Dŵr Cymru
Welsh Water

Procedural Document

Sewers for Adoption 7th Edition Addendum

March 2023

Document ID: AP_(03)_10

Document Control

Version Control

Version	Status	Date	Author(s)	Description of Change
1	Draft	02/2013	Andrew Herbert	First Draft for comment
1	General Issue	15/03/2019	Andrew Herbert, Morgan Combstock	Following Review
2	General Issue	04/03/2021	Andrew Herbert, Morgan Combstock	Minor modifications
3	General Issue	08/03/2023	Andrew Herbert / Gethin Jones / Paul Mears / Simon Flaherty / Gareth Humphreys / Sean Quick	General Review / spec updates

Authorisation

Name	Role	Company	Date
Rob Dorr	Technical Standards Manager	DCWW	10/03/2023

Review

This document is to be reviewed by 30/03/2026.

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1 Purpose

Sewers for Adoption 7th Edition does not extend to specific Company requirements where a developer wishes to build a pumping station. This Addendum sets out those requirements that are specific to Dŵr Cymru Welsh Water (DCWW) where a developer wishes to design and construct a pumping station for inclusion within an adoption agreement. The clauses within the document are referenced to the Sewers for Adoption 7th edition and follow on from the clauses detailed within the main document.

It is intended that this Addendum in conjunction with Sewers for Adoption 7th Edition will provide specific guidance for the design and general specification, of sewerage elements involved when making an application to DCWW.

This Addendum does not remove the need for early engagement and constructive discussions between DCWW and developers at appropriate stages or where site specific factors need to be addressed in advance of making an application.

For discussions where a pumping station is to form part of an adoption agreement Developers should contact the Developer Services Team at the following address:

Dŵr Cymru Welsh Water
Developer Services
Fortran Road,
St Mellons,
Cardiff
CF3 0LT

Telephone: 0800 917 2652

For configuration of the Remote Telemetry Unit contact:-

Dŵr Cymru Welsh Water SmartHub
Fortran Road,
St Mellons,
Cardiff
CF3 0LT

Tel: 01443 452300
Fax: 01443 452323

Information on DCWW's current framework suppliers can be obtained from:-

Dŵr Cymru Welsh Water
Procurement Department
Fortran Road,
St Mellons,
Cardiff
CF3 0LT

2 Procurement

The equipment should be selected from preferred suppliers identified within this Addendum and associated Standard Drawings in accordance with the relevant Dwr Cymru Welsh Water (DCWW) Framework Agreements. Where the design solution requires the procurement of equipment that can only be obtained from a non-framework supplier, the Developer shall specify the requirements as part of the Particular Design Specification for the scheme or contract.

The applicable product areas detailed within this Addendum and associated Standard Drawings are:

- Pumps
- Low voltage switchgear and control gear assembly (Electrical Control Panels)
- Instrumentation
- Telemetry

Where a product is available from more than one framework supplier, or there are no relevant framework agreements, the final selection for technically compliant submissions shall be made with reference to DCWW Procurement Guidelines (available on request to the DCWW Procurement Department), whole life costs and sustainability analysis.

3 Hazardous Areas Rating

All equipment installed in wet, or dry wells, shall be rated according to the zone classification of the area in which they are to be installed.

Guidance on how to comply with the DSEAR Regulations for zone classification can be found in the current versions of the following DCWW documents which are available on request:

- DCWW DSEAR Handbook;
- DCWW Explosion Protection Document. (CAF440)

4 Designer's Responsibilities

The designer aspects of the mechanical and electrical design of the station consider the requirements, stipulations and recommendations contained in UK workplace safety legislation or Health and Safety at Work Act 1974, including (but not limited to) the following:

- Health & Safety at Work Act (HASAWA) 1974
- Codes of Practice (COPS);
- Working at Height (WAH);
- Provision & Use of Work Equipment Regulations (PUWER);
- Lifting Operations & Lifting Equipment Regulations (LOLER);
- Construction Design & Management Regulations (CDM).
- DSEAR
- EAWR 1984
- Network and Information Systems Regulations (NISR)
- BS7671 (Latest edition)

5 Part D – Pumping Stations

The clause numbers below refer to those in Sewers for Adoption; these clauses are supplementary and follow on from the clauses listed in the main document except where the sub clause number is prefixed by an '(R)', in which case it is a replacement or a revision. Where an additional (New) clause or comment is included, it will be prefixed by a '(N)'. clause.

D4.1 Location

1. (R) The minimum distance from the wet well (chamber cover edge) of the pumping station to any habitable buildings should be in accordance with Table D.1, in order to minimise the risk of odour, noise and nuisance. This dimension may be subject to change, depending on the local circumstances. and submission of proposals.

D4.2 Site Access

2. (R) A safe and reasonable vehicular access should be provided to the pumping stations at all hours for the purposes of repair and maintenance. Access should be directly from the public highway or by the provision of a dedicated access road. Vehicles should not be permitted to park in front of the vehicle access point to the pumping station. Where collapsible bollards are utilised, they should be able to be secured by a Standard DCWW Abloy padlock. Long reversing routes are not acceptable. Shared access with domestic driveways are not suitable. A vehicle track analysis is required to confirm the suitability of any access road.

D4.3 Site Layout

5. (R) Gates and fencing are required around the compound. For details, please contact Developer Services Team for security classification of assets.

The level of security classification will determine the type of Security Fence required and/or which type of secure enclosure/kiosk may be necessary. Fencing/Gates constructed from a 'Weld Mesh' type material should be used NB: Palisade Fencing is not acceptable.

The developer must carry out a site based and desktop risk assessment to determine any fencing requirements from a Health and Safety perspective.

The higher grade of fencing requirement as a result of the above procedures will be the minimum required for the site.

11. (R) For pumping stations in a fenced compound, the whole area should be covered with a hardstanding. (NB: Gravel/Stone infill is not acceptable). The hardstand area should extend beyond the lower edge of the compound fencing, with the fence/gate starting from the base.

15. (N) Flush davit sockets must be equipped with a captive/tethered cover designed to limit the ingress of debris. The davit socket should incorporate a drain hole through the wet well slab to allow water drainage. A lifting davit is required, this should be stored at a suitable location on site.

16. (R) Typical Layouts for Type1 & 2 and Type 3 pumping station are shown on DCWW standard drawing no: SDM4101/004 & SDM4101/005.

D4.4 Kiosk Positioning

1. b (R) there is at least 750mm wide permeable hard standing in front of the kiosk. Due diligence shall be paid to the inconvenience that the kiosk might have on neighbouring properties and the obstruction of view caused by the kiosk position.

D4.5 Storage

1. (R) To ensure that sewage flooding does not occur at, or upstream of the pumping station. during plant or power failure, additional storage should be provided. This storage should be. above the high-level alarm and below the invert of the inlet pipe from the incomer chamber to the wet well. NB: should the valve chamber base/drain be lower than the incomer inlet, this should be used as the upper level when calculating emergency storage provision.

2. (c) (N) DCWW will only consider adopting storage which utilises sewers and manholes in exceptional circumstances.

5. (N) Peak design flow is 6 x Dry Weather Flow (DWF).

6. (N) An emergency overflow is normally required on all pumping stations, however if this is not attainable 50% additional storage over and above the design flow for the development is required.

D5.2 Reliability

2. (N) In this case it may be possible to use 50 mm nominal bore rising mains although consideration should be given to the maximum length of main and the delivery pressure.

D5.3 Hydraulic Design

3(a). (N) Retention time and septicity (it may be necessary to use chemical dosing or to reduce retention times by using a smaller main or a smaller sump: or to use a water replenishing system to provide additional flow during low flow conditions. For potable water supplies this will require approval from the local water networks distribution team.

4. (R) In all cases, a separate manhole and short section of gravity sewer should be constructed at the end of the rising main to enable the flow to gravitate to a manhole on the existing public sewer. Detailed design of the entry arrangements should ensure that sewer maintenance operations can be undertaken at the manhole without difficulty and avoid turbulence which could cause gas formation, surcharge, or flooding. In certain circumstances where it is not practicable to place a separate manhole upstream of an existing manhole, DCWW may agree that the end of the rising main can discharge directly into an existing manhole on the public sewer.

D6.1 General

3. (R) The relays within the level control unit should be configured to achieve the following pump unit control philosophy based on three level set points (L1 to L3):

a) Level rising through 'snore' level (L1) – no action;
b) Level rising through duty/standby pump unit stop level (L2) – no action;
c) Level rising through duty pump unit start level (L3) – start duty pump unit;
d) Level falling through duty pump unit start level (L3) – no action;
e) level falling through duty/standby pump unit stop level (L2) – stop duty pump unit if duty pump unit running or stop standby pump unit if standby pump unit running;
f) Level falling through 'snore' level – inhibit both pump units (L1).

6. (N) Consideration should also be given to the use of smaller pump units on the same guide rails as an interim measure. However, consideration should be given to the design of the thermal overload protection.

D6.2 Hazardous areas

1. (R) Parts of a sewage pumping station can be hazardous zones in accordance with the Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR). A risk assessment, considering any guidance from DCWW, should be carried out in accordance with DSEAR. This should be discussed with DCWW at an early stage in proceedings.

DCWW Guidance: The Risk assessment must be carried out referencing the guidelines included in the DCWW DSEAR handbook NB: the latest version of this document should be requested from DCWW, DCWW Explosion Protection Document (CAF 440), and DCWW Procedural Document for Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR). NB: If any area is deemed to have a Zoned classification, the Explosion Protection Document (CAF 440) must be completed.

D6.3 Wet Well – general.

3. (R) Benching should be provided to eliminate 'dead zones' in the wet well where siltation would otherwise occur. Benching should start no more than 100 mm from the pump unit volute.

The slope of the benching should not be flatter than 60° to the horizontal. Where the wet well is exceptionally large, varying the slope of the benching can be considered if needed to satisfy other constraints. In such cases the wet well design could incorporate a two part well, the benching of the lower (working area) part being no flatter than 60° to the horizontal, the upper part being no flatter than 30 to the horizontal.

8. (R) Typical general arrangements for Type 1, Type 2, and Type 3 wet well two pump pumping stations are shown on DCWW standard drawings, SDM4101/001, SDM4101/002 and SDM4101/003.

D6.4 Wet Well – structural design.

1. (R) Clauses D6.4.2 to D6.4.5 give guidance on the structural design of reinforced concrete wet wells. If the use of Polyethylene and Glass Reinforced Polymer GRP mouldings for package pumping stations applications is proposed prior approval from the Developer Services Team will be required.

6. (N) If plastic moulding is considered, the moulding shall incorporate all necessary inlet and outlet nozzle connections, and preformed benching of the bottom section to prevent debris accumulating in dead zones. In addition, for increased depths and/or non-standard site conditions, increased wall

thicknesses shall be used in conjunction with the inclusion of external reinforcing ribs around the circumference of the PPS.

7. (N) The base of the tank shall either be flat or incorporate either stabilising feet or a circular base ring to enable the tank to be positioned on a RC slab at the bottom of the excavation. The pumping station shell moulding should incorporate an anti-flotation skirt to enable wet concrete, when poured around the station, to flow into the skirt as a mechanical key to offset the effects of buoyancy.

8. (N) The requirements for the foundation slab and backfilling shall be as directed in the manufacturer's technical guidance literature. In locations subject to high water tables, the designer shall ensure that all necessary measures have been implemented to prevent flotation of the tank under all operating conditions. The uplift force can be considerable particularly if the water table reaches up to ground level. Anti-flotation requirements and minimum GRP thickness should be calculated to ensure the pumping station can resist these forces.

9. (N) The Contractor shall make provision for the wet well to be naturally vented directly to atmosphere and far away from any source of ignition.

D6.5 Valve chamber

1. (R) The valve chamber should be separate from the wet well, but maybe structurally attached to the wet well. Valves should not be installed in the wet well. The use of Polyethylene and Glass Reinforced Polymer GRP mouldings for valve chambers is acceptable if deemed more cost effective to concrete structures.

4. (R) The valve chamber should be provided with a hand operated valve with a gravity drain into the wet well. This discharge drain should be protected to ensure flows of flammable atmospheres cannot enter the valve chamber from the wet well. The method of protection should be determined by the risk assessment carried out in accordance with the Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR). A penstock with an extension spindle to the underside of the cover for tee key operation can be used as an alternative. Valve chamber floor should be benched to direct any spill flows to the discharge drain.

6. (R) The opening covers should extend over the full valve chamber. Where it is impractical to have fully opening covers then consideration shall be given to smaller access covers suitable for man access. However, consideration should be given to any headroom restrictions during, installation and maintenance of pipework and valves.

7. (R) The valve chamber should have a maximum depth of 1.5m from cover level to the floor of the valve chamber. A typical valve chamber arrangement is shown on DCWW standard drawings, SDM4101/001, SDM4101/002 and SDM4101/003.

D6.6 Flow metering

1. (R) For Type 3 and Type 4 pumping stations where the design flow of any pump unit is greater than 30 litres/second, a flow meter shall be provided in the valve chamber or in a separate chamber to monitor discharge performance.

For Type 3 and Type 4 pumping stations where the design flow is less than 30 litres/second but located in a sensitive location such as bathing water area then a flow meter shall be required.

2(c).(R) where it is not practicable for a drain back to the wet well then, the flow meter chamber shall have a watertight cover.

D6.7 Access into wet well, valve chambers and flow meter chambers

1. (R) Openings in access covers should be large enough to allow for pump units, valves, and flowmeters to be lifted easily and safely out of the wet well/chamber for above-ground inspection, maintenance, or replacement. Where man access is required, openings should not be smaller than 900 mm x 900 mm. For specific installations larger opening may be required. The use of step irons is unacceptable and step rungs are preferred as a secondary means of egress.

2(i). The cover frame should provide facilities for demountable handrailing which can be erected prior to any maintenance on the pump units being undertaken. Depending on the site conditions, the handrail can be fixed permanently but with removable sections to allow pump unit removal. Chains should not be used for handrails. Covers and hinged safety grids should be positioned to give fall protection in the upright position where practical.

D6.10 Kiosk

1. (R) The kiosk should, as a minimum, include the following equipment:

a) The electrical assembly;
b) The telemetry outstation;
c) A kiosk heating and lighting system (with the inclusion of Kiosk emergency lighting);
d) An RCD switched 240 V socket.
e) Cable containment trunking.
f) Where practical an external 'Flood light' type light positioned on the roof of the kiosk (directed toward the wet well/valve chamber), the light should be switched from inside the kiosk and not have PIR control.

D6.11 Kiosk construction

12. (R) Statement removed.

14. (R) The kiosk doors should be fitted with a multipoint locking system with hasp and staple. The hasp and staple should be at least 90 mm long horizontally, 30 mm wide vertically and be suitable for a 30 mm padlock as a minimum. The kiosk doors should also be fitted with an Abloy manufactured key barrelled lock.

15. (R) Where specified by DCWW, the kiosk should meet the required security rating in accordance with GS102 DCWW Guidance to Security Standards (WUKSS), which is available on request.

6 Part F – Mechanical & Electrical Specification for Small Pumping Stations

F1.1 Hazardous area appliances

1. (R) All electrical and mechanical equipment selected for use in a hazardous area shall have undergone an appropriate conformity assessment procedure (CAP) to demonstrate compliance with the essential health and safety requirements of European Directive 94/9/EC (ATEX 95), as enacted in the UK by the Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 1996 and the Equipment and Protective Systems (Amendment) Regulations 2001.

DCWW Guidance:- The Risk assessment must be carried out referencing the guidelines included in the DCWW DSEAR handbook, DCWW Explosion Protection Document (CAF 440).

F1.2 Operation and maintenance documentation

1. (R) Operation and maintenance documentation for all equipment shall be provided together with as-built drawings and operational manuals for the pumping station. Three hard copies and one electronic copy are required.

F2.1 Introduction

1. (R) The pumping station shall incorporate two identical submersible pump units arranged in a duty/standby configuration. To enable standardisation, it is preferred that the Developer use the relevant DCWW framework suppliers for pumps.

F2.3.6 Impellers

7. (N) The pump will have impellers with suitable methods of attachment to shafts.

F2.3.14.1 General

4. (R) Statement removed

5. (R) Lifting chains shall be provided, permanently fixed within the wet well.

F2.3.14.2 Lifting Chain Location System

1. (R) Statement removed

F2.3.14.3 Lifting Chains

9. (N) Submersible chains are examined in batches after removal from service. To enable this 5-year rotation, 20 % additional service chains shall be provided, i.e., where one to five similar chains are provided for the contract then a suitable spare chain shall be provided; if six chains are supplied then two suitable spares shall be provided etc. Every chain in the batch shall be capable of fulfilling the duty of the others.

10. (N) All lifting Appliances shall be tested and supplied with an Individual Test Certificate (Certificate of

Conformity), for each item of lifting equipment which shall include:

- The name of DCWW for the "Owner or Occupier"
- The serial number
- The safe working load (SWL)
- DCWW Asset Number

NB: all lifting chains shall comply with DCWW's current specification, a copy of this specification is available upon request.

F2.3.16 Pump Unit Protection Sensors

3. (R) Statement removed.

F3 ELECTRICAL

F3.1 Scope (R)

1 This Addendum defines the requirements for the electrical equipment incorporated within the pumping station. This electrical equipment shall typically comprise:

a) An incoming power supply.
b) a low voltage switchgear and control gear assembly (hereafter termed the 'Electrical Assembly') incorporating the incomer, motor starters, control circuit supplies, common control equipment and interface for connection to the telemetry outstation, see clause F.3.3;
c) The pumping station electrical installation, incorporating all electrical components, equipment and cabling outside the Electrical Assembly, and the pumping station Earthing and bonding system, see clause F.3.3;
d) Instruments associated with the pumping station including the ultrasonic transducer head (fitted at an elevated level within the wet well, on a hinged stainless-steel bracket), float switches, and flow meter (if required), see clause F.3.5; and
e) (R) A Remote Telemetry Unit (RTU) with appropriate 4G Modem connection (Note: Ovarro S2000 is the required outstation.), see clause F.3.6.

F3.2.1 General

F3.3.1 General

2. (R) The form of separation of the Electrical Assembly shall be Form 2a or 2b for type 1 and type 2 pumping stations, subject to the results of an approved risk assessment, which considers the need for a pump to continue running while work is carried out on the panel. This shall consider factors such as, the volume of flow, the practicality of dealing with this flow by other means when the pumping station is not operational, the location of the pumping station location and the consequences of the risk of flooding or pollution occurring if the pumping station is not operational. For type 3 pumping stations and above, the electrical assembly shall be Form 4.

F3.3.4 General Cable Size

6.1.1 F.3.3.4.1 General

F3.3.5 Cabling and Wiring

F.3.3.5.1 General

1. (R) Power circuit wiring shall be 600-volt grade multi stranded copper tri-rated switchgear cable to BS 6231 or equivalent. Power cable size shall be 2.5mm² CSA to BS7671 (As amended). Control circuit wiring (including ICA/PLC wiring) shall be multi stranded copper tri-rated switchgear cable to BS 6231 or equivalent and multicore wiring shall comply with BS 6500 or equivalent. Minimum cable size shall be 1.0mm² for motor starter control circuit wiring, and 0.5 mm² for ICA/PLC wiring. Inter-compartment wiring shall comply with the clause above but may also utilise multicore PVC multi- stranded copper wire to BS 6500 or equivalent. Cable cores shall be sleeved to achieve the required colour coding.

2. (R) Analogue signal cabling shall comprise screened cables (individually and/or collectively screened) and/or twisted pairs. Cable to BS5308 (Parts 1 &2) Specification.

6.1.2 F.3.3.5.2 Installation

5. (N) Suitable segregations between cables serving different circuit categories as referenced in BS7671 shall be provided for at all times.

6.1.3 F.3.3.5.3 Identification of Wiring

5.(N) All wiring, pre and post switching such as relay or contacts shall be identified. Brown, black, grey phases shall be identified at both ends in accordance with schematic diagrams. Each wire shall be identically marked at each end, with the first character nearest to the termination end of the wire. The wire marking system employed shall be one of a proprietary pre-printed insulated sleeve type.

6. (N) The number of every wire associated with circuits entering or leaving a compartment shall be prefixed by the compartment reference.

6.1.4 F.3.3.5.4 Termination of Wiring

6.1.5 F.3.3.5.4.1 (N) General

1. The crimps shall be applied by means of a ratchet style crimping tool using the correct size of die. Where equipment is fitted with flat headed screw terminals, wire ends shall be fitted with crimped spades. Compression type terminals shall not be used, but where equipment (e.g., contactors) are complete with cage type terminals are then direct conductor termination shall be permitted.

2. All internal wiring shall be terminated at both ends (including spare cores).

3. Sufficient slack shall be provided within each cable terminated to allow for at least one re-termination.

4. Terminal mounts shall be suitable for the CSA of the wiring terminated.

5. Unless otherwise agreed, all terminals shall be arranged in single layer (i.e., no “piggy-back” terminals).

6. All circuit terminal rails shall include 10 % spare space, as built, and commissioned.

7. Wiring shall be terminated using crimped cable ends, lugs or any other approved method that is suitable for the conductor and type of termination.

8. Only the crimp/lug (or equivalent) manufacturer’s recommended tools and equipment shall be used to perform the termination. All of the strands forming the conductor shall be connected at the

point of termination.

9. Wiring shall be terminated so that all internal wiring is connected to one side of a terminal rail and all external cabling and wiring is connected to the other side of the same terminal rail.

10. Screw type terminals shall be used. Compression type terminals are shall not be used, however where cage type terminals are present on equipment (e.g., contactors), then they shall be permitted.

11. Only one conductor shall be connected to a termination point. Where this is not reasonably practicable, then no more than two conductors shall be connected to one side of a terminal.

12. Sufficient, suitably sized, and coloured earth terminals and end stops shall be provided at the ends of the terminal rail.

13. Where a means of circuit disconnection is specified by the particular specification, suitable hinged link type terminals shall be provided where circuit disconnection is required (e.g., for analogue signal circuits, the isolation of external control devices and for all alarm and telemetry circuits). Hinged-link type terminals shall not be used for the isolation of power circuits.

14. Unless otherwise specified in the particular specification, fused terminals shall be provided for circuits feeding solenoid valves.

15. Terminals shall be grouped by bands with raised separators between bands. Where the I/O from a modular device such as a PLC is wired down to terminals the terminals shall be grouped in a similar order to the I/O module.

16. Proprietary shorting bars or combs shall be utilised where it is necessary to common terminals. Where practicable, cable trunking shall be positioned a minimum of 30 mm from any terminal.

17. Terminals shall be safely and easily accessible after all wiring has been installed and terminated.

18. Terminals shall face the compartment door for ease of connection.

19. Terminals shall be positioned and identified in accordance with the schematic diagrams for the Assembly.

20. Horizontal terminals shall be numbered left to right and vertical terminals top to bottom.

21. Where practicable, for incoming mains facilities a minimum distance of 300 mm shall be provided between the gland plate and terminals.

22. Groups of terminals shall be secured with an end stop at either end, which may be an earth terminal.

23. For incomers and large feeder compartments, where the cable is glanded within the compartment, the layout of terminals shall comply with BS 5372, and unless agreed otherwise with the Purchaser, where more than one multi-core power cable enters an incomer compartment, a further 500 mm (minimum), in addition to the 300 mm above, shall be provided between the gland plate and the terminals of the associated protective device. All live terminals shall be adequately shrouded to achieve a minimum of IP2X.

24. To facilitate the termination of cable cores, a minimum distance of 100 mm shall be provided between the entry point of cables into a compartment and the associated terminals; this shall be increased, as required, for larger cables.

25. Where practicable, a minimum distance of 30 mm shall be provided between the exit point of wiring from trunking and the associated terminals.

26. Terminals used for the connection of intrinsically safe circuits shall be coloured blue and be physically separated from other terminal groups by a minimum distance of 50 mm. These terminals shall have a clear shrouded cover and be fitted with an appropriate warning label.

27. If practicable or recommended by the device manufacturer, screened signal cables shall be wired directly to and terminated at the device. If this is not practicable, the method of interface termination shall not compromise the integrity of either the conductors or screen.

28. Screened signal cables shall have the screen solidly connected to earth at the instrument end. To comply with EMC requirements, it may also be necessary to connect the screen to earth at the non-instrument end. If this is the case and such a connection will not compromise safety or performance, the screen shall be solidly connected to earth at the non-instrument end. If this is the case and such a connection will compromise safety or performance, the screen shall be capacitive coupled to earth at the non-instrument end.

29. If it is necessary to connect the screen to earth, either directly or via a capacitive coupling, a proprietary 360° connection shall be used.

30. If it is necessary to isolate the screen from earth a suitable length of the overall sheath and the screen shall be removed, and a 30 mm long silicone rubber over-sleeve installed over the point of separation of conductors, screen, and overall sheath.

31. Terminals of 16mm and above shall be of “bolted type”.

32. The colour code for terminations shall be in accordance with Table 2 below.

Table 1 – Colour Coding for Terminations

Function	Colour
Protective Conductor	Green and Yellow
Phase Conductors	Beige or Grey

Neutral	Beige or Grey
Power >50V	Beige or Grey
Control >50V	Beige or Grey
Control <50V	White
Instrumentation Analogue	White
Intrinsic Safety Analogue and Digital	Blue
Intruder/Interlocks ≥ 110 V	Orange
Telemetry	Pink

F3.3.6 Indicator Lamps, Push-Buttons and Selector Switches

4. (R)

Table 2 - Table for Colour Coding for Pushbuttons

Colour	Function
Black	Stop/Off, Close
White	Start/Run, Reset, Open
Red on a Yellow Background	Emergency Stop

F3.3.7 Connection for a Mobile Generator

1. (R) For type 3 pumping stations that have been risk assessed as requiring a connection for a mobile generator then a facility shall be provided.

3. (N) Mobile generator appliance inlet (incomers up to and including 125 Amps) this shall be a 5 pole (L1, L2, L3 +N+E) male appliance socket to BS EN60309-2;

4. (N) Mobile generator connection box (incomers up to and including 125 Amps).

5 (R). Where a mains/generator changeover incoming section is specified, an in-line isolation device shall be provided for the generator supply. This may be accomplished preferably by the use of a 'Powerlock' Generator Connection, or alternatively an appliance inlet socket and plug fitted at the control panel/MCC.

6. (N)Mains/generator manual changeover switches that have the termination of the mains supply in the same vertical plane as the generator supply are not to be used.

7. (N)A second phase failure relay shall be supplied on the DNO live side as well as the load side to indicate via telemetry when DNO mains is restored where the load side relay will indicate generator mains failed supply.

F3.3.8 Abnormal Operation

6.1.6 F.3.3.8.2 Pump unit Failure (Initiated by Hard-Wired Pump unit Protection Systems)

1. The control system shall incorporate the following hard-wired pump unit protection systems:

a) Motor overload protection;
b) (R) motor over-temperature protection or pump stator over-temperature protection (Klixon switch);

6. Statement deleted two stage protection is not required on pumps rated less than 70kW.

7. Statement deleted two stage protection is not required on pumps rated less than 70kW.

8. (R) When a remote reset signal and relay is installed and triggered from the telemetry unit, if the hard-wired protection systems detailed in clause 3.3.8.1a, above is activated, the telemetry system shall allow the operator a maximum of three remote resets after which the drive shall be locked out.

Note: DCWW has the ability to include the limit on remote resets in their telemetry base station.

6.1.7 F.3.3.8.4 Back-Up Control Mode

1.(R) The back-up control mode shall be configured as a control system operating independently of the ULC.

2. (N) Upon receipt of a 'High Wet Well Level' signal from the back-up level control, the control system shall transmit a 'Back-up Control System Activated' alarm to telemetry.

F3.3.9 Telemetry Signals

1.(R) A telemetry outstation is to be provided by the Developer, terminal blocks shall be provided in the Electrical Assembly for interfacing the pumping station and each pump unit with the telemetry outstation. The function of each terminal shall be as specified in Tables F.3 to F.6.

Table 3 – Telemetry Requirements for Pumping Station Monitoring (R)

Function	Description	Signal Type	Terminal Numbers	Type 1	Type 2	Type 3
Site mains DNO power health	Normal/Failed	Digital Input	Refer to DCWW drawings	✓	✓	✓
High wet well alarm (F.3.3.8.4)	Normal/High	Digital Input	Refer to DCWW drawings	✓	✓	✓
High wet well alarm (F.3.3.8.4)	Normal/High	Digital Input	Refer to DCWW drawings	✓	✓	✓
Back-up control system activated (F.3.3.8.4)	Normal/Activated	Digital Input	Refer to DCWW drawings	✓	✓	✓
Maintenance in progress	Off/On	Digital Input	Refer to DCWW drawings	✓	✓	✓
Level Controller Health (F.3.3.8.3)	Normal/Failed	Digital Input	Refer to DCWW drawings	×	×	×
Flow Meter Health	Normal/Failed	Digital Input	Refer to DCWW drawings	×	×	✓
Emergency Overflow Operating (Note 1)	Normal/Overflow	Digital Input	Refer to DCWW drawings	✓	✓	✓
Wet Well Effluent Level		Analogue Input	Refer to DCWW drawings	×	×	✓
Pumping Station Overload (Pump unit running & elevated level reached)		Digital Input	Refer to DCWW drawings	×	×	×
Rising Main Delivery Flow (Totalised)		Pulsed Input	Refer to DCWW drawings	×	×	Note 2
Rising Main Delivery Pressure		Analogue Input	Refer to DCWW drawings	×	×	×
Power Consumption		Pulsed Input	Refer to DCWW drawings	×	×	Note 3

Note 1: Only required when there is an emergency overflow where this is provided on a replacement pumping station.

Note 2: Only required if the design flow rate of each pump unit is above 30l/s.

Note 3: Only required on Type 3 pumping stations if each pump unit is rated above 3.5kW utilising the intelligent starters VT module or where a power monitor unit is installed at the incomer.

Table 4 – Telemetry Requirements for the Monitoring of Each Pump Unit

Function	Description	Signal Type	Terminal Numbers	Type 1	Type 2	Type 3
Pump unit running	Running/Stopped	Digital Input	Refer to DCWW drawings	✓	✓	✓
Pump unit tripped	Normal/Tripped	Digital Input	Refer to DCWW drawings	✓	✓	✓
Pump unit available/not available	available/unavailable	Digital Input	Refer to DCWW drawings	✓	✓	✓
Motor stator temperature	Normal/High	Digital Input	Refer to DCWW drawings	×	×	✓
Pump unit vibration caution (Note 1)	Normal/Caution	Digital Input	Refer to DCWW drawings	×	×	×
Pump unit vibration high (Note 1)	Normal/High	Digital Input	Refer to DCWW drawings	×	×	×
Pump unit seal failure (moisture in pump)	Normal/Failed	Digital Input	Refer to DCWW drawings	×	×	Note 3
Pump unit lower bearing temperature	Normal/High	Digital Input	Refer to DCWW drawings	×	×	×
Pump unit load (for partial pump blockage)	Normal/Under load	Digital Input	Refer to DCWW drawings	×	×	Notes 2 & 4

Note 1: Statement removed.

Note 2: Only required if each pump unit rated at or above 22kW.

Note 3: Only required if each pump unit rated at or above 7.5kW.

Note 4: Will Normally be required in all cases where the pump unit is in a hazardous zone in accordance with Dangerous Substances and Explosive Atmospheres Regulations.

Note 5: On type 1 & 2 pumping stations where there are insufficient digital inputs available it is acceptable to complex auto available and pump tripped signals.

8. (R) It is recommended to contact the DCWW OT O&M department for advice on the selection of the correct remote telemetry station supplier for the application.

6.1.8 F.3.3.11.1 General

4. (R) DCWW has a preferred option when Form 4 Assemblies are required, to use intelligent field-bus (Profibus) components. The field-bus communicates with the intelligent incomer compartment, intelligent starter compartments and intelligent common control compartment which houses a PLC & HMI. If the developer wishes to consider this option, the DCWW Electrical Specifications ES301 and

ES302 addendum to WIMES3.01 are available on request to the DCWW Developer Services Department.

6.1.9 F.3.3.11.2 Incomer Compartment

3(e). (N) It is accepted by DCWW that when a power monitor unit performs the power monitoring there would be no requirement for a panel mounted voltmeter and ammeter. In line with BS7671 a type 1 & 2 Power Surge Protection Device shall be provided at the incomer to prevent an inherited lightning surge causing damage to the pumping station. A means of external isolation shall be provided via a pad-lockable grip handle to a fuse switch isolator is a minimum requirement.

6.1.10 F.3.3.11.3 Control Circuit Supplies

9. (N) It is acceptable to DCWW for the CCTs not to have secondary earth screens on their secondary supplies and it is DCWW preference for the secondary supply to be 110 v AC and not 24 V AC.

6.1.11 F.3.3.11.4 Motor Starter Compartments

5(l). (N) It is preferred if the common reset Push button can be incorporated in the Off position of the auto/off/hand selector switch on form four panels.

F.3.3.11.5 Common Control Compartment (CCC)

4. (R) The design and construction of the CCC shall enable safe inspection, testing, calibration, and diagnostic activities to be carried out with the CCE energised and accessible and shall be provided to IP2X as a minimum. Safe testing shall be afforded by the use of circuits supplied from the Control transformer at 110v AC & 24v DC voltage systems where segregation of circuits employing different voltages. Additional localised shrouding of circuits above extra-low voltage shall be provided to IP2X minimum. 400-volt circuits are not permitted within the common control compartment.

6.1.12 F.3.3.12.3 Incomer

6. (N) It is DCWW preference to have the kiosk services distribution board mounted externally to the main incomer enclosure in a suitable location within the kiosk and the incomer to be fitted out with a fuse- fed, single phase and neutral, feeder to supply the Kiosk distribution board. The DCWW preference is to not fit voltmeters and ammeters to Type 1 & 2 stations but supplement with a ‘mains healthy’ lamp.

6.1.13 F.3.3.12.4 Control Circuit Supplies

8. (N) It is DCWW preference to not install screens to secondary voltages. Control circuit supplies shall be derived from a control circuit transformer at 110v AC in preference to 24v DC control from a power supply.

6.1.14 F.3.3.12.5 Motor Starters

8. (N) With respect to clause F.3.3.12.5.1e) , DCWW motor starters on type 1 & 2 stations may incorporate only the following motor protection:

a) Motor over-temperature protection;

b) Pump unit mechanical seal failure protection (if the pump unit is rated at or above 7.5 kW);

9. (N) Brown out timers shall be provided to auto recover the motor starter to available status after a power dip.

F.3.3.12.6 Common Control Section

1(g). (N) In many of the Type 1 & 2 pumping stations it is not practicable to install ultrasonic controllers due to the dimensional size of the well. In such stations the level control shall be carried out by float switches. The float switches shall be installed at four levels.

- HH
- Pump Start
- Pump Stop
- LL (snore)

Where an ultrasonic controller is supplied.

Emergency Pump back up control, shall be included when a HH float switch is installed.

8. (N)It is acceptable to DCWW to use 110v AC for control circuits as well as extra low voltages and, but it is preferred to use individual termination block by voltage type or to fit raised separators between voltage bands or type when sharing the same terminal block.

6.1.15 F.3.4.1.5 Junction Boxes

7. (N) Junction boxes shall not be installed internal to wet wells irrespective to DSEAR zone classification of the pumping station. If junction boxes are to be installed for cabling between the wet well and kiosk it shall be installed on suitable up stands external to the wet well in a suitably rated IP enclosure. Where the kiosk and wet well are located at a convenient distance apart the cabling shall be wired directly from the kiosk to the wet well in a continuous underground duct or ducts.

F3.4.3 Cables

3.4.3.5 (R)Table F7 deleted and replaced with the following tables.

Table 5 – Cables

Type of Cable	Relevant Standard	Voltage Rating
XLPE/PVC	BS 7889	600/1000
XLPE/AWA/PVC and XLPE/SWA/PVC1	BS 5467	600/1000
PVC/PVC	BS 6346	600/1000
PVC/AWA/PVC and PVC/SWA/PVC1	BS 6346	600/1000
Single core PVC2, 3	BS 6004 (Table 1)	450/750
Flat twin earth PVC	BS6004 (Table 5)	300/500
Flexible PVC/PVC4	BS 6500 (Table 26 or 28)	300/500
Flexible PVC/PVC5	BS 7919 (Table 40 or 41)	600/1000
Armoured, heat and oil resisting and flame retardant (formally designated HOFR) 1, 6	BS 7919 (Table 16 or 17)	450/750
Flexible, heat and oil resisting and flame retardant (formally designated HOFR) XLPE/LSF7	BS 7211	450/750
XLPE/AWA/LSF and XLP/SWA/LSF1, 7	BS 6724	450/750
XLPE/LSF7, 8, 9	BS 7629	600/500
XLPE/AWA/LSF and SLPE/SWA/LSF1, 7, 8	BS 7846	600/1000

NOTES:

1 Aluminium wire armoured shall be used to reduce the magnitude of induced voltages and currents.
2 The insulation shall be phase coloured and, if used in single-phase systems. Line cables shall be brown and neutral cables blue.
3 Only to be used within conduit or trunking.
4 Only to be used in offices and similar buildings.
5 For industrial environment use.
6 This type of cable shall comply with BS 6883, Section 3 (insulation type GP4 (BS 7655-1, Section 1.2); sheathing type A/RS3 (BS 7655-2, Section 2.3).
7 Only to be used in public areas and in areas where there is significant risk of harm to persons or equipment in the event of a fire involving cabling.
8 These cables shall be used if there is a specific requirement to maintain circuit integrity under fire conditions in accordance with BS 6387 and BS 7346-6 (e.g., gas detection systems, fire detection/alarm/fighting systems, protected lighting circuits, emergency lighting systems).
9 This cable is not to be buried directly in the ground or in the fabric of the building.

Unless specified in the particular specification, signal and instrument cables shall have stranded copper conductors and comply with BS 5308 Part 2 and of Types 1 and 2. All multi-pair signal and instrument cables shall have as a minimum number of spare pairs as follows:

- Cables above and including 5 pair shall have 20 % spare cores.
- A minimum of 2 pair cable shall be installed (note: 1 pair cable is not acceptable).

Table 6 – Cable Colours and Applications - Signal & Instrument Cables

Cable Application	Colour
Protective Conductors	Green/Yellow
Intrinsically safe cables	Light blue
Profibus DP Cables	Purple
Profibus PA Cables	Blue
Ethernet Cables	Green
Fire detection/alarm/fighting system cables	Red
Emergency lighting and gas detection cables	Black
Security system cables	Grey

Table 7 – Colour Coding for Wiring

Function	Colour
Protective Conductors	Green/Yellow
Power Circuits	
Phase L1 conductor of three phase circuit	Brown[1]
Phase L2 conductor of three phase circuit	Black[1]
Phase L3 conductor of three phase circuit	Grey[1]
Phase conductor of single-phase circuit	Brown[2]
Neutral conductor	Blue
Control Circuits	
110 V AC	Red
ELV (e.g., 24 V AC or DC, 30 V DC, etc.)[3,4]	Yellow
Intercompartment Wiring	
Unsheathed	Red or Yellow, according to voltage
Sheathed	Grey sheath, black cores
Neutral or mid-wire conductor (all circuits)	Blue
Signal Circuits	

Volt free:	
Voltage known	Red or yellow, according to voltage
Voltage unknown	Red
Analogue (4-20 mA, 1-5 V DC):	
Single core	Yellow
Screened single pair or multipair	According to relevant standard[5]
Telemetry	Pink
Intrinsically safe (IS) (including Profibus IS)	Light blue (sheath)
Current transformer (CT) circuits	Black
Profibus DP networks (non-armoured cables)	Purple (sheath)
Profibus PA networks (non-armoured cables)	Black (sheath)

Notes:

1. Brown may be used for all three phases, identified L1, L2 & L3 at each end of the conductor and at intervals along its length.
2. If there is more than one type of single-phase wiring present within the Assembly, the wiring shall be phase coloured;
3. ELV is defined as voltages up to 50 V AC or 120 V DC ;
4. Additional labelling shall be provided to prevent confusion where 24 V DC or AC and 30 V DC control circuits are installed in the same compartment.
5. e.g., for cables to PAS 5308-1/BS EN 50288-7 a single pair is coloured black/blue, for PAS 5308-2/BS EN 50288-7, a single pair is coloured white/blue.

F3.4.4 Installation of Cables

5(g). (N) Separate ducts shall be provided for each of the following cables:

- DNO incomer including supplied earth.
- Pumps power cabling between Kiosk and wet well.
- Pump protection, float switches or/and ultrasonic controller between kiosk and wet well.

13. (R) After installation of cables, all ducts shall be sealed with a proprietary, fire-retardant and gas and watertight sealing system. Polyurethane foam may only be used to seal the kiosk duct after the wet well has been risk assessed and declared as un-zoned as agreed by DCWW Fire and Explosion group.

F.3.4.5.1 Glanding

5. (N) It is DCWW preference when a cable is glanded through a painted or otherwise coated metallic surface, earth continuity is electrically tested and recorded between the gland and the enclosure. The contact surface shall be cleaned or a “banjo lug” used to provide continuity between the gland and

the enclosure by drilling and bolting. All pipework flanges should be straddled by an appropriate earth bonding cable, to ensure continuity.

F3.5.1 Flowmeter Specification

1. (R) For Type 3 and Type 4 pumping stations where the design flow of any pump unit is greater than 30 litres/second, a flow meter shall always be provided. A flowmeter shall be provided for Type 1 & 2 pumping stations where regulatory conditions or site conditions deem it necessary. Similarly, if Type 1 & 2 pumping stations are located in sensitive locations such as bathing water areas or near a sensitive water course then a risk assessment shall be carried out to decide if a flow meter should be included. For all flowmeter installations, please refer to: DCWW specification (ES407) Liquid Flow Metering, which is available on request.

F3.6 Telemetry outstation

1(c). (N) The required telemetry outstation is a Ovarro S2000 (NB: the Micro version of this unit is not acceptable, the full version (with the inclusion of an HMI interface) should be installed) however this must be confirmed by DCWW Developer Services Department.