



**health**

Department:  
Health  
PROVINCE OF KWAZULU-NATAL

---

**UGU DISTRICT: MURCHISON HOSPITAL: ALTERATIONS AND RENOVATIONS OF STAFF  
ACCOMMODATION**

---

---

**ANNEXURE 3**

# ARTEK 4 DRAWING REGISTER

## MURCHISON STAFF ACCOMMODATION PROJECT No. 1908

Page 1 of 2

Date : 2021.01.27

DWG NO.	REV	PAGE SIZE	DESCRIPTION	Site	House 1	House 2	House 3	House 4	House 5	House 6
			<b>SITE DRAWINGS</b>							
100	7	A1	Site Plan	•						
			<b>WORKING DRAWINGS</b>							
101-01	3	A1	House 1 - Plan Sections and Elevations		•					
101-02	0	A3	House 1 - Section B-B		•					
102-01	4	A1	House 2 - Plan Sections and Elevations			•				
103 -01	2	A1	House 3 - Plan Sections and Elevations				•			
103 -01	1	A1	House 3 - Sections & Fire Pit Details				•			
104 -01	3	A1	House 4 - Plan Sections and Elevations					•		
105-01	4	A1	House 5 - Plan Sections and Elevations						•	
106-01	4	A1	House 6 - Plan Sections and Elevations							•
107-01	2	A1	House 1 Laundry	•						
108-01	2	A1	Proposed Garage & Ex.Outbuilding-Submission	•						•
109-01	2	A1	Proposed Garages	•					•	
110-01	3	A1	Ex.Security House	•						
111-01	2	A1	Ex.Ablutions	•						
112-01	2	A1	Ex.Garage & Ex.Store	•						
114-01	1	A1	New Guard House	•						
			<b>SCHEDULES</b>							
400			<b>Door Schedules</b>							
400-01	1	A4	Door Schedule Door Type A	•	•	•	•	•		•
400-02	1	A4	Door Schedule Door Type B	•	•	•	•	•	•	•
400-03	1	A4	Door Schedule Door Type C					•		
400-04	1	A4	Door Schedule Door Type D - OMITTED							
400-05	1	A4	Door Schedule Door Type E	•	•	•	•	•	•	•
400-06	1	A4	Door Schedule Door Type F			•				
400-07	1	A4	Door Schedule Door Type G	•	•	•	•	•	•	

# ARTEK 4 DRAWING REGISTER

## MURCHISON STAFF ACCOMMODATION PROJECT No. 1908

Page 2 of 2

Date : 2021.01.27

400-08	1	A4	Door Schedule Door Type H		•					
400-09	1	A4	Door Schedule Door Type I		•	•				
400-10	1	A4	Door Schedule Door Type J			•			•	
400-11	1	A4	Door Schedule Door Type K						•	
401			<b>Window Schedules</b>							
401-01	1	A4	Window Schedule W1	•	•	•	•		•	•
401-02	1	A4	Window Schedule W2	•	•	•	•		•	
401-03	1	A4	Window Schedule W3	•	•		•		•	•
401-04	1	A4	Window Schedule W4				•			
401-05	1	A4	Window Schedule W5	•			•			
401-06	1	A4	Window Schedule W6	•						•
401-07	1	A4	Window Schedule W7							•
401-08	1	A4	Window Schedule W8					•		
401-09	1	A4	Window Schedule W9					•		
401-10	1	A4	Window Schedule W10					•		
401-11	1	A4	Window Schedule W11					•		
401-12	1	A4	Window Schedule W12						•	
402	0	A4	Sanware Schedule	•	•	•	•	•	•	•
403	1	A4	Finishes Schedule	•	•	•	•	•	•	•
404	1	A4	Ironmongery Schedule	•	•	•	•	•	•	•
405	0	A4	Burglar Bar Schedule	•	•	•	•	•	•	•
			<b>DETAILS</b>							
600-01	0	A1	House 1 & 2 - Tiling Layout		•	•				
601-01	0	A1	House 3 & 4 -Tiling Layout				•	•		
602-01	0	A1	House 5 & 6 -Tiling Layout						•	•
603-01	0	A1	Site Buildings	•						
601	0	A1	Joinery Fittings Layout - House 1		•					
602	0	A1	Joinery Fittings Layout - House 2			•				
603	0	A1	Joinery Fittings Layout - House 3				•			
604	0	A1	Joinery Fittings Layout - House 4					•		

**ARTEK 4  
DRAWING REGISTER**

**MURCHISON STAFF ACCOMMODATION  
PROJECT No. 1908**

Page 3 of 2

Date : 2021.01.27

605	0	A1	Joinery Fittings Layout - House 5								•	
606	0	A1	Joinery Fittings Layout - House 6									•
607	0	A1	Kitchen Fittings - House 1 (Unit 1)		•							
608	0	A1	Kitchen Fittings - House 1 (Unit 2)		•							
609	0	A1	Kitchen Fittings - House 2			•						
610	0	A1	Kitchen Fittings - House 3 (Unit 1)				•					
611	0	A1	Kitchen Fittings - House 3 (Unit 2)				•					
612	0	A1	Kitchen Fittings - House 4					•				
613	0	A1	Kitchen Fittings - House 5						•			
614	0	A1	Kitchen Fittings - House 6									•
615	0	A1	Laundry Fittings - Ex.Laundry Block		•							
616	0	A1	Laundry Fittings - House 2			•						
617	0	A1	Laundry Fittings - House 3 (Unit 2)				•					
618	0	A1	Laundry Fittings - House 4					•				
619	0	A1	Laundry Fittings - House 5						•			
620	0	A1	Laundry Fittings - House 6									•
621	0	A1	Bedroom Cupboards - House 1 (Unit 1)		•							
622	0	A1	Bedroom Cupboards - House 1 (Unit 2)		•							
623	0	A1	Bedroom Cupboards - House 2			•						
624	0	A1	Bedroom Cupboards - House 3 (Unit 1)				•					
625	0	A1	Bedroom Cupboards - House 3 (Unit 2)				•					
626	0	A1	Bedroom Cupboards - House 4					•				
627	0	A1	Bedroom Cupboards - House 5						•			
628	0	A1	Bedroom Cupboards - House 6									•
629	0	A1	Joinery Fittings - New Guard house	•								
630	0	A1	Joinery Fittings - Ex. Guard house	•								
			<b>REPORTS</b>									
n/a	1		FIDPM Stage 4 Report	•	•	•	•	•	•	•	•	•
n/a	0		Stage 4 Milestones	•	•	•	•	•	•	•	•	•



Rev. No.	Date	Description	By
01	21.03.2020	Issued for Weight, Test & Price Award	VAR
02	04.09.2020	Added Notes to Volume 2	VAR
03	10.09.2020	Door operated as handle for room	VAR
04	27.03.2021	PL & EL with finished	VAR

PROJECT: ALTERATIONS AND RENOVATIONS TO EXISTING STAFF ACCOMMODATION AT MAIN HARDING ROAD MURCHISON ON REM PTN 1.3 & 5 OF ERF 7108

CLIENT: PUBLIC WORKS

PROVIDER: DEPARTMENT OF PUBLIC WORKS

PROFESSIONAL SERVICE PROVIDER: HANU S. ALEXANDER

ARCHITECT: MTRK ZI

DATE: 2020

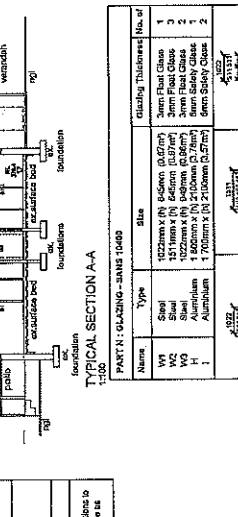
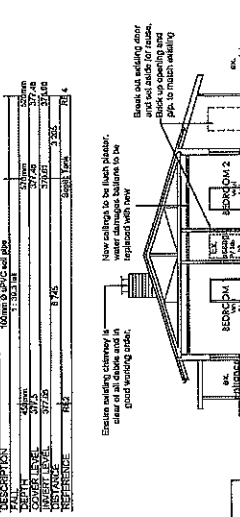
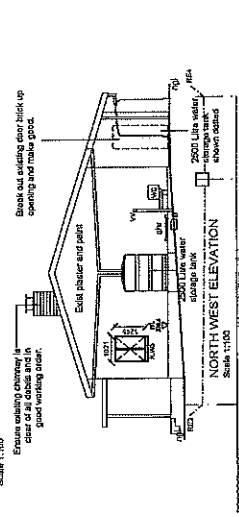
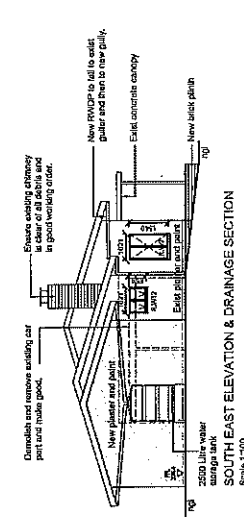
PROJECT NO: 101-01

DATE: 1908

PROVINCE OF KWAZULU-NATAL

LOCALITY PLAN: HOUSE 1 BUILDING 1

HOUSE 1 GROUND STOREY PLAN SECTION & ELEVATIONS



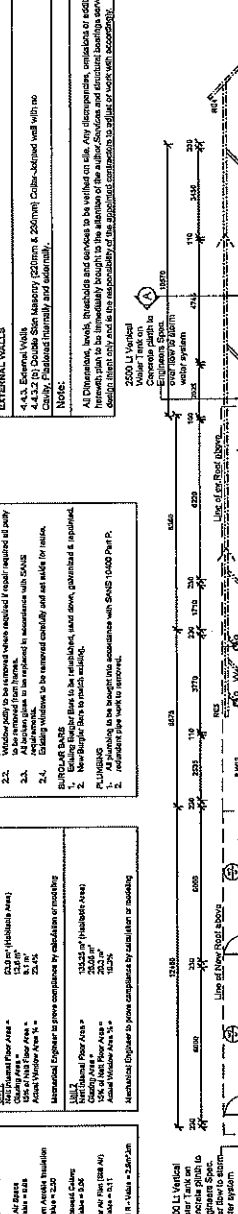
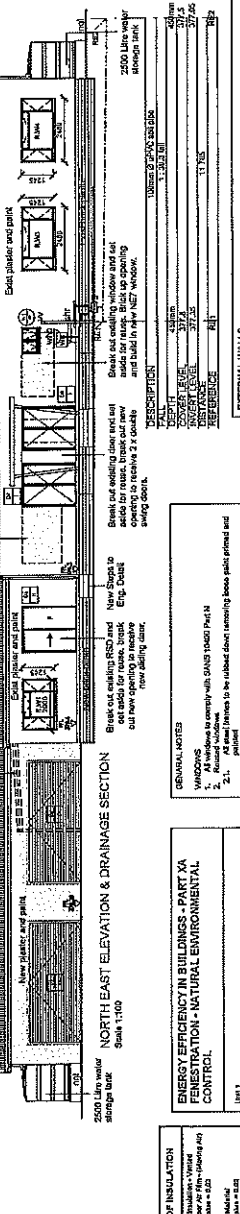
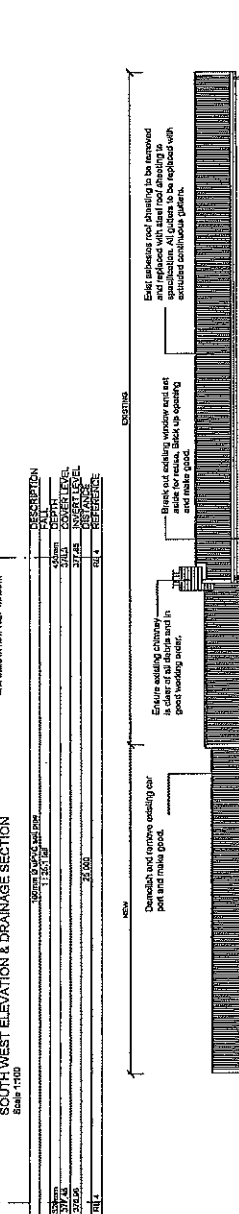
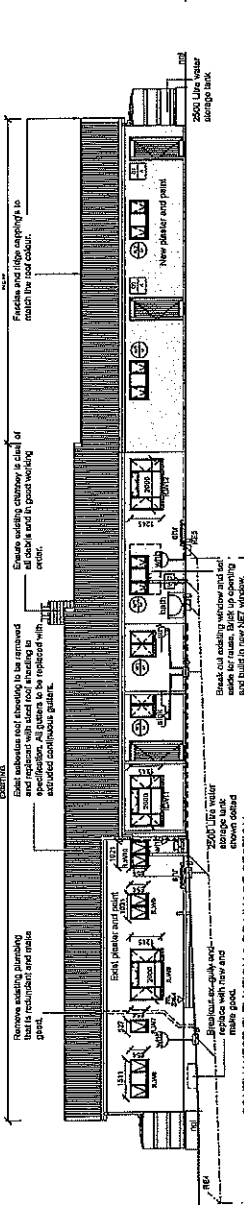
GLAZING TABLE

Name	Type	Size	Quantity	Thickness	No. of Glazing Units
WC	Shed	1025mm x 1525mm (R)	1	10	1
WC	Shed	1025mm x 1525mm (R)	1	10	1
WC	Shed	1025mm x 1525mm (R)	1	10	1
WC	Shed	1025mm x 1525mm (R)	1	10	1
WC	Shed	1025mm x 1525mm (R)	1	10	1
WC	Shed	1025mm x 1525mm (R)	1	10	1

NOTE: Refer to drawing for details.

HOUSE 1 ASSET SCHEDULE

UR1	UR2	Total	Volume 1	Volume 2	Total	Total FAR	Total Coverage
50.0m²	155.0m²	205.0m²	10.0m³	10.0m³	20.0m³	1.0	10.0%
17.5m²	72.0m²	89.5m²	10.0m³	10.0m³	20.0m³	1.0	10.0%
207.0m²	227.0m²	434.0m²	20.0m³	20.0m³	40.0m³	2.0	20.0%
50.0m²	155.0m²	205.0m²	10.0m³	10.0m³	20.0m³	1.0	10.0%
17.5m²	72.0m²	89.5m²	10.0m³	10.0m³	20.0m³	1.0	10.0%
207.0m²	227.0m²	434.0m²	20.0m³	20.0m³	40.0m³	2.0	20.0%

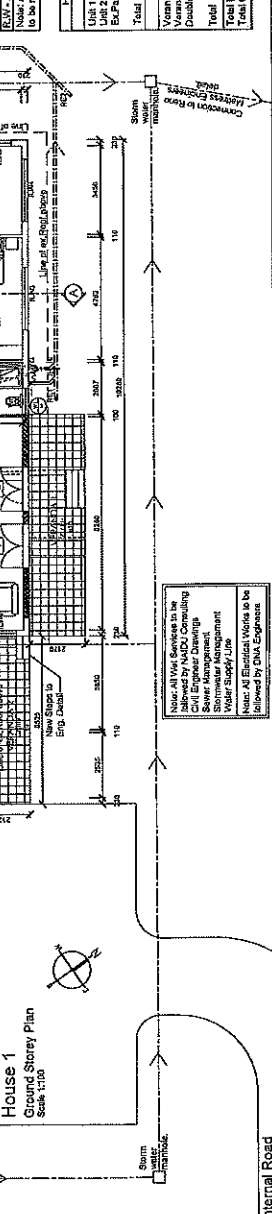


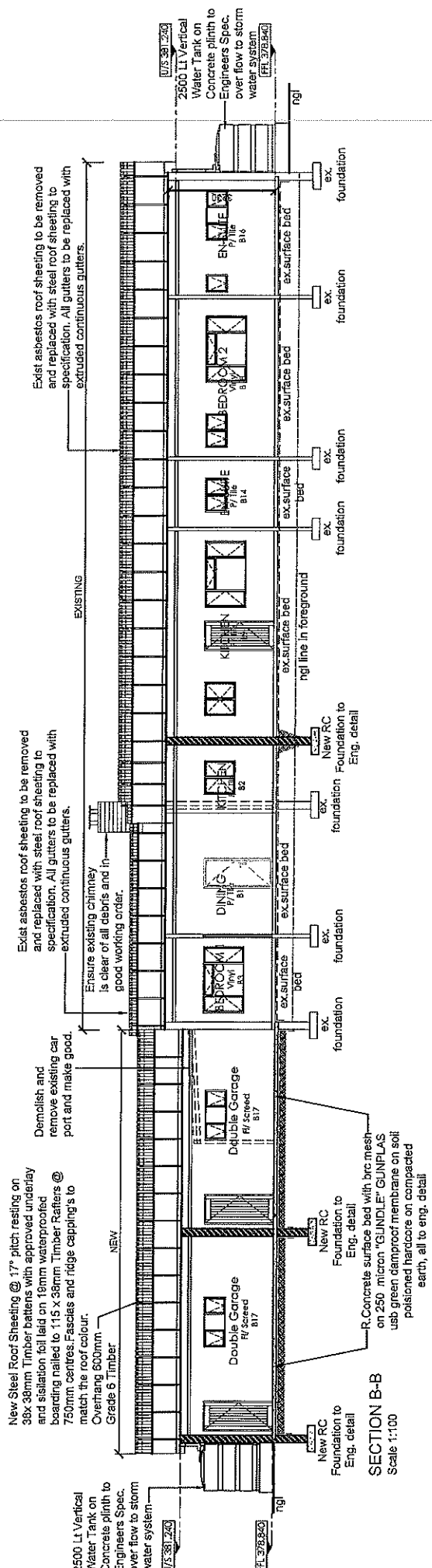
GENERAL NOTES

1. Windows to be replaced with SANS 1400 Part 1 windows.
2. Windows to be replaced with SANS 1400 Part 1 windows.
3. Windows to be replaced with SANS 1400 Part 1 windows.
4. Windows to be replaced with SANS 1400 Part 1 windows.
5. Windows to be replaced with SANS 1400 Part 1 windows.

REINFORCEMENT NOTES

1. Reinforce concrete to provide adequate structural strength.
2. Reinforce concrete to provide adequate structural strength.
3. Reinforce concrete to provide adequate structural strength.
4. Reinforce concrete to provide adequate structural strength.
5. Reinforce concrete to provide adequate structural strength.





SECTION B-B  
Scale 1:100

REVISIONS

Rev.	Date	Description	By

PROJECT  
ALTERATIONS AND RENOVATIONS TO EXISTING  
STAFF ACCOMMODATION AT MAIN HARDING ROAD  
MURCHISON ON REM PTN 1,3 & 5 OF ERF 7108

DRAWING DESCRIPTION  
House 1  
Section B-B

Scale 1:100  
Date September 2020  
Drawn VAR

ARCHITECT  
ARTEK 4 ARCHITECTS (KZN) CC

Durban: 46 Lena Afrane Road, Glenwood, Durban 4000  
tel: 031 201 0445 fax: 031 201 6609 email: admin@artek4.co.za  
Port Shepstone: 19 Tradewinds, Marine Drive, Shelly Beach  
tel: 039 652 2447 fax: 039 652 2446 email: admin@artek4.co.za

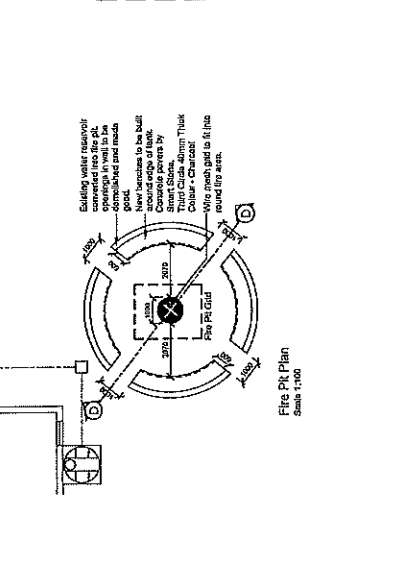
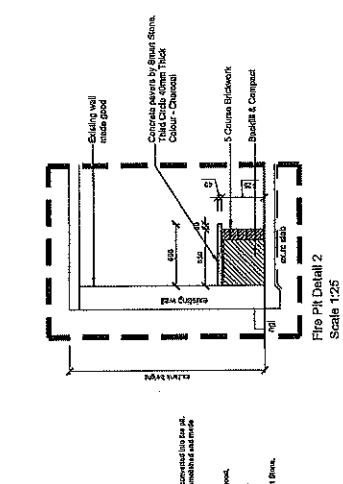
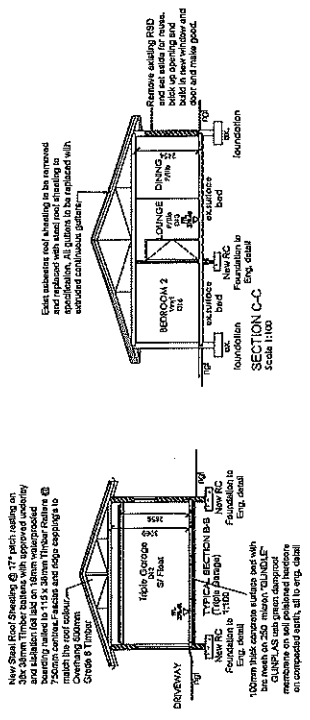
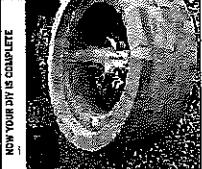
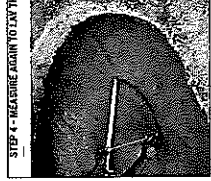
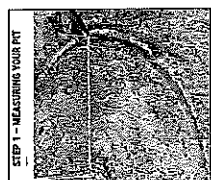
Project No. 1908  
Drawing No. 101-01

Rev. 0



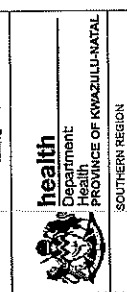






87	91 (0.202)	Fire Pit Details & Images
----	------------	---------------------------

HEALTH DEPARTMENT SIGNATURES  
 IDENTITY DIRECTOR GENERAL  
 HEAD OFFICE PROGRAMME MANAGER  
 DISTRICT MANAGER  
 CEO MANAGER OF THE FACILITY  
 DON PROJECT MANAGER  
 JUN MANAGING AGENT PROJECT MANAGER  
 PROFESSIONAL SERVICE PROVIDER  
 NAME: S.M. GOVENDER  
 PR. 2013



PROJECT  
 MURCHISON HOSPITAL ALTERATIONS  
 AND RENOVATIONS TO STAFF  
 ACCOMMODATION - PTN 5 OF ENF 7108

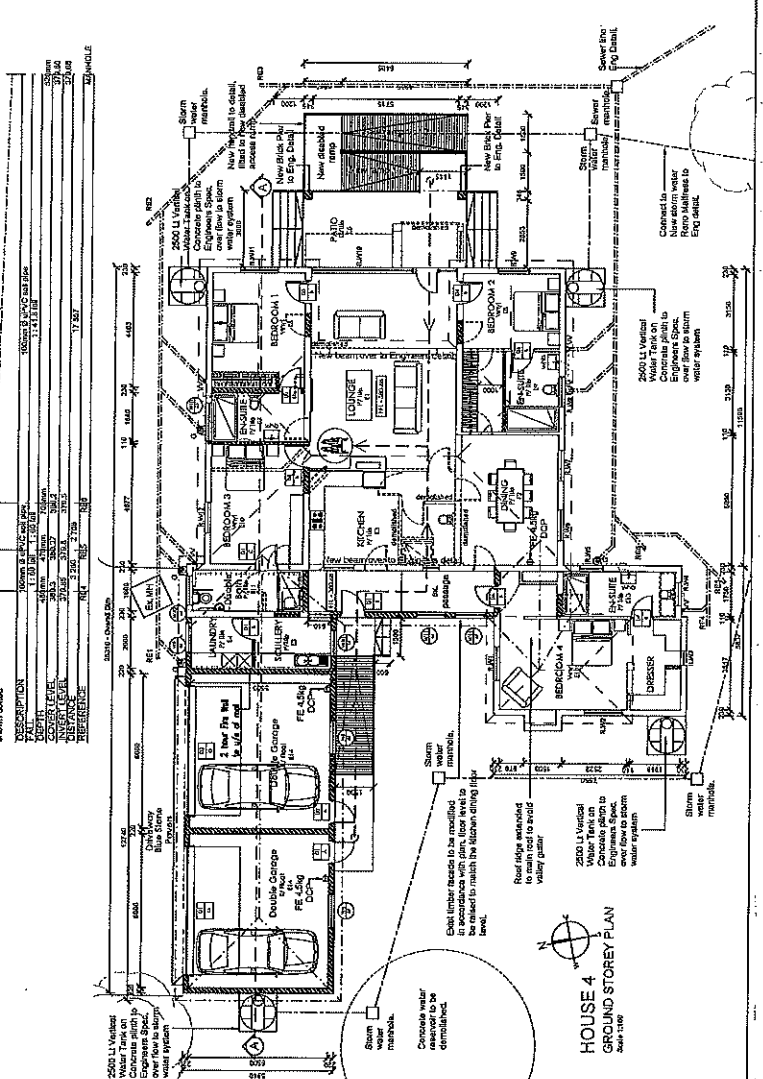
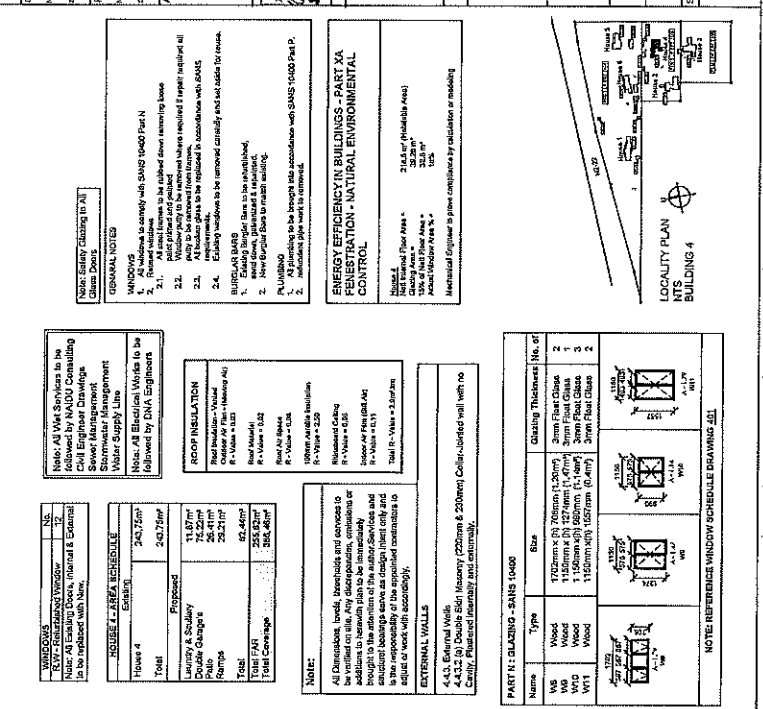
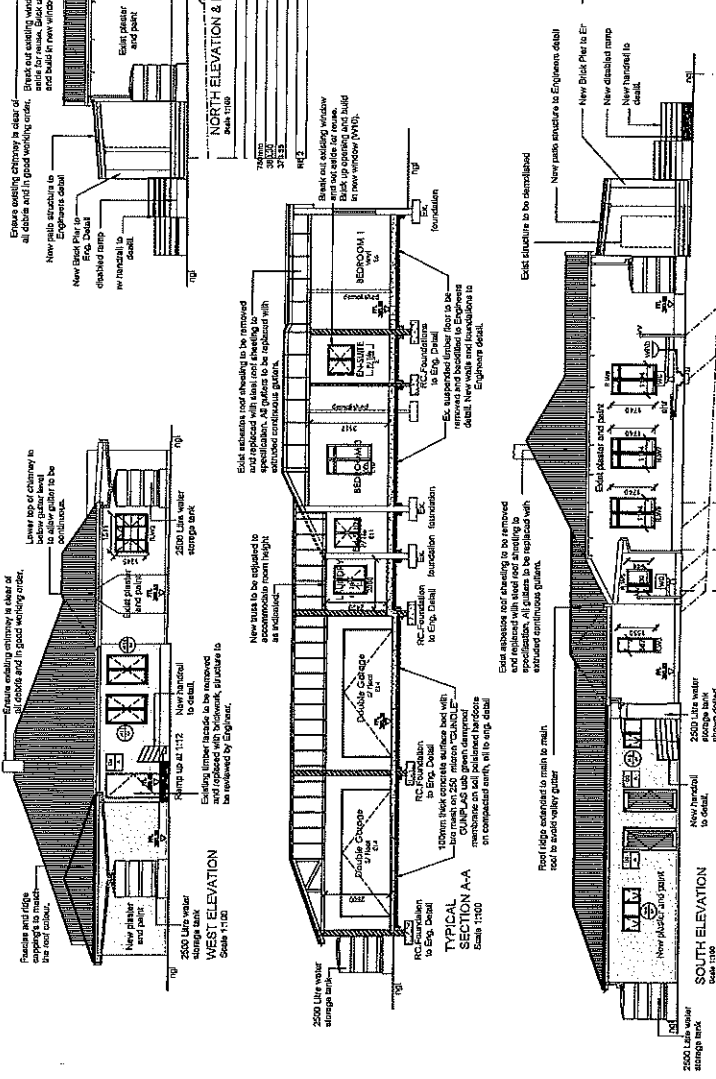
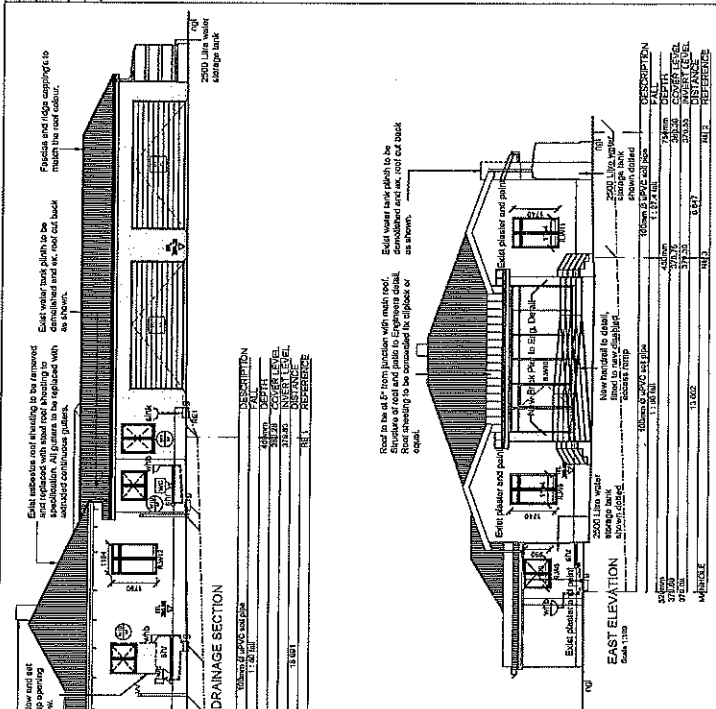
Drawn	Date	Approved
Mark	09/06/2010	AS SHOWN
Rev.	Drawing No.	Project No.
1	103-02	1908

Stamped by Plans Approval Committee

REV. NO.	DATE	DESCRIPTION	BY
01	20.02.2020	Final Design	MM
02	24.03.2020	Final Design	MM
03	24.03.2020	Final Design	MM
04	07.04.2021	Final Design	MM

**OWNER:** KZN DEPARTMENT OF PUBLIC WORKS  
**DATE:** 09/02/2021  
**PROJECT:** PUBLIC WORKS  
**PROFESSIONAL SERVICE PROVIDER:** ARCHITECT: ANTEA ARCHITECTS (Pty) Ltd  
**DRAWING NO.:** PR\_5913  
**DATE:** 04/04/2021

**PROJECT:** ALTERATIONS AND RENOVATIONS TO EXISTING STAFF ACCOMMODATION AT MAIN HARDING ROAD MURCHISON ON REM PTN 1, 3 & 5 OF ERF 71 DB  
**DRAWING DESCRIPTION:** HOUSE 4 GROUND STOREY PLAN, SECTIONS & ELEVATIONS  
**DATE:** 04/04/2021  
**PROJECT NO.:** 104-01  
**STAMPED BY:** [Signature]  
**STAMPED BY:** [Signature]



REVISIONS	DATE	DESCRIPTION	BY
01	20.02.2020	Final Design	MM
02	24.03.2020	Final Design	MM
03	24.03.2020	Final Design	MM
04	07.04.2021	Final Design	MM

Rev. No.	Date	Description	By
01	15/03/2018	Issue For Tender & Tender Documents	VAR
02	27/03/2018	Issue For Tender & Tender Documents	VAR
03	09/07/2018	Final Design & Construction Documents	VAR
04	23/09/2018	Final Design & Construction Documents	VAR
05	07/03/2021	P.L. Renewal	VAR

**PROJECT:** HEALTH SERVICES - RENOVATIONS TO EXISTING STAFF ACCOMMODATION AT MAIN HARDING ROAD MURCHISON ON REM PTN 1.3 & 5 OF ERF 7108

**PROJECT:** ALTERATIONS AND RENOVATIONS TO EXISTING STAFF ACCOMMODATION AT MAIN HARDING ROAD MURCHISON ON REM PTN 1.3 & 5 OF ERF 7108

**PRODUCT:** health  
Department of Health  
PROVINCE OF KWAZULU-NATAL  
SOUTHERN REGION

**DRAWING DESCRIPTION:** BUILDING 5  
GROUND STOREY PLAN, SECTION & ELEVATIONS

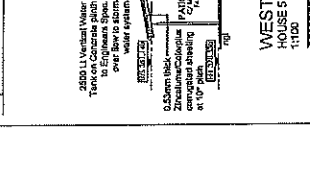
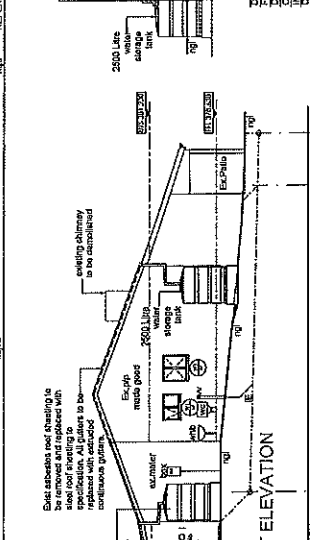
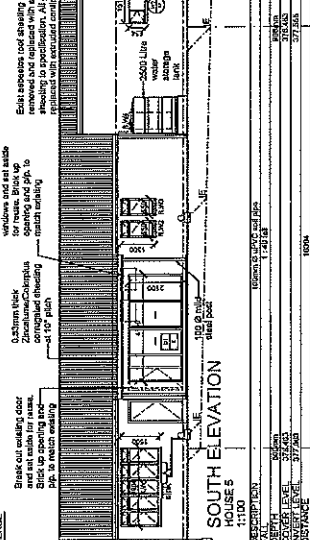
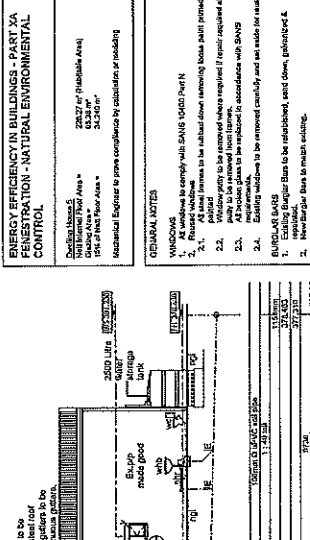
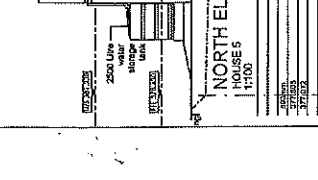
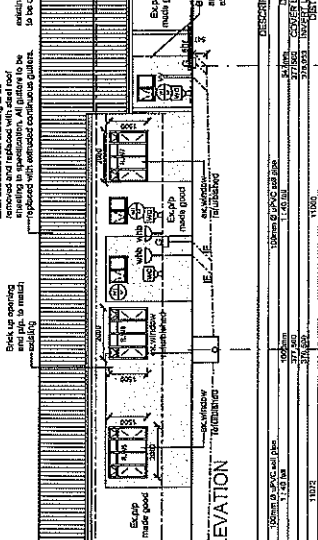
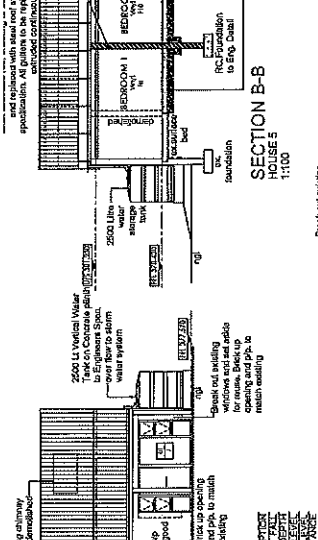
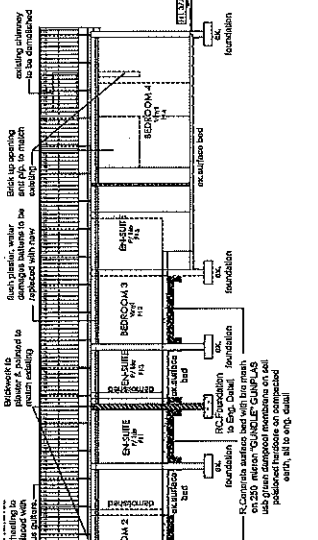
**Scale:** 1:100  
**Date:** MAY 2020  
**Project No.:** 1005-01  
**Sheet No.:** 5  
Checked by: [Name]  
Drawn by: [Name]

**OWNER:** HEALTH DEPARTMENT OF PUBLIC WORKS  
**PROFESSIONAL SERVICE PROVIDER:** MUELLER ARCHITECTS  
**DATE:** 09/03/2021

**ARCHITECT:** MUELLER ARCHITECTS  
11416 HAROLD ROAD  
BLOEMFONTEIN  
1015

**REVISIONS:**

- 01: As submitted to JSE for approval
- 02: As submitted to JSE for approval
- 03: As submitted to JSE for approval
- 04: As submitted to JSE for approval
- 05: As submitted to JSE for approval
- 06: As submitted to JSE for approval
- 07: As submitted to JSE for approval
- 08: As submitted to JSE for approval
- 09: As submitted to JSE for approval
- 10: As submitted to JSE for approval



**ENERGY EFFICIENCY IN BUILDINGS - PART 2A**  
FENESTRATION - NATURAL ENVIRONMENTAL CONTROL

Minimum Glazing Area\* 28.22 m² (table 4A)

Glazing Area\* 43.56 m²

Area of Floor Area\* 47.33 m²

Minimum glazing ratio to be 59.82%

Architectural Engineer to prove compliance by calculation or modeling

**TERMINAL NOTES**

1. All windows to comply with SANS 1040 Part B.
2. At least 10% of the floor area must be glazed with low-e glass.
3. Glazing must be double-glazed (or equivalent) with a minimum U-value of 0.6 W/m²K.
4. All glazing must be protected from direct solar radiation.
5. Glazing must be protected from direct solar radiation.
6. All glazing must be protected from direct solar radiation.
7. All glazing must be protected from direct solar radiation.

**WINDOW SCHEDULE**

Name	Type	Size	Quantity
W1	Steel	1920mm x 1065mm (0.83m²)	1
W2	Steel	1510mm x 1065mm (0.83m²)	4
W3	Steel	1510mm x 865mm (0.67m²)	1
W4	Steel	1510mm x 865mm (0.67m²)	1
W5	Steel	1510mm x 865mm (0.67m²)	1
W6	Steel	1510mm x 865mm (0.67m²)	1
W7	Steel	2000mm x 1510mm (2.99m²)	1
W8	Steel	1510mm x 865mm (0.67m²)	1
W9	Steel	1510mm x 865mm (0.67m²)	1
W10	Aluminium	4890mm x 2100mm (8.27m²)	1
W11	Aluminium	2400mm x 2100mm (5.04m²)	1
W12	Aluminium	2400mm x 2100mm (5.04m²)	1

**PART 2 - GLAZING - SANS 1040B**

Name	Type	Size	Quantity
W1	Steel	1920mm x 1065mm (0.83m²)	1
W2	Steel	1510mm x 1065mm (0.83m²)	4
W3	Steel	1510mm x 865mm (0.67m²)	1
W4	Steel	1510mm x 865mm (0.67m²)	1
W5	Steel	1510mm x 865mm (0.67m²)	1
W6	Steel	1510mm x 865mm (0.67m²)	1
W7	Steel	2000mm x 1510mm (2.99m²)	1
W8	Steel	1510mm x 865mm (0.67m²)	1
W9	Steel	1510mm x 865mm (0.67m²)	1
W10	Aluminium	4890mm x 2100mm (8.27m²)	1
W11	Aluminium	2400mm x 2100mm (5.04m²)	1
W12	Aluminium	2400mm x 2100mm (5.04m²)	1

**NOTE: REFERENCE WINDOW SCHEDULE DRAWING SET**

**HOUSE 5 - AREA SCHEDULE**

Name	Area (m²)	Volume (m³)
House 5	212.24m²	33.00m³
Pass	82.33m²	0.00m³
Total	294.57m²	33.00m³

**HOUSE 5 - PERMITTED GLAZING AREA SCHEDULE**

Name	Area (m²)	Volume (m³)
House 5	212.24m²	33.00m³
Pass	82.33m²	0.00m³
Total	294.57m²	33.00m³

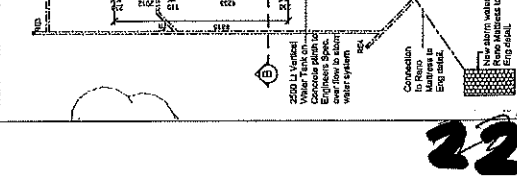
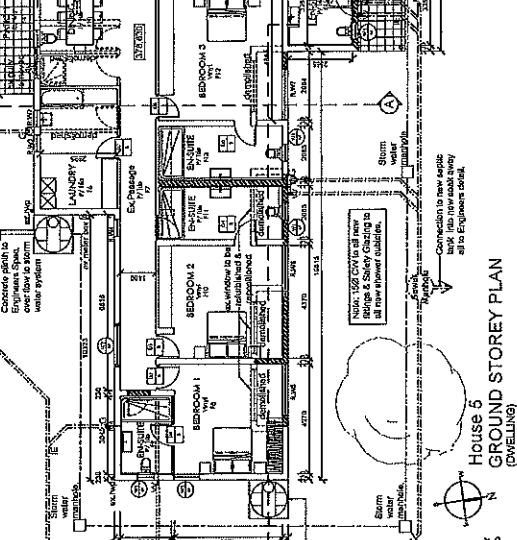
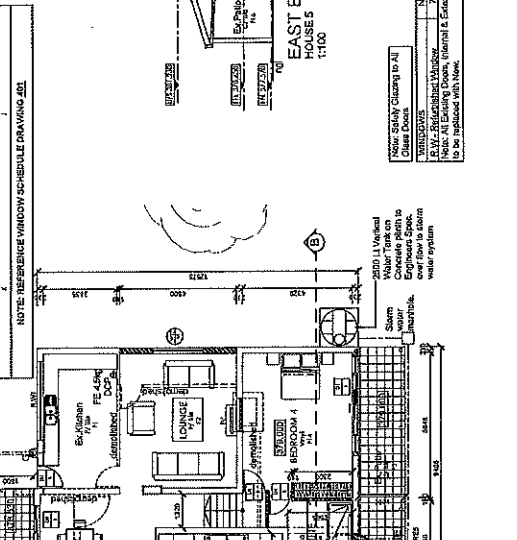
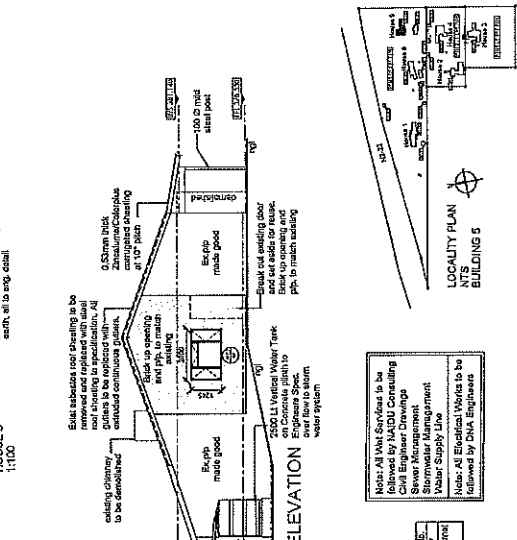
**EXTERNAL WALLS**  
4.4.3 External Walls  
4.4.3.1 Double Skin Masonry (250mm & 200mm) Crib-worked walls with no cavity. Placed normally and externally.  
4.4.3.2 All external brick, concrete or other materials must be finished as per specification. The finish must be in accordance with the specification of the manufacturer of the material and the project drawings. The finish must be in accordance with the specification of the manufacturer of the material and the project drawings. The finish must be in accordance with the specification of the manufacturer of the material and the project drawings.

**ROOF INSULATION**  
4.4.4 Roof Insulation  
4.4.4.1 All roofs must be insulated with mineral wool insulation of minimum R-value of 1.0. The insulation must be in accordance with the specification of the manufacturer of the material and the project drawings. The insulation must be in accordance with the specification of the manufacturer of the material and the project drawings. The insulation must be in accordance with the specification of the manufacturer of the material and the project drawings.

**INTERNAL WALLS**  
4.4.5 Internal Walls  
4.4.5.1 All internal walls must be finished as per specification. The finish must be in accordance with the specification of the manufacturer of the material and the project drawings. The finish must be in accordance with the specification of the manufacturer of the material and the project drawings. The finish must be in accordance with the specification of the manufacturer of the material and the project drawings.

**ROOF FINISH**  
4.4.6 Roof Finish  
4.4.6.1 All roofs must be finished as per specification. The finish must be in accordance with the specification of the manufacturer of the material and the project drawings. The finish must be in accordance with the specification of the manufacturer of the material and the project drawings. The finish must be in accordance with the specification of the manufacturer of the material and the project drawings.

**ROOF FINISH**  
4.4.6.2 All roofs must be finished as per specification. The finish must be in accordance with the specification of the manufacturer of the material and the project drawings. The finish must be in accordance with the specification of the manufacturer of the material and the project drawings. The finish must be in accordance with the specification of the manufacturer of the material and the project drawings.



227

**REVISIONS**

Rev No.	Date	Description	By
01	04-12-2021	Version 01a Change	MAT
02	24-02-2022	Remove door panel, handle & window	MAT
03	24-02-2022	Remove door panel, handle & window	MAT
04	24-02-2022	Remove door panel, handle & window	MAT
05	24-02-2022	Remove door panel, handle & window	MAT

**OWNER:** KWA ZULU DEPARTMENT OF PUBLIC WORKS  
**PROJECT:** Public Offices  
**DATE:** 04/02/2022  
**PROFESSIONAL SERVICE NUMBER:** PLS 2873  
**DRAWING:** DATE: 04/02/2022

**ARCHITECT:** MATHEW GOODEY ARCHITECTS  
 28th Floor, 132 West Street, Durban  
 Phone: 031 304 1234 Fax: 031 304 1235  
 Email: info@matheWG.com

**public works**  
 Department  
 Public Works  
 PROVINCE OF KWAZULU-NATAL

**health**  
 Department  
 Health  
 PROVINCE OF KWAZULU-NATAL

SOUTHERN REGION

**PROJECT:** ALTERATIONS AND RENOVATIONS TO EXISTING STAFF ACCOMMODATION AT MAIN HARDING ROAD MURCHISON REM PTN 1.5 & 5 OF ERF 7108

**DRAWING DESCRIPTION:** HOUSE 6  
**GROUND STOREY PLAN, SECTIONS, & ELEVATIONS**

Drawn	Date	Rev
MAT	MAY 2020	VAR
MAT	11-00 / 50	001
MAT	1908	001
MAT	108-01	001

Stamped by: [Signature]

**GLASS TABLE**

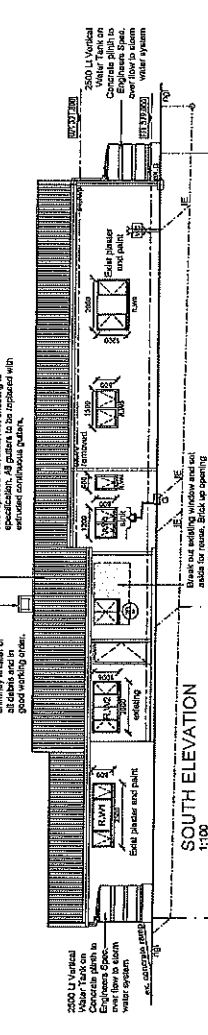
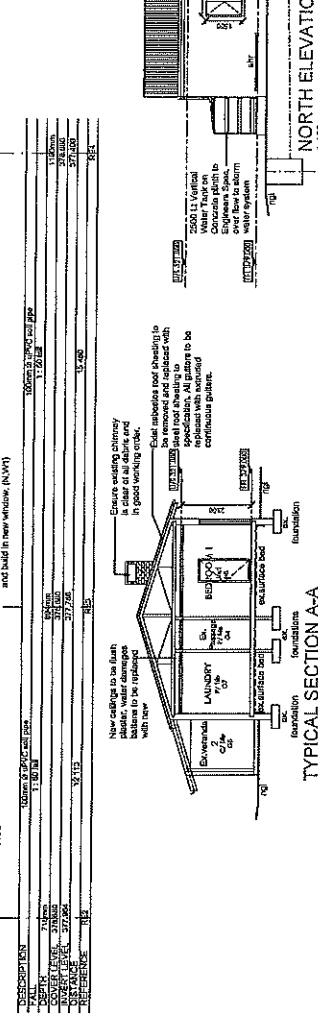
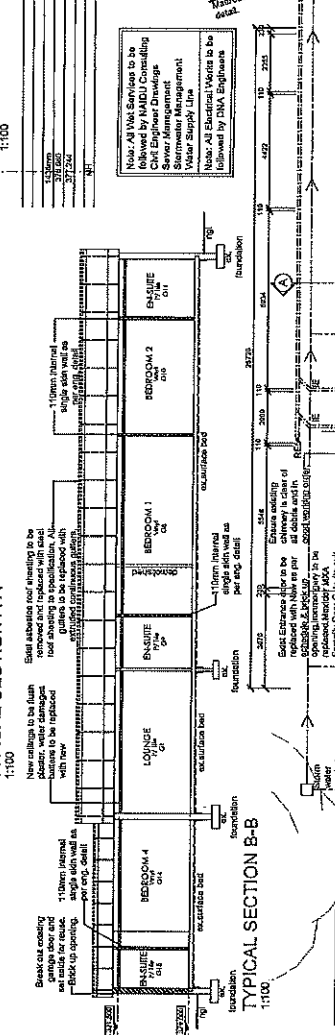
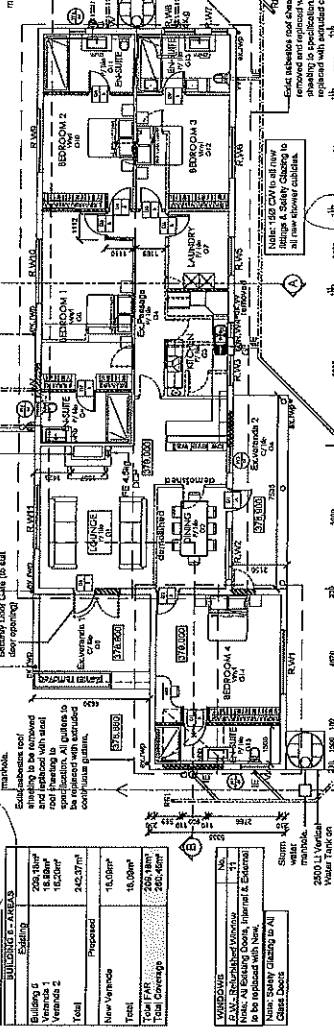
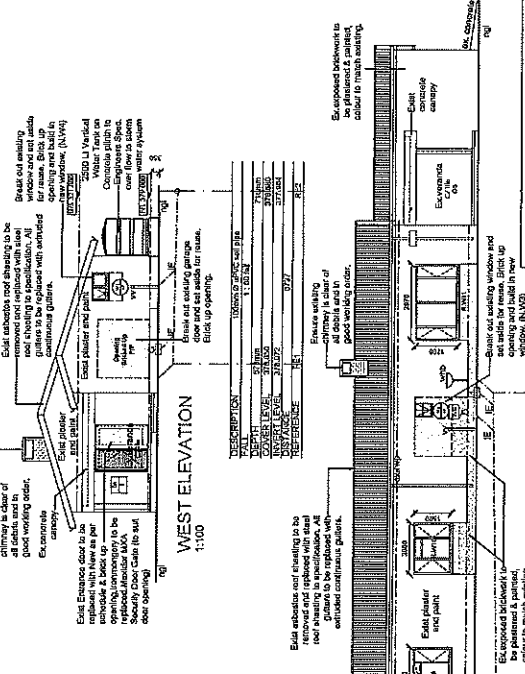
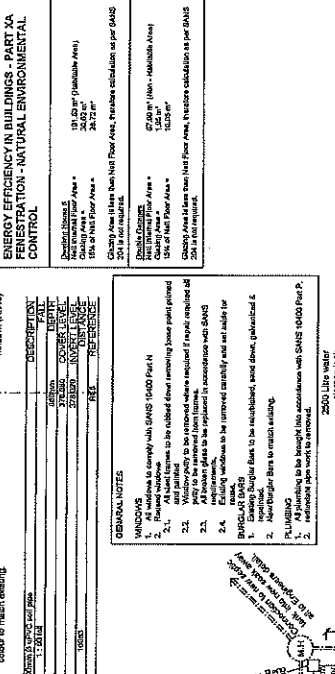
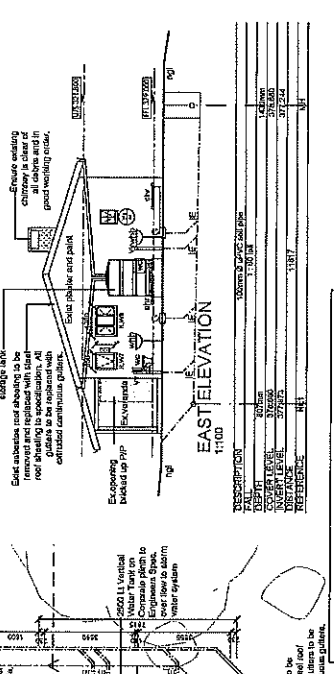
Item	Type	Size	Quantity	Glazing Thickness	No. of
WT	Steel	1022mm x 856mm (36" x 33.7")	1	3mm	1
WG	Steel	1022mm x 856mm (36" x 33.7")	1	3mm	1
VS	Aluminum	2000mm x 1000mm (78.7" x 39.4")	1	3mm	1
SD 1	Aluminum	2000mm x 1000mm (78.7" x 39.4")	1	3mm	1

**ROOF INSULATION**

Item	Material	Thickness	Quantity
RI-1	Extruded Polystyrene	25mm	1
RI-2	Extruded Polystyrene	25mm	1

**EXTERNAL WALLS**

Item	Material	Thickness	Quantity
E-1	200mm Reinforced Concrete	200mm	1
E-2	200mm Reinforced Concrete	200mm	1
E-3	200mm Reinforced Concrete	200mm	1



**HOUSE 6 GROUND STOREY PLAN (BEDDINGS) 1:100**

**Notes:**  
 1. All dimensions, levels, materials and finishes to be as indicated on this drawing. Any discrepancies, omissions or additions to the design shall be the responsibility of the client. The architect shall not be responsible for the construction of the building or its performance.  
 2. All work shall be done in accordance with the latest edition of the South African Building Regulations (SABR) and other applicable legislation.  
 3. All materials shall be of standard quality unless otherwise specified.  
 4. All electrical and plumbing work shall be done in accordance with the relevant codes of practice.

**EXTERNAL WALLS**  
 4.0.3 External Walls  
 4.0.3.1 80mm Reinforced Concrete  
 4.0.3.2 80mm Reinforced Concrete  
 4.0.3.3 80mm Reinforced Concrete

**BUILDING AREA SUMMARY**

Item	Area	Total
Bedroom 1	15.00m <sup>2</sup>	15.00m <sup>2</sup>
Bedroom 2	15.00m <sup>2</sup>	15.00m <sup>2</sup>
Bedroom 3	15.00m <sup>2</sup>	15.00m <sup>2</sup>
Bedroom 4	15.00m <sup>2</sup>	15.00m <sup>2</sup>
Living Room	15.00m <sup>2</sup>	15.00m <sup>2</sup>
Dining Room	15.00m <sup>2</sup>	15.00m <sup>2</sup>
Kitchen	15.00m <sup>2</sup>	15.00m <sup>2</sup>
Bathroom	15.00m <sup>2</sup>	15.00m <sup>2</sup>
Laundry	15.00m <sup>2</sup>	15.00m <sup>2</sup>
Storage	15.00m <sup>2</sup>	15.00m <sup>2</sup>
Other	15.00m <sup>2</sup>	15.00m <sup>2</sup>
<b>Total</b>	<b>120.00m<sup>2</sup></b>	<b>120.00m<sup>2</sup></b>

**ENERGY EFFICIENCY IN BUILDINGS - PART 2A FENESTRATION - NATURAL ENVIRONMENTAL CONTROL**

**General Notes:**  
 1. All windows and doors shall be glazed with double glazing.  
 2. The glazing shall be of standard quality unless otherwise specified.  
 3. The glazing shall be in accordance with the relevant codes of practice.  
 4. The glazing shall be of standard quality unless otherwise specified.

Rev. No.	Date	Description	By
1	2020/02/09	When the title added into drawings, the user's name and address should be added to the title block and the user's name and address should be added to the title block.	W/P
2	2020/02/28	Final drawings to be used for construction.	W/P
3	01/04/2021	Final drawings to be used for construction.	W/P

Rev. No. Date Description By

OWNER:	NAME: SAJOU DEPARTMENT OF PUBLIC WORKS ADDRESS: SAJOU DEPARTMENT OF PUBLIC WORKS TELEPHONE: (011) 265 2211
PROFESSIONAL SERVICE PROVIDER:	NAME: S.A. MOHAMMAD ADDRESS: SAJOU DEPARTMENT OF PUBLIC WORKS TELEPHONE: (011) 265 2211
ARCHITECT:	NAME: S.A. MOHAMMAD ADDRESS: SAJOU DEPARTMENT OF PUBLIC WORKS TELEPHONE: (011) 265 2211

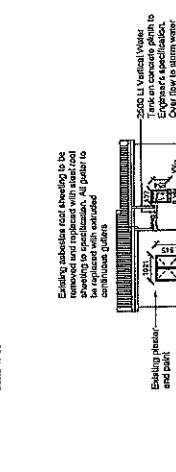
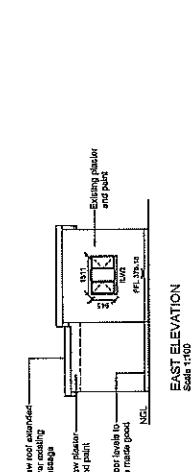
**Public Works**  
Department of Public Works  
PROVINCE OF KWAZULU-NATAL  
**health**  
Department of Health  
PROVINCE OF KWAZULU-NATAL  
SOUTHERN REGION

PROJECT: ALTERATIONS AND RENOVATIONS TO EXISTING STAFF ACCOMMODATION AT MAIN HARDING ROAD DURCHISON ON REM PTN 1, 3 & 5 OF ERF 7108

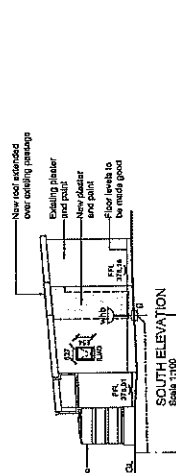
PROJ. NO.: SA/2019/2000

EX-LAUNDRY GROUND STOREY PLAN, SECTION & ELEVATIONS

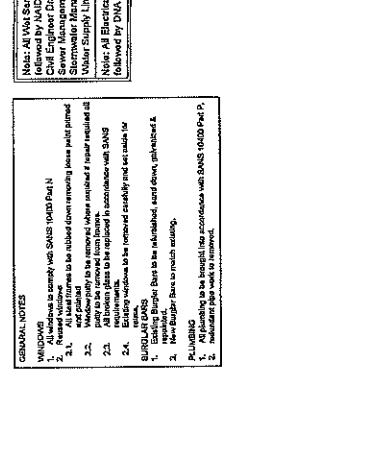
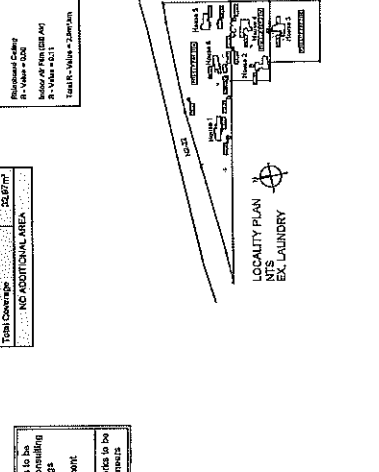
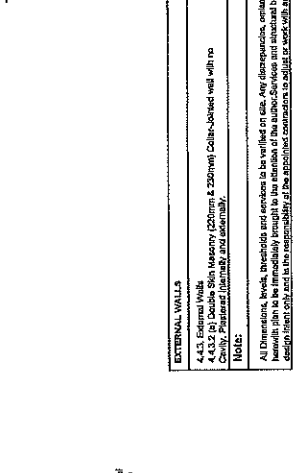
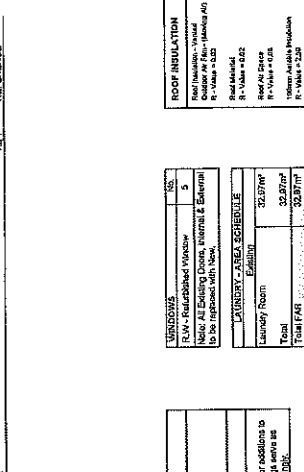
Date	MAY 2020
Project No.	107 - D1
Scale	1:100
Drawn by	S.A. MOHAMMAD
Checked by	S.A. MOHAMMAD
Approved by	S.A. MOHAMMAD
Stamp/Signature	[Signature]



DESCRIPTION		PAVEMENT	CONCRETE LEVEL	FLOOR LEVEL	FINISH LEVEL	REFERENCE
00	Level 00	0000	0000	0000	0000	
01	Level 01	0100	0100	0100	0100	
02	Level 02	0200	0200	0200	0200	
03	Level 03	0300	0300	0300	0300	



DESCRIPTION		PAVEMENT	CONCRETE LEVEL	FLOOR LEVEL	FINISH LEVEL	REFERENCE
00	Level 00	0000	0000	0000	0000	
01	Level 01	0100	0100	0100	0100	
02	Level 02	0200	0200	0200	0200	
03	Level 03	0300	0300	0300	0300	





Rev. No.	Date	Description	By
01	22.03.2021	Finalized General Notes	WAK
02	23.03.2021	Finalized General Notes	WAK
03	04.03.2021	Finalized General Notes	WAK

Rev. No.	Date	Description	By
04	04.03.2021	Finalized General Notes	WAK
05	04.03.2021	Finalized General Notes	WAK

Rev. No.	Date	Description	By
06	04.03.2021	Finalized General Notes	WAK
07	04.03.2021	Finalized General Notes	WAK

Rev. No.	Date	Description	By
08	04.03.2021	Finalized General Notes	WAK
09	04.03.2021	Finalized General Notes	WAK

Rev. No.	Date	Description	By
10	04.03.2021	Finalized General Notes	WAK
11	04.03.2021	Finalized General Notes	WAK

Rev. No.	Date	Description	By
12	04.03.2021	Finalized General Notes	WAK
13	04.03.2021	Finalized General Notes	WAK

Rev. No.	Date	Description	By
14	04.03.2021	Finalized General Notes	WAK
15	04.03.2021	Finalized General Notes	WAK

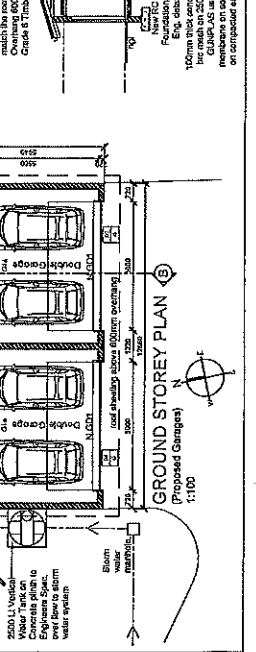
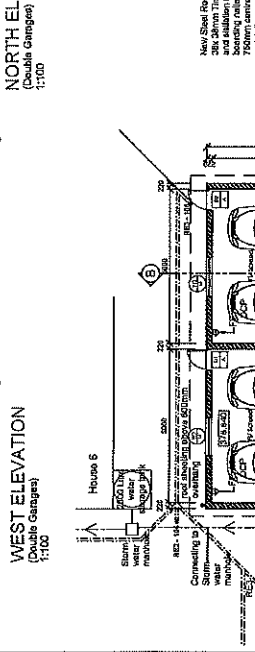
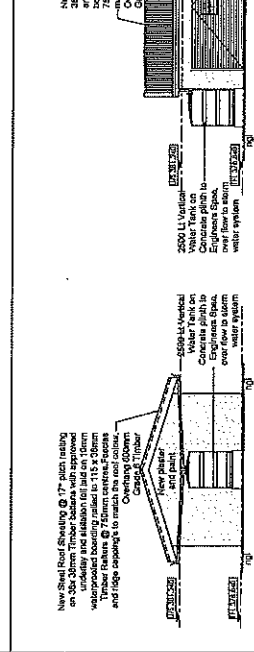
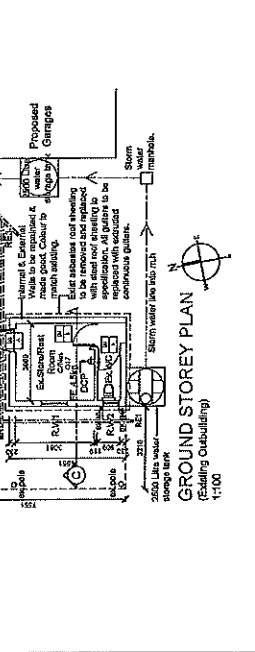
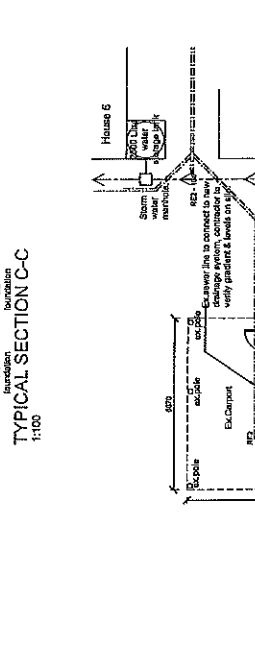
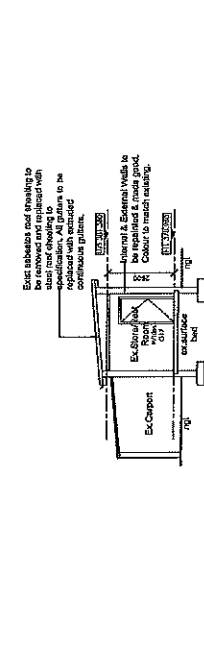
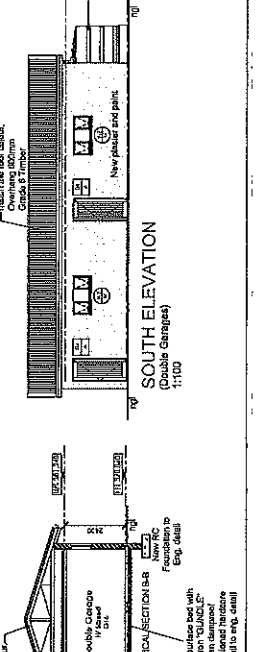
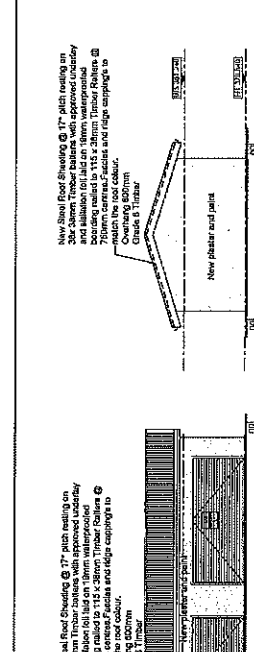
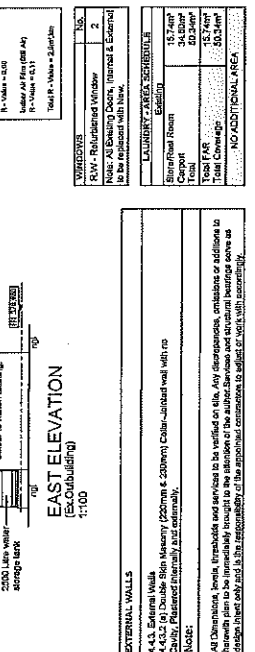
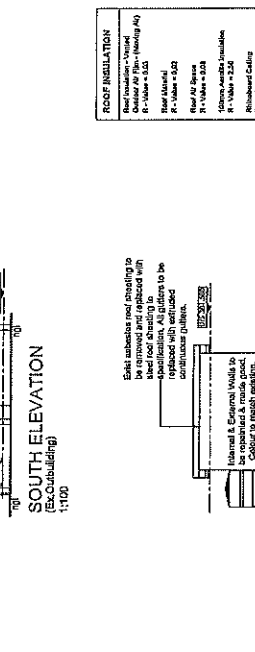
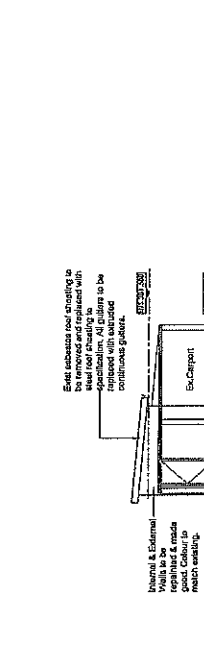
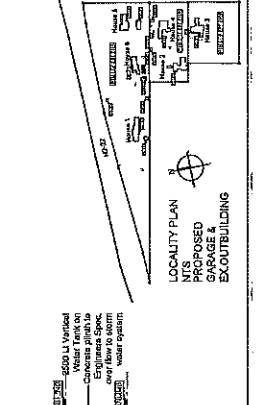
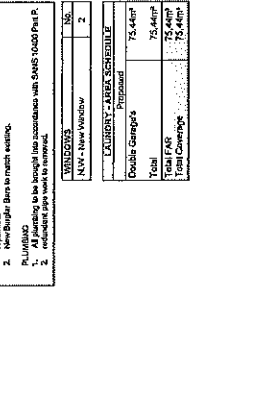
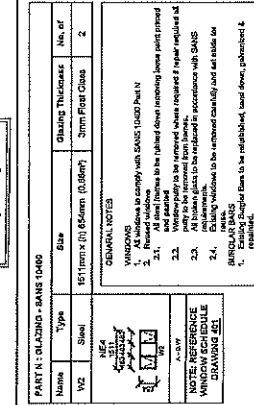
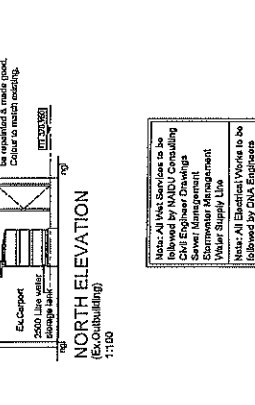
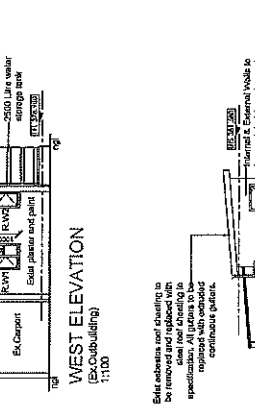
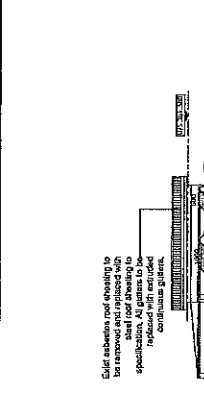
Rev. No.	Date	Description	By
16	04.03.2021	Finalized General Notes	WAK
17	04.03.2021	Finalized General Notes	WAK

Rev. No.	Date	Description	By
18	04.03.2021	Finalized General Notes	WAK
19	04.03.2021	Finalized General Notes	WAK

Rev. No.	Date	Description	By
20	04.03.2021	Finalized General Notes	WAK
21	04.03.2021	Finalized General Notes	WAK

Rev. No.	Date	Description	By
22	04.03.2021	Finalized General Notes	WAK
23	04.03.2021	Finalized General Notes	WAK

Rev. No.	Date	Description	By
24	04.03.2021	Finalized General Notes	WAK
25	04.03.2021	Finalized General Notes	WAK

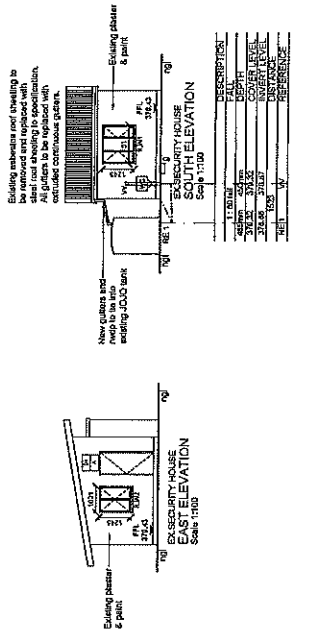


NOT DATE : Thursday, 04/03/2021 12:28:01  
 FILE PATH : \\K:\AS\Projects\2021\20210304 - KwaZulu-Natal - Health - Double Garage & Ex-Cubuilding\Drawings\20210304 - KwaZulu-Natal - Health - Double Garage & Ex-Cubuilding.dwg  
 SHEET SIZE : A1

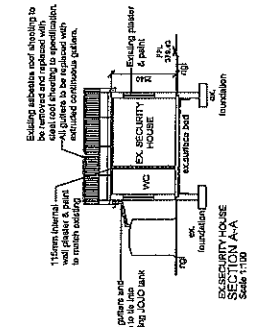




Rev. No.	Date	Description	By
01	15/05/2021	As Issued (Subject to SA, issues & contract)	VWP
02	20/07/2021	Revisions in response to SA issues	VWP
03	07/08/2021	Final Design & Issue	VWP



Note: All VWP Services to be provided by NCE Consulting  
 Call for Drawings  
 Tender Management  
 Tender Supply List  
 Note: All Electrical Works to be followed by DNA Engineers



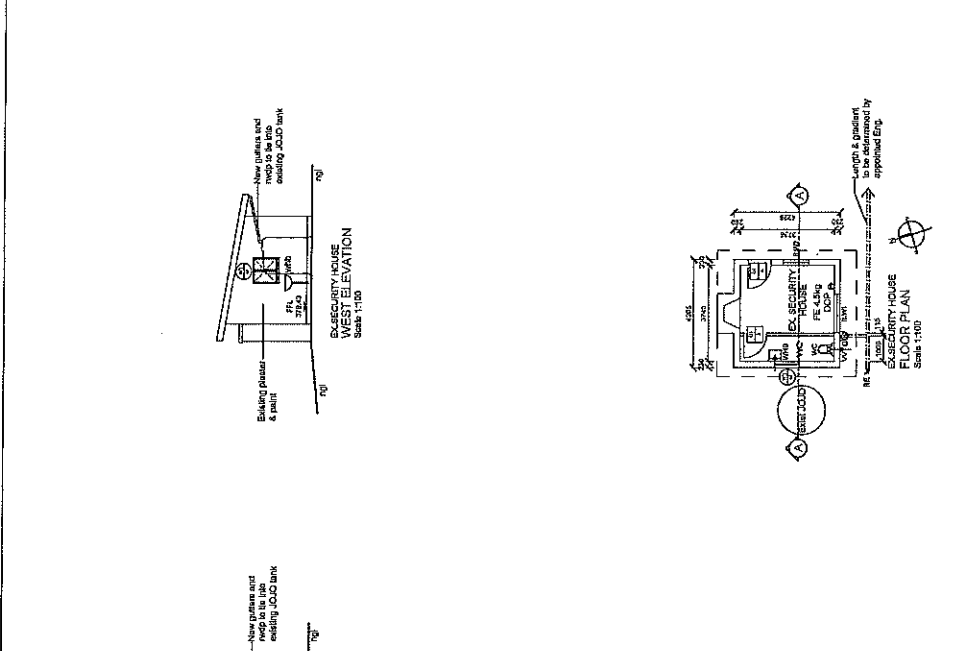
PART 1: QUANTITY - SAND 15400			
Name	Type	Size	Quantity (M³) (No. of)
WC	Block	1025mm(h) x 640mm (Ø.85m)	Sumi-Flux-0105 2

**Notes:**  
 All Dimensions, levels, thresholds and finishes to be worked on site. Any discrepancies, omissions or additions to this drawing shall be the responsibility of the architect. The architect shall be responsible for ensuring that the drawings are accurate and complete.

ITEM	DESCRIPTION	UNIT	QUANTITY	AMOUNT (R)
<b>CONCRETE</b>				
1	Cast in situ concrete (S1)	m³	15.87	15.87
<b>IRONWORK</b>				
1	Reinforcement bars (S1)	kg	18.87	18.87
<b>FINISHES</b>				
1	Plaster (S1)	m²	18.87	18.87
<b>TOTAL</b>				
				<b>18.87</b>

**GENERAL NOTES**  
 1. All works to comply with SANS 10400 Part 1.  
 2. All works to be done in accordance with the specifications and drawings.  
 3. All materials to be of good quality and to be approved by the Engineer.  
 4. All work to be done in accordance with the specifications and drawings.

**ROOF INSULATION**  
 Roof Insulation - 100mm EPS  
 R-Value = 0.18  
 Total R-Value = 0.18



**public works**  
 Department:  
 Public Works  
 PROVINCE OF KWAZULU-NATAL

**health**  
 Department:  
 Health  
 PROVINCE OF KWAZULU-NATAL

**SOUTHERN REGION**  
 PROJECT:  
 ALTERATIONS AND RENOVATIONS TO EXISTING STAFF ACCOMMODATION AT MAIN HARDING ROAD MURCHISON ON REM PTN 13 & 5 OF ERF 7108

DRAWING DESCRIPTION:  
 EX-SECURITY HOUSE PLAN, SECTIONS & ELEVATIONS

DATE	BY	PP	NO.
1:100	MAY 2021		
1:100	11-01		3

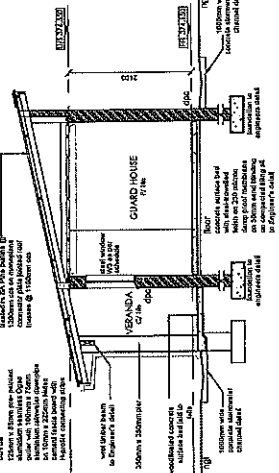
Checked by: [Signature]  
 Drawn by: [Signature]



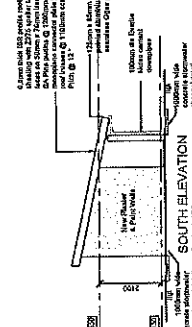


Rev. No.	Date	Description
01	23/08/2021	Final Design Released
02	02/09/2021	Final Design
03		

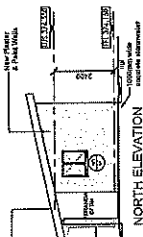
<b>OWNER</b> KZN DEPARTMENT OF PUBLIC WORKS <b>DEPARTMENT</b> Public Works <b>PROFESSIONAL SERVICE PROVIDER</b> M & M ARCHITECTS <b>ARCHITECT</b> M & M ARCHITECTS (Pty) Ltd Suite 11, 4th Floor, Africa House, Grahamstown, Durban 4001, 4002, 4003, 4004, 4005, 4006, 4007, 4008, 4009, 4010, 4011, 4012, 4013, 4014, 4015, 4016, 4017, 4018, 4019, 4020 P.O. Box 13005, Durban, 4013 Tel: +27 31 246 4000 Fax: +27 31 246 4001 Email: info@m&m.co.za www.m&m.co.za (Public Works Building)	<b>DATE:</b> 02/09/2021 <b>PR. NO:</b> 05/03/2021	<p style="text-align: center;"><b>health</b> Department Health PROVINCE OF KWAZULU-NATAL SOUTHERN REGION</p> <p><b>PROJECT</b> ALTERATIONS AND RENOVATIONS TO EXISTING STAFF ACCOMMODATION AT MAINFORTHING ROAD DURBISON ON REM P1 N 13 &amp; S OF ERF 7108</p> <p><b>DRAWING INFORMATION</b> NEW GUARD HOUSE G.FLOOR PLAN, SECTION &amp; ELEVATIONS SCALE: 1:100/80 DATE: MAY 2020 PROJECT No.: 174-01 1908 Checked By: Phiso Approved Chibanda Drawn By: Phiso Approved Chibanda</p>
--	--	--



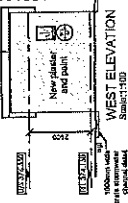
SECTION A-A  
Scale: 1:50



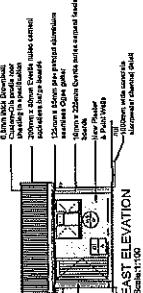
SOUTH ELEVATION  
Scale: 1:100



NORTH ELEVATION  
Scale: 1:100



WEST ELEVATION  
Scale: 1:100

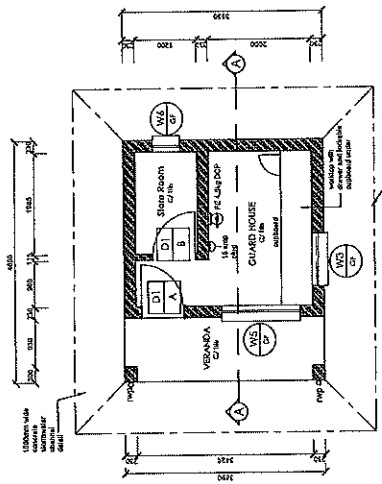


EAST ELEVATION  
Scale: 1:100

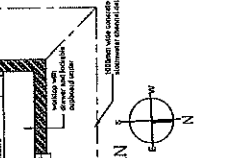
Notes:  
1. All drawings to comply with SANS 1040 Part 1  
2. All drawings to be submitted to the relevant authorities for approval  
3. All drawings to be submitted to the relevant authorities for approval  
4. All drawings to be submitted to the relevant authorities for approval  
5. All drawings to be submitted to the relevant authorities for approval  
6. All drawings to be submitted to the relevant authorities for approval  
7. All drawings to be submitted to the relevant authorities for approval  
8. All drawings to be submitted to the relevant authorities for approval  
9. All drawings to be submitted to the relevant authorities for approval  
10. All drawings to be submitted to the relevant authorities for approval

**EXTERNAL WALLS**  
4.4.3. External Walls  
4.4.3.2. (a) Double Skin Masonry (DSM) Chimney-Attached wall with no cavity, finished internally and externally.  
**NOTE**  
All Corrosion, leaks, drips, stains and defects to be verified on site. Any discrepancies, variations or additions to the plan to be immediately brought to the attention of the author-engineer and structural engineer before work commences. The responsibility of the appropriate contractor is to rectify any such defects.

**ROOF INSULATION**  
Roof Insulation - Veranda  
R-Value = 8,00  
Roof Insulation - Guard House  
R-Value = 10,00  
Roof Insulation - Veranda  
R-Value = 1,00  
Roof Insulation - Guard House  
R-Value = 1,00  
Total R-Value = 8,00



GROUND STOREY PLAN  
Scale: 1:50



LOCALITY PLAN  
Scale: 1:1000

Window No.	Window Type	Window Area (m²)	Window Perimeter (m)
1	1500 x 2100	31.50	42.00
2	1500 x 2100	31.50	42.00
3	1500 x 2100	31.50	42.00
4	1500 x 2100	31.50	42.00
5	1500 x 2100	31.50	42.00
6	1500 x 2100	31.50	42.00
7	1500 x 2100	31.50	42.00
8	1500 x 2100	31.50	42.00
9	1500 x 2100	31.50	42.00
10	1500 x 2100	31.50	42.00
11	1500 x 2100	31.50	42.00
12	1500 x 2100	31.50	42.00
13	1500 x 2100	31.50	42.00
14	1500 x 2100	31.50	42.00
15	1500 x 2100	31.50	42.00
16	1500 x 2100	31.50	42.00
17	1500 x 2100	31.50	42.00
18	1500 x 2100	31.50	42.00
19	1500 x 2100	31.50	42.00
20	1500 x 2100	31.50	42.00
21	1500 x 2100	31.50	42.00
22	1500 x 2100	31.50	42.00
23	1500 x 2100	31.50	42.00
24	1500 x 2100	31.50	42.00
25	1500 x 2100	31.50	42.00
26	1500 x 2100	31.50	42.00
27	1500 x 2100	31.50	42.00
28	1500 x 2100	31.50	42.00
29	1500 x 2100	31.50	42.00
30	1500 x 2100	31.50	42.00

Part	Type	Size	Glazing Thickness	No. of
W1	Window	1500mm x 2100mm	10mm	1
W2	Window	1500mm x 2100mm	10mm	1
W3	Window	1500mm x 2100mm	10mm	1
W4	Window	1500mm x 2100mm	10mm	1
W5	Window	1500mm x 2100mm	10mm	1
W6	Window	1500mm x 2100mm	10mm	1
W7	Window	1500mm x 2100mm	10mm	1
W8	Window	1500mm x 2100mm	10mm	1
W9	Window	1500mm x 2100mm	10mm	1
W10	Window	1500mm x 2100mm	10mm	1
W11	Window	1500mm x 2100mm	10mm	1
W12	Window	1500mm x 2100mm	10mm	1
W13	Window	1500mm x 2100mm	10mm	1
W14	Window	1500mm x 2100mm	10mm	1
W15	Window	1500mm x 2100mm	10mm	1
W16	Window	1500mm x 2100mm	10mm	1
W17	Window	1500mm x 2100mm	10mm	1
W18	Window	1500mm x 2100mm	10mm	1
W19	Window	1500mm x 2100mm	10mm	1
W20	Window	1500mm x 2100mm	10mm	1
W21	Window	1500mm x 2100mm	10mm	1
W22	Window	1500mm x 2100mm	10mm	1
W23	Window	1500mm x 2100mm	10mm	1
W24	Window	1500mm x 2100mm	10mm	1
W25	Window	1500mm x 2100mm	10mm	1
W26	Window	1500mm x 2100mm	10mm	1
W27	Window	1500mm x 2100mm	10mm	1
W28	Window	1500mm x 2100mm	10mm	1
W29	Window	1500mm x 2100mm	10mm	1
W30	Window	1500mm x 2100mm	10mm	1
W31	Window	1500mm x 2100mm	10mm	1
W32	Window	1500mm x 2100mm	10mm	1
W33	Window	1500mm x 2100mm	10mm	1
W34	Window	1500mm x 2100mm	10mm	1
W35	Window	1500mm x 2100mm	10mm	1
W36	Window	1500mm x 2100mm	10mm	1
W37	Window	1500mm x 2100mm	10mm	1
W38	Window	1500mm x 2100mm	10mm	1
W39	Window	1500mm x 2100mm	10mm	1
W40	Window	1500mm x 2100mm	10mm	1
W41	Window	1500mm x 2100mm	10mm	1
W42	Window	1500mm x 2100mm	10mm	1
W43	Window	1500mm x 2100mm	10mm	1
W44	Window	1500mm x 2100mm	10mm	1
W45	Window	1500mm x 2100mm	10mm	1
W46	Window	1500mm x 2100mm	10mm	1
W47	Window	1500mm x 2100mm	10mm	1
W48	Window	1500mm x 2100mm	10mm	1
W49	Window	1500mm x 2100mm	10mm	1
W50	Window	1500mm x 2100mm	10mm	1

NOTE: REFER TO WINDOW SCHEDULE DRAWING 401



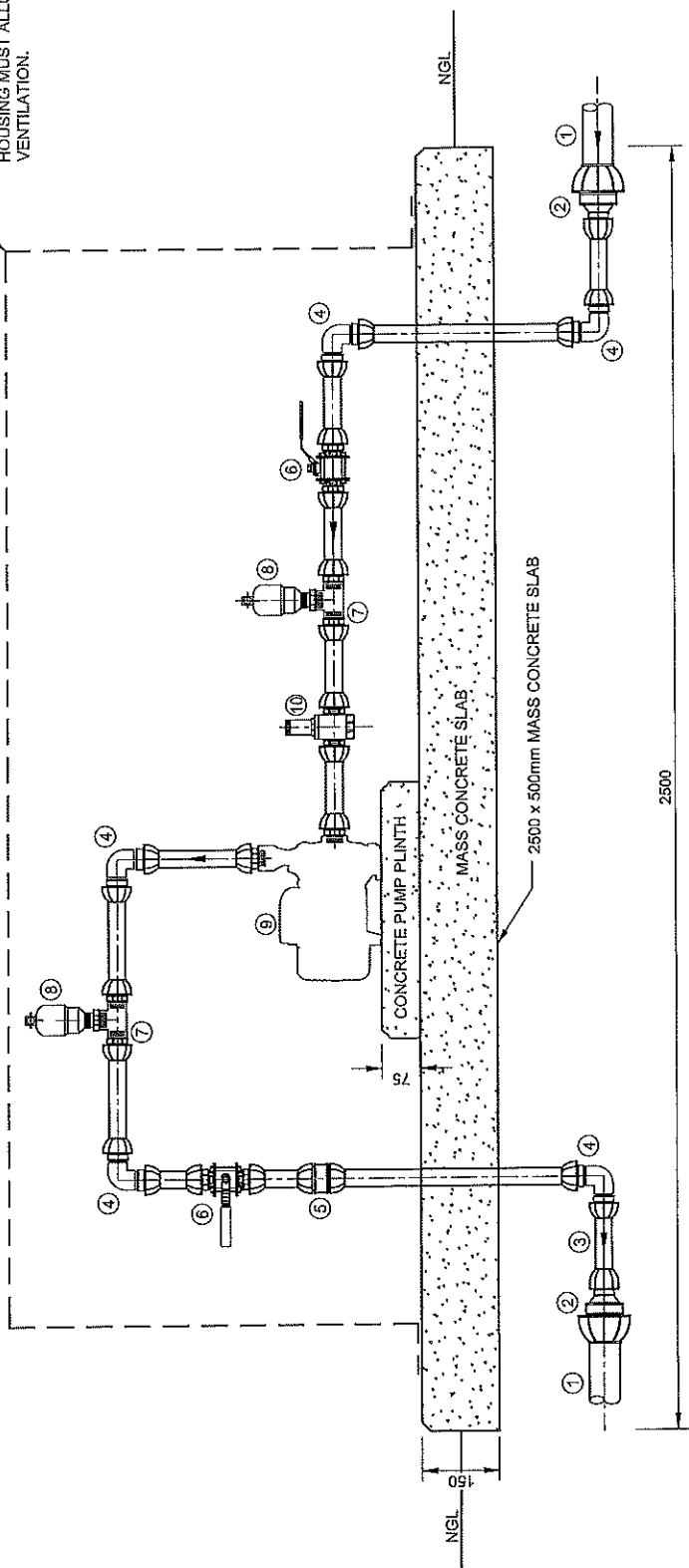
- NOTES:**
1. ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE SPECIFIED.
  2. THE LOCATION OF ALL UTILITY LINES SHALL BE AS SHOWN ON THIS PLAN.
  3. THE LOCATION OF ALL UTILITY LINES SHALL BE AS SHOWN ON THIS PLAN.
  4. THE LOCATION OF ALL UTILITY LINES SHALL BE AS SHOWN ON THIS PLAN.
- GENERAL NOTES:**
1. ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE SPECIFIED.
  2. THE LOCATION OF ALL UTILITY LINES SHALL BE AS SHOWN ON THIS PLAN.
  3. THE LOCATION OF ALL UTILITY LINES SHALL BE AS SHOWN ON THIS PLAN.
  4. THE LOCATION OF ALL UTILITY LINES SHALL BE AS SHOWN ON THIS PLAN.
- STORMWATER NOTES:**
1. ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE SPECIFIED.
  2. THE LOCATION OF ALL UTILITY LINES SHALL BE AS SHOWN ON THIS PLAN.
  3. THE LOCATION OF ALL UTILITY LINES SHALL BE AS SHOWN ON THIS PLAN.
  4. THE LOCATION OF ALL UTILITY LINES SHALL BE AS SHOWN ON THIS PLAN.

PORTABLE WATER RETIC	
WATER MAIN	—
PIPE 2 / 450	—
PIPE 3 / 450	—
PIPE 4 / 450	—
PIPE 5 / 450	—
PIPE 6 / 450	—
PIPE 7 / 450	—
PIPE 8 / 450	—
PIPE 9 / 450	—
PIPE 10 / 450	—
PIPE 11 / 450	—
PIPE 12 / 450	—
PIPE 13 / 450	—
PIPE 14 / 450	—
PIPE 15 / 450	—
PIPE 16 / 450	—
PIPE 17 / 450	—
PIPE 18 / 450	—
PIPE 19 / 450	—
PIPE 20 / 450	—
PIPE 21 / 450	—
PIPE 22 / 450	—
PIPE 23 / 450	—
PIPE 24 / 450	—
PIPE 25 / 450	—
PIPE 26 / 450	—
PIPE 27 / 450	—
PIPE 28 / 450	—
PIPE 29 / 450	—
PIPE 30 / 450	—
PIPE 31 / 450	—
PIPE 32 / 450	—
PIPE 33 / 450	—
PIPE 34 / 450	—
PIPE 35 / 450	—
PIPE 36 / 450	—
PIPE 37 / 450	—
PIPE 38 / 450	—
PIPE 39 / 450	—
PIPE 40 / 450	—
PIPE 41 / 450	—
PIPE 42 / 450	—
PIPE 43 / 450	—
PIPE 44 / 450	—
PIPE 45 / 450	—
PIPE 46 / 450	—
PIPE 47 / 450	—
PIPE 48 / 450	—
PIPE 49 / 450	—
PIPE 50 / 450	—
PIPE 51 / 450	—
PIPE 52 / 450	—
PIPE 53 / 450	—
PIPE 54 / 450	—
PIPE 55 / 450	—
PIPE 56 / 450	—
PIPE 57 / 450	—
PIPE 58 / 450	—
PIPE 59 / 450	—
PIPE 60 / 450	—
PIPE 61 / 450	—
PIPE 62 / 450	—
PIPE 63 / 450	—
PIPE 64 / 450	—
PIPE 65 / 450	—
PIPE 66 / 450	—
PIPE 67 / 450	—
PIPE 68 / 450	—
PIPE 69 / 450	—
PIPE 70 / 450	—
PIPE 71 / 450	—
PIPE 72 / 450	—
PIPE 73 / 450	—
PIPE 74 / 450	—
PIPE 75 / 450	—
PIPE 76 / 450	—
PIPE 77 / 450	—
PIPE 78 / 450	—
PIPE 79 / 450	—
PIPE 80 / 450	—
PIPE 81 / 450	—
PIPE 82 / 450	—
PIPE 83 / 450	—
PIPE 84 / 450	—
PIPE 85 / 450	—
PIPE 86 / 450	—
PIPE 87 / 450	—
PIPE 88 / 450	—
PIPE 89 / 450	—
PIPE 90 / 450	—
PIPE 91 / 450	—
PIPE 92 / 450	—
PIPE 93 / 450	—
PIPE 94 / 450	—
PIPE 95 / 450	—
PIPE 96 / 450	—
PIPE 97 / 450	—
PIPE 98 / 450	—
PIPE 99 / 450	—
PIPE 100 / 450	—

FOR CONSTRUCTION

PLAN LAYOUT

PUMP ASSEMBLY HOUSING TO BE SPECIFIED BY CONTRACTOR AND APPROVED BY ENGINEER ON SITE. HOUSING MUST ALLOW FOR ADEQUATE VENTILATION.

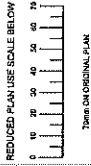


**TYPICAL SECTION:  
BOOSTER PUMP ASSEMBLY DETAIL**  
SCALE 1:10

PIPEWORK FITTINGS			QTY
ITEM	NO DIA	DESCRIPTION	
1	50	HDPE PIPE	2
2	50 x 25	REDUCER	2
3	25	HDPE PIPE	5
4	25	90° BEND	1
5	25	NON-RETURN VALVE	2
6	25	FEMALE/FEMALE DZR APPROVED BRASS BALL-O-STOP WITH 2 MALE COMPRESSION ADAPTERS	2
7	25	EQUAL TEE WITH FEMALE THREADED OFFTAKE	2
8	25	AIR RELEASE VALVE	2
9		PEDROLLO CPM150 SINGLE PHASE PUMP PRESSURE SUSTAINING VALVE WITH 2 MALE COMPRESSION ADAPTERS	1
10	25	COMPRESSION ADAPTERS	1

- NOTES:**
- EXACT POSITION OF PUMP STATION TO BE INDICATED BY ENGINEER ON SITE.
  - FINAL ASSEMBLY TO BE DETERMINED ON SITE.
  - A 220V ELECTRICAL CONNECTION WILL BE REQUIRED TO OPERATE THE SINGLE PHASE PUMP.
  - PIPEWORK AND FITTINGS PRESSURE CLASS = PN12.5
  - MINIMUM STRENGTH OF CONCRETE TO BE 25 MPa AT 28 DAYS
  - ALL EXPOSED CONCRETE EDGES TO HAVE A 25mm x 25mm CHAMFER.

**FOR CONSTRUCTION**



CONSULTANT:



1st Floor No. 2 The... Tel: +27 (0) 31 784 607  
Boulevard West Way... Fax: +27 (0) 31 206 011  
Durban, KwaZulu-Natal, South Africa. Email: info@naiducosting.com

CONTRACT NO.: D734-S3-5400

FOR CONSTRUCTION

R/I (Rev.)

Description:

DP24-53-000 PLAN LAYOUT

Rev.	Date	Reason for Construction
0	08/03/20	ISSUED FOR CONSTRUCTION

Project No. D734

Contract No.

Project Title

MURCHISON HOSPITAL

Drawing Title

STANDARD DETAILS

POTABLE WATER

Scale

Author

Checked

Approved

Issue

Quantity

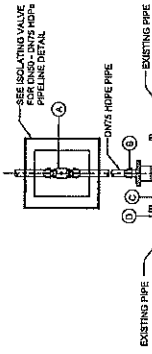
2 of 1

0

FOR CONSTRUCTION

NOTES:  
MINIMUM TRENCH DEPTH = 300mm

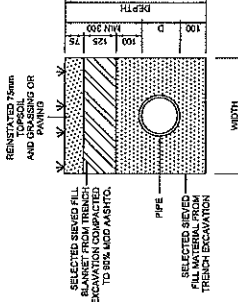
NO.	DESCRIPTION
1	20mm Ø PPRc HDPE PIPE
2	20mm Ø PPRc VALVE
3	MALE BRASS BALL-STOP
4	16mm BALL-STOP VALVE
5	20mm Ø PLASTIC STOP COCK
6	PLASTIC COVER FOR STOP COCK
7	PLASTIC END CAP



TYPICAL TIE-IN DETAIL  
SCALE 1:20

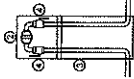
ITEM NO.	DESCRIPTION	NO. OF
A	16mm BALL-STOP VALVE	1
B	20mm Ø PLASTIC STOP COCK	1
C	PLASTIC COVER FOR STOP COCK	1
D	PLASTIC END CAP	2

NOTES:  
1) BACKFILL TO BE PLACED IN LAYERS.  
2) MINIMUM COVER TO ALL PIPE TO BE 300mm.

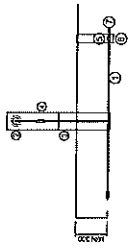


TYPICAL SECTION OF TRENCH & BEDDING FOR HDPE PIPES

PIPE DIAMETER	TRENCH WIDTH	MAX TRENCH DEPTH
UP TO 100mm	400mm	500mm
100mm	500mm	600mm

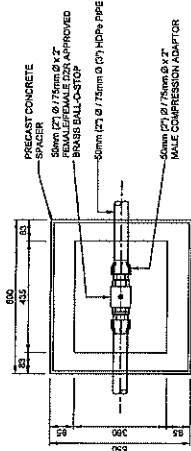


WATER METER SECTION



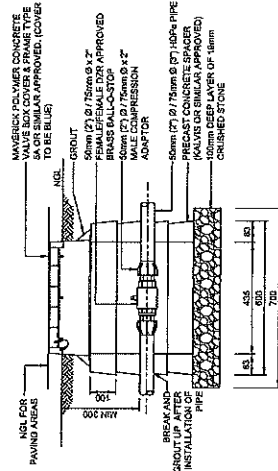
CONNECTION AT PROPERTY ELEVATION

PRECAST CONCRETE SPACER CAN BE REPLACED BY BRICK & MORTAR CHAMBER



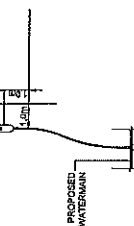
PLAN 1:10

NOTES:  
1. ALL COMPRESSION FITTINGS TO BE PN10.  
2. STAG & HDPE TO BE USED AT ALL BRASS VALVE & FITTINGS ONLY.  
3. PLASTIC ON THREADED FITTINGS.



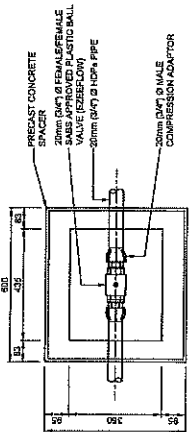
SECTIONAL ELEVATION 1:10

ISOLATING VALVE FOR DN50 - DN75 HDPE PIPELINE



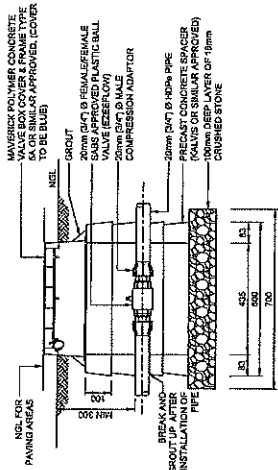
CONNECTION AT PROPERTY PLAN

PRECAST CONCRETE SPACER CAN BE REPLACED BY BRICK & MORTAR CHAMBER



PLAN 1:10

NOTES:  
1. ALL COMPRESSION FITTINGS TO BE PN10.  
2. STAG & HDPE TO BE USED AT ALL BRASS VALVE & FITTINGS ONLY.  
3. PLASTIC ON THREADED FITTINGS.



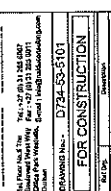
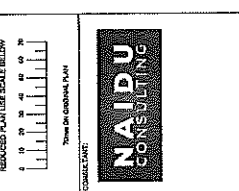
SECTIONAL ELEVATION 1:10

ISOLATING VALVE FOR DN20 HDPE PIPELINE







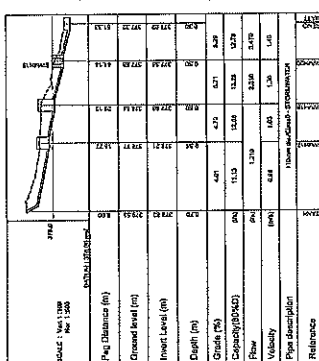


2014/15  
 2015/16  
 2016/17  
 2017/18  
 2018/19  
 2019/20  
 2020/21  
 2021/22  
 2022/23  
 2023/24  
 2024/25  
 2025/26  
 2026/27  
 2027/28  
 2028/29  
 2029/30  
 2030/31  
 2031/32  
 2032/33  
 2033/34  
 2034/35  
 2035/36  
 2036/37  
 2037/38  
 2038/39  
 2039/40  
 2040/41  
 2041/42  
 2042/43  
 2043/44  
 2044/45  
 2045/46  
 2046/47  
 2047/48  
 2048/49  
 2049/50  
 2050/51  
 2051/52  
 2052/53  
 2053/54  
 2054/55  
 2055/56  
 2056/57  
 2057/58  
 2058/59  
 2059/60  
 2060/61  
 2061/62  
 2062/63  
 2063/64  
 2064/65  
 2065/66  
 2066/67  
 2067/68  
 2068/69  
 2069/70  
 2070/71  
 2071/72  
 2072/73  
 2073/74  
 2074/75  
 2075/76  
 2076/77  
 2077/78  
 2078/79  
 2079/80  
 2080/81  
 2081/82  
 2082/83  
 2083/84  
 2084/85  
 2085/86  
 2086/87  
 2087/88  
 2088/89  
 2089/90  
 2090/91  
 2091/92  
 2092/93  
 2093/94  
 2094/95  
 2095/96  
 2096/97  
 2097/98  
 2098/99  
 2099/100

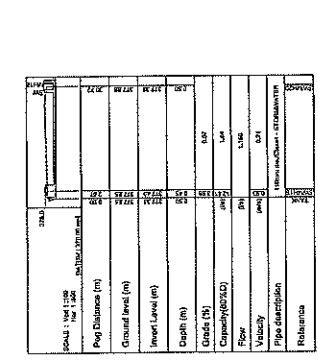
FOR CONSTRUCTION

PROJECT NO: D794-S3-5101  
 SHEET NO: 1 OF 1

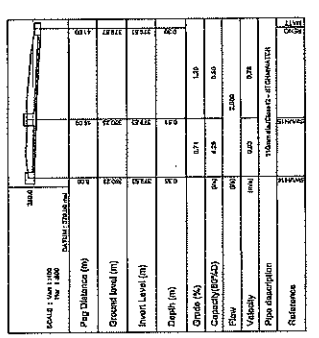
MURDOCH HOSPITAL  
 DNT10 STORMWATER MAIN  
 LONGITUDINAL SECTIONS



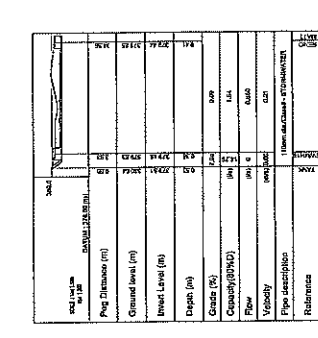
Station	Ground level (m)	Invert level (m)	Depth (m)
3194.00	2.05	1.45	0.60
3194.10	1.95	1.35	0.60
3194.20	1.85	1.25	0.60
3194.30	1.75	1.15	0.60
3194.40	1.65	1.05	0.60
3194.50	1.55	0.95	0.60



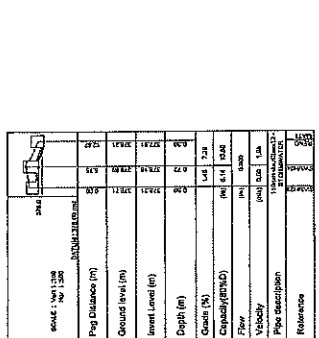
Station	Ground level (m)	Invert level (m)	Depth (m)
3194.50	1.55	0.95	0.60
3194.60	1.45	0.85	0.60
3194.70	1.35	0.75	0.60
3194.80	1.25	0.65	0.60
3194.90	1.15	0.55	0.60
3195.00	1.05	0.45	0.60



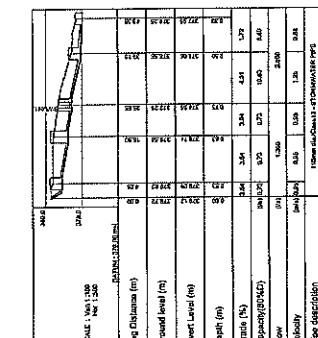
Station	Ground level (m)	Invert level (m)	Depth (m)
3195.00	1.05	0.45	0.60
3195.10	0.95	0.35	0.60
3195.20	0.85	0.25	0.60
3195.30	0.75	0.15	0.60
3195.40	0.65	0.05	0.60
3195.50	0.55	0.00	0.60



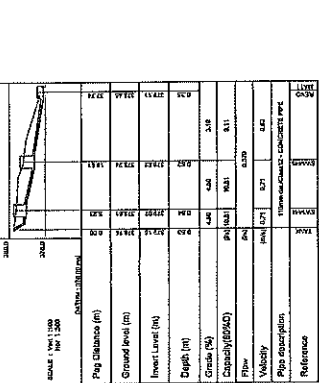
Station	Ground level (m)	Invert level (m)	Depth (m)
3195.50	0.55	0.00	0.60
3195.60	0.45	-0.10	0.60
3195.70	0.35	-0.20	0.60
3195.80	0.25	-0.30	0.60
3195.90	0.15	-0.40	0.60
3196.00	0.05	-0.50	0.60



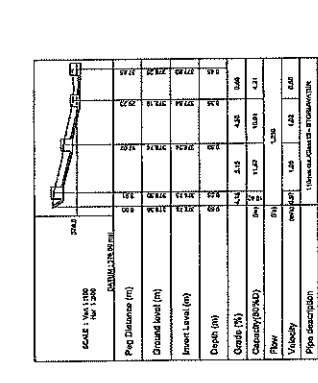
Station	Ground level (m)	Invert level (m)	Depth (m)
3196.00	0.05	-0.50	0.60
3196.10	-0.05	-0.60	0.60
3196.20	-0.15	-0.70	0.60
3196.30	-0.25	-0.80	0.60
3196.40	-0.35	-0.90	0.60
3196.50	-0.45	-1.00	0.60



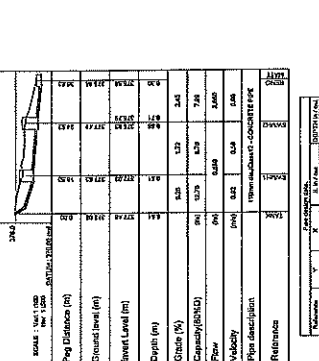
Station	Ground level (m)	Invert level (m)	Depth (m)
3196.50	-0.45	-1.00	0.60
3196.60	-0.55	-1.10	0.60
3196.70	-0.65	-1.20	0.60
3196.80	-0.75	-1.30	0.60
3196.90	-0.85	-1.40	0.60
3197.00	-0.95	-1.50	0.60



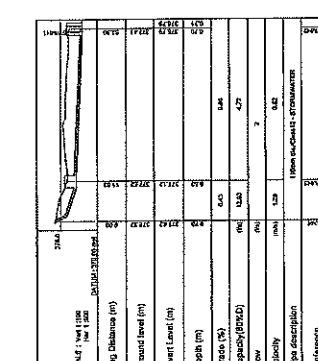
Station	Ground level (m)	Invert level (m)	Depth (m)
3197.00	-0.95	-1.50	0.60
3197.10	-1.05	-1.60	0.60
3197.20	-1.15	-1.70	0.60
3197.30	-1.25	-1.80	0.60
3197.40	-1.35	-1.90	0.60
3197.50	-1.45	-2.00	0.60



Station	Ground level (m)	Invert level (m)	Depth (m)
3197.50	-1.45	-2.00	0.60
3197.60	-1.55	-2.10	0.60
3197.70	-1.65	-2.20	0.60
3197.80	-1.75	-2.30	0.60
3197.90	-1.85	-2.40	0.60
3198.00	-1.95	-2.50	0.60



Station	Ground level (m)	Invert level (m)	Depth (m)
3198.00	-1.95	-2.50	0.60
3198.10	-2.05	-2.60	0.60
3198.20	-2.15	-2.70	0.60
3198.30	-2.25	-2.80	0.60
3198.40	-2.35	-2.90	0.60
3198.50	-2.45	-3.00	0.60



Station	Ground level (m)	Invert level (m)	Depth (m)
3198.50	-2.45	-3.00	0.60
3198.60	-2.		





No. 6 The Boulevard, West Way  
Office Park  
7 Harry Evans Road, Westville, 3615  
Tel: +27 31 285 6007  
Fax: +27 31 285 9011

PROJECT:

**MURCHISON HOSPITAL STAFF RESIDENCE**

NC PROJECT no.:

**D734**

PAGE: 001

**DRAWING REGISTER - STRUCTURAL**

DWG NO.	DESCRIPTION	SCALE	SIZE	CURR.	REV.	DATE ISSUED
<b>STRUCTURAL DRAWINGS</b>						
<b>Building 1</b>						
D734-6001-001	Building 1, Foundation, Surface Bed Layout & Detail Sections	AS SHOWN	A0	0		1/27/2021
D734-6001-002	Standard Details - Sheet 1	AS SHOWN	A1	0		1/27/2021
D734-6001-003	Standard Details - Sheet 2	AS SHOWN	A1	0		1/27/2021
D734-6001-004	Building 1, Foundation Reinforcement Details	AS SHOWN	A0	0		1/27/2021
<b>Building 2</b>						
D734-6002-001	Building 2, Foundations, Surface Bed Layouts & Detail Sections	AS SHOWN	A0	0		1/27/2021
D734-6002-002	Standard Details - Sheet 1	AS SHOWN	A1	0		1/27/2021
D734-6002-003	Standard Details - Sheet 2	AS SHOWN	A1	0		1/27/2021
D734-6002-004	Building 2, Foundation Reinforcement Details	AS SHOWN	A0	0		1/27/2021
<b>Building 3</b>						
D734-6003-001	Building 3, Foundation, Surface Bed Layouts & Detail Sections	AS SHOWN	A0	0		1/27/2021
D734-6003-002	Building 3, Steel Beam, Timber Layout & Section	AS SHOWN	A0	0		1/27/2021
D734-6003-003	Standard Details - Sheet 1	AS SHOWN	A1	0		1/27/2021
D734-6003-004	Standard Details - Sheet 2	AS SHOWN	A1	0		1/27/2021
D734-6003-005	Building 3, Foundation Reinforcement Details	AS SHOWN	A0	0		1/27/2021
<b>Building 4</b>						
D734-6004-001	Building 4, Surface Bed Layout & Detail Sections	AS SHOWN	A0	0		1/27/2021
D734-6004-002	Building 4, Foundation Layout	AS SHOWN	A0	0		1/27/2021
D734-6004-003	Building 4, Steel Beam Layout & Section	AS SHOWN	A0	0		1/27/2021
D734-6004-004	Standard Details - Sheet 1	AS SHOWN	A1	0		1/27/2021
D734-6004-005	Standard Details - Sheet 2	AS SHOWN	A1	0		1/27/2021
D734-6004-006	Building 4, Foundation Reinforcement Details	AS SHOWN	A0	0		1/27/2021
<b>Building 5</b>						
D734-6005-001	Building 5, Foundation, Surface Bed Layouts & Detail Sections	AS SHOWN	A0	0		1/27/2021
D734-6005-002	Standard Details - Sheet 1	AS SHOWN	A1	0		1/27/2021
D734-6005-003	Standard Details - Sheet 2	AS SHOWN	A1	0		1/27/2021
D734-6005-004	Building 5, Foundation Reinforcement Details	AS SHOWN	A0	0		1/27/2021
<b>Building 6</b>						
D734-6006-001	Building 6, Main Building & Double Garage Foundations, Surface Bed Layout & Detail Sections	AS SHOWN	A0	0		1/27/2021
D734-6006-002	Standard Details - Sheet 1	AS SHOWN	A1	0		1/27/2021
D734-6006-003	Standard Details - Sheet 2	AS SHOWN	A1	0		1/27/2021
D734-6006-004	Building 6, Double Garage Foundation Reinforcement Details	AS SHOWN	A0	0		1/27/2021
<b>New Guard House</b>						
D734-6007-001	New Guard House, Foundation, Surface Bed, Timber Beam Layout & Section	AS SHOWN	A1	0		1/27/2021
D734-6007-002	Standard Details - Sheet 1	AS SHOWN	A1	0		1/27/2021
D734-6007-003	Standard Details - Sheet 2	AS SHOWN	A1	0		1/27/2021
D734-6007-004	New Guard House Foundation Reinforcement Details	AS SHOWN	A0	0		1/27/2021
<b>Proposed Garage</b>						
D734-6008-001	Proposed Garage / Ex. Guard House, Ex. Laundry, Foundations, Surface Bed Layout & Sections	AS SHOWN	A0	0		1/27/2021
D734-6008-002	Standard Details - Sheet 1	AS SHOWN	A1	0		1/27/2021
D734-6008-003	Standard Details - Sheet 2	AS SHOWN	A1	0		1/27/2021
D734-6008-004	Proposed Garage Foundations Reinforcement Details	AS SHOWN	A0	0		1/27/2021

RECEIVED BY:

SIGNATURE:

DATE:

DISTRIBUTION

Client	Department of Health	NUMBER OF COPIES
Principal Agent/ Architect	Arch 4	
Quantity Surveyor	Turner & Townsend	
Civil / Structural Engineer	Nalini Consulting	PDFs
Mechanical Engineer	SMA Mechanical Consulting Engineers	
Electrical Engineer	DMA	
Architect	Arch 4	
Contractor		
Clerk of works		
Resident Engineer- Civil / Structural		
C.L.O		

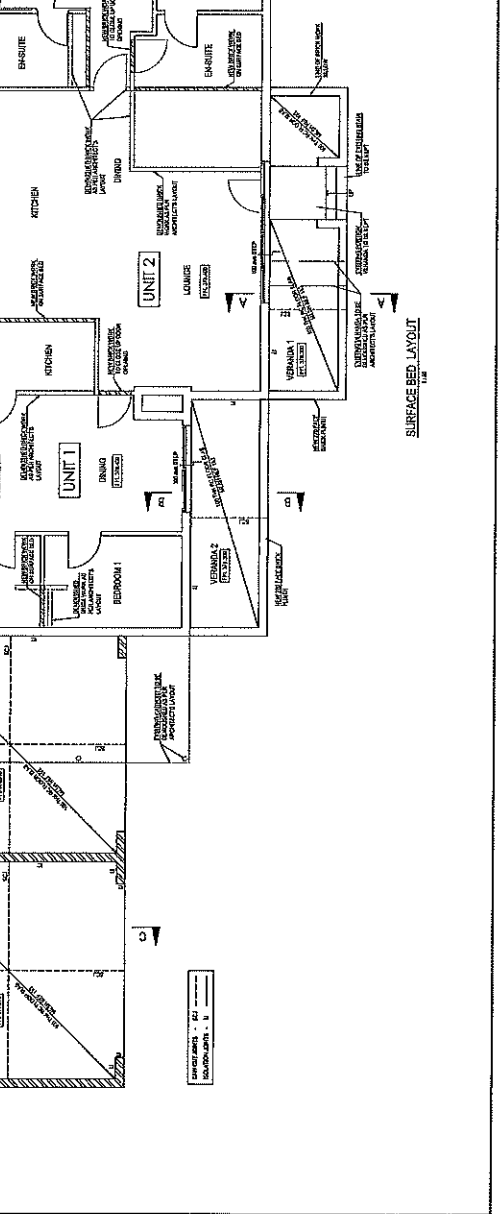
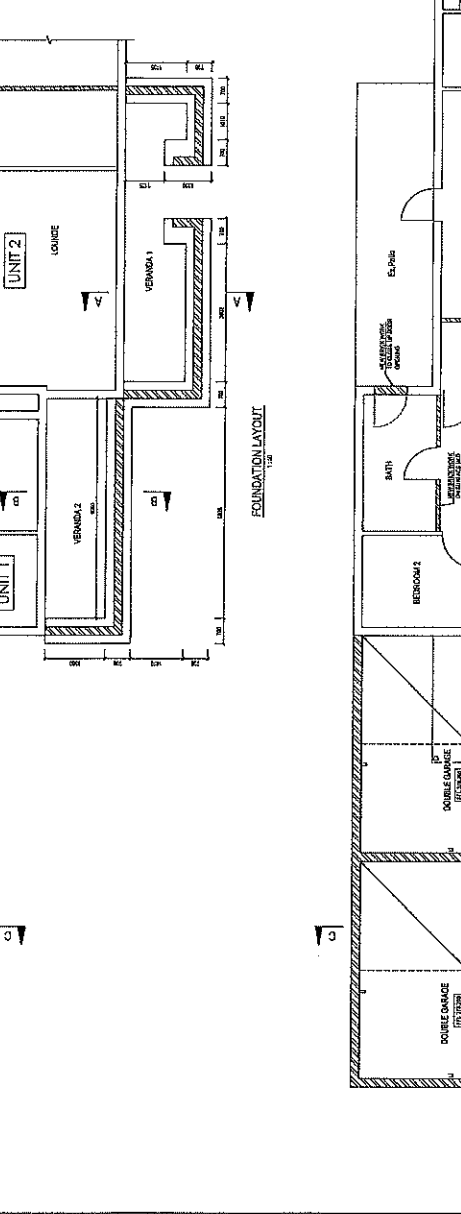
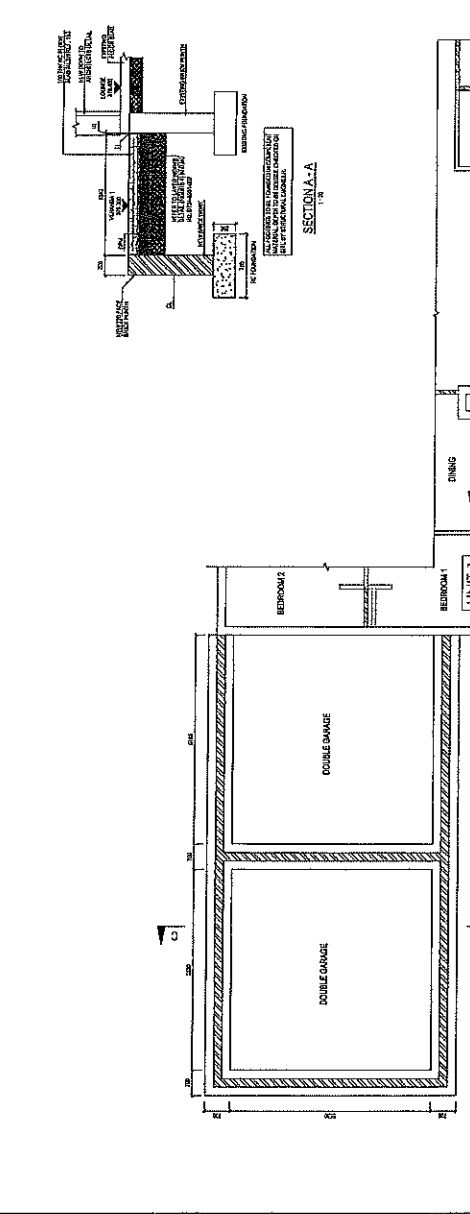
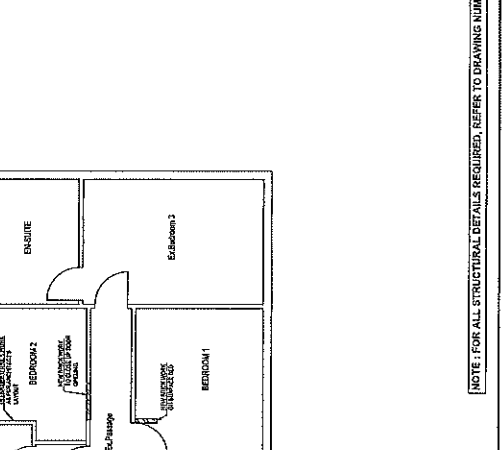
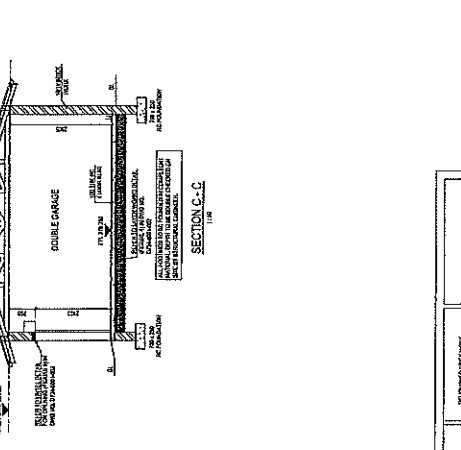
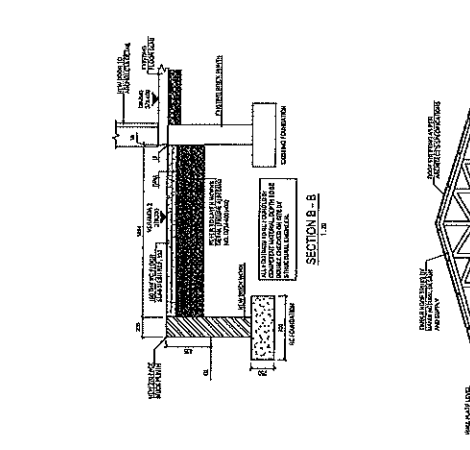
243

NO.	DATE	DESCRIPTION	BY
1	05/20/2018	FOR APPROVAL	AD

<b>REVISIONS</b> NO. DATE DESCRIPTION BY			
1	05/20/2018	FOR APPROVAL	AD

- REVISIONS**
1. ALL WORK TO BE DONE IN ACCORDANCE WITH THE SPECIFICATIONS OF THE NATIONAL BUILDING REGULATIONS (NBR) AND THE NATIONAL ELECTRICAL REGULATIONS (NER).
  2. ALL WORK TO BE DONE IN ACCORDANCE WITH THE SPECIFICATIONS OF THE NATIONAL BUILDING REGULATIONS (NBR) AND THE NATIONAL ELECTRICAL REGULATIONS (NER).
  3. ALL WORK TO BE DONE IN ACCORDANCE WITH THE SPECIFICATIONS OF THE NATIONAL BUILDING REGULATIONS (NBR) AND THE NATIONAL ELECTRICAL REGULATIONS (NER).
  4. ALL WORK TO BE DONE IN ACCORDANCE WITH THE SPECIFICATIONS OF THE NATIONAL BUILDING REGULATIONS (NBR) AND THE NATIONAL ELECTRICAL REGULATIONS (NER).
  5. ALL WORK TO BE DONE IN ACCORDANCE WITH THE SPECIFICATIONS OF THE NATIONAL BUILDING REGULATIONS (NBR) AND THE NATIONAL ELECTRICAL REGULATIONS (NER).
  6. ALL WORK TO BE DONE IN ACCORDANCE WITH THE SPECIFICATIONS OF THE NATIONAL BUILDING REGULATIONS (NBR) AND THE NATIONAL ELECTRICAL REGULATIONS (NER).
  7. ALL WORK TO BE DONE IN ACCORDANCE WITH THE SPECIFICATIONS OF THE NATIONAL BUILDING REGULATIONS (NBR) AND THE NATIONAL ELECTRICAL REGULATIONS (NER).
  8. ALL WORK TO BE DONE IN ACCORDANCE WITH THE SPECIFICATIONS OF THE NATIONAL BUILDING REGULATIONS (NBR) AND THE NATIONAL ELECTRICAL REGULATIONS (NER).
  9. ALL WORK TO BE DONE IN ACCORDANCE WITH THE SPECIFICATIONS OF THE NATIONAL BUILDING REGULATIONS (NBR) AND THE NATIONAL ELECTRICAL REGULATIONS (NER).
  10. ALL WORK TO BE DONE IN ACCORDANCE WITH THE SPECIFICATIONS OF THE NATIONAL BUILDING REGULATIONS (NBR) AND THE NATIONAL ELECTRICAL REGULATIONS (NER).

<b>REVISIONS</b> NO. DATE DESCRIPTION BY			
1	05/20/2018	FOR APPROVAL	AD



FOR APPROVAL  
 NOTE: FOR ALL STRUCTURAL DETAILS REQUIRED, REFER TO DRAWING NUMBERS DT/4-601-002 & DT/4-601-003

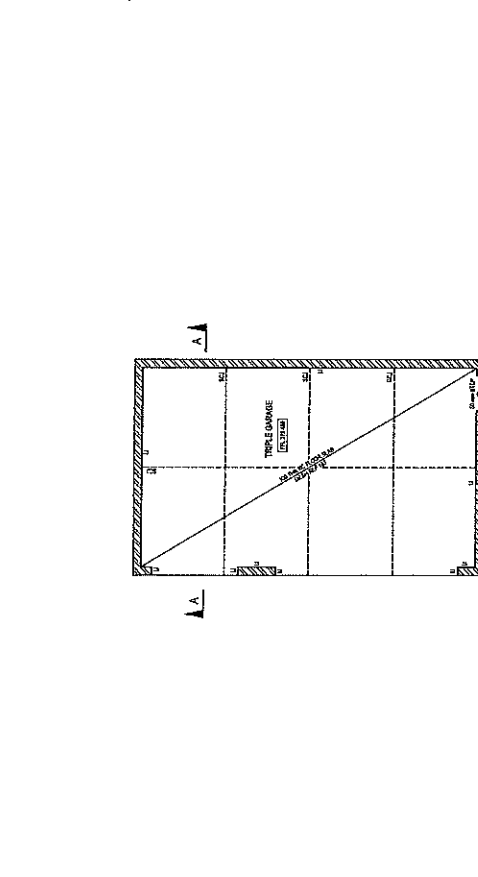
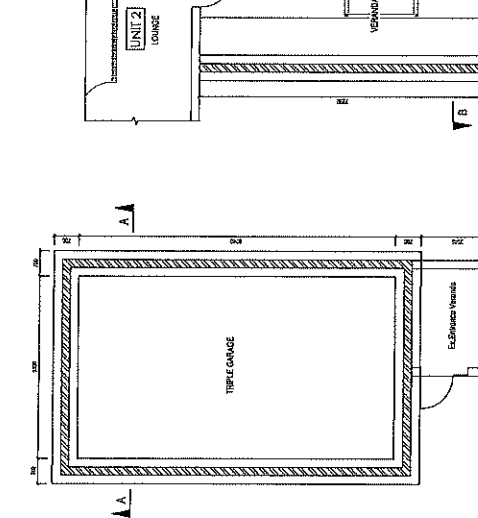


NO.	DATE	DESCRIPTION	BY
1.	11/11/2011	FOR APPROVAL	AD
2.	11/11/2011	FOR APPROVAL	AD

- REVISIONS**
1. REVISED TO ACCORDANCE WITH THE FOLLOWING FACTORS:  
 A. ALL DIMENSIONS TO BE IN METERS UNLESS OTHERWISE SPECIFIED.  
 B. ALL DIMENSIONS TO BE TO FACE UNLESS OTHERWISE SPECIFIED.  
 C. ALL DIMENSIONS TO BE TO CENTER UNLESS OTHERWISE SPECIFIED.  
 D. ALL DIMENSIONS TO BE TO CENTER UNLESS OTHERWISE SPECIFIED.
  2. REVISED TO ACCORDANCE WITH THE FOLLOWING FACTORS:  
 A. ALL DIMENSIONS TO BE IN METERS UNLESS OTHERWISE SPECIFIED.  
 B. ALL DIMENSIONS TO BE TO FACE UNLESS OTHERWISE SPECIFIED.  
 C. ALL DIMENSIONS TO BE TO CENTER UNLESS OTHERWISE SPECIFIED.  
 D. ALL DIMENSIONS TO BE TO CENTER UNLESS OTHERWISE SPECIFIED.
  3. REVISED TO ACCORDANCE WITH THE FOLLOWING FACTORS:  
 A. ALL DIMENSIONS TO BE IN METERS UNLESS OTHERWISE SPECIFIED.  
 B. ALL DIMENSIONS TO BE TO FACE UNLESS OTHERWISE SPECIFIED.  
 C. ALL DIMENSIONS TO BE TO CENTER UNLESS OTHERWISE SPECIFIED.  
 D. ALL DIMENSIONS TO BE TO CENTER UNLESS OTHERWISE SPECIFIED.
  4. REVISED TO ACCORDANCE WITH THE FOLLOWING FACTORS:  
 A. ALL DIMENSIONS TO BE IN METERS UNLESS OTHERWISE SPECIFIED.  
 B. ALL DIMENSIONS TO BE TO FACE UNLESS OTHERWISE SPECIFIED.  
 C. ALL DIMENSIONS TO BE TO CENTER UNLESS OTHERWISE SPECIFIED.  
 D. ALL DIMENSIONS TO BE TO CENTER UNLESS OTHERWISE SPECIFIED.

**REVISIONS**

1. REVISED TO ACCORDANCE WITH THE FOLLOWING FACTORS:  
 A. ALL DIMENSIONS TO BE IN METERS UNLESS OTHERWISE SPECIFIED.  
 B. ALL DIMENSIONS TO BE TO FACE UNLESS OTHERWISE SPECIFIED.  
 C. ALL DIMENSIONS TO BE TO CENTER UNLESS OTHERWISE SPECIFIED.  
 D. ALL DIMENSIONS TO BE TO CENTER UNLESS OTHERWISE SPECIFIED.
2. REVISED TO ACCORDANCE WITH THE FOLLOWING FACTORS:  
 A. ALL DIMENSIONS TO BE IN METERS UNLESS OTHERWISE SPECIFIED.  
 B. ALL DIMENSIONS TO BE TO FACE UNLESS OTHERWISE SPECIFIED.  
 C. ALL DIMENSIONS TO BE TO CENTER UNLESS OTHERWISE SPECIFIED.  
 D. ALL DIMENSIONS TO BE TO CENTER UNLESS OTHERWISE SPECIFIED.
3. REVISED TO ACCORDANCE WITH THE FOLLOWING FACTORS:  
 A. ALL DIMENSIONS TO BE IN METERS UNLESS OTHERWISE SPECIFIED.  
 B. ALL DIMENSIONS TO BE TO FACE UNLESS OTHERWISE SPECIFIED.  
 C. ALL DIMENSIONS TO BE TO CENTER UNLESS OTHERWISE SPECIFIED.  
 D. ALL DIMENSIONS TO BE TO CENTER UNLESS OTHERWISE SPECIFIED.
4. REVISED TO ACCORDANCE WITH THE FOLLOWING FACTORS:  
 A. ALL DIMENSIONS TO BE IN METERS UNLESS OTHERWISE SPECIFIED.  
 B. ALL DIMENSIONS TO BE TO FACE UNLESS OTHERWISE SPECIFIED.  
 C. ALL DIMENSIONS TO BE TO CENTER UNLESS OTHERWISE SPECIFIED.  
 D. ALL DIMENSIONS TO BE TO CENTER UNLESS OTHERWISE SPECIFIED.



**HEALTHCARE CONSULTANTS**

**NAIDU CONSULTING**  
110/112 Sturt Street, Adelaide, SA 5000  
Tel: 08 8234 1111 Fax: 08 8234 1111

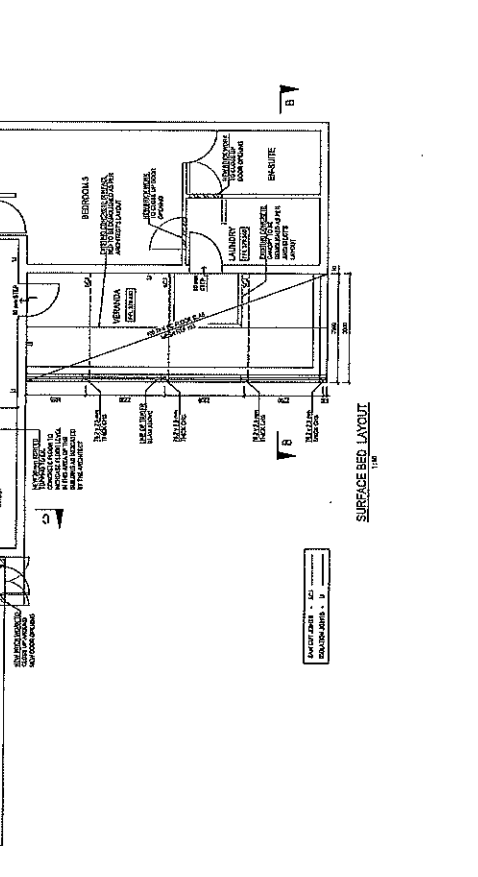
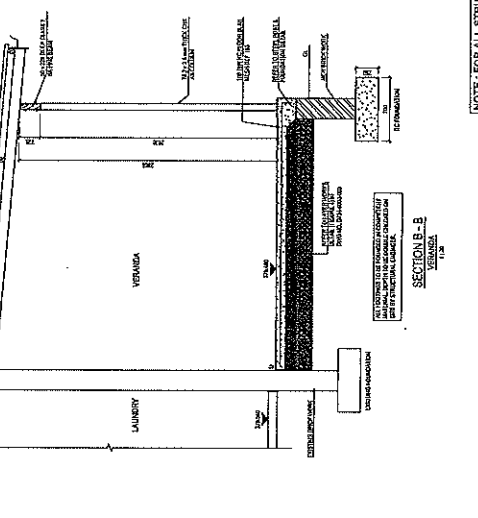
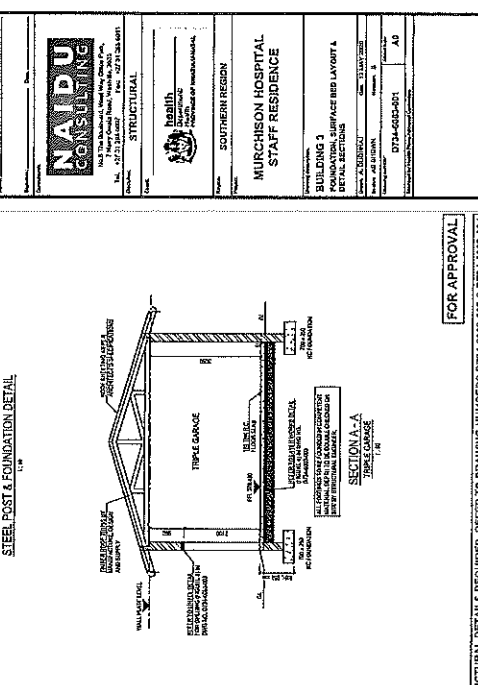
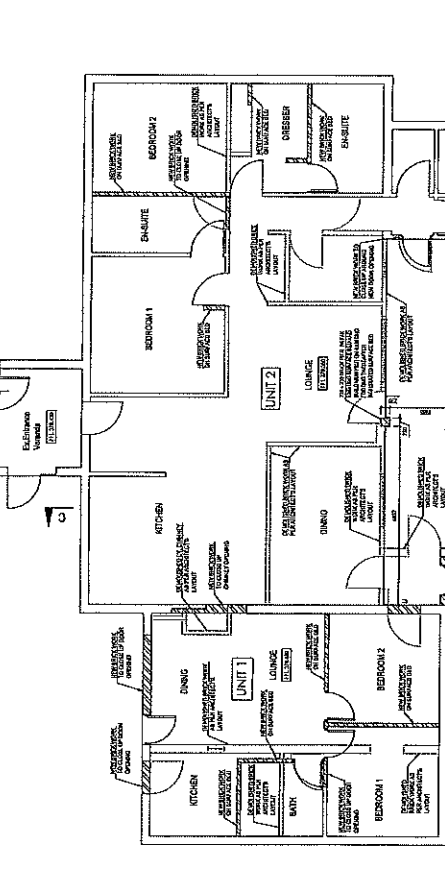
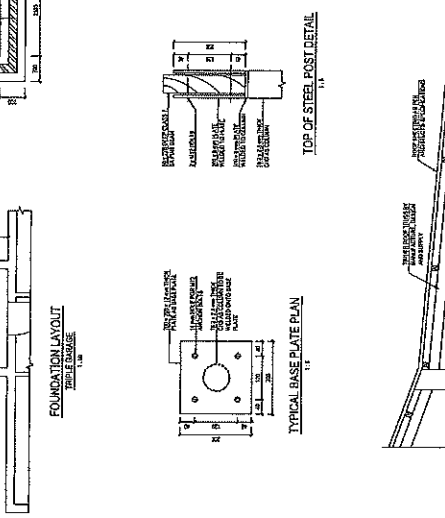
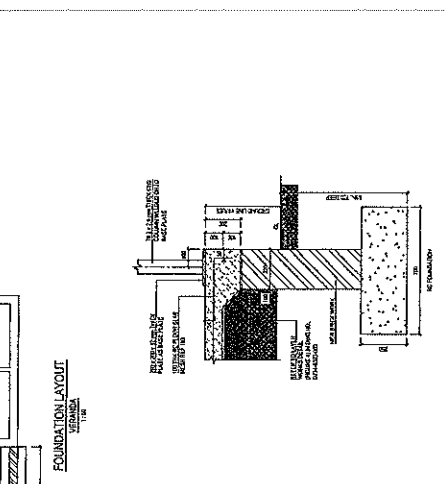
**STRUCTURAL**

**health**  
SOUTHERN REGION

**MURCHISON HOSPITAL STAFF RESIDENCE**

PROJECT NO: 0734-600-000  
DRAWING NO: SURFACE BED LAYOUT A  
DETAILS: SECTIONS

DATE: 11/11/2011  
BY: AD  
CHECKED: AD  
SCALE: AS SHOWN  
PROJECT NO: 0734-600-000



NOTE: FOR ALL STRUCTURAL DETAILS REQUIRED, REFER TO DRAWING NUMBERS 0734-600-000 & 0734-600-001

FOR APPROVAL

NO.	DATE	DESCRIPTION
1	12/01/2011	ISSUED FOR PERMIT
2		

REVISIONS		

1. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 2. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 3. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 4. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 5. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 6. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 7. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 8. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 9. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 10. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:

11. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 12. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 13. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 14. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 15. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 16. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 17. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 18. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 19. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 20. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:

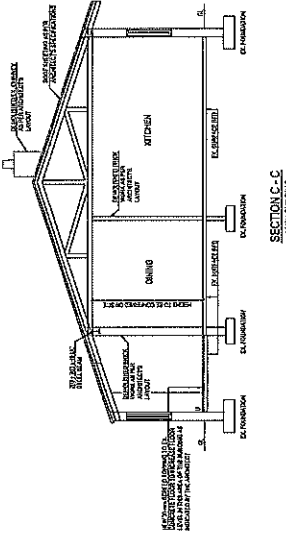
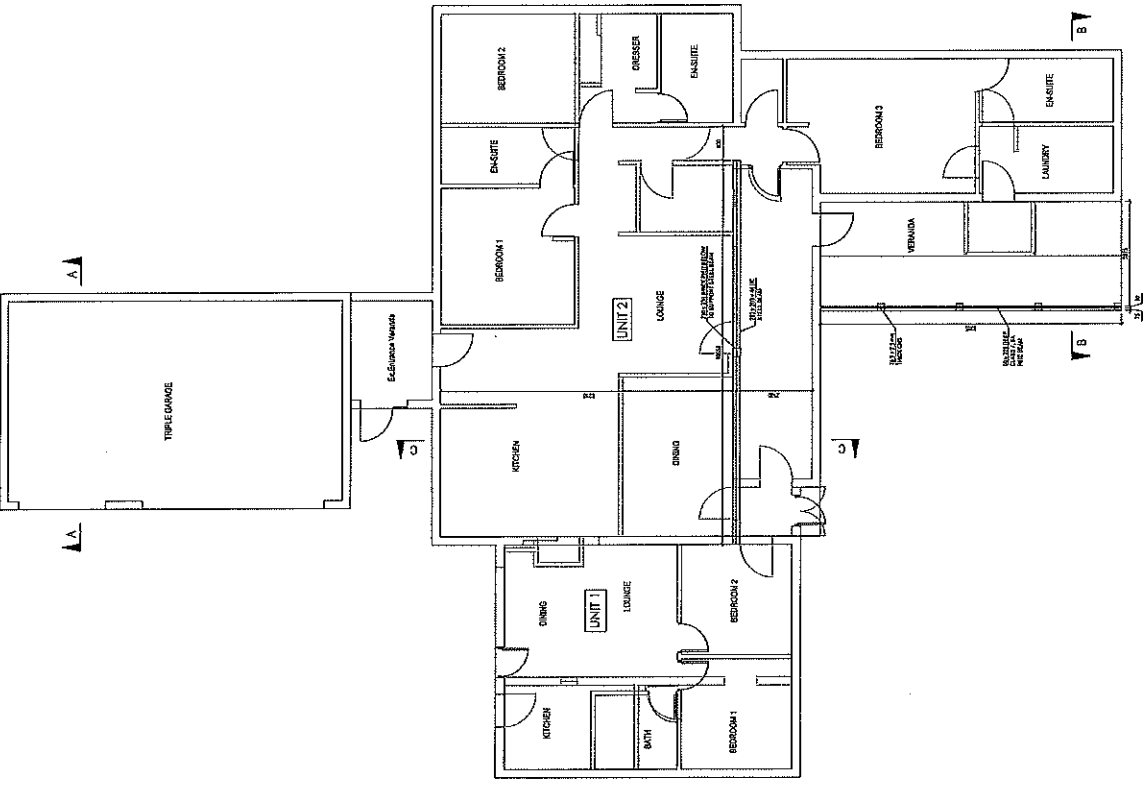
21. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 22. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 23. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 24. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 25. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 26. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 27. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 28. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 29. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 30. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:

31. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 32. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 33. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 34. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 35. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 36. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 37. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 38. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 39. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 40. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:

41. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 42. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 43. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 44. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 45. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 46. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 47. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 48. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 49. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 50. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:

51. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 52. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 53. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 54. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 55. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 56. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 57. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 58. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 59. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 60. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:

61. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 62. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 63. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 64. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 65. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 66. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 67. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 68. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 69. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:  
 70. ALL WORK TO BE DONE IN ACCORDANCE WITH THE FOLLOWING REGULATIONS:



STEEL BEAM & TIMBER BEAM LAYOUT

FOR APPROVAL

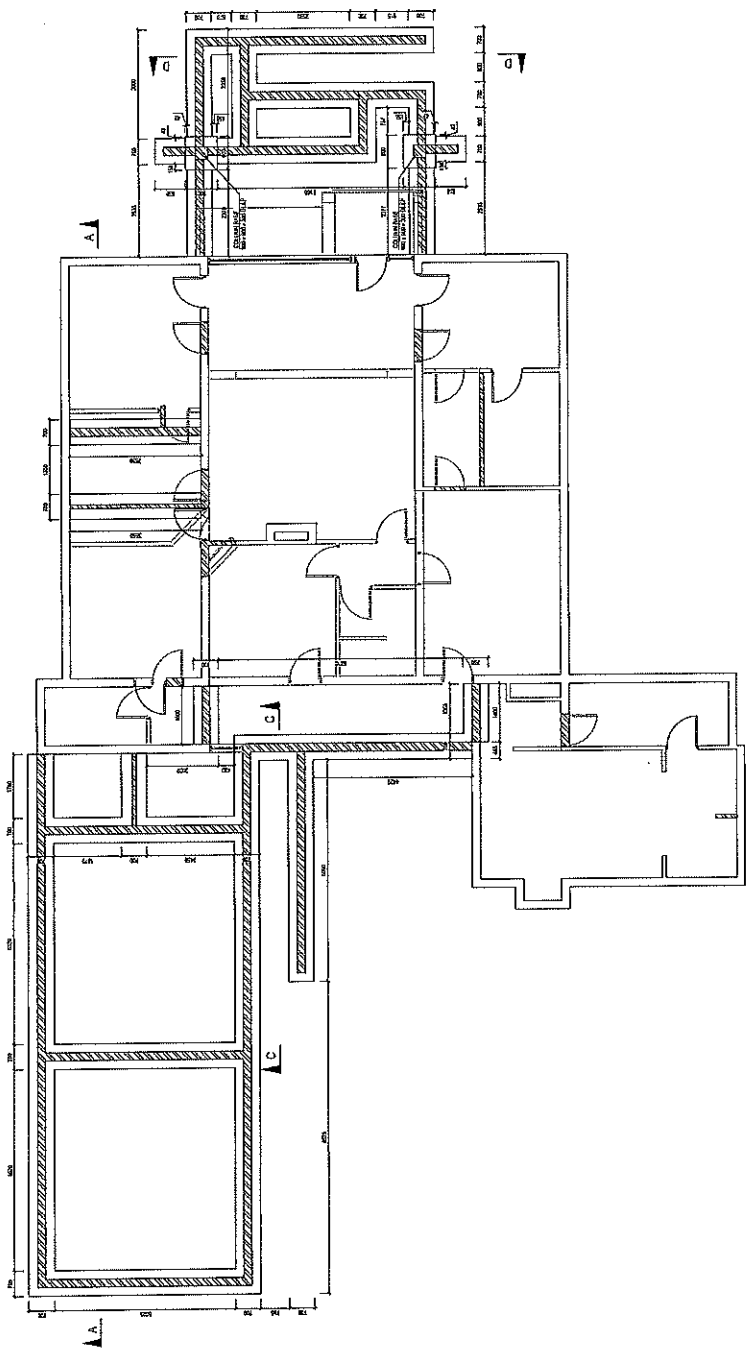
NOTE: FOR ALL STRUCTURAL DETAILS REQUIRED, REFER TO DRAWING NUMBERS DT34-8003 & DT34-8003-004

247





1. Check and approve the drawings in accordance with the instructions of the client.
2. Check and approve the drawings in accordance with the instructions of the client.
3. Check and approve the drawings in accordance with the instructions of the client.
4. Check and approve the drawings in accordance with the instructions of the client.
5. Check and approve the drawings in accordance with the instructions of the client.
6. Check and approve the drawings in accordance with the instructions of the client.
7. Check and approve the drawings in accordance with the instructions of the client.
8. Check and approve the drawings in accordance with the instructions of the client.
9. Check and approve the drawings in accordance with the instructions of the client.
10. Check and approve the drawings in accordance with the instructions of the client.
11. Check and approve the drawings in accordance with the instructions of the client.
12. Check and approve the drawings in accordance with the instructions of the client.
13. Check and approve the drawings in accordance with the instructions of the client.
14. Check and approve the drawings in accordance with the instructions of the client.
15. Check and approve the drawings in accordance with the instructions of the client.
16. Check and approve the drawings in accordance with the instructions of the client.
17. Check and approve the drawings in accordance with the instructions of the client.
18. Check and approve the drawings in accordance with the instructions of the client.
19. Check and approve the drawings in accordance with the instructions of the client.
20. Check and approve the drawings in accordance with the instructions of the client.



FOUNDATION LAYOUT

**NAIDU CONSULTING**  
 11/11/2018  
 11/11/2018

STRUCTURAL

SOUTHERN REGION

MURCHISON HOSPITAL  
 STAFF RESIDENCE

BUILDING 4  
 FOUNDATION LAYOUTS

PROJECT NO: D734-4004-002  
 SHEET NO: A0

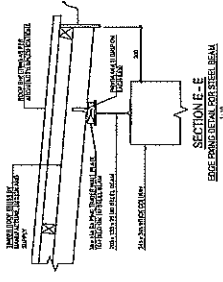
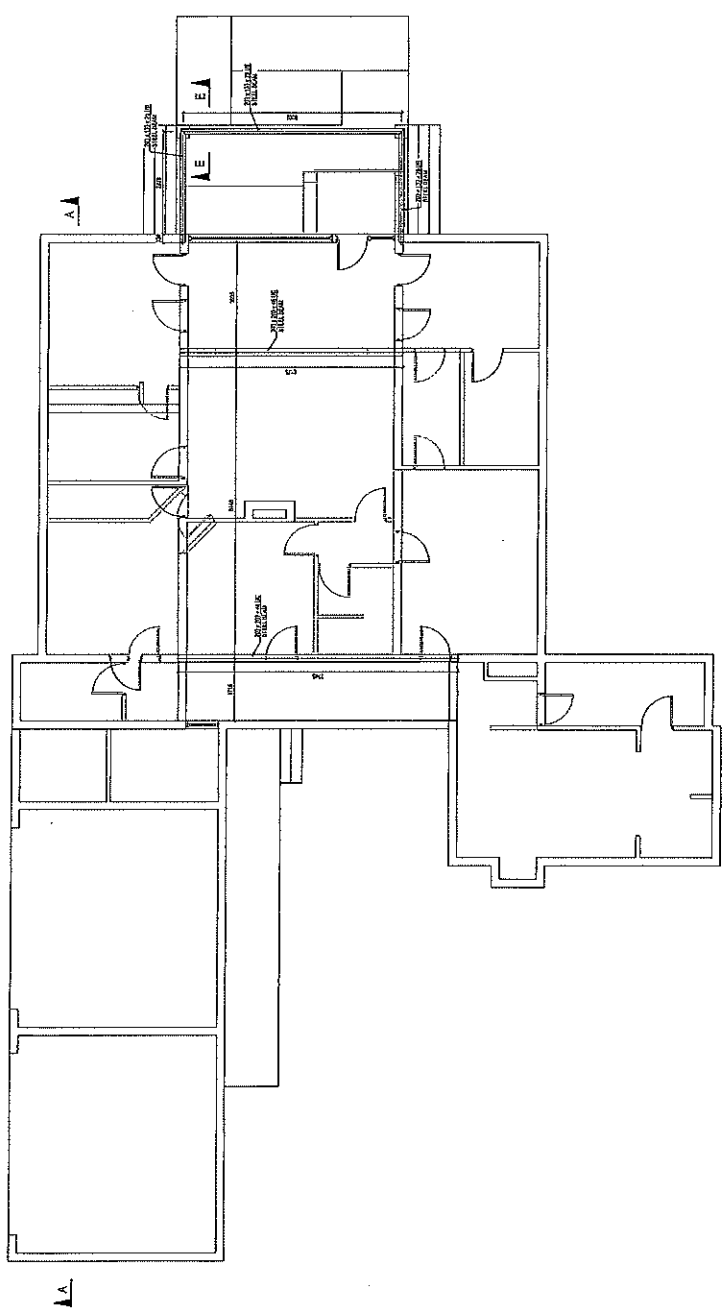
FOR APPROVAL  
 NOTE: FOR ALL STRUCTURAL DETAILS REQUIRED, REFER TO DRAWING NUMBERS D734-4004-004 & D734-4004-005

249

REVISIONS		
NO.	DATE	DESCRIPTION
1	15/08/2017	FOR APPROVAL
2		
3		

<b>REVISIONS</b> NO. DATE DESCRIPTION BY 1 15/08/2017 FOR APPROVAL 2 3		PROJECT NO: 17010000000000000000 PROJECT NAME: MURCHISON HOSPITAL STAFF RESIDENCE DRAWING NO: 0774-6004-003 DATE: 15/08/2017 DRAWN BY: JAB CHECKED BY: JAB APPROVED BY: JAB
PROJECT NO: 17010000000000000000 PROJECT NAME: MURCHISON HOSPITAL STAFF RESIDENCE DRAWING NO: 0774-6004-003 DATE: 15/08/2017 DRAWN BY: JAB CHECKED BY: JAB APPROVED BY: JAB		CLIENT: SOUTH COAST HEALTH PROJECT: MURCHISON HOSPITAL STAFF RESIDENCE BUILDING: 4 FLOOR: 4 SECTION: RC BEAM & STEEL BEAM LAYOUT & SECTION
PROJECT NO: 17010000000000000000 PROJECT NAME: MURCHISON HOSPITAL STAFF RESIDENCE DRAWING NO: 0774-6004-003 DATE: 15/08/2017 DRAWN BY: JAB CHECKED BY: JAB APPROVED BY: JAB		PROJECT NO: 17010000000000000000 PROJECT NAME: MURCHISON HOSPITAL STAFF RESIDENCE DRAWING NO: 0774-6004-003 DATE: 15/08/2017 DRAWN BY: JAB CHECKED BY: JAB APPROVED BY: JAB

- REVISIONS**
1. ALL DIMENSIONS TO BE SHOWN IN METERS.
  2. ALL DIMENSIONS TO BE SHOWN TO THE NEAREST MILLIMETER.
  3. DIMENSIONS TO BE SHOWN TO THE NEAREST MILLIMETER.
  4. DIMENSIONS TO BE SHOWN TO THE NEAREST MILLIMETER.
  5. DIMENSIONS TO BE SHOWN TO THE NEAREST MILLIMETER.
  6. DIMENSIONS TO BE SHOWN TO THE NEAREST MILLIMETER.
  7. DIMENSIONS TO BE SHOWN TO THE NEAREST MILLIMETER.
  8. DIMENSIONS TO BE SHOWN TO THE NEAREST MILLIMETER.
  9. DIMENSIONS TO BE SHOWN TO THE NEAREST MILLIMETER.
  10. DIMENSIONS TO BE SHOWN TO THE NEAREST MILLIMETER.
  11. DIMENSIONS TO BE SHOWN TO THE NEAREST MILLIMETER.
  12. DIMENSIONS TO BE SHOWN TO THE NEAREST MILLIMETER.
  13. DIMENSIONS TO BE SHOWN TO THE NEAREST MILLIMETER.
  14. DIMENSIONS TO BE SHOWN TO THE NEAREST MILLIMETER.
  15. DIMENSIONS TO BE SHOWN TO THE NEAREST MILLIMETER.
  16. DIMENSIONS TO BE SHOWN TO THE NEAREST MILLIMETER.
  17. DIMENSIONS TO BE SHOWN TO THE NEAREST MILLIMETER.
  18. DIMENSIONS TO BE SHOWN TO THE NEAREST MILLIMETER.
  19. DIMENSIONS TO BE SHOWN TO THE NEAREST MILLIMETER.
  20. DIMENSIONS TO BE SHOWN TO THE NEAREST MILLIMETER.

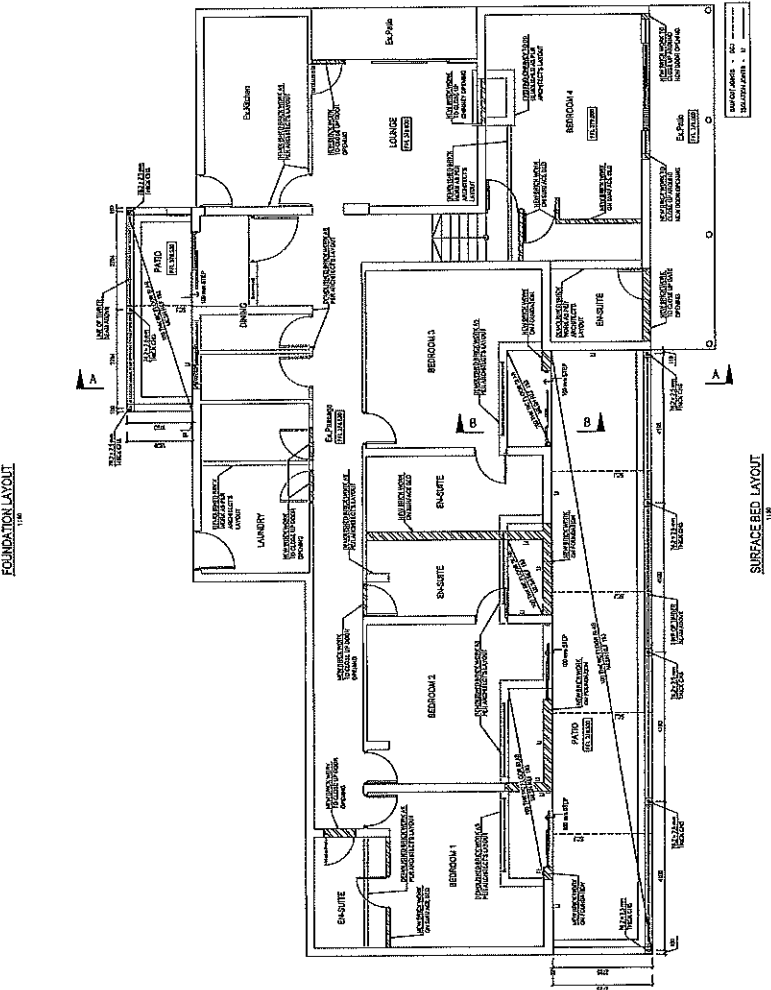
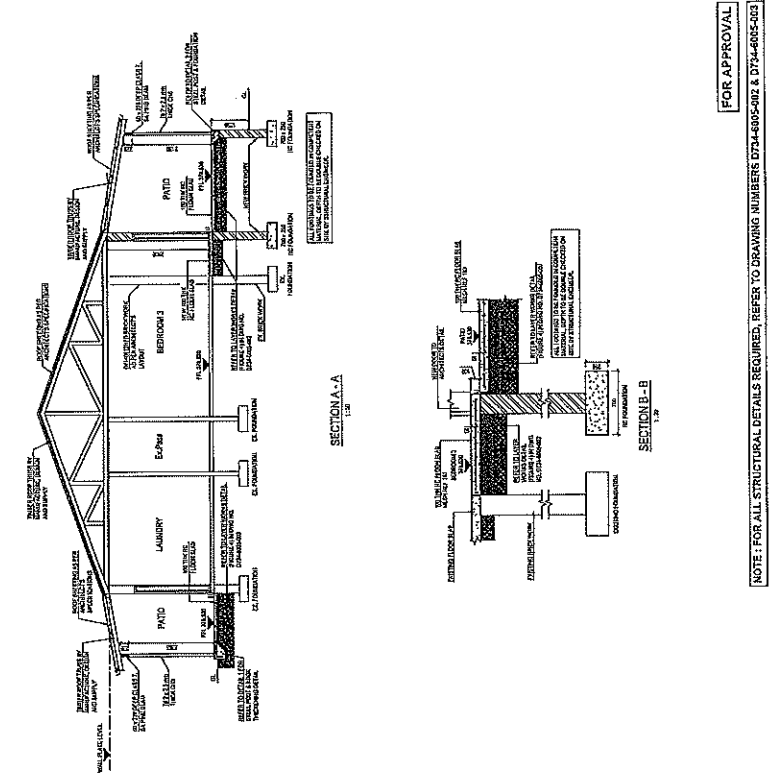
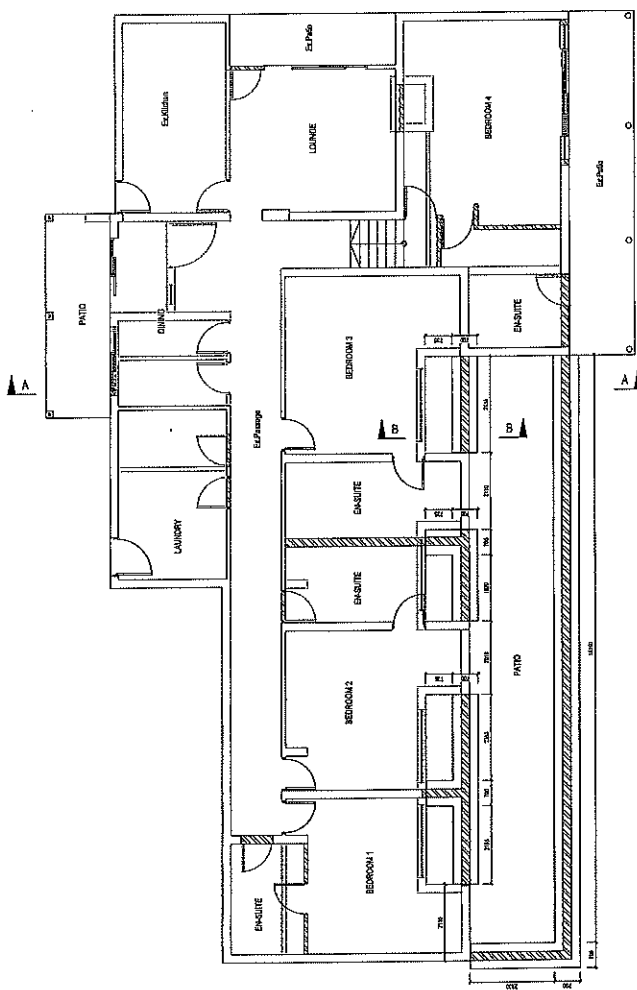
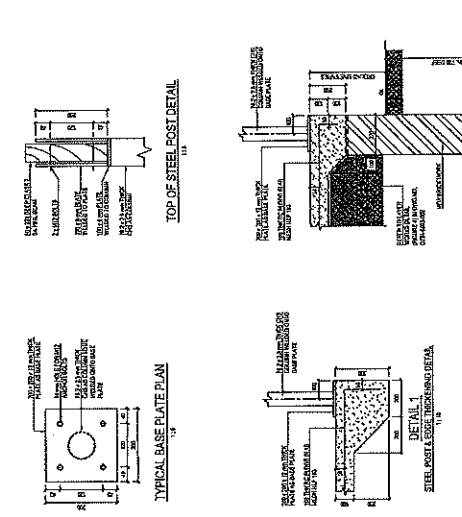


NOTE: FOR ALL STRUCTURAL DETAILS REQUIRED, REFER TO DRAWING NUMBERS 0774-6004-004 & 0774-6004-005

FOR APPROVAL

NO.	DATE	DESCRIPTION	BY
1	10/20/2018	ISSUED FOR PERMITS	AS

1. ALL WORK SHALL BE IN ACCORDANCE WITH THE FOLLOWING METHODS OF CONSTRUCTION UNLESS OTHERWISE SPECIFIED.
2. FINISHES SHALL BE AS SHOWN ON THE DRAWINGS UNLESS OTHERWISE SPECIFIED.
3. ALL WORK SHALL BE SUBJECT TO THE APPROVAL OF THE LOCAL HEALTH DEPARTMENT AND THE LOCAL BUILDING DEPARTMENT.
4. ALL WORK SHALL BE SUBJECT TO THE APPROVAL OF THE LOCAL HEALTH DEPARTMENT AND THE LOCAL BUILDING DEPARTMENT.
5. ALL WORK SHALL BE SUBJECT TO THE APPROVAL OF THE LOCAL HEALTH DEPARTMENT AND THE LOCAL BUILDING DEPARTMENT.
6. ALL WORK SHALL BE SUBJECT TO THE APPROVAL OF THE LOCAL HEALTH DEPARTMENT AND THE LOCAL BUILDING DEPARTMENT.
7. ALL WORK SHALL BE SUBJECT TO THE APPROVAL OF THE LOCAL HEALTH DEPARTMENT AND THE LOCAL BUILDING DEPARTMENT.
8. ALL WORK SHALL BE SUBJECT TO THE APPROVAL OF THE LOCAL HEALTH DEPARTMENT AND THE LOCAL BUILDING DEPARTMENT.
9. ALL WORK SHALL BE SUBJECT TO THE APPROVAL OF THE LOCAL HEALTH DEPARTMENT AND THE LOCAL BUILDING DEPARTMENT.
10. ALL WORK SHALL BE SUBJECT TO THE APPROVAL OF THE LOCAL HEALTH DEPARTMENT AND THE LOCAL BUILDING DEPARTMENT.

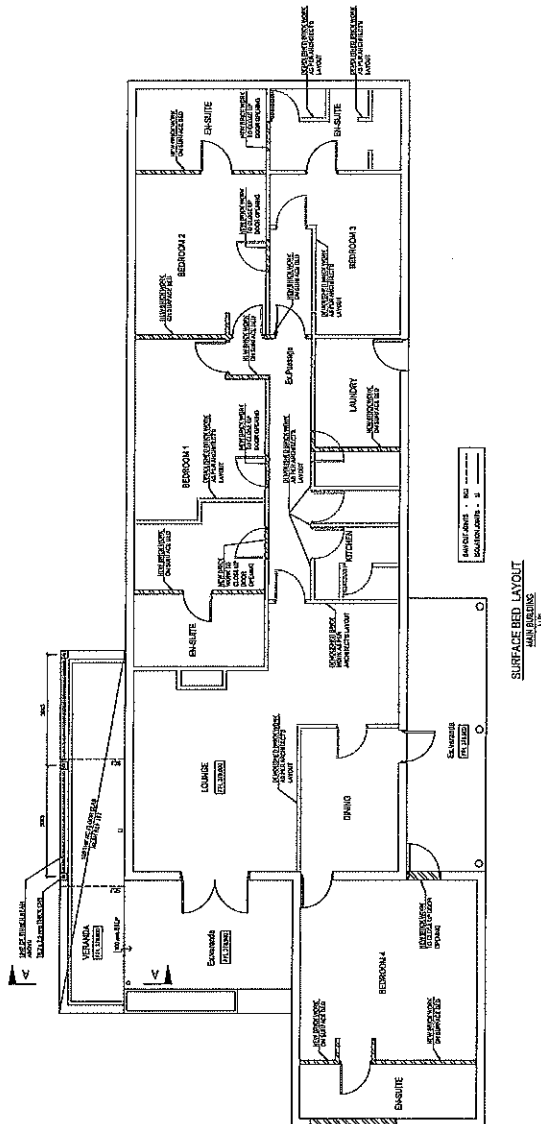
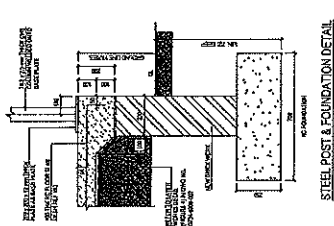
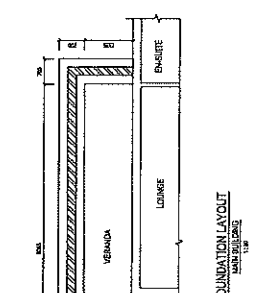
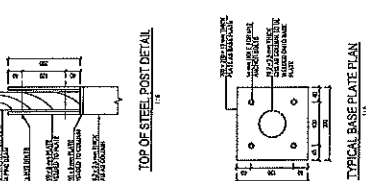
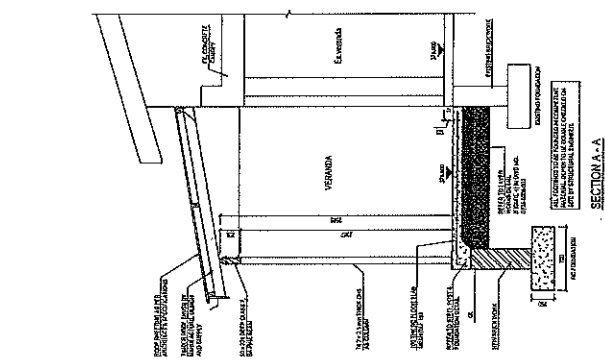
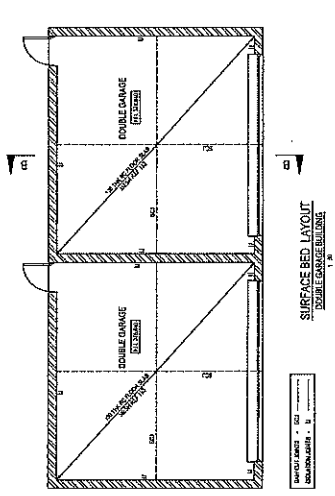
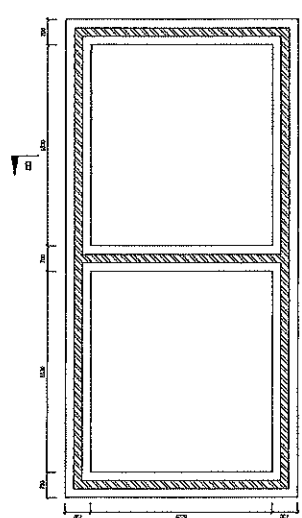
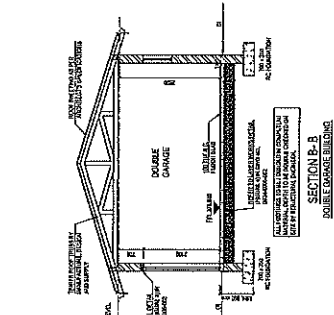


health  
SOUTHERN REGION  
MURCHISON HOSPITAL  
STAFF RESIDENCE  
BUILDING 3  
HEALTHCARE, 100 KILBURN AVENUE & GLEN  
HEALTHCARE  
Date: 13 MAY 2018  
Project: A  
Drawing: D734-605-001  
Rev: 01  
AD

FOR APPROVAL  
NOTE: FOR ALL STRUCTURAL DETAILS REQUIRED, REFER TO DRAWING NUMBERS D734-605-002 & D734-605-003

NO.	DATE	REVISIONS	BY
1	15/05/2018	ISSUED FOR APPROVAL	AD

- GENERAL NOTE:**
1. ALL WORK TO BE ACCORDANCE WITH THE BUILDING REGULATIONS OF SAU AND THE
  2. FOUNDATION SHALL BE CONSTRUCTED WITH REINFORCED CONCRETE TO BE FINISHED TO THE FINISH OF THE CONSTRUCTION OF THE FOUNDATION.
  3. FOUNDATION SHALL BE CONSTRUCTED TO BE FINISHED TO THE FINISH OF THE CONSTRUCTION OF THE FOUNDATION.
  4. FOUNDATION SHALL BE CONSTRUCTED TO BE FINISHED TO THE FINISH OF THE CONSTRUCTION OF THE FOUNDATION.
  5. FOUNDATION SHALL BE CONSTRUCTED TO BE FINISHED TO THE FINISH OF THE CONSTRUCTION OF THE FOUNDATION.
  6. FOUNDATION SHALL BE CONSTRUCTED TO BE FINISHED TO THE FINISH OF THE CONSTRUCTION OF THE FOUNDATION.
  7. FOUNDATION SHALL BE CONSTRUCTED TO BE FINISHED TO THE FINISH OF THE CONSTRUCTION OF THE FOUNDATION.
  8. FOUNDATION SHALL BE CONSTRUCTED TO BE FINISHED TO THE FINISH OF THE CONSTRUCTION OF THE FOUNDATION.
  9. FOUNDATION SHALL BE CONSTRUCTED TO BE FINISHED TO THE FINISH OF THE CONSTRUCTION OF THE FOUNDATION.
  10. FOUNDATION SHALL BE CONSTRUCTED TO BE FINISHED TO THE FINISH OF THE CONSTRUCTION OF THE FOUNDATION.
  11. FOUNDATION SHALL BE CONSTRUCTED TO BE FINISHED TO THE FINISH OF THE CONSTRUCTION OF THE FOUNDATION.
  12. FOUNDATION SHALL BE CONSTRUCTED TO BE FINISHED TO THE FINISH OF THE CONSTRUCTION OF THE FOUNDATION.
  13. FOUNDATION SHALL BE CONSTRUCTED TO BE FINISHED TO THE FINISH OF THE CONSTRUCTION OF THE FOUNDATION.
  14. FOUNDATION SHALL BE CONSTRUCTED TO BE FINISHED TO THE FINISH OF THE CONSTRUCTION OF THE FOUNDATION.
  15. FOUNDATION SHALL BE CONSTRUCTED TO BE FINISHED TO THE FINISH OF THE CONSTRUCTION OF THE FOUNDATION.
  16. FOUNDATION SHALL BE CONSTRUCTED TO BE FINISHED TO THE FINISH OF THE CONSTRUCTION OF THE FOUNDATION.
  17. FOUNDATION SHALL BE CONSTRUCTED TO BE FINISHED TO THE FINISH OF THE CONSTRUCTION OF THE FOUNDATION.
  18. FOUNDATION SHALL BE CONSTRUCTED TO BE FINISHED TO THE FINISH OF THE CONSTRUCTION OF THE FOUNDATION.
  19. FOUNDATION SHALL BE CONSTRUCTED TO BE FINISHED TO THE FINISH OF THE CONSTRUCTION OF THE FOUNDATION.
  20. FOUNDATION SHALL BE CONSTRUCTED TO BE FINISHED TO THE FINISH OF THE CONSTRUCTION OF THE FOUNDATION.



FOR APPROVAL

NOTE: FOR ALL STRUCTURAL DETAILS REQUIRED, REFER TO DRAWING NUMBERS D724-6054-002 & D724-6054-003

**NAIDU CONSULTING**  
 105/115, Ashok Nagar, Hyderabad - 500 081  
 Ph: 011-2610 2611  
 Fax: 011-2610 2611  
 E-mail: naidu@naiduconsulting.com

**STRUCTURAL**

**South**  
 Project of MURCHISON HOSPITAL

**SOUTHERN REGION**

**MURCHISON HOSPITAL STAFF RESIDENCE**

**BUILDING 6 DOUBLE GARAGE**  
 MAIN BUILDING, MURCHISON HOSPITAL STAFF RESIDENCE

**PROJECT MANAGER**  
**DR. PROJECT MANAGER**

**PROJECT NO.**  
**0724-6054-001**

**DATE**  
**15/05/2018**

**BY**  
**AD**

NO.	DATE	DESCRIPTION	BY
8	22/05/2023	1. FOR APPROVAL	AD

**GENERAL NOTES**

- ALL WORK IN ACCORDANCE WITH THE RELEVANT SECTIONS OF DAVIS 10A.
- DRAWINGS TO BE READ IN CONJUNCTION WITH THE ARCHITECT'S DRAWINGS.
- DIMENSIONS TO BE CHECKED ON SITE PRIOR TO CONSTRUCTION. ANY DISCREPANCIES TO BE REPORTED TO THE ENGINEER.
- FOUNDATION EXCAVATIONS TO BE APPROVED BY THE ENGINEER.
- REINFORCING TO BE CHECKED BY THE ENGINEER.
- ALL JOISTS OR BRACES TO BE APPROVED BY THE ENGINEER.
- POSITION OF CONSTRUCTION JOISTS TO BE APPROVED BY THE ENGINEER.
- CONCRETE STRENGTHS @ 28 DAYS:
  - FOOTINGS: 25 MPa
  - WALLS: 25 MPa
  - SLAB WALLS: 25 MPa
- COVER TO STEEL REINFORCING: 50mm.
- REINFORCEMENT SHALL BE HOT ROLLED AND SHALL COMPLY WITH THE STANDARD SPECIFICATIONS AND TEST METHODS FOR CONCRETE REINFORCING BARS AND WELDED WIRE FABRIC AS SET OUT IN THE STANDARD SPECIFICATIONS FOR CONCRETE.
- CONCRETE SHALL BE SUPPLIED AND PLACED BY A LICENSED CONCRETE PUMP.
- MINIMUM BRACE LENGTH - 45 BAR DIA. EXCEPT WHERE OTHERWISE SHOWN.
- MINIMUM BRACE LENGTH - 45 BAR DIA. EXCEPT WHERE OTHERWISE SHOWN.
- STRENGTH OF FORMWORK:
  - SLAB WALLS
  - SHALL BE DESIGNED TO WITHSTAND THE FULL WEIGHT OF CONCRETE TO BE CAST.
  - ALL SHARP EXPOSED EDGES TO BE CHAMFERED 5x15mm.
  - ALL FACE DIMENSIONS PARALLEL TO BOTTOM EDGE OF SHEET ON CONTACT.
- ALL WATERPROOFING TO INHERENTLY DRAIN.
- IF ANY FLOOR JOISTS ARE TO BE REMOVED, THE ENGINEER AND STRUCTURAL ENGINEER MUST BE APPROVED BY THE ENGINEER. ALL JOISTS MUST BE APPROVED BY THE ENGINEER PRIOR TO REMOVAL.
- ALL AREA REINFORCING CONCRETE SLAB MUST BE ON REINFORCING CHAIRS UNLESS OTHERWISE SPECIFIED.

HEALTH DEPARTMENT SIGNATURES:

FACILITY: \_\_\_\_\_

FACILITY MANAGER: \_\_\_\_\_

DISTRICT MANAGER: \_\_\_\_\_

DOH PROJECT LEADER: \_\_\_\_\_

Checked by: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Consultant:

**NAIDU CONSULTING**

104 The Boulevard, West Way Office Park,  
7 Henry Davis Road, Waukele, 3535  
Tel: +97 31 250 0007 Fax: +97 31 250 0111

STRUCTURAL

health  
NORTH  
SOUTHERN  
PROVINCE OF KWAZULU-NATAL

Region: SOUTHERN REGION

Project: MURCHISON HOSPITAL STAFF RESIDENCE

Drawing Name: NEW GUARD HOUSE FOUNDATION, SURFACE BED, TIMBER BEAM LAYOUT & SECTION

Date: 05 MAY 2023

Drawn by: AS SIKHON

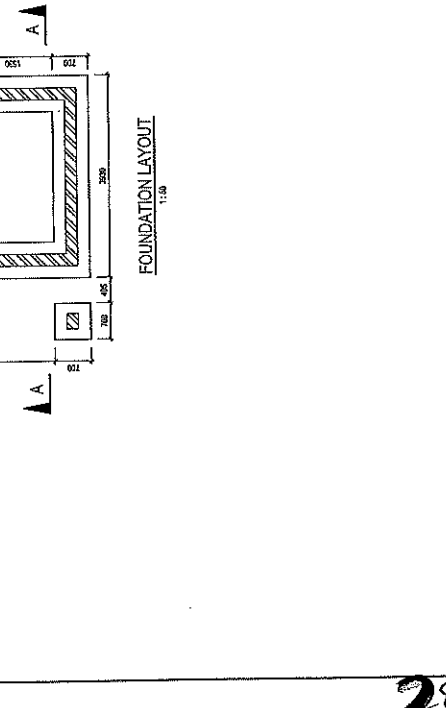
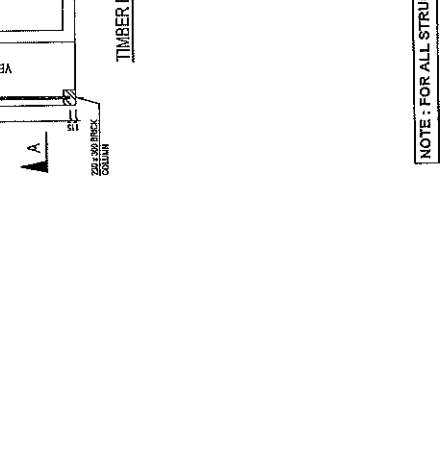
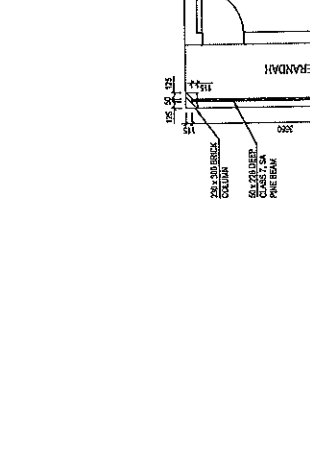
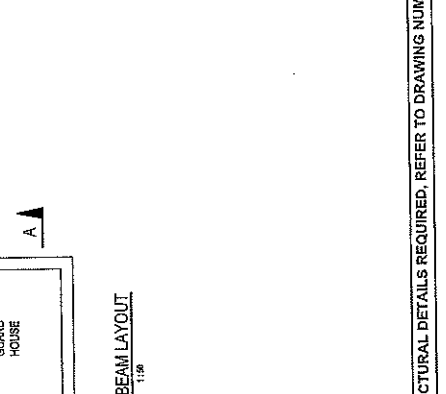
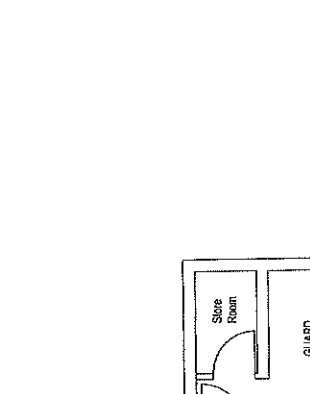
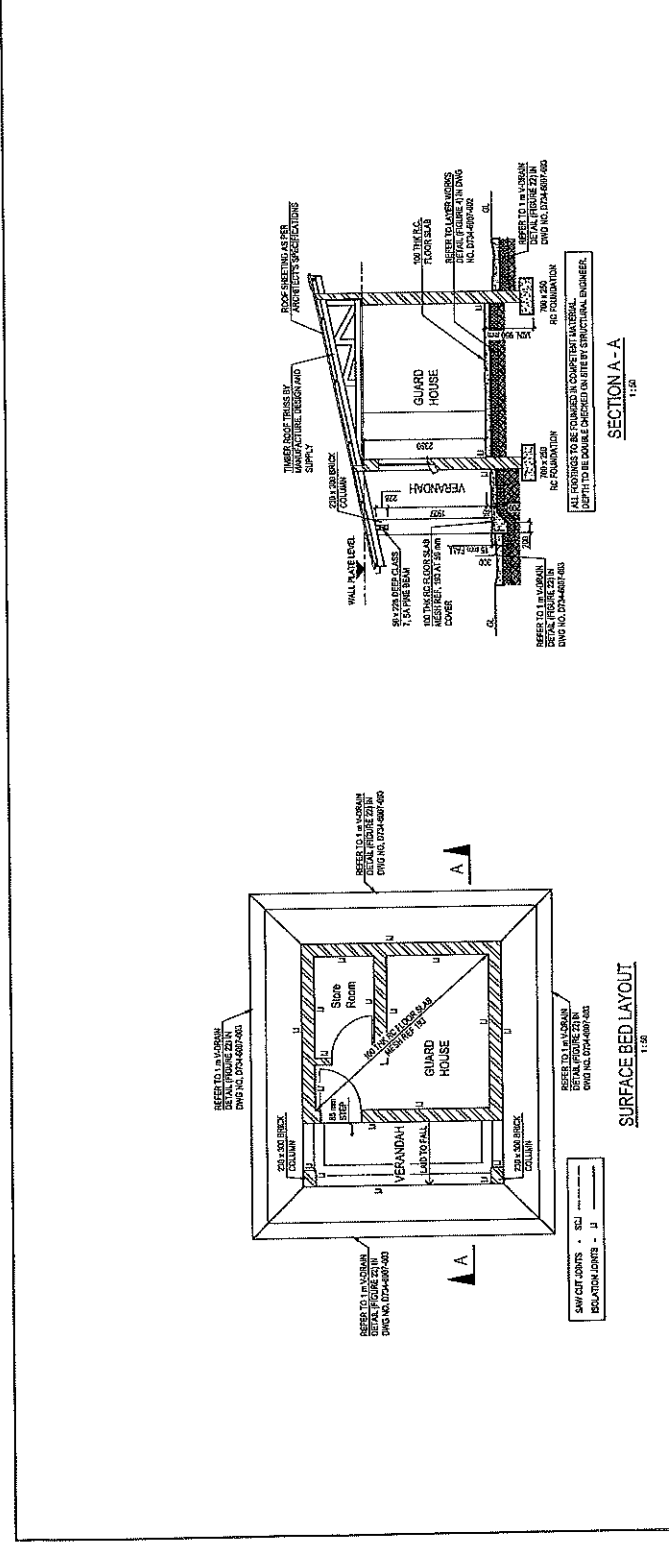
Checked by: \_\_\_\_\_

Scale: 1:50

Sheet No: D734-6007-001

Sheet Date: A1

Issued by: South West Asset Management



FOR APPROVAL

NOTE: FOR ALL STRUCTURAL DETAILS REQUIRED, REFER TO DRAWING NUMBERS D734-6007-002 & D734-6007-003



# MURCHISON HOSPITAL: ALTERATIONS AND RENOVATIONS TO STAFF ACCOMMODATION

## AIR CONDITIONING AND VENTILATION INSTALLATION

(MURC2018)

### PARTICULAR TECHNICAL SPECIFICATIONS

Prepared by:



**MAHESH KHOOSAL AND ASSOCIATES cc**

58 Hilken Drive  
UMHLANGA ROCKS  
4320

**Contact person:** Mr M Khoosal  
**Phone Number:** (031) 5368306

Prepared for: Dept. of Health



**health**

Department:  
Health  
PROVINCE OF KWAZULU-NATAL



**MURCHISON HOSPITAL: ALTERATIONS AND RENOVATIONS TO STAFF  
ACCOMMODATION**

**AIR CONDITIONING AND VENTILATION INSTALLATION**

**PART A: SUPPLEMENTARY SPECIFICATIONS**

**INDEX**

	<u>PAGE No.</u>
1. SCOPE OF WORKS	3.2
2. GENERAL	3.2
3. CONTRACT PRICE ADJUSTMENT	3.2
4. CONTRACT PERIOD	3.2
5. FINAL DELIVERY	3.2
6. PERIOD OF LIABILITY	3.2
7. MATERIALS AND WORKMANSHIP	3.2
8. MANUFACTURER'S RATING	3.3
9. MACHINERY AND OCCUPATIONAL HEALTH AND SAFETY ACT.1993	3.3
11. SIMILAR OR EQUAL	3.3
12. DRAWINGS	3.3
13. BUILDER'S WORKS	3.3
14. PRE-TENDER SITE VISIT	3.3
15. AIR CONDITIONING UNITS	3.3
16. DUCTWORK	3.4
17. EXTRACTOR FANS	3.4
18. ELECTRICAL EQUIPMENT AND WIRING	3.4
19. NOISE AND VIBRATION	3.5
20. COMMISSIONING AND TESTING	3.5
21. GUARANTEE AND MAINTENANCE	3.5
22. PAINTING	3.5
23. OPERATING MAINTENANCE MANUALS AND AS BUILT DRAWINGS	3.6
24. SCHEDULES OF PARTICULARS AND INFORMATION	3.6

**MURCHISON HOSPITAL: ALTERATIONS AND RENOVATIONS TO STAFF  
ACCOMMODATION  
AIR CONDITIONING AND VENTILATION INSTALLATION**

**PART B: SUPPLEMENTARY SPECIFICATIONS**

1. **SCOPE OF WORKS**

This specification is for the supply, delivery, installation and 12-month guarantee and maintenance of air conditioning and ventilation systems to the residential units and includes but not limited to the following;

- Individual split DX ducted type air conditioners,
- Window/wall mounted extractor fans with motion sensors
- Service, maintenance and guarantee for 12-month period

2. **GENERAL**

This supplementary specification, is for supply delivery and installation of air conditioning equipment, and is to be read inconjunction with the tender drawings.

3. **CONTRACT PRICE ADJUSTMENT**

The bill of quantities is provisional and shall be remeasured.

Escalation shall be as indicated elsewhere in the tender documentation.

4. **CONTRACT PERIOD**

As indicated in the main tender document.

5. **FINAL DELIVERY**

Final delivery shall be as prescribed in the main tender document.

6. **PERIOD OF LIABILITY**

The period of liability shall be as prescribed in the main tender document , but shall not be less than 12 months from practical handover.

7. **MATERIALS AND WORKMANSHIP**

All Materials and equipment used shall be new, free from rust, defects, or damage and be suitable for the purpose for which it is used.

Materials shall comply with the latest issue of the relevant SABS or BS Specification where applicable and it should be noted that these are the minimum standards required.

If any material or workmanship is not to the satisfaction of the department, it shall be rectified and/or replaced at the Contractor's cost and all rejected material shall be immediately be removed from the site.

The contractor is responsible for the correct and complete erection of the installation and inspections executed by the Department do not exempt the contractor of this obligation.

8. **MANUFACTURER'S RATING**

All equipment shall be able to work within the rated capacity, as determined by the manufacturer. Any equipment offered for use out of these limits shall not be acceptable, and the contractor will be required to replace them with the correct size at his/her own cost.

Contractors shall hand in the rated capacities of all equipment as well as descriptive literature with the tender documents.

9. **MACHINERY AND OCCUPATIONAL HEALTH AND SAFETY ACT.1993**

All equipment covered in this specification shall comply in all respects with the Machinery and Occupational Health and Safety Act No.85 of 1993.

11. **SIMILAR OR EQUAL**

Any trade name mentioned merely serves as a guideline and does not indicate preference for that specific make. Tenderers are at liberty to offer any other equipment and/or materials, which complies with the specification requirements and is similar and equal approved.

12. **DRAWINGS**

The following drawing forms part of this document;

- M621/AC/01 (REV.C) – Air conditioning and Ventilation Layout: House 1
- M621/AC/02 (REV.C) – Air conditioning and Ventilation Layout: House 2
- M621/AC/03 (REV.C) – Air conditioning and Ventilation Layout: House 3
- M621/AC/04 (REV.C) – Air conditioning and Ventilation Layout: House 4
- M621/AC/05 (REV.B) – Air conditioning and Ventilation Layout: House 5
- M621/AC/06 (REV.B) – Air conditioning and Ventilation Layout: House 6

The drawings that accompany this specification are schematic and do not necessarily indicate the exact position, size or detail of equipment.

**NOTE. All final positions and dimensions are to be verified on site prior to any equipment or material being ordered or manufactured**

13. **BUILDER'S WORKS**

All builder's works such as cutting of holes and openings in walls and ceilings and making good thereof to match existing shall form part of the main contract.

14. **PRE-TENDER SITE VISIT**

As per the tender advert. Additional cost arising later out of lack of awareness of site conditions, will not be entertained by the Client.

15. **AIR CONDITIONING UNITS**

All Air conditioning equipment shall be of the Inverter type.

Equipment offered and listed in the schedules shall be capable of performing the specified duties and complying fully with the specification requirements in all respects. Should it transpire that such equipment, even when offered by make, model and/or type, is unsuitable or incapable of meeting performance in accordance with the specified requirements in any respect, the contractor shall nevertheless be responsible for any additional costs incurred in providing the required or suitable equipment.

Tenderers shall submit the rated capacities of all equipment as well as descriptive literature with the tender documents.

Air conditioning units as indicated on the tender drawing(s) shall be supplied and installed under this contract.

All split type air conditioning units shall run on R410 refrigerant.

The maximum noise levels within the offices shall not exceed NC 35.

Panels shall be made of sheetmetal, zinc coated, primed and factory finished with silicone polyester paint.

All refrigerant piping shall be insulated. Piping in roof void shall be run on galvanised brackets fabricated from off-the-shelf "C" section channels and bolts and nuts or medium duty cable trays. Exposed piping shall be run in PVC trunking painted to architect's colour.

All support brackets shall be hot-dipped galvanised, primed and painted to special colour as advised by the Engineer. Brackets shall be bolted to walls using rawl bolts of a minimum diameter of 8mm. Raw or cut edges shall be cold galvanised on site.

**Split units shall be installed and commissioned by a certified refrigeration mechanic;** proof of certification will be required to be provided with the tender and as and when requested by the Engineer.

Drain pipes from all units shall be provided to nearest drain point outside of the building. Drain piping shall be Class 6 PVC for water. Drain piping shall be surface run on face of building and painted to special colour advised by Architect during construction stage.

a. **Split type direct expansion type air conditioning units**

All split type direct expansion type air conditioning units shall be of a reputable make with the local supplier agent having had the right of sales for at least the last five years. Notwithstanding the above, the make of equipment shall be similar or equal to Airco, Mcquay, Dalkin, Panasonic, LG, Samsung or Dunham Bush.

Service ports and connections at final connections to units shall be insulated using non-drip tape and painted over to match. All refrigeration piping and commissioning shall be carried out by a qualified refrigeration mechanic. Copies of applicable qualifications shall be attached with the tender.

16. **DUCTWORK**

All ductwork shall be sheetmetal galvanised and manufactured to SABS 1238 latest amended, for low velocity.

Allowance shall be made for cross support members to be fixed to roof members for supporting of ducting.

17. **EXTRACTOR FANS**

Wall/window mounted extractor fans shall be of the type with long life bearings, and equal or approved to Xpelair, complete with sleeves and external louvre. Fans shall be provided with motion sensor mounted on the ceiling. Electrician shall provide a single power point in the ceiling. The air conditioning contractor shall wire from this point to the fan via the motion sensor.

18. **ELECTRICAL EQUIPMENT AND WIRING**

Power supply at close proximity to each air conditioning or extract system shall be provided under the electrical section of this tender. All electrical work from these points to equipment shall form part of this section of the tender. Evaporators shall be provided with a local isolator under the air conditioning section of the contract.



All wiring shall be done in accordance with the SABS code of Practice for wiring of premises and carried out by a licensed Electrician, proof to be submitted within 7 days from date of letter of acceptance of tender, and a compliance Certificate furnished at First delivery.

An electrical compliance certificate will be required.

19 **NOISE AND VIBRATION**

Equipment offered shall be free of vibration and noise.

Air intake plenums shall which are in or near occupied areas (e.g. ceiling spaces) shall be internally lined with sound absorbing material.

Air conditioning units mounted in the ceiling shall be mounted on anti-vibration pads or hung using anti-vibration hangers.

Make necessary correction in an approved manner without additional charge for noise or vibration in excess of specified limits and for excessive transmission of noise or vibration due to faulty equipment or workmanship.

After commissioning of all plant, should the Client complain of noise problems in general, the Air conditioning Sub-contractor shall be requested to make sound level tests over the normal frequency bands to prove the NC ratings in the areas concerned. This shall be done at the Contractors expense.

Should any area have NC ratings exceeding those stipulated elsewhere in this document, the Contractor is to fully assist the Engineer in investigating the source of the problem. Should noise emanating from the suppliers equipment be cause for the complaint, onus will be upon the Contractor to remedy the fault by replacement of the item or items concerned. Noise attenuation of sound baffles will not be considered as suitable for reduction of excessive noise from plantroom equipment.

All equipment shall be selected such that the following sound levels, are not exceeded.

i) All areas unless otherwise indicated : NC35

20. **COMMISSIONING AND TESTING**

Commissioning and testing shall be done inn accordance with ASHRAE Commissioning Guideline 1-1996 for the mechanical services and CIBSE Commissioning Codes for the other services.

21. **GUARANTEE AND MAINTENANCE**

The entire air conditioning installation shall be maintained and guaranteed for a period of 12 months following first delivery, with extended warranty for corrosion as specified elsewhere. The Contractor shall make good any defects due to inferior materials or workmanship during this period and shall be entirely responsible for carrying out of regular quarterly inspections and servicing of all components of the installation and service schedule in the form of a check list and log sheets in accordance with the manufacturer's instructions.

22. **PAINTING**

All exposed steel surfaces, including new galvanized and stainless steel shall be painted. All steel surfaces to be painted shall be prepared according to SABS 064 (Code for the preparation of steel surfaces for painting). Thereafter the surfaces shall be painted with a zinc chromate primer, followed by one coat of universal undercoat and one final coat of high gloss enamel paint, the colour of which shall be determined by the Department's Representative.

23. **OPERATING MAINTENANCE MANUALS AND AS BUILT DRAWINGS**

4 copies of the operating and maintenance manuals complete with as-built drawings, suppliers brochures and installation manuals, thermostat operating instructions, circuit diagrams and commissioning data shall be submitted as a prerequisite for first delivery. Commissioning data shall have the equipment serial numbers, make and model numbers and actual amps drawn.

Each manual shall also be provided with a scanned copy of the entire manual and drawings on a CD.

24. **SCHEDULES OF PARTICULARS AND INFORMATION**

All schedules which accompany the mechanical work specification form an integral part of it and shall be duly completed in every detail; FAILING which, the tender in question may be rendered ineligible for consideration.

Under no circumstance will statements such as:

- See attached pamphlets
- Refer to catalogue
- Data to follow
- As given by supplier, etc. be acceptable to the Department.

The principal contractor shall ensure that the equipment offered and listed on the schedules will be capable of performing the specified duties and complying with the Specification requirements in all respects. Should it transpire that such equipment, even when offered by make, model and/or type, is suitable or incapable of meeting, or performing in accordance with the specification requirements in any respect, the Principal Contractor shall nevertheless be responsible for any additional cost incurred in providing the required or suitable equipment.

Whenever a specific make, model or type of equipment has been prescribed in the specification and the tenderer offers an alternative, or equal make or type of equipment in his tender, the Department will on acceptance of such tender inform the prospective contractor in writing as to the make, and/or type of equipment accepted. HOWEVER, it should be noted that the use of words "OR EQUAL" by the tenderer is to be discouraged and could lead to the disqualification of the tender.

**SCHEDULES OF INFORMATION**

Tenderer shall complete the information required below at tender stage. Failure to provide all information may render the tender non compliant.

A. Split Air conditioning unit

Make and Model: \_\_\_\_\_

B. Window/wall mounted extractor fans

Make and Model: \_\_\_\_\_



REVISIONS	
No.	Description

**FOR HAC STAGE 1**

HEALTH DEPARTMENT SIGNATURE \_\_\_\_\_  
 HEALTH DEPARTMENT OFFICIAL \_\_\_\_\_

PROJECT MANAGER \_\_\_\_\_  
 CO-ORDINATOR OF THE FAMILY \_\_\_\_\_  
 PROJECT MANAGER \_\_\_\_\_  
 PROJECT MANAGER \_\_\_\_\_  
 PROFESSIONAL SERVICE PROVIDER \_\_\_\_\_  
 NAME \_\_\_\_\_ DATE \_\_\_\_\_

ARCHITECT: **MAHESH KHOSLA ARCHITECTS (Pty) Ltd**  
 2nd Floor, 48 Levee Road, Durban North, Durban  
 Tel: 031 251 9176 Fax: 031 251 9177  
 Email: mahesh@mkasouthafrica.co.za  
 mahesh@mkasouthafrica.co.za

**health**  
 Department  
 HEALTH SERVICES  
 PROVINCE OF KWAZULU-NATAL

SOUTHERN REGION

PROJECT: MURCHISON HOSPITAL ALTERATIONS AND RENOVATIONS TO STAFF ACCOMMODATION - OPTION 1

DRAWING DESCRIPTION: BUILDING 2 / QUARTERS GROUND STOREY PLAN, SECTIONS, ELEVATIONS

Scale: Date: 1:100 MAY 2008 Rev: 0

Project No.: 1002-08

REV	DESCRIPTION	DATE
C	FOR HAC STAGE 1	25/03/2011
B	FOR HAC STAGE 1	17/09/2010
A	FOR HAC STAGE 1	07/07/2010

CONSULTANT INFORMATION:  
**MAHESH KHOSLA & ASSOCIATES**  
 Mechanical Consulting Engineers  
 FAC 204/04

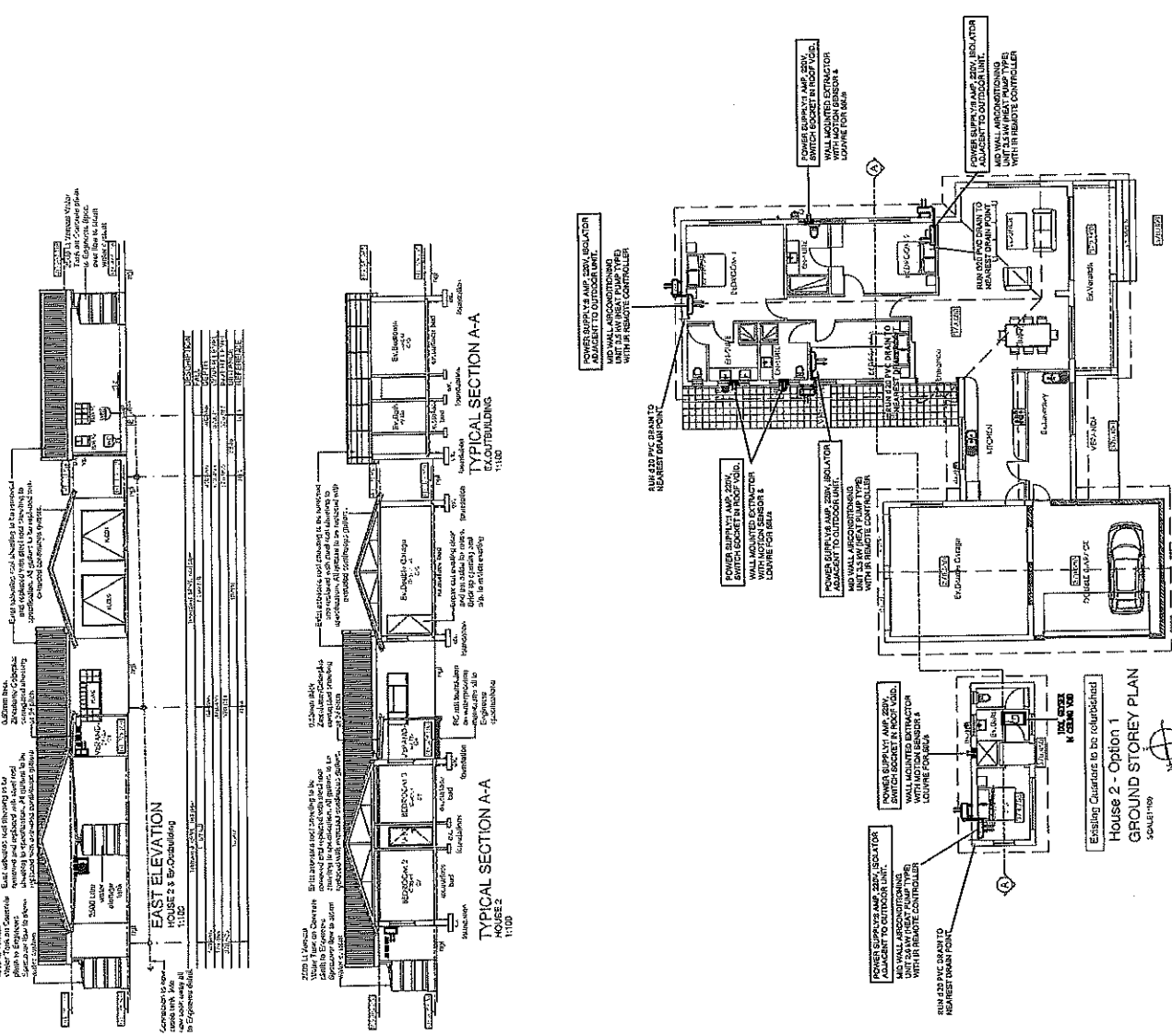
PROJECT TITLE: MURCHISON HOSPITAL ALTERATIONS AND RENOVATIONS TO STAFF ACCOMMODATION - OPTION 2

DRAWING TITLE: HAC LAYOUT HOUSE 2 FLOOR PLAN

DESIGNED BY: AM DATE: SCALE: AS SHOWN  
 DRAWN BY: AM DATE: FULL NAME: MCKI  
 CHECKED BY: MK DATE: 12/04/2010  
 PROJECT NO.: 1002/08/2010

PREPARED BY: H KHOSLA DATE: 10/01/2010

Checked by: Please Approval Comment: \_\_\_\_\_















REV.	DATE	DESCRIPTION

**FOR HIAC STAGE 4**

HEALTH DEPARTMENT DISBURSERS  
 SUPPLY ELECTRICAL CABLES  
 LEAD OF FIBRE OPTIC CABLES  
 CONTRACT MANAGER  
 CEO NUMBER OF THE FACILITY  
 SUPPLY PRODUCT MANAGER  
 MANAGER OF THE HEALTH DEPARTMENT  
 PROFESSIONAL SERVICE PROVIDER  
 ADDRESS  
 APPOINTMENT DATE  
 ARCHITECT

**health**  
 Department of Health  
 PROVINCE OF KWAZULU-NATAL  
 SOUTHERN REGION

**MURCHISON HOSPITAL ALTERATIONS AND RENOVATIONS TO STAFF ACCOMMODATION - OPTION 1**  
 PTN 3 OF ERF 7108

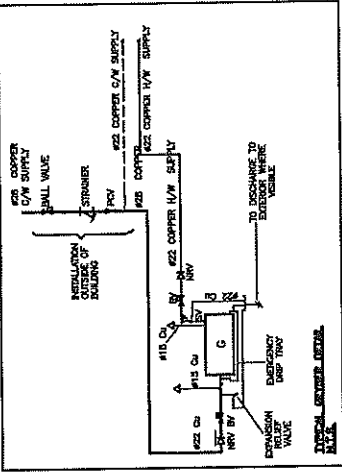
DISCIPLINE: PLUMBING  
 DRAWING TITLE: SUBMISSION GROUND STOREY PLAN, SECTIONS, ELEVATIONS  
 SCALE: 1:100  
 DATE: 2023-04-09  
 PROJECT NO: 1948  
 DRAWING NO: 104-06  
 SHEET NO: 01 OF 07 (01/07/2024)  
 DRAWN BY: M. KHOSLA  
 CHECKED BY: M. KHOSLA  
 APPROVED BY: M. KHOSLA

CONSULTING ARCHITECT: **MKA** MAHESH KHOOSAL & ASSOCIATES  
 PLD/01/01/010  
 PROJECT NO: 1948

**MURCHISON HOSPITAL ALTERATIONS AND RENOVATIONS TO STAFF ACCOMMODATION - OPTION 1**  
 PTN 3 OF ERF 7108

DESIGNED: M. KHOSLA  
 DATE: 12/05/20  
 CHECKED: M. KHOSLA  
 DATE: 12/05/20  
 PRINCIPAL: M. KHOSLA  
 DRAWN BY: M. KHOSLA  
 SCALE: AS SHOWN  
 SHEET NO: 01 OF 07  
 REV: C

Checked by: How Approval Committee

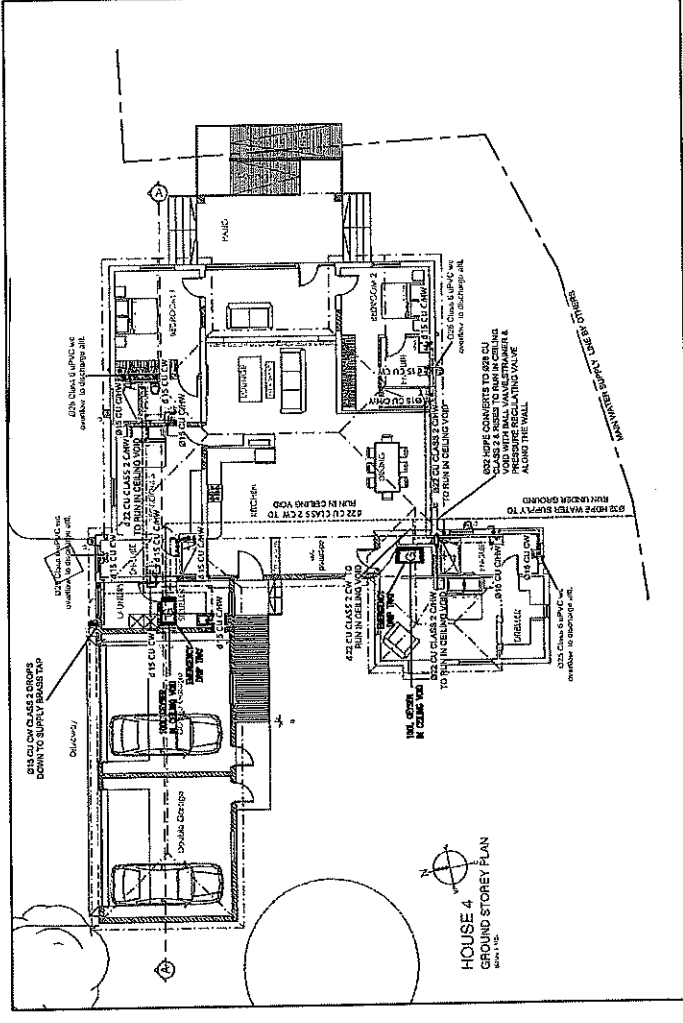


**NOTES**

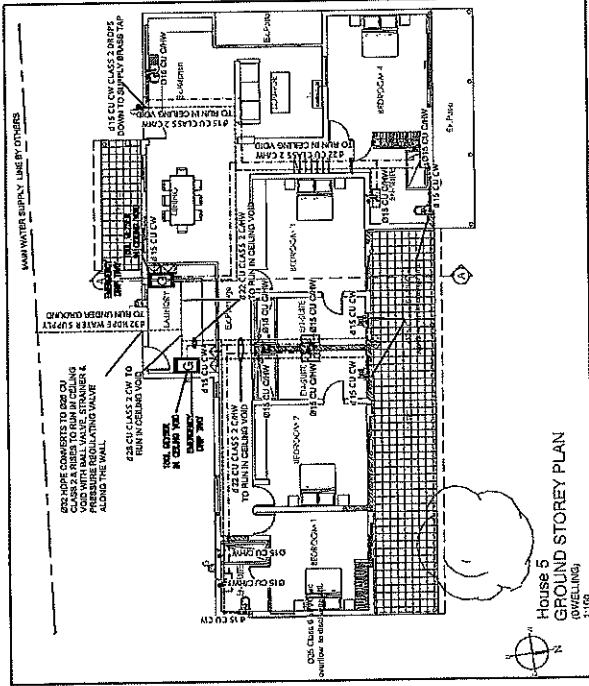
1. ALL WORK TO BE DONE OUT OF HOURS  
 2. ALL WORK TO BE DONE IN ACCORDANCE WITH THE SANS 10400-10:2017  
 3. ALL WORK TO BE DONE IN ACCORDANCE WITH THE SANS 10400-10:2017  
 4. ALL WORK TO BE DONE IN ACCORDANCE WITH THE SANS 10400-10:2017  
 5. ALL WORK TO BE DONE IN ACCORDANCE WITH THE SANS 10400-10:2017  
 6. ALL WORK TO BE DONE IN ACCORDANCE WITH THE SANS 10400-10:2017  
 7. ALL WORK TO BE DONE IN ACCORDANCE WITH THE SANS 10400-10:2017  
 8. ALL WORK TO BE DONE IN ACCORDANCE WITH THE SANS 10400-10:2017  
 9. ALL WORK TO BE DONE IN ACCORDANCE WITH THE SANS 10400-10:2017  
 10. ALL WORK TO BE DONE IN ACCORDANCE WITH THE SANS 10400-10:2017

ITEM	DESCRIPTION	UNIT	QTY	REMARKS
1	425 COPPER C/W SUPPLY SMALL VALVE	EA	1	
2	STRAINER	EA	1	
3	422 COPPER C/W SUPPLY	M	10	
4	425 COPPER I/W/W SUPPLY	M	10	
5	EXPANSION VALVE	EA	1	
6	EMERGENCY STOP TAP	EA	1	
7	TO DISCHARGE TO DRAINAGE	EA	1	

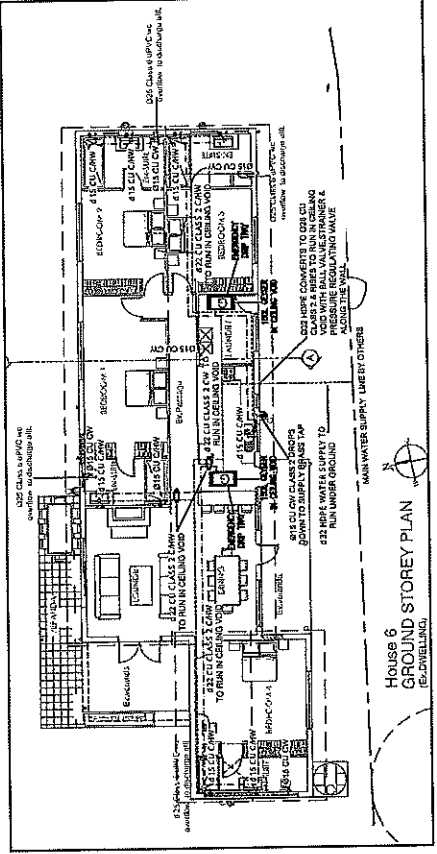
SYMBOL	DESCRIPTION
△	STOP VALVE
▽	NON-RETURN VALVE
○	STRAINER
□	PRESSURE CONTROL VALVE WITH EXPANSION DRAIN PIPED TO FLOOR
◇	EXPANSION RELIEF VALVE
⊕	EXHAUSTION DRAIN COCK
⊖	SAFETY VALVE
⊕	MAGNUM BREAKER
⊖	HOT WATER CENTER



HOUSE 4  
 GROUND STOREY PLAN  
 1:100



HOUSE 5  
 GROUND STOREY PLAN  
 1:100



HOUSE 6  
 GROUND STOREY PLAN  
 (E-DWELLING)  
 1:100

ANNEXURE E

**ELECTRICAL SPECIFICATION**

PROJECT: MURCHISON STAFF RESIDENCE

205

270 ~~269~~

## Contents

PART A: GENERAL SPECIFICATIONS.....	3
A1. DESCRIPTION OF WORK .....	3
A2. DESIGN CRITERIA .....	4
A3. EARTHING AND LIGHTNING PROTECTION .....	7
A4. LIGHTING FIXTURES .....	10
A5. CIRCUIT WIRING AND OUTLET POINTS.....	15
A6. DUCTS AND POWER SKIRTING.....	20
A7. TESTING .....	23
A8. STREET AND AREA LIGHTING.....	26
A9. LV CABLES .....	35
A10. SWITCHBOARDS AND DISTRIBUTION BOARDS .....	41
A11. CONDUIT AND OUTLET BOXES.....	47
PART B: PARTICULAR SPECIFICATIONS.....	57
B1. DETAILED SCOPE OF WORK.....	57
B2. DRAWING SCHEDULE.....	58
B3. MEASUREMENT AND PAYMENT .....	59
B4. SCHEDULED PAY ITEMS (PI).....	59
B5. LUMINAIRE SCHEDULE.....	71
B6. EQUIPMENT SCHEDULE.....	73
B7. CABLE SCHEDULE .....	75



## PART A: GENERAL SPECIFICATIONS

### A1. DESCRIPTION OF WORK

#### A1.1 RELATED DOCUMENTS

A. The requirements of the General Conditions, Supplementary Conditions, technical specifications and Drawings apply to all Work herein and forms part of the scope of work.

#### A1.2 SCOPE

A. General: Provide all labour, materials, tools, machinery, equipment, supplies, transportation, storage, utilities, appliances, hauling, hoisting, excavation, backfill, supervision, and services necessary to complete the Electrical, Communications, and Electronic Work under this Contract. Coordinate Work with the Work of the other trades so as to resolve conflicts without impeding job progress.

B. Examine the Architectural, Structural, Mechanical, Plumbing, and Electrical Drawings and other Sections of the Specifications in order to determine the extent of Work required to be completed. Failure to examine all the Contract Documents for this Project will not relieve the Contractors of the responsibility to perform all the Work required for a complete, fully operational and satisfactory installation.

C. Project Location: The Work to be performed under this Contract is in connection with the construction and erection of **the electrical installation at Murchison Staff Residence, Port Shepstone.**

D. Work Included: The Work includes, but is not limited to, the supply installation and commissioning of material and equipment associated with the following systems, equipment, and services:

##### A1.2.1 ELECTRICAL SYSTEM:

- 1.1. Electrical service provisions, LV distribution network, LV equipment, distribution boards and small power and lighting systems,
- 1.2. Area lighting and metering systems
- 1.3. A system of empty conduits and other provisions as required for installation of the telephone, data, fire alarm and security systems.
- 1.4. Conduits and boxes in slabs on or below grade, inaccessible space below slabs above grade, and walls below grade, in cooperation with other trades.
- 1.5. Earthing and Lightning protection system.
- 1.6. Testing and commissioning of the full electrical system

##### A1.2.2 TELEPHONE INFRASTRUCTURE:

- 1.1. Manholes and sleeves

## A2. DESIGN CRITERIA

### A2.1 CODES AND STANDARDS

A. Code Design Basis: The following codes and ordinances were used in the design of the project and shall be complied with during construction of the project.

- a) The Occupational Health and Safety Act no. 85 of 1993, as revised.
- b) The National Building Regulations and Building Standards Act 1977 (Act 103 of 1977) as amended,
- c) The South African National Standards (SANS)

B. Standards: Refer to standard specifications for general administrative/procedural requirements related to compliance with applicable standards. This Work and all materials shall meet the standards set forth in the applicable portions of the following recognized standards:

- a) Building Code – SANS 10400
- b) Electrical Wiring Code – SANS 10142
- c) Other relevant SANS Codes as applicable

### A2.2 COMPLIANCE WITH STANDARD SPECIFICATIONS

Except where otherwise specified, the equipment shall comply with the current editions of the relevant specifications of the South African Bureau of Standards and the British Standards Institution or the International Electro Commission recommendations.

### A2.3 SITE AND SYSTEM CONDITIONS

#### A2.3.1 Site Conditions

Altitude:	The altitude in the area varies between 2 m and 50 m above mean sea level.
Temperature:	Ambient temperature between 5°C and 44°C. Average daily maximum ambient: 32°C.
Humidity:	Maximum – 100 % Average – 82 %
Rainfall:	Approximately 1500 mm per annum. An average of 2 – 3 working days per month is lost due to inclement weather. No claims for delays as a result of adverse weather conditions will be considered.
Lightning:	The area is subject to severe lightning storms, approximately 4,5 flashes/km <sup>2</sup> /year.
Pollution:	<b>HEAVY.</b> It is continually subject to strong wind and a saline corrosive air being on the coast.
Wind:	Design wind speed of 108 km/h (700 pa).
Mean annual value of solar radiation:	1,0 kW/m <sup>2</sup>

#### A2.3.2 Electricity Supply System

The electricity on the property is fed by Eskom. The nominal system voltage is 11 kV, 400 V

three phase and 230 V single phase.

The maximum MV-system voltage is 12,5 kV.

The system frequency is 50 Hertz and the phase rotation is R-W-B anti-clockwise.

#### A2.4 GENERAL REQUIREMENTS

##### A2.4.1 Safe Design and Standardization

All equipment supplied and installed under this contract shall be designed:

- To prevent any injury to personnel employed on the construction, operation and maintenance of the plant.
- To facilitate inspection, cleaning and repair of the equipment.
- To operate continuously and satisfactorily in the prevailing site conditions.
- To be able to withstand without damage such sudden variations of electrical load as may be met under normal working conditions, including short circuits and lightning strikes.
- To obviate risks of accidental short-circuits due to animals, birds and insects.
- To avoid pockets in which water can collect in outdoor equipment.
- To avoid condensation in closed compartments by the provision of adequate ventilation or where necessary, heaters.
- Such that conductors can carry normal load and fault currents without overheating or other damage.
- Such that moving parts can be readily lubricated. Grease nipples shall be provided in accessible positions for this purpose.
- To be vermin proof.
- To be corrosion resistant.

#### A2.5 QUALITY OF MATERIALS AND WORKMANSHIP

All materials and equipment for this Contract shall be new and undamaged. Corresponding parts shall be interchangeable.

Where so directed by the specification or by the Engineer, the Contractor shall provide samples and test certificates of materials for approval.

The labour used by the Contractor shall at all times be adequately qualified and experienced for the particular task.

#### A2.6 FIXINGS AND CONNECTIONS

A. Nuts and Bolts: Metric size nuts and bolts shall be used unless otherwise specified. Each bolt or stud shall project at least one thread but not more than 6 mm from the nut. Special spanners shall be provided where nuts and bolts are not easily accessible. The nuts on the moving plant or plant subject to vibration shall be fixed by means of locknuts, "Loctite" or other approved locking method. Bolts and studs shall be adequately sized to carry the loads, which may be imposed on them.

B. Materials of Nuts and Bolts: Only stainless steel nuts, bolts and washers shall be used for all electrical connections.

#### A2.7 NON CORRODING MATERIALS

A. Because steel corrodes rapidly in the coastal conditions pertaining to Murchison, **non-corroding materials** shall be used in the construction of outdoor equipment.

B. The permissible grades and alloys are as follows:

Stainless Steel:	Grade 316 or better
Extruded Aluminium:	6082-T6
Cast Aluminium:	L-2520
Glass fibre:	To the relevant SANS specification

#### A2.8 GALVANISING AND PAINTING

Murchison has a highly corrosive atmosphere and special attention shall be given to all finishes.

**NO** drilling, cutting, bending, punching, welding and forming of the steel or any surface damage shall be allowed **after galvanising** or painting.

All the steel work shall be prepared, hot dipped galvanised and painted using the processes detailed hereunder:

A: For all unpainted steel work:

- Pickle,
- Hot dip galvanised in accordance with SANS 121.

B: For all painted steel work

- For the primer coat: Apply a single coat of Epoxy Prima to a minimum of 40 microns dry film thickness.
- For the intermediate coat: Apply a single coat of Highbuild Aluminium Flake Filled Epoxy to a minimum of 125 microns dry film thickness.
- For the final coat: Apply a single coat of a Highbuild Aluminium Flake Filled Epoxy to a minimum of 125 microns dry film thickness.

C. Damage to paint work during transit or erection shall be touched up with matching paint.

### A3. EARTHING AND LIGHTNING PROTECTION

#### A3.1 CODES AND STANDARDS

A. Codes and Standards: The earthing and lightning protection shall comply fully with the applicable SANS specifications as set out below and all equipment shall bear the mark of approval of the South African Bureau of Standards.

- a) The latest issue of SANS 10313: Protection against lightning - Physical damage to structures and life hazard Requirements of surge protective devices
- b) The latest issue of SANS 61312: Requirements of surge protective devices
- c) The latest issue of SANS 62305: Protection against lightning
- d) The latest issue of SANS 10292: Earthing of low-voltage (LV) distribution systems
- e) The latest issue of SANS 10199: The design and installation of earth electrodes
- f) The latest issue of NRS076: Earthing of distribution substations with nominal voltages up to and including 132 kV

B. Manufacturers: If they comply with these specifications and requirements will be acceptable.

**C: Installers: The electrical contract shall appoint a specialist Earthing and Lightning Protection Contractor to design and install the earthing and lightning protection system. The specialist installer must be certified or registered installers of the manufacturers or their representatives. Manufacturers or their representatives must also have registered offices in South Africa and the local office must carry sufficient stock and spare parts for the project.**

#### A3.2 SCOPE OF WORKS

The specialist contractor shall:

- Carry out earth resistivity tests on the site of works and provide a test results certificate together with recommendations of the installation to the Engineer.
- Once approved, supervise the installation in compliance with SANS requirements.
- Carry out interim earthing tests and if below required value, improve on earthing installation until earthing values are achieved.
- Provide as-built drawings of the complete earthing and lightning protection system.
- Provide test certificates and a sign-off certificate of the completed earthing and lightning protection system.

#### A3.3 DESIGN CRITERIA

A provisional earthing and lightning protection system is indicated on the drawings and measured in the Bill of Quantities. The earthing system shall follow the same trench and rod system as indicated on the drawings.

Earthing shall be installed in trenches of 600mm deep below finished ground level (FGL)

The tops of the earth rods shall be no less than 600mm below FGL with rods installed vertically. If this is not achievable, then rods should be installed in a horizontal position and indicated on as-built drawings.

Final measures will be based on installed quantities up to the Bill measured values only. Material above bill measured quantities shall be approved by the Engineer prior to installation.

#### A3.4 EARTHING OF SUBSTATIONS

952

276

All substations shall be earthed in accordance with the requirements of the supply authority. If no earthing is specified and no specific requirements of the supply authority exist, the following method shall be adopted.

A main earth bar (minimum cross-sectional area 50 mm x 6 mm and of HDHC copper) must be provided and fixed to the high voltage room wall by means of shock proof insulators. Suitable space shall be provided between the earth bar and the wall.

All earth wires shall be secured to the earth bar by means of 10 mm diameter brass bolts. Lock nuts shall be provided for all terminals.

The following connections shall be made from this earth bar system:

1. 70 mm<sup>2</sup> insulated stranded conductor to the transformer neutral.
2. Copper tape to the transformer tank.
3. 70 mm<sup>2</sup> bare copper earth conductor to MV switchgear earth bar.
4. 70 mm<sup>2</sup> copper earth conductor to switchgear frame and board.
5. 2 x 70 mm<sup>2</sup> bare copper earth conductors to earth mat/earth rods.

Where necessary, earth connections shall be protected against mechanical damage and corrosion.

Two earth rods shall be driven into the ground in the immediate vicinity of the substation at least 3m apart with their tops not less than 600 mm below ground level. The rods shall be interconnected with a 70 mm<sup>2</sup> bare copper conductor buried at a depth of not less than 750 mm. A 70 mm<sup>2</sup> earth conductor shall be taken from each of the two earth rods to the main earthing bar in the high voltage room.

#### A3.5 EARTHING OF SWITCH ROOMS

The earthing of switch rooms shall conform to the earthing requirements of substations as described above.

#### A3.6 EARTHING OF OUTDOOR EQUIPMENT

In cases where substations contain transformers or switchgear installed outdoors, the compulsory fence, if no other method is specified, shall be earthed as follows:

1. A 70 mm<sup>2</sup> earth conductor shall be installed 400 mm below ground level and 500 mm from the fence on the outside of the substation along the entire perimeter of the fence. This earth conductor shall be earthed at each corner by means of a 1,8m earth rod and the rod and earth conductor bonded to the fence. The earth conductor shall be bonded, at least at two points, to the main earthing system.
2. A 70 mm<sup>2</sup> earth conductor shall also be buried at a depth of 400 mm around each transformer and switch and bonded to the main earthing system.

#### A3.7 EARTHING OF BUILDINGS

All hot and cold water pipes and discharge pipes shall be interconnected by means of 12 x 1,6mm solid or perforated copper tape and clamped with brass bolts and nuts. Copper tapes shall be fixed to walls by means of brass screws at intervals not exceeding 250mm.

Iron roofs, gutters, down-pipes, etc., shall be interconnected in the same way.

Connections shall be carried out with brass bolts and nuts (not self-tapping screws).

Iron roofs shall be connected at intervals not exceeding 15m with a common earth conductor of bare copper wire. The common earth conductor shall run under the roof over the full length firmly fixed to the upper purlin.

This earth conductor shall also be connected to the main earth conductor of every distribution board.

When plastic conduit is used, a 2,5mm<sup>2</sup> bare copper conductor shall be installed throughout for earth continuity.

This copper conductor shall be securely fixed to all metal appliances and equipment, including switch boxes, socket outlet boxes, draw boxes, switchboards, luminaires etc.

277 376

### A3.8 EARTHING OF LV SYSTEMS

A separate earth connection shall be installed from every sub-distribution board to the earth terminal on the main distribution board. These earth connections shall consist of bare copper conductors, drawn into conduit or piping, together with PVC conductors or cables.

Socket outlets shall be connected with 2,5 mm<sup>2</sup> earth conductor to the earth busbar in the relative distribution board.

The earth terminals of lighting circuits shall be connected to the nearest earth terminals by means of 2,5 mm<sup>2</sup> stranded copper conductors.

A readily accessible earthing terminal shall be provided for the bonding of other services such as a telephone, an audio or a video system, and the like, to a building. Such an earth terminal shall be bonded to the consumers earth terminal by a conductor of at least 6mm<sup>2</sup> copper or equivalent, and shall be identified by the earth symbol. Labels shall be fitted to all distribution boards where the readily accessible earthing terminal for the bonding of other services is provided.

The earth terminals on the main distribution board shall be earthed by means of a 70 mm<sup>2</sup> bare copper conductor connected to the earth mat.

### A3.9 EARTHING OF INSTALLATION

The trench earth shall consist of minimum 70mm<sup>2</sup> bare copper conductor buried in a 600mm trench around each building.

**Roofs, gutters and down pipes:** All metal parts of roofs, gutters and down pipes shall be bonded and earthed. The roof and gutters shall be connected at 15m intervals or as shown on the drawings to this conductor by means of 50mm<sup>2</sup> down conductors or equivalent as approved by the engineer in 20mm PVC conduit. All bolts and nuts to be galvanised. Self-tapping screws are not acceptable. The earth should be connected to the earth mat.

**Sub-distribution boards:** A separate earth connection shall be supplied between the earth busbar in each sub-distribution board and the earth busbar in the Main Switchboard. These connections shall consist of a bare or insulated stranded copper conductors installed along the same routes as the supply cables or in the same conduit as the supply conductors. Alternatively armoured cables with earth continuity conductors included in the armouring may be utilised where specified or approved.

**Sub-circuits:** The earth conductors of all sub-circuits shall be connected to the earth busbar in the supply board in accordance with SANS 10142.

**Non-metallic Conduit:** Where non-metallic conduit is specified or allowed, the installation shall comply with the specification for "conduit and conduit accessories".

Stranded copper earth conductors shall be installed in the conduits and fixed securely to all metal appliances and equipment, including metal switch boxes, socket-outlet boxes, draw-boxes, switchboards, luminaires, etc. The securing of earth conductors by means of self-threading screws will not be permitted.

**Flexible Conduit:** An earth conductor shall be installed in all non-metal flexible conduit. This earth conductor shall not be installed externally to the flexible conduit but within the conduit with the other conductors. The earth conductor shall be connected to the earth terminals at both ends of the circuit.

**Connection:** Under no circumstances shall any connection points, bolts, screws, etc., used for earthing be utilised for any other purpose. It will be the responsibility of the Contractor to supply and fit earth terminals or clamps on equipment and materials that must be earthed where these are not provided.

Unless earth conductors are connected to proper terminals, the end shall be tinned and lugged.

### A3.10 LIGHTNING PROTECTION

The lightning Protection system shall be designed and installed by a certified specialist contractor.

The lightning protection system of buildings and structures shall include:

- Bonding of metal roofs and structures
- Installation of 8mm aluminium Lightning conductor on concrete and non-metallic roof structures
- Bonding of lightning protection system with earthing system.

The contractor to use approved methods for joints, terminations and bonding.

- Lightning conductors shall be fixed to walls and parapets by means of raised galvanised saddles and secured onto the structure.
- If waterproofing is installed, lightning conductors to be installed above the waterproofing membrane.
- Care must be taken to prevent damage to waterproofing membranes and any damage or penetration onto waterproofing membranes must be first approved by the waterproofing installers prior to drilling/cutting.
- All repairs to waterproofing membranes must be done by the specialist waterproofing installers at the contractors cost.
- Down conductors to be 50mm copper conductor in PVC conduit to the earth mat of test points as indicated on the drawings.
- Test points shall be installed 600mm above finished ground level in a suitably approved IP65 box with a removable cover.
- Test points shall be provided with a bolted connection and labelled for future testing.
- Down conductor tails from the test point to earth mat/rod shall be of 50mm<sup>2</sup> copper conductor and to be exothermically welded onto the earth mat/rod. No crimps or clamps will be allowed.
- All drilling of holes onto structures and frames and re-instatement of protective coatings, eg. paint or galvanising shall form part of this contract.
- All connections to earth rods and conductor joints shall be by means of exothermic welds.
- Bonding to steel reinforcing shall be by means of approved clamps.
- All connections between different metals shall be by means of suitable bi-metal connections.

## A4. LIGHTING FIXTURES

### A4.1 CODES AND STANDARDS

A. Codes and Standards: The lighting fixtures shall comply fully with the applicable SANS specifications as set out below and all equipment shall bear the mark of approval of the South African Bureau of Standards. The latest issue of the SANS codes will be applicable:

- a) SANS 475: Luminaires for interior lighting, streetlighting and floodlighting - Performance requirements
- b) SANS 1464: Safety of luminaires Part 22: Luminaires for emergency lighting
- c) SANS 10114-1: Interior lighting Part 1: Artificial lighting of interiors
- d) SANS 10114-2: Interior lighting Part 2: Emergency lighting
- e) SANS 10389-1-3: Exterior lighting Part 1-3
- f) SANS 61547: Equipment for general lighting purposes – EMC immunity requirements
- g) SANS 62560: Self-ballasted LED lamps for general lighting services by voltage > 50V - Safety specifications
- h) SANS 62031: LED modules for general lighting – Safety specifications
- i) SANS 60598: Luminaires - Part 1: General requirements and tests



- j) SANS 1662: Self ballasted LED Tubular lamps for general lighting services > 50V - Safety requirements.
- k) SANS 62612: Self ballasted LED lamps for general lighting services with supply voltages > 50V - Performance requirements.

B. Manufacturers: If they comply with these specifications and requirements, products of the following manufacturers will be acceptable:

**The manufacturer must be an ISO9001 certified company. Proof of certification is to be submitted together with the tender document, failing which the tender may be disregarded. Products must carry the SABS mark or an international certification and approved for use in South Africa.**

#### A4.2 FLUORESCENT LIGHTING FIXTURES

A. General: Furnish and install fluorescent lighting fixtures of the types and manufacturers scheduled on the Drawings. Fixtures shall be furnished with all required accessories and trim as required for a complete installation in the ceiling type shown on the Architectural Drawings.

B. Lamps: Fluorescent fixtures shall be complete with lamps of the type, colour, wattage, and size indicated on the Lighting Fixture Schedule.

D. Ballasts:

1. General: Ballasts for use on 230 Volt systems shall be suitable and guaranteed for a voltage range of 205 Volts to 240 Volts. Ballasts for use on 400 Volt systems shall be suitable and guaranteed for a voltage range of 380 Volts to 420 Volts.

2. Electronic Ballasts: Fluorescent fixtures indicated to be provided with electronic ballasts shall be complete with parallel wired, Class "P" thermal protected, electronic ballasts certified by CE and complying with SANS limits governing EMI and RFI.

a. Electronic ballasts shall comply with SANS standards for surge protection. Total harmonic distortion shall not exceed 10%. Ballast case operating temperature shall not exceed 60°C.

Electronic ballasts shall be capable of starting at temperatures of 0°C or higher. Power factor shall not be less than 0.95.

3. Dimming Ballasts: Wherever fluorescent fixtures are to be dimmed, the fixture supplier shall coordinate the type of dimming ballast to be used with the dimming equipment supplier to insure compatibility. The fluorescent lighting fixtures shall be provided with circuit interrupting lamp holders as required for the single or double lamp dimming ballasts being used.

4. Low Temperature Ballasts: Unless otherwise indicated, where fluorescent lighting fixtures are installed in unheated areas of the building(s) or parking garages, or where installed outdoors, the fixtures shall be provided with the appropriate ballasts with a minimum Sound rating as recommended by the manufacturers.

5. Low Leakage Ballasts: Where fluorescent fixtures are installed on isolated power circuits, low leakage ballast suitable for isolated power use shall be provided.

E. Louvers: Lighting fixture louvers shall be, pre-anodized aluminium semi-specular low-iridescent parabolic louvers. Louver shall be securely fastened with T-hinges and spring-loaded cam latches. The louver should be capable of hinging and latching from either side. All steel parts, excluding fasteners, shall be painted after fabrication. Pre-coat finishes shall not be acceptable.

F. Fluorescent fixtures in continuous rows shall be supplied with all fixture couplings, close nipples and/or other accessories recommended by the manufacturer for continuous row installation.



280

G. Guards: Fluorescent strip fixtures with exposed bare lamps shall be provided with guards as required by safety codes.

#### A4.3 LED LIGHTING FIXTURES

A. General: Furnish and install LED lighting fixtures of the types and manufacturers scheduled on the Drawings. Fixtures shall be furnished with all required accessories and trim for a complete installation in the ceiling type shown on the Architectural Drawings.

B. Lamps: LED fixtures shall be complete with lamps of the type, colour, wattage and size indicated on the Luminaire Schedule, or as specified by the lighting fixture manufacturer. Unless otherwise noted, all lamps shall be Cool white.

C. Minimum requirements:

- The minimum lamp life should be equal or greater than 30 000 hours
- The Colour Rendering Index (CRI) must be 80 or greater
- Power factor must be greater than 0.9
- Test reports from an approved and accredited test laboratory must be submitted when called for.
- Alternate fixture manufacturers shall submit computer generated illumination calculations and files (.ies) to the engineer for approval

D. Luminaire Markings: All products shall be marked according to SANS 62031 as follows:

- Lamp rating in Watts
- Lamp life in hours
- Colour Correlated Temperature (CCT) or colour name
- Colour Rendering Index (CRI)
- Initial lamp life output
- Energy Efficiency Marking /label per SANS codes

#### A4.4 AREA AND FLOODLIGHTING FIXTURES

A. Area and Floodlighting fixtures have been selected for specific features, beam characteristics and style. Alternate fixtures will be considered for approval based upon compliance with procedures as described below.

B. Alternate fixture manufacturers shall submit computer generated illumination calculations and files (.ies) to the engineer for approval

C. Floodlighting fixtures shall consist of a cast aluminium housing and housing door assembly. The housing shall contain the optical components and a removable ballast drawer assembly. The unit shall be supported by cast aluminium, adjustable mounting bracket. The unit shall contain no weep or drain holes. A filtered vent hole into the fitter chamber shall be provided. The entire unit shall be classified as a sealed type. It shall bear a IP rating.

D. Housing shall be a single piece aluminium casting, forming a watertight shell. It shall contain the electrical and optical component compartments.

E. Housing door shall be cast aluminium and shall hold a tempered heat and impact resistant clear glass lens. It shall be gasketed with high temperature resistant gasket and shall be hinged to the fixture housing with a non-corrosive hinge assembly. It shall be held closed with corrosion resistant captive screws, or stainless steel, spring loaded, quick release latches.

F. All gasketing material shall be high temperature resistant rubber. All areas that are gasketed shall be of metal to metal or metal to glass interface contact design, to control gasket compression. All gasketing shall provide component compartment sealing, to prevent external atmospheric containment intrusion.

G. Ballast assembly shall be a self-contained, removable tray assembly of modular design and shall contain all electrical components of the ballast. It shall have a polarized, quick disconnect, mate and lock power input plug. It shall be field interchangeable without requiring the luminaire to be removed. The ballast shall be specifically designed for the lamp type specified and at the voltage specified. Ballast shall be constant wattage autotransformer, high power factor type, with starting current less than operating current.

H. The socket shall be mogul porcelain enclosed and shall have a spring-loaded, centre contact. It shall be properly positioned to allow correct location of the lamp in the reflector assembly. It shall be specifically designed to withstand the high voltage impulse needed to start the lamp.

I. Reflector assembly shall be construction of high purity, reflective aluminium material, and shall be designed to provide optimum photometric results in conjunction with the fixtures and the light sources for which they are designed. Fixtures must be available with a minimum of four different reflector assemblies to provide various photometry performances.

J. Glare shields will be available.

K. All painted parts shall be coated with powder coat thermoset polyester enamel, formulated to provide no appreciable fading, blistering, or peeling within five (5) years. Colour shall be as specified in the lighting schedule.

#### A4.5 SUBMITTALS

A. Shop drawings submittals shall include, but not be limited to, the following:

1. Cut sheets on all lighting fixtures with all accessories and details clearly indicated.
2. Cut sheets and complete technical data on ballasts, lamps, lens, poles, etc.
3. Photometric performance data.
4. Computer generated illumination calculations in the latest Dialux format and files (.ies) to the engineer for approval
5. Additional information as required.

#### A4.6 INSTALLATION

A. All lighting fixtures shall be furnished complete with mounting accessories to suit the specific service and installation intended. The Electrical Contractor shall verify the required fixture ceiling/trim coordination prior to light fixture orders.

B. Fixtures shown on the fixture schedule to be recessed shall be complete with plaster frames, mounting yokes, rod hangers, etc., and/or any other accessories required to fit the fixture to the ceiling construction.

However, where ceiling system cannot maintain said support, provide supplemental steel support members connected to the building structure capable of carrying the weight of the fixture plus 100kg at each support without sagging. Provide the necessary supports for hangers located between structural members. Securely fasten the luminaire to the ceiling framing members. In plaster ceilings, provide threaded hanger rods secured to the main ceiling suspension structure and supplementary horizontal steel members as required, and to the luminaire housing, using two nuts at each end of rod.

C. Connect each ceiling-recessed luminaire into the conduit system by means of flexible cable with plug top not more than 3m or less than 1.2m in length routed from an above-ceiling outlet point.

D. Provide alignment clips on all pendant or ceiling mounted luminaires used in continuous rows.

282

E. Chain-suspended lighting fixtures shall be connected to the outlet box mounted directly above the fixture using flexible metallic conduit, and the flexible metallic conduit shall be strapped to the fixture chain.

F. Fixture supports shall be provided in all outlet boxes from which fixtures are suspended. Fixtures shall not be suspended by means of cover or canopy screws. Canopies shall completely cover the ceiling opening of all ceiling fixtures except lay-in fixtures in T-bar construction, and trimless fixtures.

G. Where surface mounted lighting fixtures (i.e., exit lights, etc.) are installed on lay-in panels in T-bar ceiling construction, the outlet boxes shall be rigidly supported to the ceiling system using metal channels spanning perpendicular across the T-bars and securely attached to each side of the outlet box.

H. Connect each fixture housing to the equipment grounding conductor by means of a crimped spade-type terminal connector secured to the housing with a self-tapping screw.

I. All fixtures shall be clean at the time of acceptance of the Work, and shall be properly aimed or adjustable as required. No extra will be permitted for cleaning, aiming or adjustable fixtures to meet the requirements of the Engineer at the time of acceptance of the Work.

J. All lamps used during construction and prior to final inspection, shall be replaced prior to final acceptance of the building by the Owner.

K. The locations indicated for outlet boxes of lighting fixtures are diagrammatic. Outlets shall be located as required to coincide with suspension hangers where they occur and with structural and architectural elements of the building and shall be located in accordance with the Architectural Reflected Ceiling Plan (RCP).

#### A4.7 MOUNTING AND POSITIONING OF LUMINAIRES

The Contractor is to note that in the case of board and acoustic tile ceilings, i.e. as opposed to concrete slabs, close co-operation with the building contractor is necessary to ensure that as far as possible the luminaires are symmetrically positioned with regard to the ceiling pattern.

The layout of the luminaires as indicated on the drawings must be adhered to as far as possible and must be confirmed with the Engineer or representative.

Fluorescent luminaires installed against concrete ceilings shall be screwed to the outlet boxes and in addition 2 x 6mm expansion or other approved type fixing bolts are to be provided. The bolts are to be  $\frac{3}{4}$  of the length of the luminaires apart.

Fluorescent luminaires to be mounted on board ceilings shall be secured by means of two 40mm x No. 10 round head screws and washers. The luminaires shall also be bonded to the circuit conduit by means of locknuts and brass bushes. The fixing screws are to be placed  $\frac{3}{4}$  of the length of the fitting apart.

Earth conductors must be drawn in with the circuit wiring and connected to the earthing terminal of all fluorescent luminaires as well as other luminaires exposed to the weather in accordance with the "Wiring Code".

Luminaires are to be screwed directly to outlet boxes in concrete slabs. Against board ceilings the luminaires shall be secured to the bracing or joists by means of two 40mm x No. 8 round head screws.

#### A4.8 LUMINAIRE IDENTIFICATION

Lighting outlets are numbered on the drawings.

The numbering of the outlets defines the circuitry and control required. Each luminaire shall be furnished with the wattage and colour as specified or as implied by the catalogue number of the luminaires specified.

The luminaire shall bear the SANS 60598-2-3 and SANS 60598-2-5 safety mark or equivalent International rating. The luminaire shall have a Ta rating not less than = 40°C. The luminaire shall be manufactured by an ISO 9002 accredited company. The luminaires company shall be a ISO Marked Bearing Company or International Equivalent.

#### A4.9 GENERAL

The electrical subcontractor shall only commence with the installation of light fittings after the paintwork in the vicinity of the fitting is complete and dry. Care shall be taken to ensure that ceiling boards and paintwork is not damaged during the installation of light fittings.

The type of light fittings to be used are indicated and specified on both the relevant drawings as well as in the lighting schedule.

**Positions of light fittings:** The mounting positions of light fittings are indicated on the relevant drawings and shall be verified on site.

**Mounting heights of light switches:** Light switches shall be installed 1,4 metres above finished floor level unless specified to the contrary.

**Mounting of light fittings:** Surface mounted fittings shall be screwed to the ceiling by means of at least two 4 mm diameter electroplated self tapping screws. On concrete, plastered and brick surfaces good quality plastic expansion plugs shall be used and on suspended and soft ceilings a solid timber backing strip of at least 40 x 40 mm timber shall be supplied and installed between supports and the screws fixed to these backing strips. Surface mounted fluorescent fittings will be firmly mounted to ensure close contact with the ceiling over the entire length of the fitting. On concrete slabs the fittings shall be mounted by means of two screws into the ceiling conduit box as well as two round headed 4 mm x 30 mm electroplated self tapping screws and plastic expansion plugs, one at either end. On suspended ceilings the fittings shall be similarly mounted but timber backing strips of at least 40 x 40 x 450 mm shall be placed in position on top of the ceiling board and the end screws secured to these strips to spread the load.

### A5. CIRCUIT WIRING AND OUTLET POINTS

#### A5.1 CODES AND STANDARDS

A. Codes and Standards: The conduit and conduit accessories shall comply fully with the applicable SANS specifications as set out below and the conduit shall bear the mark of approval of the South African Bureau of Standards.

- a) The latest issue of SANS 60614 and SANS 61035, parts 1 and 2: Metallic conduit and accessories
- b) The latest issue of SANS 950: Non-metallic conduit and accessories
- c) The latest issue of SANS 1507: Electric cables with extruded solid dielectric insulation for fixed installations.

#### A5.2 CONDUCTORS

A. All wiring shall, unless expressly stated otherwise in the detail specification, comprise of PVC insulated, stranded copper conductors and bare stranded copper or green PVC insulated, stranded earth continuity conductors. The conductors shall comprise of high conductivity annealed stranded copper conductors and shall be insulated with general purpose PVC, of the 600/1000 grade. All conductors used for the wiring of the electrical installation shall comply with SANS 1507.

Conductors shall be from new stocks and shall be delivered to site with unbroken seals.

**B. PVC insulated unarmoured cables with a bare earth conductor**

(i) ~~General: This section covers the following PVC insulated unarmoured cables with a bare earth conductor:~~

- (1) PVC insulated flat multicore cable with a bare earth conductor
- (2) PVC insulated round multicore cable with a bare earth conductor and with metal stiffening.

The cable shall comply with the requirements of SANS 1507.

(ii) ~~Installation: The cables shall be installed in accordance with SANS 1507 and as specified in the detail specification.~~

The cables shall be terminated by means of PVC glands fitted with a neoprene seal. The neoprene seal shall have a round opening for the round multicore cable and a rectangular shaped opening for the flat multicore cable.

**C. Wiring terminals:** Terminal bodies and screws shall be constructed from non-corrosive metal, enclosed in fire resistant, moulded plastic insulating bodies. No part of the terminal body or fastening screws shall project beyond the insulating material which shall afford suitable protection against accidental contact by personnel and against short circuits or tracking.

The terminal block and its associated mounting rail shall be constructed in such a manner as to ensure a firm and positive fastening of the terminal block to the rail. Terminal blocks shall be held in position by means of standard end clamps. It shall furthermore be possible to extend the terminal block by adding additional terminal blocks within the terminal sequence without having to disconnect or dismantle the terminal strip.

It shall be possible to intermix terminals of various sizes, for different conductor sizes, whilst utilising the same mounting rail. Where smaller terminal blocks occur adjacent to larger terminal blocks, suitable shielding barriers shall be inserted to conceal the terminals that might otherwise be exposed.

The terminal bodies and clamping screws shall be so constructed as to ensure that conductors are not needed or severed when the clamping screws are tightened. Screws shall not come into direct contact with the conductors. Each terminal block shall have provision for clip-in numbering or labelling strips to be installed, together with protective, clear caps over the sheets.

### A5.3 INSTALLATION

**A.** The electrical subcontractor shall ensure that the wiring of the electrical installation for the building or other structure is carried out in accordance with SANS 10142.

**B. Wireways:** All unarmored conductors shall be installed in conduits, trunking or power skirting and such conductors shall under no circumstances be exposed.

**C. Circuits:** The circuits for the complete electrical installation are indicated on the relevant drawings. The following are the maximum number of points normally connected to each type of circuit unless otherwise indicated on the drawings:

- Light points per circuit = 8
- Socket outlets per circuit = 4
- Airconditioner points per circuit = 2
- Stoves, etc = 1

Conductors supplying circuits which are fed from different switchboards shall not be installed in the same wireway. The wiring of one circuit only will be allowed in a 20 mm diameter conduit, with the exception of the wiring from switch boards to fabricated sheet metal boxes located close to switchboards, in which case more than one circuit will be allowed. For larger conduit sizes the requirements of SANS 10142 shall be met.

**D. Looping and joints:** A loop-in wiring system where conductors are looped from outlet to outlet shall be employed. Joints in conductors shall be avoided as far as possible but where it becomes

unavoidable, joints will be accepted in cable channels only and not in conduits. Joints shall be soldered or shall alternatively consist of approved ferruling properly covered with the correct size heat-shrink sleeves. The use of PVC insulation tape is not acceptable.

**E. Grouping of conductors:** In cases where the conductors of more than one circuit are installed in the same wireway, the conductors of each separate circuit, including the circuit earth continuity conductor, shall be grouped at intervals of at least one (1) metre using plastic cable ties. The conductors of different circuits shall however remain separate in order to ensure that any given circuit may be withdrawn from the wireway. Conductors entering distribution boards or control boards shall be grouped and bound by means of plastic cable bands. The use of PVC insulation tape for grouping conductors will not be accepted.

**F. Pulling-through of conductors:** The electrical subcontractor shall take utmost care whilst pulling conductors through conduit to ensure that the conductors are not kinked, twisted or strained in any manner. Care shall furthermore be taken to ensure that conductors do not come into contact with materials or surfaces that may damage or otherwise adversely affect the insulation and durability of the conductor.

**G. Conductor colours:** The colours of conductor PVC insulation shall comply with SANS 10142. The colours of conductors for sub-circuits shall as far as possible correspond with the colour of the supply phase. The colours of conductors for the wiring of two-way and intermediate switches shall preferably differ from the colour of phase conductors.

**H. Earth continuity conductors:** Bare copper earth continuity conductors or green PVC insulated stranded copper earth continuity conductors, as specified in the detail specification, shall be used throughout the installation.

When earth continuity conductors are looped between earth terminals of equipment, the looped conductor ends shall be twisted together and then ferruled or soldered to ensure that a positive earth continuity is maintained when the conductors are removed from any earth terminal.

Where bare copper earth wires are specified for circuits installed in power skirting and floorducting, the electrical subcontractor shall provide a suitable length of PVC sleeving over the bare earth conductor where it passes behind or is connected to power outlets to ensure that such an earth conductor does not come into contact with any live parts.

**I. Wiring inside vertical wireways:** Conductors installed in vertical wireways shall be secured at intervals not exceeding 5m to support the weight of the conductors. Approved clamps shall be supplied and installed in suitable draw-boxes for this purpose.

**J. Conductor sizes:** The conductor size for each circuit type is specified in the detail specification. In the event that a conductor size is not specified in the detail specification, the following minimum conductor sizes shall be used:

Circuit	Minimum Conductor (Size)	
	Phase (mm <sup>2</sup> )	Earth (mm <sup>2</sup> )
Lighting	1,5	2,5
Socket outlet	2,5	2,5
Stove	6.0	6.0
Air-conditioner	4.0	2.5
Geyser	4.0	2.5

**K. Single pole switches:** Single pole switches shall be connected to the phase conductor and shall not be connected to the neutral conductor.

420

286

**L. Three phase outlets:** With the exception of three phase outlets, wirings to circuits connected to different phases shall not normally be present at lighting, switch or socket outlet boxes. Where this is unavoidable, barriers shall be provided between terminals or connections of the various phases and the box shall be suitably labelled internally and externally to indicate the presence of three phase voltages.

A separate neutral conductor shall be installed together with each three phase circuit to outlets intended for equipment connection by means of isolators or sockets, irrespective of whether the particular equipment normally requires a neutral or not.

**M. Connections:** The insulation of conductors shall only be removed over the portion of the conductors that enter the terminals of switches, socket-outlets or other equipment. When more than one conductor enters a terminal, the strands shall be securely twisted together. Under no circumstances shall any of the strands be removed to enable easier insertion of the conductors into terminals.

No more than two conductors shall be permitted to be fastened to any one terminal. The electrical contractor shall take care to ensure that the copper strands are not kinked during the removal of the insulation. PVC insulated conductors shall not be used for the direct connection to equipment where the temperature exceeds 75°C, such as stoves, geysers, electric water heaters and high power LED lamps. Silicon coated or other approved conductors shall be used in such cases.

**N. Terminals:** Terminals shall be sized and current rated to match the conductors that are connected to them.

A5.4 POWER OUTLETS

**A.** The electrical contractors shall only commence with the installation of power outlets in the conduit outlets allowed therefore of the plasterer and painter have completed their work in the vicinity of the outlet.

**B. Socket outlets with switches:** All socket outlets with switches shall be of the standard 16A 3-pin pattern, white in colour. Emergency socket outlets shall be red, with the flattened earth pin on top. UPS outlets shall be blue, with the flattened earth pin on the right.

Units for flush mounting shall be suitable for 100 x 100 x 50 mm deep flush wall box. Surface mounted patterns shall be housed in heavy pressed steel boxes. Shutters shall be provided. All socket outlets with switches shall be continuously rated at 16A and shall be suitable for operation on a 250V, 50 Hz, a.c. system.

All socket outlets with switches shall fully comply with SANS 164 as amended. Covers shall have bevelled edges which overlap the box.

**C. Isolators:** Moulded case isolators shall be of the double pole ON-LOAD type. Toggles shall be interlocked with the covers. All isolators shall comply with SANS 60947. To distinguish the switches from circuit breakers the operating handles of isolators shall have a distinctive colour and where called for in the "particular specification" the switch shall be clearly and indelibly labelled "ISOLATOR".

A5.5 INSTALLATION

**A.** Socket outlets and power outlets shall be installed in the positions as indicated on the drawings.

**B. Socket outlets:** Unless otherwise specified socket outlets shall be installed at the following heights above finished floor level, measured to the underside of the outlet:

Outlet Point	Location	Height (from finished floor level to underside of outlet)
Socket Outlet	General applications	300mm

287 ~~286~~



Socket Outlet	Kitchens	1200mm
Geyser isolator	Within 1m of geyser	500mm
Heaters, fans & airconditioners	Within 1m of unit	1500mm

**C. Connections to geysers:** Each geyser shall be connected to a separate circuit with a separate earth conductor. The conduit from the distribution board shall terminate in a 100 x 100 x 50 mm outlet box within 1 metre of the geyser. A suitably rated double pole isolator shall be installed in the outlet box. A flexible conduit shall be installed between the isolator and the geyser.

**D. Connections to heaters, fans and airconditioners:** A suitably rated double pole isolator shall be supplied and installed within 1 metre of heaters, fans and air conditioners. Where the equipment is out of reach the isolator shall be installed 1,5 metres above floor level. Flexible cords of sufficient rating may be used for the final connection to the equipment.

Where control units are to be installed the units shall be installed 1,5 metres above floor level.

#### A5.6 LIGHT SWITCHES

**A. Flush mounted switches:** Flush mounted switches shall comply with SANS 60947 and shall bear the SABS mark. All flush mounted switches shall be suitable for mounting in 100 x 50 x 50 mm galvanised steel wall boxes unless otherwise specified in the detail specification.

The switch mechanism shall be of the tumbler operated micro-gap type with silent operation and shall be rated for 16 A at 250 V and 50 Hz.

Switches shall have protected terminals for safe wiring. Multi-lever switches shall be constructed so as to enable individual defective switches to be removed and replaced without having to remove the remaining switches.

The mounting holes provided on the yoke strap shall be slotted to allow for easy alignment. A brass earthing terminal shall furthermore be provided on the yoke to ensure the positive earthing of the switch assembly.

**B. Switches with pilot light indication:** Flush mounted switches with pilot light indication shall comply with the relevant SANS specification and shall bear the SABS mark.

Switches with pilot light indication shall be suitable for mounting in 100 x 50 x 50 mm galvanised steel wall boxes. The switch shall be rated at 16 A at 250 V and 50 Hz. A red neon indication lamp shall form an integral part of the switch level and shall light-up when the switch is in the on position.

**C. Cover plates for switches:** Cover plates for flush mounted switches shall have levelled edges which overlap the wall box in order to conceal all wall imperfections and shall conform to SANS 60947.

Cover plates shall be finished in ivory coloured baked enamel and shall bear the identical manufacturing batch number.

**D. Surface mounted switches:** Surface mounted switches shall comply with SANS 60947 and shall bear the SABS mark. Surface mounted switches shall consist of single or multiple switches, not exceeding four, and shall be mounted in a pressed steel box of heavy duty construction.

The switch mechanism shall be of the tumbler operated micro-gap type with silent operation and shall be rated for 16 A at 250 V and 50 Hz.

A brass earthing terminal shall furthermore be provided on the switch construction to ensure the positive earthing of the switch assembly and enclosure.

The covers of surface mounted switches shall have toggle protectors.

**E. Watertight Switches:** Watertight switches shall consist of 10A switches on porcelain bases in cast iron or aluminium alloy housing. Contacts must be of heavy duty brass construction and a quick acting spring mechanism shall be fitted. A rigid operating knob shall be clearly marked to indicate the "ON" and "OFF" positions. Conduit entry shall be provided through a tapped hole. The complete unit shall be watertight.

## A5.7 TELEPHONE AND DATA OUTLETS

Telephone and data outlets in walls shall comprise of 100 mm x 100 mm x 50 mm deep wall boxes which shall be flush mounted in the wall, in the position shown on the relevant drawing, with the underside 300 mm above the finished floor level. The wall box shall be fitted with a blank cover plate. All outlet boxes shall align up neatly with adjacent socket outlet wall boxes. Telephone and data outlets in floors fitted with floor ducting shall be of the same type as the floor outlets for power socket outlets and shall normally be provided in the same outlet box. Telephone and data outlets in power skirting shall be provided in the positions shown on the relevant drawing and the electrical subcontractor need only provide a separate short length cover plate at these positions. The cover plate for the fixing of the telephone and data outlet shall not exceed 250 mm in length and shall be secured in such a manner that adjacent cover plate sections may be removed without disturbing the telephone outlet.

## A6. DUCTS AND POWER SKIRTING

### A6.1 CODES AND STANDARDS

A. Codes and Standards: The ducts and power skirting shall comply fully with the applicable SANS specifications as set out below and the conduit shall bear the mark of approval of the South African Bureau of Standards.

a) SANS 61084: Cable trunking and ducting systems for electrical installations

B. Manufacturers: If they comply with these specifications and requirements, products of the following manufacturers will be acceptable:

**The manufacturer must be an ISO9001 certified company. Proof of certification is to be submitted together with the tender document, failing which the tender may be disregarded.**

**Products must carry the SABS mark or an international certification and approved for use in South Africa.**

**Installers must be certified or registered installers of the manufacturers or their representatives. Manufacturers or their representatives must also have registered offices in South Africa and the local office must carry sufficient stock and spare parts for the project.**

### A6.2 POWER TRUNKING

The Contractor shall be responsible for the supply and installation of all power trunking complete with corner pieces, end pieces, junction pieces, supply conduits, cover plates and power outlets as specified and indicated on the drawings.

The power trunking must comply with SANS 61084. The Contractor must ensure that the power trunking is installed to satisfaction of the Employer's representative before commencing with the wiring of the power trunking.

### A6.3 UNDERFLOOR DUCTING

This section covers two or three compartment underfloor ducting in buildings.

The ducting and associated accessories shall be manufactured from 2 mm thick sheet steel. The sheet steel shall either be galvanised prior to the manufacturing of the ducting or shall be epoxy powder coated after manufacture. The three compartment ducting shall be subdivided into three approximately equal compartments, of which the centre compartment shall be used for electrical power distribution with the outer two compartments for other services.

289 288

Outlets shall be provided on a modular basis in the ducting for the installation of pedestal or recessed outlets. The openings shall have removable flush cover plates and shall have tapped holes for the installation of the pedestal or recessed outlets.

The underfloor ducting shall be complete with flush cross-over, T-junction and right angle bend draw boxes. The junction boxes shall be complete with cross-over of services and removal cover plates secured by means of countersunk screws.

Pedestals: Pedestals suitable for two or three services as specified shall be manufactured from die-cast aluminium or pressed steel. The pedestals shall be epoxy coated of an approved colour after the manufacturing hereof.

The underfloor ducting with accessories shall be installed strictly in accordance with the manufacturer's instructions. The ducting shall be fixed to the floor by approved means.

Upbends shall be supplied and installed where ever the ducting is terminated at distribution boards, telephone distribution boards or behind power skirting.

The power circuit wiring shall be installed in the centre compartment of the ducting. Sufficient slack shall be left in the form of a loop at each outlet in the ducting in the area to be served by the ducting. Galvanised draw wires shall be installed in the other compartments to enable cables to be drawn in by others. The entire installation shall be effectively earthed and bonded together.

#### A6.4 POWER SKIRTING

This section covers the supply and installing of two or three compartment power skirting.

The power skirting and covers shall be manufactured from 1 mm thick sheet steel or aluminium and shall be manufactured in modular lengths. The length of the skirting shall not exceed 2,5 metres and, unless otherwise specified in the detail specification, the covers shall be supplied in 1 metre lengths.

The covers shall either snap on or shall be fixed by means of toggle or swivel nuts. Each modular cover shall be punched and prepared for the installation of a standard three pin socket outlet. The punched holes shall be blanked off with easily removable blanking plates, painted the same colour as the power skirting. Suitable brackets shall be supplied for the fixing of the socket outlet to the channel.

All internal and external bends and off sets shall be factory made.

The power skirting and cover shall be epoxy powder coated of an approved colour after the manufacturing thereof.

Conduits for the circuit wiring to the power skirting shall be installed in the floorslabs and chased into the walls to terminate in flush conduit boxes behind the power skirting at the heights of the compartments for the telephone, power and other service compartments.

The wiring shall pass through large diameter holes, suitably bushed, cut in the rear of the power skirting.

Where power skirting is interrupted by doorways bridging conduits shall be installed for each of the service compartments.

#### A6.5 WIREWAY TRUNKING

A. General: This section covers the supply and installation of wireway trunking and accessories in buildings.

B. Materials: The covers of the wireway trunking shall be secured to the framework by at least four points per section. Covers shall be so designed that they can be easily removed after installation of the trunking. Sections of the trunking which pass through walls and floors shall have separate covers. Fire barriers of non-flammable, non-conducting material shall form an integral part of each section. The fire barriers shall be so placed as to prevent the spreading of fire from one floor to another.

C. Installation: Trunking shall be of the size and type as specified in the detail specification. The electrical contractor shall ensure that the trunking is installed in accordance with the routes indicated on the relevant drawings.

However should the electrical contractor discover that the indicated route is not practically possible, or for some other reason the route clashes with other services, he shall immediately contact the engineer for clarification in this regard.

D. Ceiling space: Trunking for use as wireways shall be installed as specified on the drawings. When installed in open ceiling spaces, trunking shall be mounted as close as is physically possible to immediately below the apex of the roof to allow maximum working space. The trunking shall be installed along the full length of the open ceiling space. Individual conduits shall be extended from the trunking to switch and socket outlet boxes, light points, distribution boards, etc. The trunking shall be installed in one straight length and all joints shall be both electrically and mechanically continuous. The trunking shall only be installed where there is a minimum clearance of 750 mm as measured between the top of the final trunking installation and the underside of the roof sheeting. The trunking shall be securely fixed to every roof truss or member by means of round headed screws or approved truss clamps.

Both incoming and outgoing conduits shall be bonded to clean surfaces, both internally and externally, by means of two locknuts and a female brass bush. A solid brass bushnut installed from inside the trunking may also be used. Conduits which are extended from the trunking to outlets and power points shall be installed along roof members. Suitable timber or other supports shall be provided for free standing conduits extended from the trunking.

E. Suspending or fixing trunking against walls: The electrical contractor shall provide all the necessary hangers, supports, brackets and fixing hardware for the securing of the trunking installation.

Trunking up to and including 76 mm x 76 mm shall be supported at regular maximum spacings of 600 mm and larger channels at regular maximum spacings of 1 m. Trunking runs shall be carefully planned to prevent clashes with other services and to ensure that all covers can be easily removed after completion of the installation. Purpose made clamps and hangers shall be provided as required. Where however it is not possible to support the trunking at the specified spacings, such trunking sections shall be supported in a sound manner and to the approval of the engineer.

F. Cast in concrete: Where trunking is to be cast into concrete, the insert type of trunking shall be used. Spacer blocks shall be used where required to prevent the trunking from being deformed during the casting of the concrete.

The trunking shall be filled with polystyrene or other suitable fillers, prior to casting, to prevent the ingress of concrete. The trunking shall furthermore be securely fixed in position to the shuttering.

G. Conduit connections: Conduit connections shall be bonded to clean surfaces, both internally and externally, by means of either two locknuts and a female brass bush or by means of a solid brass nut inserted from the inside of the trunking. Conduit connections may be made by means of a conduit box if the trunking is wide enough to allow a hole to be punched through the back or side thereof. All holes through which conductors pass shall be fitted with bushes, grommets or shall be aligned with PVC strip grommet.

H. Joints and bends: Two adjoining lengths of trunking shall be aligned and shall be securely joined by means of fishplates fixed by means of mushroom bolts, washers and nuts. Alternatively connection pieces that are pop-riveted to both adjoining sections may be used. All adjoining lengths of trunking shall be rectangular and shall burr tightly. Special care shall be taken to ensure that the covers fit tightly across the joints.

Where the trunking passes through an expansion joint in the structure, suitable expansion joints shall be provided in the trunking by means of fishplates which are to be pop-riveted or screwed to the trunking on one side of the expansion joint and floating flecky, without obstruction in the trunking on the opposite side of the expansion joint.

Bends and T-joints shall be constructed to ensure compliance with the minimum allowable bending radii as specified in SANS 10142, in the case of PVC insulated cables and conductors.

All burrs and sharp edges shall be removed from the cut edges of the trunking and the inside edges shall be lined with a suitable rubberised or plastic compound to prevent laceration of the conductor insulation during installation.

I. Circuits: The conductors for each individual circuit, including the earth continuity conductor for that circuit, shall be grouped together at regular spacings not exceeding 500 mm by means of PVC cable ties or straps.

Each circuit to be installed inside the trunking shall be individually laid to avoid unnecessary tangling of the grouped conductor. The utilized cross sectional area of the trunking shall not normally exceed 50% of the total cross section of the specified trunking.

J. Earthing: A separate earth continuity conductor of size as specified in the detail specification shall be installed from the main earth bar or terminal to the trunking where it shall be terminated to ensure a proper earthing of the trunking. The earth conductor shall be equipped with a crimped or soldered lug and shall be bolted to the wall of the trunking by means of a 6 mm Ø brass bolt, washers and nut.

K. Cover plates: Cover plates shall be installed over the full length of the installed trunking. Flush mounted trunking shall be provided with overlapping metal cover plates with plastic edge trim to cover irregularities in the wall recess. Where required and when specified, in the detail specification, cover plates shall be attached to the trunking by means of screws at suitable intervals to prevent warping.

L. Verminproofing: After installation all trunking shall be suitably verminproofed. Any holes present in the trunking shall be sealed by means of screwed metal plugs or else with metal strips which are tube-bolted or pop-riveted to the trunking. No timber or other temporary form of plug shall be accepted. Coverplates shall be installed over the full length of the trunking.

## A7. TESTING

### A7.1 INSTALLATION TESTS

Tests as stipulated in the "Occupational Health and Safety Act no. 85 of 1993, as amended, and in the "Code of Practice for the Wiring of Premises" SANS 10142 (as amended), must be done. Test report forms must be filled in fully and correctly in ink, signed by the installation electrician and handed to the Engineer or its representative.

Tests must be conducted on site after the whole installation is complete, unless the Engineer grants written permission to the contrary. The tests must include a full-load test for an adequate period to ensure the satisfactory working of the installation. If negative test results are obtained, faults must be rectified and tests again done.

The contractor must supply all testing apparatus, correctly calibrated.

All tests shall be carried out in conjunction with and to the satisfaction of the Supply Authority and in the presence of the Engineer or his representative. The contractor shall make all arrangements for testing and inspection, the costs thereof being included in the Tender Price.

Each length of cable shall be tested for insulation and polarity by means of a 1000 Volt Megger designed for that purpose. In the case of underground cables this shall be done before back filling. In addition, the earth-loop impedance of each conductor earth electrode shall be measured. The earth resistance shall be tested by means of an approved instrument. "Danger" notices shall be displayed at remote ends of cables under test.

The contractor shall ensure that the installation is completed in every respect and that there are no major defects prior to notifying the Engineer (in writing) for a first delivery inspection. The Engineer will accept zero minor defects during the final inspection. Should the number of defects be exceeded at the final inspection then the Engineer will terminate that inspection and request that the contractor arrange an additional final inspection.

### A7.2 SUBMITTALS

A. Submittals shall include, but not be limited to, the following:

1. Three (3) copies of certified test results for each test indicated herein, for approval and future references.
2. Certifications as required herein.
3. Additional information as required in the specifications.

#### A7.3 CONDUCTOR TESTS (600 Volts or less)

A. Prior to energizing of all new feeders, test all conductors for continuity of circuitry and for short circuits. No submittal is required for this test. Each wiring system with devices connected must test free from short circuits and grounds.

B. Each new feeder conductor shall have its insulation resistance tested after its installation is completed except for connection at its source and point of termination.

C. Test shall be made using a Megger or equivalent at a voltage of not less than 1000 VDC, and after one minute of operation at slip speed. Resistance shall be measured by connecting one terminal of the megger to the conductor and other terminal to earth. Reading shall be observed after 15 seconds of operation of the megger.

D. Conductors which do not meet or exceed the following insulation resistance values shall be removed, replaced, and retested.

E. Conductor test results shall indicate weather conditions, temperature, relative humidity, date and time, feeder tested, conductor size and type and resistance measurements.

#### A7.4 SERVICE SWITCHBOARD EARTH RESISTANCE TEST

A. Perform a earth resistance test on the switchboard earthing system for comparison of future inspection and testing data by the Owner. Overall system resistance shall not exceed 25 ohms. Eliminate any stray currents, shorts, or non-consistencies in the grounds system.

B. The test shall be performed using a Megger Earth Tester or equivalent test instrument and shall not be performed immediately following wet weather conditions.

C. Switchboard earth resistance test results shall indicate weather conditions for test, earthing system tested, earthing configuration and test results.

#### A7.5 EARTH FAULT PROTECTION SYSTEM TESTS

A. Factory test: The switchboard ground fault protection system shall be factory tested prior to shipment.

The switchboard manufacturer shall provide factory ground fault interlocking and protection system test for circuit testing, and verification of interlocking and tripping characteristics. The manufacturer shall pass predetermined values of current through the relay sensors, and measure the relay tripping time for each phase, and neutral. The measured time/current relationships shall be compared to the relay trip characteristics curves. If the relay trips outside the range of values indicated on the curve, the relay shall be replaced. This test shall include verification of polarity of the ground sensor circuits' interconnection.

B. Certified "factory test" results shall indicate relay number, device served, actual characteristic curves, design characteristic curves and overall test results.

C. Field test: Following completion of the construction and prior to final acceptance testing, the earth fault protection system shall be field tested and reset to the manufacturer's recommended setting for both time and current, by a representative of the Manufacturer. The field test shall be conducted in a similar manner to the factory test in that a cable from a low voltage, high-current test set shall be passed through each current sensor. This test shall also demonstrate the

complete system reliability in that it must operate the associated shunt trips and show that the overcurrent devices which they operate will actually open.

D. Certified "field test" results shall indicate relay tested, relay settings, and test results.

#### A7.6 GENERATOR SYSTEM TESTS

A. Upon completion of installation of the electric generating system and after the building normal power source has been energized, test the package electric generating system to demonstrate standby capability and compliance with specified requirements, including automatic start-up, controls, full load acceptance, and automatic shut-down.

B. Tests shall include operation of the standby electric power system with voltage check while the system is operating to ensure proper operation of the generator, transfer switches, and other system components.

C. Operation of the system shall simulate standby power conditions, that is, a simulated loss of main electrical power to the building with sufficient load available in the building systems or through the use of a portable load bank to sufficiently demonstrate packaged electric generating system. Test period shall be minimum of 2 hours continuous trouble free operation with at least 4 automatic transfer switch operations (each switch) within the period of operation.

D. Refer to specification 008: Generator systems for additional tests.

#### A7.7 SPECIAL TESTING

A. Certify in writing that the system operation is in accordance with specifications and code requirements.

#### A7.8 BALANCING OF ELECTRICAL CIRCUITS

A. The system of feeder and branch circuits for power and lighting shall be connected to distribution board bus-bars in such a manner that loads connected thereto will be balanced on all phases as close as practicable.

B. Should there be any unfavourable condition of unbalance on any part of the electrical system, the electrical contractor shall make such changes that may be necessary to remedy the unbalanced condition.

C. Prior to completion of the project, provide a complete list of all panels stating the measured loads on each phase. Test results shall indicate panels tested, amperage per phase, and any remedial action taken.

#### A7.9 OPERATIONAL TESTING

A. Take voltage and currents readings for each feeder and motor circuit under maximum operating conditions. Questionable readings shall be repeated at no cost for confirmation.

B. Controls for lighting and receptacle circuits shall be demonstrated.

C. Demonstrate running of motors with controls and interlocks.

D. Demonstrate operation of electrical equipment appliances.

#### A7.10 CABLES

Each cable shall be tested after installation in accordance with SANS 1507 (up to 1kV) and SANS 97 (up to 11kV) as well as the requirements of the local and supply authorities.

LV cables shall be tested by means of a suitable megger at 1kV and the insulation resistance shall be tabulated and certified.

MV cables shall be pressure tested in accordance with the manufacturer's recommendations and exact leakage current shall be tabulated and certified.

The contractor shall make all arrangements, pay all fees and provide all equipment for these tests. The cost of testing shall have been included in the tender price.  
The contractor shall notify the Engineer and if applicable the Supply Authority timeously so that their representative may witness the tests.

On completion of the tests on any cable, the contractor shall without delay submit three (3) copies of the certified test results to the Engineer.

The contractor shall provide all the testing equipment as required for the respective tests.

## A8. STREET AND AREA LIGHTING

### A8.1 CODES AND STANDARDS

A. Codes and Standards: The Street and area lighting fixtures shall comply fully with the applicable SANS specifications as set out below and all equipment shall bear the mark of approval of the South African Bureau of Standards. The latest issue of:

- a) SANS 10225: The design and construction of lighting masts
- b) SANS 15607: Specification and qualification of welding procedures for metallic materials - General rules
- c) SANS 15609: Specification and qualification of welding procedures for metallic materials - Welding procedure specification Part 1: Arc welding
- d) SANS 62: Steel pipes Part 1: Pipes suitable for threading and of nominal size not exceeding 150 mm
- e) SANS 62: Steel pipes Part 2: Screwed pieces and pipe fittings of nominal size not exceeding 150 mm
- f) SANS 657: Steel tubes for non-pressure purposes Part 1: Sections for scaffolding, general engineering and structural applications
- g) SANS 121/ISO 1461: Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods
- h) SANS 10098-1: Public lighting Part 1: The lighting of public thoroughfares.
- i) SANS 10098-2: Public lighting Part 2: The lighting of certain specific areas of streets and highways
- j) ARP 035: Guidelines for the installation and maintenance of street lighting
- k) SANS 60598-1: Luminaires Part 1: General requirements and tests
- l) SANS 60598-2-3: Luminaires Part 2-3: Particular requirements - Luminaires for road and street lighting
- m) SANS 1088: Luminaire entries and spigots

B. Manufacturers: If they comply with these specifications and requirements, products of the following manufacturers will be acceptable:

**The manufacturer must be an ISO9001 certified company. Proof of certification is to be submitted together with the tender document, failing which the tender may be disregarded.**

**Products must carry the SABS mark or an international certification and approved for use in South Africa.**

**Installers must be certified or registered installers of the manufacturers or their representatives. Manufacturers or their representatives must also have registered offices**



**in South Africa and the local office must carry sufficient stock and spare parts for the project.**

## A8.2 STREET LIGHTING

A. Street lighting to be manufactured to SANS specification and suitable for use as per SANS 10098.

The luminaires shall be delivered completely assembled with housing, ballast, photoelectric control unit, lighting management system and protector lens. Luminaires shall be Class 1 of IEC 60598-1 and be of the totally enclosed type. The luminaire output shall be provided as nominal flux at  $T_q$  of 35 °C.

The luminaires shall have minimum rating of IP 65 in accordance with SANS 60529 for both the light and ballast compartments, when normally mounted as per SANS 475.

A Street lighting Management system is to be incorporated as part as the street lighting installation. Contractors and suppliers are to ensure that the street lighting supplied is fully compatible with the street lighting management system supplied. The lights should be able to be controlled locally and remotely from a remote computer.

## A8.3 CONSTRUCTION OF LUMINAIRES

A. The housing shall be robustly constructed, weatherproof, hail proof, insect proof, corrosion proof, ultraviolet light resistant and vandal resistant. Luminaires shall be suitable for operation at an ambient temperature,  $T_a$ , of 35°C. Fixing devices, junctions, lips and the like shall be designed to shed water. Pockets and ledges in which condensation may accumulate shall be avoided.

B. The luminaires shall be supplied with a built-in PECU capable of performing a minimum of 8 000 switching operations under full load, and shall be located in a position where it is least likely to be affected by luminaire heat.

C. LED luminaires shall contain a heat sink with no fans, pumps or liquids, and the design of the heat sink shall prevent the accumulation of dirt and nesting of insects or ants, thus ensuring effective heat dissipation.

D. The luminaires shall be constructed from light weight durable materials which for all parts shall be compatible and failure or deterioration shall not occur due to electrolytic action or by differential thermal expansion. Where glass reinforced polyester (GRP) is used it shall comply with the requirements of SANS 141 for Type F laminate products. Luminaires manufactured from polymeric material shall be ultraviolet stabilized. Luminaires shall have successfully passed the accelerated ageing test specified in SANS 60598.

E. Luminaires with aluminium housings shall be of grade LM 6 (EN1706 AC-44100) (or higher) aluminium alloy and shall comply with BS 1490. Bidders offering aluminium housings shall submit a metallurgical report from an independent metallurgist confirming the grade of aluminium for all the luminaires offered. The client reserves the right to submit luminaires for metallurgical testing when necessary.

F. Powder coated luminaires shall be light grey or white in colour. A powder coating that cracks as a result of corrosion of the aluminium base shall be considered a failure under warranty.

G. Ferrous components shall be hot-dip galvanised and shall withstand the test specified in the current edition of SANS 121 for heavy duty application.

H. Small components (such as toggle clips, bolts, screws, nuts, washers) shall be manufactured of stainless steel (grade 304 or better).

I. Due attention shall be paid to the accessibility of parts and to other requirements necessary for efficient maintenance and cleaning, where required. If screws are used to secure covers, they shall be held captive when opened.

J. The ballast or driver shall be mounted internally and be replaceable with the aid of commonly available hand tools.

K. The LED module or array shall be designed in such a way that the failure of one LED shall not cause additional LED's to switch-off.

#### A8.4 PROTECTOR LENS

A. The protector shall be resistant to heat and shall not discolour after prolonged exposure to the atmosphere or artificial light. Protectors manufactured from high-impact acrylic shall be ultra-violet stabilized. Bidders shall submit certified data regarding degradation of the material and depreciation of light transmission under working conditions, namely temperature and ultra-violet irradiation. Polycarbonate protectors are not acceptable. High-impact glass is the preferred material for the protector lens.

B. A protector, when fitted, shall form a seal preventing the entry of moisture, dust and insects into the lamp housing. A one-piece gasket shall be used for this purpose. The material of the gasket shall be a silicon sponge material and shall not deteriorate or suffer permanent deformation during the life of the luminaire. The gaskets shall not deteriorate due to light, heat or compression to which they will be exposed in practice and shall be screened against radiation from the light source.

C. The gasket shall be fitted into a groove in the housing and shall be kept in place by a tongue provided on the diffuser, thus ensuring the integrity of the IP65 rating. Further, the gaskets shall not work loose during maintenance of the luminaire.

#### A8.5 POWER SUPPLY OR DRIVER REQUIREMENTS

A. LED module(s) drivers shall be housed fully within the body of the luminaire and be suitable for operation with the specified rating of luminaire.

B. The output frequency of the drivers shall be 100 Hz or greater, to avoid visible flicker.

C. The harmonic distortion levels of the LED module driver(s) shall comply with the limits given in SANS 61000-3-2.

D. The LED module driver(s) shall operate at a power factor of 0,85 or greater, and the harmonic distortion levels shall be limited so as to not cause interference on the electrical network.

E. The power supply or driver compartment (containing the LED module driver) shall be sealed by a hinged non-corrosive, light-weight cover and shall be accessible from underneath. No components shall be mounted onto this cover. The cover shall be secured onto the fitting such that the provisions of clause 8.2 of IEC 60598 are met. Screws or bolts, if used, shall be held captive once loosened. Control gear shall be mounted on a removable gear-tray for ease of maintenance and not on the access door.

F. The power supply or driver compartment shall be so designed that there is sufficient space to permit repairs, replacement of components and reassembly without difficulty and without the removal of the luminaire from its mounting.

#### A8.6 EARTHING

A. The luminaire shall be earthed in accordance with Clause 13 of the Electrical Machinery Regulations of the OHS ACT (Act 85 of 1993).

B. Metal parts of luminaires which may become alive in the event of an insulation fault and which are not accessible when the luminaire is mounted but liable to come into contact with the supporting surface shall be permanently and reliably connected to an earthing terminal and shall withstand the test specified in IEC 60598-2-3.

C. Protection against electric shock shall be maintained for all methods and positions of installation in normal use. Protection shall also be maintained after removal of all parts which can be removed by hand, except those parts of lamp holders specified in SANS 60238.

D. Earthing terminals shall comply with sub-clause 7.2 of IEC 60598-1. All parts of an earth terminal shall be made of brass or other corrosion resistant metal and the contact surfaces shall be bare metal and not painted or varnished surfaces.

E. All earth connections shall be effected by means of suitable lugs appropriately made to avoid all possibility of electrolytic corrosion.

F. An earth connection shall be provided in all instances, even if the luminaire is fully insulated and even if all conductive parts, which could become alive in the event of an insulation fault, are not accessible. This is to facilitate future wiring should the luminaire be replaced by a unit which requires an earth connection.

#### A8.7 PHOTO-ELECTRIC CONTROL UNIT (PECU)

A. The luminaires or street lighting kiosk as per drawings shall be supplied with a PECU capable of performing a minimum of 8 000 switching operations under full load, and shall be located in a position where it is least likely to be affected by luminaire light.

B. The switch on photometric level of the PECU shall be at 25 lux  $\pm$  10%.

C. The switch off photometric level of the PECU shall be at 15 lux  $\pm$  10%.

D. The PECU shall be designed to fail to the "off" state of the switch.

E. The degree of protection provided to any part of a PECU which is open to the environment shall be at least IP 65 in accordance with SANS 60529.

F. All materials used in the manufacture of the PECU shall be UV stabilized in such a way that damage due to solar radiation will not cause the photometric performance of the PECU to deteriorate beyond the specified limits within a period of at least 10 years.

G. The change over switch shall be capable of switching 10 Amps alternating current at 230volts

H. The unit shall comprise a photo cell, thermal actuator and change-over switch. The cover of the unit shall be manufactured from a tough, durable material providing protection against tampering. The cover shall have good weathering properties. It shall be ultra violet resistant and shall not deteriorate when exposed to sunlight for prolonged periods.

I. The operation level shall be factory preset for "ON" and "OFF" at a light level as indicated. Voltage variations shall not materially affect the operational levels.

J. A time delay of not less than 15 seconds shall be provided to prevent the unit from functioning due to lightning or other short period changes in illumination.

K. The unit shall be effectively safeguarded against voltage surges by means of a suitable surge protector which shall preferably form an integral part of the unit.

L. The unit shall be of the two part, base and daylight switch type and shall be supplied complete.

#### A8.8 WIRING

A. The internal wiring of the luminaires shall be flexible and suitably insulated to withstand the voltage and the temperature encountered in service. Wiring colours shall be: live-brown (or red), neutral-blue (or black) and earth-green/yellow.

B. Wiring to the Light / LED module compartment shall be suitably grommited to prevent the ingress of insects into the light / LED module compartment.

4.9.3 The supply terminals shall accept 4mm<sup>2</sup> wires and be easily accessible. No part of the cover shall damage the supply wires when closed.

#### A8.9 STREETLIGHT LUMINAIRE MARKINGS

A. Each luminaire shall be distinctly marked with black writing on a white background using 25 mm high lettering on the outside of the control gear compartment, such that it is clearly visible from the ground, with the following information:

- a) Rated wattage of luminaire *and lamp type* in accordance with the description specified in Schedule A, e.g. 50 W LED; and
- b) The name of supplier followed by the luminaire model, e.g. *SUPPLIER X, LUMINAIRE MODEL NAME*.

B. Each luminaire shall bear the name or trade mark of the manufacturer and the date of manufacture

C. Luminaires delivered without the specified markings shall be rejected.

#### A8.10 STREET LIGHT LUMINAIRE PACKAGING

A. Each luminaire shall be delivered completely assembled ready for use and shall be individually packed in suitable containers such as cardboard boxes. The luminaires may be packed two per box. The containers shall be marked with appropriate description and stock code of the luminaire contained within.

#### A8.11 LUMINAIRE DOCUMENTATION

A. Full technical and descriptive details, relating to all the items offered shall be submitted so the offer can be fully evaluated. This shall include:

- a) Actual design data and results, and encrypted luminaire data files in an electronic format.
- b) Name of luminaire;
- c) The method of manufacture of the Luminaire;
- d) The dimension & weight of the Luminaire;
- e) The self cleaning properties of the Luminaire;
- f) The cooling mechanism of the Luminaire to adequately dissipate heat;
- g) Country of design, manufacture and assembly;
- h) Standards to which the luminaire conforms to (National & International);
- i) Specify life span of LED Module driver(s) or Power Supply

#### A8.12 STREETLIGHT LUMINAIRE SPARES

A. Bidders shall state their recommendations regarding the stocking of spare parts, which will be ordered at the discretion of the client and shall indicate whether such spare parts are available ex local stocks.

B. Any spare apparatus shall be subject to the same specification, tests and conditions as similar material supplied under the main contract.

#### A8.13 STREET LIGHT LUMINAIRE TEST REPORTS

A. Failure to provide test reports of the following tests called for may result in the rejection of the Bid:

- a) Type test according to IEC 60598-1:2004 and IEC 60598-2-3:2003.
- b) IP rating test reports for all items offered in accordance with SANS 60529.

B. A separate ambient temperature (Ta rating) test report shall be provided, in accordance with SANS 475.

C. The test reports shall be issued by SANS or IEC accredited test authority.

D. Bidders offering luminaires with aluminium housings shall submit a metallurgical report confirming the grade of aluminium.

E. Certified data from a recognised test authority regarding degradation of the material and depreciation of light transmission under working conditions, i.e. temperature and ultra-violet irradiation for the following:

- a) material of the body;
- b) material of the bowl; and
- c) material of the reflector.

The performance test reports which include the following:

- a) Photometric requirements;
- b) Static wind force test;
- c) External and internal wiring;
- d) Protection against electric shock;
- e) Thermal tests;
- f) Power factor;
- g) Resistance to corrosion;
- h) Insulation resistance and electric strength;
- i) Resistance to heat, fire and tracking; and
- j) Accelerated ageing tests.

F. An encrypted luminaire data file for each luminaire offered in an electronic format suitable for use with the Dialux Lighting Design Software package. The encrypted data file shall be produced by an accredited independent laboratory. This data file shall be supplied on a CD or flash drive with each bid.

G. Failure to submit such information may preclude further consideration of the bid.

#### A8.14 MATERIAL TESTING

Luminaires offered may be subjected to an accelerated aging test to evaluate the design and quality of materials used.

#### A8.15 TECHNICAL SPECIFICATION FOR STEEL STREET LIGHTING POLES

**A. Scope:** This specification details the manufacture, supply, delivery, off-loading and stacking of vertical street lighting poles as specified below and in the Bill of Quantities as depicted on drawings.

**B. System and service conditions:** The street lighting poles shall be for outdoor use in the area of installation and shall be suitable for conditions as set out in Section 0002: Design Criteria.

**C. Design Data:** The steel tubes shall comply fully with SANS 657: Part 1 except where amended herein. All items shall be manufactured from new materials.  
The steel street lighting poles shall be designed to support one luminaire of unit mass of approximately 15 kg.

The steel street lighting poles shall be manufactured of grade 300W steel or equivalent, in accordance with SANS 657 with a minimum yield stress of 300 MPa and a minimum tensile strength of 450 MPa.

The steel street lighting poles shall be capable of withstanding a fluctuating wind load in accordance with the requirements of SANS 10225.

The maximum horizontal deflection at the spigot end, when subjected to two thirds of the design loading, shall not exceed 0,025 of the developed length above ground.

The maximum vertical deflection at the spigot end, when subjected to the mass of the luminaries shall not exceed 1,5 % of the total length of the pole.

Tenders must be accompanied by full technical details including comprehensive strength calculations certified by a qualified professional structural engineer.

Design wind speed: Terrain Category 2 with wind speed of 144km/ hour

**D. Street lighting poles:** The steel street lighting poles shall have minimum wall thicknesses as indicated on the drawings.

Protection sleeves shall be fully seal welded onto the steel street lighting poles. The dimensions of the protection sleeves shall be 600 mm long mild steel with a thickness of at least 3,5 mm and shall extend 300 mm above and below ground level.

Base plates, as per drawings shall be fitted to all steel street lighting poles.

A fuse box opening 300 mm long, 95 mm wide shall be provided 1000- 3000 mm above the ground line as indicated on the drawings. All edges are to be free from burrs and protrusions. The pole dimensions shown shall be increased to provide the required modulus of section or, alternatively, interior reinforcing shall be provided, should either of these requirements be necessary. A M6 stainless steel set screw (for earthing purposes) shall be fitted adjacent to the stud which is used to fasten the cover plate for the fuse box opening.

Alternative shapes of fuse - box openings may be considered but drawings showing full details of the proposed alternative arrangements shall be submitted with tender for approval.

**E. Cover plate for fuse box opening:** A curved mild steel cover plate of the same wall thickness as the steel pole shall be fitted to cover the fuse box opening. The cover plate shall be permanently attached to the pole by a fixing mechanism eg chain which shall be welded onto both the cover plate and pole. The plate shall be secured in the closed position by means of a M10 - 25 mm galvanized or stainless steel stud welded to the pole, and a unique heptagonal (seven-sided) M10 stainless steel or brass nut. Once the cover is secured to the pole the nut shall not protrude beyond the diameter of the pole, and it shall only be possible to remove the nut with the aid of a tube spanner. The tenderer shall submit a fully detailed working drawing of any alternative cover and fixing mechanism offered, eg for cover plates of UV stabilised, impact resistant plastic. Due to the prevalence of removal and theft of cover plates by vandals within the area of supply, preference will be given to designs whereby the cover plate sits flush with the exterior surface in order to prevent external leverage by means of tools and other implements. The cover plate shall fit against the steel streetlight pole to give a flush exterior appearance. A one piece silicon gasket (approximately 2 mm thick) shall be provided for sealing the cover plate to the pole.

**F. Cable access:** For all steel street lighting poles, two 100 mm \_ 65 mm slot shall be cut opposite one another at 90° to the fuse-box opening. The slots shall be well radiused and free of burrs.

#### **G. Alternative Designs**

Alternative designs of steel street lighting poles may be considered for acceptance provided that the poles are supplied in one piece.

For the alternative design, the tenderer shall submit with its tender, fully dimensioned drawings, and design calculations. These designs and calculations shall have been carried out by a qualified professional structural engineer. Documentary proof of compliance with this requirement will be required. It shall be required that the fuse box opening, cover plates, cable entries, protection sleeves, fins, spigots and joints be in accordance with the drawings submitted.

**H. Welding:** All welding shall be continuous and in compliance with SANS 15607/SANS 15609. All welds shall be dressed where necessary. No welded pieces (pipe reducers) shall be inserted

in the poles. All joints shall be bevelled prior to welding and shall present a symmetrical appearance after welding.

**I. Protection against Corrosion:** Before galvanizing, all weld slag shall be removed from each pole by shot- or sand-blasting and a visual inspection shall be carried out to ensure the efficiency of this operation. All items shall be hot-dip galvanized in accordance with SANS ISO 121/ISO 1461.

No plugging at the ends of the poles during galvanizing shall be acceptable. The process used, shall comply completely with the requirements of SANS 121/ISO 1461 and the thickness of galvanizing shall comply with the thickness laid down in that standard for the various diameters. Manufacturers shall produce certificates to the satisfaction of the Engineer with Methods and Standards showing that the specified thickness of galvanizing has been attained.

A8.16

#### A8.16.1 MARKING

A. The steel street lighting pole shall be clearly stamped, 50 mm below the fuse box cover plate, with 12 mm number and letter punches with the following:

- (a) the Contract number,
- (b) the manufacturer's name, and
- (c) the pole size.

B. The lettering and numbers shall be clearly visible after hot-dip galvanizing.

C. Alternative methods of marking poles may be considered provided that a full description of the marking process shall be submitted with the tender documents.

#### A8.16.2 INSPECTION

A. In addition to the requirements listed below, all poles shall comply with the test requirements of SANS 0225.

#### A8.16.3 PRIORITY OF WRITTEN SPECIFICATION

A. In the event of any disagreement between the written specification and the drawings, the written specification will take priority over the drawing(s).

#### A8.17 CONCRETE ENCASEMENT OF SERVICES

A. Should the drawings or Bill of Quantities specify concrete encasement of services, the following is to be adhered to with regards to in-situ 20MPa Concrete Encasement of low voltage cables, sleeves for Low Voltage, ICT services and other future services.

The unit of measure shall be the length of concrete encasement constructed and finished. The concrete encasement shall be 250mm wide x 400mm deep for service sleeves and 300mm wide x 200mm deep for cables alone.

All LV and intermediate voltage cables shall be totally encased in concrete and enforced using bonding agent and chicken wire mesh.

Encasements shall be done in one meter sections. Service sleeves are laid into position; as per construction drawings as well as shuttering installed to obtain a class F1 surface finish. The concrete encasement will be constructed of standard 20MPa concrete with 19mm grade crush stone size.

Furthermore, cube tests shall be performed on the concrete and results submitted to the Engineer.

One set of cubes shall be submitted to the engineer for independent testing.

#### A8.18 SUBMITTALS

A. Shop drawings submittals shall include, but not be limited to, the following:

1. Cut sheets on all lighting fixtures with all accessories and details clearly indicated.
2. Cut sheets and complete technical data on ballasts, lamps, lens, poles, etc.
3. Photometric performance data.
4. Detailed information of the pole dimensions
5. Test reports and certificates of thickness of galvanising
6. Additional information as required.

#### A8.19 INSTALLATION

A. Mounting and installation of luminaires for street light and high mast lighting to be in accordance with the manufacturers recommendations. Due to the mounting height of the luminaires

#### A8.20 MOUNTING

A. Street light arms are inclined at  $15^{\circ}$  to the horizontal. If the luminaire offered is designed to be installed at  $0^{\circ}$  it shall have a mechanism to allow adjustment back to  $0^{\circ}$ . The luminaire shall be clearly marked with angles of inclination, and full details of how to adjust the angle of inclination shall be supplied. The angle of inclination must be clearly stated as this affects design data.

B. Luminaire entries shall be of a material that is inherently corrosion resistant and compatible with the galvanised mild steel supporting spigot to such a degree that deterioration by electrolytic action will not occur.

C. Spigot entries shall be designed to fit easily over the bracket pipe and shall be truly parallel to the fitting axis and shall comply with Table 1 of SANS 1088:1990 as follows:

a) For Type 2 luminaires (side entry), the inside diameter of the spigot entry shall be 50 mm to 55 mm.

D. The luminaire shall be secured on its spigot by at least two stainless steel M10 hexagonal-head screws as specified in ISO 4762. The construction of the housing shall be such that cracking cannot occur during the process of fixing the luminaire to the pole or bracket.

#### A8.21 GENERAL

The electrical subcontractor shall only commence with the installation of light poles or masts after the surrounding final civil finish level has been established or completed. The type of light fittings to be used are indicated and specified on both the relevant drawings as well as in the lighting schedule.

**Positions of light fittings:** The mounting positions of light fittings are indicated on the relevant drawings and shall be verified on site.

#### A8.22 GUARANTEE

A. All luminaires offered shall have a minimum guarantee period of five years. The scope of this guarantee includes the LED module drivers, luminaire housing, LED module(s), brackets, photoelectric control unit receptacle, protector lens. If luminaires are found to have failed within this period as a result of poor manufacturing processes and/or poor materials it shall be replaced free of charge by the manufacturer.



B. Luminaires bearing a date of manufacture exceeding four months prior to the date of delivery shall not be accepted.

## A9. LV CABLES

### A9.1 CODES AND STANDARDS

A. Codes and Standards: Cables supplied and installed shall comply with the following Acts and regulations:

1. The latest issue of SANS 10142-1: "Code of Practice for the Wiring of Premises- Part 1: Low Voltage Installations",
2. The Occupational Health and Safety Act, 1993 (Act 85 of 1993) as amended,
3. The Local Government Ordinance 1939 (Ordinance 17 of 1939) as amended and the municipal by-laws and any special requirements of the local supply authority,
4. The Fire Brigade Services Act 1993, Act 99 of 1987 as amend,
5. The National Building Regulations and Building Standards Act 1977 (Act 103 of 1977) as emended,
6. The Post Office Act 1958 (Act 44 of 1958) as amended,
7. The Electricity Act 1984 (Act 41 of 1984) as amended,
8. The Regulations of the local Gas Board where applicable.

B. Manufacturers: If they comply with these specifications and requirements, products of the following manufacturers will be acceptable:

**The manufacturer must be an ISO9001 certified company. Proof of certification is to be submitted together with the tender document, failing which the tender may be disregarded.**

**Products must carry the SABS mark or an international certification and approved for use in South Africa.**

**Installers must be certified or registered installers of the manufacturers or their representatives. Manufacturers or their representatives must also have registered offices in South Africa and the local office must carry sufficient stock and spare parts for the project.**

### A9.2 SUBMITTALS

Shop drawing submittals shall include, but not be limited to, the following:

1. The Contractor shall submit to the Engineer for review, a list of the proposed manufacturers of cables, cable lugs, cable connectors, and termination fittings listed herein. The Contractor may install cable, cable lugs, cable connectors, joints and termination fittings furnished by any manufacturer listed on the approved submittal.
2. Cut sheets on all conductors with manufacturers name, ratings and capacities, insulation characteristics, and available colours, clearly listed.
3. Cut sheets indicating all cable lugs, termination fittings, joints and cable connectors.
4. Cut sheets indicating types of conductor identification bands.
5. Additional information as required in the specification.

### A9.3 INSTALLATION - GENERAL

All cables laid directly in the ground shall be laid at a depth such that the vertical distance from the top of the cable to the finished ground surface is not less than the values given below:

Cables in open ground or under pedestrian paved areas      MV Cables      LV cables

Residential sites	800mm	450mm
Industrial sites	1000mm	500mm
Road Crossings	1100mm	1100mm
Railway crossings	1500mm	1500mm

Cables shall not be laid in the ground if any corrosive agent is found in the ground.

Before cable laying is commenced, all cable trenches shall be drained, the bottoms graded and compacted and all loose stones and similar debris removed.

Cable trench width for one or two cables shall be a maximum of 550mm. The width shall be increased as more cables are installed allowing for at least two cable diameter spacing for each cable added.

#### A9.4 HANDLING OF CABLE DRUMS ON SITE

**Note:** It is recommended that a correctly designed spreader must be used to load and unload the drums with a crane.

Every drum must be mounted on jacks or on a cable-drum trailer with a horizontal supporting beam of suitable size and strength to handle the width and weight of the drum. The drum may not be allowed to rotate freely when the cable is rolled off. (Free rotation causes the cable to twist and loosen the windings, which can cause the inside armouring/insulation of the cable to be stretched). The cable must enter the trench from the top of the reel. All cables ends including that left on the drum or in a trench must be sealed to prevent the penetration of moisture into the cable. The free cable end on the drum must be fastened to the side of the drum.

#### A9.5 CABLE LAYING

Cable rollers shall be used at all times to run out cables. Rollers shall be spaced so that the length of cable will be totally suspended during the laying operation.

Where cables have to be drawn through pipes or ducts, a suitable cable sock shall be used and care shall be exercised to avoid abrasion, elongation or distortion of any kind.

Where cables have to be drawn around corners, well lubricated securely fixed skid plates shall be used.

Cables shall be pulled into trenches etc, by hand or approved winch system only.

#### A9.6 SPACING OF CABLES

Cables installed in a common trench shall be laid parallel to each other spaced as follows:  
(LV: up to 1000V; MV: 1000V to 11000V)

LV/LV	:	2 x cable diameters
LV/MV	:	300mm minimum

When MV and LV cables have to be installed in the same trench, the MV cable shall be laid on the one side of the trench at a depth as specified and covered with soil. The LV cable shall be then laid on the other side of the trench at the depth specified. Cables shall not be buried on top of each other unless layers are specified. The minimum spacing between layers shall be 200mm.

Cables for telephones, communication systems and other low voltage systems (less than 50V) shall be separated from power cables by at least 1000mm. All control or pilot cables shall be laid at least 300mm from power cables.

#### A9.7 INSTALLATION IN BUILDINGS

Particular attention shall be paid to the application of grouping factors in respect of current rating and the appropriate spacing of cables shall be allowed.

Cables for services above 650 volts shall be run separately from all other cables with a minimum clearance of 2300mm. cables for service below 100 volts including sound and telephone systems shall also be segregated from all other cables.

All cables shall be adequately supported throughout their length as specified by the Wiring Regulations or, where not specified as recommended by the cable manufacturers. No joints shall be allowed in cables of less than 300m length, unless as specified or specifically approved.

Cable run indoors shall be supported on cable trays or cable rack, secured thereto by heavy duty plastic strapping. The cables shall be fixed at intervals not greater than those stipulated in SANS 10142 and shall be spaced sufficiently to avoid de-rating in terms of SANS 10142 – 1. Cables shall be individually fixed so that any one may be removed from a group without disturbing the others.

Every run of cable shall be a single length without joints. Save that where a run exceeds the general drum length of where the length of a run is increased after the cable is delivered on site, a through box will be permitted. Such through boxes shall be so placed as to afford easy access for maintenance and repair; when they are required in underground cable runs the contractor shall provide special cable markers to locate them.

All cable tails shall be provided with either cable lugs or ferrules as may be appropriate. At each sealing end straps-on cable markers shall be fixed, showing clearly and indelibly the number and size of cable cores and the destination of the cable.

#### A9.8 CABLES IN CONCRETE TRENCHES

In concrete trenches, cables shall be laid side by side on the bottom of the trench without cross-overs. When necessary to maintain spacing factors, cables shall be fixed to the sides of the trench using cleats as specified for installation above floor level.

#### A9.9 CABLES IN DUCTS

The total cross sectional area of all cables installed in a duct shall not exceed 50% of the internal cross sectional area of the duct. After installation of the cables, duct stoppers shall be fitted to each end of each duct run and at the entry to the building to effectively seal the duct from ingress of vermin, etc.

#### A9.10 CABLE ROUTES

Cables shall follow the routes shown on the drawings; the routes shall only be varied with the written permission of the Engineer. Where no routes are defined on the drawings the contractor may select routes to his reasonable preference but shall obtain written approval of them before installing the cables.

The contractor shall, before trenching commences, familiarizes him with the routes and site conditions and the procedure and order of doing the work shall be planned in conjunction with the general construction program for other services and building requirements.

The contractor shall acquaint himself with the position of all the existing services such as storm water pipes, water mains, sewer mains, gas pipes, telephone cables, etc. before any excavations are commenced. For this purpose he shall approach the Engineer's representative, the local municipal authority and any other authority which may be involved, in writing.

The Engineer reserves the right to alter any cable route or portion thereof in advance of cable laying. Payment in respect of any additional or wasted work involved shall be at the documented rates.

The removal of obstructions along the cable routes shall be subject to the approval of the Engineer.

#### A9.11 CABLE JOINTS

Cable joints shall be carried out strictly in accordance with the manufacturers instruction and by personnel competent in jointing the cables involved.

No joints in cable runs will be allowed unless a cable run exceeds the maximum length available on a cable drum (normally 300m)

The joint shall not impair the characteristics of the cable.

Joints shall be fully water and air tight and shall be free of voids and air pockets

The crossing of cores in joints shall not be permitted under any circumstances.

The contractor shall notify the Engineer timeously of the day on which jointing is to be carried out in order that the inspection may be arranged if so required. Any cable joint not inspected by the Engineer because of insufficient notice being given shall be opened for inspection and redone at the discretion of the Engineer and at the cost of the contractor.

#### A9.11.1 CONNECTION OF CABLE CORES

When cutting away insulation from cable cores to fit into lugs, care shall be taken that no strands are left exposed. Under no circumstances may any of the conductor strands be nicked or cut away to fit into lugs

Contact surfaces shall be thoroughly cleaned and smoothed and fixing bolts shall match the hole size of the lug.

Suitable lugs shall be crimped to cable core ends using mechanical or pneumatic tools designed for the purpose.

Cables that are connected to clamp type terminals where that clamping screws are not in direct contact with the conductor, need not be lugged but the correct terminal size shall be used.

Ferrules shall be used where cable cores are connected directly to equipment with screws against the conductor strands.

#### A9.12 TRENCHING

The contractor shall, before trenching commences, familiarise himself with the routes and site conditions. The procedure and order of doing the work shall be co-ordinated with the general construction programme.

Trenching shall be programmed in advance and the approved program shall not be departed from except with the consent of the Engineer.

The contractor will be held responsible for damage to any existing services brought to his attention by the relevant authorities and shall be responsible for the cost of repairs.

The contractor shall take all the necessary precautions and provide the necessary barriers, warning signs and/or lights to ensure that the public and/or employees on site are not endangered.

The contractor shall ensure that the excavations will not endanger existing structures, roads, railways, other site constructions or other property.

Trenches shall connect the points shown on the drawings in a straight line. The Engineer beforehand shall approve any deviations due to obstructions or existing services.

Trenches shall be as straight as possible and shall be excavated to a depth as indicated in this specification.

The excavated material shall be placed adjacent to each trench in such a manner as to prevent nuisance, interference or damage to adjacent drains, gateways, trenches, water furrows, other works, properties or traffic. Where this is not possible the excavated materials shall be removed from site and returned for back filling on completion of cable laying.

In the event of damage to other services or structures during trenching operations the contractor shall immediately notify the Engineer and institute repairs.

Prior to cable laying the trench shall be inspected thoroughly and all objects likely to cause damage to the cables either during or after laying shall be removed.

Where ground conditions are likely to reduce maximum current carrying capacities of cables or where the cables are likely to be subjected to chemical or other damage or electrolytic action, the Engineer shall be notified before installing the cables. The Engineer will advise on the course of action to be taken.

Extreme care shall be taken not to disturb surveyor's pegs. These pegs shall not be covered with excavated material. If the surveyor's pegs are disturbed, a person qualified to do so shall replace them.

The contractor shall ensure that the excavations will not endanger existing building structures, roads, railways, or other site construction or other property before excavating.

The contractor shall take all the necessary precautions and provide the necessary warning signs, barricades, shoring and/or lights to ensure that the public and /or personnel on site are not endangered.

Trenching crossing roads, footpaths or access ways shall not be left uncovered. If cables cannot be laid immediately, the contractor shall install sleeves or temporary "bridges" or cover plates, of sufficient strength to accommodate the traffic concerned.

The bottom of the trench shall be smooth and free of any sharp dips or rises which may cause tensile forces in the cable during backfilling.

The nature of the soil can be encountered is classified as follows:

- a) **Soft Soil:** Shall mean ground that can removed by pick and shovel and includes hand pickable soil that can be loosened by hand pick and includes hard shale, compact gravel stone and rocks up to 0.003 cubic meters in volume.
- b) **Soft rock:** Shall mean rock that can only be excavated by machine excavation and includes granite, quartzitic sandstone, slate and rock of similar or greater hardness, solid shale and boulders over 0.03 cubic meter in volume.
- c) **Hard Rock:** Shall mean rock that can only be excavated by explosives.

Should blasting be necessary, the contractor shall obtain all necessary authorities from the relevant departments and Local Authorities. The contractor shall take full responsibility and observe all conditions and regulations set forth by the above Authorities.

The necessary insurance cover must be obtained to cover possible damage and losses.

Blasting shall be subject to the approval of the Engineer.

#### A9.13 CABLE SLEEVES

Where cables cross under roads, railway tracks, other service areas, etc and where cables enter buildings, the cables shall be installed in heavy duty uPVC pipes. The sleeves shall be heavy duty class 34 uPVC sleeving with a wall thickness of not less than 1,5mm thick and a smooth finish inside. Roads and railway crossings shall be done at right angles.

Sleeves shall be a minimum diameter as specified and shall extend at least 1,0m beyond the road edge or kerb on either side of the crossing.

After installation of cables, the ends of all sleeves shall be sealed with a non-hardening watertight compound. All sleeves intended for future use shall likewise be sealed.

Where sleeves have to be built into structures by others, the Contractor shall supply the sleeves and ensure that they are installed correctly.

#### A9.14 CABLE INSTALLATION AND BACK FILLING

The Contractor is responsible to ensure that the cable is installed at the depths specified, Cables depths indicated from finished ground level (FGL) must be installed accordingly. It is the Contractor's responsibility to ensure that cable depths are measured from a finished final ground level. The contractor will be responsible to excavate and re-install the cable if this depth is not found to be correct.

Before the cable is laid into the trench, the bottom of the trench shall be filled across the full width with a 50mm layer of suitable sifted soil and levelled off. After cable laying, a further layer of bedding shall be provided to extend 50mm above the cables.

If there is no suitable soil available on site, the contractor shall import fill and make all the necessary arrangements to do so. The cost of importing soil for bedding purpose shall be included in the rates for excavations.

The bedding under joints shall be fully consolidated to prevent subsiding.

The contractor shall not commence with the back filling of trenches before the Engineer has inspected the cable installation. Should the Contractor fail to give timely notification, the trenches shall be re-opened at the Contractor's cost. Such an inspection shall not be unreasonably delayed.

Cables (1000V to 11000V) shall be provided with a yellow coloured plastic marking tape installed 400mm above the cable. The tape shall be marked with a red skull and crossbones with the words "Electric Cable". This marking tape shall be installed over the entire length of the cable.

The maximum accepted diameter of stones present in the back fill material is 75mm.

The backfill shall be compacted in 150mm layers and sufficient allowance shall be made for final settlement. The contractor shall maintain the refilled trench at his expense for the duration of the contract. The surface shall be made good to the same density and to match the surrounding areas on completion.

In the case of road ways or paved areas, the excavations shall be consolidated to the original density of the surrounding material and the surface finish reinstated.

#### A9.15 CABLE MARKERS

Cable markers shall consist of concrete blocks dimensioned as follows:

300mm high, 150mm x 150mm and 250mm x 250mm at the bottom.

A stainless steel plate for labelling shall be cast into the tops of the blocks in such a manner that they cannot be prised loose. The wording as follows as well as arrows indicating cable direction shall be clearly stamped on the plates.

- For MV and LV cable routes: "ELECTRICAL CABLES"
- For joint positions: "ELECTRIC CABLE JOINT"

Cable markers shall be installed on the surface along all the underground routes and shall project 50mm above finished ground level. If the projected markers could be a hazard to pedestrians or other traffic, they shall be installed flush with the surface.

Cable markers shall be installed at all change in direction, at the beginning and the end of cable runs (i.e. where a cable enters a substation or building), above all joints, above cable pipe entries and exits and at intervals not exceeding 50m along the cable route. The position of cable markers shall be indicated on the "as built" drawings.

#### A9.16 TESTING - GENERAL

LV cables shall be tested by means of a suitable megger at 1kV and the insulation resistance shall be tabulated and certified.

The contractor shall make all arrangements, pay all fees and provide all equipment for these tests. The cost of testing shall have been included in the tender price.  
The contractor shall notify the Engineer and if applicable the Supply Authority timeously so that their representative may witness the tests.

On completion of the tests on any cable, the contractor shall without delay submit three (3) copies of the certified test results to the Engineer.

The contractor shall provide all the testing equipment as required for the respective tests.

## **A10. SWITCHBOARDS AND DISTRIBUTION BOARDS**

### **A10.1 CODES AND STANDARDS**

A. Codes and Standards: Cables supplied and installed shall comply with the following Acts and regulations:

- a) The latest issue of SANS 556: "Low-voltage switchgear Part 1: Circuit-breakers
- b) The latest issue of SANS 1765: "Low-voltage switchgear and controlgear assemblies (distribution boards) with a rated short-circuit withstand strength up to and including 10 kA"
- c) The latest issue of SANS 60439: 1-5: "Low-voltage switchgear and controlgear assemblies",
- d) The latest issue of SANS 60947: 1-8: "Low-voltage switchgear and controlgear",
- e) The latest issue of SANS 1973: "Low-voltage switchgear and controlgear ASSEMBLIES Part 1-8",
- a) The latest issue of NRS 003: "Metal-clad switchgear - For rated a.c. voltages above 1 kV and up to and including 24 kV Part 2: Standardized panels
- b) Codes and standards as per Section 002: Design Criteria.

B. Manufacturers: If they comply with these specifications and requirements, products of the following manufacturers will be acceptable:

**The manufacturer must be an ISO9001 certified company. Proof of certification is to be submitted together with the tender document, failing which the tender may be disregarded.**

**Products must carry the SABS mark or an international certification and approved for use in South Africa.**

**Installers must be certified or registered installers of the manufacturers or their representatives. Manufacturers or their representatives must also have registered offices in South Africa and the local office must carry sufficient stock and spare parts for the project.**

### **A10.2 DISTRIBUTION SWITCHBOARDS**

A. Distribution switchboards shall have construction with group mounted circuit protective devices and include the following:

- 1. Switchboard
- 2. Circuit Protective Devices

B. Switchboards shall consist of the required number of vertical sections bolted together to form one metal enclosed rigid switchboard for circuit protective devices and busbar work. Front and side plates shall be screw removable.

C. Switchboards shall be designed as freestanding switchgear with front only access or otherwise noted on the drawings. This switchgear shall be designed with group mounted devices and isolated busbars, expandable for future sections by the addition of simple splice plates on the horizontal busbar. An air space of at least 50mm or a minimum 3mm thickness insulating barrier shall be provided between end of bus bar and end panel. Switchboard shall be front and rear aligned to a common depth. Switchboard shall be of indoor switchboard construction.

D. The switchboard shall include all protective devices and equipment as shown with necessary interconnections, instrumentation, and control wiring. Small wiring, necessary fuse blocks, and terminal blocks within the switchboard shall be furnished. All groups of control wires leaving and switchboard shall be furnished with terminal blocks with suitable numbering strips. All wiring within switchboard enclosure shall utilize insulated copper conductors.

E. Enclosure Construction:

1. Switchboard framework shall be fabricated on a preformed steel base, or base assembly, consisting of a minimum of 1.6mm corrosion resistant mild steel and commercial channel welded or bolted together to rigidly support the entire shipping unit for moving on rollers and floor mounting. The framework shall be formed of gauge mild steel, rigidly welded and bolted together to support all cover plates, busbars, and component devices during shipment and installation.

2. Each switchboard section shall have an open bottom and individually removable top plates for installation and termination of cables and conduit. Top and bottom conduit areas shall be clearly shown and dimensioned on the shop drawings. All closure plates shall be formed up on all sides, screw removable and small enough for easy handling by one man.

3. All steel surfaces shall be chemically cleaned and treated to provide a bond between paint and metal surfaces to prevent moisture entrance and rust formation under the paint film. The paint finish shall be two (2) coats of gray enamel over a rust-inhibiting phosphate primer. Baked enamel finish is acceptable if applied to properly prepared surface.

F. The switchboard shall be completely assembled, wired, adjusted and tested at the factory. After assembly, the complete switchboard will be tested for operation under simulated service conditions to assure the accuracy of the wiring and the functioning of all equipment. The main circuits shall be given a dielectric test of 2200 Volts for one minute between live parts and ground and between opposite polarities.

The wiring and controls shall be given a dielectric test of 1500 Volts for one minute between live parts and ground. A certified test report shall be available to the engineer for approval.

G. Busbars:

1. The switchboard busbars shall be 98% conductivity copper with bolted joint connections and of sufficient cross-sectional area to continuously conduct rated full load current with a maximum temperature rise of 65°C above an ambient temperature of 40°C. The switchboard shall have a full size, full length isolated neutral bus and a full-length copper earth bars.

2. The bus bars shall be rigidly braced to comply with the integrated equipment rating of the switchgear. The minimum interrupting current rating shall not be less than 65,000 AMPS symmetrical. The main horizontal bus bars between sections shall be located on the back of the switchboard to permit maximum available conduit area. Busbar supports shall be non-carbonizing, non-tracking insulators arranged to provide short circuit bracing as specified. All bolted joint hardware shall be equipped with lock washers and torqued to the Manufacturer's recommended settings. Bolted joint connection surfaces for copper busbars shall be silver plated.

Torque settings shall be provided for use during installation.

3. Busbars shall be arranged A-B-C, left-to-right, top-to-bottom, and front-to-rear, throughout. A ground busbar shall be secured to each vertical section structure and extend the entire length of the switchboard.

112

319



4. Where "space" is shown on one-line drawings, space shall be provided for installation of future switches, sized as shown.

5. Distribution feeder conductors shall be terminated on the "load side" of switchboard devices with hydraulically applied, high conductivity, compression lugs approved for the purpose. Where conductor connections are required to the main bus, they shall be made with copper bodied compression connectors.

H. Integrated Equipment Rating: Each switchboard, as a complete unit, shall be given a single integrated equipment rating by the manufacturer. The integrated equipment short-circuit rating shall certify that all equipment is capable of withstanding the stresses of a fault equal to that shown on the drawings, in RMS symmetrical amperes. Such ratings shall have been established by actual tests by the manufacturer, in equipment of similar construction as that of the project switchboard. This test data shall be available and furnished, if requested, with or before the submittal of shop drawings.

I. Electronic Power Monitoring System:

1. Each switchboard shall be provided with an electronic circuit monitoring system.

2. The Circuit Monitor shall accept inputs from industry standard instrument transformers. The current and voltage signals shall be digitally sampled at a rate high enough to provide accurate RMS sensing and valid data for wave form analysis beyond the 30th harmonic based on a fundamental frequency of the 50 Hz. All set-up parameters required by the Circuit Monitor shall be stored in non-volatile memory (no backup battery) and retained in event of a control power interruption. The instantaneous values and the time and date for the highest peak of all demand readings shall also be maintained in non-volatile memory.

3. The Circuit Monitor shall have capability to perform the following readings:

- a. Current per Phase RMS ( $\pm 1\%$ ).
- b. Three Phase Average RMS Current ( $\pm 1\%$ ).
- c. Apparent RMS Current ( $\pm 1\%$ ).
- d. Phase-to-Phase and Phase-to-Neutral Voltage ( $\pm 1\%$ ).
- e. Three Phase and per Phase Power Factor ( $\pm 2\%$ ).
- f. Three Phase Real and Reactive Power ( $\pm 2\%$ ).
- g. Three Phase KVA ( $\pm 2\%$ ).
- h. Frequency ( $\pm 0.5\%$ ).
- i. Temperature ( $\pm 2-1/2^{\circ}\text{C}$ ).
- j. Average Demand Current per Phase ( $\pm 2\%$ ).
- k. Peak Demand Current per Phase ( $\pm 2\%$ ).
- l. Average Real Power Demand ( $\pm 2\%$ ).
- m. Predicted Real Power Demand ( $\pm 2\%$ ).
- n. Peak Real Power Demand ( $\pm 2\%$ ).
- o. Accumulated energy ( $\pm 2\%$ ).
- p. Accumulated reactive energy ( $\pm 2\%$ ).

4. The Circuit Monitor waveform capture capability shall, upon user command, capture and store, in non-volatile memory, three phase voltage and current samples consisting of 256 data points each.

The data points shall represent at least three cycles of each current or voltage waveform. The samples shall be evenly gathered from each voltage and current phase input such that the original power signals with proper magnitude and phase relationships may be reconstructed. It shall be possible to recreate the original power signal from the stored data with sufficient accuracy such that steady-state power harmonic analysis will provide valid information on harmonic content up to the 30th harmonic.

5. All data and calculated values stored in the Circuit Monitor shall be accessible to external devices by means of a built-in RS485/RS422 serial communications port. It shall be possible to connect from one communication port to another such that up to 16 Circuit Monitors may be connected to form a continuous string extending up to 1000m. These strings shall form

individual data transfer networks that comply with the RS485 multi-drop communications standards.

Communication rates for each circuit monitor shall be adjustable up to 19,200 Baud.

6. Circuit Monitors shall be installed by the switchboard manufacturer. All control power, CT, PT, and communications components shall be factory wired and harnessed within the switchboard line-up.

The Circuit Monitor shall be mounted on the front panel of the main switchboard incoming line compartment.

#### A10.3 SUBMITTALS

A. Shop drawing submittals shall include, but not be limited to, the following:

1. Switchboard shop drawings with all busbar and switch ratings, capacities, characteristics, features and associated accessories clearly indicated.
2. The minimum setting of the earth fault devices and the recommended setting for normal building operation.
3. Sufficient information to show that switchboard overcurrent protection devices have been fully coordinated with load side overcurrent protection devices and the Supply Authorities primary overcurrent protection. This shall include time/current curves and trip settings.
4. Equipment room layout showing switchboards, panelboards, motor control centres, etc., with required clearances as specified in the SANS codes.

#### A10.4 INSTALLATION

A. Install switchboard where shown, in accordance with the manufacturer's written instructions and recognized industry practices to ensure that the switchboards comply with the requirements and serve the intended purposes.

B. Install switchboard on a nominal 100 mm high reinforced concrete housekeeping pad. The housekeeping pad shall extend 80 mm beyond the housing of the switchboard unless shown otherwise. The entire assembled switchboard shall be anchored to continuous 40 mm x 150 mm channels for the full length.

The channels shall be embedded in the concrete housekeeping pad. Bolt studs shall be at least 10 mm in diameter and located not more than 750 mm apart centre to centre. The mounting channels shall be continuous single-piece structural channels and shall be levelled when embedded in the concrete housekeeping pads. The channel and bolt studs shall be furnished and installed by the Electrical Contractor.

#### A10.5 EQUIPMENT OF SWITCHBOARDS AND DISTRIBUTION KIOSKS

The fault-breaking capacity of each breaker shall be certified by IEC test to be not less than the prospective fault levels marked on the wiring schedules. When used as main L.T. switches protecting transformers, they shall be submitted to the Supply Authority for trip testing.

Moulded case circuit-breakers shall comply with IEC 157-1 or SANS 156:2007 as amended, shall be of fixed or draw-out execution as set out in the Project Specification. It shall have fault-breaking capacities certified by I.E.C. test to be equal to or greater than the prospective fault levels marked on the wiring schedules. Wherever possible, circuit breakers shall bear the SABS mark.

Miniature circuit-breakers shall comply with SANS 156:2007 as amended and shall bear the SABS mark. The fault-breaking capacity of miniature circuit breakers shall be certified by SABS test to be not less than the values set out in the wiring schedules.

Current-limiting circuit breakers, suitably certified, are acceptable in all cases.

313

313 313

In general circuit-breaker overload trip systems of the thermal or hydraulic-magnetic types are equally acceptable. In cases where high ambient temperatures or widely varying extremes of ambient temperature are expected hydraulic-magnetic devices shall be preferred; alternatively thermal devices with ambient temperature compensation may be offered. Where circuit breakers have to sustain motor-starting currents and the like, circuit breakers shall be hydraulic-magnetic with appropriate tripping characteristics. Where described in the Project Specification as being for short-circuit protection only, the circuit breakers shall be supplied without overload trip devices.

Switches shall comply with the requirements of SANS 60947 as amended and shall be capable of safely making onto fault currents of the magnitudes shown on the wiring schedules. Main switches of distribution boards shall additionally comply with the requirements of SANS 60947 applicable to switch-disconnectors. The main switches shall be rated for uninterrupted duty. Other switches shall be rated for 8-hour duty - the utilization category shall in all cases be AC22. All switches and switch-disconnectors shall bear the SABS mark.

Contactors shall comply with SANS 60947 and shall be rated to perform not less than 1 000 000 operations at the current ratings and duties quoted on the wiring schedules. They shall be so fixed as to ensure adequate coil ventilation. Contactors shall comply with the detailed requirements set out later in this Specification.

The internal wiring of switchboards shall be done with colour-coded PVC-insulated stranded conductors and shall include all phase, neutral, earth and control wires between equipment and to terminal blocks. Wiring channels shall be made spacious enough to permit the easy passage of all circuit wiring with adequate spacing between different circuits to promote ventilation. All the wires of each circuit or sub-circuit shall be braided together with approved strapping and shall be so arranged as to permit any individual circuit to be examined or renewed without disturbing any other circuits. Stranded conductors shall be terminated in crimped lugs of ferrules; manual crimping shall be done with makers' special tools which will not release until the full crimping pressure has been achieved; the ends of conductors from 50mm<sup>2</sup> cross-sectional areas upwards shall be crimped by hydraulic machine.

**A10.6 SPARE SPACE**

All distribution boards shall be of adequate size to accommodate specified equipment and a minimum of 30% spare capacity shall be allowed for future equipment unless specifically stated in the detail specification.

**A10.7 LABELS AND LEGENDS**

All labels shall be of plastic "sandwich board" material, the legends being engraved through the front plastic layer to the contrasting inner layer.

The lettering of legends shall not be less than 6mm high in sans-serif capitals; white lettering on black ground or black lettering on white ground shall be selected as necessary to ensure maximum legibility and contrast with the switchboard finish. All labels shall be secured by at least two bolts or rivets per label and shall be accurately level and central over their subjects.

**A10.8 BUSBARS**

Bus bars shall be of copper or aluminium and shall comply with SANS 1195 as amended. Copper bus bars shall be tinned after fabrication; the current ratings shall be those assigned by the Copper Development Association. Multiple bars shall be arranged with air gaps between the sections, equal to the section thickness. Insulating busbar supports shall be provided at intervals related to the prospective short-circuit fault currents, the following table being a guide for single-section bus bars:

BUSBAR SECTION mm x mm	kA at 400 V FOR INSULATING SPACINGS OF			
	450mm	610mm	760mm	915mm
25 x 9,5	29	21	17	14
40 x 9,5	47	35	27	23
50 x 9,5	55	47	39	33



314 ~~413~~

75 x 9,5	61	53	47	43
100 x 9,5	67	58	52	47

#### A10.9 COLOUR FINISH

The front panels of normal supply, standby power and no-break supply sections shall be painted in distinctive colours as follows:

Normal supply : Light Orange, colour B26 of SANS 1091.  
Standby power : Signal Red, colour A11 of SANS 1091.  
UPS supply: Light Blue, colour of SANS 1091.

Refer to the DB schematic for details. The DB manufacture to supply three (3) x sets of drawings for approval prior to manufacture.

#### A10.10 RECESSED AND SEMI-RECESSED DISTRIBUTION BOARDS

A. Distribution boards shall consist of the following parts:

The bonding tray shall be constructed from 1,60 mm corrosion resistant mild sheet steel. Bracing gussets with cam-shaped slots shall be welded on the four corners. Knock-outs shall be provided in the upper and lower sides of the distribution boards. Expanded metal shall be spot-welded to the back of all bonding trays for 102,5 mm thick walls.

The architrave frame shall be constructed from 1,20 mm sheet steel with square edges.

The architrave frame shall form 25 mm border around bonding tray and shall be fixed to the tray in such a manner as to allow for adjustment for the inequalities in wall the finish.

A minimum of 75 mm shall be allowed between the inside of the architrave frame and the equipment. Distribution board numbers consisting of white engraved lettering on a black background shall be fixed to the top of the architrave frame.

Doors shall be constructed from 1,20 mm sheet steel, reinforced to ensure rigidity.

Doors shall be mounted flush in architrave frames. Door catches shall be constructed of chromium-plated brass and shall be mounted flush in the door. Built-in locks shall be provided when specified in the distribution board schedule.

The chassis shall be fixed to the architrave frame. The chassis shall be reinforced, with the necessary provision for fixing of the switchgear. A distance of 75 mm shall be allowed between rows of equipment.

Panels shall be rigidly constructed from 1,6 mm sheet steel with machine-cut openings for flush mounted equipment. Panels shall be fixed to the architrave frame on studs with chromium plated hexagon dome headed nuts, or captive fasteners such that a clearance of 40 mm is maintained between panels and doors. Chromium-plated handles shall be supplied to facilitate removal of panels.

Busbars shall be of tinned HDHC solid copper with adequate cross-section and shall only be supplied if called for in the Schedules. Busbars are to be mounted on suitable isolators and shall be drilled and tapped.

Each distribution board shall be supplied with copper neutral and earth bars. Adequate terminals shall be provided.

Each busbar must be supplied with one larger terminal for the feeder cable.

Wiring shall be by means of PVC insulated conductors with sizes to suit the relevant switchgear. The ends of wires shall be provided with suitable lugs, firmly crimped or soldered for connection to busbars.

Wiring shall, where possible, be carried out in front of the chassis and shall be neatly bound in horizontal and vertical rows by means of approved plastic cable ties. Wiring shall be kept free of any current carrying parts.

Ends of wires which are connected to the clamps of miniature circuit breakers, shall be turned together firmly before insertion into terminals.

Finish: Welding joints and steelwork shall be ground smooth and free from blemishes.

Metal components of the framework, panels and chassis, shall be painted in accordance with the procedure detailed below. Baked enamel or electrostatically applied powder coating may be used.

1. Surface preparation: Prior to painting, all metal parts shall be thoroughly cleaned of rust, millscale, grease and foreign matter to a continuous metallic finish. Sand or shot blasting, or acid pickling and washing may be employed for this purpose.

2. Baked enamel finish: Immediately after cleaning all surfaces shall be covered by a rust inhibiting, tough, unbroken metal phosphate film and then thoroughly dried to SANS 10064. Within forty eight (48) hours after phosphating, a passivating layer consisting of a high quality zinc chromate primer shall be applied, followed by two (2) coats of high quality baked enamel to SANS 2808 Codes. The minimum paint thickness after baking shall be 0,6 mm. The paint shall have a shock resistance of 25 kg-cm on 0,9 mm soft steel plate and a scratch resistance of 2 kg.

3. Powder coated finish: Immediately after cleaning the metal parts shall be pre-heated and then covered by a micro structured paint powder applied electrostatically. The paint shall be baked on and shall harden within 10 minutes at a temperature of 190°C. The minimum paint thickness after baking shall be 0,05 m and the paint cover shall have a shock resistance of 25 kg-cm on 0,9 mm soft steel plate and a scratch resistance of 2 kg.

#### A10.11 SURFACE MOUNTED DISTRIBUTION BOARDS

Surface mounted distribution boards shall comply with SANS 60456 and shall be similar to the specification for flush mounted boards, except that the architrave frames and bonding trays are not required. In this case a box shall be supplied manufactured from 1,60 mm corrosion resistant sheet steel with knock-outs at the top and bottom for conduit entry. The board shall have a 25 mm wide frame around the flush mounted door, if required.

#### A10.12 TRAINING

A. Installation of the switchgear shall require no special tools. Product training shall be made available at the purchaser's facility if required.

### A11. CONDUIT AND OUTLET BOXES

#### A11.1 CODES AND STANDARDS

A. Codes and Standards: The conduit and conduit accessories shall comply fully with the applicable SANS specifications as set out below and the conduit shall bear the mark of approval of the South African Bureau of Standards.

- n) The latest issue of SANS 60614 and SANS 61035, parts 1 and 2: Metallic conduit and accessories
- o) The latest issue of SANS 950: Non-metallic conduit and accessories

B. Manufacturers: If they comply with these specifications and requirements, products of the following manufacturers will be acceptable:

**The manufacturer must be an ISO9001 certified company. Proof of certification is to be submitted together with the tender document, failing which the tender may be disregarded.**

**Products must carry the SABS mark or an international certification and approved for use in South Africa.**

**Installers must be certified or registered installers of the manufacturers or their representatives. Manufacturers or their representatives must also have registered offices**

918

316 316

in South Africa and the local office must carry sufficient stock and spare parts for the project.

#### A11.2 CONDUIT AND ACCESSORIES

The type of conduit and accessories required for the service, i.e. whether the conduit and accessories shall be of the screwed type, plain-end type or of the non-metallic type and whether metallic conduit shall be black enamelled or galvanised, is specified in the particular specification.

Electrical and ICT distribution within buildings shall be as follows:

- Cable trays – in open areas and accessible ceilings
- Cable Baskets – in accessible ceilings
- PVC Conduits – in accessible ceilings and hidden conduits
- Galvanised steel conduits – exposed and surface mounted

Unless other methods of installation are specified for certain circuits, the installation shall be in conduit throughout. No open wiring in roof spaces or elsewhere will be permitted.

All conduit fittings, except couplings, shall be of the inspection type. Where cast metal conduit accessories are used, these shall be of malleable iron. Zinc base fittings will not be allowed.

Bushes used for metallic conduit shall be provided in addition to locknuts at all points where the conduit terminates at switchboards, switch-boxes, draw-boxes, etc.

Draw-boxes are to be provided in accordance with the "Wiring Code" and wherever necessary to facilitate easy wiring.

For light and socket outlet circuits, the conduit used shall have an external diameter of 20mm. In all other instances the sizes of conduit shall be in accordance with the "Wiring Code" for the specified number and size of conductors, unless otherwise directed in the particular specification or indicated on the drawings.

Only one manufactured type of conduit and conduit accessories will be permitted throughout the installation.

Running joints in screwed conduit are to be avoided as far as possible and all conduit systems shall be set or bent to the required angles. The use of normal bends must be kept to a minimum with exception of larger diameter conduits where the use of such bends is essential.

Under no circumstances will conduit having a wall thickness of less than 1,6mm be allowed in screeding laid on top of concrete slabs.

Bending and setting of conduit must be done with special bending apparatus manufactured for the purpose and which are obtainable from the manufacturers of the conduit systems. Damage to conduit resulting from the use of incorrect bending apparatus or methods applied must on indication by the Engineers inspectorate staff, be completely removed and rectified and any wiring already drawn into such damaged conduits must be completely renewed at the Contractor's expense.

Conduit and conduit accessories used for flame-proof or explosion proof installations and for the suspension of luminaires as well as all load bearing conduit shall in all instances be of the metallic screwed type.

All conduit and accessories used in areas within 50 km of the coast shall be galvanised to SANS specifications.

Tenderers must ensure that general approval of the proposed conduit system to be used is obtained from the local electricity supply authority prior to the submission of their tender. Under no circumstances will consideration be given by the Employer to any claim submitted by the

317 318

Contractor, which may result from a lack of knowledge in regard to the supply authority's requirements.

### A11.3 SCREWED METALLIC CONDUIT AND ACCESSORIES

Screwed metallic conduits shall comply with SANS 60614 and shall bear the SABS mark. Screwed metallic conduits shall comprise of a heavy gauge, welded or solid drawn, black enamelled or hot-dipped galvanised, screwed steel tube.

Galvanised conduits shall be hot-dipped on both the inside and outside thereof, in accordance with SANS 121.

All conduit ends shall be reamed and threaded on both sides and shall be delivered to site with a steel coupling fitted at one end and a plastic screw on cap on the opposite end.

All screwed metallic conduit accessories shall be of malleable cast iron or pressed steel with brass bushes and all accessories shall be in accordance with SANS 60614 Part II. No alloy or pressure cast metal accessories or zinc base alloy fittings will be accepted.

All accessories whether galvanised or black enamelled shall be supplied with brass screws.

Locknuts are to be of the narrow, hexagonal type. Ring type lock nuts shall not be accepted except when used in round grouping boxes.

Bushnuts and male or female conduit bushes shall be manufactured from solid brass. Brass alloy bushnuts and bushes shall not be accepted.

In general screwed steel conduit shall be used in the wiring of buildings. The installation shall conform to requirements of SANS 10142. All joints in conduit tubing shall be red leaded to prevent rust. Galvanised conduit and accessories shall be used in the following circumstances and normally be electro-galvanised or cadmium plated:

- 1) In damp areas
- 2) In areas exposed to the weather
- 3) For all installations within 50 km of the coast. (These conduits and accessories shall be hot-dip galvanised to SANS 121).
- 4) In plenum chambers containing humidifying equipment.
- 5) For surface mounted conduit installations in kitchens and boiler rooms.
- 6) In screed resting directly on soil.
- 7) For connection points to future installations.
- 8) For underground conduit containing earthing conductors.
- 9) In buildings where animals are housed such as cattle, sheep, dogs, etc.

Screwed conduits shall be terminated by means of a brass female bush and two lock nuts in pressed steel switchboards and distribution boxes, cable ducts, power skirting, etc. The conduit end shall only project far enough through the hole to accommodate the bush and locknut.

A female bush and two lock nuts shall be used to terminate conduits at draw boxes and outlet boxes without spouts should there be sufficient room in the box. Where there is insufficient room, a coupling, brass male bush and locknut may be used with sufficient allowance for the reduction of the internal diameter by the male bush. Mechanical and electrical continuity shall be maintained throughout the conduit installation. The resistance of a completed joint shall not exceed 0,2 ohm. Under no circumstances shall conduit be relied upon for earth continuity

### A11.4 PLAIN-END METALLIC CONDUIT AND ACCESSORIES

As an alternative to threaded metallic conduit, plain-end or unthreaded metallic conduit and accessories may be used. Plain-end conduit shall be manufactured from mild steel having a minimum wall thickness of 0,9 mm and shall comply with SANS 60614. Bending and setting of plain-end conduit shall be undertaken using the correct bending apparatus as recommended by the manufacturer of the conduit.

Galvanised conduits shall be hot-dipped on both the internal and external surfaces, in accordance with SANS 121. All plain-end metallic conduit accessories shall be of malleable cast iron or pressed steel and shall comply to SANS 60614.

Where specified plain-end conduit shall be installed. The following shall apply:

Bending and setting of plain-end conduit shall be done with special benders and apparatus manufactured for this purpose. Damaged conduit resulting from the use of incorrect bending apparatus shall be completely removed and rectified at the electrical contractor's expense.

#### A11.5 PVC CONDUIT AND ACCESSORIES

PVC conduit shall comply with SANS 950 and shall bear the SABS mark. PVC conduit shall be constructed from rigid PVC and shall be supplied in standard 4 metre lengths. PVC conduit shall be white in colour and shall be nonflammable. The minimum softening temperature shall be at 75°C.

All PVC conduit accessories shall be fully in accordance with SANS 950 and shall bear the SABS mark.

Where specified for a particular service, PVC conduit shall be installed.

All PVC conduit shall be installed in accordance with SANS 950. Insulated heat-resistant boxes shall be used for outlets of totally enclosed luminaires and other fittings where excessive temperatures are likely to occur. Luminaires and other fittings shall not be supported by PVC conduit of conduit boxes.

These fittings shall be secured to the surrounding structure in an acceptable way.

#### A11.6 FLEXIBLE CONDUIT

Flexible steel conduit and adaptors shall comply with BS 731, part 1 where applicable. Flexible steel conduit shall be of a galvanised steel construction which is not required to be waterproof, but shall be verminproof and suitable for protection of cables against mechanical damage. In moist or damp areas flexible steel conduit shall be of the plastic sheathed galvanised steel type. Flexible polypropylene tubing shall only be fastened to PVC conduit installations.

In installations where the equipment has to be moved frequently to enable adjustment during normal operation, for the connection of motors or any other vibrating equipment, for the connection of thermostats and sensors on equipment, for stove connection and where otherwise required, flexible conduit shall be used for the final connection to the equipment.

Flexible conduit shall be connected to the remainder of the installation by means of a draw box. The flexible conduit may be connected directly to the end of a conduit if an existing draw box is available within 2 m of the junction and if the flexible conduit can easily be rewired.

Flexible conduit shall consist of metal reinforced plastic conduit or PVC covered metal conduit with an internal diameter of at least 15 mm, unless approved to the contrary. In false ceiling voids, flexible conduit of galvanised steel constructions may be used. Connectors for coupling to the flexible conduit shall be of the gland or screw-in type, manufactured from either brass or mild steel plated with zinc or cadmium.

#### A11.7 EARTH CLAMPS

Earth clamps shall comprise of copper strips having a minimum thickness of 1 mm and shall not be less than 12 mm wide. Earth clamps shall be provided complete with a 25 mm x 4 mm brass bolt, washer and nut and shall be constructed so that the clip can be firmly attached to the conduit without the need for any additional packing.

#### A11.8 FLUSH MOUNTED STEEL WALL BOXES

Flush mounted steel wall boxes shall be manufactured from heavy gauge sheet steel and shall be galvanised. All wall boxes shall comply with SANS 1085. The boxes shall be provided with the necessary mounting lugs to suite the units for which the box is intended. Mounting highs shall be drilled and tapped at 82,5 mm centres suitable for fastening either flush mounted switch and socket outlet units. All fastening screws shall be provided with the box. Single gang wall boxes shall be approximately 500 mm wide by 100 mm long by 50 mm deep, with one knock-out at each end and at the back, and with two knock-outs on each side thereof. Double gang wall boxes shall be approximately 100 mm wide by 100 mm long by 50 mm deep, with two knock-outs on each end and with at least two knock-outs on the back, and on each side. All knock-outs are to be suitable for making-off 20 mm diameter conduits.



#### A11.9 FLUSH MOUNTED PVC WALL BOXES

Flush mounted PVC wall boxes shall be manufactured from rigid PVC and shall be white in colour. All PVC wall boxes shall comply with SANS 950. The boxes shall be provided with the necessary mounting lugs to suite the units for which the box is intended. Mounting lugs shall be drilled at 82,5mm centres and shall be provided with no 6 screw threads.

The boxes shall be of approximately the same physical dimensions as those specified for steel wall boxes and shall have 20 mm knock-outs. Facilities shall be provided for the fixing of earth terminals to the box.

#### A11.10 ROUND GROUP-TYPE STEEL BOXES

The boxes shall be manufactured in accordance with SANS 1085 where applicable. The boxes shall be of the long spout pattern and shall be constructed from either store enamelled jet black or galvanised steel, or from malleable cast iron. The two cover fixing holes shall be diagonally opposite each other, and shall be drilled and tapped at 50 mm centres. The internal dimensions shall be approximately 60 mm in diameter by 60 mm deep for use in concrete work. Shallower boxes shall be used in open roof spaces.

Threaded spouts shall be suitable for 20 mm diameter conduit. Round box covers shall be constructed from pressed enamelled or galvanised steel and shall be seared by using brass screws.

#### A11.11 ROUND GROUP-TYPE PVC BOXES.

The boxes shall be similar in shape to those specified for steel boxes and shall have spouts which are to be reinforced with webs. The cover screw pillars shall be provided with tapped brass inserts and provision shall be made for a brass earthing terminal adjacent to one or both of the pillars. PVC round box covers shall be of PVC and shall be secured by means of 2 cadmium plated or brass screws at 50 mm centres. The boxes shall be fully in accordance with SANS 950.

#### A11.12 DRAW WIRES

All draw wires for unused conduits shall comprise of galvanised steel wire having a minimum diameter of 2 mm.

#### A11.13 INSTALLATION REQUIREMENTS

All accessories such as boxes for socket outlets, switches, lights, etc shall be accurately positioned. It is the responsibility of the electrical contractor to ensure that all accessories are installed level and square at the correct height from the floor, ceiling or roof level as specified. It shall be the responsibility of the electrical contractor to determine the correct final floor, ceiling and roof levels in conjunction with the principle contractor. Draw boxes shall not be installed in positions where they will be inaccessible after completion of the installation. Draw boxes shall be installed in inconspicuous positions to the approval of the engineer's representative and shall be indicated on the "as built" drawings. Galvanised steel draw wires shall be installed in all unwired conduit, e.g. conduits for future extensions, telephone installations and other services. The edge of flush mounted outlet boxes shall not be deeper than 10 mm from the final surface. Spacer springs shall be used under screws where necessary. Oversize cover plates shall be provided on all flush mounted round conduit boxes, where required. Surface mounted boxes shall be provided with standard size cover plate.

#### A11.14 INSTALLATION IN CONCRETE

In order not to delay building operations, the electrical subcontractor shall ensure that all conduits and accessories which are to be cast in concrete are placed in position in good time. The electrical contractor or his representative shall be in attendance when the concrete is cast. Draw boxes, expansion joints and round ceiling boxes shall be installed where required and shall be neatly finished to match the finished slab and wall surfaces. Ceiling draw boxes shall be of the

313

320 313