proteus
ENGINEERS

WINDIMURRA VANADIUM PTY LTD

WINDIMURRA VANADIUM PROJECT

STANDARD SPECIFICATION

FOR

ELECTRICAL DESIGN CRITERIA

DOCUMENT APPROVALS

NAME	PEN	DATE	SIGNATURE
L. FORD	RED	18/9	
H. ZANDBERG	GREEN	18/9/2007	
J. PAROLIN	AQUA	18/9/2007	
~~L. BOURGUIGNON~~	~~BROWN~~		
~~C. PRITCHARD~~	~~ORANGE~~		
J. DENNIS	BLUE		
M. WESTLUND	LIGHT GREEN		

DOCUMENT NO.: 06033-S-00E-001

proteus
ENGINEERS

CLIENT REVEW / APPROVAL

☐ .....APPROVED EXCEPT AS NOTED
☑ .....APPROVED
☐ .....NOT APPROVED

REVIEWED BY.....
DATE ...../...../.....

B	08/06/07	Issued for Client Approval	TI	MG	TI
A	29/11/06	Issued	TI	STM	STM
NO	DATE	REVISION DESCRIPTION	BY	CHK	APP

PERTH
T: (61 8) 9481 3200
F: (61 8) 9481 2249
370 Murray Street
Perth WA 6000
PO Box 7537
Cloisters Square WA 6850

BUNBURY
T: (61 8) 9792 5633
F: (61 8) 9792 5644
19 Stirling Street
Bunbury WA 6230
PO Box 1045
Bunbury WA 6231

W: www.proteuseng.com.au
E: proteus@proteuseng.com.au
Proteus Consultants Pty Ltd
ABN 75 731 449 224

proteus
ENGINEERS

CONTENTS

proteus
ENGINEERS

1.0 INTRODUCTION

The purpose of the Electrical Design Criteria is to specify project specific design requirements.

The order of precedence for all project design documents shall be as follows:

1) WVPL Design documents i.e. standards and specifications
2) Proteus Electrical Design Criteria
3) Proteus Basis of Design

2.0 GENERAL

2.1 Scope

The design criteria shall be used for the design of all electrical, instrumentation and control works and equipment associated with process plant, infrastructure and industrial facilities for the Windimurra Vanadium Project.

2.2 Applicable Documents

The electrical design shall be in accordance with the following project specifications:

Doc No	Doc Title
06033-G-00-E-001	Windimurra Vanadium Project Electrical Basis of Design
06033-S-00-X-001	Windimurra Vanadium Project Project Specification
06033-S-00-X-002	Windimurra Vanadium Project Site Data and Project Requirements Specification
06033-S-00-X-003	Windimurra Vanadium Project Project Numbering Specification
C5270-00-ESE-7310	Standard Specification 400V Motor Control Centres
C5270-00-ESE-7315	Standard Specification Transportable Switchrooms – Non Combustible Construction
C5270-00-ESS-003	Standard Specification E&I Equipment and Cabling Installation
C5270-00-ESS-005	WVPL Standard Specification Power Transformers
C5270-00-ESS-006	Standard Specification

proteus
ENGINEERS

Doc No	Doc Title
	Testing and Commissioning of E&I System
C5270-00-ESS-007	Standard Specification E&I Requirements for Mechanical Package Equipment
C5270-00-ESS-010	Standard Specification Preparation of Electrical Drawings
C5270-00-GSS-002	Standard Specification Site Data and General Project Requirements
C5270-00-GSS-003	Standard Specification Vendor Drawings and Data
C5270-00-GSS-004	Standard Specification Packing of Goods
C5270-00-GSS-005	Standard Specification Project Numbering System
C5270-00-GSS-006	Standard Specification Preferred Electrical and Instrumentation Vendors List
C5270-00-MSS-004	Standard Specification Painting and Protective Coatings
C5270-00-MSS-005	Standard Specification Roof and Wall Sheeting and Roof Plumbing
C5270-00-MSS-006	Standard Specification Thermal Insulation

2.3 Design Standards

In the first instance, refer to the WVPL/TPJV standard specifications. In the second case to the Proteus 'Electrical Basis of Design' document, unless otherwise noted in the Design Criteria.

2.4 Safety Standards

All statutory requirements as specified in the project data specifications including Department of Consumer and Employment Protection – Resources Safety shall be followed. All equipment shall be to Australian Standards

proteus
ENGINEERS

3.0 DESIGN PHILOSOPHY

The Electrical Design shall be in accordance with the specifications listed in Section 2.2. The overall design philosophy will be to follow the project specification and standards issued for use on the project. Where requirements are not specific the original plant Signet design drawings and documentation shall be used as a guide.

The drawings listed below are to be referenced as part of the design philosophy.

Drawing No	Rev	Doc Title
TI0Q968-SL-001	J	Windimurra Vanadium Project High Voltage Generation and Distribution Single Line Diagram
C5270-00-I-1500	P1	Windimurra Vanadium Project Control System Architecture System Wide Block Diagram
TI0Q968-LA-001	A	Windimurra Vanadium Project RMU -5 Way General Arrangement
TI0Q968-LA-001	B	Windimurra Vanadium Project RMU -4 Way General Arrangement
C5270-00-E-S1010	P1	Standard Drawings Electrical Standards 400kW and Below DOL Schematic Diagram
C5270-00-E-S1017	P1	Standard Drawings Electrical Standards Feeder for SS, VSD, L&SP, DB Schematic Diagram
C5270-00-E-S1000	0	Standard Drawings Electrical Standards Single Line Diagram & Schematic Symbols
C5270-00-E-S1001	0	Standard Drawings Electrical Standards Instrumentation & Electrical Symbols
C5270-00-E-S1002	0	Standard Drawings Electrical Standards 2500kVA Transformer Compound Layout
C5270-00-E-S1003	0	Standard Drawings Electrical Standards Earth Pit and Earthing Layout

proteus
ENGINEERS

Drawing No	Rev	Doc Title
C5270-00-E-S1004	0	Standard Drawings Electrical Standards Lighting Tower Design Details
C5270-00-E-S1005	0	Standard Drawings Electrical Standards Heinelec HPR DB 136/42 Pole Switchboard Layout
C5270-00-E-S1006	0	Standard Drawings Electrical Standards 400V L&SP Distribution Board Single Line Diagram
C5270-00-E-S1007	0	Standard Drawings Electrical Details Sheet 1
C5270-00-E-S1008	0	Standard Drawings Electrical Details Sheet 2
C5270-00-E-S1009	0	Standard Drawings Electrical Details Sheet 3
C5270-00-E-S1010	P1	Standard Drawings Electrical Standards 400kW and Below DOL Schematic Diagram
C5270-00-E-S1012	P1	Standard Drawings Electrical Standards Conveyor and Walkway Lighting Details
C5270-00-E-S1013	P1	Standard Drawings Electrical Standards Floodlighting Pole Details
C5270-00-E-S1016	P1	Standard Drawings Electrical Standards PLC Outdoor Enclosure – General Arrangement
C5270-00-E-S1017	P1	Standard Drawings Electrical Standards Feeder for SS, VSD, L&SP, DB – Schematic Diagram
C5270-00-E-S1020	P1	Standard Drawings Electrical Standards Typical Transportable Switchroom Layout

proteus
ENGINEERS

Drawing No	Rev	Doc Title
C5270-00-I-S1000	0	Standard Instrumentation Installation Details Sheet 1
C5270-00-I-S1001	0	Standard Instrumentation Installation Details Sheet 2

4.0 PLANT DESCRIPTION

4.1 Power Generation

The power station will be designed and supplied by Alinta.

4.2 Power Distribution

The switchboard at the power station will feed two sets of ringed supplies for the process plant, an 11kV overhead line to outlying structures and a power station services transformer plus MCC.

The power distribution package work will be undertaken by Alinta.

4.2.1 HV Distribution

Power will be distributed from the power station to within the process plant at 11kV utilising a Ring Main Unit design. From the power station Ring Main Unit feeder systems the load will be distributed to two main sources, these being:

- 11kV Distribution to the Areas 10,15,12,50 (TPJV process areas)
- 11kV Distribution to the Areas 19 Substation, Area 20 Substation (including 30,35, and 40) and Area 45 Substation (including 36,41,45) for Drytech and Proteus process areas)

All step down distribution transformers for the 11/3.3kV (Proteus substation) and 11/0.433kV (Drytech and Proteus substations) shall be specified and supplied by Alinta. The battery limit for Proteus shall be the transformer secondary terminals.

The areas external to the process plant will be supplied from the power station via an overhead line will be:

Area 25 Calcine Dump
Area 50 Potable Water
Area 55 Borefields
Village
Mining Contractors Workshop etc

All design construction and commissioning for the 11kV distribution within the plant and external to the plant will be carried out by Alinta.

proteus
ENGINEERS

4.2.2 LV Distribution

The Proteus scope of work battery limits starts at the secondary terminals of the step-down transformer. The main LV distribution centre for Proteus loads shall be the Area 19 Magnetite Feed Substation and the Area 20 Roasting Substation. Other area which requires LV distribution within the plant is Area 50 High Saline Ponds.

The Magnetite Feed substation has two MCCs, a HV MCC to specifically feed the VSD driven Kiln ID fan and one LV MCC for the adjacent LV loads. There is no requirement for an emergency bus in this substation.

The Roasting substation LV MCC is in three sections Bus A, B and C. There is a bus-tie between bus A and B which is left open in normal operation. There is also a bus–tie between bus B and C which is closed during normal operation. During a black-out situation this second bus-tie between bus B and C is opened and bus C is supplied by a black start generator from the power station.

The Bus A and Bus B plus Bus C section of the MCCs shall be fed via the 2.5MVA transformer; in the event of a transformer failure the bus tie between Bus A and Bus B can be closed. In this mode of operation a small amount of load may need to be shed to prevent transformer overload.

The design approach is consistent with the original plant design intent. Additional LV loads will be fed from individual MCCs distributed throughout the plant area as required.

Both 20-MCC-501A and 20-MCC-501B will have power factor correction units to maintain the nominated site power factor.

4.3 Substations

The transportable substations to be supplied by Proteus are located near the Wet Feed and also the Desilication area. The substations will be named Area 19 Magnetite Feed and Area 20 Roasting.

The Area 19 substation will feed the entire wet end feed process and associated drives. The substation will also house the VSD's as required for these areas, lighting and small power distribution boards and the process control cubicles.

The Area 20 substation will feed the entire Kiln and associated drives, Leaching, Desilication, AMV Precipitation drives. The substation will also house the VSD's as required for these areas, lighting and small power distribution boards and the process control cubicles.

Space within the substation has been allowed for the Drytech supplied MCC (Motor Control Centre) which feeds and controls Area 40 process area.

A third substation has been costed by Proteus for the Drytech electrical equipment within areas 36, 41 and 45. This will be a transportable substation based on sizing given by Drytech. This substation will feed the entire FeV furnace auxiliary drives AMV Drying and V2O3 Production drives. The substation will also house the VSD's as required for these areas, lighting and small power distribution boards and the process control cubicles.

proteus
ENGINEERS

4.4 Main Control Room

The main control room for the process plant is an existing building located near the Slug Dose Tanks. The building will be refurbished with a new distribution board, cabling lighting and small power services as required.

The main process plant control system will be supplied by TPJV.

4.5 Plant Services

4.5.1 Harmonic Filtering

Harmonic levels at the Roasting Substation to be reviewed in accordance with the Site Data and General Project Requirements.

4.5.2 Communications

There will be communications via a telemetry system to control and monitor outlying process areas. The telemetry system base station will be supplied by TPJV. However, the repeater station and associated antennas within the process plant area will be supplied by Proteus. Each remote MCC that Proteus has responsibility for, Proteus will supply the telemetry receiver, antenna and associated power supplies.

4.5.3 Telephone

There will be a telephone system within the plant as shown on the communications block diagram; the scope of supply is by TPJV.

4.5.4 Fire Detection

Fire detection is supplied for the Main Plant Control Room building with the signals cabled back to the Area 19 Magnetite Feed and Area 20 Roasting substation. Fire detection is as supplied for the Area 19 Magnetite Feed and Area 20 Roasting substation each MCC tier has smoke detection plus smoke detection with the substation building as part of the substation package.

Signals from the substation fire indication board are wired back to the process control cubicle within the substation. Fire detection signals are wired back to the Master Control Panel located in the PowerStation.

Scope of supply for the Fire Detection system for all other areas will be by TPJV.

4.5.5 Evacuation System

Proteus will supply the evacuation sirens, junction boxes and cabling back to the main control for connection to the evacuation system by others.

proteus
ENGINEERS

4.5.6 Cable Ladder

Proteus will design and install cable ladder for the HV distribution up to the TPJV tie point based on the cable data and information supplied by Alinta for the HV cabling.

4.5.7 CCTV

There will be a CCTV (Closed Circuit Television) system within the plant as shown on the CCTV block diagram; the scope of supply will be TPJV.

4.5.8 Kiln Infrared Scanner

There will be a Kiln Infrared Scanner system within the plant as shown on a block diagram; to be supplied by Thermal Systems.

4.5.9 High Temperature Camera

A high temperature camera system will be installed to monitor the Burning Zone and Kiln internal walls. The high temperature camera system will be supplied by Proteus.

4.5.10 Process Water

Water is stored in the raw water distribution and process water tank near the Reagents area in the main process plant after being pumped from the raw water supply tank.

4.6 Process Plant Control

See the Process Plant Description and Process Control Philosophy documents.

4.7 Outlying areas

4.7.1 Tailings

Not part of Proteus Scope.

4.7.2 Area 50 - High Saline Ponds

The High Saline Pond MCC will be fed by a LV feeder from the power station services MCC via an underground route. The process will be controlled by a telemetry system.

4.7.3 Area 25 - Calcine Dump

The battery limit of the Calcine Dump area starts at the LV terminals of the pole transformer. All overhead power line, poles, fittings, support and transformer will be design and supplied by Alinta.

There are two MCCs for the Calcine dump area; the first MCC 25-MCC-501 is an identified existing MCC which will be refurbished. This MCC will be fed from a pole

top transformer. The second MCC 25-MCC-502 will be a new MCC and is fed from 25-MCC-501. The power supply for the second MCC will be supplied by Proteus.

The process will be controlled by a telemetry system, the base station within the plant to be supplied by WVPL and the telemetry receiver to be supplied as part of the MCC package.

4.7.4 Mining Workshop

Not Proteus scope.

4.7.5 Village

Not Proteus scope.

4.7.6 Area 55 - Borefield Transfer Pumps East

The Borefield Transfer Pump East area located near the storage tank has a battery limit from the LV terminals of the pole transformer. All overhead power line, poles, fittings, support and transformer will be design and supplied by Alinta. There is one MCC for the Borefield Transfer Pump East area, which will be a new MCC fed from the pole top transformer.

The pumps will be controlled by a telemetry system, the base station within the plant to be supplied by WVPL and the receiver to be supplied by Proteus.

4.7.7 Area 55 - Borefield Transfer Pumps North

The Borefield Transfer Pump North area located near the storage tank has a battery limit from the LV terminals of the pole transformer. All overhead power line, poles, fittings, support and transformer will be design and supplied by Alinta. There is one MCC for the Borefield Transfer Pump North area, which will be a new MCC fed from the pole top transformer.

The pumps will be controlled by a telemetry system, the base station within the plant to be supplied by WVPL and the receiver to be supplied by Proteus.

4.7.8 Area 55 - Low Saline Collection Pumps

This area is now deleted.

4.7.9 Borefield Pumps

Proteus will cost the Borefields electrical/instrumentation and control equipment only. The battery limits are from the LV terminals of the pole transformer to the motor terminals. All overhead power line, poles, fittings, support and transformer will be design and supplied by Alinta. All mechanical equipment including pumps, motors and backup generators will be supplied and installed by WVPL. The design and costing will be based on the original Signet design.

proteus
ENGINEERS

4.8 Process Control System

The process control system architecture has been developed from the overall control system block diagram which was developed by others for implementation on the project.

The process control system (PCS) consists of dedicated ControlLogix controllers installed in each process Area (as required), with the controllers communicating to the Citect SCADA system over fibre-optic Ethernet. ? Confirm.

All motor drives (DOL and Soft-Starters) will be interfaced to the Area controller using DeviceNet. Each DeviceNet network will require a 1786-CN2DN ControlNet to DeviceNet converter module and the number of nodes in one DeviceNet network will be limited to a maximum of 30 devices (theoretically the DeviceNet network can service a maximum 64 devices).

All VSD's will be interfaced to the Area controller using ControlNet network. The maximum number of nodes in a ControlNet network will be limited to a maximum of 60 devices (theoretically ControlNet network can service a maximum of 100 devices).

The maximum number of devices is assumed, no project specification or performance criteria was available at the time of the estimate.

Redundant controllers are not required for process areas included in Proteus scope of work. Burner Management Systems (BMS) will be hard-wired and will comply with all Office of Energy Safety requirements.

4.9 Process Control Network

The overall Process Control Network (PCN) consists of an Ethernet ring (fibre-optic), ControlNet ring (fibre-optic, critical load shedding services) sharing a multi-core fibre (24 core, Single Mode fibre) with other services such as Office LAN, Voice over IP telephones, CCTV system etc. The PCN will be isolated from the rest of the administrative network by installing fire-walls and routers.

4.10 Instrumentation

Field instruments will be wired to field I/O cabinets located strategically throughout the process plant area. Flex IO blocks (both analog and digital) will be installed in field termination cabinets. The Flex IO blocks will communicate with the Area controllers using ControlNet and hence each Flex IO block systems will be treated as one ControlNet node. Flex IO design limits the number of IO Blocks (both analog and digital) to a maximum of eight (8). If the IO required in a particular location requires more than 8 Flex IO blocks, then a second ControlNet node will be added to the Field I/O cabinet.

All analog field instruments will be capable of HART communications and hence Flex IO analog blocks (input and output) will also be HART compatible and allow the device diagnostic information to pass through the modules.