



# **Sewage Pump Station - Specific Electrical Requirements**



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## 1. INTRODUCTION

This document outlines the specific requirements for electrical and telemetry aspects of a Goulburn Valley Water (GVW) sewage pump station. It shall be read in conjunction with GVW's General Electrical Specification and Sewer Pump Station Design Manual.

For quantities, ratings and specific requirements of an individual site refer to the Site Specific Specification for that site.

## 2. POWER SUPPLY

### 2.1. Grid Supply

The switchboard shall be provided with 3 phase mains power supply to adequately operate pumps, pump controls, telemetry equipment, and metering and 10 amp general power outlet.

The consultant shall arrange with the Electricity Supply Company for connection of electrical supply including meeting the associated costs as part of the project. The Corporation shall only meet the costs associated with electricity consumption due to the operation of the pump station i.e. not connection costs or upgrading of electrical supply to the pump station site.

### 2.2. Alternative Supply

The pump station shall be designed to operate from an alternative power supply via one standard connection should mains power fail for an extended period. Refer to Draft Backup generator and ATS Design Guideline.

During the commissioning of the pump station, an alternative electrical supply shall be provided and be capable of operating all of the pump station electrical consuming equipment. The consultant shall ensure that the alternative power supply operates all electrical equipment within its normal parameters.

The alternative electrical supply connection point shall be installed on the switchboard cabinet in a manner that does not require the cabinet door to remain open.

## 3. ELECTRICAL AND ELECTRONIC EQUIPMENT

The following electrical and electronic equipment and materials shall be supplied and installed. The phase rotation needs to be checked and consistent with GVW generator supply. Refer to Draft Backup generator and ATS Design Guideline.

### 3.1. Meters

The following meters are required to be installed:

- Eastern Energy/Powercor (SECV) meter;
- 3 phase switching volt meter
- Ammeter for each pump;

- 5 digit hours run meter (2 No.);
- A magnetic flowmeter with 4-20 mA output; and
- A power meter

### 3.2. Ancillary

Accessible to maintenance personal 10 Amp general power outlet located on the escutcheon panel of the distribution board.

### 3.3. Flowmeters

Electromagnetic flowmeters are to be installed on the discharge rising mains from all industrial and large catchment pump stations.

Flowmeters are to be installed on the discharge pipework immediately downstream of the valve pit and are to be wholly contained within the pump station site. Flowmeters are to be installed below ground within a concrete pit fitted with a trafficable lid and in accordance with the Goulburn Valley Water's 1.10.1 Electromagnetic flow meter below ground installation and pit details W12 – W16.

The location of the flowmeter and all cabling is to be included in the 'As Constructed' information with a location plan fixed to the inside of the control cabinet.

Internal:

The flow meter will be mounted external to the switchboard.

External:

The flow meter will be mounted internal to the switchboard.

### 3.4. Installation - Cables Conduits and Junction Boxes

Cabling is to be positioned in conduits as shown on Corporation drawing No. STD/6.

Cabling is to be laid to equipment in conduits which meets the Electricity Supply Corporation's requirements. Sufficient length of cabling is to be provided to facilitate easy access to and removal of pump well equipment. Cabling is to be suitable for operation in submersed raw sewage conditions.

Conduits are to be either heavy duty uPVC or 316 stainless steel and sealed via expanding foam application or similar as approved by the Corporation, to all locations where pump well gas may vent to the outside the pump well or valve pit.

Junction boxes are to be water tight, positioned to allow access to pump well and removal of pumping equipment.

### 3.5. Switchboard Cabinet

Power to pump sets are to be direct wired and positioned near the top of pump well access and suspended on a 316 stainless steel hook. The switchboard cabinet is to be constructed from 3mm thick, marine grade aluminium with sufficient space to accommodate the following equipment:

- Supply Company meter

- Amp meters
- Hour run meters
- Switchgear
- Control circuits including pump control system and circuit breakers
- Telemetry equipment
- Alternative power supply wiring
- Electric wiring so as not to present as a 'birds nest'

The cabinet is to be free standing, weather proof and powder coat finish with Dulux (Colour – Green external and Beige internal) or equivalent as approved by Goulburn Valley Region Water Corporation.

The cabinet is to be lockable by means CLO01 standard lock.

The telemetry cabinet will have GVW issue cyber lock.

The power authority section of the cabinet will provide and use their own.

The cabinet door is to swing open 180 degrees and be capable of being fixed at a 120 degrees opened position.

A LED door switch operated, light is to be fitted to the interior of the cabinet.

A door open switch is to be placed on all doors with the exception of supply authority, complete with Intruder Alarm Contacts to Digital Input No. 11 of the Terminal Strip.

The cabinet position is to be specified on detailed design plans for approval by the Corporation.

The switchboard cabinet height is to be determined by Goulburn Valley Water Project Manager.

A metal pocket is to be provided in the cabinet capable of holding details on the pump station including design plans, electrical layout plans, pump operational manuals, A4 cleaning maintenance and repair 'exercise' book.

The switchboard layout and motor control type is to be determined on a case by case basis and referenced drawings indicate the possible types.

#### 4. SEWAGE PUMP STATION INSTRUMENTATION

In addition to the controls and instrumentation specified in the General Electrical Specification the following instrumentation shall be provided:

- 4.1. Duty start / stop level float switches wired to the control system to provide backup control in the event of failure of the level transmitter in Local Auto mode.
- 4.2. A digital flow rate display mounted on the switchboard door (inner for external switchboards) for station outflow measurement where specified in the Site Specific Specification. The display shall be driven by the 4-20mA signal generated by a magnetic flow-meter mounted remotely. The flow meter signal shall also be looped into the RTU. The display shall be scaled 0 – 50L/s unless otherwise specified in the Site Specific Specification.
- 4.3. Where VSD's are used the 4-20 mA loops are to be isolated from the RTU.

#### 5. RADIO TELEMETRY EQUIPMENT

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### 5.1. Telemetry Backup

The Telemetry backup system is to be capable of operating for a period of not less than 8 hours without mains or temporary electrical supply.

### 5.2. Fail Safe

The telemetry system shall convey a breach in normal operating status condition via fail safe logic for the following conditions:

- 5.2.1. Power supply failure
- 5.2.2. Refer to the General Electrical Specification for general radio telemetry equipment requirements
- 5.2.3. The following supporting drawings in Appendix 1 shall be referred to:
  - Typical water pump station RTU
  - Typical water pump station terminal strip
  - Typical water pump station power layout
- 5.2.4. The station's telemetry interface is to be compatible with GVW's existing telemetry systems and be capable of monitoring and control.
- 5.2.5. The antenna shall be mounted on the vent stack if available or alternatively on a free standing pole.

## 6. OVERVIEW OF SEWAGE PUMP STATION CONTROL

Sewage pump station control should be supplemented with site information available from Operations Manuals. That stated below is for general information only, refer to the Site Specific Specification for further details.

### 6.1. Pump Starter – ‘Manual / Off / Auto’ Control Selection

- 6.1.1. EACH Pump Starter shall be supplied with a ‘Manual / Off / Auto’ selector switch. Selections will provide the following operation control for the pump starter –
- 6.1.2. In ‘Manual’ – Pump runs continuously, independent of the Telemetry System
- 6.1.3. In ‘Off’ – Pump is isolated from electrical control.
- 6.1.4. In ‘Auto’ – Pump operates automatically as detailed in the following clause.

### 6.2. Pump Station – ‘Local / Remote’ Automatic Control Selection

- 6.2.1. A 'Local / Remote' Control selector switch shall provide selection between controlling systems for the Pump Station automatic operation. This switch shall provide the following Control Function -
- 6.2.2. In 'Local Control' - (with 'Auto' Run Mode selected) pumps are controlled by the panel mounted Process Level Controller.
- 6.2.3. In 'Remote Control' - Pumps are controlled remotely via the Telemetry system. The local initiation of pump operation by the Process Level Controller shall be DISABLED. In this mode the Telemetry Interface will provide station level operating Set points, Pump's Duty selection ( Cycle Duty, 1 - 2 Duty or 2 - 1 Duty, etc.)

### 6.3. Pump Station LOCAL AUTO Operation

This clause describes the functionality required for wiring and process level controller configuration when pumps are in auto and when the 'Local / Remote' Control selector switch is set to Local.

- 6.3.1. The duty and standby pumps are set with the local duty selector switch.
- 6.3.2. The pumps operate under the control of the Process Level Controller (and floats if required). Operation will follow the levels pre-set in the Process Level Controller (refer to TABLE 1).

TABLE 1	
Pump Control	Level/Setting
High level alarm / float	set at 300mm above standby cut-in level
Standby cut-in level	set at 150mm above the duty cut-in level
Duty cut-in level	set at 150mm below the incoming sewer invert level
Duty cut-out level	50mm above pump cavitation level
Low level alarm/float	at the cavitation level of the pump set (Does not stop pump)
Emergency level cut-in level/float	set at 500mm above standby cut-in level
Emergency duty cut-out level/float	50mm above pump cavitation level

- 6.3.3. Pump control is to be set for not greater than 6 hours detention period.
- 6.3.4. Auto cycling of pump units is not required for Local Auto mode.
- 6.3.5. When the high level float switch is operated it shall raise an alarm on the SCADA system.
- 6.3.6. When the emergency high level float is operated the duty pump shall run independent of any controller set points until the emergency cut-out level float is operated. The emergency type pump station control shall be arranged so that it is repetitive until the station fault is rectified. The 'High Level Pump Run' indicator lamp shall be illuminated during emergency pump operation. The emergency high level float control shall remain DISABLED during:-
  - pump OFF isolation, or



- pump MANUAL control selection, or
- REMOTE AUTO control selection

### 6.4. Pump Station REMOTE AUTO Operation

This clause describes the functionality required for wiring and RTU programming when pumps are in auto and the 'Local / Remote' Control selector switch is set to Remote (telemetry).

- 6.4.1. The pump shall operate under the control of the RTU with the level signal provided via the Process Level Controller. Operation will be controlled by the GVW SCADA system independent of the levels pre-set in the Process Level Controller.
- 6.4.2. In this operation mode, 'Local Control' of the pumps is disabled.
- 6.4.3. Pump station operating levels shall be controlled in accordance with set-points pre-programmed into the telemetry processor. In this operating mode the pump station shall rely on the telemetry processor for control and monitoring. Changes to various station control set-points will be accessed via the GVW Regional SCADA System. Such access is not confined to, but includes the following:-
  - Level control set-points
  - Pumps Duty selection of Cycle, 1-2 or 2-1
  - Individual pump set inhibit
  - Alarm set-points for excessive starts
  - Alarm set-points for excessive run hours
  - Off-peak tariff control starts
- 6.4.4. In the REMOTE AUTO mode of station operation any "local" calling shall remain disabled.
- 6.4.5. Emergency high level well station running shall NOT function for this mode of operation.

### 6.5. Cavitation Level (Snore)

This method of control is when the sump level is pumped down to where the pump starts to draw air; this control is used to assist in the cleaning of debris from the sump.

### 6.6. Maintaining a Level (Snoozing operation)

When a Variable speed drive (VSD) is installed, the sump level can be maintained at a level to minimise frequent stop/ start cycles.

## 7. REFERENCE DOCUMENTS

- Goulburn Valley Water's Product Manual Supplement
- 1.10 Design Guideline – Electromagnetic Flow Meter Installation
- 1.10.1 Electromagnetic flow meter below ground installation and pit details W12-W16
- Goulburn Valley Water - General Electrical Specification
- Goulburn Valley Water – Water Pump Station – Specific Electrical Requirements
- GVW Preferred Equipment List. Note: This document is not available publically, but a current version can be made available upon request. For developer construct projects the Preferred Equipment List can be requested from Goulburn Valley Water's Land Development Group
- Draft Backup generator and ATS Design Guideline

- Drawing list:

Direct on line (DOL) single sided switchboard

- PS\_-E100 Drawing Schedule
- PS\_-E101 Single Line Diagram
- PS\_-E102 Pump 1 Control Schematic
- PS\_-E103 Pump 2 Control Schematic
- PS\_-E104 Common Control Schematic
- PS\_-E105 Level Controller Schematic
- PS\_-E106 Phase Fail MFM 24V AC
- PS\_-E107 12 V DC Power Supply
- PS\_-E108 RTU – Terminal Strip Diagram
- PS\_-E109 RTU and Radio Schematic
- PS\_-E115 Cable Schedule
- PS\_-E116 Equipment List
- PS\_-E120 Switchboard Layout
- PS\_-E125 DOL Switchboard Construction
- PS\_-E130 Site Layout

Variable Speed Drive (VSD)

- PS\_-E101 Single Line Diagram
- PS\_-E102 Pump 1 Control Schematic
- PS\_-E103 Pump 2 Control Schematic

Soft Starter

- PS\_-E101 Single Line Diagram
- PS\_-E102 Pump 1 Control Schematic
- PS\_-E103 Pump 2 Control Schematic

Double sided switchboard

- Double Sided SP

### APPENDIX A: TYPICAL SEWER PUMP STATION - INPUT / OUTPUT SCHEDULE

334	No.	Point Description / Type Pump / Structure / Tank	Point Type	Point Status Message By Telemetry System
DIGITAL INPUTS	0	AC Power Fail	Alarm	Normal / Fault
	1	Pump 1 Fault (Common Pump Faults)	Alarm	Normal / Fault
	2	Pump 1 Running	Status	Running/ Stopped
	3	Pump 2 Fault (Common Pump Faults)	Alarm	Normal/ Fault
	4	Pump 2 Running	Status	Running / Stopped
	5	RTU Power Supply Fail	Alarm	Normal / Fail
	6	Wet Well Level Low	Alarm	Normal/ Running/ Fault
	7	Odour Control Fault		
	8	Station Control Mode	Status	Local/ Remote
	9	Dry Well Level (Dry Well Sites Only)	Alarm	Normal / Flooded
	10	Intruder Alarm	Alarm	Normal / Intruder
	11	Emergency Pump Operation	Status	Normal / Operating
	12	Wet Well Level High	Alarm	Normal / High
	13	Duty Level Called	Status	Normal / Called
	14	Standby Level Called	Status	Normal/ Called
	15	Generator (334)	Status	Running/ Stop
DIGITAL OUTPUTS	0	Start Pump 1	Control	(Controlled by Telemetry)
	1	Start Pump 2	Control	(Controlled by Telemetry)
	2	Cut In Level Override ( Remote Start)	Control	(Controlled by Telemetry)
	3	Spare #4		
	4	Spare #5		
	5	Spare #6		
	6	Battery Test Output		
	7	Spare #7		(Controlled by Telemetry)
ANALOGUE INPUTS	0	Wet Well Capacity	Analog	4 - 20 mA ( 0 - 100%)
	1	Station Outflow Rate (Where Metered)	Analog	4 - 20 mA ( 0 - 100 L/s)
	2	Retic. Pressure	Analog	4 - 20mA
	3	Spare	Analog	4 - 20mA
COUNT	0	Rain Counter Input (Option)	Digital	Pulse

**Notes:**

1. A Local / Remote Duty Selector Switch shall be installed to provide a separation of Station Operation. This switch shall be wired to provide Control Circuit functions for:-
  - a. In the Local Duty Select Auto Run Mode - Local calling of pumps shall be initiated by a panel mounted Weidmuller, Model PMX420, having calling levels fixed at the Site, and
  - b. In the Remote Duty Select Mode - the Local calling shall be DISABLED, and the Telemetry Unit calling
    - i. ENABLED.
    - ii. In This mode the Telemetry Interface will provide Station Level operating Set Points, and Pumps Duty
    - iii. Selection ( Cycle Duty, 1 - 2 Duty or 2 - 1 Duty, etc. )
2. A Vegawell 52 pressure Transducer is required for "Well Level Source" at the Station. The Analogue Loop from the transducer shall be terminated to Local Control Equipment, and to Analogue Input 1 of the Terminal Strip. (Refer to Appendix E for details of Terminal Strip Interface arrangement.)
3. All Pump Station Control Circuits shall be of 24v AC Type.
4. Terminal Strip terminations shall be Voltage Free Contacts.
5. Control by Telemetry Output ( as applicable) shall be switched through a wire link, and slave Relay. Such switching shall be low voltage ( 24v AC ) , Typical.
6. All other configuration of the Station shall be in accordance with respective sections of the Specification