BRISBANE CITY COUNCIL
DEPARTMENT OF WATER SUPPLY AND SEWERAGE
MECHANICAL AND ELECTRICAL BRANCH
ELECTROLYSIS SECTION
EAGLE FARM PUMPING STATION

OPERATING MANUAL FOR:

BOGNOR ST SUBMERSIBLE PUMP STATION
CATHODIC PROTECTION SYSTEM

CLIENT:

DEPARTMENT OF WATER SUPPLY AND SEWERAGE
SEWERAGE OPERATIONS BRARCH

4TH MARCH 1994

MANUAL CONTENTS

(1.0) INTRODUCTION

Steel when buried or immersed has a tendancy to corrode (rust) as the oxidised form is more stable than the metal.

Because of this, precautions must be taken to stop or minimise the corrosion reaction to an acceptable level consistent with the design life of the structure. This is normally achieved by the use of protective coatings which control the corrosion reaction by isolating the steel from its surrounding environment.

However, it is not practicable to expect a perfect coating during construction and coating damage will also occur with time. Because of this, corrosion may occur at imperfections.

(2.0) CORROSION AND CATHODIC PROTECTION

Corrosion is an electrochemical process in that it is accompanied by a flow of electrical current.

Corrosion occurs on the surface of metals at active areas known as anodes, which are electrically continuous with less active or passive areas known as cathodes. The electric current flows from the anode through the electrolyte to the cathode, with the circuit being completed by the electrical continuity between the cathode and anode. In practice anodes and cathodes are generally part of the same metallic surface and individual anodic areas may be small.

In applying cathodic protection, an external current is applied to the surface so that the entire surface to be protected acts as a cathode. This involves the use of an auxiliary anode and when the current flow from this anode is sufficient, no part of the structure acts as an anode.

An external source of direct current such as a transformer rectifier is used in conjunction with an anode consisting of material with a very low corrosion rate.

While it is the flow of current which achieves the cathodic protection of the surface it is impractical to measure these currents over individual anodic areas to determine when cathodic protection has been achieved. However, with the flow of cathodic protection current, the structure becomes more negative with respect to the surrounding electrolyte. Because of this, it is possible to state values of metal/ electrolyte potential and is generally measured against a standard reference electrode, which permits a reproducible potential at which corrosion does not occur to be quoted.

(3.0) STRUCTURE DETAILS

Size: 2 X 9KW Submersible Sewerage Pump

Coating: Tar Epoxy Coating.

Length: N.A.

Location: Bogner St,Tingalpa UBD29,B6.

Drawings:

Construction:

486/7/7VN1T005E	Sewage submersible switchboard cubicle.
Attached Drawings	No1-4

Included Drawings:

487/7/7-VN1T003E	Switchboard electrical schematic.
486/6/25-AA1C0023E	Rectifier unit wiring diagram.
486/7/7-VN1T014E	Sw/bd termination diagram 24 volt DC distribution.
486/7/7-VN1T017E	Sw/bd termination diagram analog inputs.
486/7/7-VN1T00E	Sw/bd electrical schematic.

(4.0) CATHODIC PROTECTION DETAILS

4.1 Type of Cathodic Protection: Impressed Current

4.2 Rectifier: Standard 32 Volt, 10 Amp direct current output enclosed in a poly carbonate enclosure installed in main switchboard. Rectifier has a 240VAC supply from within SWB 69 of pump station SP252.

4.3 Cathode: The cathode point made directly to each pump as indicated on diagrams.

4.4 Anodes: One 1500 X 50mm silicone iron anode was installed suspended from the top of the wetwell from a suspension bar cast into the roof of the well.

4.5 Testpoints: Testpoints are installed on cathodically protected structures to enable testing to confirm that full cathodic protection of the structure is maintained.

On this structure 2 testpoints have been installed on the pumps and connected via disconnect plugsto terminals on the C.P. unit.

4.6 Associated Drawings:
Nil.

4.7 Associated Standards:

AS 2832.1	1985	Pipes,Cables,Ducts, Guide to Cathodic Protection. Part 1
AS 3000	1991	Australian Wiring Rules

4.8 Government Regulations:
Queensland Electricity Acts and Regulations

(5.0) PERFORMED TESTING

(1) Natural Potential Survey

(2) Current Drain Survey

(3) Rectifier Loop Resistance

(4) Foreign Structure Interference Survey and Mitigation.

(5) Final Potential Survey and Commissioning.

NOTE: Details of above testing have not been included in this manual but are available upon request.

(6.0) CONCLUSION

Full cathodic protection has been achieved on these sewerage pumps.

The cathodic protection system is to be registered with the Queensland Electricity Commission and has approval to operate.

(7.0) MAINTENANCE

The cathodic protection system is maintained on a monthly basis after commissioning. These checks involve testing rectifier operation and recording of pipe to soil potentials. Monthly, Six momthly and sixty monthly maintenance procedures are detailed as attached below.

(7.1) CPS Monthly Maintenance Details.

Required:

1/ Notify plant operator and/or sign entry logs where necessary.
2/ Have appropriate keying.

Labour:

One tradesperson, one vehicle. 20 minutes per site.

Procedure:

1/ Identify installation.
2/ Check system for operation.
3/ Record voltmeter.
4/ Record ammeter.
5/ Comments.
6/ Log entry.

(7.2) CPS 6 Monthly Maintenance Details.

Required:

1/ Notify plant operator and/or sign entry logs where necessary.
2/ Have appropriate keying.
3/ Set of tools. (Electricians)
4/ Multimeter.
5/ DC clampmeter.
6/ Copper sulphate reference cell and leads.
7/ Cleaning equipment.
8/ Gatic cover lifters.

Labour:

One tradesperson electrical, one laborer, one vehicle.
Two hours per site.

Procedure:

1/ Identify system.
2/ Check system for operation.
3/ Record voltmeter.
4/ Record ammeter.
5/ Record "on" potentials for all test points.
6/ Record "instant off" potentials for all test points.
7/ Record "off" potentials for all test points.
8/ Perform loop resistance and record.
9/ Check and record anode string currents.
10/ Comments.
11/ Log entry.

(7.3) CPS 60 Monthly Maintenance Details.

Required:

1/ Notify plant operator and/or sign entry logs where necessary.
2/ Have appropriate keying.
3/ Set of tools. (Electricians)
4/ Multimeter.
5/ DC clampmeter.
6/ Copper sulphate reference cell and leads.
7/ Cleaning equipment.
8/ Gatic cover lifters.
9/ Rectifier load bank.
10/ PCS2000 Detection Equipment.

Labour:

One tradesperson electrical, one laborer, one vehicle.
Eight hours per site.

Procedure:

1/ Identify system.
2/ Check system for operation.
3/ Record voltmeter.
4/ Record ammeter.
5/ Record "on" potentials for all test points.
6/ Record "instant off" potentials for all test points.
7/ Record "off" potentials for all test points.
8/ Perform loop resistance and record.
9/ Check and record anode string currents.
10/ Load test rectifier for 10 minutes.
11/ Check all switchboard and testpoint terminals for tightness.
12/ Check all switchboard and testpoints are labelled and I.D. tags attached.
13/ Check plans are correctly drawn and modify if necessary.
14/ Remove and inspect anodes.
15/ Recheck all interference (CPS) bleeds.
16/ Pipecamp structure if applicable.
17/ Apply for "continue to operate" permit if applicable.

BRISBANE CITY COUNCIL
MEMORANDUM

To	File No.
From	Date 20/12/93
Subject BOGNOR Rd SUB PUMP STATION UBD 29 B6	

Location BOGNOR Rd

UBD Reference 29 B4

TYPE 2 SUBMERSIBLE PUMPS

DATE INSTALLED 20-12-93

SWITCHBOARD N° PIMS SWB 69

CATHODIC PROT N° CPS 125

STATION N° SP252

NATURAL POTENTIAL $CuSO_4$ To STRUCTURE -810 mV

Loop Resistance
10 Volt AT 1 Amp
15 Volt AT 1.6 Amp
20 Volt AT 2.2 Amp
25 Volt AT 2.8 Amp
28 Volt AT 3.1 Amp

Unit Reading 3 Volts at 0.3 Amps

$CuSO_4$ To Structure ON
OFF

Anode Current 0.3 Amps

Anode TYPE 7500 x 50 mm Silicon Iron

Weight of Anode 12 kG

Depth of Well 4.3 meTERS

BRISBANE CITY COUNCIL

MEMORANDUM

To	File No.
From J. TAYLOR	Date 20/12/93
Subject Bognor Rd. initial Testing C.P.	

ITEM	NATURAL ~~OFF~~	ON 10Volts @ 1Amp	OFF
Zn1 - CuSO4	-1143 mV	-1695 mV	-1175 mV
Zn2 - CuSO4	-1128 mV	-1628 mV	-1140 mV
Cat1 - CuSO4	-910 mV	-1782 mV	-1099 mV
Cat2 - CuSO4	-810 mV	-1780 mV	-1107 mV
~~Cat~~			
Earth stake - CuSO4	-803 mV	-1737 mV	-1056 mV
Reo Bar - CuSO4	-342 mV	-1193 mV	-596 mV
Anode - CuSO4	-731 mV		-540 mV
Cat1 - Zn1	-331 mV	+103 mV	-11.5 mV
Cat2 - Zn2	-316 mV	+173 mV	-89 mV

LOOP RESISTANCE

Volts	Amps
10	1
15	1.6
20	2.2
25	2.8
28	3.1

ON POTENTIALS (UNPOLARISED)

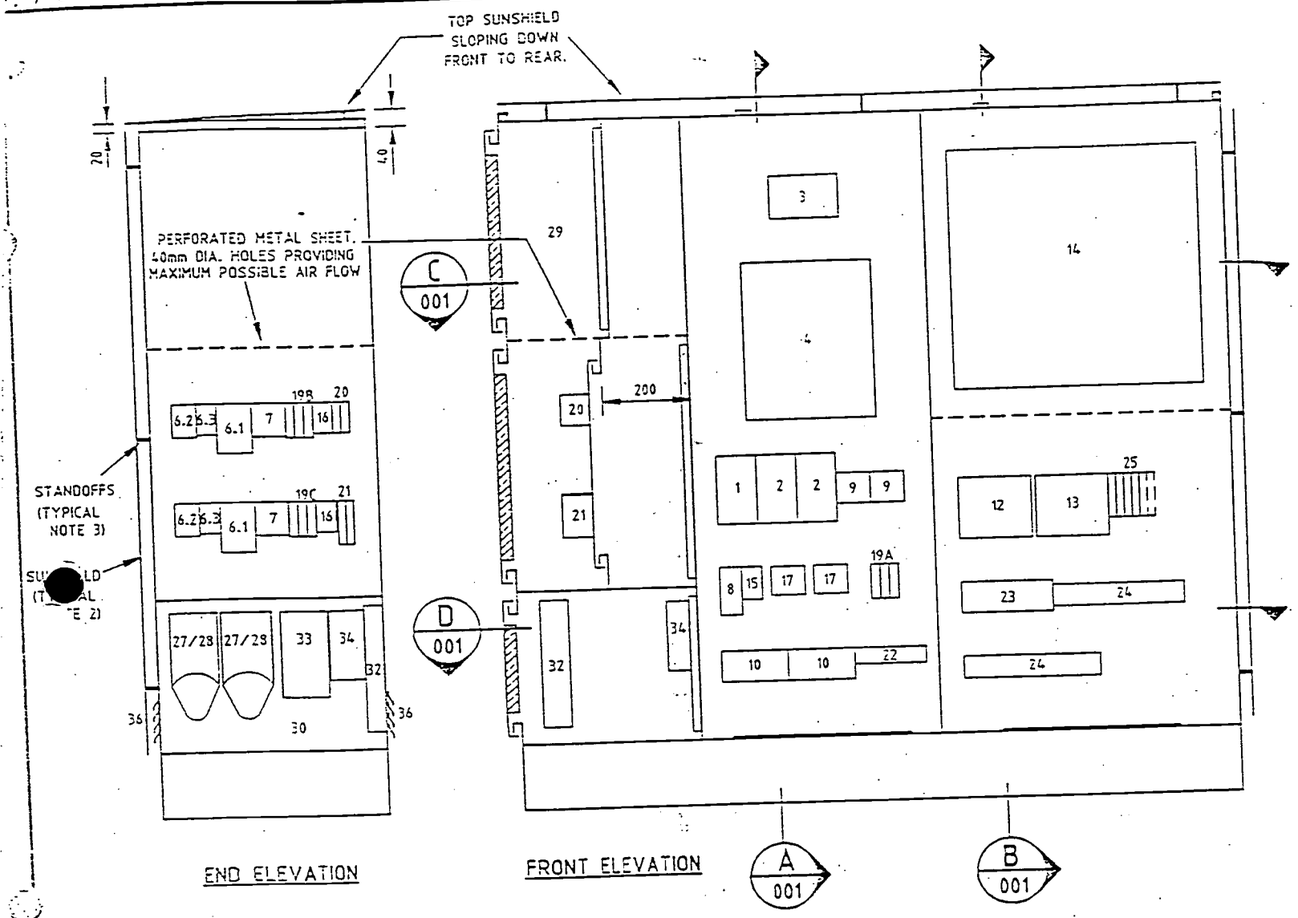
Cathode 1 - CuSO4 -1102 mV

Cathode 2 - CuSO4 -1106 mV

Volts 3 Amps .3

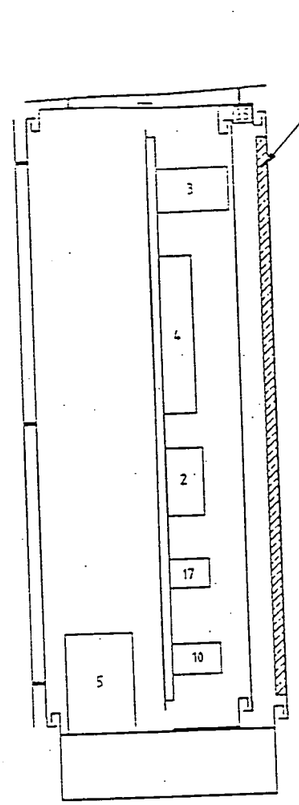
Cathode 1 - Cathode Return 1 -0.1 ohm

Cathode 2 - Cathode Return 2 0.9 ohm

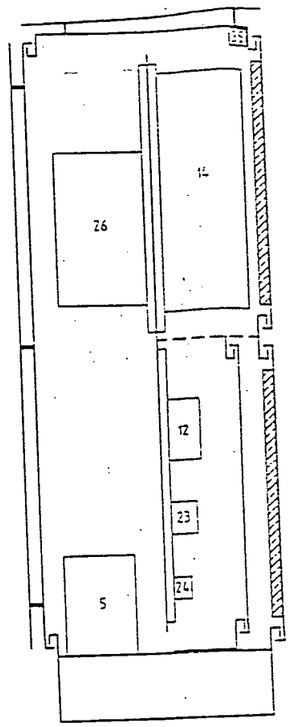


END ELEVATION

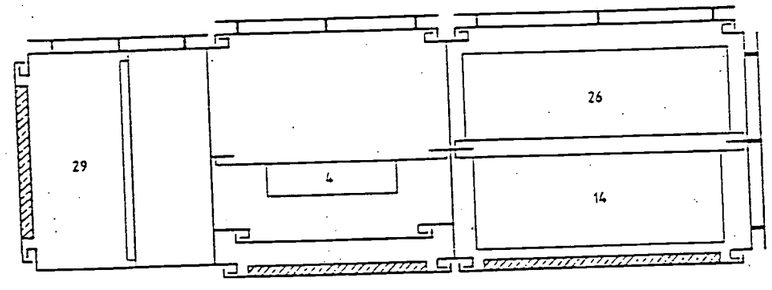
FRONT ELEVATION



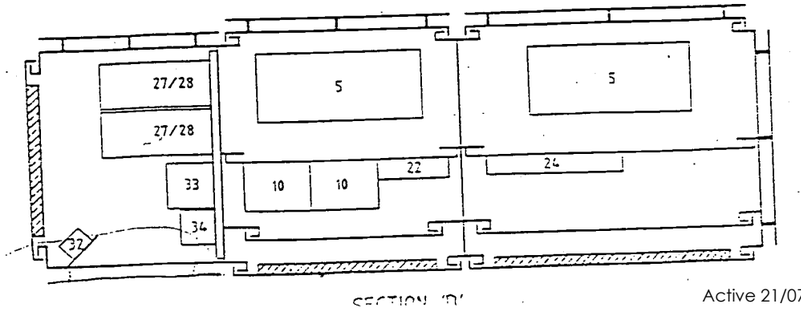
SECTION 'A'



SECTION 'B'



SECTION 'C'



SECTION 'D'

100 50 0 100 200 300
SCALE IN MILLIMETERS

NOTES

1. DOOR INSULATION TO BE 25mm THICK FIBREGLASS THERMAL INSULATION IN ALUMINIUM SANDWICH. INSULATION TO BE SECURELY FASTENED TO INSIDE OF DOOR BY MEANS OTHER THAN ADHESIVE.
2. ALL SUNSHIELD MATERIALS 316 STAINLESS STEEL SHEETING 1.6mm THICK.
3. 30mm LONG STAINLESS STEEL STANDOFFS TO BE DEMOUNTABLE FROM INSIDE THE CUBICLE. BUT BE WELDED TO ACTUAL SUNSHIELD. STANDOFFS TO BE 12mm DIAMETER 316 SS ROD.

No	DATE	AMENDMENT	INITIALS
A	22.6.93	ISSUED FOR APPROVAL	O.L.P.

AMENDMENT & ISSUE REGISTER

MANAGER	DIRECTOR OF PLANNING & DESIGN
DATE:	DATE:

DIRECTOR OF CONSTRUCTION	DIRECTOR OF M & E SERVICES	DIRECTOR OF SEW. OPERATIONS/W.S. DISTRIBUTION
DATE:	DATE:	DATE:

DESIGN	K.H.	21.6.93	ENGINEER IN CHARGE
DRAWN	O.L.P.	21.6.93	SUPERVISING ENGINEER
TRACED			
CHECKED			

CADD FILE No. 77005A

REFERENCES

BRISBANE CITY COUNCIL
DEPARTMENT OF WATER SUPPLY & SEWERAGE
MECHANICAL & ELECTRICAL SERVICES
Brisbane City

PROJECT
SP252 BOGNOR STREET
SEWAGE SUBMERSIBLE PUMP STATION

TITLE
SEWAGE SUBMERSIBLE SWITCHBOARD CUBICLE - SUNSHIELD & THERMAL INSULATION DETAILS

SCALE: NTS | No. 2 OF 3 SHEETS | AMEND.

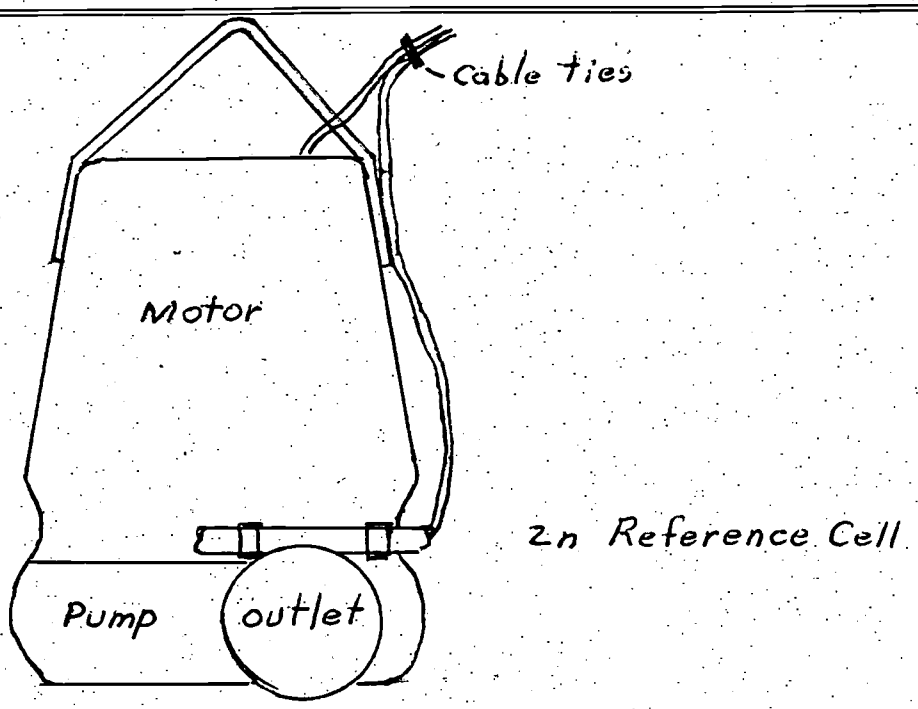
DRAWING No. 486/7/7-VN1T005E | A

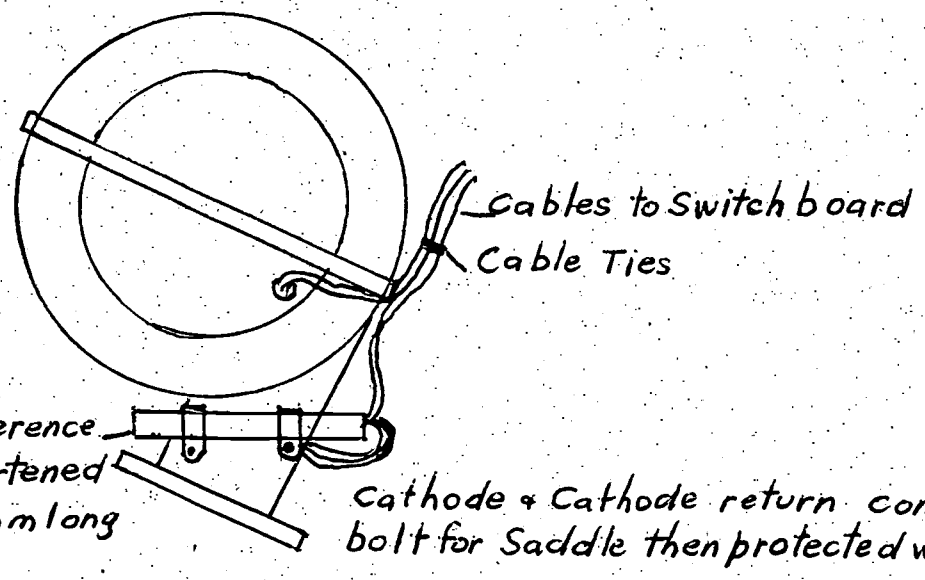
REFERENCE DRAWINGS	
BOGNOR STREET SEWAGE SUBMERSIBLE SWITCHBOARD ELECTRICAL SCHEMATIC & THREE LINE DIAGRAM SHEET 1 OF 3	486/7/7-VN1T001E
SHEET 2 OF 3	486/7/7-VN1T002E
SHEET 3 OF 3	486/7/7-VN1T003E

Brisbane City Council
Dept of Water Supply and Sewerage
Eagle Farm Pump Station
Electrical Workshop

Date: 22-12-93
Site Plan for: Bognor Rd Sub Pump Station

Details of Zinc reference cell Atachment





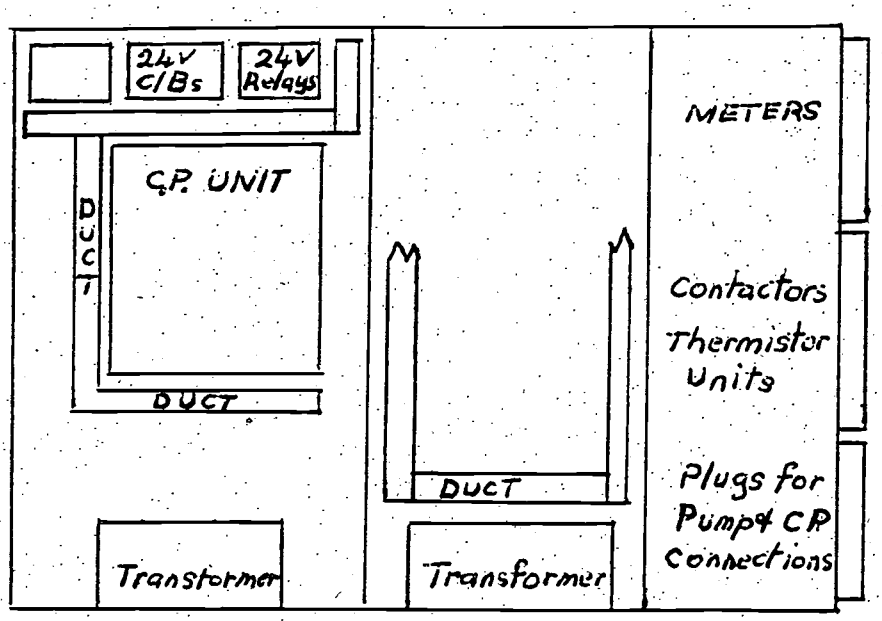
D:\123r3cp\siteplan

Brisbane City Council
Dept of Water Supply and Sewerage
Eagle Farm Pump Station
Electrical Workshop

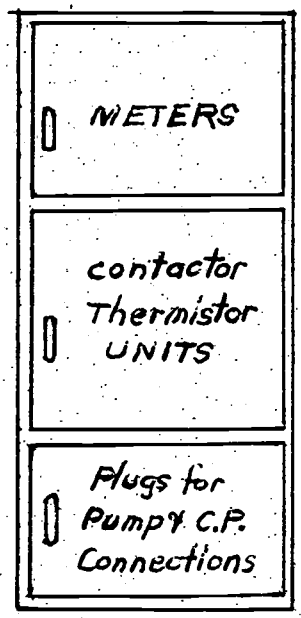
Date: 22 : 12 : 93

Site Plan for: Bognor Rd. Sub Pump Station.

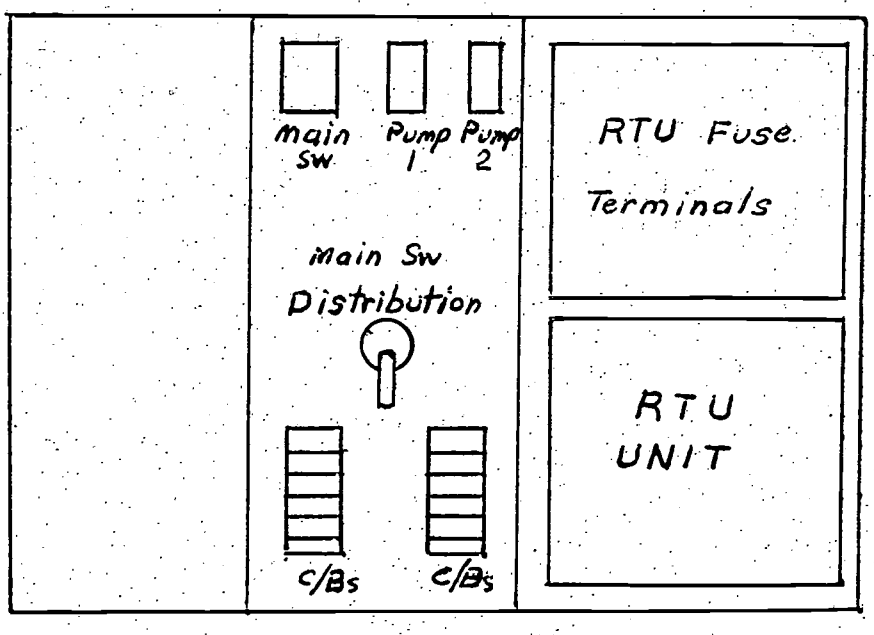
Switchboard



EASTERLY VIEW



SOUTH VIEW

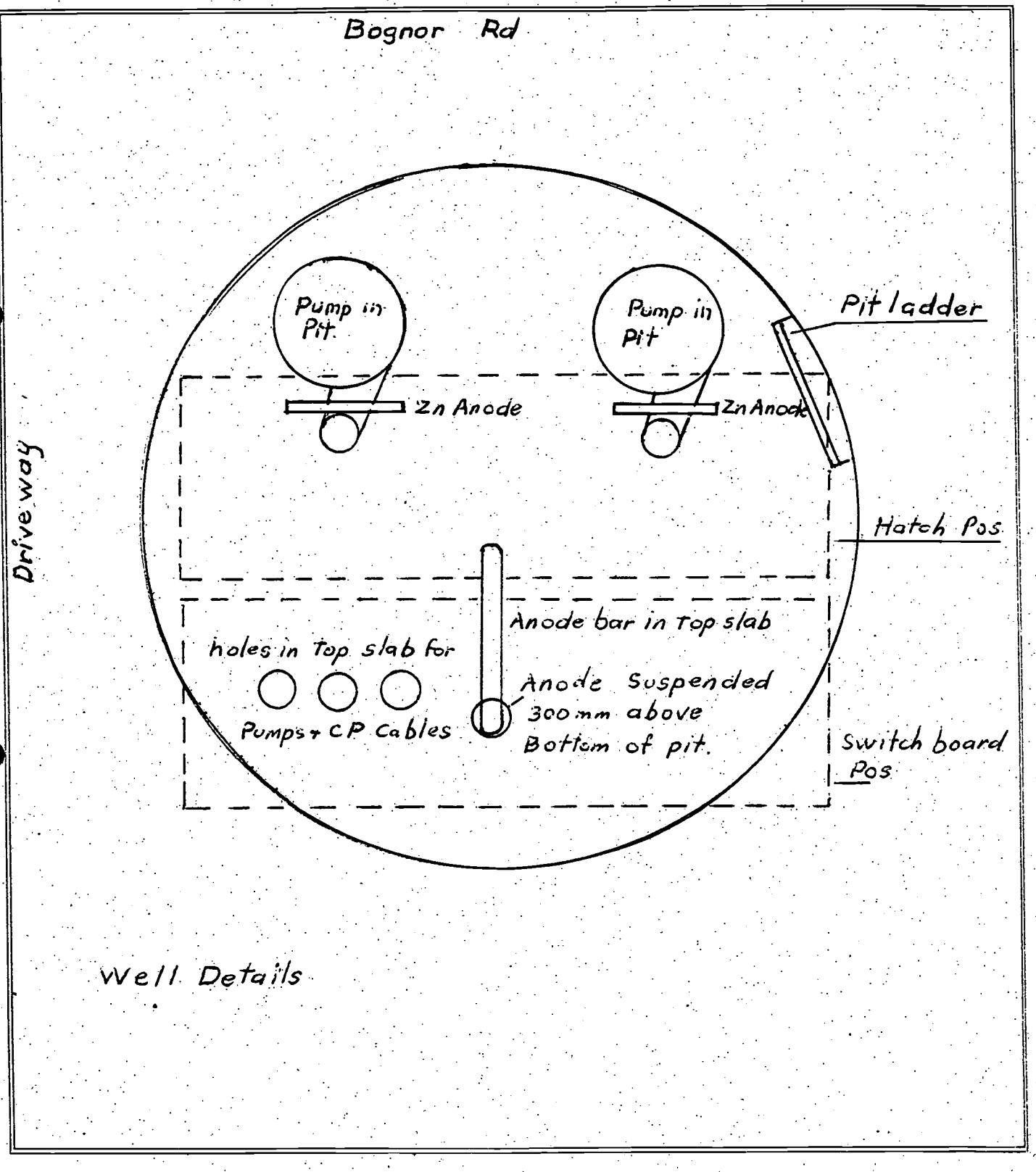


WESTERLY VIEW

D:\123r3cp\siteplan

Brisbane City Council
Dept of Water Supply and Sewerage
Eagle Farm Pump Station
Electrical Workshop

Date: 22 :12:93
Site Plan for: Bognor Rd. Sub Pump Station
Well Details



Well Details

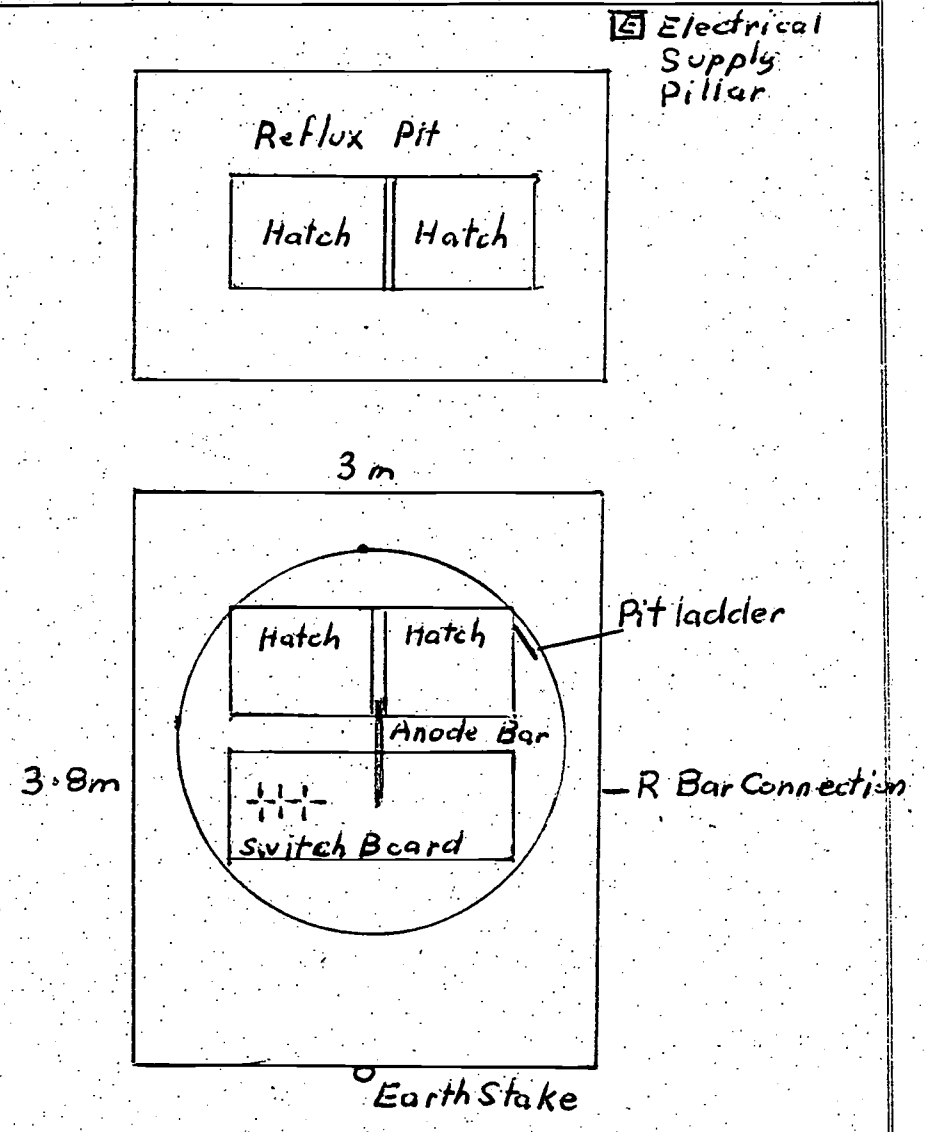
D:\123r3cp\siteplan

Brisbane City Council
Dept of Water Supply and Sewerage
Eagle Farm Pump Station
Electrical Workshop

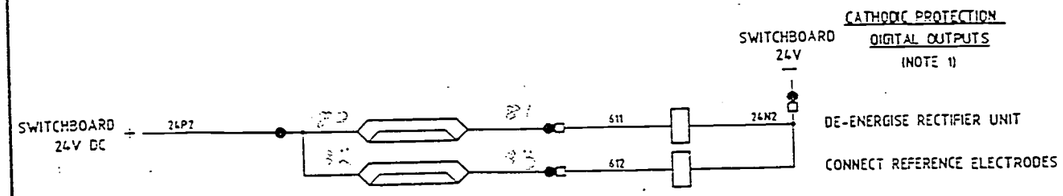
Date: 22-12-93
Site Plan for: Bognor Rd Sub Pump Station
UBD 29 B6

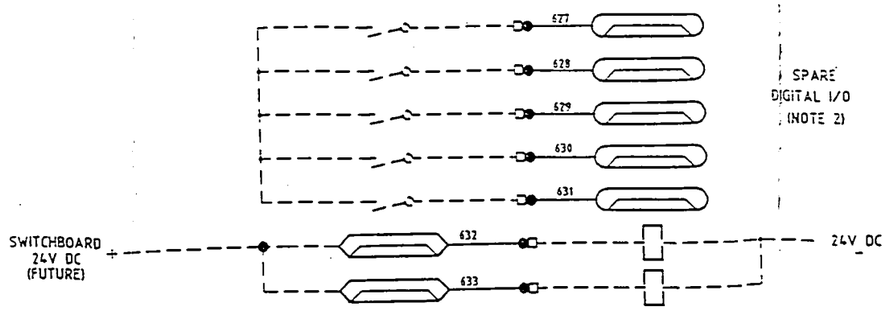
Bognor Rd

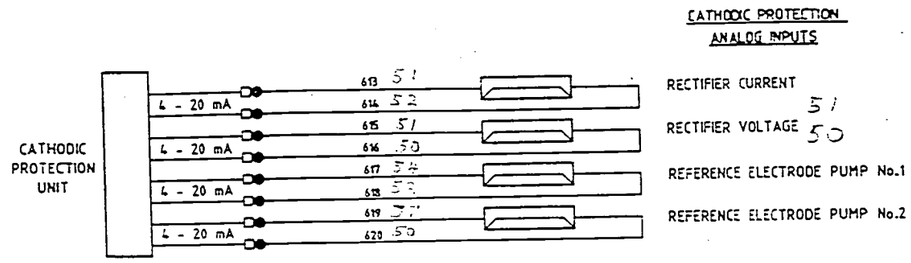
Tiled Patern Driveway

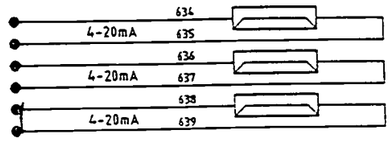


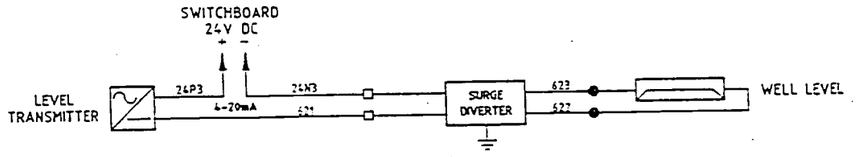
D:\123r3cp\siteplan

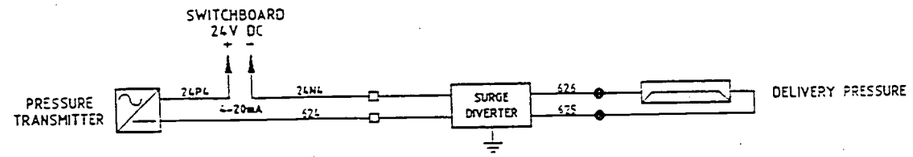


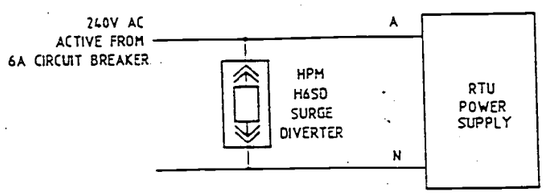


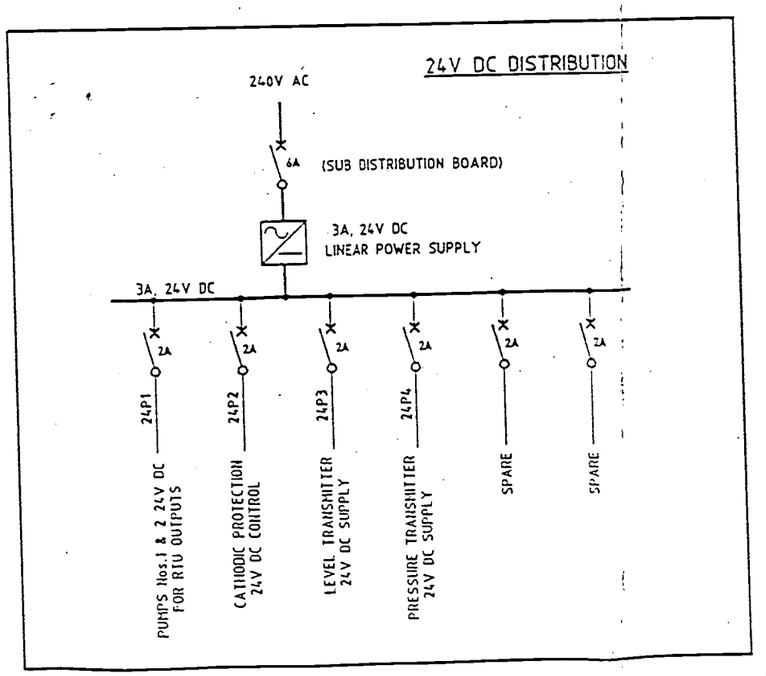












NOTES

1. THE TWO (2) 24V DC INTERFACE RELAYS ARE PART OF THE CATHODIC PROTECTION UNIT CONTROL SYSTEM.
2. RELAY COILS & CONTACTS SHOWN AS DOTTED ARE FOR FUTURE ONLY.
   ALLOW ONLY FOR SWITCHBOARD INTERFACE TERMINALS & SPACE FOR TWO (2) ADDITIONAL 24V DC INTERFACE RELAYS.

No	DATE	AMENDMENT	INITIALS
B	16.9.93	ISSUED FOR CONSTRUCTION	O.L.P.
A	17.6.93	ISSUED FOR APPROVAL	O.L.P.

AMENDMENT & ISSUE REGISTER

MANAGER DATE:	DIRECTOR OF PLANNING & DESIGN DATE:

DIRECTOR OF CONSTRUCTION DATE:	DIRECTOR OF M & E SERVICES DATE:	DIRECTOR OF SEW. OPERATIONS/W.S. DISTRIBUTION DATE:

DESIGN	K.H.	15.6.93	ENGINEER IN CHARGE
DRAWN	O.L.P.	17.6.93	SUPERVISING ENGINEER
TRACED			
CHECKED			

CADD FILE No. 77T003B

REFERENCES

BRISBANE CITY COUNCIL
DEPARTMENT OF WATER SUPPLY & SEWERAGE
MECHANICAL & ELECTRICAL SERVICES
Brisbane City

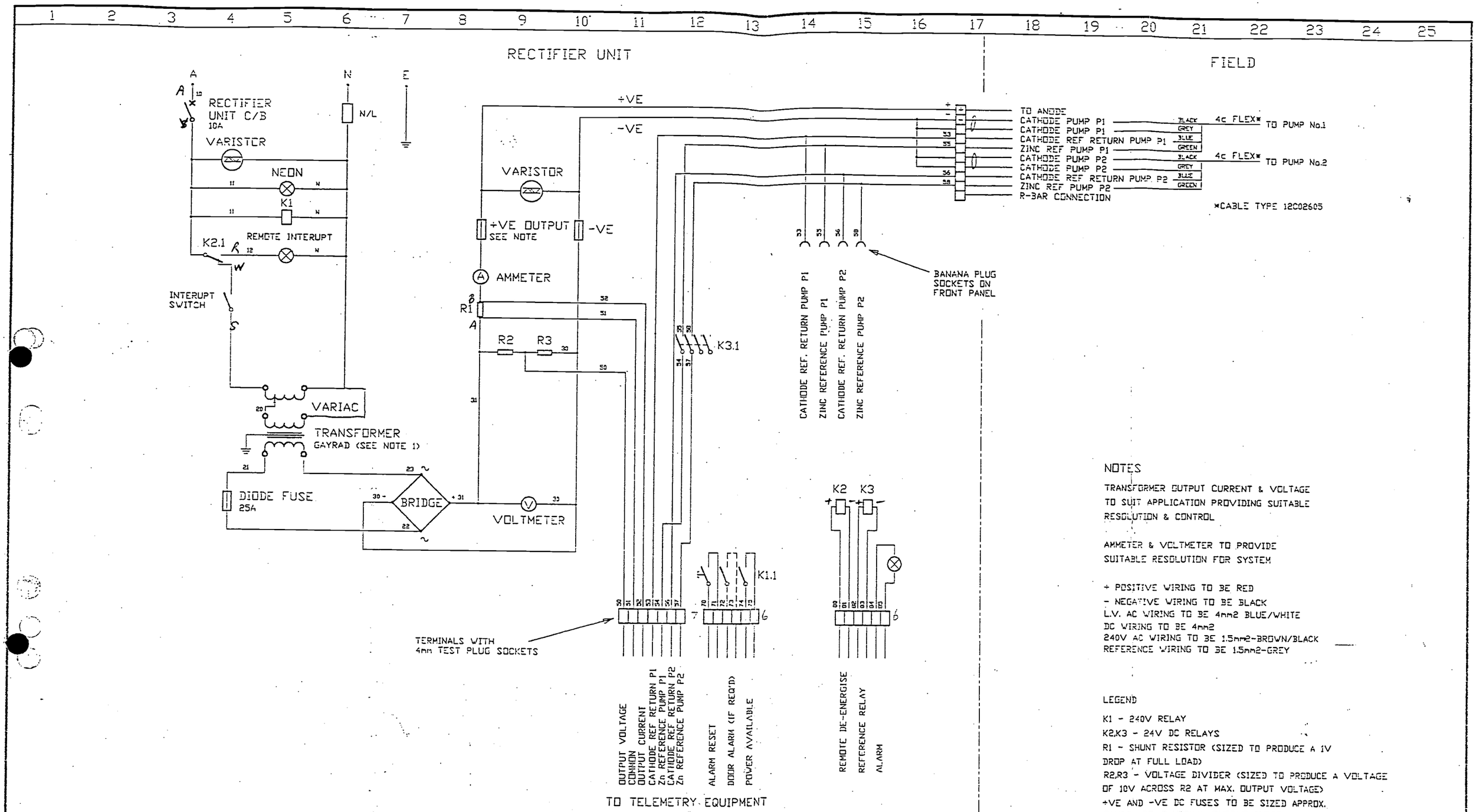
PROJECT
SP252 BOGNOR STREET
SEWAGE SUBMERSIBLE PUMP STATION

TITLE
SWITCHBOARD ELECTRICAL SCHEMATIC & THREE LINE DIAGRAM

SCALE: NTS | No. 3 OF 3 SHEETS

DRAWING No. 486/7/7-VN1T003E | AMEND. B

ORIGINAL



NOTES

TRANSFORMER OUTPUT CURRENT & VOLTAGE TO SUIT APPLICATION PROVIDING SUITABLE RESOLUTION & CONTROL

AMMETER & VOLTMETER TO PROVIDE SUITABLE RESOLUTION FOR SYSTEM

\+ POSITIVE WIRING TO BE RED
\- NEGATIVE WIRING TO BE BLACK
L.V. AC WIRING TO BE 4mm2 BLUE/WHITE
DC WIRING TO BE 4mm2
240V AC WIRING TO BE 1.5mm2-BROWN/BLACK
REFERENCE WIRING TO BE 1.5mm2-GREY

LEGEND

K1 - 240V RELAY
K2,K3 - 24V DC RELAYS
R1 - SHUNT RESISTOR (SIZED TO PRODUCE A 1V DROP AT FULL LOAD)
R2,R3 - VOLTAGE DIVIDER (SIZED TO PRODUCE A VOLTAGE OF 10V ACROSS R2 AT MAX. OUTPUT VOLTAGE)
+VE AND -VE DC FUSES TO BE SIZED APPROX. 5AMPS ABOVE NORMAL OUTPUT CURRENT

NO.	BY	DATE	REVISION	CHECK	APPR
0	R.L.	25.8.93	ISSUED FOR CONSTRUCTION		

BRISBANE CITY COUNCIL
DEPARTMENT OF WATER SUPPLY & SEWERAGE
MECHANICAL & ELECTRICAL SERVICES

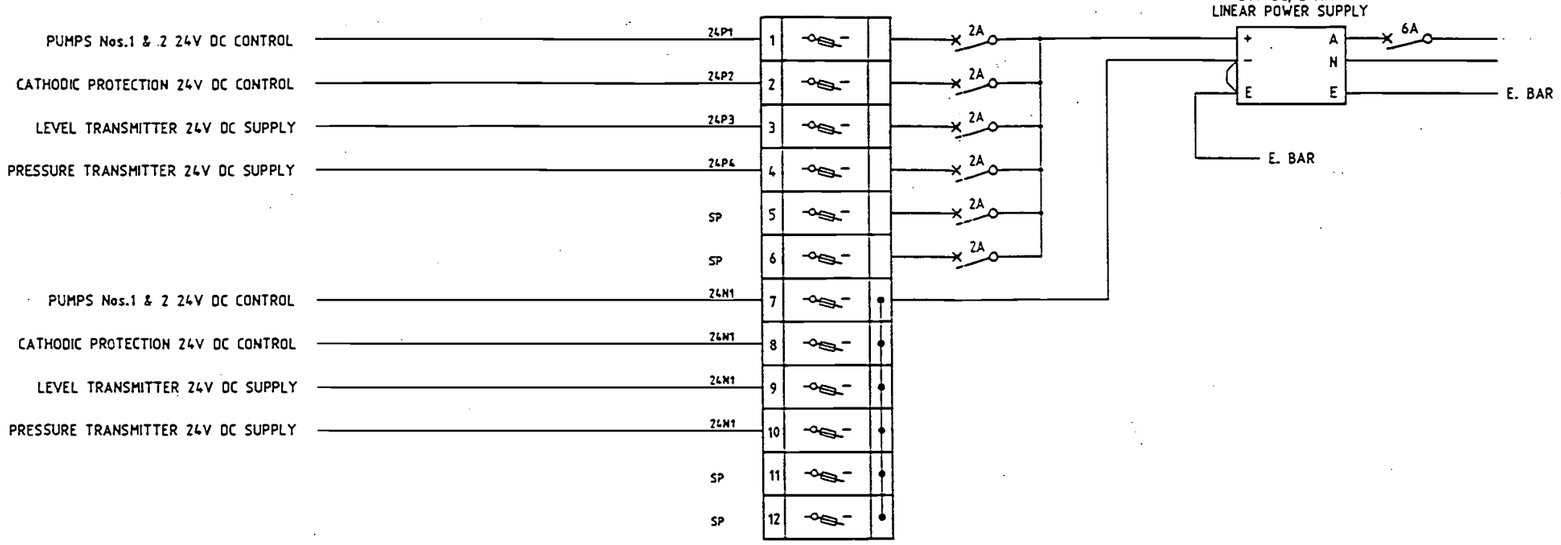
PROJECT: STANDARD CATHODIC PROTECTION SUBMERSIBLE PUMP STATION
TITLE: RECTIFIER UNIT WITH DATA LOGGING FACILITIES WIRING DIAGRAM

	NAME	DATE		NAME	DATE	SCALE	SIZE
DRAWN	R.L.	19.10.93	SUPER ENG.				A3
DESIGN			SENIOR ENG.				AMEND
CHECKED			ELECT. ENG.				0

DRAWING No. 486/6/25-AA1C0023E
ACADRIS FILE No. A625C23

SWITCHBOARD

24V DC DISTRIBUTION
TERMINAL STRIP



NOTES

No	DATE	AMENDMENT	INITIALS
A	16.9.93	ISSUED FOR CONSTRUCTION	O.L.P.

AMENDMENT & ISSUE REGISTER

MANAGER	DIRECTOR OF PLANNING & DESIGN
DATE:	DATE:

DIRECTOR OF CONSTRUCTION	DIRECTOR OF M & E SERVICES	DIRECTOR OF SEW. OPERATIONS/W.S. DISTRIBUTION
DATE:	DATE:	DATE:

DESIGN	K.H.	1.9.93	ENGINEER IN CHARGE
DRAWN	O.L.P.	2.9.93	SUPERVISING ENGINEER
TRACED			
CHECKED			

CADD FILE No.	REFERENCES
77T014A	

BRISBANE CITY COUNCIL
DEPARTMENT OF WATER SUPPLY & SEWERAGE
MECHANICAL & ELECTRICAL SERVICES
Brisbane City

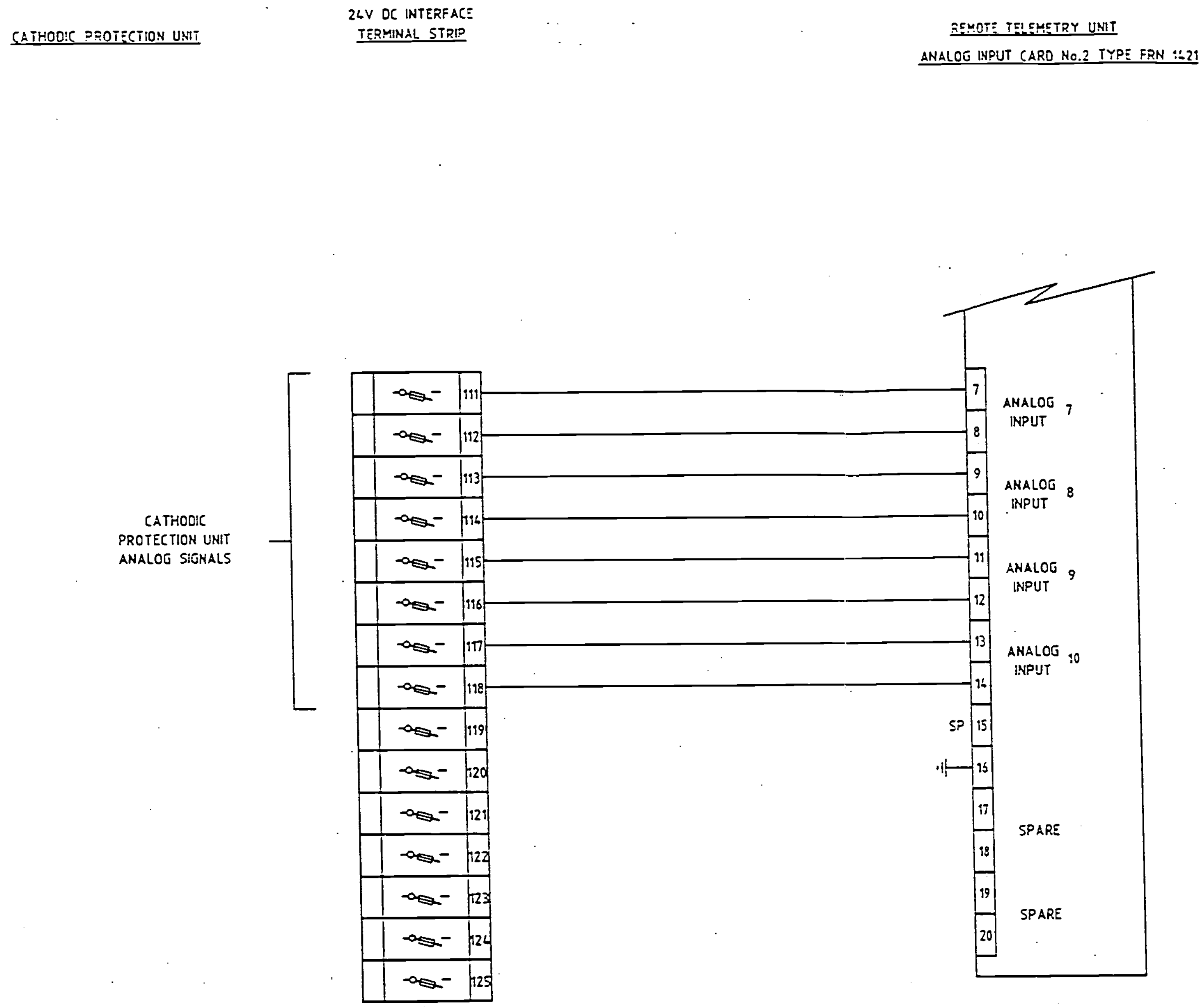
PROJECT
SP252 BOGNOR STREET
SEWAGE SUBMERSIBLE PUMP STATION

TITLE
SWITCHBOARD TERMINATION DIAGRAM
24V DC DISTRIBUTION

SCALE: NTS | No. 1 OF 1 SHEETS

DRAWING No. 486/7/7-VN1T014E | AMEND. A

ORIGINAL



NOTES

No	DATE	AMENDMENT	INITIALS
A	16.9.93	ISSUED FOR CONSTRUCTION	O.L.P.

AMENDMENT & ISSUE REGISTER

MANAGER DATE:	DIRECTOR OF PLANNING & DESIGN DATE:	
DIRECTOR OF CONSTRUCTION DATE:	DIRECTOR OF M & E SERVICES DATE:	DIRECTOR OF SEW. OPERATIONS/W.S. DISTRIBUTION DATE:

DESIGN	K.H.	16.9.93	ENGINEER IN CHARGE
DRAWN	O.L.P.	16.9.93	SUPERVISING ENGINEER
TRACED			
CHECKED			

CADD FILE No. 77T017A

REFERENCES

Brisbane City

BRISBANE CITY COUNCIL
DEPARTMENT OF WATER SUPPLY & SEWERAGE
MECHANICAL & ELECTRICAL SERVICES

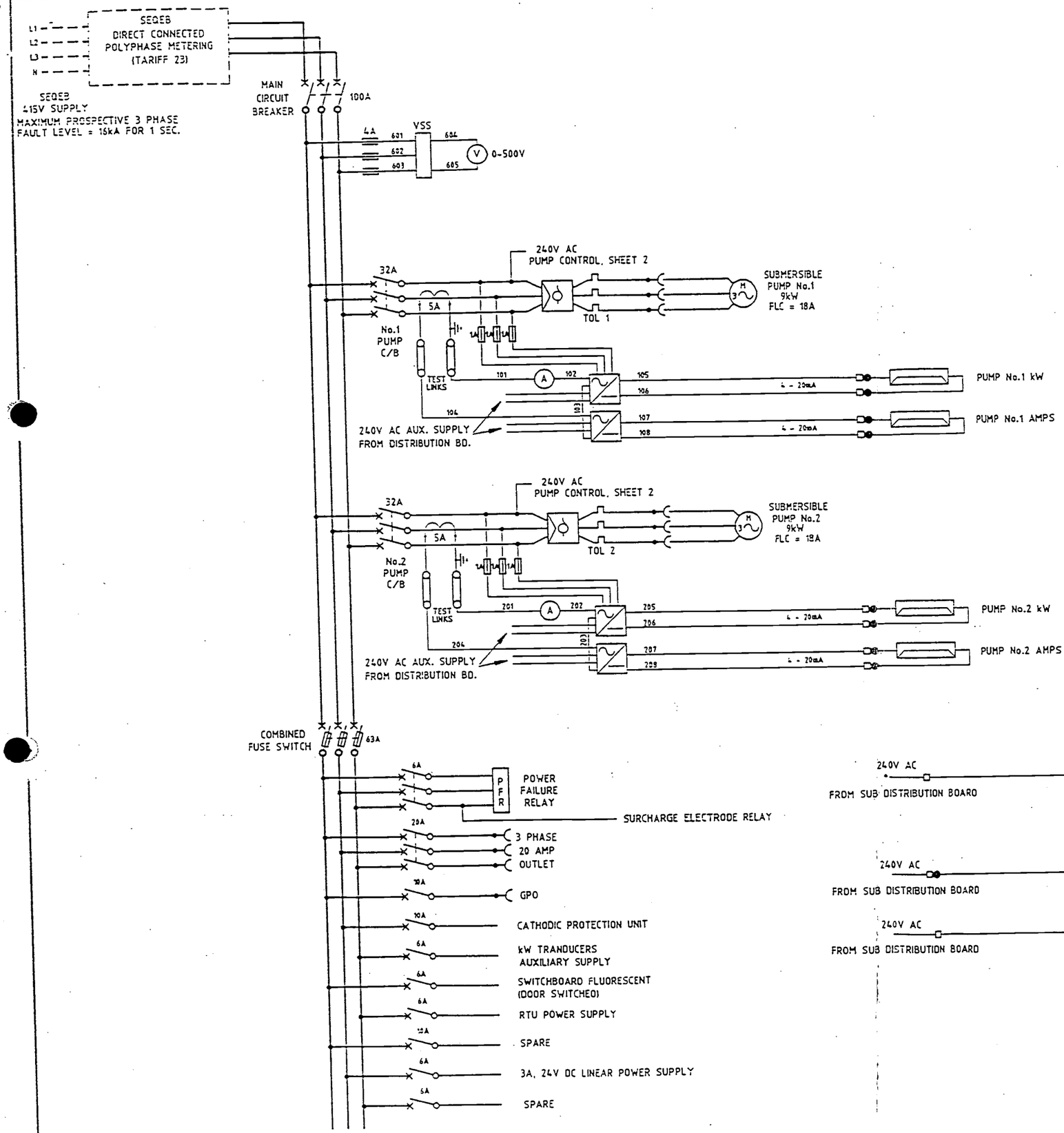
PROJECT
SP252 BOGNOR STREET
SEWAGE SUBMERSIBLE PUMP STATION

TITLE SWITCHBOARD TERMINATION DIAGRAM
ANALOG INPUTS

SCALE: NTS | No. 3 OF 3 SHEETS

DRAWING No. 486/7/7-VN1T017E | AMEND. A

ORIGINAL



NOTES

1. SWITCHBOARD NEUTRAL & EARTH LINKS TO BE POSITIONED ADJACENT TO EACH OTHER IN CLOSE PROXIMITY TO THE MAIN INCOMING SWITCH.

No	DATE	AMENDMENT	INITIALS
B	16.9.93	ISSUED FOR COSTRUCTION	O.L.P.
A	17.6.93	ISSUED FOR APPROVAL	O.L.P.

AMENDMENT & ISSUE REGISTER

MANAGER	DIRECTOR OF PLANNING & DESIGN
DATE:	DATE:

DIRECTOR OF CONSTRUCTION	DIRECTOR OF M & E SERVICES	DIRECTOR OF SEW. OPERATIONS/W.S. DISTRIBUTION
DATE:	DATE:	DATE:

DESIGN	K.H.	15.6.93	ENGINEER IN CHARGE
DRAWN	O.L.P.	17.6.93	SUPERVISING ENGINEER
TRACED			
CHECKED			

CADD FILE No. 77T001B

REFERENCES

BRISBANE CITY COUNCIL
DEPARTMENT OF WATER SUPPLY & SEWERAGE
MECHANICAL & ELECTRICAL SERVICES

Brisbane City

PROJECT
SP252 BOGNOR STREET
SEWAGE SUBMERSIBLE PUMP STATION

TITLE
SWITCHBOARD ELECTRICAL SCHEMATIC & THREE LINE DIAGRAM

REFERENCE DRAWINGS	
BOGNOR STREET SEWAGE SUB. SWITCHBOARD CONSTRUCTION & GENERAL ARRANGEMENT SHEET 1 OF 3	486/7/7-VN1T004E
SHEET 2 OF 3	486/7/7-VN1T005E
SHEET 3 OF 3	486/7/7-VN1T006E

SCALE: NTS | No. 1 OF 3 SHEETS

DRAWING No. 486/7/7-VN1T001E | AMEND. B

ORIGINAL