25 Bunya Street
Eagle Farm Q
4009
Ph. (07) 3403 8888
Fx. (07) 3403 1898

16 th June 2005

OPERATING MANUAL FOR:

ARCHERFIELD ROAD TRUNK MAIN AUGMENTATION

CATHODIC PROTECTION SYSTEM

CLIENT:

BRISBANE WATER
WATER SYSTEM SERVICES

MANUAL CONTENTS

DRAWINGS

(1.0) INTRODUCTION

Steel when immersed or covered in water has a tendency to corrode (or rust) as the oxidized form is more stable than the metal.

Because of this, precaution must be taken to stop or minimize 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 practical to achieve a perfect coating and coating damage will always occur with time. Because of this, corrosion may occur at imperfections in the paint coating, causing further deterioration in the coating as well as loss of metal.

As a result of this, the coating defects must be rectified by periodic maintenance or an additional method of protection used to prevent this deterioration and corrosion occurring. This additional protection is achieved by the cathodic protection system.

(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 slow 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 at which corrosion does not occur. This metal/electrolyte potential is generally measured against a standard reference electrode which allows a reproducible potential at which corrosion does not occur to be quoted.

(3.0) MAINS DETAILS

Size: 660 mm dia mild steel cement lined.

Coating: Medium Density Polyethylene.

Length: Appox 1.2 km.

Location: From Valve 1147 cnr Archerfield Rd. and Littleton Rd. Richlands, to Valve 753 Inala Reservoir.

Construction Drawings:

486/1/22-C0024E	Cathodic Protection Standard Switchboard Cabinet
486/1/22-AAT0001E	Cathodic Protection Test Points

Note: S55 Trunk Main 600mm is also on this system. This main goes from V1146 Archerfield Rd. and Littleton Rd. to Inala Reservoir.

(4.0) CATHODIC PROTECTION DETAILS

(4.1) Type of Cathodic Protection: Impressed Current.

(4.2) Rectifier: Standard 20 Volt, 20 amp direct current output enclosed in a stainless steel switchboard. This system has 1 rectifier installed. The rectifier is McEwan Park, bounded by Azalea St. and Archerfield Rd, and has a 240V supply from PRV 008 switchboard.

(4.3) Cathode: The cathode point is located on the 660 mm dia mains, adjacent to the scour valve, at Archerfield Rd. and Azalea St. corner. A second cathode point is on the S55 main at the same location. The cathode point is where the cabling from the rectifier is attached to the structure under cathodic protection.

(4.4) Anodes: Four 1500 x 75mm silicone iron anodes were installed approximately 30 metres from the trunk mains, in a vertical bed 5 metres deep, in McEwan Park adjacent to the rectifier. One anode is for the new 660 main and three for the S55 600 main. The anodes are backfilled with cokebreeze thereby improving anode - ground resistance. The anodes are identified by a marker post and label. See layout drawing.

(4.5) Test Points: Test points are installed on cathodically protected structures to enable testing to ensure full protection of the mains. On these mains three test points have been installed on the trunk main which can be identified from the layout drawing.

(4.6) Associated Drawings:

Cathodic Protection Test Point Details	- 486/1/22-AAT0001E
Standard Rectifier Wiring Diagram	- 486/6/25-AA1C0021
Cathodic Protection Test Point & Anode Bed Locations	Trunk Main.

(4.7) Associated Standards:

AS/NZS 3000	2000	Electrical Installations
AS/NZS 2832.1	1998	Cathodic Protection of Metals-Pipes and Cables.

(4.8) Government Regulations:

Queensland Electricity Safety Rules and Regulations. 2002

(5.0) PERFORMED TESTING

(1) Natural Potential Survey.

(2) Testing of Insulated Flanges, Joints.

(3) Soil Resistance Testing.

(4) Current Drain Survey.

(5) Pipe Coating Anomaly Survey.

(6) Rectifier Loop Resistance.

(7) Foreign Structure Interference Survey and Mitigation.

(8) Final Potential Survey and Commissioning.

(6.0) CONCLUSION

Full Cathodic protection has been achieved on this section of trunk mains. The cathodic protection system is registered with the Electrical Safety Office, Department of Industrial Relations, and has approval to operate.

(7.0) MAINTENANCE

The cathodic protection system is maintained on a bimonthly basis after commissioning. These checks involve testing rectifier operation and recording of pipe to soil potentials.

16 th June, 2005.
Cathodic Protection Unit.

CPS Bimonthly 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.

16 th June, 2005.
Cathodic Protection Unit

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.

16 th June, 2005.
Cathodic Protection Unit

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 to reregister system if applicable

Brisbane Water Engineering Services

CP Form No. 23

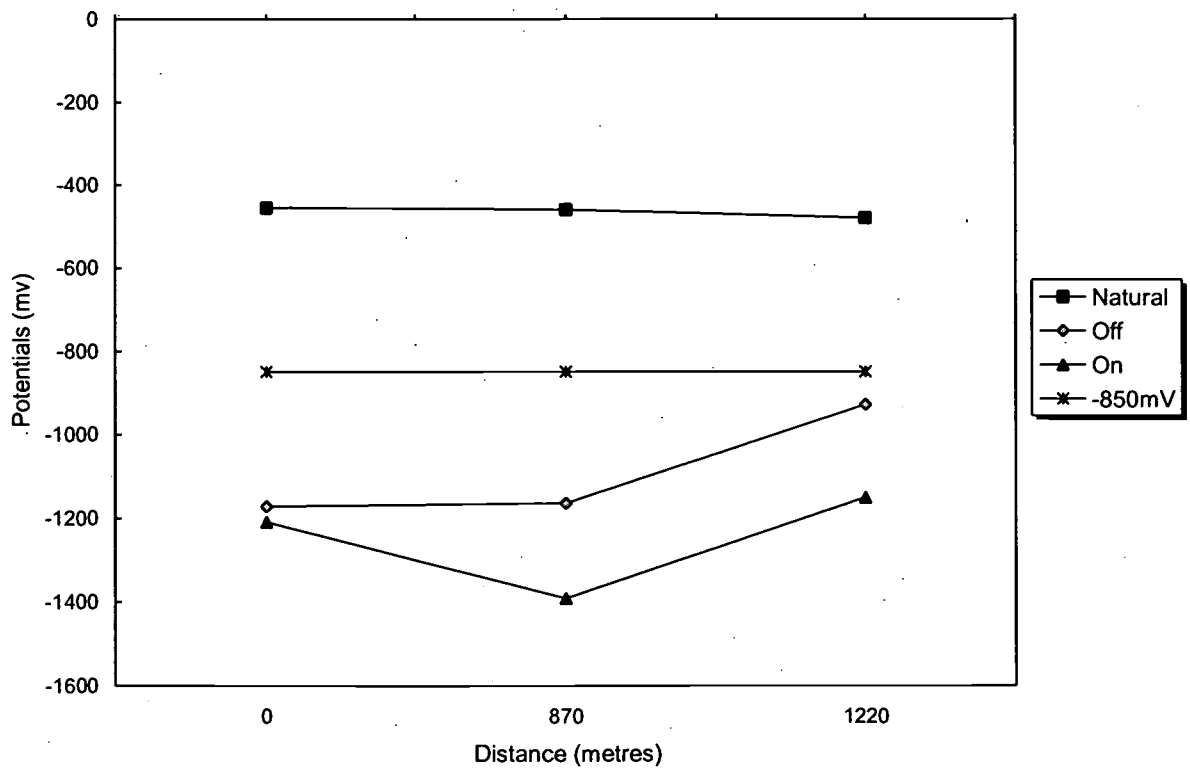
Electrical Engineering Unit

Cathodic Protection System Potential Recording Form

Project Archerfield Road Trunk Main Augmentation **Date** 21st June 2005

Test Point number	Distances to T.P.	Potentials to CuSO4			Distance	
	(metres)	Natural (mV)	Off (mV)	On (mV)		TP.No1
1	0	-455	-1172	-1209	0	Government
2	870	-460	-1164	-1391	870	Road
3	1220	-480	-928	-1150	1220	
4						Rectifier at
5						TP. No2
6						Azalea St
7						
8						TP. No3
9						Littleton Rd.
10						
11						
12						
13						
14						

Graph of potentials vs pipelength



Revision 24/06/2005 PTARCHERFIELD

Brisbane Water Engineering Services

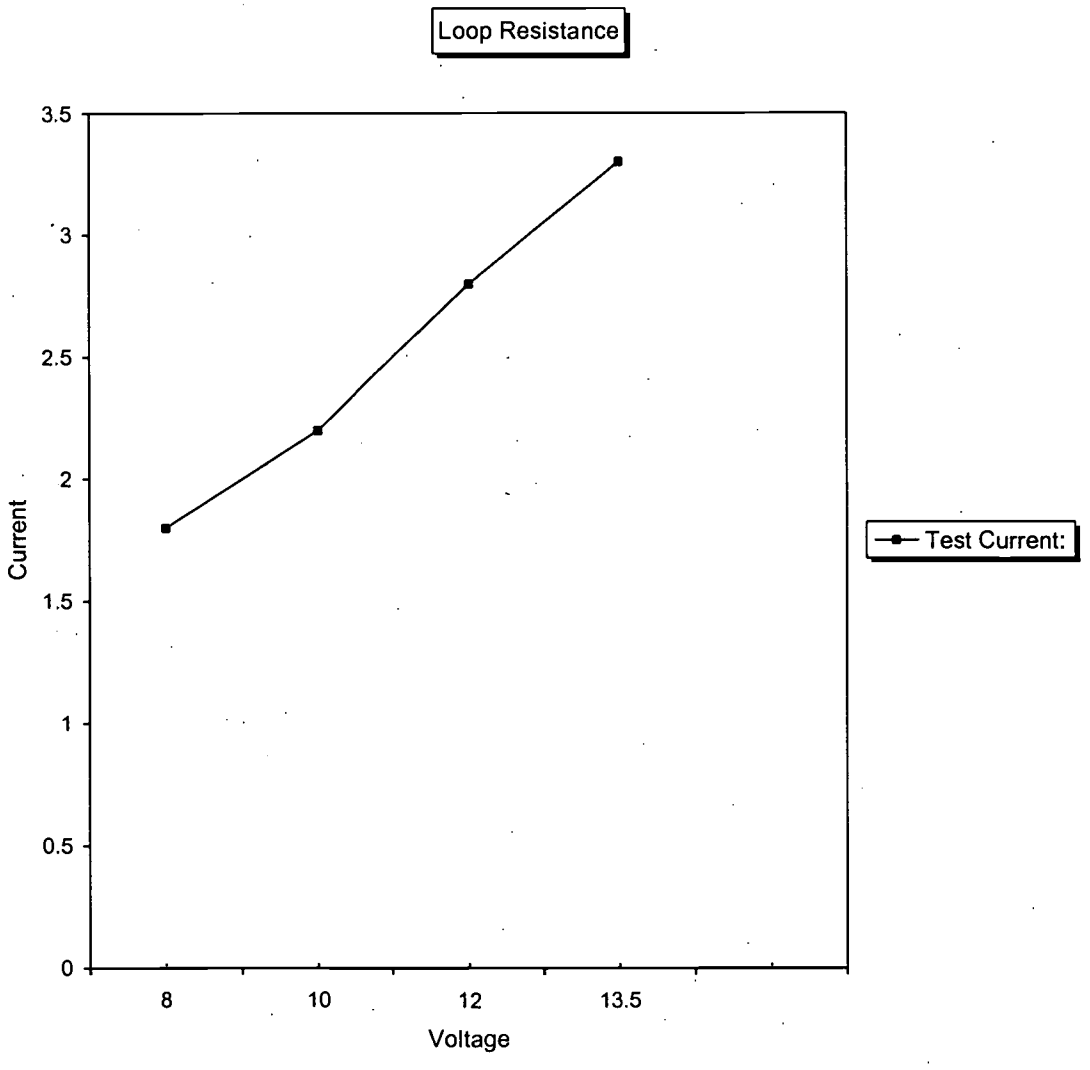
Electrical Engineering Unit

Cathodic Protection System Loop Resistance — Azalea St. Rectifier CPS 212

Date: 21st June 2005
Cathodic Protection System: Archerfield Road Trunk Main Augmentation S55
System Operating Volts: 8 System Operating amps 1.8

Test Voltage: (volts)		Test Current: (amps)	
8		1.8	
10		2.2	
12		2.8	
13.5		3.3	

Loop Resistance (ohms)
4.2857143



4/10/2005

Brisbane Water Engineering Services

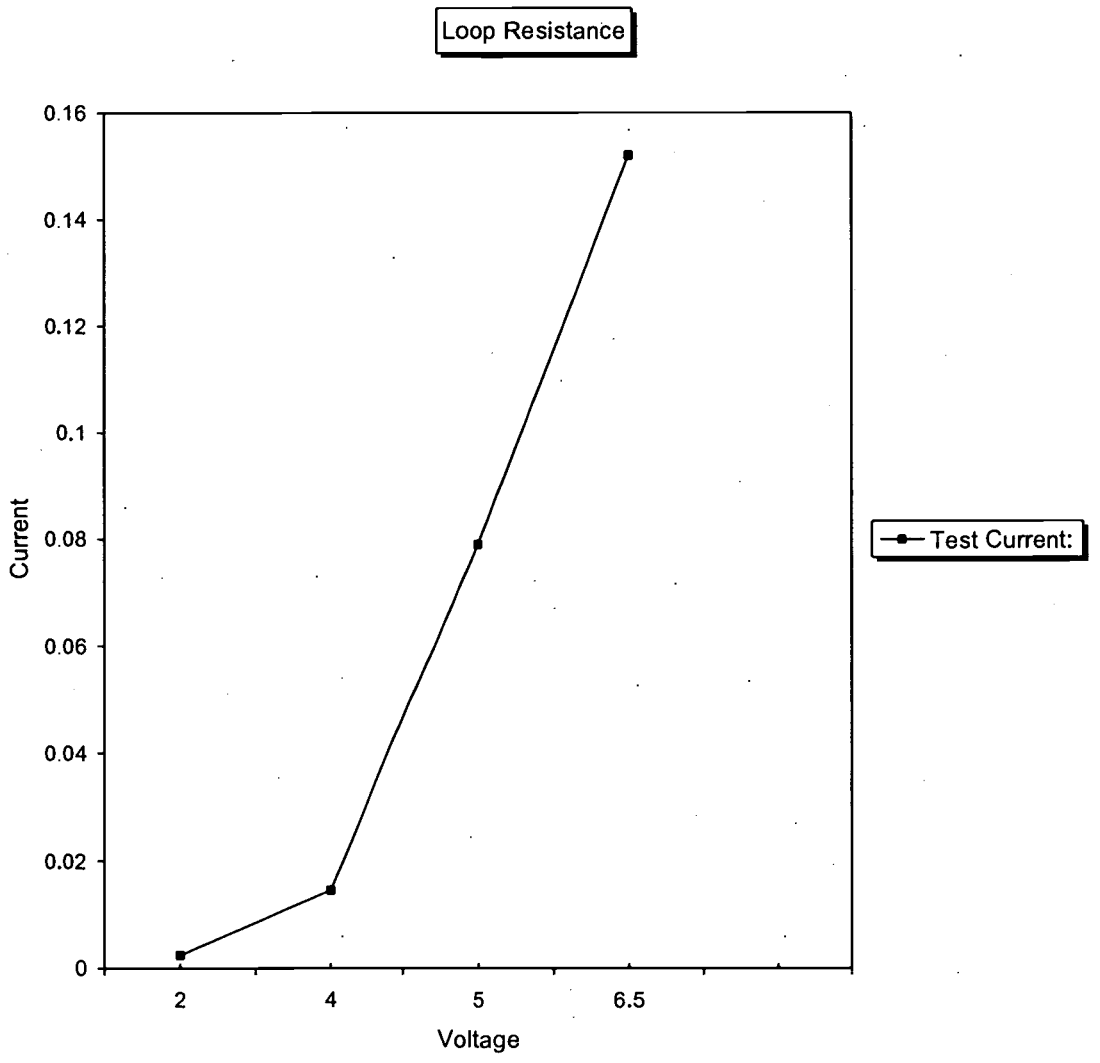
Electrical Engineering Unit

Cathodic Protection System Loop Resistance — Azalea St. Rectifier CPS 212

Date: 21st June 2005
Cathodic Protection System: Archerfield Road Trunk Main Augmentation
System Operating Volts: 4 System Operating amps 14.5ma

Test Voltage: (volts)	Test Current: (amps)
2	0.0024
4	0.0145
5	0.079
6.5	0.152

Loop Resistance (ohms)
63.291139



24/06/2005

Brisbane Water Engineering Services

CP Form No.18

Electrical Engineering Unit

Standard Cathodic Protection Test Point Data Gathering Form

Project ...Archerfield Rd TM Augmentation... Date ...13-1-05...

TP Location ...Cnr Archerfield Azelea St... TP No. ...2...

Mains Size ..... TP Type ...B...

POTENTIAL TESTING

CATHODE TO CATHODE RETURN (RESISTANCE)	
ZINC REFERENCE TO PIPE	
CuSo4 REFERENCE TO PIPE	
ZINC TO CuSo4	

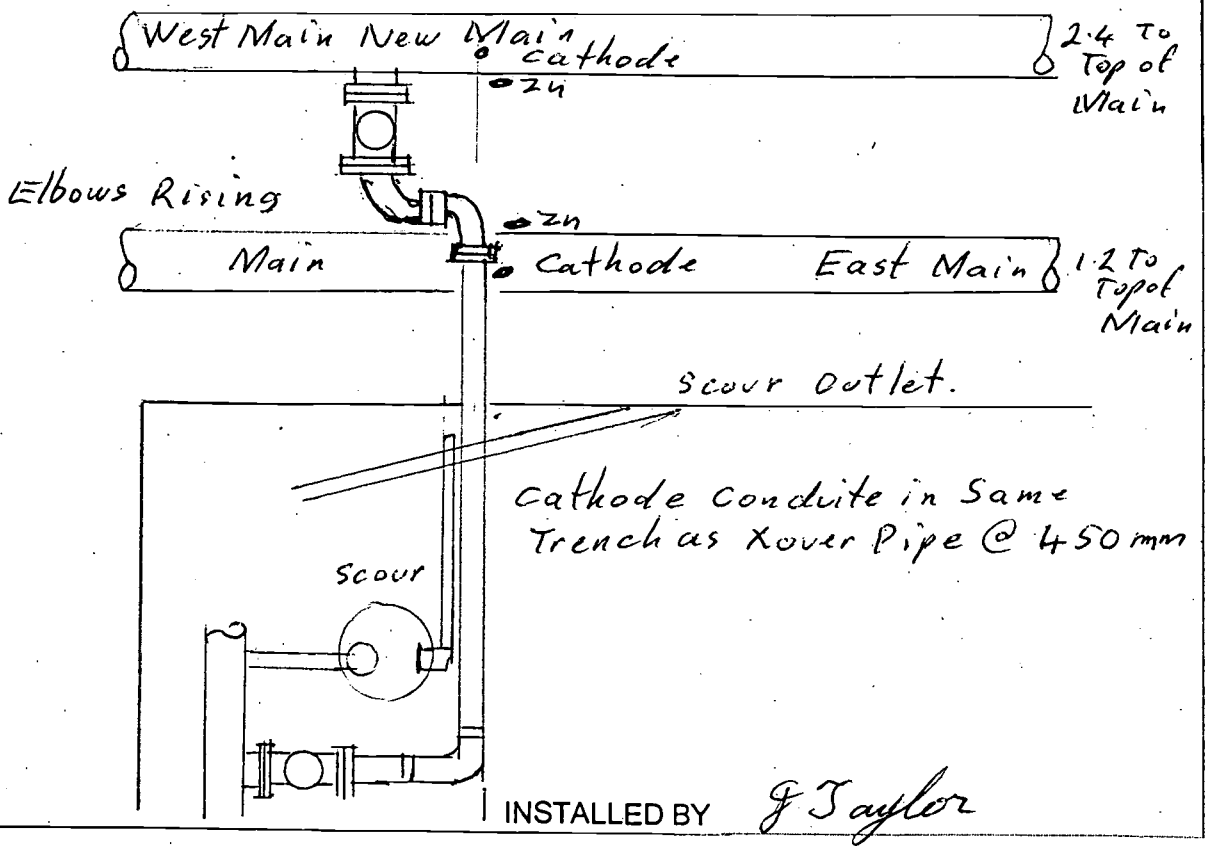
EARTH TESTING

TEST NO. 1

PIN SPACING _____ RESISTIVITY _____

MEGGER READING _____

COMMENTS / LOCATION DRAWING



INSTALLED BY J Taylor

Revision 08/01/96

Brisbane Water Engineering Services

CP Form No. 16

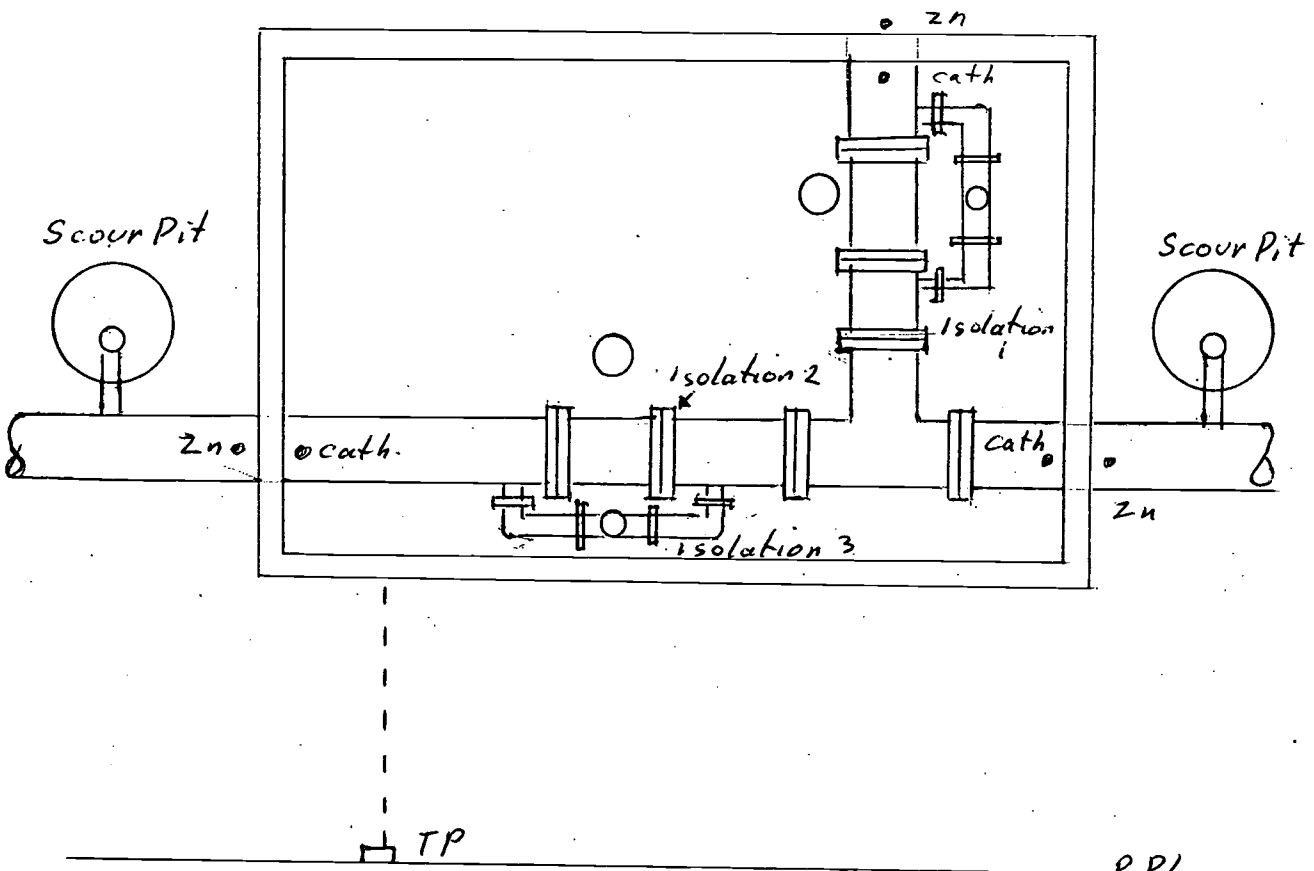
Electrical Engineering Unit

Site Plan Drawing Sheet

Project Archerfield Rd TM Amplification

Date 6-9-04

Littleton St



Isolation 1 F-F > 999 mΩ Bolts 16 off 140 x 28
F-B > 999 mΩ

Isolation 2 F-F 0.7 mΩ
F-B 1.2 mΩ

Isolation 3 F-F 2.0 mΩ Bolts 8 off $3\frac{1}{2}" \times \frac{3}{4}$
F-B 5 mΩ

COMPILED BY J Taylor

Revision 09/28/95

Brisbane Water Engineering Services

CP Form No. 16

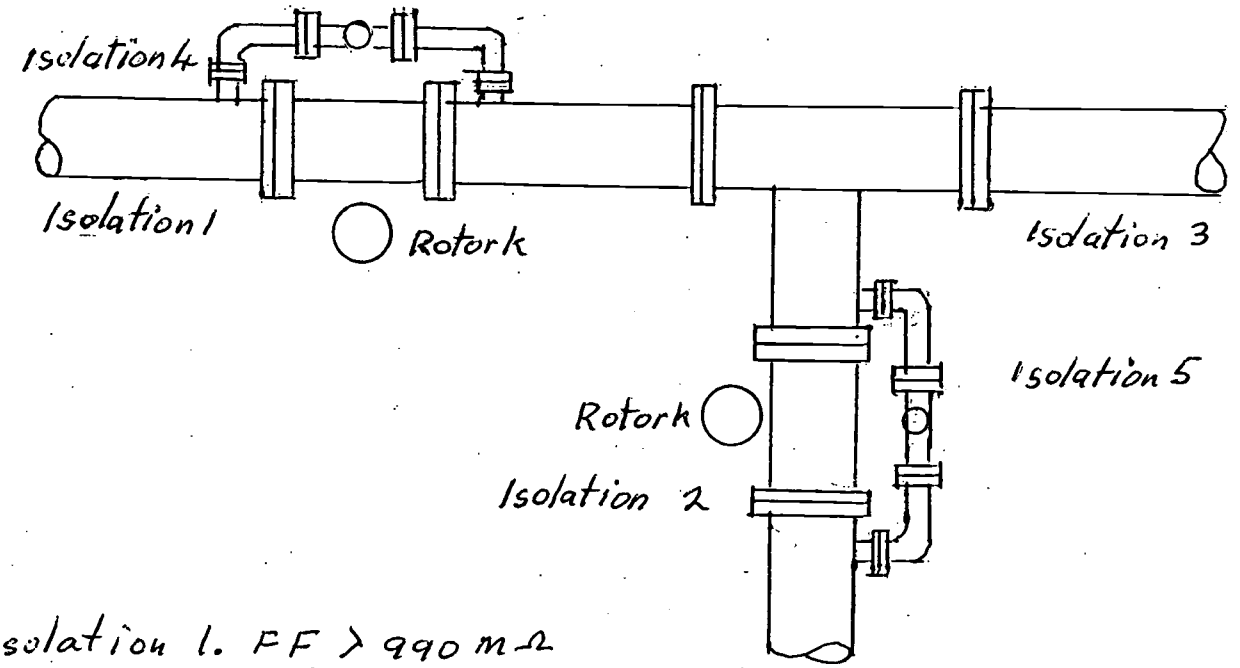
Electrical Engineering Unit

Site Plan Drawing Sheet

Project Archerfield Rd TM Amplication

Date 27-10-04

Inala Reservoir End Isolation



Isolation 1. FF > 990 mΩ
FB > 990 mΩ

Isolation 2. FF > 990 mΩ
F-B > 990 mΩ

Isolation 3 FF > 990 mΩ
F-B > 990 mΩ

Bolts @ 1,2,3, 16 off 140x28 @ 220 Flbs

Isolation 4 F-F > 890 mΩ
F-B > 640 mΩ

Isolation 5 F-F > 990 mΩ
F-B > 130 mΩ

Bolts @ 4,5. 8 off 3 ½" x ¾"

Tested in Air No Pipes Connected

COMPILED BY JS

Revision 09/28/95

Brisbane Water Engineering Services

CP Form No. 17

Electrical Engineering Unit

Cathodic Protection Anode Bed Testing

Project Archerfield Rd Amplifacation **Date** 26-5-05

ANODE MATERIAL:	Silicon Iron	BURIAL:	Verticle
ANODE SIZE/WEIGHT:	1.5m x 75m 76kG	TEST POINT TYPE:	2 Type B
ANODE PACKAGING:	Direct + Coke Breeze	SOIL RESISTIVITY:	
ANODE DEPTH:	4 mtrs	SIGNAGE:	

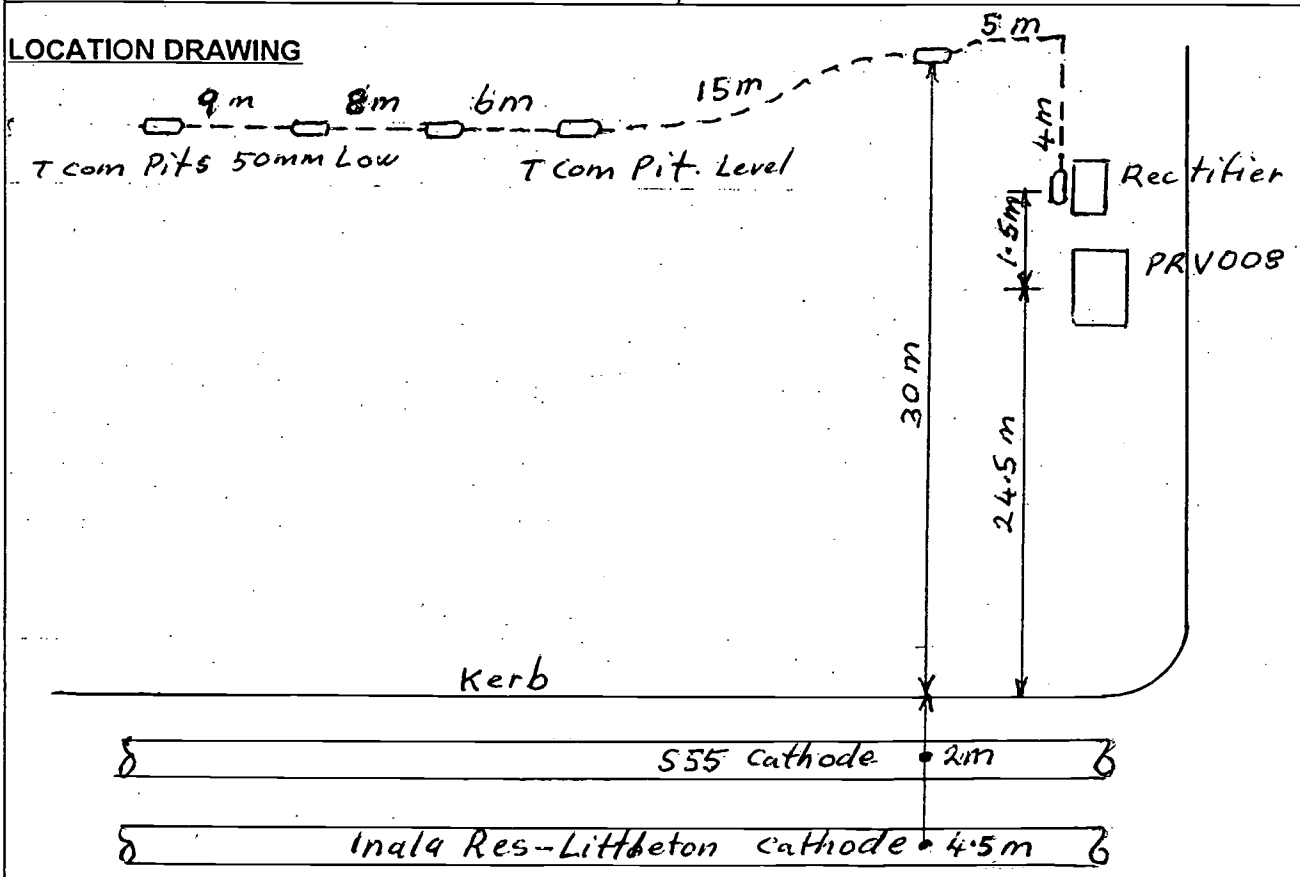
RESISTANCE TO GROUND:

ANODE NO.1	7.0
ANODE No.2	5.0
ANODE No.3	5.0
ANODE No.4	6.5
ANODE No.5	
TOTAL	Individual To Rectifier

ANODE CURRENT

ANODE No.1	
ANODE No.2	
ANODE No.3	
ANODE No.4	
ANODE No.5	
TOTAL	

LOCATION DRAWING



TESTED BY J. TAYLOR

Revision 09/28/95

FORM 9
V3.01-04

Queensland Government

Department of Industrial Relations
ABN 52 293 849 579

APPLICATION TO REGISTER A REGISTERABLE CATHODIC PROTECTION SYSTEM

PLEASE COMPLETE ALL SECTIONS OF THIS FORM- PLEASE PRINT

Application Details

Name of system owner:	**Brisbane City Council / Brisbane Water**	
		ABN 72002765795
Postal address:	**GPO Box 1434 Brisbane 4001**	
Contact name:		**TEL**

Name of authorised agent of system owner:	**Brisbane Water Network Services**	
		ABN 72002765795
Postal Address:	**268 Cullen Ave Eagle Farm 4009**	
Contact Name:	**Kerry McGovern**	
		TEL 07 34078364

Type of Application: (Tick as appropriate)			
	√	New System	
	☐	Alteration to an existing system, Registration No:	
	☐	Renewal of system, Registration No:	
Location of system:	From Inala Reservoir to Littleton St. Richlands		
	Rectifier (McEwan Park) Azalea Street Inala.		POST CODE 4077
Structure to be protected:	**600 mm and 660 mm dia Mild Steel Trunk Main**		
Maximum operating current:	**4.00**	**Amperes DC**	**Water or Marine environment Maximum operating voltage:** _____ **Volts**

Declaration

I/We, being the owner/operators of the cathodic protection system described above, make application for the registration of this system and certify with respect to the system that:

(i) I/We have complied with the requirements of Part 11 of *Electrical Safety Regulation 2002*;
(ii) tests pursuant to section 177 of *Electrical Safety Regulation 2002*, based on the maximum operating current stated this application have been performed;
(iii) the maximum operating voltage stated in this application in the case of the system operating with an anode/s immersed in water or a marine environment corresponds to the maximum operating current mentioned in paragraph (ii); and
(iv) any necessary interference mitigation measures for foreign structures (in the case where the system is currently registered) have been tested and are operating satisfactorily.

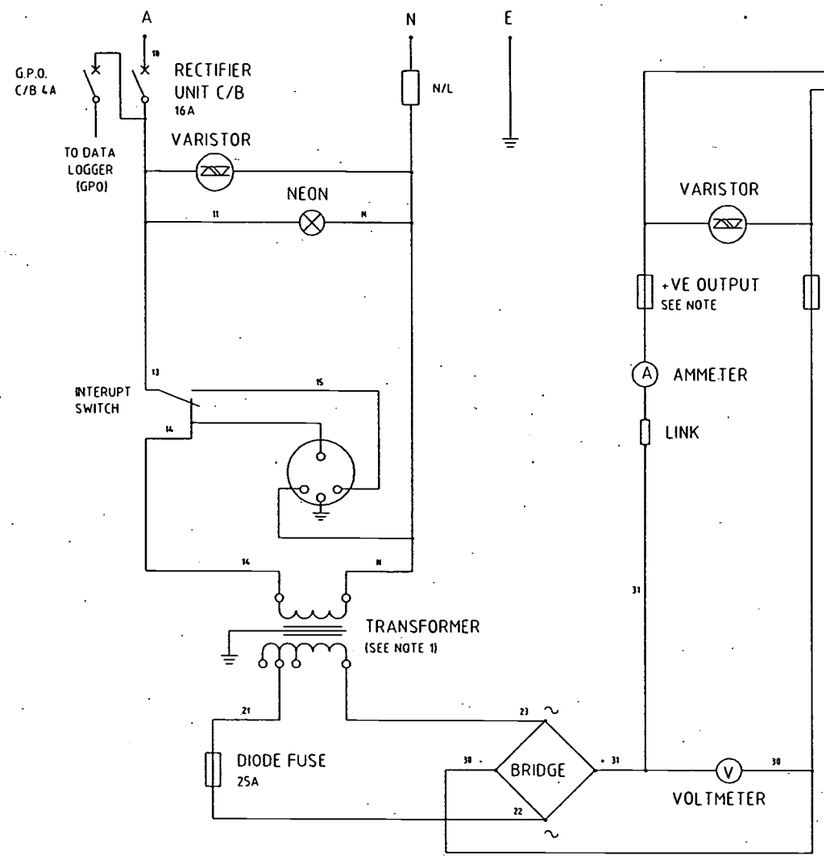
Signature of system owner: _____ **Day Month Year**

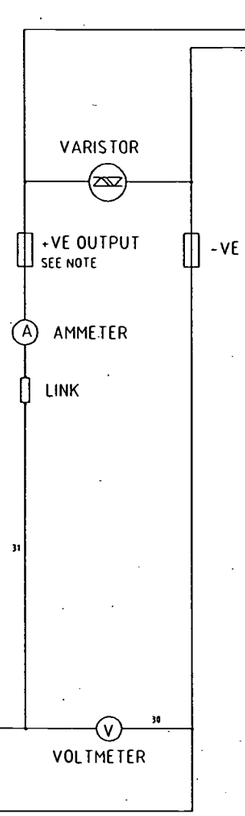
PRIVACY STATEMENT. The Department of Industrial Relations respects your privacy and is committed to protecting your personal information. The information provided on this form is for the purpose of applying for the registration of a cathodic protections system and monitoring compliance under the Electrical Safety Act 2002, and will be managed within the requirements of Information Standard 42. The Department may be required to disclose your personal information to other government agencies, entities, or persons as may be required by law or that are outsourced functions. This information may also be used for statistical research, information provision and evaluation of our services. We will assume that we have your permission to do this unless you tell us otherwise. You can do this at any time by contacting Equipment Safety on (07) 3237 0281. Further information on our privacy policy is available at www.dir.qld.gov.au

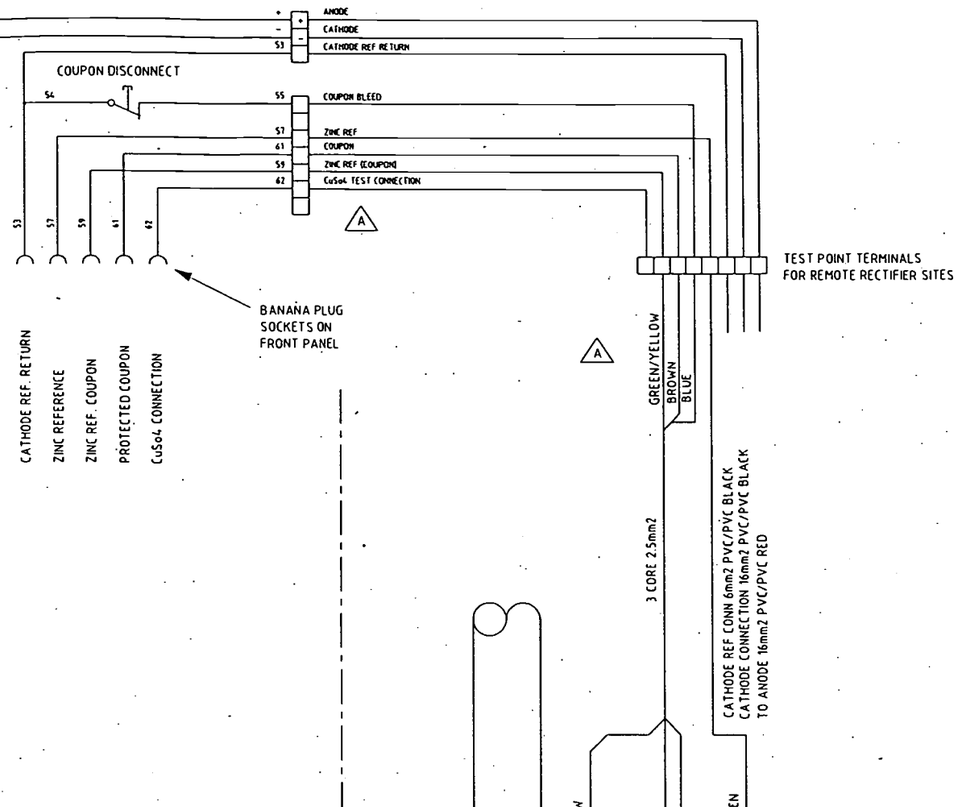
Application of accompany registration fee of $205.00
Application for systems to be immersed in a marine environment must have technical schedule attached.
Forward to: Electrical Safety Office, LMB 2234 Brisbane Qld 4001
Please note: This is a GST free supply. No tax invoice will be issued.

RECTIFIER UNIT

FIELD







NOTES

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

2. AMMETER & VOLTMETER TO PROVIDE SUITABLE RESOLUTION FOR SYSTEM

3. + 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

4. +VE AND -VE DC FUSES TO BE SIZED APPROX. 5AMPS ABOVE NORMAL OUTPUT CURRENT

NO.	DATE	AMENDMENT	INITIALS
D	07.03.05	VARIAC REMOVED, TRANSFORMER MID TAP SEC ADDED	DPM
C	16.10.96	TELEMETRY REMOVED, BV BARRIER UPDATED	DPM
B	11.4.96	CHANGES AS SHOWN	RL
A	18.10.93	CHANGES AS SHOWN	RL
1	25.8.93	ISSUED FOR CONSTRUCTION	RL

	NAME	DATE
DESIGN	J.S.	3.8.93
DRAWN	R.L.	3.8.93
CHECKED	J.S.	25.8.93

PRINCIPAL ENGINEER — R.P.E.Q. NO. — DATE — M.Jukes 25.8.93
MANAGER ENGINEERING — DATE
PRODUCTION / NETWORK DELEGATE — DATE

Brisbane City

JOB FILE
ACAD FILE A625C24-RevD
SURVEY No. — FIELD BOOK
SURVEYED — A.H. DATUM

Brisbane Water — Projects - Engineering

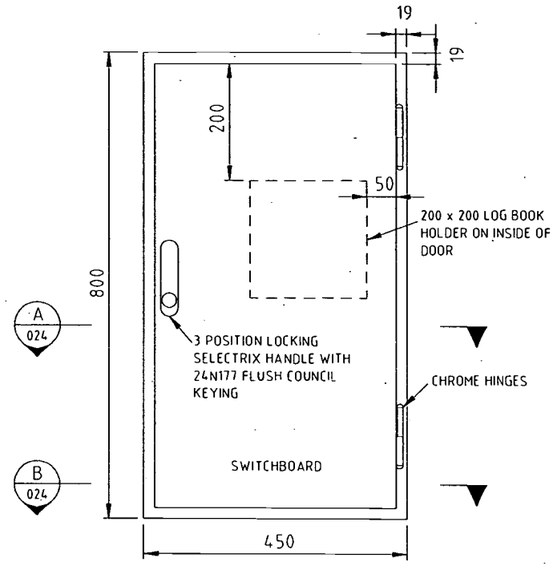
PROJECT: STANDARD CATHODIC PROTECTION

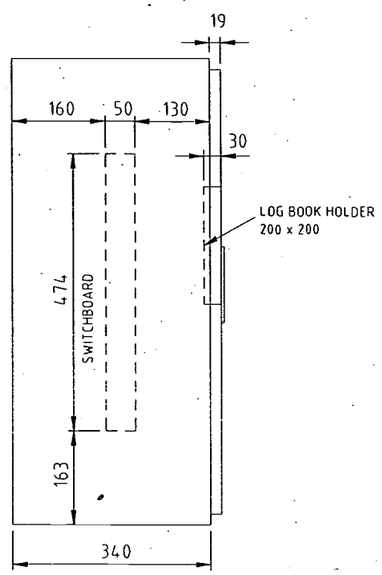
TITLE: RECTIFIER UNIT WITHOUT LOGGING FACILITIES WIRING DIAGRAM

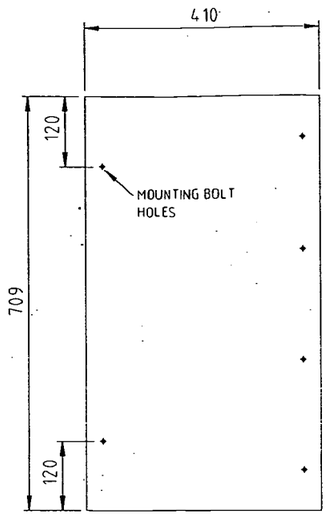
SCALE - | N° OF SHEETS

DRAWING N° 486/6/25-AA1C0021E | AMEND. D

Q:\PSEDRAWING2\Standard Drawings\Sewerage\Infrast\CathodicProtection\a625c21e-RevD.dwg, 08/03/2005 02:24:12 PM







FRONT INSULATED PANEL
(6mm THICK SUPPLIED)

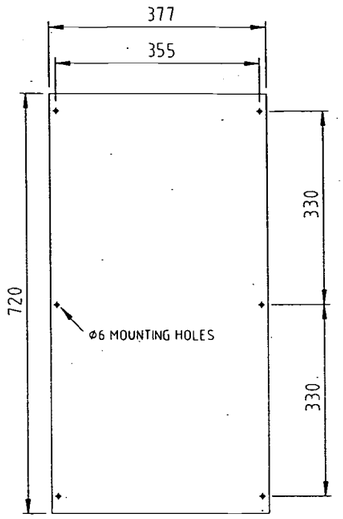


FIG.1
EQUIPMENT PANEL DETAILS

1. CABINET TO BE MANUFACTURED FROM 1.6mm 2B STAINLESS STEEL.

2. UNLESS SPECIFIED, SUPPLY CABINET WITH PLINTH. (MOUNT PLINTH TO SWITCHBOARD CABINET USING STAINLESS STEEL SCREWS).

3. REAR EQUIPMENT PANEL TO BE ZINC PLATED STEEL. POWDER COATED 'ORANGE'. (FULL LENGTH, FULL WIDTH & REMOVABLE). SEE FIG.1.

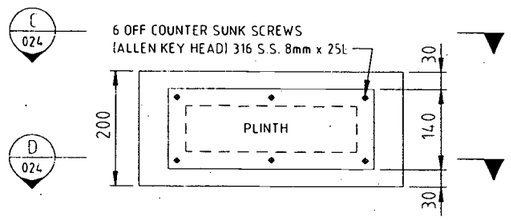
4. DOUBLE HINGED PANEL SUPPLIED BY B.C.C.

5. PROVIDE 1/4" WW STAINLESS STEEL STUDS TO DOOR & SWITCHBOARD CABINET.

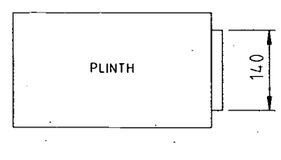
6. DEGREE OF WEATHER PROTECTION IP55.

7. SELECTRIX TYPE HANDLE TO BE SUPPLIED & FITTED BY SWITCHBOARD MANUFACTURER. HANDLE TO BE 1107 SS CU1. KEY TO BE 24N177.

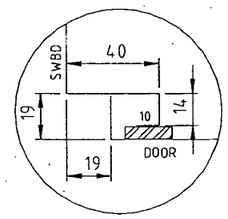
8. DOUBLE HINGED PANEL MOUNT TO BE SUPPLIED WITH MOUNTING BOLTS & NUTSERTS TOP & BOTTOM. SEE DETAIL A.



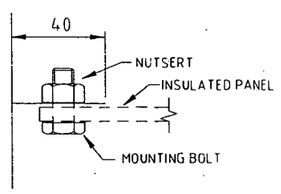
FRONT ELEVATION
SWITCHBOARD & PLINTH



SIDE ELEVATION
SWITCHBOARD & PLINTH

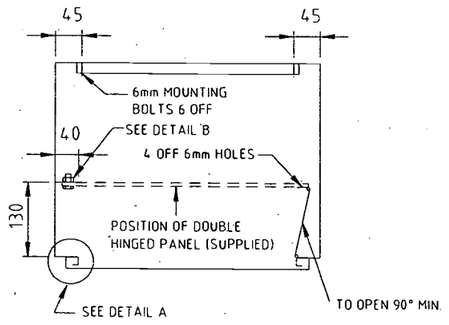


DETAIL A
DOOR/CORNER DETAIL

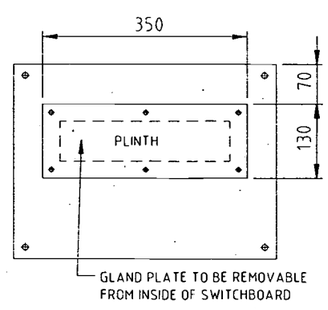


DETAIL B

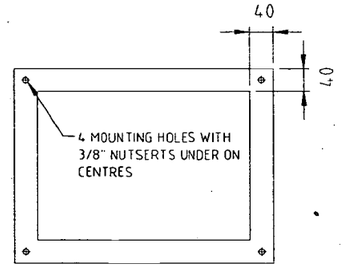
NUMBER OF SWITCHBOARDS REQUIRED	
NUMBER OF PLINTHS REQUIRED	



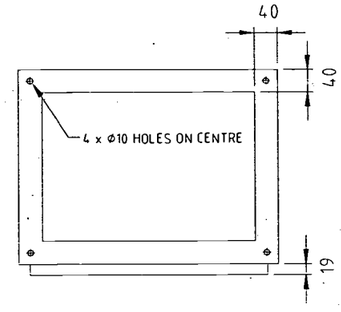
SECTION A-A
(SHOWING HINGED PANEL)



SECTION B-B
(SHOWING GLAND PLATE)



SECTION C-C
PLINTH MOUNTING DETAILS



SECTION D-D
PLINTH MOUNTING DETAILS

NO.	DATE	AMENDMENT	INITIALS
C	9-02	NOTE 7 REVISED	RT
B	11-95	MODIFIED	D.L.P.
A	5-92	ISSUED FOR APPROVAL	D.L.P.

DIRECTOR OF P.D. & P.S. — DATE
ENGINEER IN CHARGE — DATE
SUPERVISING ENGINEER — R.P.E.Q. NO. — DATE

	NAME	DATE
DESIGN	K McG	5-5-92
DRAWN	D.L.P	7-5-92
CHECKED		

Brisbane City

JOB FILE			
ACAD FILE	22C0024-Rev-C	SHEET SIZE	A1
SURVEY No.		FIELD BOOK	
SURVEYED		A.H. DATUM	

Brisbane Water — Professional Services — Engineering

PROJECT: CATHODIC PROTECTON

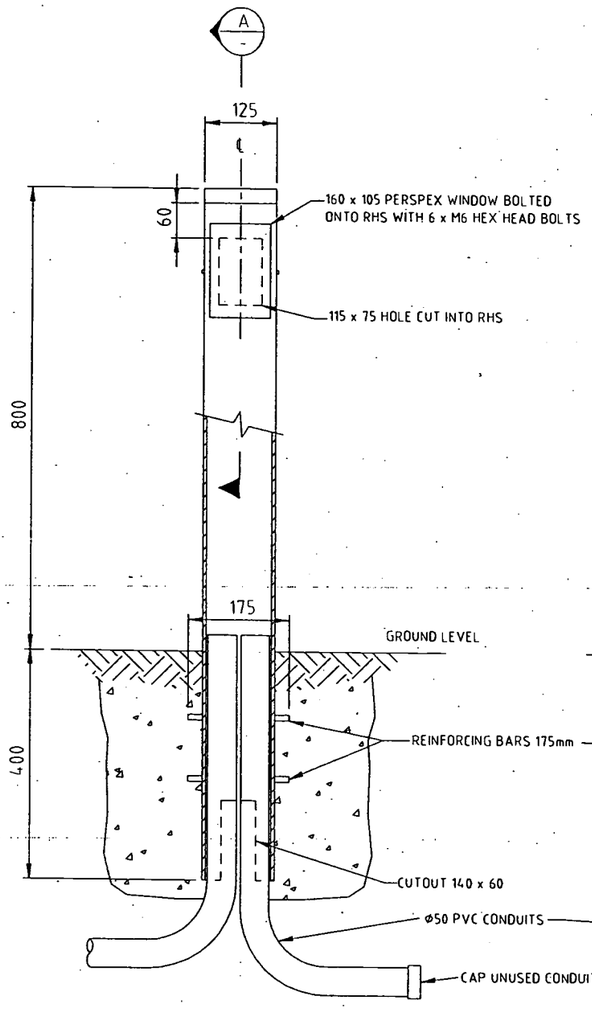
TITLE: STANDARD SWITCHBOARD CABINET

SCALE: NTS | N° 1 OF 1 SHEETS

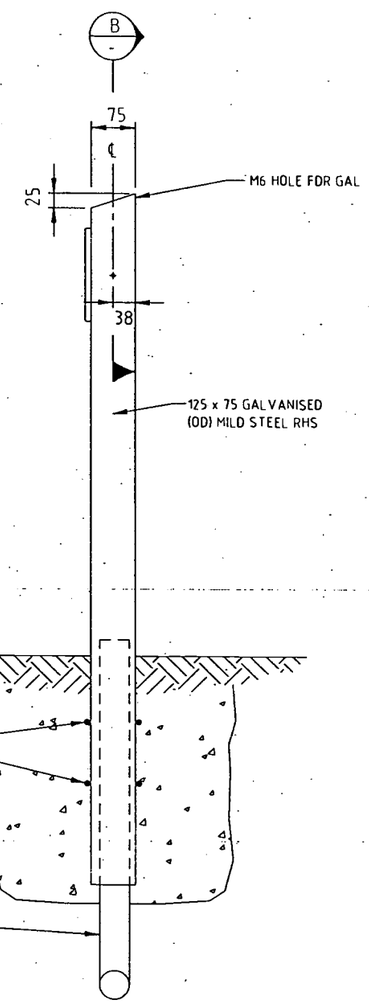
DRAWING N°: 486/1/22-C0024E | AMEND: C

NOTES

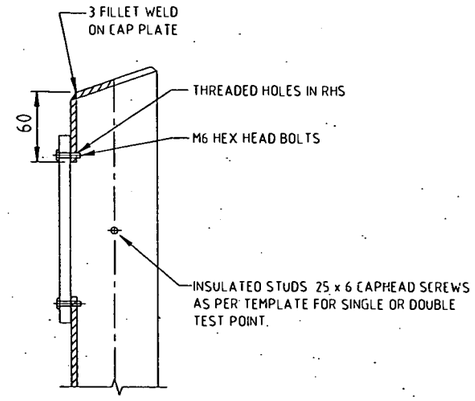
1. HOT DIP GALVANISE AFTER FABRICATION.



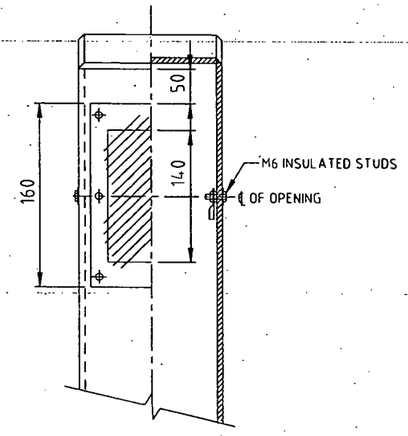
FRONT ELEVATION SECTIONED



SIDE ELEVATION



SECTION A-A



SECTION B-B

NO.	DATE	AMENDMENT	INITIALS
C	9-02	NOTE 7 REVISED	HT
B	11-95	MODIFIED	D.L.P.
A	5-92	ISSUED FOR APPROVAL	D.L.P.

DIRECTOR OF P.D. & P.S. — DATE
ENGINEER IN CHARGE — DATE
SUPERVISING ENGINEER — R.P.E.Q. NO. — DATE

	NAME	DATE
DESIGN	K.McG.	5-5-92
DRAWN	D.L.P.	7-5-92
CHECKED		

Brisbane City

JOB FILE			
ACAD FILE	22T0001-RevA	SHEET SIZE	A1
SURVEY No.		FIELD BOOK	
SURVEYED		A.H. DATUM	

Brisbane Water — Professional Services — Engineering

PROJECT: CATHODIC PROTECTON

TITLE: STANDARD TEST POINT CONSTRUCTION DETAILS

SCALE NTS | N° 1 OF 1 SHEETS

DRAWING N° 486/1/22-AAT0001E | AMEND C