by R930
- v) Department of Public Works specification PW371-A (Edition 2.0): Construction Works: General Specification.
- vi) SANS 10142: The Wiring of Premises Part 1: Low Voltage Installations
- vii) SANS 10252: Water supply and drainage for buildings
- viii) SANS 10162: Structural use of steel
- ix) SANS 121/ISO 1461 and SANS 32/ISO 10240 Hot dip galvanizing
- x) SANS 14713/ISO 14713 Protection against corrosion of iron and steel in structures.
- xi) SANS 10163: Structural use of Timber
- xii) SANS 204: Energy efficiencies in buildings
- xiii) SANS 10082: Timber frame buildings
- xiv) SANS 517: Light steel frame buildings
- xv) National Environmental Management: Waste Act (59/2008) and regulations
- xvi) National Environmental Management Act (107/1998) and regulations
- xvii) All other relevant specifications, standards and documents whether referenced in the above documents or not.

This specification is supplemental to the above and more specific. Any conflicting information must be referred to the Principal Agent for clarification.

1.2 The modular structures and site facilities are intended for use on a daily basis at the schools.

1.3 The appointed contractor to design, manufacture, deliver, install and commission all the facilities shall be responsible for the proper and safe functioning of the installation and any claim on the grounds of want of knowledge will not be entertained.

2. BID DOCUMENT

- 2.1. Tenderer to submit proof of full Agrément Certificate for proposed modular building system.

3. LEGAL REQUIREMENTS

- 3.1. During the supply, installation and commissioning all work shall be carried out according to the requirements of the Occupational Health and Safety Act and regulations. After completion the site and complete school and surrounding site shall comply with the Occupational Health and Safety Act as well as the national building regulations as per SANS 10400.
- 3.2. All registration certificates, written local authority approvals, test certificates and certificate of compliance shall be submitted to the Principal Agent before the installation will be accepted for first delivery.

4. WARRANTY

- 4.1. The contractor is to guarantee the new buildings, site works associated with the foundations and workmanship for a period of 90 days against any defects (latent or obvious), non-conformance and/or failure from date of works completion.
- 4.2. In the event that the contractor does not attend to such defects after being notified, the Principal Agent / The Client and/or user reserve the right to effect the rectification of the defect and recover the costs thus incurred from the contractor. This guarantee period in no way affect the latent defect liability period as specified in the JBCC contract.

5. SITE

- 5.1. The classrooms, admin offices, ablution blocks, etc and site works associated with the foundations are to be installed at the schools listed in the Scope of Works
- 5.2. The sites are located within rural areas and the security, safety and compliance with all legal requirements form part of this contract.
- 5.3. The areas have a high incidence of un-employment and it is a condition of this contract that local labour be employed.

6. CONSTRUCTION PERIOD

- 6.1. The construction period is as indicated in the Contract Data.

7. MAKING GOOD TO TRADES AND CLEARING SITE

- 7.1. After completion of the installation the site and all trades shall be made good and left in a clean and neat condition. All packaging material, rubble, crates and items used for commissioning shall be removed from the site and disposed of in a correct and legal manner.

8. SUMMARY OF SCOPE OF WORK

- 8.1. This specification is for the design, manufacture, supply, delivery, installation, painting, testing and commissioning of modular structures and site works associated with the foundations must be in accordance with the approved Agreement South Africa Certificate. The supply and installation require the following main actions with the following main requirements as well as any ancillary equipment mentioned below:
- 8.1.1. Prepare construction drawings and submit to Principal Agent for approval of work associated with the project prior to commencement.
 - 8.1.2. Comply with all health and safety requirements as per Occupational Health and Safety Act as well as this specification.
 - 8.1.3. Provide a health and safety plan for approval complete with all the requirements of the OHS Act and this specification.
 - 8.1.4. Obtain the services of a registered professional engineer to design the foundations and issue a conformance certificate of the installation after completion.
 - 8.1.5. Roofs to walkways 2,2m wide along the length of the front facades of all units.
 - 8.1.6. Complete electrical installation with all fittings, cables, DB's for a complete functional school, including the supply, installation and connection to a complete weather proof electrical kiosk on a concrete plinth with sleeves for housing the electrical controls. Kiosk shall be lockable complete with key alike locks as specified above, from 3CR12 and powder coated as provided to ESKOM.
 - 8.1.7. Complete plumbing installation including rainwater disposal, sanitary fittings, sanitary plumbing, water supplies, fire appliances, etc. inside the units. Connections to sewer and water main points to be provided by others.
 - 8.1.8. Fire extinguishers and associated signage.
 - 8.1.9. All test certificates, compliance certificates, local authority approvals including structural engineers certificate confirming that buildings and foundations conform to the engineers design and is suitable for the loads and electrical COC for the system.
 - 8.1.10. Full maintenance of the buildings and internal plumbing during the 3 month defects liability period.
 - 8.1.11. All other items and requirements, whether specifically mentioned or not, for a complete, functional, safe and durable schools complying with all the relevant codes and specifications.
 - 8.1.12. All safety notices, health and safety plan and safety equipment.
 - 8.1.13. Set of three keys per lock.
 - 8.1.14. A 100 liter direct solar geyser for sink in staff room. Geyser to be mounted inside roof space with access for maintenance. All to be done according to SANS 10400 and SANS 1052
 - 8.1.15. Three sets of data books each with all data sheets, as built drawings, engineers certificate, municipal approval, occupation certificate and inspection sheets with electrical COC and dismantling and re-location procedures.
 - 8.1.16. Two sets of as built drawings in the following format:
 - a) One set electronic drawings in autocad .dwg format, and

b) One set pdf's of all drawings.

8.1.17. The contractor must include for all items that may be required to ensure a functional building to comply with the building regulations. If the contractor is unsure of what is required, he must contact the Principal Agent.

8.1.18. All Tenderers must submit a detailed construction schedule, defining the construction Materials and Methods used to manufacture and install their product.

8.1.19. Tenderers must be available to present their proposed product to the evaluation committee on a date to be arranged. Factories and previous constructed structures must be accessible for an on-site inspection by representatives of the evaluation committee.

9. GENERAL

9.1. All buildings offered shall comply with all aspects of the National Building Regulations as interpreted in SANS 10400 and SANS 204. Compliance with SANS 204 shall be achieved without the use of mechanical ventilation and/or air-conditioning.

9.2. The following design criteria must be taken into account in the design of the structure:

9.2.1. The buildings shall be designed and constructed in such a way that each building can be relocated to another site without major dismantling.

9.2.2. The interior walls are to be painted with light coloured paint above 1200mm to ensure that the interiors are clean and bright. The area below 1200 should be painted in a colour that does not show dirt easily. The wall paint should be of a high quality to enable easy cleaning and a highly vandal resistant surface.

9.2.3. Ample windows are encouraged to provide adequate ventilation as well as light to be installed in accordance with requirements of SANS 204.

9.2.4. All windows are to be openable with clear glass and burglar proofing installed.

9.2.5. The building should be vermin and vandal proof and built with high quality material and workmanship to ensure longevity of the structure.

9.2.6. All material chosen should be rust proof and used in such a way that where contact with water is inevitable the necessary precautions is taken to ensure durability.

9.3. The finished floor level of all the buildings shall be a maximum of 250mm above the general surrounding ground level. The edges all-round the raised buildings shall be sealed off with a corrosion proof material capable of withstanding impact that can be expected at a school e.g. kicked with a boot or banged with a school bag with a 10kg load. The skirt shall be totally vermin and insect proof but any water that may accumulate during high rain fall, must be able to drain away.

9.4. All supports and adjusting mechanisms shall be hot dipped galvanised after manufacture in accordance with SANS 121 / ISO1461.

9.5. Prior to submitting building plans and SANS 10400 calculations to local authority for approval, the plans must be submitted to the Principal Agent / Department of Basic Education for comment and acceptance.

- 9.6. All materials and workmanship are to be of the highest quality and must comply with the latest edition of all relevant SANS specifications and standards as required by SANS 10400: The application of National Building Regulations) and the DPW Construction Works Specification (PW371-A), which is obtainable from the Department of Public Works, and shall be read in conjunction with this tender document and shall be referred to for the full descriptions of work to be done and materials to be used.
- 9.7. AGRÉMENT SOUTH AFRICA:
- 9.7.1. Any alternative building method employed to construct the proposed modular structures will be required to have an approved AGRÉMENT SOUTH AFRICA CERTIFICATE.
- 9.7.2. The contractor must submit with his tender a certified copy of relevant and valid CSIR Agrément Certificate and all other SANS approval certificates.
- 9.7.3. The certificate is required to be still valid and registered by referring to the agreement south Africa website: www.Agrément.co.za or by contacting the Agrément South Africa office on 012 841 3708.
- 9.7.4. Any variations from the certificate needs to have been approved by the ASA in writing.
- 9.7.5. The party responsible for the supply and erection of the system is the certificate holder or a licensee of the certificate holder who is registered with the ASA. The party responsible for the erection must also be registered with the CIDB register of contractors <http://registers.codb.org.za/reports/contractorslisting.asp>
- 9.7.6. The name of the certificate holder is printed on the certificate. In the case of licensees all enquiries must be made with ASA. Certified proof of license with certificate holder to be submitted together with tender.
- 9.7.7. Copies of the full ASA certificate for the system to be submitted with the tender and be made available on each site where the system is to be implemented. Please note that the full certificate is approximately 20 to 30 pages long. The front cover will not be accepted as the full certificate.
- 9.7.8. The terms and conditions of the Agrément South Africa certificate are to be adhered to completely to ensure approval at completion.
- 9.7.9. Please note that any unsatisfactory service and problems with the erection of the system will be reported to the Agrément South Africa board. This could affect the validity of the certificate in future.
- 9.7.10. Please also note that the ultimate responsibility for satisfactory work done by any licensee will still be with the original certificate holder and it is therefore in his best interest to ensure that the system is used and erected satisfactory.
- 9.8. On completion of the project, the contractor must issue to the employer the following certificates:
- 9.8.1. Certificate from a Registered Civil/Structural Engineer as to the suitability of design of the foundations.
- 9.8.2. An electrical certificate of compliance for the complete installation (COC)
- 9.8.3. All certificates required to be issued to the local Municipality.
- 9.8.4. Certificate from a Registered Engineer that the design and construction of the buildings comply with the requirements of SANS 10400 and SANS 204

- 9.8.5. The contractor must supply certificates for the treatment of all timber against termites and dry rot.
- 9.8.6. Engineers certificate for roof construction.
- 9.9. Care must be exercised not to damage private property or local authority property on the outside of the fence line or in any servitude. Any claim for such damage is for the contractor's account. The contractor must arrange with the owner of such property for mutually acceptable construction before commencing the work.
- 9.10. All repairs, reworks and making good shall match original in all respects.
- 9.11. Boundary pegs shall not be disturbed. If accidentally disturbed, it should be returned to its exact original position.
- 9.12. Bidders to ensure that they acquaint themselves with the work to be done and make allowance in the tender price for the proper completion of the work although not all items may be specified.
- 9.13. The successful bidder shall not take any instructions from anyone other than the Principal Agent. No verbal instruction shall be entertained by the Contractor without a follow up written Site Instruction from the Principal Agent.
- 9.14. Contractor to inform the Principal Agent of any cost implications associated with an instruction prior to commencement of the work.

10. CLASSROOMS, OFFICE, GRADE-R AND STORE

- 10.1. Classrooms shall be a minimum of 60m² in size and the length to breadth ratio must be able to fit a total of 40 school desks (1000 x 450mm), 1 teachers' desk, 1 standard steel stationary cabinet, with adequate space for chairs and circulation. The floor to ceiling height shall not be less than 2.70 m above finished floor level. Provision must be made for extended eaves overhang along the entire length of the entrance side of the building to adequately cover the 1.8m wide walkways/ verandahs (constructed by others) which shall connect all classrooms, offices and ablution blocks.
- 10.2. Office and Store shall have a combined minimum area of 25m². A wall with a semi-solid door should divide the rooms. The floor to ceiling height shall not be less than 2.70 m above finished floor level.
- 10.3. Supply and fit 1800mm melamine cupboard with post form top complete with drop in stainless steel single bowl sink with 15mm hot and cold-water pillar taps in kitchen area.

11. FOUNDATIONS

- 11.1. No soil tests are available. The contractor shall undertake his own soil testing to determine the size and type of foundations required below the building supports. All foundations must be designed by a Registered Engineer, who must issue an approval certificate at completion. The soil around the foundations where the building supports are mounted must be protected from erosion. The walkway/ verandah cover support require foundations adequately sized to comply with the relevant SANS standard and soil conditions.
- 11.2. Depending on the type of construction offered, three foundation construction methods are recommended, a) Strip footings and b) Raft foundations and c) adjustable pedestal foundations. The contractor to supply foundations details with his tender.
- 11.3. Contractor to provide standard concrete test cubes for foundation concrete. Testing must be done by a SANAS accredited testing laboratory for all structural and foundation concrete. Location of batch in structure to be identified with each test cube. Test results as well as identified positions to be recorded in data book.
- 11.4. Irrespective of type of construction, special care shall be taken to ensure that uplift and lateral wind forces as calculated according to SANS 0160 and that all buildings and structures can resist such forces. In the case of pedestal foundations, the buildings must be secured to prevent wind movement.
- 11.5. The general minimum requirements for foundations are as described below:

11.5.1. STRIP FOOTINGS

- a) The minimum size of a strip footing shall be 700 x 250mm. The average depth of excavation from formation level is 600mm, and this average depth will stand (no adjustments will be made after completion). Actual dimensions shall however be to the design prepared by a registered Professional Engineer.
- b) All concrete in footings to have a minimum 28 day strength of 20MPa and the contractor must supply test cube results to comply for every 24m³ of concrete cast. The first set of cubes to be tested at 7 days with the minimum required 7 day test strength of 13 MPa and if the tests comply with these specifications then the remaining cubes to be tested at 28 days confirming a strength of 20MPa.
- c) All foundation brickwork to be 220mm wall of well burnt bricks, with a minimum strength of 14MPa. Foundation walls to project a minimum of 340mm above the finished platform level or natural ground level. Brick force to be supplied in every course and shall be galvanised welded fabric formed of two hard drawn wire of diameter not less than 2.8mm and not more than 3.55mm held apart by cross wires at 300mm centres.
- d) The exposed plinth to be constructed with hard burnt face bricks, quality of a FBS brick, of an approved colour and a minimum strength of 14 MPa.
- e) The damp proof course to be 375 micron embossed waterproof sheeting. Damp proof shall be installed against a mortar filled raked edge sloping down and outwards.
- f) All backfilling of trenches to be of suitable granular materials in maximum 150 thick layers and compacted to 95% mod AASHTO.

11.5.2. RAFT FOUNDATIONS

- a) The foundations to be constructed according to the Engineer's specification and Design.
- b) The Design to comply fully with the National Building Regulations as per SANS 10400, SANS 10161, the Joint Structural Division (SAICE/IstructE)'s Code of Practice, and the NHBRC's Home Building Manual.
- c) All concrete to be a minimum of 25MPa and the design of the Raft Foundation to cater for the required differential heave as determined by the Soils Investigation.
- d) The contractor to provide details of a raft foundation designed for a differential heave of

15mm. The details provided must include beam sizes, beam spacing, floor slab thickness and reinforcing. The cost of any deviation from this due to an increased or decreased differential heave will be adjusted based on the schedule of rates. Top of raft, to project a minimum of 340mm above the finished platform level or natural ground level.

12. CONCRETE PIERS/BASES

- 12.1. The supports of each building shall be mounted on concrete bases/piers. The minimum size of each base shall be 600 mm X 600 mm X 150 mm thick.
- 12.2. The maximum load per base shall be 750 kg. Each base shall be cast on compacted platforms consisting of a 150 mm layer of G7 and top layer of 150mm of G5. Layers to be individually compacted to 95% mod AASHTO.
- 12.3. The platform size below the concrete bases shall be at least 1.5m X 1.5m.
- 12.4. 250-micron DPC to be placed between the concrete and compacted platform.

13. FLOOR CONSTRUCTION

- 13.1. As the required buildings must be of the pre-fabricated type that can be easily relocated, the floor construction shall be an integral part of the building design and shall also be of the pre-fabricated type that can be easily relocated.
- 13.2. The minimum requirement for the floor is as follows:
 - 13.2.1. Floor construction to comply with the requirements of SANS 10400. Floors to be constructed out of 19mm thick shutter board or similarly approved material, on an engineered designed galvanized steel structure. The underside of the floorboards must be treated with two coats of carbolineum, or an equally approved product. The construction method used, must be completely removable, transported and re-erected on an alternative site.
 - 13.2.2. The floor construction shall be such that the hardness and deflection fall within the requirements of the vinyl floor tile manufacturer's minimum specification.
 - 13.2.3. All floors to be finished with semi flexible vinyl floor tiles size 300 x 300 x 2.5mm thick (colour samples submitted to Principal Agent for approval) laid with an adhesive to pattern and two coats approved sealer to be applied prior to handover.
 - 13.2.4. Skirting to be 19 x 69mm hardwood screwed to framework and finished with three coats polyurethane suede varnish all-round. If the contractor wishes to use an alternative, he must supply the information with his tender as an alternative. Tender price must however be based on 19 X 69mm hardwood skirting as specified.

13.2.5. Details of the galvanised support structure must be approved by a registered engineer as well as the Principal Agent prior to manufacture.

13.2.6. All thresholds to be grano with reeding or an approved alternative.

13.3. The area under the floor structure of the raised modular structures shall be closed with a durable and corrosion proof side wall material. The material shall be capable of withstanding impact that can be expected at a school e.g. kicked with a boot or banged with a school bag with a 10kg load. The skirt shall be totally vermin and insect proof but any water that may accumulate during high rain fall, must be able to drain away.

13.4. All surfaces under buildings including v-joints to external walls must be treated with termite proofing. Guarantee Certificates from a registered applicator must be provided.

14. EXTERNAL AND INTERNAL WALLING

14.1. The wall construction method contemplated must allow for the dismantling, transportation and re-location on an alternative site, estimated not further than 200km. A re-location manual, detailing the dismantling and re-erection of the structure must be submitted with the tender.

14.2. All walling to comply with the requirements of approved Agreement South Africa certificate.

14.3. All internal walls to have a dado rail of a minimum dimension of 19 x 100mm, fitted at a) 500mm centre line above finished floor level for Grade R, b) 575mm centre line above finished floor level for grades 1 to 6 and c) 750mm centre line above finished floor level for grades 7 to 12 (height to be adjusted to the table chair height for primary or secondary schools). Dado rail to be manufactured from hardwood or an approved durable impact resistant material, twice angle rounded and finished with an acceptable finish. Dado rail to be secured to the walls with minimal holes into the wall surface.

14.4. All buildings shall have two gable ends. The full gable end construction shall be from the same material as the walls and comply to the requirements of Agreement South Africa certificate. The gable trimming shall match the roof sheeting.

15. DOORS

15.1. All doors shall bear the SABS mark of approval and shall be manufactured by a SABS permit holder.

15.2. External Doors:

15.2.1. All external doors to be 44mm x 813 x 2032mm meranti framed ledged and braced doors formed of 44 x 220mm top and bottom rail, 22 x 100mm bracing rail and stiles, 22 x 69mm tongued grooved and V jointed one side boarding, twice countersink screwed at intersection with internal panels rebated and filled with 6mm Sapele veneered plywood or similar approved.

15.2.2. All joints between rails and stiles shall be of mortise and tenon construction with min.3mm brass pins.

15.2.3. All doors fitted with an approved corrosion proof durable door handle and a barrel type lockset, three brass butt hinges, standard profile weather drip and rubber doorstop fixed to floor.

15.3. Internal Doors:

15.3.1. Internal doors shall be semi-solid flush type. The bottom of the doors shall be at least 150mm above finished floor level.

16. WINDOWS

16.1. Window areas and windows shall comply with the requirements of SANS 10400 and SANS 402. The roof overhangs shall be such that the thermal performance of the building comply with SANS 402.

16.2. The glazing thickness to be 6,4mm or to approval translucent safety glazing to prevent breakage and shall comply with the requirements of SANS 10400.

16.3. Where steel windows are used, members must be constructed out of FX7 sections and shall be hot dipped galvanised. Other window types will be considered for approval. All dissimilar metals shall be isolated to prevent galvanic corrosion. Earth bonding shall however be maintained as required by SAN 1042

16.4. Outwards opening bottom pivot type window shall be used on the walkway side of the classrooms and offices. (see vi below). This is to ensure that no opening sections open onto the walkway at a head height level.

16.5. The following window sizes shall be used for tendering purposes. Window sizes shall however comply with the requirements of SANS 10400 and SANS 402 with respect to lighting, ventilation, safety and thermal performance. The proposed minimum sizes are as follows:

16.6. Three 889w x 854h mm of which the top half is open able with bottom hung section(on the walkway side) and four 889w x 1248h mm (on the opposite side) are used per classroom, two 889 x 1248h mm for the Office and two 889w x 854h mm for the Store. Windows in the toilet areas shall be frosted and sized according to SANS requirements for lighting and ventilation. Provide at least one 600 X 600 open-able window in each toilet and additional windows in the circulation space in order to comply with SANS requirements.

16.7. All windows to be fully burglar proofed with an approved burglar bar system manufactured from corrosion proof material. Burglar bars shall however not restrict the opening capability so that the fresh air requirements according to SANS 10400 are satisfied.

17. ROOF CONSTRUCTION AND COVERING

17.1. The construction of the roof can be conventional prefabricated timber trusses with bracings (to SANS 10163), or a steel construction (to SANS 10162). The design and erection to be approved by a Registered Engineer and a certificate of compliance issued on completion.

17.2. The roof pitches to be not less than 15° and the Live and Wind Loads to be in accordance with SANS 10160.

17.3. The minimum roof covering must be pre-painted zinc aluminium AZ150 with a minimum thickness of 0,6mm 500 MPa corrugated iron roof sheeting in single lengths fixed to purlins. IBR profile and concealed fixing roofs will be considered and preferred. If the contractor wishes to use an alternative, he must supply the information with his tender for consideration. All cut ends shall be re coated with an approved paint that match the original colour.

- 17.4. All capping, eaves closure, barge boarding etc to be included and comply with the specifications.
- 17.5. All roofs to have a min. of 600mm eaves overhang, and min. 300mm verge overhang. The overhang dimensions may be increased to comply with the requirements of SANS204.
- 17.6. 15 x 225 Fibre cement or other similar approved fascia boards shall be fitted and painted to paint manufactures specifications. Only brass screws shall be used to fit fascia boards. 38 X 76 backing timber shall be installed between the trusses. Fascia boards shall not fixed by screwing into the end grain of any timber.
- 17.7. The roofs to be fitted with 125 x 150 x 125mm x 0.80mm thick powder coated pre-painted zinc aluminium AZ150 500MPa sheet steel or other similar approved gutter with 75mm wide laps fixed to falls to fascia with brackets not exceeding 1000mm centres, including all ends, outlets, etc.
- 17.8. Powder Coated Pre-painted rainwater downpipe must be allowed for at each corner of each class modular unit. Down pipes to be fitted with leaf filters before water is allowed to flow into the rainwater harvesting tanks. Final number off downpipes will be adjusted after contract award according to flow calculations based on the maximum rainfall of the area and actual roof area.
- 17.9. All roofs to have 38 x 228mm gang boarding along entire length of building if an attic is created.
- 17.10. Roofs ties to be provided in order to ensure that the roof structure is correctly tied to the supports or alternatively to the slab as per the requirements to the Engineer.

18. CEILINGS

- 18.1. All classrooms, offices and stores must be fitted with ceilings. Ceilings could be an integrated system with the roof sheeting or a conventional ceiling construction. Ceiling construction shall be such that the thermal performance of SANS 204 as well as structural and fire performance as per SANS 10400 are fully satisfied.
- 18.2. A typical ceiling construction shall consist of 6,4mm Gypsum board sheets with hardwood cover strips or pre painted 'H' profile metal jointing strips, continuous in one direction and cut in between in the other direction, between sheets and fixed to 38 x 50mm brandering at 400mm centers including additional brandering at outer edge of rooms and along joints of ceiling plates. Ceiling supports and roof construction shall be designed to include the loading imposed by the Insulation requirement according to SANS 204.
- 18.3. If the contractor wishes to use alternative, e.g. suspended ceilings, he must supply the information with his tender for consideration.
- 18.4. An approved painted cornice at junction of wall and ceilings must be provided.
- 18.5. All ceilings to be insulated with a SABS approved insulation material and shall comply with the thermal performance required by SANS 402 and fire performance required by SANS 10400
- 18.6. Provide one trap door in conventional ceilings per block.

19. PAINTING

- 19.1. If not pre-painted with a system equal or similar to "Colorbond", all exposed surfaces and un exposed surfaces subjected to corrosion shall be painted using an approved standard painting system. The painting system shall be designed and guaranteed by the paint manufacturer for a minimum period of five years. All paint and painting systems shall be certified by independent certifying body(ies) such as SABS, SANS, ISO, ASTM and BS. Un-certified paint and paint systems shall not be accepted.

19.2. The following basic guidelines shall form the basis on which the painting system is chosen:

19.2.1. Internal Walls:

- a) One coat sealer/undercoat and two coats topcoat.

19.2.2. Timber Doors:

- a) One coat sealer/undercoat and two coats topcoat (Varnish will not be acceptable)

19.2.3. External fibre-cement sheeting:

- a) One coat sealer/undercoat and two coats topcoat

19.2.4. Windows:

- a) Windows that are not pre-painted according to an approved painting system or anodised/ galvanised, shall be painted on site. One under coat/etch primer shall be applied prior to installation. The full painting system shall then be applied after installation.

19.3. All painting systems together with ISO, ASTM, SANS, SABS or BS certificates to be submitted for approval prior to commencement of work.

20. SUNDRIES

20.1. Writing Boards

20.1.1. Supply and fit two standard baked enamel writing boards each size 2 400 x 1 200mm high per class room. Each writing board to be complete with a chalk rail. Writing boards to be secured to the walls with minimal number of holes into the wall surface, chalk rail not to be more than 900mm above FFL.

20.2. Pinning Boards

20.2.1. Supply and fit 12mm thick x 1,2m high soft board, or similarly approved pinning board across the full width of the rear of each classroom. Pinning boards to have a 44 x 22mm rebated hardwood surround, finished with three coats polyurethane suede varnish. Pinning boards to be secured to the walls with minimal number of holes into the wall surface.

20.3. Fire Extinguishers

20.3.1. Supply and fit one (1) 4,5kg DCP fire extinguishers per room, fixed to a hardwood backing with minimum size of 380mm X 180mm X 22mm with 4 X 5mm chamfer around exposed edges. Fire extinguisher handle to be 1200mm above FFL. Inside of wall shall be complete with internal bracket to carry fire extinguisher and hardwood backing. Fire extinguisher and hardwood backing to be secured to the wall through the reinforcing bracket.

20.4. Long-arms

20.4.1. Should windows be of pivot type, supply and fit one 1 200mm long-arm per classroom and admin office, fitted behind the door with two brackets.

20.5. Cupboards

20.5.1. Supply and fit one pre-painted steel stationary cabinet size 900x450x1800mm, painted in a light approved paint colour, to each classroom and office. Screw cupboard to the wall.

20.6. Signage: Supply and install the following minimum signage:

- 20.6.1. Revere engraved clear 5mm thick acrylic plastic above each external door giving room number. Numbers shall be min. 50mm high and acrylic size shall be 70 high by 70 wide. All number signs shall be of equal size.
- 20.6.2. Standard SANS fire extinguisher and arrow signs. One pointing down arrow and one fire extinguisher sign shall be mounted above each fire extinguisher and above each door of the room where the fire extinguisher is mounted.
- 20.6.3. Each sign shall be fixed with four min. 3mm diameter stainless steel screws. Signs on the tanks shall be pre glued and no screws shall be used. Where screws penetrate wall covering, polyurethane sealer shall be applied to prevent moisture penetration into the wall.

21. ELECTRICAL INSTALLATION

- 21.1. All fittings and accessories shall bear the SABS / SANS mark of approval and must be presented to and approved by the Principal Agent / Departmental Representative prior to installation.
- 21.2. Fluorescent fittings shall be twin-tube, or as specified elsewhere, broad open-channel, fitted with electronic ballasts (Professional). Timber must be provided to secure fittings where necessary. Fittings must be mounted flush with the ceiling and cover-strips must be neatly cut to accommodate the fittings.
- 21.3. The fittings shall be properly secured with plated wood screws, screwed into timber. "Butterfly" screws will not be accepted. Timber supports to be provided between the steel beams in a steel roof construction, the fittings shall not to be screwed to the suspended ceiling frame-work.
- 21.4. The minimum luminance required at a level of 750mm from the floor level is 250 lux.
- 21.5. The supply and installation at ceiling height of the following minimum quantities shall be allowed for in the tender price:
 - 21.5.1. Classrooms: 6 of 2 x 58 Watt open channel fluorescent fittings similar or equal approved to ILM/ATL/FMII/258 in each class room.
 - 21.5.2. Offices: 2 of 2 x 58-Watt open channel fluorescent fittings similar or equal approved to ILM/ATL/FMII/258 in each office.
 - 21.5.3. Store areas: 1 of 2 x 58-Watt open channel fluorescent fittings similar or equal approved to ILM/ATL/FMII/258 in each storeroom.
 - 21.5.4. External Lighting:
 - a) All lighting will be LED fittings inside and out and hand switched on and off.
 - b) Inside light fittings will be the 'double fluorescent' type.
 - c) Outside lights will be of an approved waterproof type.
 - d) External lighting shall be done with white deep base round die cast aluminium fittings with 2 x PL9 lamps and two ballasts. The fitting shall be complete non-discolouring polycarbonate lens secured with three stainless steel screws.
 - e) Allow one luminaire above each external door, one luminaire above each exposed gable end and one luminaire per two class rooms on the north and south boundary elevations.
 - f) All external lighting shall be switched with photo cell detectors and contactor. Allow two photo cells and contactors for this project. One each for the north wing and one for the south wing. The maximum number of luminaires switched by a photo cell and contactor combination shall be 10. The contactor rating shall be at least 30% more than the maximum current of all the luminaires switched by the contactor.
 - g) All external luminaires shall be properly sealed to prevent water, dust and insect ingress.

Special care shall be taken when fitting the electrical wiring to maintain the seal. The minimum IP rating shall be IP56.

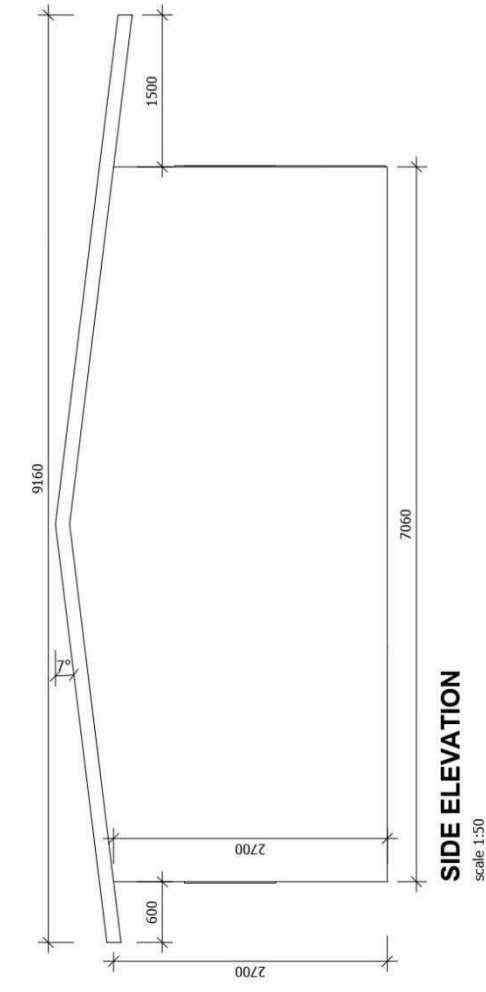
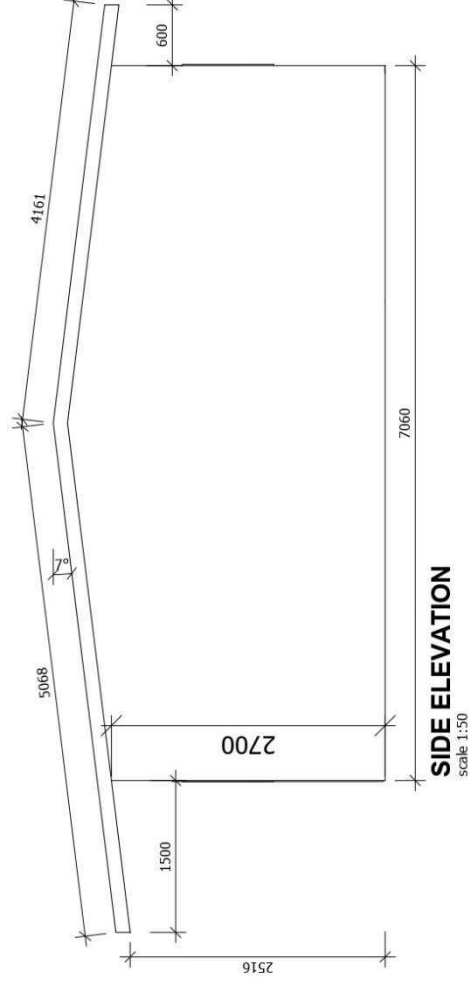
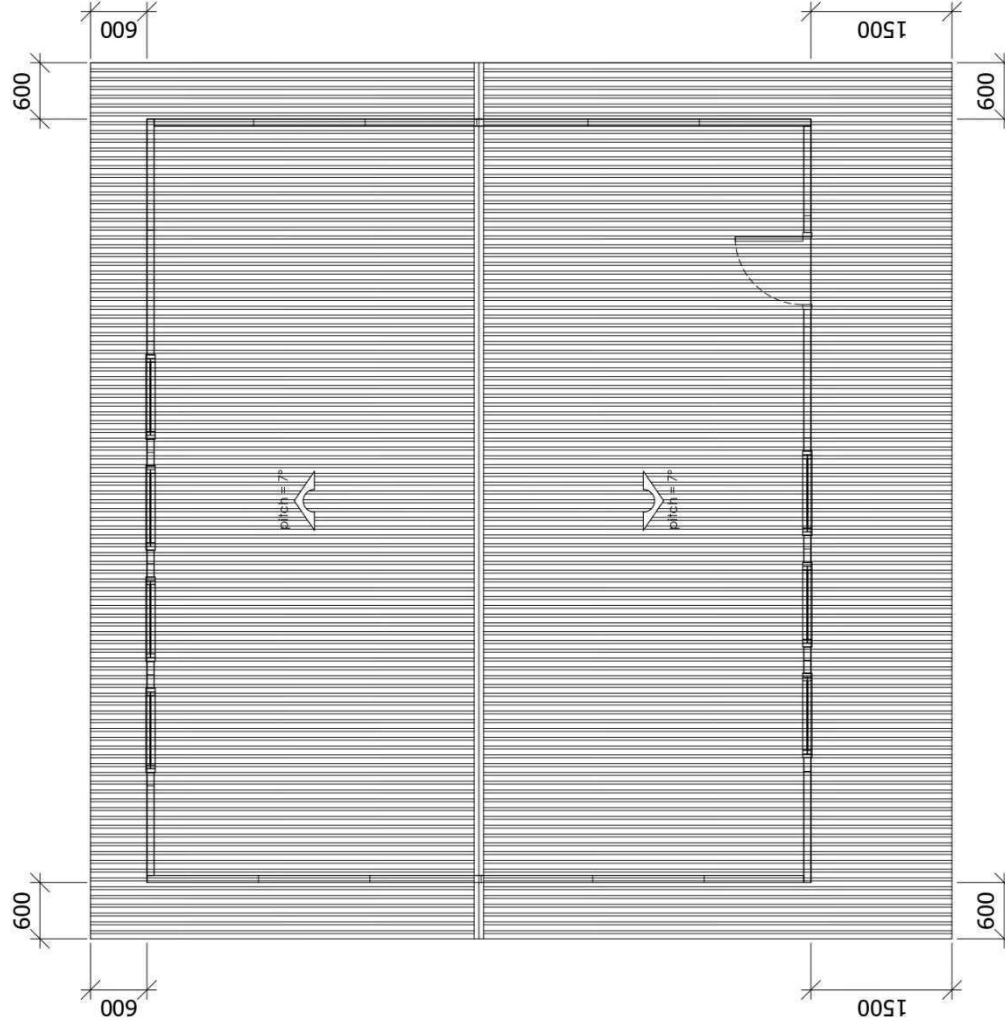
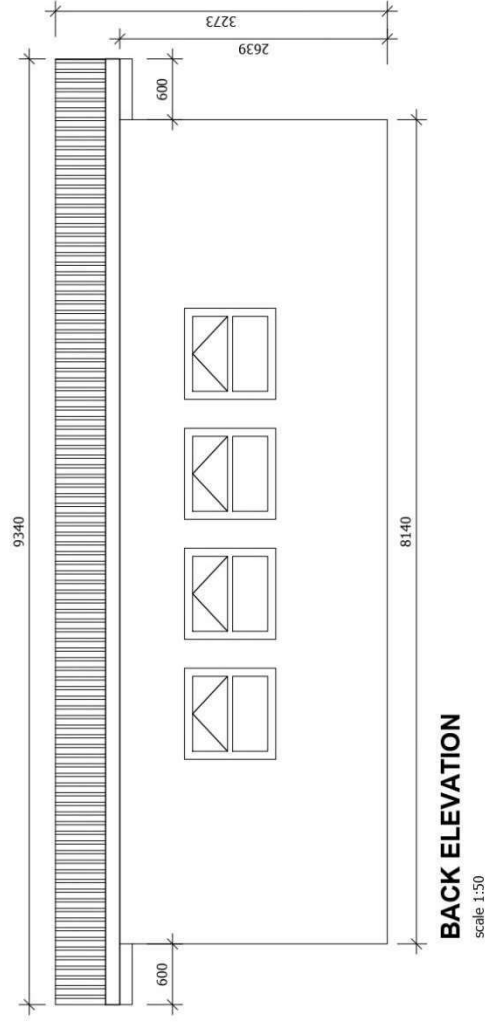
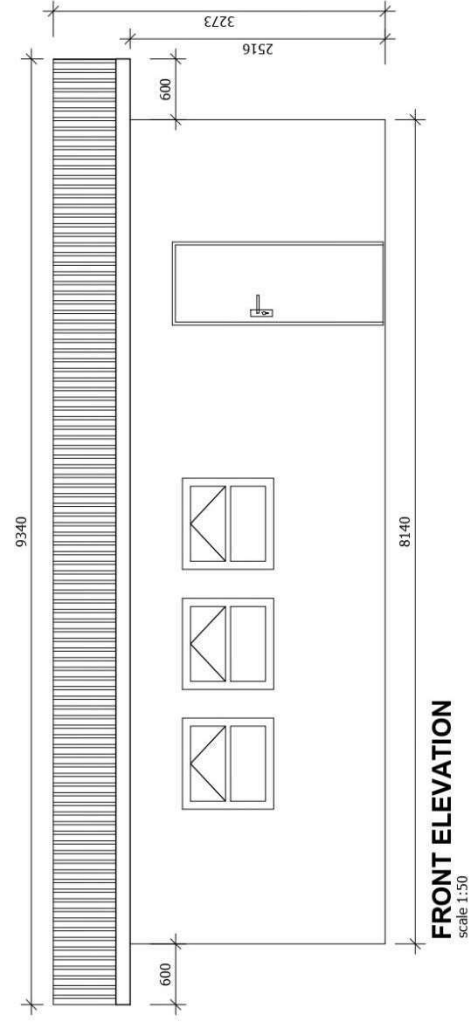
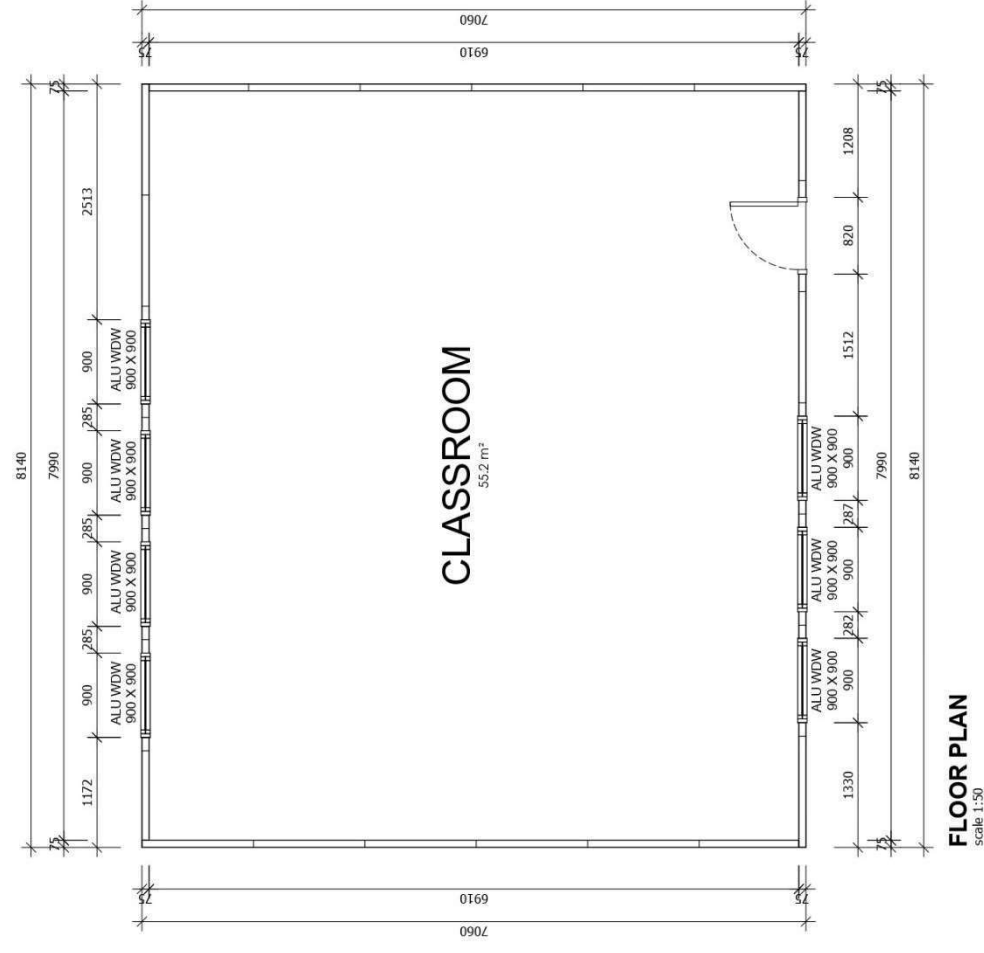
- 21.6. The round 2 x PL9 luminaire shall be either by Beacon lighting BL/RD-NB 2 X PL9W or any other equal and approved type and make. Fluorescent tubes and lamps are to be of the highest quality. No inferior or "no-name" brands will be accepted only that which comply with the applicable SABS/SANS . All fitting/s requested must be provided complete with tubes. Contractor must allow for, Phillips or Osram, tri-phosphor lamps colour: White
- 21.7. The single-lever light switches are to be equal or other approved to Crabtree type 2471, complete with steel cover-plates and steel screws. The contractor must allow for 1 x single lever switch complete with 50mm x 100mm box and white faceplate per classroom, per office, per store. The light switch is to be mounted next to the door and at 1200mm above floor level to the centre of the switch.
- 21.8. Socket outlets are to be equal or other approved to Crabtree type 6861 complete with steel cover-plates and steel screws. Bidders must allow for the supply and installation of 1 x duo 16A socket outlet complete with 100mm x 100mm box and white faceplate per classroom. The socket outlet is to be mounted adjacent to the classroom blackboard and at 1200mm to the centre of the outlet box. In the office areas, 2 of Socket outlets must be allowed for mounted adjacent to the desk position. The Store Areas will also require 1No. Socket outlet mounted adjacent to the door.
- 21.9. All socket outlets, switches etc. shall be fitted with powder coated steel cover plates and plated steel screws. The use of pop-rivets will be agreed upon on site.
- 21.10. New DB's where required shall be custom-made and installed complete with switch gear. Colour: White. DB to be installed externally to the ablution block. Allowance must be made for at least six (6) spare MCB spaces. The spares shall be fitted with blanks. The circuit breakers shall be labelled. Labeling and legends shall be fully descriptive i.e give the exact location of the outlets e.g. "Socket outlet: class room 2"
- 21.11. A danger sign is to be fitted to the face-plate. An engraved label is to be screwed to the outside of the door, identifying the DB as "SDB-B fed from SDB-A" etc. The Contractor must allow for one DB for each classroom block or where a classroom is constructed as a single unit at any particular site.
- 21.12. The socket outlets shall be wired with three 3 of 20A MCB's. One per class room wing and one for the office and store. A separate 20A MCB shall be provided for the sewage treatment plant.
- 21.13. Lighting shall be wired with four of 10A MCB's. One for offices and stores, one for south wing, one for north wing, one for toilet blocks and two for external lighting.
- 21.14. Lighting and socket outlet circuits shall be connected to two separate earth leakage units. Each circuit per circuit breaker shall be wired with a separate neutral back to the relevant DB. Neutrals shall be clearly marked as to what circuit it is connected to.

- 21.15. Cables must be drawn through 'galvanized kick-pipes' for all surface entry/exits to buildings. 'Kick-pipes' to be neatly saddled at intervals not exceeding 1m. Kick-pipes to extend at least 300mm below ground and part the entry point into the building. All openings shall be sealed with expanding fire stop foam, neatly trimmed once cured and covered with 1mm galvanised cover plate.
- 21.16. The installation is to be properly tested and commissioned on completion and an 'original' Certificate of Compliance issued for the installation.
- 21.17. The Contractor must ensure that the premises are left in a clean, neat and tidy condition on completion of the installation. All expended materials no longer required must be removed from site unless specifically requested by the Departmental Representative not to do so.
- 21.18. On completion of the contract, the successful contractor shall notify the Principal Agent at least 7 days in advance before delivery will be taken.
- 21.19. All materials used must as a minimum conform to the relevant SANS standards and must bear the SABS mark.
- 21.20. Expended hazardous materials e.g. Fluorescent tubes, etc must be removed from site and disposed of in the legally required manner as prescribed by the Occupational Health and Safety Act.
- 21.21. The use of 'twin & earth' will NOT be permitted. 'Surfix' will be permissible with the approval from the Departmental Representative or Consulting Engineer.
- 21.22. The minimum wire sizes shall be:
- a) Each lighting circuit: 1,5mm² multi strand copper conductors with PVC insulation + 2,5mm² multi strand earth (with 10A.MCB)
 - b) Each plug circuit: 2,5mm² multi strand copper conductors with PVC insulation + 2,5mm² multi strand earth (with 20A MCB)
- 21.23. The use of PVC flexible hose as a substitute for PVC or any other type/s of conduit will not be permitted. However, in situations where the use of regular conduit is either impractical/impossible, written permission must be obtained from the Departmental Representative/Consulting Engineer prior to the installation thereof.
- 21.24. With all 3 phase supply installations, it is the responsibility of the Contractor to ensure that the load is 'balanced' over the 3 phases.
- 21.25. All wiring shall be done in conduit and sleeves. All materials used shall comply to the relevant SANS standard.

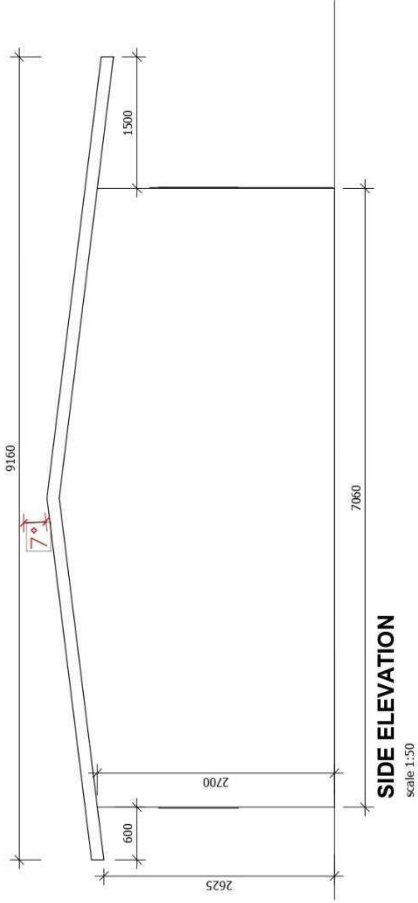
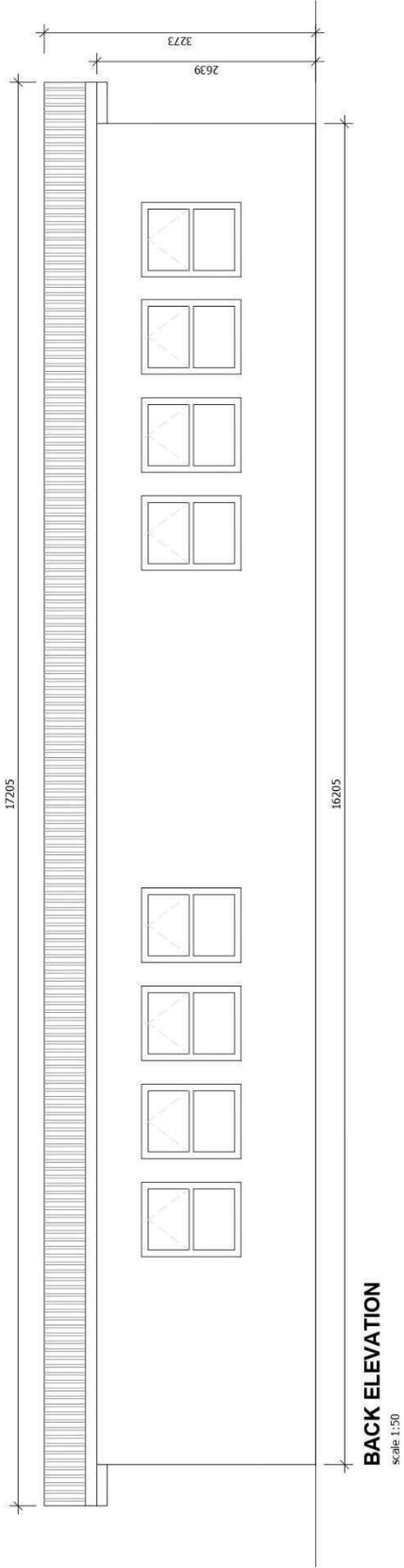
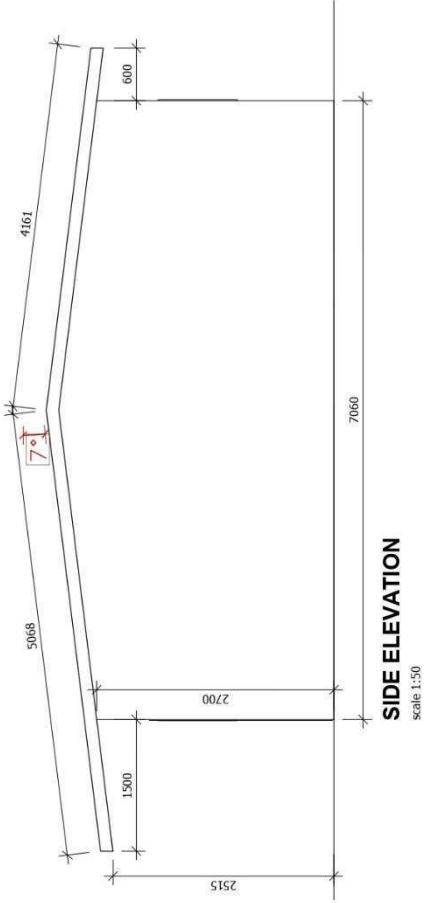
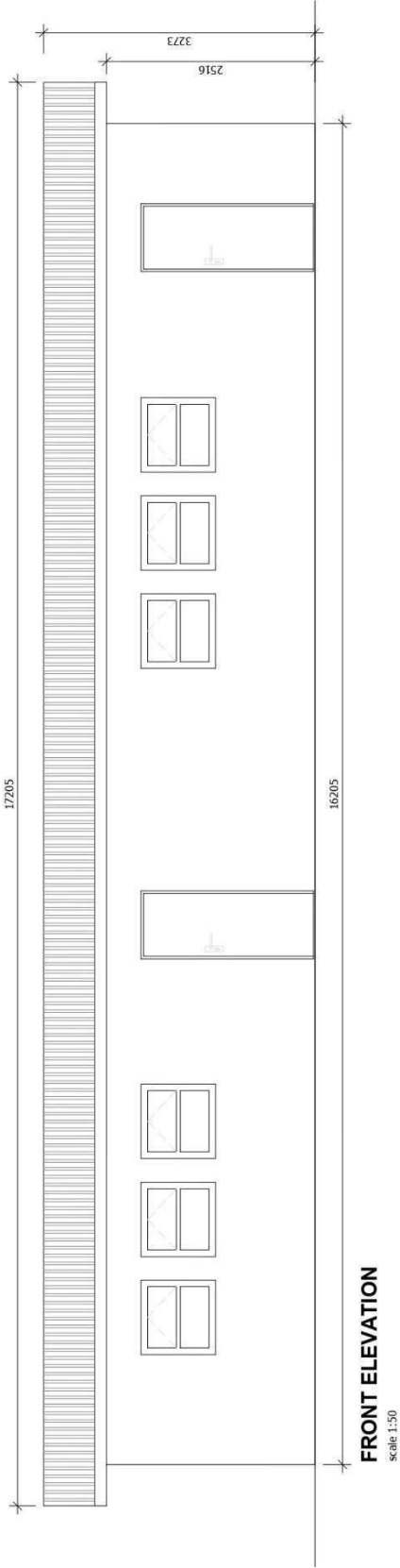
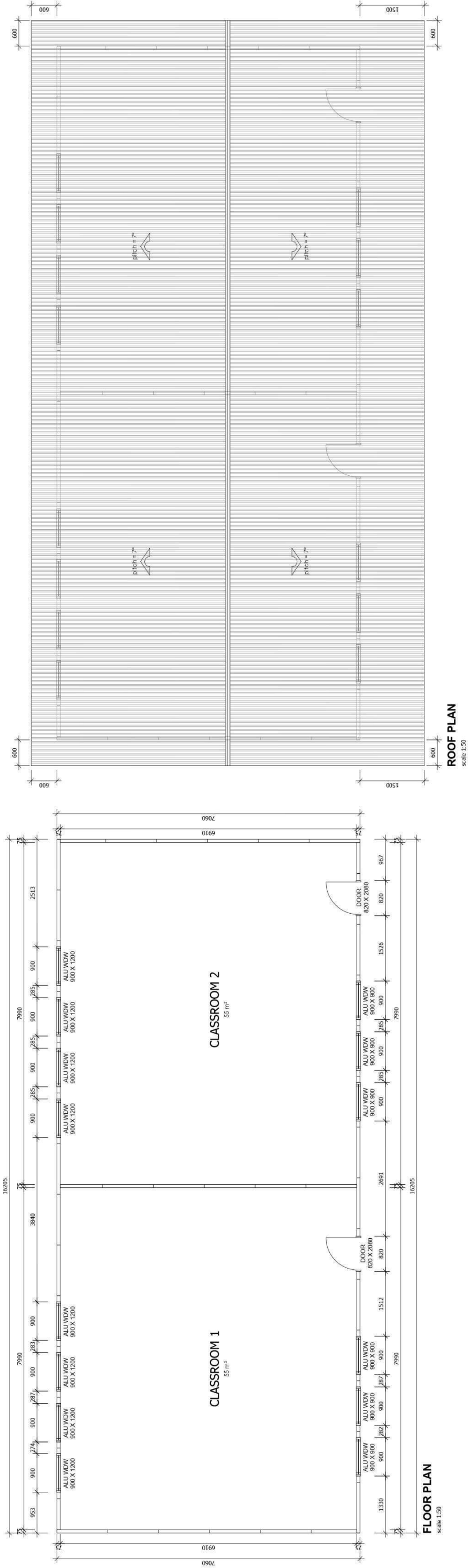
ANNEXURE C

PROFORMA MODULAR UNIT LAYOUT DRAWINGS

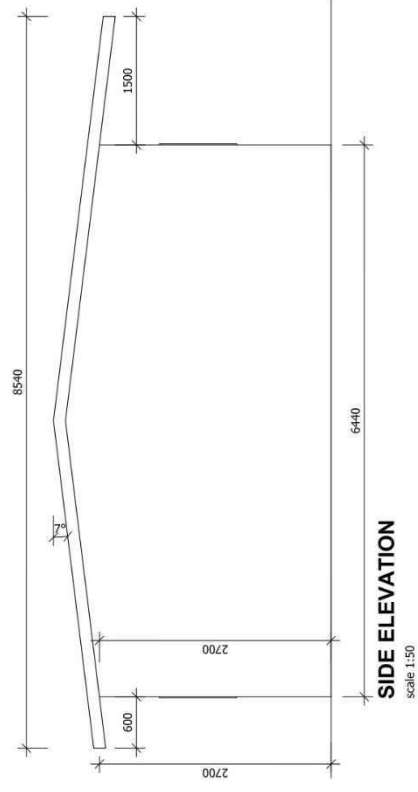
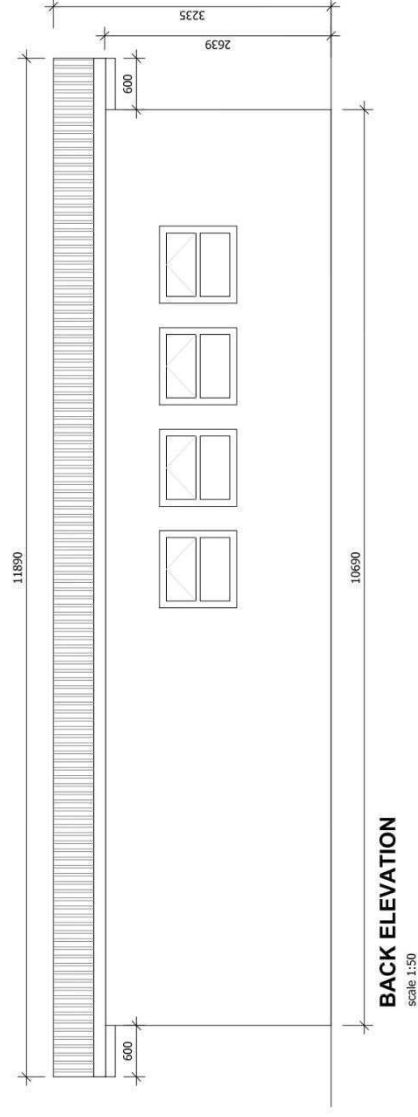
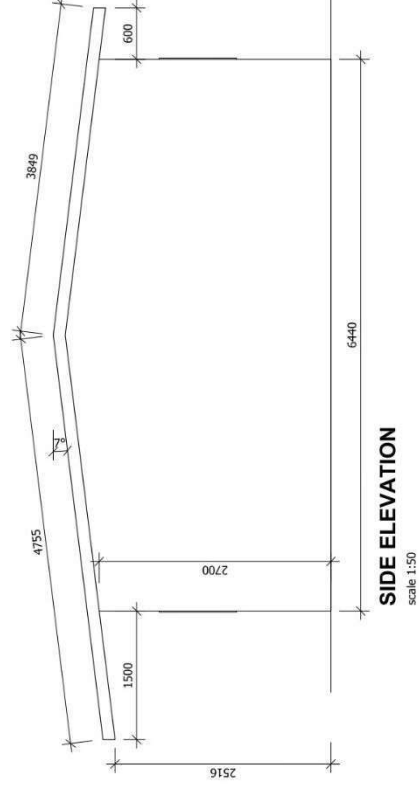
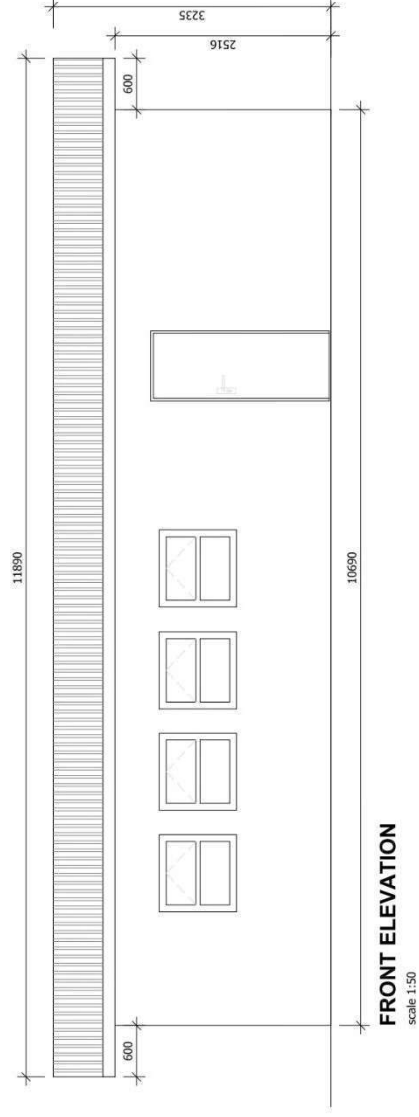
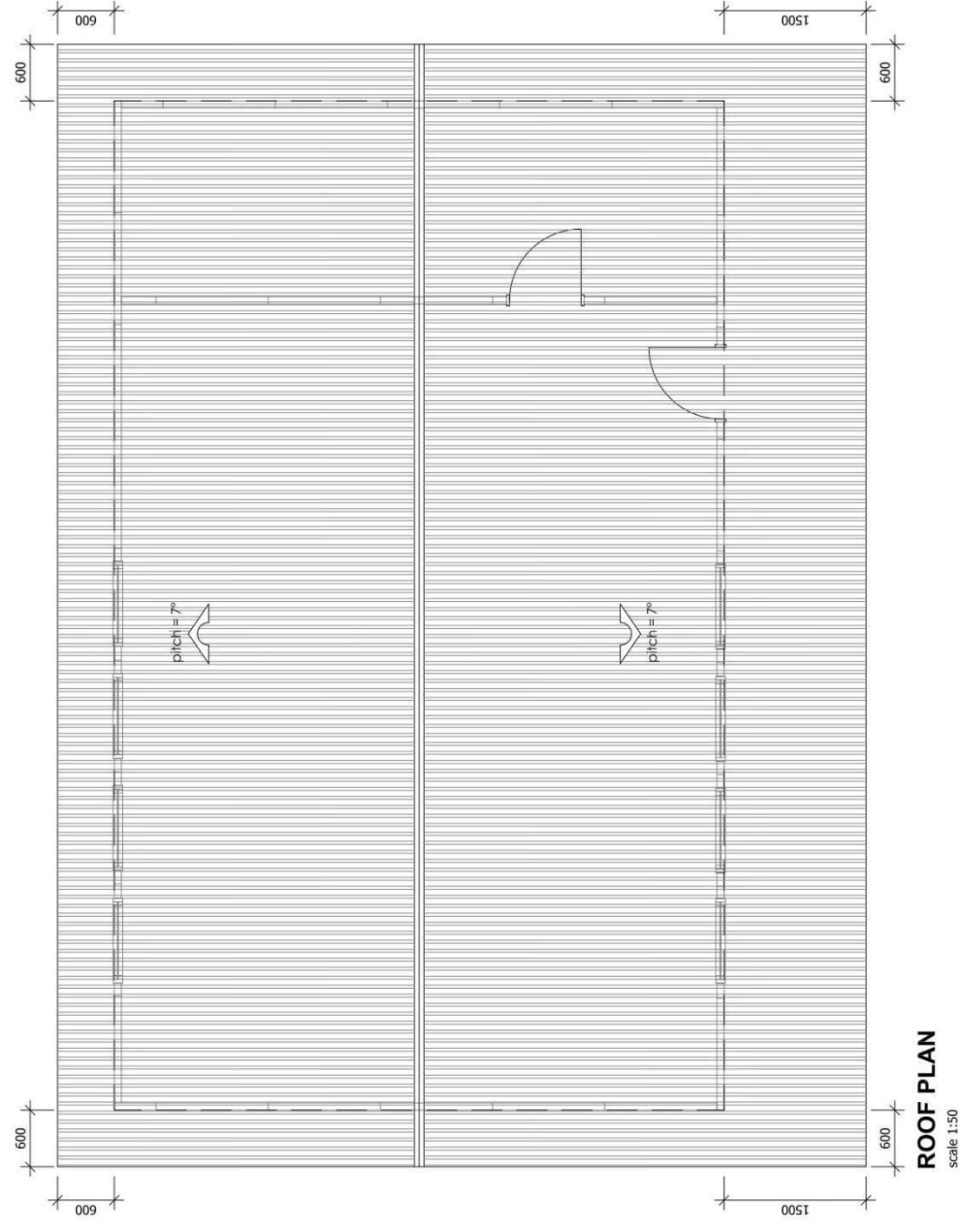
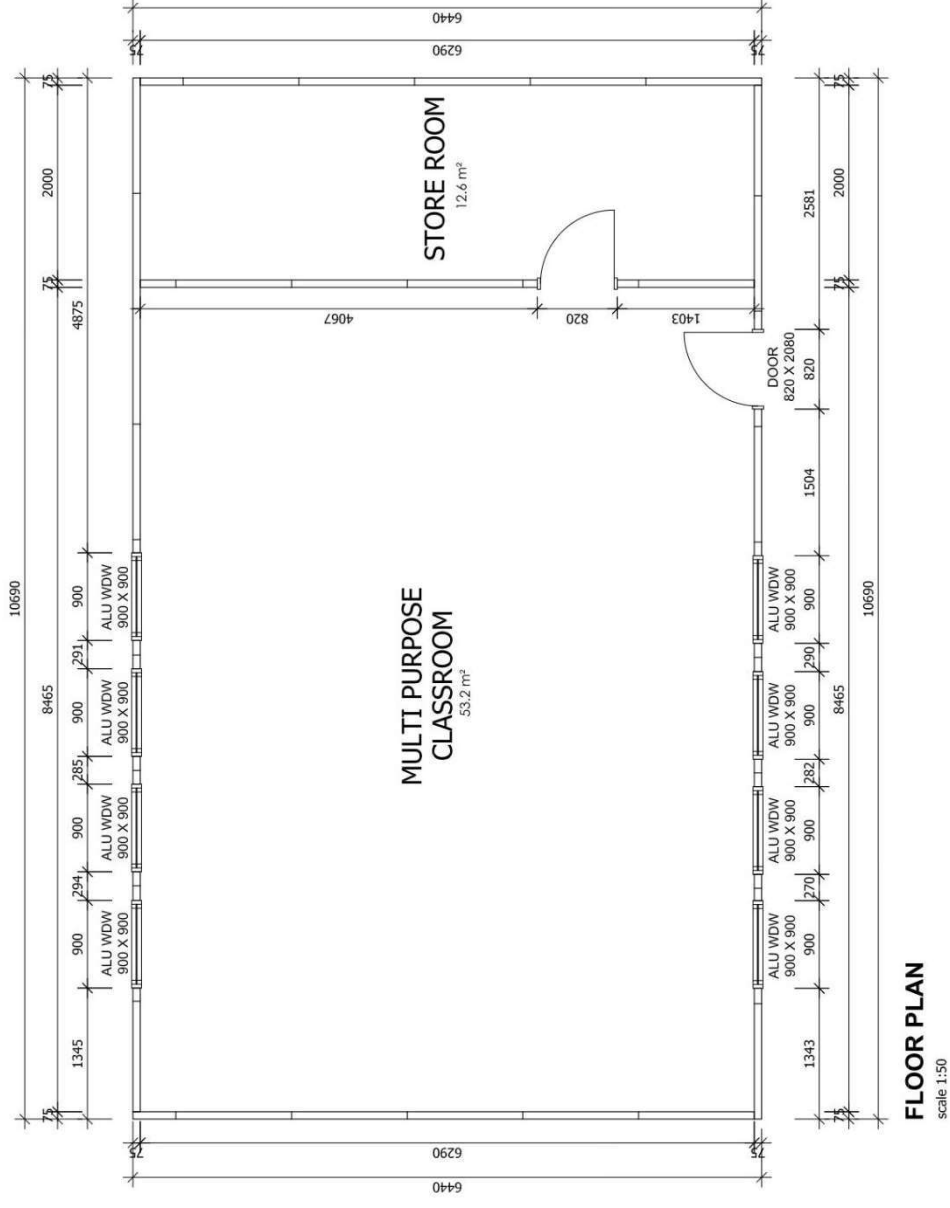
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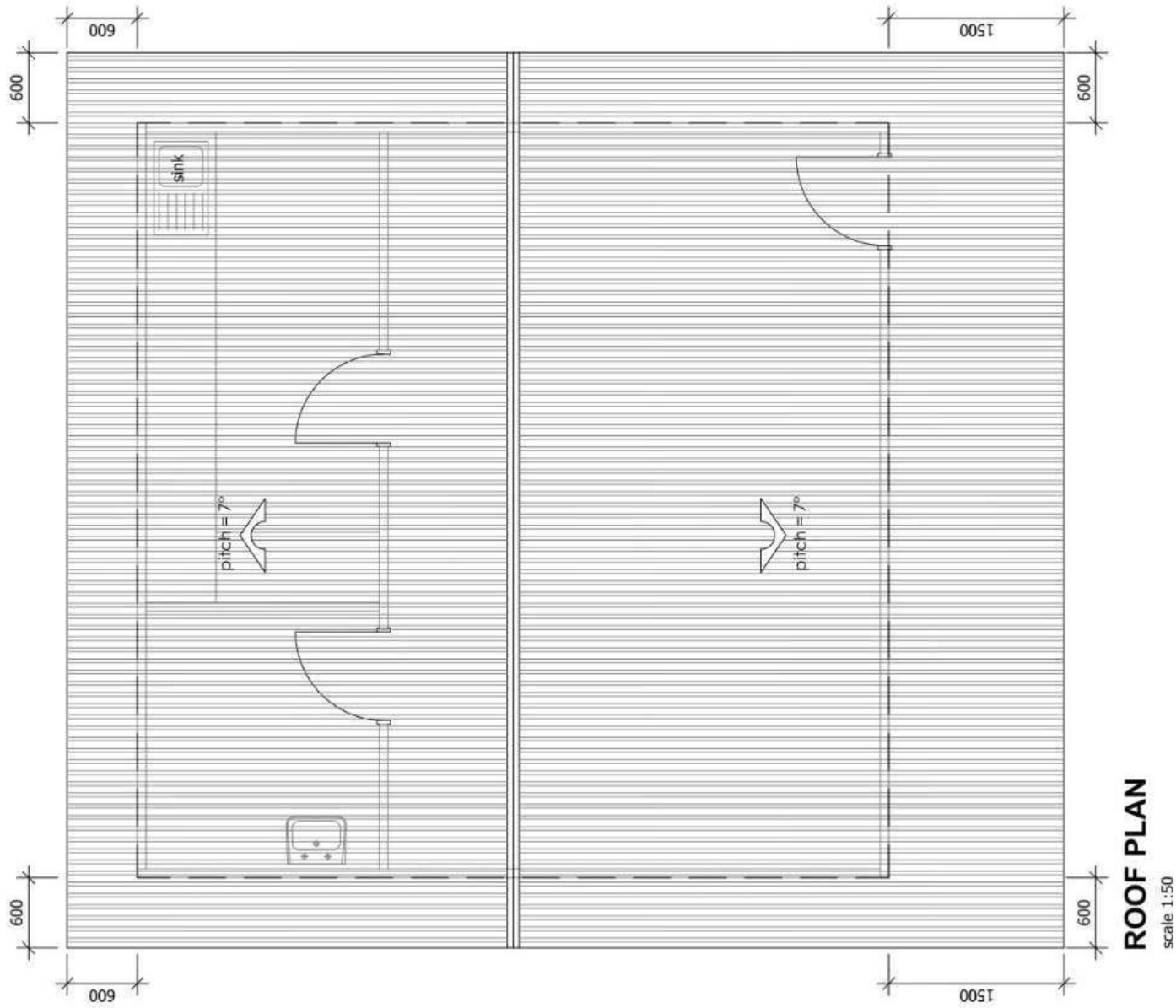
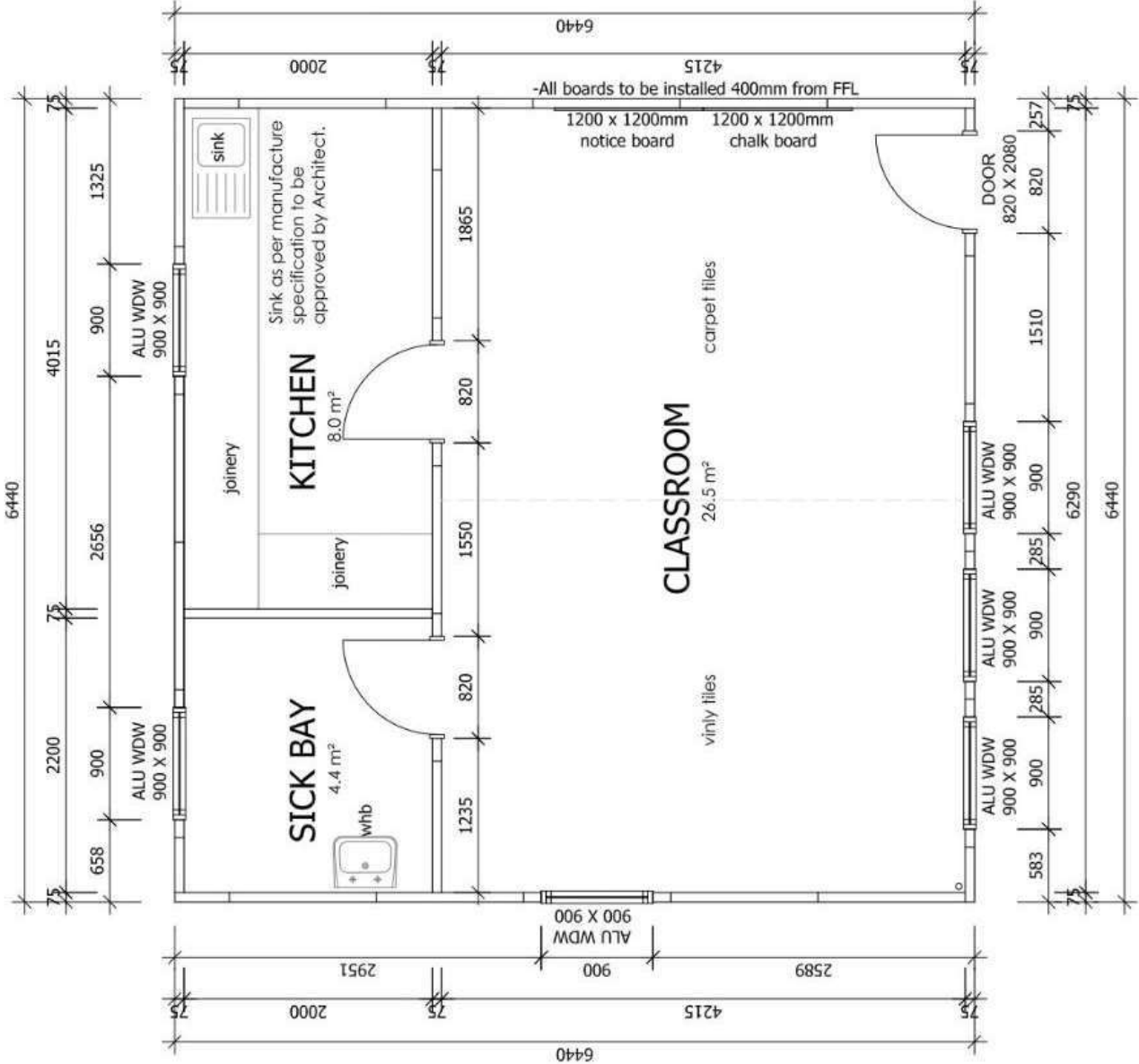


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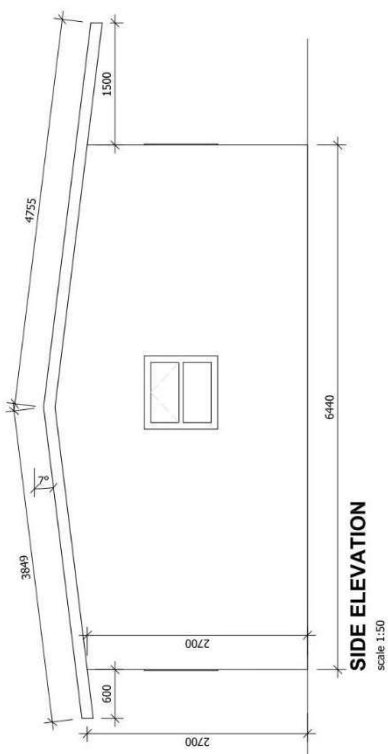
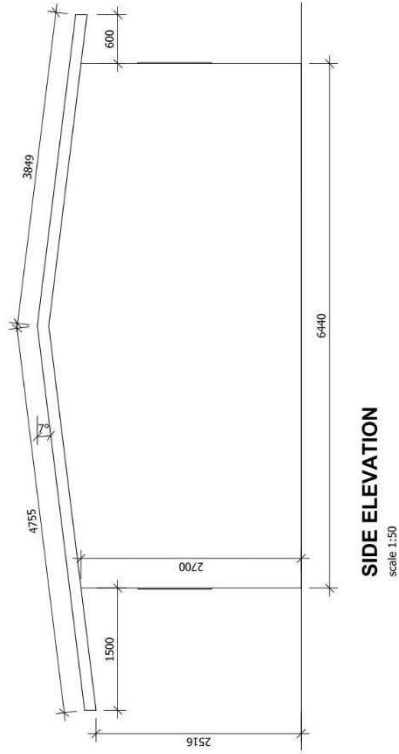
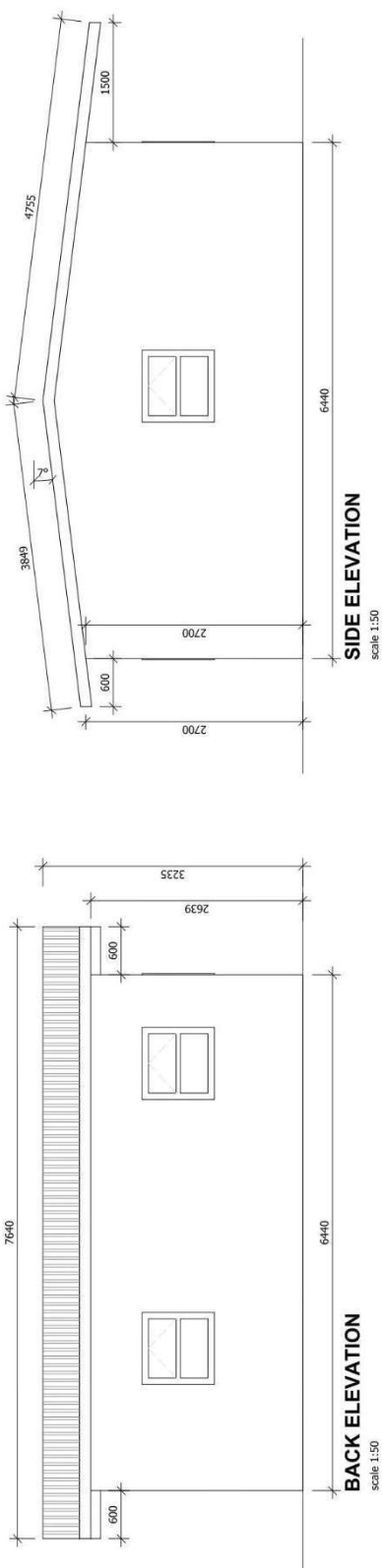
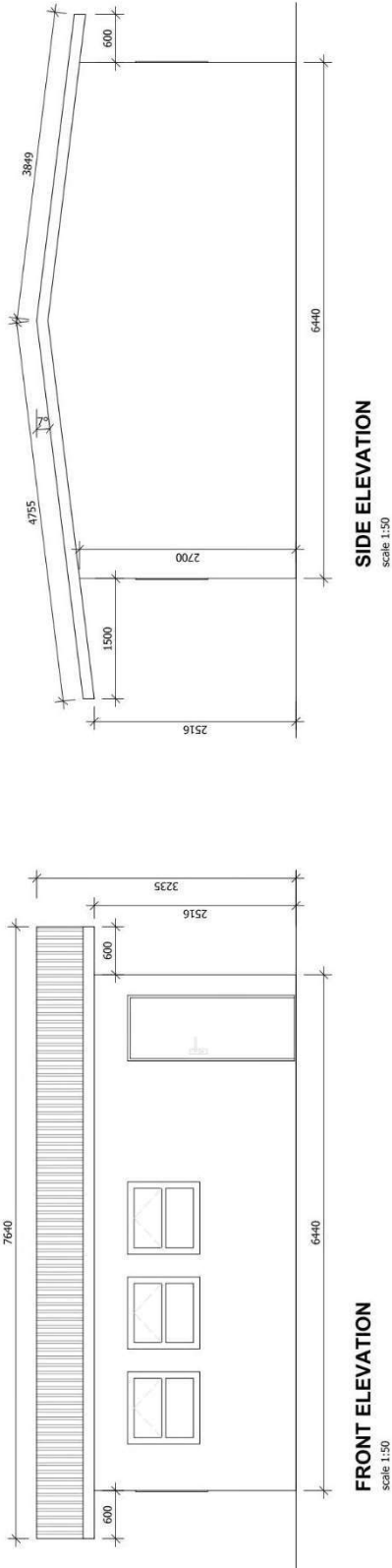
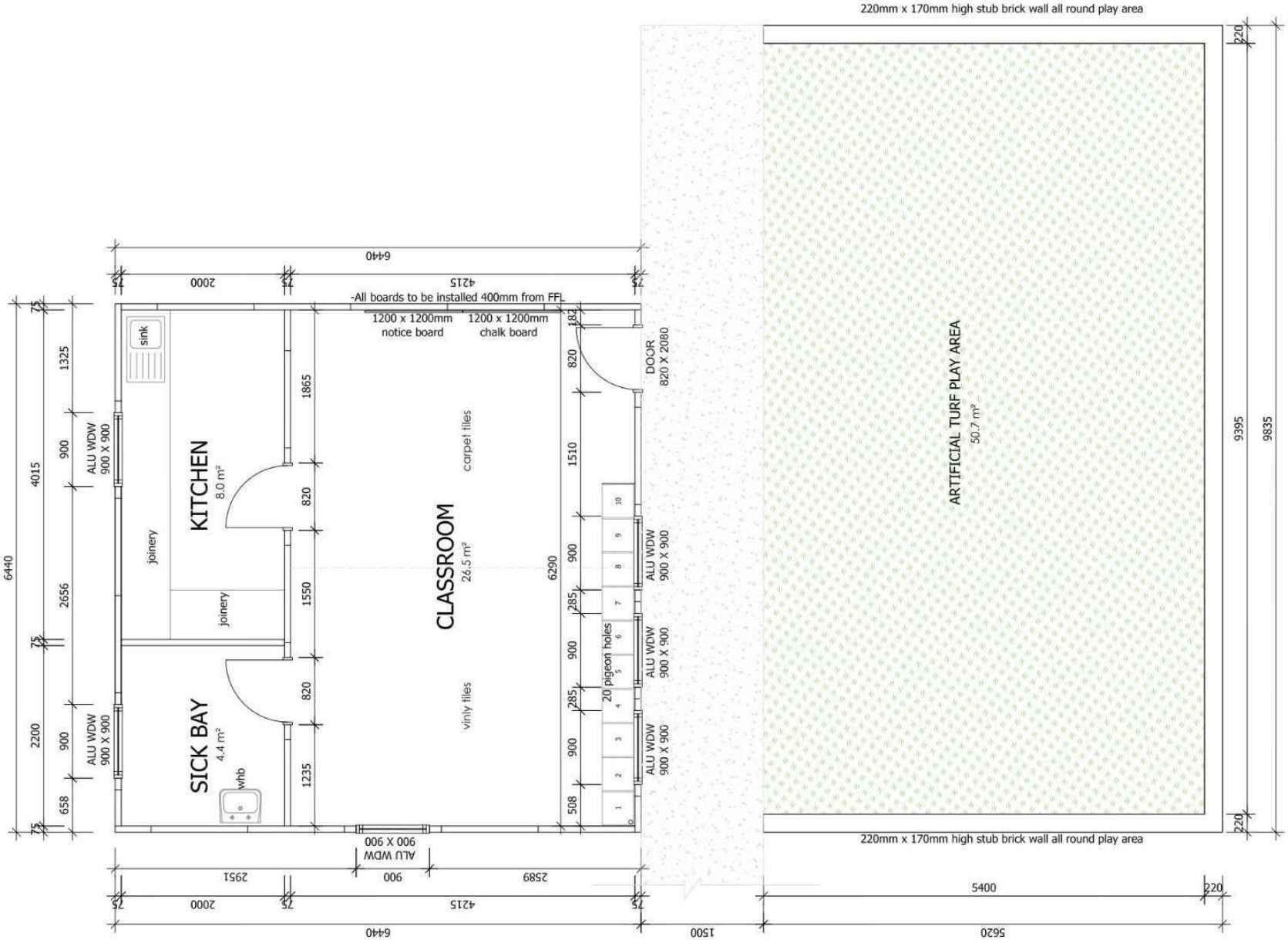


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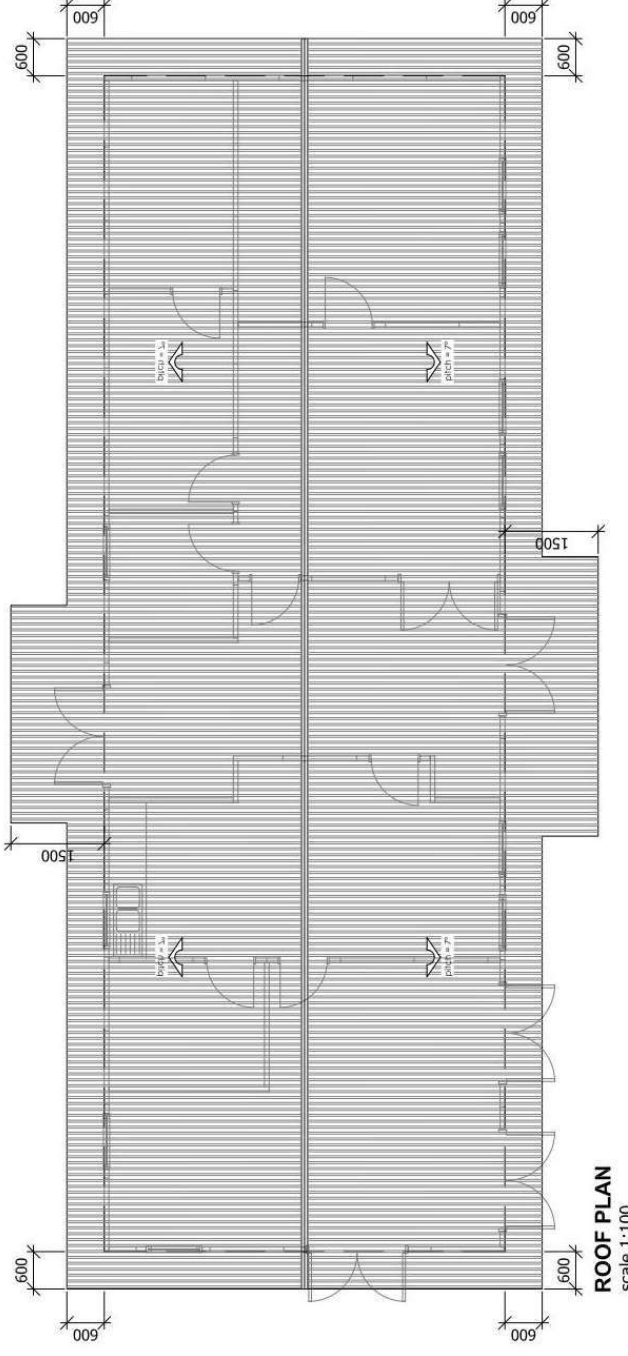
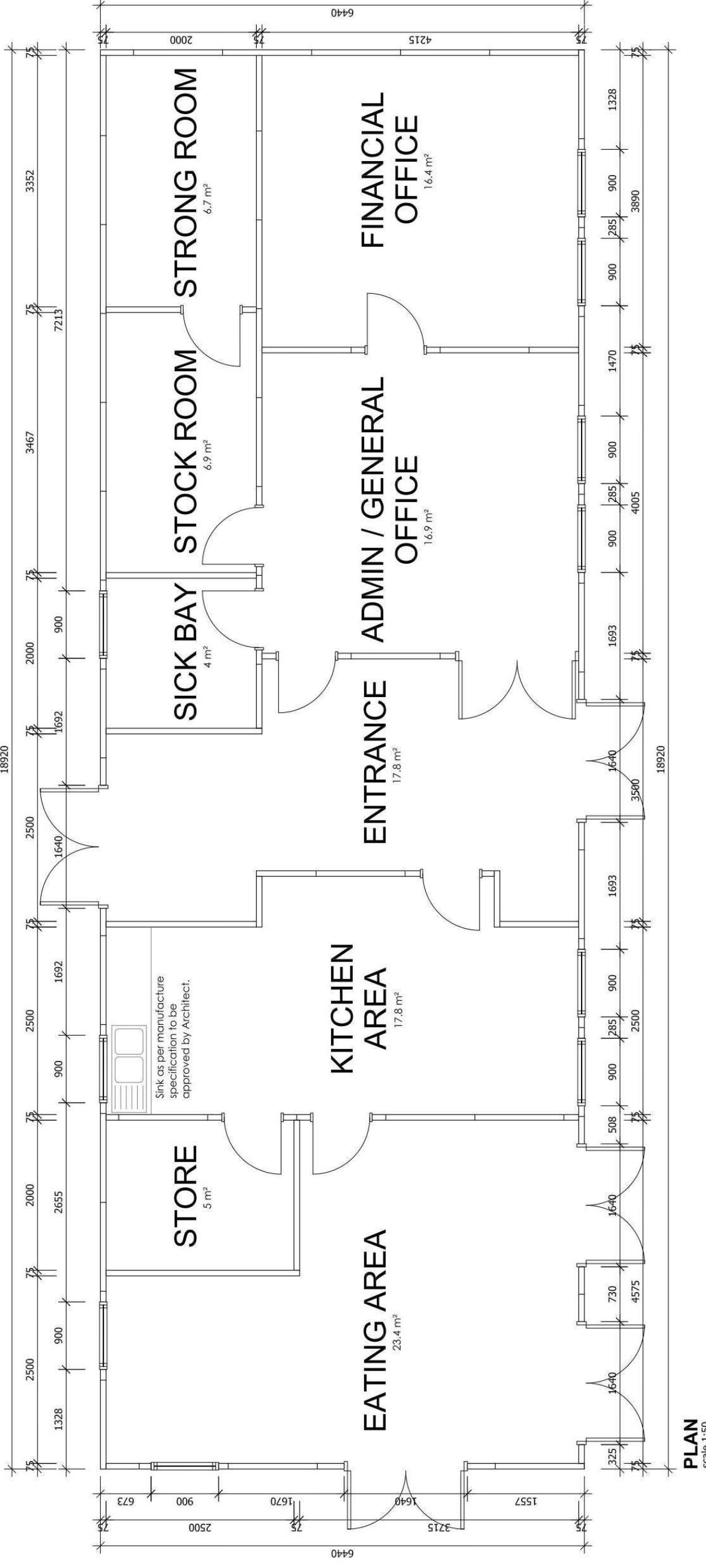




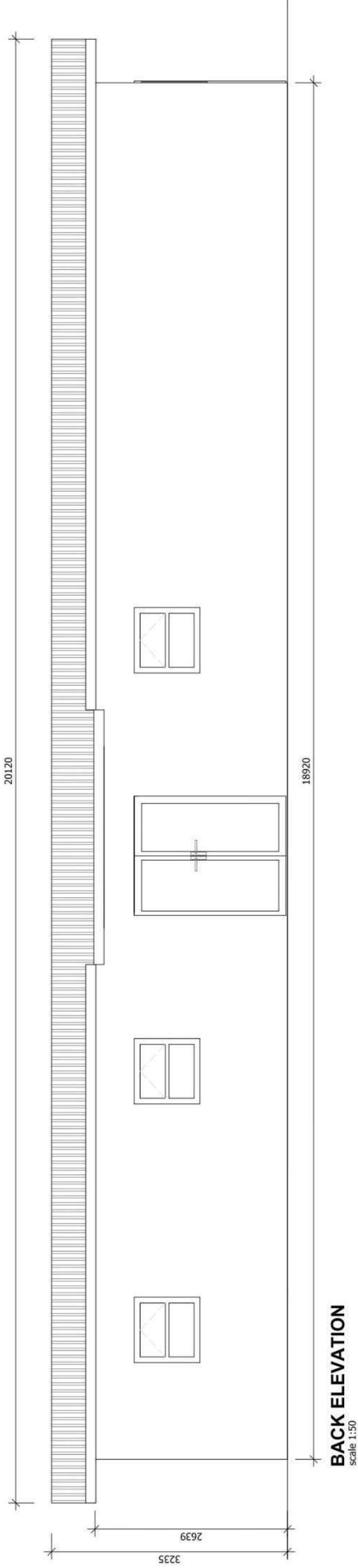
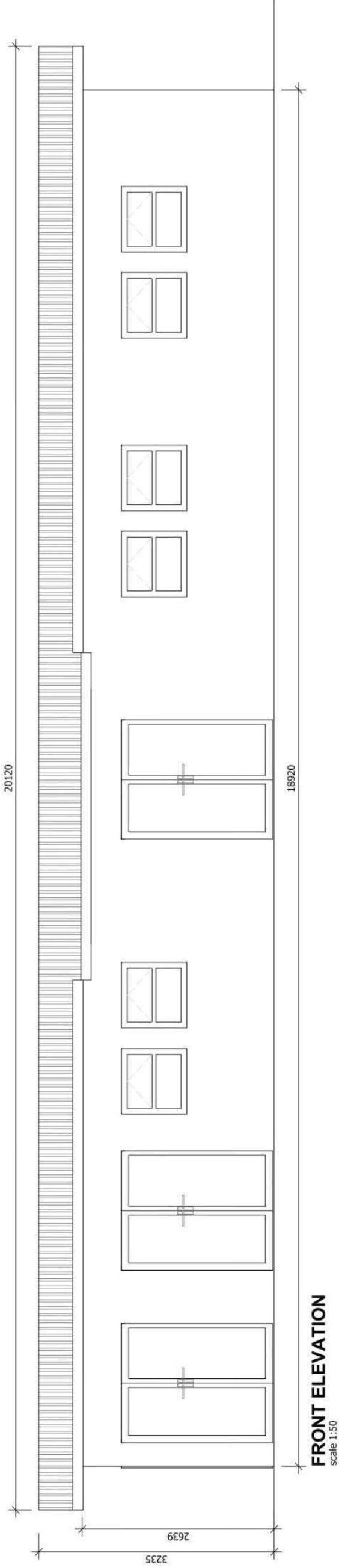
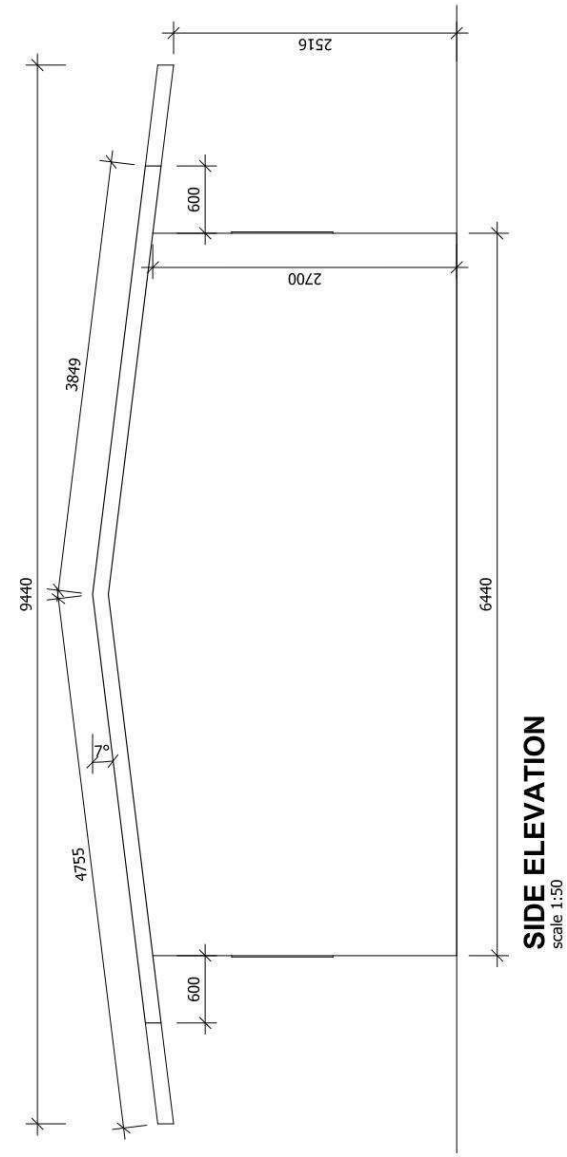
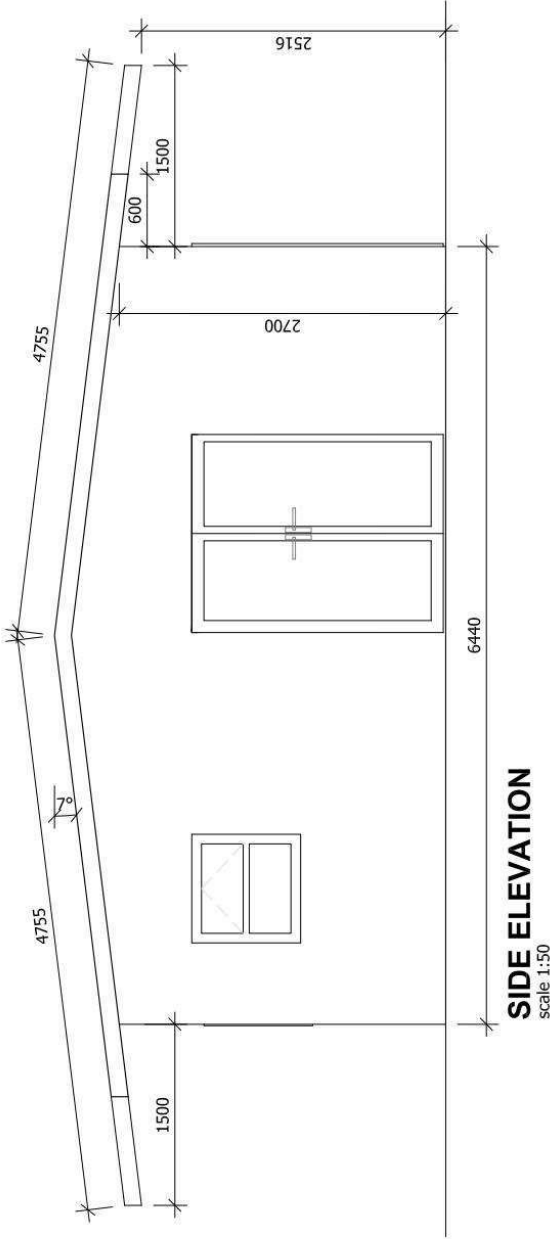
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MODULAR STRUCTURES TYPICAL LAYOUT DRAWINGS : COMBINED ADMINISTRATION AND NUTRITION UNITS



MODULAR STRUCTURES TYPICAL LAYOUT DRAWINGS : COMBINED ADMINISTRATION AND NUTITION UNITS



ANNEXURE D

RAFT FOUNDATION SHOP DRAWINGS (PREVIOUS PROJECT PHASE)

[illegible]

GENERAL NOTES:

- THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL SPECIFICATIONS, STANDARDS, DRAWINGS AND SUBMITTALS.
- DIMENSIONS MUST NOT BE SCALED OR ASSUMED. DIMENSIONS WILL BE CORRECTED IN WRITING BY THE ENGINEER.
- UNLESS OTHERWISE NOTED, FINISH TO THE ENGINEER FOR REVIEW AND APPROVAL PRIOR TO ANY WORK BEING CARRIED OUT.
- SUPPLY COMPACTION RESULTS TO THE ENGINEER FOR REVIEW AND APPROVAL PRIOR TO ANY WORK BEING CARRIED OUT.
- STEEL TRAVEL FOR VINYL FLOOR FINISH
- WOOD FLOOR FOR CERAMIC FLOOR FINISH
- CONCRETE FINISH TO THE ENGINEER
- COVER TO REINFORCEMENT:
 - SLAB = 30mm
 - BEAM = 50mm
 - FOUNDATIONS & RC WALLS = 50mm BOTTOM / 30mm TOP
- DIMENSIONS AND LEVELS TO BE VERIFIED BY CONTRACTOR ON SITE. ALL DIMENSIONS MUST BE SHOWN HERE. TO BE REDORDED TO THE ENGINEER IMMEDIATELY.
- UNLESS OTHERWISE NOTED IN THE PROJECT TECHNICAL SPECIFICATIONS, ALL MATERIALS AND WORKMANSHIP SHALL COMPLY WITH S.A.S. 1200 SERIES OF SPECIFICATIONS.
- BRICKWORK TO BE 100mm THICK AND 100mm HIGH AT EVERY LAYER ABOVE DOORS AND WINDOWS, CLASS 1 MORTAR.
- STRUCTURE OF T.O.S. MAKE MINIMUM COMPRESSIVE STRENGTH OF 10.0 MPa.
- 50mm BLINDING TO BE 100mm AND CAST BELOW FOUNDATION.
- INSPECT THE REINFORCEMENT PRIOR TO CASTING OF CONCRETE.

REFERENCE DRAWINGS
DO NOT SCALE - IF IN DOUBT, ASK

CLIENT

CLIENT'S NAME
DATE

DBSA
DEVELOPMENT BANK OF SOUTHERN AFRICA
Postal Address
P.O. Box 234
Hawley House,
South Africa

FOR APPROVAL
DATE
DESCRIPTION

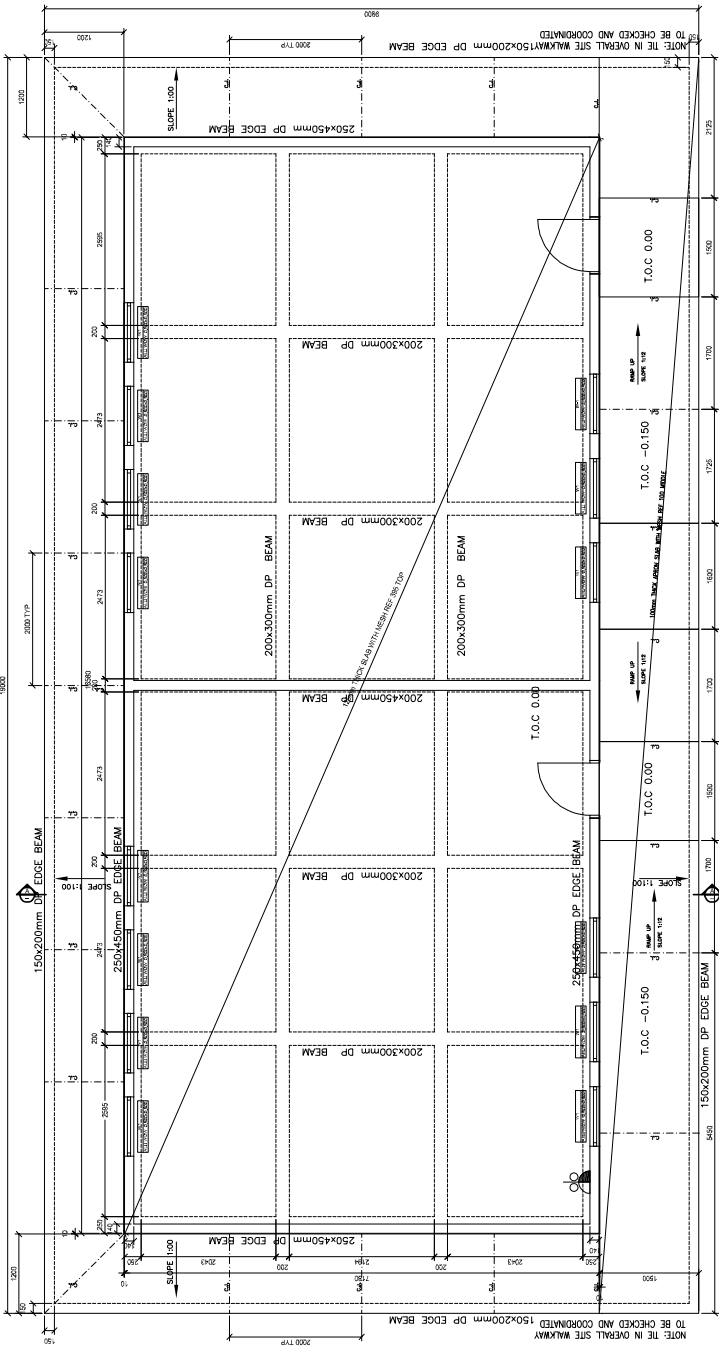
DOUBLE CLASSROOM
CONCRETE RAFT LAYOUT SECTIONS AND DETAILS

FOR APPROVAL
DATE
SCALE
S.D. H.M. A.S. SHOWN

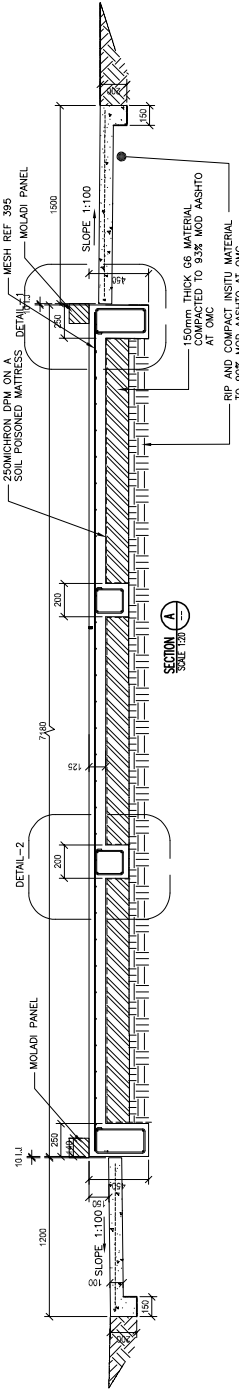
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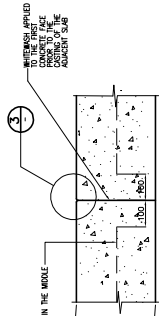
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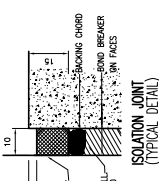
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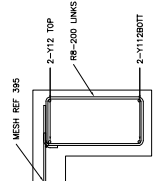
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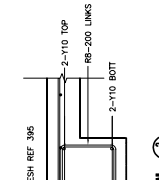
APRON SLAB/CHANNEL
CONSTRUCTION JOINT DETAIL (c)
SCALE 1:5



ISOLATION JOINT
(TYPICAL)
SCALE 1:1




MESH REINFORCEMENT
SCALE 1:10



MESH REINFORCEMENT
SCALE 1:10

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS' DRAWINGS AND ENGINEER'S DRAWINGS.
2. DIMENSIONS MUST NOT BE CORRECTED OR ASSUMED. DIMENSIONS MUST BE SPECIFIED IN WRITING BY THE ENGINEER.
3. ALL DIMENSIONS RELATES TO THE FINISHED FLOOR LEVEL AND APPROVAL SHALL NOT WORK TO BE CORRECTED OUT.
4. UNLESS OTHERWISE NOTED, FINISH TO CONCRETE TO BE AS FOLLOWS:
 - 50mm FLOOR FLOOR FINISH
 - 100mm FLOOR FOR CERAMIC FLOOR FINISH
 - 50mm FLOOR FOR TERRAZZO
 - 50mm STAIR TREADS
 - 50mm RC SLAB
 - 50mm RC WALLS
 - 50mm RC JOISTS
 - 50mm RC BEAMS
 - 50mm FOUNDATIONS & RC WALLS
5. UNLESS OTHERWISE NOTED, FINISH TO 50mm BOTTOM OF CONCRETE TO BE:
 - 50mm TOP
 - 50mm TOP
6. DIMENSIONS AND LEVELS TO BE VERIFIED BY CONTRACTOR ON SITE.
7. DIMENSIONS AND LEVELS TO BE VERIFIED BY CONTRACTOR ON SITE.
8. UNLESS OTHERWISE NOTED, ALL DIMENSIONS SHALL BE REPORTED TO THE ENGINEER IMMEDIATELY.
9. UNLESS OTHERWISE NOTED IN THE PROJECT TECHNICAL SPECIFICATIONS, ALL DIMENSIONS SHALL BE COMPATIBLE WITH S.A.S. 1000 SERIES OF SPECIFICATIONS.
10. BRICKWORK TO HAVE STONES APPROVED BY ARCHITECT.
11. ALL DIMENSIONS TO HAVE MINIMUM COMPRESSION ABOVE DOORS AND WINDOWS. CLASS 1 MORTAR.
12. DIMENSIONS SHALL TO HAVE MINIMUM COMPRESSION ABOVE DOORS AND WINDOWS. CLASS 1 MORTAR.
13. UNLESS OTHERWISE NOTED, FINISH TO CONCRETE TO BE:
 - 50mm BLANDING TO BE 100mm AND CAST BELOW
14. UNLESS OTHERWISE NOTED, FINISH TO CONCRETE TO BE:
 - 50mm BLANDING TO BE 100mm AND CAST BELOW
15. UNLESS OTHERWISE NOTED, FINISH TO CONCRETE TO BE:
 - 50mm BLANDING TO BE 100mm AND CAST BELOW

DRAWING NUMBER	DESCRIPTION	REV
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**DO NOT SCALE - IF
IN DOUBT, ASK
REFERENCE DRAWINGS**

CLIENT APPROVED _____ CLIENT'S NAME _____ DATE _____
 CLIENT'S SIGNATURE _____
 OUR EMERGING AGENT _____

CLIENT'S NAME _____

AGENT'S SIGNATURE _____

INVENTING AGENT _____



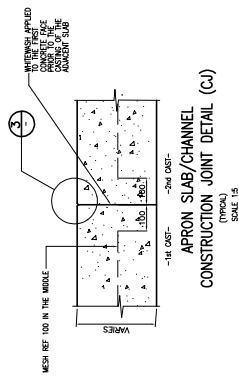
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South Main

D	01-04-2022	FOR APPROVAL	S.D
REV	DATE	DESCRIPTION	CHKD

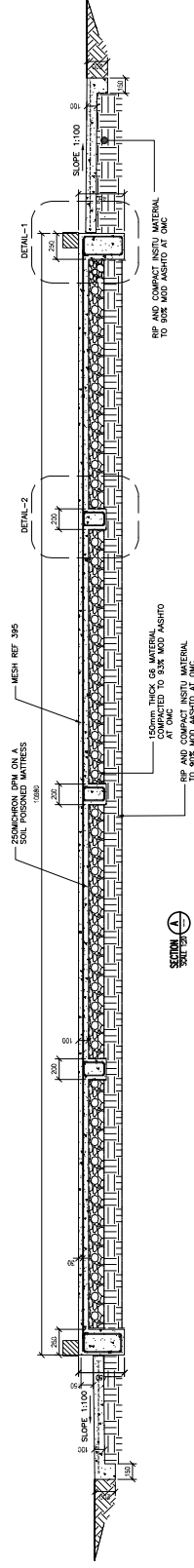
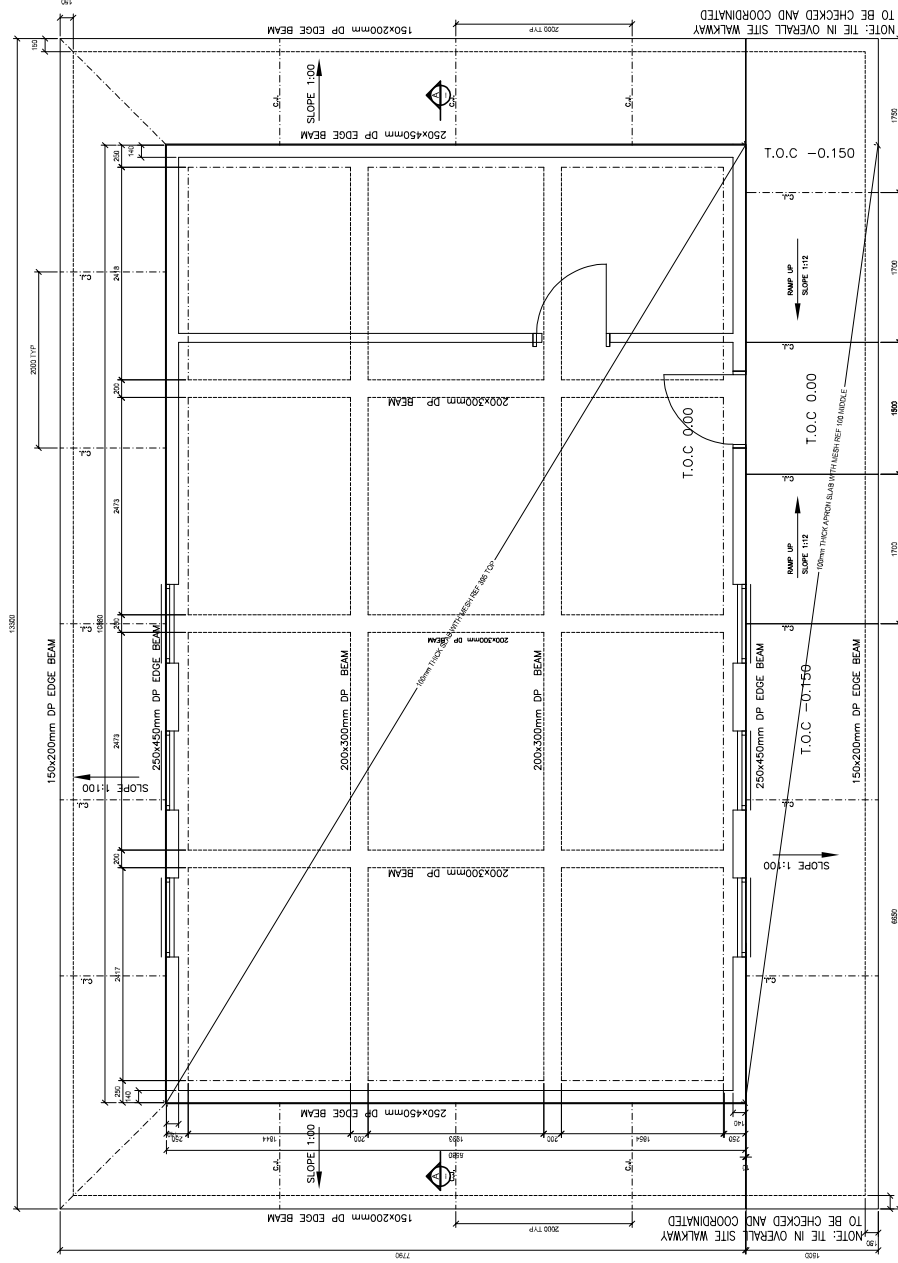
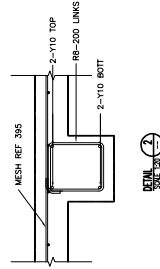
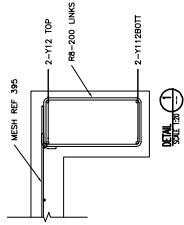
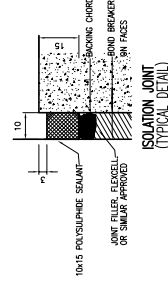
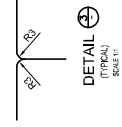
MINYAKA JUNIOR SECONDARY SCHOOL
EASTERN CAPE PROVINCE • SOUTH AFRICA

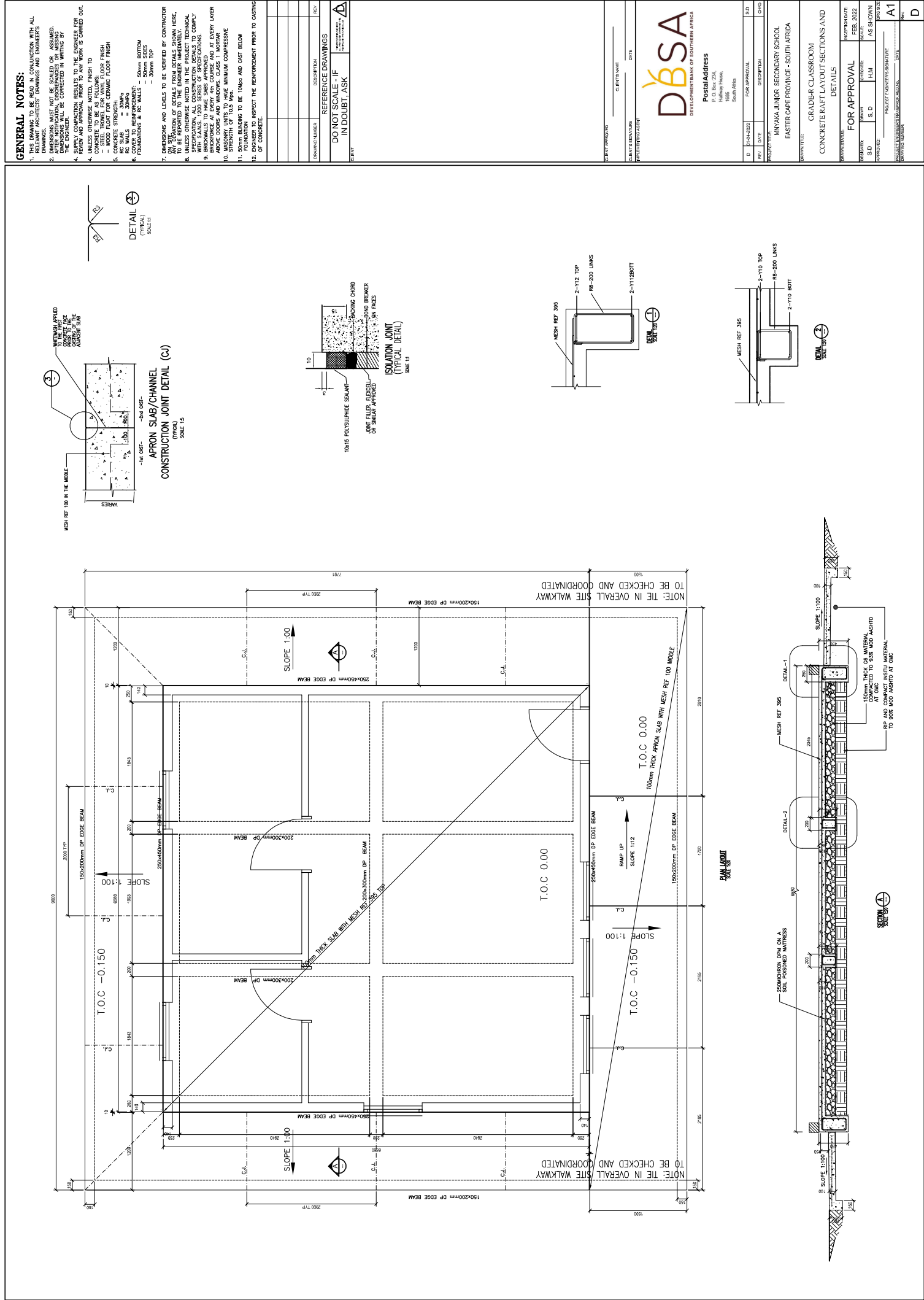
MULTI-PURPOSE CLASSROOM
 CONCRETE RAFT LAYOUT SECTIONS AND
 DETAILS

GRANT STATUS:	FOR APPROVAL						INCEPTION DATE:	FEB. 2022
	DESIGNED:	S.D.	DRAWN	S.D.	CHECKED:	H.M.	SCALE:	AS SHOWN
APPROVED:								FIG. SIZE:
PROJECT ENGINEER'S SIGNATURE _____								A1
PROJECT ENGINEER'S DRAWING NO.: _____								DATE:



APRON SLAB/CHANNEL
CONSTRUCTION JOINT DETAIL (CJ)





ANNEXURE E

PROJECT ELECTRICAL SPECIFICATIONS

PARTICULAR SPECIFICATIONS:

EELP – ELECTRICAL/ELECTRONIC: EARTHING AND LIGHTNING PROTECTION

PRELUDE

This particular specification details the successful supply, manufacturing, factory inspection test at the contractors premises, careful handling / transportation to the clients premises, safe storage as required and successful installation and commissioning for the above mentioned.

The contractor will furthermore responsible to uphold the electrical equipment during the Defects Liability Period.

This particular specification should be read in conjunction with the following;

- Section C3.4.3 of the tender document – Variation and additions to the Electrical / Electronic standard and particular specifications; and
- Associated drawings as issued with the Tender document; and
- Schedule of Quantities as per project specific.

Whereas conflicts in the above mentioned exists, this should be brought under the attention of the Engineer within a week before the Tender closes.

All materials and equipment to be supplied shall be new and of the best quality available.

All equipment shall bear the SABS mark.

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EELP EARTHING AND LIGHTNING PROTECTION

EELP 1 SCOPE OF WORKS

As specified in the project specifications.

EELP 2 STANDARDS AND TESTS

The earthing and lightning protection shall conform to and be in accordance with the latest applicable South African Bureau of Standards Codes and Standards:

The following Standard Specifications and drawings shall apply;

Table 1: Applicable Standards

Standard No.	Description
OHSA	Occupational Health and Safety Act
SANS 10089-1	Electrical Code for Petroleum Industry
SANS 10121	Cathodic Protection of Buried and Submerged Structures
SANS 10123	The Control of Undesirable Static Electricity
SANS 10142	Code of Practice for the wiring of Premises
SANS 10198-12	Installation of Earthing System
SANS 10199	Design and installation of an Earth Electrode
SANS 10199	The Design and Installation of and Earth Electrode
SANS 10200	Neutral Earthing in Medium Voltage Industrial Power Systems
SANS 10292	Earthing of Low Voltage (LV) distribution systems
SANS 10313	The protection of structures against lightning
SANS 1063	Earth rods and Couplers
SANS 1063	Earth Rods and Couplers
SANS IEC 61000-5-2	Electromagnetic Compatibility (EMC) Part 5: Installation and mitigation guidelines Section 2: Earthing and Cabling
SANS IEC 61024-1	Protection of Structures against Lightning Part 1: General principles
SANS IEC 61024-2	Protection of Structures against Lightning Part 2: Risk Management
SANS IEC 61024-3	Protection of Structures against Lightning Part 3: Physical damage to structures and life hazard
SANS IEC 61024-4	Protection of Structures against Lightning Part 4: Electrical and electronic systems within structures
SANS IEC 61312-1	Protection against Lightning Electromagnetic Impulse Part 1: General principles
SANS IEC 61312-4	Protection against Lightning Electromagnetic Impulse Part 4: Protection of Equipment in existing structures
SANS IEC 61643-1	Surge Protective Devices Connected to Low Voltage Power Distribution Systems Part 1: Performance requirements and testing methods
SANS IEC TS 61312-2	Protection against Lightning Electromagnetic Impulse (LEMP) Part 2: Shielding of structures, bonding inside structures and earthing
SANS IEC TS 61312-2	Protection against Lightning Electromagnetic Impulse (LEMP) Part 2: Shielding of structures, bonding inside structures and earthing

The lightning protection system shall be designed to protect lives and property from the destructive effects of lightning. The lightning designer shall assess corrosion effects of the lightning protection system and design accordingly.

The installation shall satisfy the requirements of all relevant South African Statutory Regulations.

Where applicable, equipment items shall carry the SABS mark to demonstrate compliance with the regulations.

EELP 3 GENERAL REQUIREMENTS

Equipment and materials to be used, shall be of high quality, and shall comply with all relevant specifications, codes as mentioned in this particular specification as well as the Occupational Health and Safety Act of 1993(Act 85 of 1993).

Where equipment and material does not comply with the relevant particular specifications it shall be submitted to Engineer for approval before installation.

All materials used for the earthing and lightning protection system shall withstand the electric and electromagnetic effects of lightning current and predictable stresses without being damaged.

Materials and sizes shall be chosen bearing in mind the possibility of corrosion of either the earthing and lightning protection system or the structure to be protected.

The installation shall be in accordance with SANS 10313: Code of Practice for the protection of structures against lightning and the requirements of this specification.

All equipment and material shall comply with the relevant National and International standard standards as listed in the specification. Where equipment does not comply it shall be submitted to the Engineer for approval.

The system of protection will be finials/air terminals, down conductors and earth spike or roof conductors, down conductors and earth spike.

EELP 4 OPERATING CONDITIONS

All material and equipment supplied and fitted must be designed and manufactured for successful operation under the prevailing environmental conditions.

EELP 5 GENERAL PRINCIPLES

Evaluation of Risk: The risk of lightning strike shall be evaluated as described in SANS 10313 and SANS IEC 61024-2.

Effective height of a structure: The effective height of the highest point shall be determined by considering the average height of building, trees and structures and land profile of the surrounding area.

Ground flash density (Ng): The ground flash density (Ng) for general buildings, structures and installations shall be estimated from the average ground flash density given in Annexure C of SANS 10313 as a general guide.

EELP 6 AIR-TERMINATION SYSTEM

The air-termination system should be composed of any combination of the following elements:

- Rods;
- Stretched wires;
- Meshed conductors.

For the design of the air-termination system the following methods should be used:

- Protective angle method
- Rolling sphere method
- Mesh size method

The air-termination system shall be designed and installed in accordance with all the relevant SABS / SANS / IEC standards as mentioned in this document.

EELP 7 LIGHTING PROTECTION SYSTEM

The requirement of the SANS 62305-3 shall comply for the system. The lighting protection system earthing shall be bonded to the fixed electrical installation protective earthing in accordance with the requirements of SANS 10142-1.

EELP 8 EXTERNAL LIGHTNING PROTECTION SYSTEM

The requirement of the SANS 62305-3 and SANS 10313 shall comply for the system. Earth electrodes shall be designed in accordance with SANS 10199.

EELP 8.1 General

External down-conductors shall be installed between the air-termination system and the earth termination system.

The average distance between the down-conductors shall comply with SANS IEC 62305-3.

Down-conductors shall be uniformly placed along the perimeter of the structure and with a symmetric configuration. Down-conductors shall be arranged in such a way that from the point

of strike to earth several parallel current paths exist and the length of the current paths is kept to a minimum. The formation of loops shall be avoided.

In order to reduce the probability of damage due to lightning current flowing in the lightning protection system, the down-conductors shall be arranged in such a way that from the point of strike to earth:

- a) several parallel current paths exist;
- b) the length of the current paths is kept to a minimum;
- c) equipotential bonding to conducting parts of the structure is performed according to the requirements

The down-conductor system shall be designed and installed in accordance with all the relevant SABS standards as mentioned in this document.

EELP 8.2 Construction

The down-conductors shall be installed so that, as far as practicable, they form a direct continuation of the air-termination conductors. Down-conductors shall be installed straight and vertical such that they provide the shortest and most direct path to earth.

Down-conductors shall not be installed in gutters or down-spouts even if they are covered by insulating material.

Down-conductors of an lightning protection system not isolated from the structure to be protected may be installed as follows:

- a) wall is made of non-combustible material, the down-conductors may be positioned on the surface or in the wall;
- b) wall is made of readily-combustible material the down-conductors may be positioned on the surface of the wall, provided that their temperature rise due to the passage of lightning current is not dangerous for the material of the wall;
- c) wall is made of readily-combustible material and the temperature rise of down conductors is dangerous, the down-conductors shall be placed in such a way that the distance between them and the wall is always greater than 0,1 m. Mounting brackets may be in contact with the wall.

When the distance from down-conductor to a combustible material cannot be assured, the cross-section of the conductor shall be not less than 100mm².

EELP 8.3 Natural components

The following parts of the structure should be considered as natural down-conductors:

- a) The metal installations provided that:

The electrical continuity between the various parts is made durable in accordance with SANS 62305-3.

Their dimensions are at least equal to that specified in SANS 62305-3 for standard down conductors.

- b) the metal of the electrically-continuous reinforced concrete framework of the structure;
- c) the interconnected steel framework of the structure;
- d) the facade elements, profile rails and metallic sub-constructions of facades, provided that

Dimensions conform to the requirements for down-conductors shall be as SANS 62305-3 and that for metal sheets or metal pipes thicknesses shall be not less than 0,5mm.

Electrical continuity in a vertical direction conforms to the requirements of the SANS 62305-3.

EELP 8.4 Test Joints

At the connection of the earth termination, a test joint should be fitted on each down conductor, except in the case of natural down-conductors combined with foundation earth electrodes. For measuring purposes, the joint shall be capable of being opened with the aid of a tool. In normal use it shall remain closed.

The joint should be capable of being opened with the aid of a tool for measuring purposes, but normally it should be closed.

EELP 9 INTERNAL & EXTERNAL LIGHTNING PROTECTION SYSTEM

The SANS 62305-3 shall apply. For the protection against over-voltages of internal systems, see SANS 62305-4.

EELP 10 EARTH-TERMINATION SYSTEM

The design shall cater for the dispersion of the lightning current into the ground, whilst minimizing any potentially dangerous over-voltages, the shape and dimensions of the earth-termination system are the important criteria.

The lightning protection system earthing shall be bonded to the fixed electrical installation protective earthing in accordance with the requirements of SANS 10142-1. **ALL EARTHING AND BONDING ABOVE GROUND SHALL BE DONE WITH KWENA-ANTI THEFT CABLE.**

The requirements of SANS 62305-3 apply with the additions given in 10.2 and 10.3. Earth rods shall comply with the requirements of SANS 1063, and earth electrodes shall be installed in accordance with the requirements of SANS 10199. Specific attention is drawn to the requirements for explosive manufacturing and storage areas.

ALL EARTHING AND BONDING ABOVE GROUND SHALL BE KWENA ANTI-All earthing and Bonding may it be above ground

EELP 10.1 Earth Resistivity and Electrode

Necessary earth resistivity tests on site, and invite to the Engineer for inspections must be arranged. Tests will be in accordance with the requirements of BS 1013.

After all earth electrodes/trench earth's have been installed, an earth megger shall be used to test the earth resistance at the earth bar or connection point to the main station earth and the results recorded. Note that all ECC connections, and any other bonding material shall be disconnected from the earth connection point whilst the earth is being tested.

The following are the maximum acceptable earth electrode resistances: Electrical Earth

- a) Main substation - 1 ohm
- b) Buildings Ring Earth - 1 ohm
- c) Transformer Yard - - 1 ohm
- d) Miniature substations and kiosks - 1 ohm
- e) High masts - 5 ohms
- f) Instrument Earth - < 1 ohm

EELP 10.2 Type B Arrangement

Type B arrangement as per SANS IEC 62305-3 shall be used.

Ring conductor external to the structure which will be in contact with the soil for at least 100% of its total length, or a foundation earth electrode. Earth electrodes may also be meshed.

The number of electrodes shall not less than the number of the down-conductors, with a minimum of two.

EELP 10.3 Installation of earth electrodes

The embedded depth and the type of earth electrodes shall be such as to minimize the effects of corrosion, soil drying and freezing and thereby stabilize the conventional earth resistance.

The requirements of SANS 62305-3 apply with the additions given in 10.2 and 10.3.

Earth rods shall comply with the requirements of SANS 1063, and earth electrodes shall be installed in accordance with the requirements of SANS 10199.

EELP 11 COMPONENTS

Components of an lightning protection system shall be manufactured from the materials listed in SANS IEC 62305-3 or from other materials with equivalent mechanical, electrical and chemical (corrosion) performance characteristics.

Earth electrodes shall be designed in accordance with SANS 10199.

EELP 11.1 Fixing

Air-terminations and down-conductors shall be firmly fixed so that the electrodynamic or accidental mechanical forces will not cause conductors to break or loosen as per SANS IEC 62305-1.

EELP 11.2 Connections

The number of connections along the conductors shall be kept to a minimum. Connections shall be made secure by such means as brazing, welding, clamping, crimping, seaming, screwing or bolting. Connections of steelwork within reinforced concrete structures shall conform to SANS IEC 62305-3.

EELP 12 EQUIPOTENTIAL BONDING

Equipotentialization shall be achieved by interconnecting the lightning protection with all structural metal parts, all below indicated but limited to the following:

- a) metal installations,
- b) internal systems,
- c) external conductive parts and lines connected to the structure.

Have a nominal cross-sectional area of at least 2,5 mm² copper or equivalent for indoor, and outdoor shall be aluminium, the conductors will be either cast in to the concrete or shall be so arranged that it cannot be tampered with.

EELP 12.1 Lightning equipotential bonding for external conductive parts

For external conductive parts, lightning equipotential bonding shall be established as near as possible to the point of entry into the structure to be protected.

Bonding conductors shall be capable of withstanding the lightning current flowing through them evaluated in accordance SANS IEC 62305-1 and SANS 10142.

The requirements of SANS 62305-3 and SANS 10142 shall apply. For the protection against over-voltages of internal systems, see SANS 62305-4.

EELP 12.2 Lightning equipotential bonding for internal systems

Lightning equipotential bonding shall be installed strictly according to SANS 10313, SANS 10142 and SANS IEC 62305-3.

EELP 12.3 Lightning equipotential bonding for lines connected to the structure to be protected

Lightning equipotential bonding for electrical and telecommunication lines shall be installed in accordance with 6.2.3 of SANS IEC 62305-3.

EELP 13 TOUCH AND STEP VOLTAGES

The requirements of SANS 62305-3 apply.

EELP 14 RISK MANAGEMENT

The requirements of SANS 62305-2 apply. The Contractor shall allow for the purchase of the spreadsheet-based risk calculator which has been developed by IEC TC 81 (see annex E in SANS 62305-2:2011). The software program can be purchased directly from the IEC and shall be submitted as proof of design.

EELP 15 MAST PROTECTION FOR THATCHED ROOFS

The requirements of SANS 62305-3 shall apply with the additions given in 11.2 to 11.7. Metals used in the construction of a thatched roof shall be bonded and earthed. Water pipes, vent pipes, tanks, gas pipes, antennas, telephone and bell wires, burglar alarms and electrical wiring and conduit within 1 000 mm of the thatch shall be shielded, bonded and earthed as per SANS 10142-1.

EELP 15.1 Dangerous Sparking

Dangerous sparking between an lightning protection system and a metal, an electrical or a telecommunication installation can be mitigated which is detailed SANS 62305-3.

EELP 15.2 Ageing of thatch

Ageing of the thatch, flammable gases could evolve within the thatch and the thatch could ignite.

EELP 15.3 Metals in or on the thatch

The requirements of SANS 62305-3 shall apply.

EELP 15.4 Protection by masts

At least lightning protection level III (see SANS 62305-3) shall apply in the case of thatched structures.

EELP 15.5 Earthing of masts

All free-standing masts shall be earthed in accordance SANS 10199, and shall comply with SANS 62305-3.

EELP 16 STRUCTURES WITH EXPLOSIVE OR FLAMMABLE SUBSTANCES

The requirements of SANS 62305-3 apply with the additions given in 12.2 and 12.3.

EELP 17 DESIGN REQUIREMENTS

The requirements of SANS 62305-3 and SANS 10313 shall apply.

EELP 18 INSPECTION OF LIGHTING PROTECTION SYSTEM

The requirements of SANS 62305-3 apply and all required forms shall be in place for Engineers inspection. An Installation safety report see annex A of SANS 10313 shall be issued in respect of an inspected and compliant lighting protection system by the lighting protection system designer and installer.

EELP 19 DANGER SIGNS

Danger signs on aluminium plates shall be supplied on each door and shall be in accordance with the Occupational Health and Safety Act, Act 85 of 1993.

EELP 20 EARTH BAR

A copper earth bar shall be provided and mounted not less than 40mm from the wall or fixed structure approximately 1000mm above the final floor level and final position will be confirmed with Engineer in the position as indicated on the drawings and agreed on site. The mounting shall be electrically insulated from the wall.

A solid 200 mm x 30 mm x 5mm copper earth bar shall be provided. The earth bar shall be provided with 6 x 6mm holes evenly spaced along the entire length. 6 mm ϕ cadmium plated high tensile steel bolts complete with nuts and lock-washers shall be provided for each hole. Serrated washers shall not be used between the copper earth bar and the lug.

The earth bar shall be connected with a 70mm² Kwena Anti-Theft conductor to the building earth-termination system (system earth mat) and the tenderer shall allow for 100m of Kwena Conductor to the earth bar for tender purpose.

EELP 21 INFORMATION TO BE SUBMITTED BY THE SUCCESSFUL TENDERER

The successful Tenderer /Contractor shall submit three prints of the under mentioned drawings to the engineer for approval, before manufacturing.

- a) Earthing and Lightning Protection drawings.
- b) Multiview Projections including elevations showing dimensional information including details such as, but not limited to, the following:
 - Front views
 - Side views
 - Rear view
 - Floor plan view
 - Roof view

All drawings will be obtainable from the Engineer.

- c) Structure descriptions which will be indicated on Multiview protections and elevations showing the following:
- All Bonding
 - All Earthing and Lightning Protection equipment.
 - Earth Mat locations
 - Conductor Network
 - Fixings
 - Air terminals
 - Conductor Joint clamps
 - Earth Electrode Positions
 - Earth Inspection Pits
 - Other information as required for approval
- d) Conduit locations
- e) Unit descriptions including information such as, clamps, conductor sizes, earth electrode depth, earth inspection pits all as mentioned above (item c).
- f) Design and manufacturer Engineers approved drawings shall be provided to the Engineer in PDF format.
- g) Data sheets and publications on all major components including, but not limited to, the following:
- Aluminium Conductor
 - KWENA Bonding Conductors
 - Clamps
 - Control power transformers
 - Pilot devices
 - Relays
 - All clarifications and exceptions must be clearly identified

After completion of the work, the contractor shall submit three final copies of each of the above-mentioned drawings showing the final layout / as built.

EELP 22 MEASUREMENT AND PAYMENT

Measurement and payment will be done in accordance with the methods stated below:

EELP 22.1 Design, Drawings and General

The rate tendered shall include for the provision of the necessary design information for all items measured under the respective schedule. Earthing and Lightning Protection System installation, design information shall include, but limited to, the following:

- Manufacturer's product data of lightning protection and earthing and all related components.
- Dimensioned and Professional Engineer signed drawings of lightning and earthing system showing accurately scaled basic units including, but not necessarily limited to,

auxiliary compartments, unit components and combination units all as specified under PEL 20.

<u>Pay Item</u>	<u>Unit</u>
(a) Provide design drawings and design information for Earthing and Lightning Protection System	Sum
(b) Provide operating and maintenance manuals and “as built” drawings as specified	Sum
(c) Provide risk management calculations and IEC Program as specified	Sum

EELP 22.2 Supply and Delivery to Site

Rate tendered to include for all material, equipment, plant, testing apparatus, labour, manufacturing, factory applied corrosion protection, factory acceptance testing, transport, import duties, handling and possibly double handling, delivery to and off-loading at Site as well as temporary storage prior to installation. For miniature substation, the rate tendered shall be for the complete miniature substation and shall include, but not limited to, the detailed in this particular specification. Any special devices shall be listed separately in Variations and Additions to the Standard and Particular Specifications Section C3.4.2.

<u>Pay Item</u>	<u>Unit</u>
(a) Supply and delivery to site of lightning protection / down conductor system complete as specified, inclusive of all connection points, terminals, interconnections, bonding points and test points for the entire system, including for “natural components.	Sum
(b) Supply and delivery suitable earth-termination system /earth mat as specified	Sum
(c) Supply and delivery suitable earth bar as specified	Each

EELP 22.3 Installation

Rate tendered to include for all plant, tools, labour, rigging, handling, placing into position, aligning, fixing, grouting, but not limited to and getting ready for testing and commissioning

Install of earthing and lightning protection system shall be accordance with the manufacturer's written instructions and recognized industry practices, to ensure that the earthing and lightning protection system complies with the requirements and serves the intended purposes. Comply with the requirements of SABS and IEC standards and applicable portions of "Standard of Installation", for installation of earthing and lightning protection system but not limited to.

<u>Pay Item</u>	<u>Unit</u>
(a) Site installation of lightning protection / down conductor system complete as specified, inclusive of all connection points, terminals,	Sum

interconnections, bonding points and test points for the entire system, including for “natural components.

- | | | |
|-----|---|------|
| (b) | Site installation of suitable earth-termination system / earth mat as specified | Sum |
| (c) | Site installation of suitable earth bar as specified | Each |
| (d) | Earthing resistance survey upon completion of the excavations and test report | Sum |

EELP 22.4 Commissioning

Rate tendered to include for the drafting of the necessary testing and commissioning plans, attendance of required local and/or overseas specialists, testing apparatus, instruments and equipment, any/all equipment required for testing purposes and to prove performance, any/all temporary works, and compilation of final commissioning report.

Contractor shall submit three copies to the Engineer. Contractor shall notify the Engineer one week in advance of the test so that the Engineer may be present.

<u>Pay Item</u>		Unit
(a)	Commissioning of complete lightning protection system, inclusive of down conductor, earth-mat and earth spikes, etc.	Sum
(b)	Certificate of compliance of lightning protection system	Sum

PARTICULAR SPECIFICATIONS:

EMCA – ELECTRICAL/ELECTRONIC: MULTICORE CABLES AND EARTH WIRES

PRELUDE

This particular specification details the successful supply, manufacturing, factory inspection test at the contractors premises, careful handling / transportation to the clients premises, safe storage as required and successful installation and commissioning for the above mentioned.

The contractor will furthermore responsible to uphold the electrical equipment during the Defects Liability Period.

This particular specification should be read in conjunction with the following;

- Section C3.4.3 of the tender document – Variation and additions to the Electrical / Electronic standard and particular specifications; and
- Associated drawings as issued with the Tender document; and
- Schedule of Quantities as per project specific.

Whereas conflicts in the above mentioned exists, this should be brought under the attention of the Engineer within a week before the Tender closes.

All materials and equipment to be supplied shall be new and of the best quality available.

All equipment shall bear the SABS mark.

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PCA MULTICORE CABLES AND EARTHWIRES

EMCA 1 SCOPE OF WORKS

As specified in project specifications

EMCA 2 STANDARDS AND TESTS

Cables shall conform to and be in accordance with the latest applicable South African Bureau of Standards Codes and Standards:

The following Standard Specifications and drawings shall apply:

Standard No.	Description
SANS 97	Electric cables - Impregnated paper-insulated metal-sheathed cables for rated voltages 3,3/3,3 kV to 19/33 kV
SANS 1339	Electric cables - Cross-linked polyethylene (XLPE) insulated cables for rated voltages 3,8/6,6 kV to 19/33 kV
SANS 1507	Electrical cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1900/3300V)
SANS 1713	Electric cables - Medium-voltage aerial bundled conductors for voltages from 3,8/6,6 kV to 19/33 kV
SANS 10142	Code of Practice for the wiring of Premises

EMCA 3 CONSTRUCTION DETAILS

EMCA 3.1 LOW VOLTAGE CABLES

All multi core cables shall be stranded metal annealed copper conductor, PVC insulated, PVC bedded, single wire armoured and PVC sheathed in accordance with SANS 1507 as amended to date for cables with copper conductors and insulated for 500/3300 volt grade.

Cables for status and analogue signals shall consist of the requisite size and number of copper twisted pairs, individually and overall screened, PVC sheathed, steel wire armoured and PVC covered, complying with the requirements of SANS 1507 where applicable.

Cables and earth wires for a specific application shall be selected strictly in accordance with the requirements laid down in SANS 10142 in respect of current rating and voltage drop. Where practicable the earth continuity conductor shall form an integral part of the cable.

EMCA 3.2 MEDIUM VOLTAGE CABLES

These cables shall be manufactured in accordance with NRS. 013-1991 and comply with SANS 97 - 1991. All the 11 kV cables shall have copper conductors and shall be suitable for use on an unearthed system.

Three core cables shall be of the fully impregnated belted type. The cable shall have a helical fibrous bedding, lead alloy E sheath, single wire armour and a PVC serving as laid down in the Variations and Additions to the Standard and Particular Specifications, all in accordance with SANS 97 - Table 18. Single core cable shall be fully impregnated, screened general purpose cable with copper conductors suitable for an earthed system. The cables shall be in accordance with Table 11 of SANS 97, shall have a lead alloy E sheath and a PVC anti-electrolytic over sheath. (Type PEC)

EMCA 3.3 FIBRE OPTIC CABLES

The cables shall have a GRP centre strengthening member, colour coded fibres in gel filled loose tubes, surrounded by interstitial water blocking gel, aramid strengthening member, paper binder, polyethylene bedding sheath, plastic coated corrugated steel type armour and polyethylene water resistant outer sheath.

The steel armour shall be polymer coated and bonded to the sheath.

The fibre shall be manufactured from pure silica cladding, minimally doped with Phosphorous and Fluorine to achieve a matched cladding and a graded Germanium doped silica core. The primary coating shall consist of two layers of UV curable acryline resin.

Attenuation uniformity shall be checked at both 850nm and 1300nm with a pulse width not exceeding 1 micro s. Fibres with points or steps of discontinuity greater than 0,3dB shall be rejected. For fibre lengths in excess of 1km the attenuation coefficient over the length of fibre shall not vary by more than 0,3dB/km.

The fibre shall withstand a mechanical strain of at least 8N for 1 second and shall have an attenuation increase of less than 0.005dB/turn under a bend resistance test using 100 turns around a 75mm diameter mandrel.

The fibre optic cable shall be of the multi mode type with fibre size of 50/125 for multi mode operation. Single mode cables shall be acceptable for longer distance communication paths

Work includes the furnishing of all labour, material, equipment, services and the performance of all operations necessary for designing, fabrication, testing and delivery

All materials and equipment to be supplied and installed under this contract shall be new and of the best quality available.

All materials and equipment shall comply with the requirements laid down in the latest editions of the BS, SABS and IEC specifications and their amendments (if any) as well as those laid down in this specification. Where items bearing the SABS mark, are available for any of the materials and equipment specified, only materials bearing the said mark, will be acceptable.

EMCA 4 JOINTING OF CABLES

EMCA 4.1 LOW VOLTAGE CABLES

Joints will only be allowed where more than one full drum length of cable is necessary to complete a specific circuit and must be restricted to the absolute minimum. All joints shall be made to the best practice by competent cable jointers using first class material. The contractor shall maintain the electrical continuity of the armouring in an approved manner at all straight through joints.

Heat shrinkable cable joint kits that will suit the relevant cable size shall be used for all low voltage cable joints

EMCA 4.2 MEDIUM VOLTAGE CABLES

On 11 kV cables, straight joints shall be made by means of heat-shrinkable straight through joints for unearthed paper insulated cables up to 11 kV. All cable joint kits shall comply with NRS 053 Specifications

The joints shall be made to the manufacturer's instructions and with materials stipulated in such instructions.

The cores of the cable shall be joined colour to colour or number to number.

EMCA 4.3 FIBRE OPTIC CABLES

Joints in fibre optic cable must be avoided as far as possible due to losses in signal strength when jointed.

The joints shall be made to the manufacturer's instructions and with materials stipulated in such instructions.

EMCA 5 TERMINATION OF CABLES

EMCA 5.1 LOW VOLTAGE CABLES

Low voltage cables shall be terminated with cable glands manufactured of bronze and comprising a barrel with sealing washer and bush nut screwed into one end and a compression nipple with wire clamping ring screwed onto the other end. The opposite end of the compression nipple must have a male electrical thread with locknut. The glands shall be suitably sized for the relevant cables, be of the adjustable type complete with armour clamps and with watertight neoprene shrouds.

Cable terminating glands for outdoor use shall be IP68 rated and provided with waterproofing double inner seals as well as waterproofing seals on nipples. Cable termination glands for high humidity and possible temporary water submerged conditions as for instance in filter lower gallery areas at water treatment plants shall also be IP68 rated with waterproofing double inner seals as well as waterproofing seals on nipples.

Cable armouring shall be earthed at each end but may not be used as earth continuity conductor.

EMCA 5.2 MEDIUM VOLTAGE CABLES

Medium voltage cable terminations shall be heat shrinkable termination kits and shall comply with NRS 053 Specifications.

The cable terminations shall be made to the manufacturer's instructions and with materials stipulated in such instructions.

EMCA 5.3 FIBRE OPTIC CABLES

Fibre optic cables shall be terminated by means of suitable glands, ST connections and bus terminals capable of direct connection to the bus interfaces on the bus stations. These bus stations will be housed in separate panels of various motor control centres.

EMCA 6 CONCRETE CABLE SLABS

The cable slabs supplied and installed under this Contract shall be formed solidly out of concrete with steel reinforcing and shall have dimensions of 1 000 x 350 x 100 mm. Alternative block sizes will be considered. The following concrete mixture is desired:

- 1.Portland cement (dry) - 1 part per volume
- 2.Clean dry river sand - 3 parts per volume
- 3.Crushed stone (size 10 mm) - 6 parts per volume

EMCA 7 CABLE TRAYS AND CABLE LADDERS

Heavy duty cable trays and cable ladders manufactured from hot dipped galvanised steel or grade 304 stainless steel, as specified in the Variations and Additions to the Standard and Particular Specifications, shall be supplied and installed as indicated on the drawings. The height of the cable ladder sides shall be 76 mm with the width to suit the number and size of cables to be installed.

EMCA 8 INSTALLATION OF CABLES

EMCA 8.1 CABLE TRENCHES

The contractor will be responsible for the excavation, bedding, back-filling, consolidating and making good of all cable trenches along the routes indicated on the drawings, with the exception of those sections of the cable routes where it is specifically indicated on the accompanying drawings that open cable ducts will be provided by others. The Contractor however will be responsible for the bedding and filling soil in cable ducts where necessary. A sealing screed to cover the cable duct shall be provided by others unless otherwise stated in the Variations and Additions to the Standard and Particular Specifications and relevant drawings.

NOTE: Tenderers shall acquaint themselves fully with the nature and formation of the ground in which the cables are to be laid, before submitting a Tender. No subsequent claim for extras due to lack of knowledge in this respect will be entertained by the Employer.

Cable trenches for L.T. power and lighting cables shall be deep enough to facilitate the laying of these cables at a depth of 750 mm below final ground level.

Trenches for H.T. power cables shall be deep enough to facilitate the laying of these cables at a depth of 1 m below ground level. The floors of all cable trenches shall be smooth and free from boulders and sharp rock projections.

Plastic danger tape shall be installed in all cable trenches 300 mm above the cables for cable protection during future excavations.

Each cable shall be laid in a bedding of river sand or sifted soil 75 mm over and 75 mm below the cable. Clayey soil will not be accepted as bedding.

No cable trench shall be back-filled before the cable(s) in the trench has been inspected and approved by the Engineer.

EMCA 8.2 UNDER GROUND CABLE PIPES

Cable pipes will be supplied and installed by others unless indicated otherwise on the drawings.

Each cable pipe shall be sealed by the Contractor under this Contract at both ends by means of bitumen impregnated jute bags or similar material, after the cable has been installed.

EMCA 8.3 CABLE SLABS

Where electrical cables cross above other services such as water pipes, sewerage pipes, other electrical cables, pilot cables and telephone cables or where danger exists that cables may be damaged due to excavations by others cables shall be protected by means of reinforced concrete slabs. The concrete slabs shall protect the cable for at least 0,5 m in both directions of the crossing.

Where electrical cables cross underneath other services such as water pipes, sewerage pipes, post office cables etc. a concrete slab shall be placed above and axial with the other service and should the free space between the two services be less than 300 mm an additional slab shall be placed axial with the electrical cable between the two services.

Where cables are laid down a grading and a possibility exist that the cables might be washed open due to rain, then cable slabs shall be placed on top of the cables for the entire length of the grading.

The concrete slabs shall be supplied and installed under this Contract.

EMCA 8.4 CABLE CROSSING WITH OTHER SERVICES

EMCA 8.4.1 GENERAL

Where a cable is laid above another service it shall not be less than 750 mm below ground level, and if this is not possible, the cable shall be laid underneath the other service and shall be protected by means of concrete slabs in the manner prescribed. The deeper or shallower positions of the cable shall only apply for a distance of 1 m on both directions of the crossing.

If not possible to cross underneath the other service the matter shall be referred to the Engineer for a decision.

EMCA 8.4.2 CLEARANCES

The following minimum clearances shall be maintained between electrical cables and other services:

	VERTICAL	HORIZONTAL
Telkom cables	0,3m	0,3m
Other water pipes	0,3m	0,3m
Sewerage pipes	0,3m	0,8m
Storm water pipes	0,3m	0,6m
Other Electrical cables	150mm	150mm

EMCA 8.5 CABLES MUST BE LAID WITHOUT DELAY

The cables shall be laid with the minimum of delay in order to backfill the trenches as soon as possible.

The Contractor shall, however not backfill the trench until each length of cable has been tested, inspected and approved by the Engineer.

Only one cable shall be laid at a time and the Contractor shall ensure that cables already laid are not damaged.

EMCA 8.6 METHOD

All cables shall be handled with the utmost care and shall be laid in accordance with the best methods observed in good modern practice. All cables shall be run out on rollers in order to prevent abrasion and no cable shall be dragged along the ground. No cable shall be bent to a radius of less than 12 times its overall diameter.

a) In Concrete Ducts

Cables shall be laid neat parallel with each other on the floor of the duct with the maximum spacing. Any other cables shall be installed on cable ladders secured to the vertical sections of the cable ducts.

b) On cable ladders

Cable shall be installed neat and parallel with each other with the maximum spacing. On Horizontal sections the cables shall be secured to the cable ladders with intervals of not more than 2m. On vertical sections or where the cable ladders are installed at an angle the cables

shall be secured to the cable ladders with intervals of not less than 500mm with suitable strapping material approved by the Engineer.

Either stainless steel or hot dipped galvanized steel cable strapping material shall be used on outdoor cable installations depending on the cable rack or ladder material.

Sections of the cable ladders shall be electrically connected and provision shall be made for crimping and expansion of the racks.

c) In Trenches

Two or more L.T. cables in the same trench shall be laid in a straight line and in parallel and not less than 75mm apart between cable route turning points, except where otherwise approved. Cable routes shall always follow routes parallel to permanent structures to facilitate as built information.

H.T. cables in the same trench shall be laid parallel and not less than 150mm apart, except where otherwise approved.

All L.T. power cables shall be laid 750mm below final ground level and H.T. power cables shall be laid 1 m below final ground level.

The contractor shall provide 3m slack at each end in each run of power cable and its associated earth wire and bury the same in the ground as near to the relevant end as possible. Where the cables and earth wires are to be installed in open ducts outside buildings, the slack shall be coiled in the ducts.

The separation between any signal cable and the nearest parallel power cable shall not be less than 150mm.

d) Against Walls

Cables and earth wires to be installed on walls, where approved by the Engineer, shall be neatly installed on heavy-duty hot dipped galvanised steel cable racks. Cables and earth wires on outside walls shall be installed in a similar manner or in suitably sized hot dipped galvanised conduit from 300 mm below up to 2,4 m above final ground level or as required. These conduits shall be secured to the walls by means of hot dipped galvanised steel bat holders at intervals not exceeding 600 mm. (Hospital Saddles).

Saddles shall only be secured by means of round-headed hot dipped galvanized screws and plugs of an approved type. (Wood will not be accepted as plugging material.) Plugs will not be allowed in joints between bricks.

e) On Poles

Cables and earth wires to be installed on poles shall be secured to the poles at intervals not exceeding 600 mm by means of 25 mm x 1,5 mm adjustable Grade 304 Stainless Steel straps. Each cable together with its associated earth wire shall be installed in a suitably sized stainless steel pipe or channel from 300 mm below up to 2,4 m above ground level. This pipe or channel shall be secured to the pole by means of 25 mm x 1,5 mm adjustable stainless steel straps at

intervals not exceeding 600 mm. To avoid metallic action between different materials Neoprene rubber strip shall be installed between the pole and the strap.

(a) Cable Channels on Structures and in Buildings

Where cable channels have been provided on structures and in buildings these must be backfilled with river sand by the contractor.

(b) Cables connected to motors and other equipment

Cables and earth wires connected to motors and other equipment shall be secured between the cable channels, cable rack or cable tray to the point of termination by means of a heavy-duty hot dipped galvanised type of cable support. The cable shall be secured to the cable support by means of steel straps or other acceptable strapping material.

EMCA 8.7 INSPECTION OF CABLES AND CABLE TRENCHES

After the cables have been installed and spaced on top of the 75mm thick layer of sand in the trenches, the installation shall first be inspected and approved by the Engineer before the trenches may be refilled. Should the Contractor not meet with the requirement, or if he fails to give the Engineer sufficient notice of an inspection, portions of the trenches or the complete trench shall have to be re-excavated by the Contractor at his own expense for inspection by the Engineer.

A logbook with three copies per page shall be kept by the Contractor on the site, in which each part of the installation that has been inspected can be recorded after inspection and approval.

EMCA 8.8 BACKFILLING OF TRENCHES

Once the cable has been laid, straightened, inspected, approved and covered with the top layer of bedding soil, the trenches shall be backfilled with soil which does not contain more than 40 % rock or shale and will pass through a sieve with 100 mm diameter holes that has been approved by the Engineer.

Back filling of cable trenches shall be done in layers of 150 mm and shall be compacted and consolidated to 95 % modified AASHTO. Test shall be carried out to ensure the required compaction at the cost of Contractor.

The Contractor shall maintain the closed up sections of the cable trenches in a proper, safe condition for the duration of the contract. Where the soil in the trenches subsides it shall be refilled and compacted to the satisfaction of the Engineer.

EMCA 9 INSTALLATION OF CABLE TRAYS AND CABLE LADDERS

The cable ladders shall be secured on suitable lengths which shall be suspended from the roof slab by means of suitable lengths 8 mm dia threaded hot dipped galvanized steel rods or secured to the walls with suitable sized hot dipped galvanized steel Rawl type bolts and shall be secured to the channel sections by means of two hot dipped galvanized nuts and washers.

The different parts of the trays and ladders must be thoroughly bonded electrically and mechanically to each other.

The cable trays and ladders shall be installed neatly, level and square/parallel to walls.

Cable straps suitable for the specific cable shall be employed to secure the cable onto the tray. Outdoor cable straps shall be stainless steel and cables shall be secured on intervals not exceeding 600mm. Cables on cable trays or ladders in outdoor environments shall be covered with removable cable tray or ladder covers of similar material.

EMCA 10 CABLE SUPPORTS TO MOTORS AND OTHER EQUIPMENT

Cables to motors and other electrical equipment shall be supported by means of hot dipped galvanized cantilever brackets and cable supports. Cables shall be strapped to these supports by means of acceptable strapping material.

EMCA 11 WIRE TRUNKING

Heavy duty hot dipped galvanised wire trunking of sufficient dimensions shall be installed against all large capacity pump set concrete plinths for installation of pump set protection sensor monitoring cables. The monitoring cables shall be installed in hot dipped galvanised conduit from the trunking to the sensor position.

EMCA 12 SENSOR TERMINATION CUBICLE

All large capacity pump set sensor cables shall be terminated in a powder coated mild steel frame mounted termination cubicle with lockable front door secured against the pump set plinth. DIN rail mounted cable conductor termination blocks shall be installed inside the termination cubicle for cable conductor termination.

EMCA 13 CABLE MARKERS

Cable ends shall be properly labelled with reference to equipment, section of plant and other requirements specified by the client at both cable ends.

Cable markers with lead labels cast into the top of the cable markers shall be supplied and installed along the cable routes under this Contract as follows:

Along straight runs of the route, not further than 25 m apart;

At turns - one on each side of the turning point, 900 mm from such turning points;

At each branch, 3 markers - i.e. one on each side of the branch, 900 mm from the branch.

The cable markers shall be installed deep enough to ensure that the top of the marker will protrude 50 mm above final ground level.

EMCA 13.1 NAME TAGS

Identification tags shall be attached to all cable ends. The tags shall be secured to cables by means of cable ties to the approval to the Engineer.

Cables shall be tagged at either end, whether the end terminates in a distribution board or an end box.

All cable cores and internal panel wiring shall be identified at both ends by means of durable colour coded wire marking ferrules in accordance with numbering systems in cable and wiring diagrams. Only closed ring interlocking type identification ferrules shall be used.

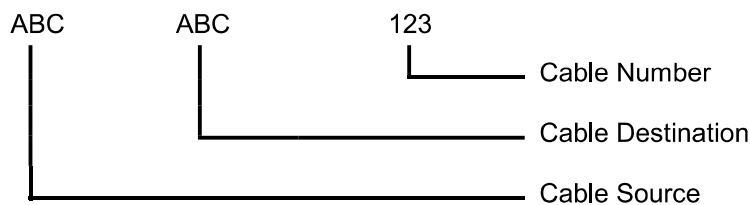
Outdoor tags shall be of stainless steel or brass type and shall be secured by means of similar strapping material.

Tags mounted indoors or protected by an enclosure shall be made of Ivorene or similar sandwich material with black letters on a white background.

All lettering and text shall be approved by the Engineer.

Letter sizes must be compatible with the application and shall not be smaller than 8mm.

a) Cable Naming Convention



b) Table of Areas

Example of area abbreviations:

ILW	-	Inlet works
IMC	-	Inlet motor control centre

c) Example of cable schedule;

Cable Number	From	To	Grade (V)	Size mm ²	No. of cores	Length (m)
ILW-IMC-001	Inlet works	Inlet motor control centre	400	185	4	55
IMC-SCR-001	Inlet works MCC	Screen 01	400	10	4	25

EMCA 14 WARNING TAPES

Warning tape shall be installed along all trench excavated cable routes 300mm above the cables.

Warning tape shall have a minimum width of 300mm and have a bright orange colour with the wording "Danger". The minimum thickness shall be 800 gauge.

EMCA 15 EARTH WIRES

Earth wires shall be installed with L.T. cables as and where indicated on the drawings or specified herein and shall consist of bare hard-drawn copper wire.

These earth wires shall be installed at the same depth as the relevant cables, with at least 75 mm clearance between any earth wire and the nearest cable, unless specifically approved otherwise.

No joint will be allowed in any run of earth wire.

Each earth wire shall be terminated at each end by means of a suitably sized bolted lug either sweated or crimped onto the wire. The lugs shall be bolted onto the relevant earth bars or earthing terminals.

EMCA 16 TESTING OF CABLES

EMCA 16.1 LOW VOLTAGE CABLES

On each completed section of laid and jointed cable, the insulation shall be tested to approval with an approved "Megger"-type instrument of not less than 500 V.

EMCA 16.2 MEDIUM VOLTAGE CABLES

On each completed section of laid and jointed high tension cable a high voltage test shall be carried out. The test shall be performed according to SABS 97 of 1991. Alternating or direct current may be used.

A certificate shall be submitted confirming the successful testing of the relevant cable.

EMCA 17 ROUTE PLANS TO BE SUBMITTED BY THE CONTRACTOR

On completion of the works, but before the certificate of completion will be issued, the contractor shall submit to the Engineer, route plans in electronic format indicating in a satisfactory manner:

- (a) The exact cable routes with reference to fixed points (e.g. buildings);
- (b) The exact lengths of cable (HT and LT) installed between terminating points and between joints where relevant; and
- (c) With reference to fixed points the exact positions of cable joints (e.g. buildings).

Electronic copies of the various plans for the marking up of the information required will be supplied to the contractor on request.

EMCA 18 MEASUREMENT AND PAYMENT

The bidder must obtain an electronic Cable Schedule and Schedule of Rates for cables. in Microsoft Excel from the engineer. The bidder must complete the Schedule of Rates for cables, this will automatically transfer the Supply, Install and Terminations values for the Cables. From this a total value for each cable will be calculated. A hard copy of the Schedule of Rates must be signed by a person duly authorized to sign and submitted with the returnable schedules. A hard copy of the Cable Schedule must also be signed by a person duly authorized to sign and submitted with the bid. A electronic copy that corresponds with the hard copies must also be submitted to the engineer by the successful bidder.

Measurement and payment will be done in accordance with the methods stated below:

EMCA 18.1 SUPPLY AND DELIVERY TO SITE

<u>Pay Item</u>	<u>Unit</u>
(a) Supply and delivery to site of cables, jointing, terminating materials, all earth wires and cable name tags as per the cables schedule supplied electronically	Sum/m
(b) Supply and delivery to site of cable route markers	Each
(c) Supply, delivery to site of concrete cable slabs	Each
(d) Supply, delivery to site of cable trays, ladders and wire trunking	Sum
(e) Supply, delivery to site of cable supports to motors and other electrical equipment	Sum
(f) Supply, delivery to site of pump set sensor termination cubicles	Sum
(g) Supply, delivery to site of cable sleeves	m
(h) Supply, delivery to site of danger tape	m

EMCA 18.2 INSTALLATION

<u>Pay Item</u>	<u>Unit</u>
(a) Installation of cables, jointing, terminating materials, all earth wires and cable name tags as per the cables schedule supplied electronically	Sum/m
(b) Installation of cable route markers	Each
(c) Installation of concrete cable slabs	Each
(d) Installation of cable trays, ladders and wire trunking	Sum
(e) Installation of cable supports to motors and other electrical equipment	Sum
(f) Installation of pump set sensor termination cubicles	Sum
(g) Installation of cable sleeves	m
(h) Installation of danger tape	m
(i) Excavating, back filling, consolidation, importation of soil and dumping of all rock and stone removed during excavations including cleaning of cable routes all according to particular specification (including hand excavations where necessary along existing cable routes.	
(j) Drilling for sleeves under road surfaces (6m Sleeves)	m

EMCA 18.3 COMMISSIONING

<u>Pay Item</u>	<u>Unit</u>
(a) Testing and commissioning of cables	Sum
(b) Updating, verifying and submission of Electronic Cable schedules with Tag numbers and final agreed lengths	Sum
(c) Drawing up of as built cable route plans	Sum

PARTICULAR SPECIFICATIONS:

ESPL – ELECTRICAL/ELECTRONIC: SMALL POWER AND LIGHTING INSTALLATIONS

PRELUDE

This particular specification details the successful supply, manufacturing, factory inspection test at the contractors premises, careful handling / transportation to the clients premises, safe storage as required and successful installation and commissioning for the above mentioned.

The contractor will furthermore responsible to uphold the electrical equipment during the Defects Liability Period.

This particular specification should be read in conjunction with the following;

- Section C3.4.3 of the tender document – Variation and additions to the Electrical / Electronic standard and particular specifications; and
- Associated drawings as issued with the Tender document; and
- Schedule of Quantities as per project specific.

Whereas conflicts in the above mentioned exists, this should be brought under the attention of the Engineer within a week before the Tender closes.

All materials and equipment to be supplied shall be new and of the best quality available.

All equipment shall bear the SABS mark.

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SPL SMALL POWER AND LIGHTING INSTALLATIONS ON BUILDINGS AND STRUCTURES

ESPL 1 SCOPE OF WORKS

As specified in the Project Specifications.

ESPL 2 STANDARDS

The following standards, regulation and drawings, etc. shall be applicable to the electrical installations related to this particular specification, whereas the latest applicable South African Bureau of Standards Codes and Standards should be used;

Table 1: Applicable Standards

Standard No.	Description
BS 3676	Switches for household and similar fixed electrical installations. Specification for general requirements
SANS 156	Moulded-Case Circuit Breakers
SANS 164	Plug and socket-outlet systems for household and similar purposes for use in South Africa
SANS 201	Energy Efficiency in Buildings
SANS 474	Code of practice for electricity metering
SANS 475	Luminaires for interior lighting, street lighting and floodlighting - Performance requirements
SANS 890	Ballasts for fluorescent lamps
SANS 950	Un-plasticized polyvinyl chloride rigid conduit and fittings for use in electrical installations
SANS 1012	Electric light dimmers
SANS 1085	Wall boxes for the enclosure of electrical accessories
SANS 1091	National colour standard
SANS 1195	Bus bars
SANS 1213	Mechanical cable glands
SANS 1239	Plugs, socket-outlets and couplers for industrial purposes
SANS 1411	Materials of insulated electric cables and flexible cords
SANS 1619	Small power distribution units (ready boards) for single-phase 230V service connections
SANS 1765	Machine-made textile floor coverings - Determination of thickness
SANS 1777	Photoelectric control units for lighting (PECUs)
SANS 10142	Code of Practice for the wiring of Premises
SANS 10114-1	Interior lighting Part 1: Artificial lighting of interiors
SANS 10114-2	Interior lighting Part 2: Emergency lighting
SANS 60309-1	Plugs, socket-outlets and couplers for industrial purposes Part 1: General requirements
SANS 60309-2	Plugs, socket-outlets and couplers for industrial purposes Part 2: Dimensional interchangeability requirements for pin and contact-tube accessories

Standard No.	Description
SANS 60570	Electrical supply track systems for luminaires
SANS 60669-1	Switches for household and similar fixed-electrical installations Part 1: General requirements
SANS 60669-2-1	Switches for household and similar fixed electrical installations Part 2-1: Particular requirements - Electronic switches
SANS 60669-2-2	Switches for household and similar fixed electrical installations Part 2-2: Particular requirements - Electromagnetic remote-control switches (RCS)
SANS 60669-2-3	Switches for household and similar fixed electrical installations Part 2-3: Particular requirements - Time-delay switches (TDS)
SANS 60669-2-4	Switches for household and similar fixed electrical installations Part 2-4: Particular requirements - Isolating switches
SANS 60669-2-5	Switches for household and similar fixed electrical installations Part 2-5: Particular requirements - Switches and related accessories for use in home and building electronic systems (HBES)
SANS 60906-3	IEC system of plugs and socket-outlets for household and similar purposes Part 3: SELV plugs and socket-outlets, 16 A 6 V, 12 V, 24 V, 48 V, a.c and d.c
SANS 60921	Ballasts for tubular fluorescent lamps - Performance requirements
SANS 60947-1	Low-voltage switchgear and control gear Part 1: General rules
SANS 60947-2	Low-voltage switchgear and control gear Part 2: Circuit-breakers
SANS 60947-3	Low-voltage switchgear and control gear Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units
SANS 61084-All	Cable trunking and ducting for electrical installations
SANS 61347-All	Lamp control gear Part
SANS 10292	Earthing of low-voltage (LV) distribution systems

ESPL 3 SPL CABLING AND ACCESSORIES

ESPL 3.1 PVC INSULATED CONDUCTORS

PVC insulated conductors shall be of high conductivity, stranded copper with Polyvinyl Chloride insulation of 600/1 000 volt grade.

The wiring of circuits shall be carried out on the "loop-in" system and no jointing of conductors in conduit runs or cutting away of wire strands will be permissible.

Connectors for use in conduit boxes shall be of the heavy brass terminal type mounted in porcelain insulators.

All plug circuits shall consist of 2 x 4mm² PVC insulated conductors plus 1 x 2,5mm² bare copper earth wire in Ø20mm conduit.

All lighting circuits shall consist of 1,5mm² PVC insulated conductors in 20mm conduit. For fluorescent lights an additional 2,5mm² bare copper earth wire shall be provided and thoroughly bonded to each fitting.

Connections between lamp holders of incandescent fittings and the conduit boxes shall consist of asbestos insulated wire or other approved heat resistant conductors.

ESPL 3.2 CONDUIT AND CONDUIT ACCESSORIES

Conduit, conduit accessories and conduit fittings shall be hot-dip galvanized both on the inside and outside

Only brass bushes and bush nuts will be acceptable.

The conduit installation shall be carried out on the "loop-in" system and no conduit shall have a diameter of less than 20 mm. All conduits shall be built into walls, concrete ceilings etc, and no conduit will be allowed on the surface.

All conduit ends shall be remerged and all joints securely screwed together. No inspection bends or elbows will be allowed in the installation. Running joints may only be used where unavoidable and shall be provided with lock nuts. All screwed joints shall be thoroughly painted with "Red Lead" in order to prevent corrosion.

No conductor may be drawn into any conduit, unless all foreign materials, moisture and sharp edges have been removed.

In event of a conduit terminating in any sheet metal box, two lock nuts and a brass bush or one lock nut and a bush-nut shall be used.

Standard round conduit boxes shall be used for light points and draw boxes. Draw boxes shall be provided with enamelled metal cover plates with brass screws.

Standard 100 x 50 x 50 mm hot dipped galvanised pressed steel boxes shall be used for all switch boxes.

Standard 100 x 100 x 50 mm hot-dipped galvanised pressed steel boxes shall be used for all plug boxes and telephone outlets.

Expansion boxes shall be provided at all expansion joints in the building. Such expansion box shall comprise a flush hot dipped galvanised sheet steel box with blank enamelled steel cover plate secured in position by means of brass screws. The conduit on the one side shall be securely fixed to the box, while the conduit on the other side shall be able to move freely in the box in order to provide for movement of the building. The conduit on the one side shall be bonded to that on the other side inside the box by means of flexible copper connections with clamps, bolts and nuts, in order to ensure earth continuity.

The conduit shall be installed in the concrete ceilings along the shortest possible routes, with the cover plates of draw boxes on the final ceiling surface. Conduit shall be installed as near as possible to the neutral axis of concrete beams, slabs and columns and deep conduit boxes shall be used.

All unwired conduits should be equipped with hot dipped galvanised draw wires with at least 200 mm ends on each end of the conduit. The ends of the draw wire shall be neatly coiled in the draw boxes.

ESPL 3.3 STANDARD 100 X 100 X 50 MM AND 100 X 50 X 50 MM BOXES

The above mentioned boxes shall be heavy gauge, hot-dip galvanized, pressed steel boxes.

ESPL 3.4 COVER PLATES

All cover plates (switch boxes, plug boxes and draw boxes) should be of baked enamelled steel.

The colour to be approval by the Engineer, with input for the Architect and Client.

ESPL 4 LIGHTING INSTALLATIONS

ESPL 4.1 LIGHT SWITCHES

Light switches shall comply with SANS 10142 and BS 3676.

Standard mounting box for all light switches: 100 x 50 x 50mm, hot dip galvanized and neat rounded corners

Light switches current rating: >16Amp and suitable for the load it is connected to.

Flush mounted switches: micro type with white rocking lever

Watertight switches to be installed in cast iron boxes, inclusive of watertight cover plates and clearly marked with "ON" and "OFF" positions.

The switch lever shall be protected where it protrudes through the cover plate.

ESPL 4.2 LIGHT FITTINGS

Light fittings shall be of the latest technology lamps and control equipment as prescribed. LED lights shall be installed as specified.

Fluorescent light fittings shall be equipped with electronic ballasts.

Fluorescent lamps colour temperature: 3 000°K unless otherwise specified.

Light fittings with filament lamps installations: wiring between the terminal box and the lamp holder shall have heat resisting insulation.

ESPL 4.3 INSECT KILLERS

As specified in the project specifications.

ESPL 5 SMALL POWER INSTALLATIONS

ESPL 5.1 POWER OUTLETS

Plug outlets shall be of the combined 3 pin, 13Amp or 16Amp socket and switch combination.

Type: flush mounted units, with a white rocking lever.

Mounting box: 100 mm x 100 mm x 50 mm and neat rounded corners.

The switch lever shall be protected where it protrudes through the cover plate.

ESPL 5.2 THREE PHASE AND MULTI-PIN PLUG OUTLETS

Three phase plug outlets shall be either;

- 63A, 400V, 5 pin units complete with plug and interlocked isolating switch; or
- 32A, 400V, 7 pin units complete with plug and interlocked isolating switch.

ESPL 5.2.1 ISOLATOR INSTALLATION

Isolation installation: 100x50x50mm, IP 65 weatherproof wall box as indicated on the drawings, as required.

Isolators shall be one of the following and as specified;

- 20A double pole;
- 30A double pole;
- 60A double pole;
- 30A triple pole; or
- 60A triple pole.

Mounting height (kitchens and other areas where cupboards are fitted): 1050 mm AFFL

Mounting height (gate motors): 500mm AFFL

Isolator units to be installed in an accessible location and in close proximity to the particular equipment (ex. air-conditioning units, geysers, extractor fans, gate motors, etc.) and as indicated on the drawings.

ESPL 6 DISTRIBUTION BOARDS

Each of the relevant distribution boards shall be built into walls or securely bolted down on the floor or plinth by means of the requisite number of foundation bolts grouted into the floor in the positions indicated on the drawings.

These positions shall be confirmed with the Engineer on site prior to installation as follows;

- a. Contractor shall install distribution board in accordance with manufacturer's instructions.
- b. Contractor shall tighten accessible bus connections and mechanical fasteners to the manufacturer's torque requirements.
- c. Contractor shall select and install fuses in fusible switches based upon field requirements.
- d. Contractor shall adjust circuit breaker settings based upon field requirements.
- e. Contractor shall adjust solid state overloads to match the installed motor characteristics.

ESPL 6.1 WALL SURFACE MOUNTED TYPE MOUNTED LV DB SPECIFICATIONS

DB board type:

- Surface mounted with doors, 1,6 mm sheet steel, with a bonding tray, chassis and removable panel.

Bonding trays:

- Adequately sized in order that all the relevant equipment is installed without cramping and adequately braced with suitable gaskets.

DB Doors:

- Secured with robust and rust proofed hinges. A single door shall not be wider than 600 mm.
- Rust proofed handles and latches. Ball type latches will not be acceptable.

DB chassis:

- Rigid and facilities shall be provided on the chassis for mounting all the relevant equipment.

Mounted:

- Panels shall be mounted in order that all equipment are flush behind the panel with only operating handles and push buttons projecting through neat machine punched slots in the panel.
- Panels shall be provided with chromium plated brass handles to facilitate removal.
- The panel shall be rigid and readily removable without necessitating the disturbance of any of the equipment on the board.

Colouring:

- Interior surfaces of the board shall be powder coated white .
- Exterior surfaces (including panels) in colour B26, SANS 1091 (Electric orange).
- Powder coating shall be of the best quality with high shock and scratch resistance.
- Before powder coating, metal parts shall be thoroughly degreased and cleaned by shot blasting to be free of rust, mill-scale and other foreign materials.

Gland Plate:

- A 3CR12 steel gland
- Fitted to the bottom section of the board to facilitate termination of cables by means of cable glands.

Busbars:

- Shall consist of tinned solid high conductivity copper mounted on suitable busbar insulators.
- Connections to busbars shall be done with suitable lugs sweated or crimped to the conductor ends, and cadmium plated high tensile steel bolts, nuts and washers.

Copper multiway neutral and earth bars:

- Shall be equipped with cadmium plated high tensile steel bolts, nuts and washers for connection of the various conductors.
- The neutral bar shall be mounted on busbar insulators, but the earth bar shall be thoroughly bonded to the metalwork of the board.

The internal wiring of the boards:

- Done with PVC insulated conductors arranged neatly horizontally, vertically and at right angles in front of the chassis.
- The conductors shall be neatly bunched by means of cable ties. (String will not be acceptable.)

Labelling:

- An engraved plastic label of the black on white sandwich type shall be screwed to the panel below each item of equipment.
- For single pole equipment a number system shall be used.
- A neatly typed legend card behind clear "Perspex" in a metal frame should be provided. The frame shall be mounted on the inside of the switchboard doors.

Sundries:

- All bolts, nuts, washers and screws used on should be rustproof.
- The use of self-tapping screws will not be allowed.

ESPL 6.2 WALL FLUSH OR SEMI-FLUSH MOUNTED DB SPECIFICATIONS

Flush and semi-flush mounted distribution boards shall be manufactured as follows;

- Constructed of 1,2mm sheet steel (minimum) and shall comply with SANS 1180 Part 1.
- Including rust hot dipped galvanised wall tray.
- Braced with of suitable gussets.
- Suitable sized to accommodate equipment without cramping as specified in the schedules.
- Expanded metal to be spot-welded at the rear of all wall trays for 110mm walls.
- Formed with bevelled or flat edges and neatly mitred and shall accommodate the panel chassis and door/s.
- The lip for the mounting of the circuit breaker carriers, and front panels shall form part of the architrave frame.

Panels Door specifications:

- Rigid and manufactured with a smooth flat finish.
- Suitably braced to ensure stiffness,
- Recessed flush in the architrave.
- Door catches shall be equal and similar to "Union" manufacture, as follows;
 - Cat No. 51741 (solid, no lock), or
 - Cat No. 5174 (with built-in lock),
- Single doors to be constructed of sheet steel and shall open at least 150 degrees.
- The distance between panel and inside of door(s) shall be not less than 40mm.

Circuit breaker carriers specifications;

- Rigid construction for mounting of equipment.
- Fixed to the architrave frame and provided with the necessary means for fixing of circuit breakers, isolators, etc.
- Width of carriers for compact circuit breakers shall be such that a distance of 10mm is maintained between the carriers.

Mounted:

- Panels shall be mounted in order that all equipment are flush behind the panel with only operating handles and push buttons projecting through neat machine punched slots in the panel.
- Panels shall be provided with chromium plated brass handles to facilitate removal.
- The panel shall be rigid and readily removable without necessitating the disturbance of any of the equipment on the board.
- Panels shall be attached to architrave by means of captive fasteners (with screw driver slots).
- Self-tapping screws are not acceptable.
- Panels can also be fitted by means of two guiding pins at the bottom or on the hinge side of the door.

Slots for equipment:

- Slots for equipment installed separately shall have the exact dimensions to accommodate only the specific equipment, as per example main switches, earth leakage relays, etc.
- A maximum tolerance of approximately + 1mm shall be maintained on all sides between slots and equipment.

Power meters:

- Where required, power meters shall also be flush mounted behind the panels and Contractors are required to co-operate with the supply Authorities in this respect.

Busbars specifications:

- Consist of solid drawn high conductivity copper with a rectangular cross-section in accordance with SANS 1195 for each phase and neutral and are to be installed in a group in the top section of all distribution boards.
- Busbars to be installed either horizontally or vertically.

- Busbars must be so arranged that horizontal bars are placed one above the other and vertical bars placed side-by-side, with the flat surface facing front wards to facilitate connections and clear of all equipment.
- Where necessary, busbars shall either be twisted to a 45° angle or shall be stepped in the horizontal plane.
- 50mm spacing between bars to be provided.
- A set of busbars should be installed in each section of a distribution board feeding more than two three phase connections including future equipment.
- These busbars shall not be mounted directly onto the terminals of any triple pole circuit breakers, fuse-switches or isolators.
- Busbars shall be mounted on coloured "ceramic" or "paxalene" or similar insulators. Colour of insulators shall be in phase colours, red, white, blue and black for neutral.
- Busbars for single pole circuit breakers shall consist of solid copper with a minimum cross-section of 1,5mm x 19mm and shall be fixed directly to the terminals of the circuit breakers. Single pole circuit breakers should be grouped distinctly separate for the three phases, in horizontal rows (one above the other) in the following sequence, red, white and blue, starting with red on top.
- Connections to busbars shall be done with lugs, sweated or crimped to cable ends and bolted to busbars with cadmium plated 6mm diameter steel bolts (machined bolts) and nuts. Bolts shall be of the hexagonal head type, with 6mm thread and must be provided with washers, spring washers and hexagonal nuts.
- Busbars are to be drilled and tapped and bolts must be screwed into the busbars from the rear. Connection facilities to busbars shall make provision for the number of three phase connections as well as spare connections specified.
- Spare bolts, complete with washers and nuts, are to be screwed into each busbar, to allow for future extensions.
- Busbars shall be mounted on a rigid chassis and the use of two chassis for the mounting of a busbar will not be permitted. Only similar metals shall be used for busbars and connections thereto.
- Each busbar shall be provided with one large terminal for the main conductor. All busbars must be accessible from the front.

Wiring specifications;

- Wiring is to be carried out from the sides and in front of the chassis with conductors neatly arranged in horizontal, vertical and at right angles rows and bound together by means of perforated plastic tape (string will not be acceptable).
- Each conductor within the harness shall be kept parallel to the others without twisting or spiralling and shall be free of links.
- Only one conductor per connection point will be permitted
- All wiring is to be kept free and away from any exposed terminals, or other non-insulated current carrying parts.
- Looping from terminals of main switch, circuit breakers, or isolators will be limited to a maximum of only two outgoing circuits per DB, more than two circuits shall be connected to the busbars.
- Only copper conductors will be permitted.
- Internal wiring in the DBs, shall consist of stranded conductors and shall be in the colours of the relevant phases being red, white, blue and black for neutral.
- Colour taped conductors will not be permitted

- Switch boards shall be supplied completely wired and ready for connection.

DB powder coated finish specifications:

- All metal parts shall be degreased, rinsed, pickled, rinsed, phosphate, neutralized and then to be thoroughly dried.
- The above process is to be followed by the following powder coating process, before distribution boards are delivered for installation.
- Powder coating finishing shall be colour B26, SANS 1091 (Electric orange) or a colour as described by the Architect. Care to be taken that all edges are properly covered with powder coating.

Labelling:

- Screwed-on, engraved labels, of the white-on-black type, shall be provided on the front of the DB to identify the equipment and instruments as indicated on the proposed layout.
- Inscriptions shall be 6mm high lettering on Ivorene labels. Fixing screws shall be chrome or brass 6BA roundhead.
- **Note:** All grouped SP circuit-breakers on distribution boards and cubicles must be numbered with suitable engraved printed plastic or Ivorene plates indicating numbers of circuit controlled.
- A neatly typed legend card behind clear "Perspex in a metal frame shall be provided for this purpose.
- The frame shall be spot welded on the inside of the switchboards doors.

ESPL 7 ACCESSORIES FOR SWITCHBOARDS

ESPL 7.1 MAINS SURGE ARRESTORS

When a surge arrestor is installed in systems with a main breaker with 250Amps or 5kA fault current, the surge arrestor shall be pre-fused to prevent the units creating a danger when subjected to high fault currents. Surge arrestors shall be pre-fused to the manufactures requirements. All surge arrestors shall be **connection type 2** as per the latest addition of the SANS 10142.

ESPL 7.2 BUILDING WITH EXTERNAL LIGHTNING PROTECTION

The main distribution board surge arrestors shall be combined type 1 & 2 and voltage compatible to the relevant installation and shall be able to withstand a lightning impulse current wave form 10/350µs at a maximum discharge current of 100kA.

Any distribution board feeding from the main distribution board shall have surge arrestors and shall be type 2 and voltage compatible to the relevant installation and shall be able to withstand a lightning impulse current wave form 8/20µs at a maximum discharge current of 40kA.

Each distribution board shall be equipped with mains surge arrestors.

ESPL 7.3 BUILDING WITH NO LIGHTNING PROTECTION

The surge arrestors shall be type 2 and voltage compatible to the relevant installation and shall be able to withstand a lightning impulse current wave form 8/20 μ s at a maximum discharge current of 40kA.

Each distribution board shall be equipped with mains surge arrestors.

ESPL 7.4 MOULDED CASE CIRCUIT BREAKERS

All moulded case circuit breakers shall be as specified in the schedules of equipment for distribution boards and shall comply with SANS 156.

The required frame sizes or rupturing capacities required are specified in the schedules for each board.

Each circuit breaker shall be provided with non-adjustable time-delayed trips.

ESPL 7.5 CURRENT LIMITING CIRCUIT BREAKERS

The current limiting circuit breakers shall be capable of remaining in service and of carrying their normal rated current after having interrupted the maximum short circuit current of 200 kA RMS at least three times.

ESPL 7.6 CONTACTORS

All contactors shall be of the totally enclosed, three pole, double air break per pole, automatic magnetic type complying with the requirements of BS 775 for "CLASS UR" contactors of the "**CLASS II MECHANICAL DUTY CLASS**" and "**A3 Make and Break Category**".

All contactors shall be provided with arc extinguishers, and readily replaceable silver or silver-alloy contacts rated for at least 2-million "on" and "off" switching operations at rated current.

Each contactor shall be provided with an AC, closing coil suitable for continuous operating and at least 15 closing operations per hour at system voltage. The contactor may not hum or chatter in service and the contacts may not bounce on closing.

ESPL 7.7 TIME SWITCHES

The time switches shall be suitable for use on a 230 volt, 50 cycle per second AC supply and shall be of the microprocessor type.

The time switches shall be digital timers suitable for rail or surface mounting and shall be programmable with daily and weekly programs, switching intervals of 1 minute and switching accuracy precise to the second.

The time base shall be of the quartz type with LED display for time, weekday, holiday program, switching position and manual override and shall have a power reserve of 250 hours at full operation. The time switches shall have a switching capacity of 16 A at 230V.

ESPL 7.8 EARTH LEAKAGE UNITS

The earth leakage units shall consist of a combination of a earth leakage relay and a moulded case circuit breaker and shall have a sensitivity as specified, it shall conform to SANS 767.

ESPL 8 EARTHING

The contractor shall do all the bonding and earthing in accordance with the latest addition of the "Code of Practice for the Wiring of Premises" SABS 10142.

Earth resistivity measurements of less than 1 ohm will be acceptable at motor control centers and distribution boards.

ESPL 9 DANGER SIGNS

Danger signs on aluminum plates shall be supplied on each door of an outdoor motor control center or distribution board and shall be in accordance with the Occupational Health and Safety Act, Act 85 of 1993.

ESPL 10 INSPECTIONS AND TESTS

All equipment will be inspected by the Engineer and tested in his presence both in the factory during manufacturing and on site during installation. The Engineer will do all inspections accompanied by the Contractor and the Contractor will do all tests with the Engineer as witness.

The Engineer will require seven (7) days notification to avail himself for any test or inspection and the Contractor must arrange for the maximum number of inspections and tests to be done on the same day. The Contractor must provide all testing facilities and instruments, all equipment required for a test or inspection.

The cost of all tests must be included in the tender price.

ESPL 10.1 TESTING OF DISTRIBUTION/MOTOR CONTROL BOARDS

Each distribution/motor control board shall be subjected to the following tests in the manufacturer's works after manufacture:

- a. A thorough inspection shall be carried out to ensure compliance with the specification and approved drawings and wiring diagrams and to ascertain that all connections are properly made.

- b. A high voltage test on all primary connections to check the insulation between phases mutually and between each phase and earth.
- c. The polarities and ratios of all potential and current transformers shall be checked.
- d. Primary and secondary injection tests shall be carried out on all switching, protection, metering interlocking and indication circuits.

The manufacturer shall submit three copies of test certificates giving details of conditions and results of tests carried out to the Engineer.

ESPL 10.2 OPERATING AND MAINTENANCE INSTRUCTIONS

Before completion of the testing of the plant, the Contractor shall provide the Employer with adequate and complete working, operating and maintenance instructions *in triplicate*, with the necessary drawings and diagrams clarifying the instructions. The Contractor will also provide 3 x "soft copies" of the complete manual in PDF format on a Suitable sized USB Flash Drive (Memory Stick)

Instructions are to be made up in book form and particular reference is to be made to:

- Maintenance of equipment;
- Precautions to be taken in running the plant;
- All instruments and components must be fully described in data sheets supplied by the relevant suppliers;
- Wiring diagrams of the complete electrical installation.

The manual must be specific for the plant supplied and all extraneous material not connected with the relevant plant shall be deleted, leaving the manual as a comprehensive coherent document, bound in a professional way such that this may be used frequently without falling apart. Standard pamphlets may be supplied as addendums, bound separately in a good quality file to serve as reference but will not be allowed as part of the main manual.

ESPL 11 SUPPORTING DOCUMENTATION

ESPL 11.1 INFORMATION TO BE SUBMITTED WITH TENDERS: 400V DB

Before manufacturing, the following information shall be submitted with each Tender in respect of all boards offered;

- a. Full technical details and descriptive literature regarding all equipment and instruments offered;
- b. Three paper prints of an outline drawing of each motor control centre and distribution board indicating the main overall dimensions and general lay-out of the boards; and
- c. Three paper prints of an outline drawing of the front end processor cabinet indicating the main overall dimensions, general layout and type of material employed on the face of the panel.

ESPL 11.2 INFORMATION REQUIRED WITH TENDER SUBMISSION

The following information regarding the switch- and distribution boards shall be submitted with each tender.

- a. The name and address of the switchboard manufacture.
- b. Descriptive literature and technical information of all equipment and instruments offered with the boards.
- c. Wiring diagrams of all distribution boards.
- d. Schematic single line diagrams of all distribution boards.
- e. Elevations showing dimensional information including details such as, but not limited to, the following:
 - Distribution boards height (less any removable lifting angles or eyes)
 - Distribution boards width
 - Distribution boards depth
 - Location of shipping splits
- f. Structure descriptions showing the following:
 - Bus ratings
 - Enclosure ratings
 - Short-circuit withstand ratings
 - Other information as required for approval
- g. Conduit locations
- h. Required bus splices
- i. Unit descriptions including information such as, starter sizes, circuit breaker frame sizes, circuit-breaker continuous ampere ratings, and pilot devices
- j. Nameplate information
- k. Manufacturer drawings shall be provided in PDF format
- l. Data sheets and publications on all major components including, but not limited to, the following:
 - Motor starters
 - Overload relays
 - Circuit breaker and fuse information including time current characteristics
 - Control power transformers
 - Pilot devices
 - Relays
 - All clarifications and exceptions must be clearly identified

After completion of the work, the contractor shall submit three final copies of each of the above-mentioned drawings showing the final layout and wiring diagram of the boards.

ESPL 11.3 AS BUILT INFORMATION

On completion of the works, but before the certificate of completion will be issued, the contractor shall submit to the Engineer, as built information in electronic format indicating in a satisfactory manner:

- a) The exact position of all electrical installation equipment in the buildings
- b) Distribution board as built wiring diagrams

c) Certificate of Compliance for all building installations

Electronic copies of the various plans for the marking up of the information required will be supplied to the contractor on request.

ESPL 12 MEASUREMENT AND PAYMENT

Measurement and payment will be done in accordance with the methods stated below:

ESPL 12.1 DESIGN, DRAWING AND GENERAL

The rate tendered shall include for the provision of the necessary design information for all items measured under the respective schedule. For distribution board's installation, design information shall include, but limited to as listed in this Particular Specifications.

<u>Pay Item</u>	<u>Unit</u>
(a) Provide design drawings and wiring diagrams as specified	Sum
(b) Provide operating and maintenance manuals and "as built" drawings as specified	Sum
(c) Allowance for short circuit analysis and coordination study and protection setting calculations	Sum

ESPL 12.2 SUPPLY AND DELIVERY TO SITE

<u>Pay Item</u>	<u>Unit</u>
(a) Supply and delivery to site of complete electrical installation equipment as specified	Sum

ESPL 12.3 INSTALLATION

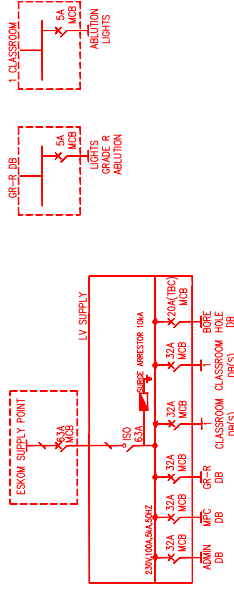
<u>Pay Item</u>	<u>Unit</u>
(a) Installation of complete electrical installation as specified	Sum

ESPL 12.4 COMMISSIONING

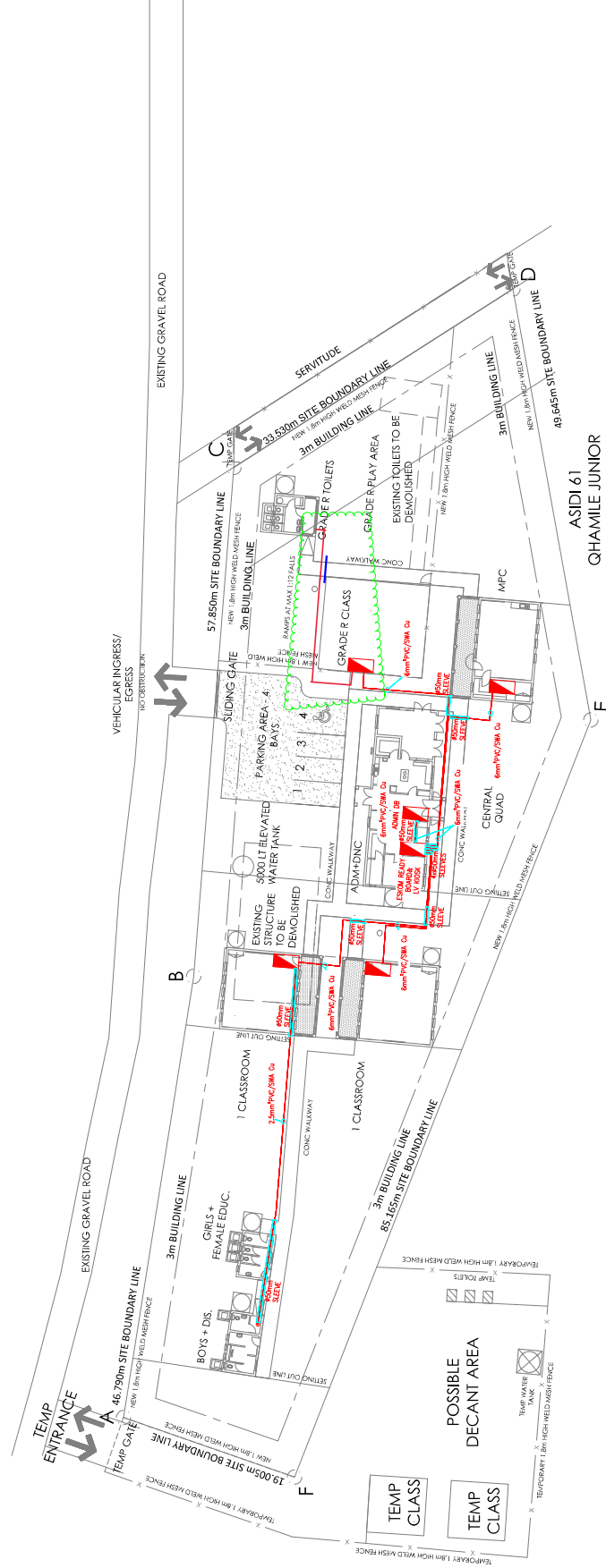
<u>Pay Item</u>	<u>Unit</u>
(a) Commissioning of complete electrical installation as specified	Sum

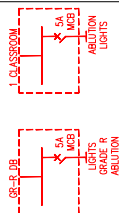
ANNEXURE F

ELECTRICAL SITE RETICULATION DRAWINGS



1. **NOTES:**
1. TRANSFORMER CONNECTION TO BE DONE VIA POLYMERIZED
2. TRANSFORMER AND SUITABLE SIZED ARJATIC CABLE
3. SUPPLY POINT TO BE INSTALLED IN ELECTRICAL
4. A MANUALLY SUPPLIED MESH TO BE SUPPLIED AND INSTALLED IN
5. DISPERSED POINT TO BE INSTALLED IN ELECTRICAL
6. THE IDENTIFICATION OF THE ELECTRICAL SUBSTATION
7. IDENTIFICATION OF THE ELECTRICAL SUBSTATION
8. IDENTIFICATION OF THE ELECTRICAL SUBSTATION
9. IDENTIFICATION OF THE ELECTRICAL SUBSTATION
10. IDENTIFICATION OF THE ELECTRICAL SUBSTATION
11. IDENTIFICATION OF THE ELECTRICAL SUBSTATION
12. IDENTIFICATION OF THE ELECTRICAL SUBSTATION

[illegible]



PROPOSED CABLE ROUTE
ELECTRICAL SLEEVES
PROPOSED DB POSITIONS

7. EXTERNAL CONNECTION TO BE DONE VIA POLE MOUNTED TRANSFORMER AND SUITABLE SIZE AIRCABLE CABLES.
8. MAIN SUPPLY TO BE INSTALLED IN DESIGNATED AREA.
9. A MAIN VLV/PTV/MSK TO BE SUPPLIED AND INSTALLED IN DESIGNATED AREA.
10. THE ESOM SUPPLY POINT TO BE THE RESPONSIBILITY OF THE ELECTRICAL SUB CONTRACTOR.
11. SITE RECTIFICATION CABLES TO BE PVC/HDG CABLES.
12. SUB-CONTRACTOR TO BE COMPLETED BY ELECTRICAL.
13. CABLES TO ABUTMENT BUILDINGS ARE FOR LIGHTS ONLY, INSTALLED IN CONDUIT AND SUPPLIED FROM NEIGHBORING CHUTE/STAIRWAYS TO BE PROPRIETARY CASECAID.
14. INTEGRATION OF ELECTRICAL SYSTEMS AT OLD AND NEW BUILDINGS TO BE DETERMINED ON SITE.
15. NEW CABLES TO BE INSTALLED ON SITE.
16. BUILDINGS AS REQUIRED.
17. APPROVED CONTRACTOR TO EXISTING BUILDINGS TO BE APPROVED CONTRACTOR.

ISSUED FOR INFORMATION PURPOSES		DESCRIPTION	DECLARATION
V/Nº	DATE		
0	2018.06.23		



VUYOLWETHU JUNIOR PRIMARY SCHOOL

NEW PROPOSED SCHOOL

CONTRACT	BUILDING OCCUPANCY CLASSIFICATION	PROJECT STAGE
PHASE	A3	

USE FILE	
ELECTRICAL	

SITE

PROPOSED SITE RETICULATION

DESIGN	C. Schoepers	DATE	
SCALE	AS SHOWN	DRAWN	R. Singh
		CHECKED	M. Lewis

DATE	RESPONSIBLE PROFESSIONAL	
	NAME	SIGNATURE
		PR NUMBER

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