

SOUTHERN WATER
 TECHNICAL SPECIFICATIONS
 MECHANICAL AND ELECTRICAL SPECIFICATIONS

**SOUTHERN WATER SUPPLEMENTARY ADDENDUM TO
 SFA6 -- PUMPING STATION DESIGN REQUIREMENTS**

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1. Objective

This document details Southern Water's requirements for Sewers and Pumping Stations built by developers and shall be read in conjunction with:

- Sewers for Adoption, 6th Edition

2. General

This Supplementary Addendum shall be read in conjunction with the WRc Sewers for Adoption 6th Edition March 2006, which is a specification for use by Developers when planning, designing and constructing conventional foul and surface water gravity sewers and pumping stations intended for adoption.

Where conflict exists between WRc Sewers for Adoption 6th Edition (SFA6) and this Supplementary Addendum, then this Supplementary Addendum shall take precedence.

At all times it shall be the responsibility of the Developer to ensure compliance with all appropriate legislation.

Design guidance detailed within the Supplementary Addendum is referenced where applicable to the corresponding clauses of SFA6. It will be the Developers responsibility to ensure that both the Developer and Southern Water are aware of their responsibilities under Construction (Design & Management) Regulations 2007. (CDM 2007)

3. Design Guidance

3.1 Clause 1.2.5

SFA6 is applicable to pumping stations which operate pumps up to and including 30kW. Where pumps exceed these design criteria the Developer shall refer also to Southern Water standards MED 4001, MED 4003, MED 4138, MED 4140, MED 4300, MED 4301, CED 4001 & CED 4010, which are available from Southern Water Policies & Standards.

3.2 Clause 1.5.2

Refer to appendix A for hazardous zone classification guidance.

3.3 Clause 1.7.1

Southern Water should issue a Provisional Certificate providing the Developer has achieved set aims. These aims are associated with the acceptance testing of the completed installation.

In addition to these aims, the issue of the Provisional Certificate is subject to provision of the following: test certificates, lifting equipment SWL certificates, lifting equipment inspection reports, IEE Regulation certificates, pressure equipment certificates, Asset Data for all equipment, WIAPs certificate and Operation & Maintenance manuals.

3.4 Clause 1.7.6

The developer shall maintain the Works in accordance with the manufacturer's instructions. Where no instructions are published, maintenance shall be undertaken in accordance with industry best practice. A record of this maintenance shall be kept and submitted to the Undertaker.

A record of all reactive maintenance, i.e. plant breakdowns, blockages, cleaning, etc shall be kept and submitted to the Undertaker. This record will assist the Undertaker in assessing if a Final Certificate will be issued.

3.5 Clause 1.9.3

The Developer shall provide and install a CSE-Seprol S250 telemetry outstation. Where site conditions do not allow use of this unit, alternative type M40 outstation may be agreed with Southern Water ICA & Telemetry Team. The telemetry system shall be configured at the Developer's expense and commissioned with the assistance of Southern Water. The Developer can obtain further information and a quotation for this work by contacting Southern Water ICA & Telemetry Team.

3.6 Clause 2.2

Pipeline materials shall comply with MED 4001.

3.7 Clause 2.4.6

The discharge end of the marker tape/wire shall enter the manhole at the discharge end through the duct, which shall be sealed and positioned above the main. The marker tape/wire shall be arranged so it can be extended one metre above ground level and be secured by stainless steel eyebolt and shackle inside the chamber without impeding access but within reach of the opening.

Marker Posts and tape shall be in accordance with CESWI-6 with Southern Water Supplementary clauses ref clause 2.75 clauses 1 -11.

3.8 Clause 2.14

During the design stage the implications of flooding shall be assessed and equipment design and location selected accordingly. Particular consideration shall be given to the location of: Motor Control Centres, electrical equipment, generators and other non-submersible plant. Equipment shall be protected against a 1-in-100 year fluvial flooding and 1-in-200 year tidal flooding.

3.9 Clause 2.16

A soil investigation shall be carried out to establish soils data, such as bearing pressure for thrust blocks, and groundwater levels and include for bore holes or trial pits to be undertaken and laboratory testing of samples for determining soil shear strength.

The suitability of excavated material for use as backfill and the compaction factor shall be determined.

Land use surveys, "walk over", corrosion, soil chemistry and resistivity surveys shall be carried out to determine the routing, material used for the pipe and the degree of corrosion protection required in accordance with MED 4001 and CESWI-6 with SW Supplementary Clauses.

Local pumping station pump discharge pipework and valves shall have fluid velocities between 1.2 m/s and 2.0 m/s.

3.10 Clause 2.18.1

Main tanker hardstanding shall be reinforced hard standing 200mm thick on 500mm type 1 granular subbase. Surrounding area shall be concrete and 150mm lower than the covers, with a drainage area filled with 40mm gravel over terram or similar. Access to all covers shall be provided. Refer to Figure 8 in this Addendum.

3.11 Clause 2.18.5

The site boundary/security fencing shall be selected to suit its location and shall meet the requirements of SEC 250 and normally shall be as follows:

Rural: post and rail.

Industrial: BS Galvanised chain link topped with 3 strands of barbed wire, set on concrete pose in accordance with BS1722: Part 1, GLC 108c.

Residential: close boarded Fencing in accordance with BS1722: Part 5, PCR 180B (morticed).

However the Developer shall assess the risk of vandalism within the location of the site when identifying security fencing, and should consider other means of boundary/security fencing (palisade, Brick etc). Where wood fencing is used, posts & gravel boards shall be concrete. Where gates are wood, posts shall be hardwood or supported by metal box-section.

3.12 Clause 2.20.2

The design of the wet well and the Sewer inlet arrangement shall ensure the following:

- Free surface and submerged vortices are absent
- Minimal deposition of grit and solids
- Flow is presented to the pumps asymmetrically in an acceptable manner and without excessive pre-swirl or air entrainment
- Wet well is materially self cleansing in terms of grit, solids and positive buoyancy material
- Wetwell surface loading of 40-45 l/s per

Where it is doubtful that the wet well design can achieve the above then physical hydraulic modelling, in accordance with Southern Water document CED 4001, shall be undertaken.

The wet well shall withstand all necessary loads in accordance with BS EN 1990 including the following loads:

- a) internal hydrostatic pressure;
- b) external hydrostatic pressure from groundwater up to the finished ground level;
- c) external ground pressure; and
- d) external imposed loads

Where a wet well is a prefabricated unit (i.e. GRP) with in-situ mass concrete, it shall be capable of withstanding hydrostatic pressure equal to depth, regardless of any provision of concrete surround.

3.13 Clause 2.21

The Developer shall make every effort to minimise the depth of the valve chamber: preferred maximum depth is 1200mm from cover level to invert level of the pipe.

3.14 Clause 2.22.1

The top of all chambers shall be 150 mm above the surrounding compound surface. This design is to ensure that vehicles cannot drive on access covers.

3.15 Clause 2.22.2

The opening in the access covers shall be a minimum of 1000 mm x 750 mm.

3.16 Clause 2.22.3

The valve chamber drain shall be supplied with a plastic flap valve with stainless steel pin. Where the chamber drain is subject to regular surcharging (i.e. monthly or greater) an additional gate valve located in the valve chamber with an extension spindle and Tee key for operation should the valve chamber be flooded. Where a gravity drain is not possible a sump pump shall be provided.

3.17 Clause 2.22.3b

Openings in access covers shall be large enough for pumps to be lifted easily and safely out of the wet well for above-ground inspection, maintenance or replacement. Openings shall not be smaller than 600 x 600 mm. Openings shall have the following features:

- a) covers shall be lockable and fabricated from galvanized steel, finished flush with the cover slab and provide a non-slip surface;
- b) hinged covers are normally preferred. The hinged cover shall incorporate a facility for securing a recessed padlock and each lid shall have assistance to ensure a lifting effort not exceeding 25 kgF;
- c) if hinged covers are not provided, the weight of each cover shall not exceed 25 kg;
- d) in a closed position, the cover shall withstand a 5 tonne static wheel load in accordance with FACTA (Fabricated Access Covers Trade Association) class B loading. The cover shall withstand FACTA class C loading where there is a risk of traffic loading on the cover;
- e) for pumping stations greater than 1.5 m deep, a hinged safety grid in two sections shall be provided below the cover and be capable of withstanding a 250 kg load;
- f) the safety grid shall be provided with a 225 mm diameter slot to allow a suction hose to pass through;
- g) a cable entry facility shall be provided within the frame to enable the main cover to be closed whilst the pump is removed;
- h) closure of the cover shall be possible with the pump at a minimum height above the frame to provide a safe working platform for maintenance in accordance with Lifting Operations and Lifting Equipment Regulations (LOLER);
- i) the cover frame shall provide facilities for demountable handrailing which can be erected prior to any maintenance on the pumps being undertaken. Depending on the Site conditions, the handrail can be fixed permanently but with removable sections to allow pump removal. Chains for handrails shall not be used; and
- j) the barriers shall withstand an impact load of 125 kg from a height of 1.85 m through a footprint of 400 mm. Safety barriers should be capable of being released to allow access to the equipment from all sides. The stanchion sockets within the frame shall be flush with the concrete slab and be sealed to prevent debris entering when not in use

3.18 Clause 2. 22. 3h & 3i

Not applicable.

3.19 Clause 2.22.4a

A vent stack connected to under ground vent pipes with a minimum diameter of 75 mm and a minimum height of 4 m shall be provided for wet wells of wastewater pumping stations. The vent stack shall be located as close to the wet well as possible; at least 3 m from the kiosk or building and a minimum of 15 m from any habitable building. Vent pipes shall be installed at the “high point(s)” of the wet well. Vent pipes may have up to two bends, but these shall be large radius. Elbow bends shall not be used. The vent pipe shall be installed to avoid it becoming ineffective due to trapped water (rain, condensation, etc.).

The external shape and colour of the vent stack shall comply with local planning requirements and conform to architectural features of similar local installations. The outlet of the vent stack shall be fitted with a grill and a mushroom shield. Where the vent stack may cause an odour nuisance in a public access area or private residential area, a passive activated carbon filter shall be installed between the vent pipe and the vent stack. The activated carbon filter shall be contained in an underground chamber fitted with a manhole cover for access.

Where an air valve is installed in the valve chamber then vent pipe(s) shall be installed at the “high point(s)” of the valve chamber. The insert pipe shall not project more than 2 mm below the underside of the cover slab. Vent standpipes shall be supported by fixing to a concrete post.

3.20 Clause 2.22.4b

Not applicable.

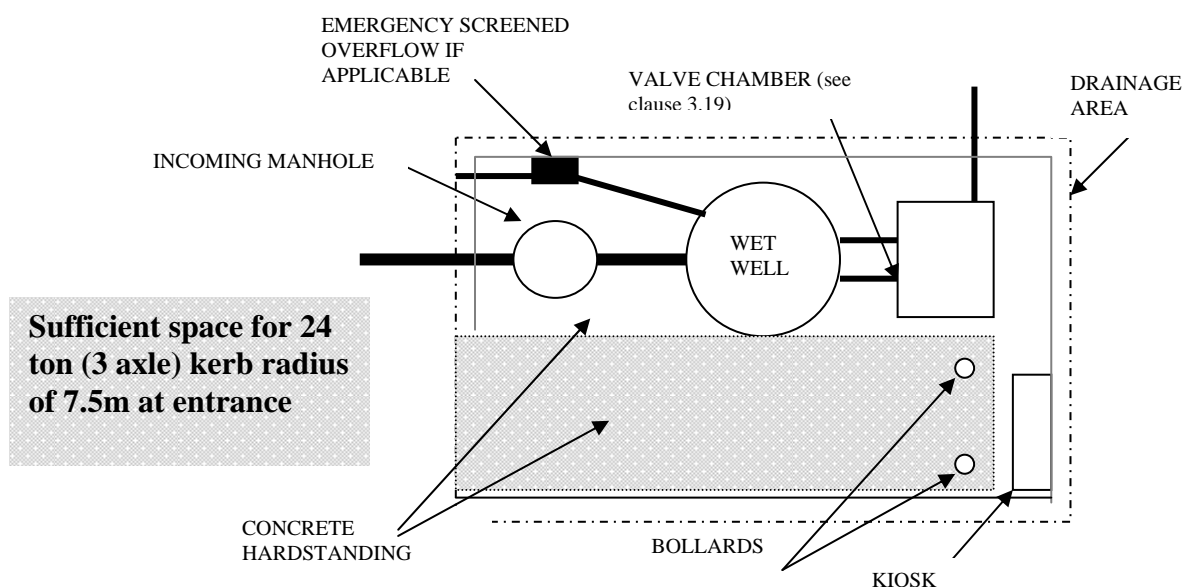
3.21 Clause 2.22.5

Stainless steel brackets or tie eye bolts located at the top of the wet well shall be provide for use with portable ladders up to a maximum of 6 metres.

Where plant is required to be removed by mobile lifting equipment or access required by man riding winches and tripods, then satisfactory space and hard standing shall be provided for the access, movement and operation of the equipment. The dimensions of the hard standing shall allow all the feet of the equipment to be sited on it when the legs are fully extended and include an additional margin of not less than 300mm from any one foot to the edge of the hard standing. The surface of the hard standing shall be flat and without irregularities in its surface, which will not allow the feet of the tripod to rest flat.

Southern Water uses a tripod system with a footprint of 1500 mm. Covers when open shall not obstruct the tripod footprint.

Figure 2.11



A typical pumping station layout for a Southern Water adoptable pumping station is shown above and shall be followed. No vehicle shall be permitted to park in the public highway in front of a site entrance gate. When the entrance is off a major highway (A or B class roads) gates shall be set back from the highway at least one vehicle length, based on the largest vehicle likely to visit the site. If outward opening, the gate shall be set back a further leaf opening width.. This requirement for gates can be relaxed if access is from estate roads and sufficient space is provided external to the site for turning/parking, and access is provided to the pumping station at all times.

3.22 Clauses 3.2 and 4.2

To meet design technical standards including the required design life for pumps, Southern Water standard for submersible pumps is ITT Flygt. It is preferred that the Developer use this manufacturer.

3.23 Clauses 3.2.2 & 4.2.2

Pumps shall comply with WIMES 1.02.

Each pumpset shall be capable of pumping the design flow rate at the mid-point of the well, plus an additional 5% on flow to take account of fall off in performance due to wear.

The Net Positive Suction Head NPSH Available shall be at least 2.0m greater than the NPSH Required. The NPSH Available shall be calculated at all points on the system curve to ensure that cavitation and vibration does not occur.

The pump system shall have adequate flow/velocity to ensure that solids and ragging materials are passed through the pump and associated pipework, without any adverse: temperature rise, vibration, internal recirculation, solids deposition or resonance.

The pump and its drive motor shall be suitably rated to allow for any increased head, due to sliming/fatting-up/scaling, deterioration of pipe material of the rising main, during the lifetime of the pump

The pump shall, where possible, not be selected with the minimum or maximum sized impeller for the selected frame size.

Pumps shall be capable of being reversed up to 100% of the normal forward running speed.

3.24 Clauses 3.2.3&8 & 4.2.3&8

The pump shall be able to operate without contravening its ATEX approval status under all of the following situations:

- Continuously at a fluid level of 'top of volute'
- Short periods (minimum of 3 seconds) at a fluid level of 'inlet to suction' or 'inlet to bell mouth', whichever is lower

3.25 Clauses 3.3.4.2 and 4.3.4.2

Pumps shall be located by means of a standard guide rail system complying with the following:

- Allow for the installation and removal of submersible pumps from the wetwell with
- Consist of a set of stainless steel grade 316 twin circular guide rails with centres of 100 mm for 50 mm diameter guide rails and centres of 124 mm for 80 mm diameter guide rails
- Positioned vertically parallel to each other and have the provision to be secured onto pump stool at one end and an adjustable upper stainless steel guide rail holder at surface level on the other. The upper guide rail holder shall utilise a method of locking the rails in position with adjustable expanding rubber inserts. These inserts shall allow for adjustment and locking from the top of the bracket at surface level. On wet wells of sufficient depth the guide rails shall utilise intermediate stainless steel support brackets every 3 m and be tied back to the vertical pipework or the wet well wall. The design of the brackets shall not interrupt lifting of the pump

3.26 Clauses 3.3.6 & 4.3.6

The impeller shall be suitable, in all respects, for the media being pumped.

The selection of the impeller type and size shall offer best efficiency, whilst taking into account: reliability, process media and potential for blockage. Where high wear rates are predicted then hardened impellers and wear rings/shrouds shall be utilised.

Generally the Purchaser's preference for impeller is the Flygt N type, but it shall remain the Developer's responsibility to ensure this selection is suitable.

3.27 Clauses 3.3.11 & 4.2

Flushing valves shall be avoided where possible. Automatic flushing valves shall be provided where the well is 3m in diameter or less and is not self cleaning.

3.28 Clause 3.3.11 Wet Well cleaning cycle

The control philosophy shall include an automated wetwell/tank cleaning cycle complying with the following:

- Cleaning cycle to be undertaken at periods of high turbulence in the wet well, i.e. high/peak flows
- Pump(s) shall pump down to the lowest possible level without drawing in air; generally this will be a fluid level of 'inlet to suction' or 'inlet to bell mouth', whichever is lower

- Once the cycle is complete the pumps shall be sequentially stopped and the system returned to normal operation
- Levels shall be so designed as to avoid overflowing, pump tripping, pump cavitation, damage to downstream equipment/processes or the generation of alarms

3.29 Clauses 3.3.14 and 4.3.13

3.29.1 Identification

All individual items of lifting equipment shall have the following identification:

- Safe Working Load
- Serial Number
- Southern Water Asset Number
- Date label, showing the next statutory date for thorough examination

This identification shall be permanent, i.e. stamped or painted and be adequately sized and positioned so that it can be clearly visible at ground level.

For the Southern Water Asset Number contact:

TATA Consultancy Services (working on behalf of Southern Water)
Southern House, Lewes Road, Falmer, Brighton, East Sussex, BN1 9PY.

3.29.2 Testing

Lifting equipment shall be load tested if deemed appropriate by the competent person registered with the Lifting Equipment Engineers Association. As a minimum all davit sockets shall be load tested in-situ.

The load applied for the test shall have a multiplication factor applied as defined by the 'Lifting Engineer Handbook' published by the 'Lifting Equipment Engineers Association'

Test loads shall be removed from the site after successful tests have been carried out.

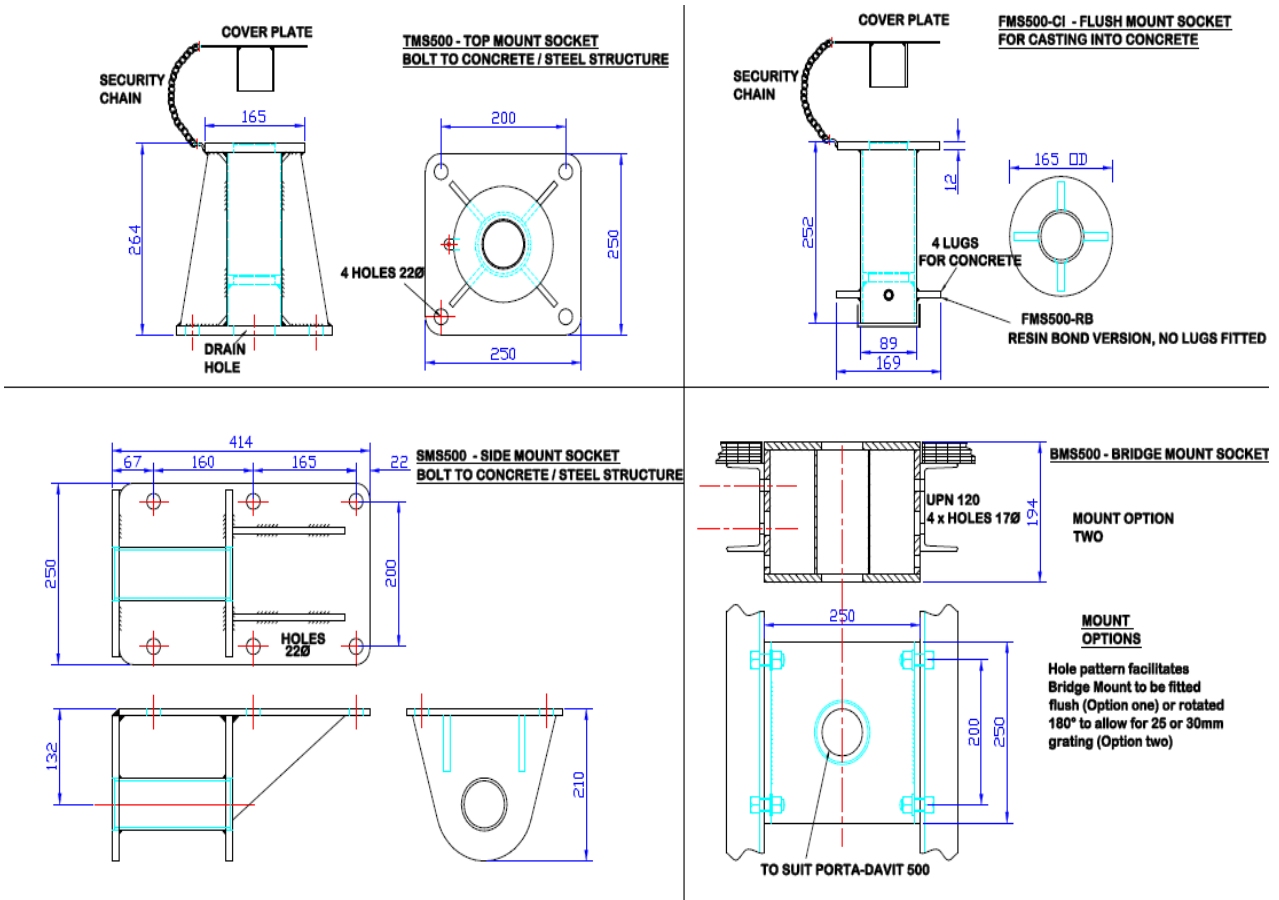
3.29.3 Documentation

Lifting equipment shall be supplied with the following:

- A 'Certificate of Conformity' from the manufacturer
- A 'Report of Thorough Examination of Lifting Equipment'. Where the 'Report of Thorough Examination of Lifting Equipment' has less than 6 month until its next inspection at the time of Final Certificate, then a further examination shall be undertaken by the Developer

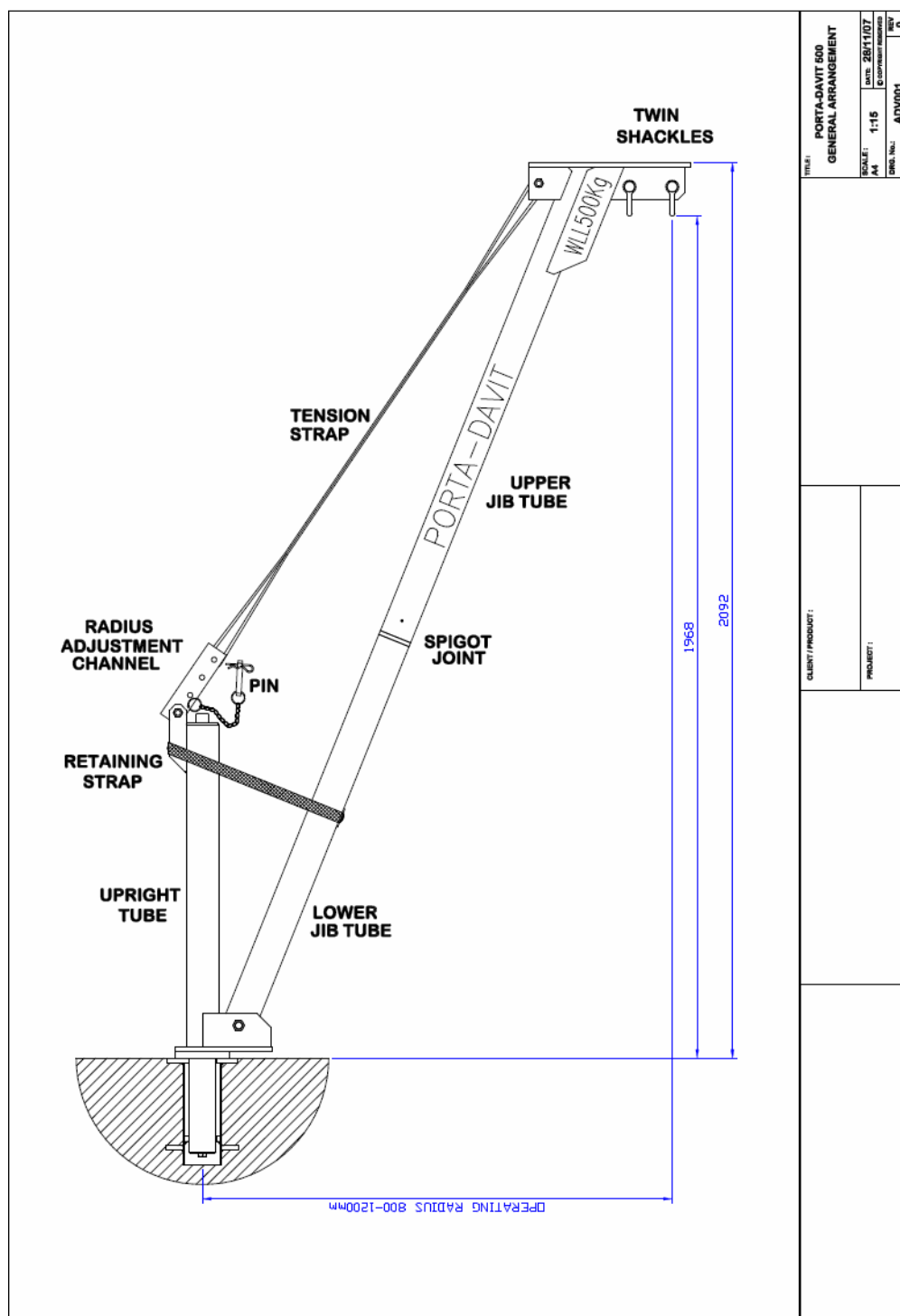
3.30 Clause 3.3.15 and 4.3.14

Davit sockets of 63mm nominal bore shall be provided in accordance with the diagram in appendix A.



MATERIALS:	CLIENT / PRODUCT:	PROJECT:	TITLE: PORTA-DAVIT 500 STANDARD SOCKET MOUNT ARRANGEMENTS SCALE: NTS date: 28/11/07 (if necessary) DRG. No.: SOCKET_OPTIONS REV: 6
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The installation of the davit socket shall ensure that it is suitable for the use of the davit shown in appendix B without the need for extensions pieces, etc. The davit location shall conform to the pump manufacturer's requirements.



3.31 Clauses 3.3.16 and 4.3.15

Submersible pumps that meet all of the following criteria shall be fitted with a length of 6 mm diameter non-rot nylon cord threaded through the lifting handle with both ends secured with 'swivel catch hooks' at the top of the wet well. Lifting chains shall not be supplied:

- Pump has a handle suitable for the Southern Water 2 tonne Lifting Hook (refer to specification below). Note this is not an instruction to use this lifting hook
- Pump weighs less than 2 tonnes
- Pump well less than 10 m deep

Submersible plant that does not meet the above criteria shall be fitted with the following:

- 316L stainless steel lifting chain complying to BS EN 818 with 50 mm internal diameter rings at a maximum of 1 m intervals
- Rated to lift twice the weight of each pumpset, subject to a minimum SWL of 500kg
- 316L stainless steel captive shackle, thus making the shackle integral with the chain
- 316 stainless steel identification tag permanently attached to the top end of the chain containing the information requested in section 3.3.14
- Where the chain/shackle is subject to vibration, then suitable means shall be taken to protect the system from damage, wear, chaffing, etc
- The shackle body and pin shall be drilled and fitted with a reusable 'R' pin (see diagram below) to prevent the pin from working loose



The cord or lifting chains shall extend a minimum of 1 m above the top of the wet well when the pump is in position and be secured to a stainless hook that can be accessed without leaning over the well, i.e. the underside of the wet well cover.

Where the Southern Water 2 tonne Lifting Hook is not appropriate then proprietary lifting systems that do not require permanent lifting chains may be considered subject to the Undertaker's approval. Such systems shall provide positive guidance of the lifting hook onto the pump lifting point without entry into the plant wet well.

Pump Handles shall comply with the following:

- Compatible with the Undertaker's 2 ton lifting hook
- Handle and securing device manufactured from 316 stainless steel with suitable galvanic corrosion isolations
- Suitable profile to ensure the nose of the lifting hook does not sit on the underside of the handle, such as 'round', 'V' or 'bevelled'
- Suitable clearance from top of pump to underside of handle to allow easy and effective location of the Purchaser's lifting hook

3.32 Clauses 3.4.1 and 4.4.1

Pumpset protection shall be provided as detailed in the Table below.

Pumpset size	Detector/switch
Less than 7.5 kW	<ul style="list-style-type: none"> • Stator Temperature
7.5 kW to 22kW	<ul style="list-style-type: none"> • Stator Temperature • Seal Leakage in Stator
22kW to 55kW	<ul style="list-style-type: none"> • Stator Temperature • Seal Leakage in Stator • Lower Bearing Temperature • Vibration.

Lower Bearing Temperature and Vibration alarms shall be 2-stage:-

- 1st stage: caution – maintenance required
- 2nd stage: fault
- Analogue signals are additionally required for Lower Bearing Temperature and Vibration see clause 3.19 & 4.1

Upon detection of any fault conditions, as detailed in the table above, the system shall:

- Stop and inhibit the pump from running until reset. (except. 1st stage caution alarms)
- Signal to PLC/HMI/SCADA (where fitted) to indicate the system has been activated
- Signal to Telemetry to indicate the condition

Alarm set points shall be set no higher than that stipulated by the pump supplier.

3.33 Clause 3.4 and 4.4 Suction Protection

Pumps shall be provided with all of the following hardwired suction protection to prevent 'snoring':

- Load/power monitoring device (in motor starter, appropriate to motor rating, capable of reliably detecting transient conditions when pump begins to draw air. Where the pump is installed in a Zoned area then the monitoring device shall trip the pump within 3 seconds.)
- Low flow signal from flowmeter, (where pumps over 20kW)

Upon detection the system shall:

- Stop and inhibit the pump from running until reset
- Illuminate the relevant fault lamp on the panel
- Signal to the PLC/HMI/SCADA to indicate that the system has been activated
- Signal to Telemetry to indicate that the system has activated

3.34 Clause 3.4 and 4.4 High Level alarm

An independent float switch shall be positioned in the Wet Well to indicate High Level. The output shall signal to PLC/HMI/SCADA (where fitted), and to Telemetry. See below Clauses 3.13.4.1(d) & (e) and 4.13.4.1(d) & (e).

The high level set point shall be set where the float switch is not routinely activated (i.e. a minimum of 100 mm above the backup level set point (and below the invert of the sewer inlet).

The switch shall not form any part of the control system.

3.35 Clauses 3.5 & 4.5

The well shall be checked for signs of: stagnation, vortices, pre-swirl, accumulation of solids.

The pumps shall be checked to ensure they are capable of delivering the design flows across the full range of operating modes i.e. parallel, operating speeds and heads without cavitation, vibration, noise and are operating efficiently.

It is preferable that pumps should operate between 80% and 105% of the pump best efficiency point, but it is recognised that this cannot always be achieved. Where a pump's best efficiency point is outside of the 80-105 range then evidence shall be provided that the most efficient pump and duty point available was selected.

The accuracy of the drop test shall be within +/- 7% on head and flow.

Accuracy of flow meter (where fitted) shall be demonstrated by comparing to the drop test results.

3.36 Clauses 3.8.1.1 and 4.8.1.1

The motor shall have an enclosure classification, as a minimum, of IP68 in accordance with BS EN 60529, suitable for a continuous submerged depth rating of 20 m or as required by the installation whichever is the greater.

3.37 Clauses 3.8.1.2 and 4.8.1.2

Where the application demands the pump to have a cooling jacket these shall be of the integral recirculation type and not utilise the process media.

3.38 Clauses 3.8.2 and 4.8.2

The minimum insulation class shall be Class H with a Class B temperature rise.

3.39 Clauses 3.8.3.4 and 4.8.3.4

A junction box, at waist height, outside the well shall be used. Disconnection of the cables from the junction box shall be undertaken without entry into the wet well or valve chamber. The junction box and the associated supports shall not obstruct the removal of the pump or cause a trip hazard. The junction box shall be GRP, suitable for the hazardous area classification of the area. Junction boxes with doors shall be triangular key lockable. Junction boxes shall have a label permanently fixed stating: **DANGER – LIVE TERMINALS** and **DO NOT TEST FROM THIS POINT**. Cable ducts from the junction box to the control panel shall be sealed against moisture and gas. See below Clauses 3.14.3.12 and 4.14.3.12.

3.40 Clauses 3. 8.4 and 4.8.4

Equipment used in classified areas under DSEAR shall be selected in accordance with Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 1996.

Electrical equipment and systems shall comply with all relevant parts of BS EN 60079 & BS EN 61241 and shall be certified for use in the appropriate zone and for the intended application.

Non-electrical equipment and systems shall comply with all relevant parts of BS EN 13463 and shall be certified for use in the appropriate zone and for the intended application.

Where work is being undertaken in an area classified as Hazardous, then all existing equipment in that area shall be assessed for suitability and where required changed/upgraded to comply with the requirements of this section.

If a motor certified for use in a classified area is to be supplied for use with variable speed or other electronic equipment, then it shall be confirmed that the motor certification remains suitable for the application.

Certification information for Hazardous Area equipment shall be clearly presented on a manufacturer's nameplate on the equipment in accordance with section 2.18 of this MED. Where certified equipment as part of a system is not individually identifiable by an existing label an additional label shall be provided to enable identification and tracking for maintenance purposes.

3.41 Clauses 3.10.1 and 4.10.1

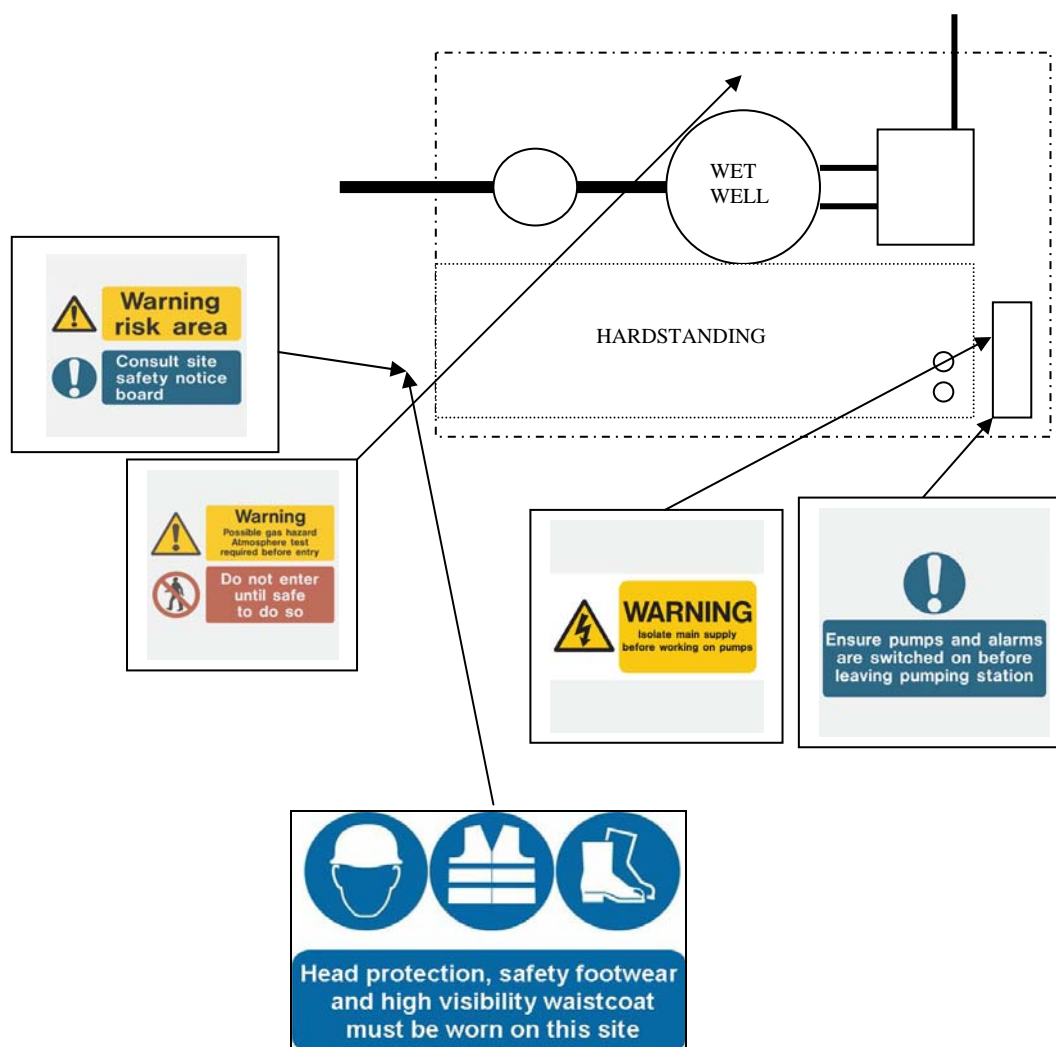
Where downstream requirements suggest variable speed drives may be required, the design shall be submitted to the Undertaker for approval before construction.

3.42 Clauses 3.10.1.7 and 4.10.1.7

Only NICEIC registered contractors shall be used for electrical installation work. In addition, for all work associated with Hazardous Area installation, contractors shall have successfully completed CompEx training modules 09 and 10.

3.43 Clauses 3.10.2 and 4.10.2

Southern Water requires additional safety signs shown below



Notices and signs shall comply with the Safety Signs Regulations Health and Safety Regulations 1996 and BS 5378:Part 1 1980.
Safety Signs and Colours shall conform to BS 5499-6:2002 Design of Graphical Symbols for use in Safety Signs Requirements.

The above signs can be obtained from:

Archer Signs & Panels (01159 273100) Rigid or plastic signs only.

Warning Risk Area (150mm x 100mm Landscape) and **Head Protection** (400mm x 300mm Landscape) signs shall be positioned externally on the gates.

Hazardous area signs shall be installed in accordance with the Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR).

Warning Possible Gas Hazard (400mm x 270mm Landscape) shall be positioned internally adjacent to the wet well valve chamber.

Warning Isolate Main Supply (150mm x 75mm) shall be positioned on the control panel inside kiosk.

Ensure Pumps (300mm x 200mm) shall be positioned externally on the kiosk doors.

In addition to the above signs a document pouch shall be fixed inside the kiosk for safety information.

3.44 Clauses 3.10.3 and 4.10.3

Operation and Maintenance manuals (O&M manuals) shall be designed to provide details of all installed equipment, describe how the pumping station will operate and how it is to be maintained.

The primary purpose of the manual is to convey information on safe operation of the site, its equipment and systems. Where the site has an overflow, emergency storage capacity or any other unusual system this shall be included in the manual with an explanation of how the system is integrated with the pumping station.

Three sets of O&M manuals must be submitted to Southern Water Services Ltd. before site hand-over for approval.

The manual should be an A4 folder (or similar) containing the following sections:

- Site Health and Safety
- Overview of pumping station design and site operation
- Site generator or mobile unit and changeover procedures
- Maintenance procedures and manufacturers' documentation
- Ultrasonic level controller configuration (setup) list
- Flowmeter configuration (where fitted)
- Telemetry configuration list
- Pumpset label data and pump system curve
- Utility account numbers, utility supplier and site telephone number
- Area classification assessment, where required see clause 1.5.2
- Certificates
- Drawings and schematic diagrams
- Asbestos free certificate in accordance with WOM

Manuals shall be produced in accordance with Southern Water's Works Operation and Maintenance manual (WOM), which is available from Southern Water Policies & Standards.

3.45 Clauses 3.10.1.8b and 4.10.1.8b

The following interlocks/protection devices shall be tested for correct operation and system response:

1. Low flow/load
2. High-level float
3. Backup float and timer
4. Failure of on non contact level control unit
5. Moisture in stator/seal chamber (where fitted)

The level controller shall be checked for correct settings and start/stop levels.

Refer to Southern Water MED4433 for required level controller settings.

Ultrasonic level controller backup float

Pumps shall be protected by an independent float switch (BACKUP) positioned in the wetwell to activate at level higher than the standby pump start level.

Upon detection the system shall:

- Once activated, the BACKUP control shall override the ultrasonic level controller until reset. Reset shall be by Manual pushbutton local to the pump control panel
- Run a pre-set number of pumps, usually pump No.1
- Illuminate the relevant fault lamp on the panel
- Signal to the telemetry to indicate that the system has activated
- When the wetwell/ level has reduced to 'clear' the BACKUP float switch, the pumps shall continue to run for a time pre-set on a hardwired timer. The pre-set time period shall equal the time taken for the pumpset to pump from the 'clear' level of the high level float to the pump stop level, assuming that there are no incoming flows into the wet/tank
- The pre-set pump(s) (usually pump No.1) shall continue to start on each operation of the backup float switch as above, until manually reset
- In Backup mode whenever Pump No.1 fails to run or the high-level float is activated, subsequently Pump No.2 shall be run every time the backup level float switch is operated, until manually reset
- Duty changeovers shall be inhibited in back-up control mode

The backup level set point shall be set where the float switch is not routinely activated (i.e. a minimum of 100 mm above the pump standby start level or the final assist level, which ever is the highest.)

3.46 Clauses 3.11.2.8 and 4.11.2.8

The doors shall be fitted externally with stainless steel lockable handles. The handles shall include a security-keyed lock, complete with stainless steel cam action catch/locking plate. Lock barrels shall be compatible with Southern Water's standard access keys for operational sites. Where personnel can enter kiosks, door locks shall be releasable internally.

3.47 Clauses 3.11.2.13(e) and 4.11.2.12(d)

The highest voltage within the kiosk shall be indicated in this 'Danger' label or adjacent.

3.48 Clauses 3.11.5.1 and 4.11.5.1

The kiosk heater shall have a local double pole isolator.

3.49 Clauses 3.11.5.3 and 4.11.5.3

The 16amp socket outlet shall be of a mechanically interlocked switched type.

3.50 Clauses 3.11.7 and 4.11.6

The Developer shall cable all telemetry plant and instrumentation signals to terminals at a common point. The common point may be the outstation or an external junction box, to be agreed with Southern Water ICA & Telemetry Team.

The following alarms and signals to telemetry shall be connected:

Digital Inputs *(shown for CSE-Septrol S250)*

Input No.	Signal Description	State
1	Site Mains Failure	Open for Alarm
2	Engineer-on-site (change to input 3 if M40)	Close for 'ON SITE'
3	---	---
4	Wet Well High Alarm	Open for Alarm
5	----	----
6	Pump No.1 Available	Open for Unavailable
7	Pump No.1 Running	Closed for Running
8	Pump No.1 Failed	Open for Alarm
9	Pump No.2 Available	Open for Unavailable
10	Pump No.2 Running	Closed for Running
11	Pump No.2 Failed	Open for Alarm
12	Backup Control Operating	Open for Alarm
13	Level Instrument Failed	Open for Alarm
14	Flowmeter Failed (where fitted), OR Ultrasound Flow Pulse (change to high speed pulse input if M40)	Open for Alarm, OR Pulse Counter
15	Pump 1 Power Meter pulse (above 3.5kW)	Pulse Counter
16	Pump 2 Power Meter pulse (above 3.5kW)	Pulse Counter

Analogue Inputs

Input No.	Signal Description
1	Wet Well Level (4-20mA = 0-100%)
2	Delivery Flow (4-20mA), where flowmeter fitted
3	Delivery Pressure (4-20mA)

Notes:

Digital Input 13 – Ultrasonics, Level Instrument Failed.

UL4 & UL5 to be connected in series and programmed in the Siemens Process Instruments (Milltronics) Level controller as mode 6 & 7 respectively, both N.O contacts.

Digital Inputs 15 & 16 – Pulsed signals for energy usage of each pump are required: refer to Southern Water MED4408.

Where a fixed standby generator is installed on site, contact Southern Water ICA & Telemetry Team for additional telemetry requirements.

The incoming PSTN line shall be provided with a lightning protection unit (LPU). The LPU shall be installed next to the telemetry outstation and connected to earth in accordance with the LPU manufacturer's recommendations.

A Southern Water standard 'Engineer-on-Site' switch shall be provided by the Developer.

The Engineer-on-Site switch is independent of an external power source, and uses a mechanical process timer to permit the engineer to select any 'ON' period of up to 120 minutes. When in use the switch provides a status signal into the outstation, which will report and inhibit alarms for the selected period of time.

Telemetry analogue input signals shall be connected across two input terminals at the outstation as 4-20 mA signal. The maximum load resistance the input will present is 250ohms. The design shall account for one leg of the loop resistance being or becoming connected to a common or zero-volt rail within the outstation

The Developer shall provide commissioning with Southern Water Engineers to be agreed with Southern Water ICA & Telemetry Team. This will include participation in point-to-point I/O testing to demonstrate the satisfactory operation of the integrated system.

3.51 Clauses 3.12.1 and 4.12.1

Push Buttons and Indicator Lamps

Push buttons and indicator lamps shall be circular and comply with BS EN 60947-5-1 and shall be coloured in accordance with BS EN 60073. Indicator lamps shall not exceed 110 volt supply and shall contain light emitting diodes.

The IP (ingress protection) rating of push buttons and indicator lamps shall be in accordance with the requirements of the overall Assembly IP rating.

Indicator lamps shall not form part of a push button or switch. A lamp test facility shall be provided.

Push buttons shall be coloured as follows:

Push Button Colour	Application
Red	Emergency stop
White	Start/on/inch
White	Valve open/close
Black	Stop/off
Yellow	Lamp test
Blue	Reset

Indicator lamp colours shall be as follows:

Indicator Lamp Colour	Application
Red	Hazardous or dangerous condition, zoned area ventilation failure, gas detected, over pressure, or Emergency Stop operated.
Green	Normal condition, motor running, valve operating, or On.
Yellow/Amber	Machine tripped or overloaded, slow rotation, seal leakage, low flow, or level alarm.
White	Available, Off, heater On, stopped, or valve fully open/closed or duty or standby level reached.

(Extract from Southern Water MED4001, Part C)

Emergency stop devices if required shall override all controls whatever their function and cut off the power supply to the drive. The device shall comply with BS EN 418 and shall be of the mushroom headed stay put type with break before latch mechanism, and twist or pull to release. Release of the mechanical latch shall not permit the plant to restart without appropriate resetting at the controlling Assembly. (MCC/Control panel). (Extract from Southern Water MED4001, Part C)

3.52 Clauses 3.12.1.2 and 4.12.1.2

When the control panel is isolated or open, any part remaining live or any part which could be energised at above Extra-Low-Voltage shall be shrouded to a minimum of IP2X and labelled to identify the hazard.

The label shall be permanently fixed in a prominent position on the front of the compartment door, preferably near the isolating handle. The label shall have a red background with white lettering of height 6mm minimum. The wording should be:-

WARNING

THIS PANEL HAS TERMINALS THAT REMAIN LIVE WHEN ISOLATED

ISOLATE ELSEWHERE BEFORE WORKING IN CUBICLE

3.53 Clauses 3.12.3.8 and 4.12.3.8

Triangular key type locks shall secure all compartment doors. Two triangular keys shall be provided for a control panel.

3.54 Clauses 3.12.5.2.2 and 4.12.5.2.2

The wiring colours shall be as follows: Cable insulation colours for multi-core or single core cables used for three phase circuits shall be brown, black, grey, and blue for phases L1, L2, L3, and neutral respectively. Alternatively, for single core cables, the colour brown may be used for all 3 phases, provided the cables are marked L1, L2, & L3 and sleeved black and grey as per phase colour where terminated. Colours for single phase circuits shall be brown and blue for phase and neutral respectively.

For alterations or extensions to existing three phase circuits that have the previously permitted wiring colours, the existing and new cables shall be marked L1, L2, L3, & N at their interface. A warning notice shall also be provided in accordance with BS 7671.

(Extract from Southern Water MED4001, Part C)

Assembly wiring colours shall be in accordance with WIMES 3.01

3.55 Clauses 3.13.2b and 4.13.2b

Phase Failure relays & fuses shall be fitted on the unswitched side of the incoming supply fuse-switch (suitably shrouded with warning labels), except where supply may be from a mobile generator: in this case the Phase Failure relay shall be fitted on the switched side of the fuse-switches. In both designs the Phase Failure relay shall monitor all three phases. The threshold voltage shall be adjustable, and monitor for the presence of two identical phases.

3.56 Clauses 3.13.3(c) and 4.13.3(c)

Fixed speed starters shall provide overload protection in accordance with the relevant clauses of WIMES 3.05 as follows:

up to and including 30 kW : thermal overloads

over 30kW (i.e. not SFA6) : refer to Southern Water standards MED4301 & MED4300

Soft start and soft start/soft stop motor starters, on board protection.

3.57 Clauses 3.13.3.3 and 4.13.3.3

A separate 110v transformer to serve the starter circuit shall be fitted to each starter compartment

One limb of the secondary windings of the control transformer shall be solidly earthed and there shall be a suitable earth divided screen between primary and secondary windings.

The control transformer shall have fuses or MCB protection of the primary and secondary windings.

3.58 Clauses 3.13.3.8 and 4.13.3.8

The Developer, in accordance with BS EN 292 and Southern Water MED4001 shall assess the requirement for emergency stop equipment. Measures taken shall be justified by risk assessment of the hazards involved and recorded.

Typical Installation – the following guidelines for submersible pumps lay down the minimum standards to which the Developer shall work when considering the use of emergency stop devices. They form the basis of the risk assessment which is the responsibility of the designer:-

- (a) Under normal circumstances there should be no requirement for an emergency stop.
- (b) Electrical supply must be isolated and locked off at the isolator before the pump is lifted.
- (c) Pump rotational checks shall normally be carried out from the pump starter control panel: where this is not practical consideration shall be given to a local ‘hold-to-run’ push button which shall be justified by a Risk Assessment submitted to and agreed with the Project Manager.

3.59 Clauses 3.13.4.1(d)&(e) and 4.13.4.1(d)&(e)

The highest predetermined liquid level shall be sensed by a float switch (Flygt ENH-10 or a similar float that is a mechanical switch in a plastic casing), freely suspended at the desired height from its own cable. When the liquid level reaches the regulator, the casing will tilt and the mechanical switch will close or break the circuit, arranged to have an open contact on high level. Such float switches will require use of an Intrinsically Safe barrier (Pepperl+Fuchs Z778 or similar).

Cables should be retained by using plastic eyelets or similar.

3.60 Clauses 3.13.4.1(c) and 4.13.4.1(c)

Southern Water standard for ultrasonic level controllers is Siemens Process Instruments‘ HydroRanger-Plus. The detector head shall be supported by stainless steel chain or bracket, not suspended on its cable. The preferred fixing method for the ultrasonic head shall be hinged unistrut (or equal equivalent) with the head fixed directly to the strut. The ultrasonic head shall be removable without the need for maintenance personnel to lean over an open well or chamber. Required setup details are given in Southern Water standard MED4433.

3.61 Clauses 3.14.3.12 and 4.14.3.12

Sealing systems used shall be in accordance with WIMES 3.02.

Expanding foam shall not be utilised.

3.62 Clauses 3.16 and 4.16

Valves shall be fitted with standard valve handles and shall only be provided with extension spindles where the valve chamber is likely to flood upon pump/valve failure.

Gate valves shall be suitable for intermittent operation with periods of idleness of up to 12 months in the open, partly open/closed and closed position without sticking.

3.63 Clauses 3.19 and 4.19

Condition/performance monitoring is required on Wastewater Pumping Stations as follows:-

a) Pressure

A suitable pressure transmitter incorporating a stainless steel flush diaphragm and with an isolating ball valve shall be installed downstream of the valves where pipework combines. This transmitter shall be cabled to the control panel to provide a pressure analogue signal to the telemetry outstation.

b) Energy

Where the individual pump rating is above 7.5kW, electrical power consumption shall be monitored per pump via metering pulses connected as input to the telemetry outstation.

c) Flow

Where the individual pump rating is equal-to or above 20kW, a suitable electromagnetic flowmeter shall be installed downstream of the valves in a chamber. The flowmeter shall provide an analogue flow signal to the telemetry outstation. Where installation of an electromagnetic flowmeter chamber is not possible (e.g. due to space restrictions), then it may be installed within an enlarged valve chamber, or a derived flow may be provided to telemetry as below.

Where the individual rating is below 20kW a pulsed flow signal shall be derived from the HydoRanger-plus level instrument and connected as input to the telemetry outstation. Where the ultrasonic level reading is not reliable an electromagnetic flowmeter shall be provided as above.

d) Vibration

Where the individual pump rating is equal-to or above 22kW, vibration shall be monitored per pump via a local analogue signal and a 2-stage alarm connected as inputs to the telemetry outstation.

e) Lower Bearing Temperature

Where the individual pump rating is equal-to or above 22kW, lower bearing temperature shall be monitored per pump via a local analogue signal and a 2-stage alarm connected as inputs to the telemetry outstation

Each transducer / monitoring device shall be suitable for the intended environment (including ATEX requirements where applicable) with a minimum rating of IP55. For further detail on Condition Monitoring requirements refer to MED 4003.

3.64 Appendix A Hazardous Zone Classification Guidance

Processes definition

Gravity wastewater network

Public sewers, manhole chambers and other internal space that form part of the sewerage network directly exposed to sewage which has not been lifted by a pumping station.

Generic drainage structure (GDS)

A miscellaneous maintained structure on a drainage catchment including: siphons, flow monitoring points, pipe bridges, individual macerators, cesspits etc.

Primary wastewater pumping station

Wastewater pumping stations which receive sewage directly from gravity wastewater network.

Zone Drawings and ATEX information

Zoned areas shall be identified on site zone drawings.

Zone drawings shall be easily eligible when displayed in standard A3 size format. Each zone drawing shall include the following information:

- Illustration of all external zoned areas and internal zoned areas which are accessible to personnel. Internal and inaccessible zoned areas for complex plant, such as sludge dryers, may be shown on zone drawings as text only.
- Legend of zones
- Zone classification for each zone
- Horizontal and vertical extent of each zone
- Temperature class of each zone
- Tag numbers (if available) of equipment containing internal zoned areas

ATEX data of all equipment installed in zoned areas shall be provided (This information shall be entered into Purchaser's equipment database such as the Ellipse).

Zoning Procedure

Contractors shall conduct assessments to determine hazardous area classification in accordance with BS EN 60079 part 10 or BS EN 61241 part 10 to confirm the general requirements detailed within this document are appropriate and sufficient for the specific location and design. Southern Water Lead DSEAR Engineer shall be consulted where a different solution is identified to the general requirements contained in Schedule 1.

Zoning should be carried out by suitably trained and experienced personnel who have knowledge of the properties of flammable materials, the process and the equipment, in consultation, as appropriate, with safety, electrical, mechanical and other engineering personnel. Training records and qualifications of the assessor shall be placed in the O&M manual.

Zoning shall take into account relevant local conditions. As a minimum the following aspects shall be identified and evaluated:

- Dangerous material
- Source of release
- Grade of release
- Type of zone
- Extent of zone

The requirement in Schedule 1 shall be used as minimum guidance for hazardous area classification. Zoning shall be carried out before new sewer and pumping stations are installed or significant modification is made to existing sewer or pumping stations.

Blanket zoning of kiosks, chambers and other areas shall be avoided by design unless it is justified. Extension of zoned area to adjacent areas connected via openings, duct or covers shall be assessed and justified individually where this cannot be avoided by practical design measures, such as sealing.

A zoning assessment template (Schedule 2) shall be completed, signed by the assessor and submitted to Southern Water where a zoned area is created or where a different zoning classification to Schedule 1 is adopted.

The following guidance shall be followed in conjunction with Schedule 1 to take into account of possible variations in process design and site conditions.

Geological methane

Individual assessment shall be carried out to determine zoning for underground facilities in areas with potential or known geological methane releases.

Generic drainage structure

Prior to introduction of new fixed electrical or mechanical equipment into a generic drainage structure (GDS) which are not specifically defined in Schedule 1, individual assessment shall be carried out to determine zoning.

Underground facilities which rely on forced ventilation for safety

Individual assessment shall be carried out to determine zoning for underground pumping stations with unrestricted access during normal operation and which rely on forced ventilation for maintaining a non-explosive atmosphere.

Odour control systems

Individual assessment shall be carried out to determine zoning for odour control plant used to treat foul air from a zoned area, (e.g. wet wells of primary wastewater pumping stations) if the volume of foul air from zoned areas exceeds 25% of the total volume of foul air treated.

Schedule 1 Hazardous area classification for potential explosive atmosphere

Process	Plant area	Provisional zoning
Gravity wastewater network	Gravity sewers and manhole chamber	Zone 2 internally
	Outfall (OTF)	Zone 2 internally
	Sewage storm tanks (SST)	Zone 2 internally
	Combined sewer overflow (CSO)	Zone 2 internally
	Generic drainage structure (GDS)	Individual assessment
Wastewater pumping station	Wet wells	Zone 2 internally
	Valve chambers (assuming a flap valve is installed to the end of the drain pipe open to the wet well).	Unclassified
	Segregated kiosks (assuming cable ducts are sealed to prevent gas ingress into the kiosks)	Unclassified
	Unsegregated kiosks	Individual assessment

Schedule 2 Template for hazardous area classification assessment

Area Classification Form (see notes) ^[3]	Reference number	
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Site Name	
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Process name	
Description of process:	

Dangerous substance		Potential source of release	
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Equipment and plant	Volume (m3)	Grade of release ^[4]	Release rate	Degree of ventilation	Availability of ventilation	Zone classification	Extend of zone

Assessment of sources of release and release rates

Assessment of ventilation

Assessment of other relevant information ^[5]

Notes

Signature	Print name	Job title / company	Date

4. Associated Southern Water Standards

MED 4001	Mechanical and Electrical General Specification
MED 4003	Condition Monitoring
MED 4004	Hazardous Area Classification
MED 4131	Ventilation Systems
MED 4138	Lifting Equipment
MED 4140	Mixed Flow Volute Submersible Sewage and Sludge Pumpsets
MED 4300	LV Switchgear & Controlgear Assemblies rated above 100Amps
MED 4301	Package Plant and Control Panels rated up to 100 Amps
MED 4408	Telemetry
MED 4415	Liquid Flow Metering
MED 4417	Control of Pumps
MED 4433	Liquid Level Measurement
CED 4001	Hydraulic Design Requirements
CED 4010	Pressure Pipelines and Rising Mains
CED 4019	Fibre Reinforced Plastic Kiosks
PSWWT 4022	Odour Control – Load Assessment and Dispersion Modelling

5. Details of Change History

Issue 3

Section No.	Paragraph No.	Change	Rational for Change
3.12	1	Additional clause on wetwell surface loading	To reflect SW specifications
3.12	3&4	Additional clause on well design and prefabricated wells	To reflect SW specifications
3.16	1	Gate valve and flap valve now required if chamber subject to flooding.	To reflect SW specifications
3.23	2	New clause on reversing of pumps	To reflect SW specifications
3.24	1	Snore period better defined	To reflect SW specifications
3.25	1	New dimensions and materials for guide rail brackets	To reflect SW specifications
3.31	2	New requirement for 'R' pin to be fitted to shackle	To reflect SW specifications
3.33	All	New wording on suction protection	To reflect SW specifications
3.34	2	New clause on float location	To reflect SW specifications
3.39	1	New clause on JB's to be installed at waist height.	To reflect SW specifications
3.44	2	New reference to asbestos free certificates	To reflect SW specifications
3.45	2	New clause on backup float	To reflect SW specifications
3.50	Table 2	Vibration & Temp. signals deleted	To reflect SW specifications
3.61	2	Use of expanding foam removed	To reflect SW specifications
3.62	d) & e)	Vibration & Temp. signals local (not telemetry)	To reflect SW specifications
3.64	5 & table	New clause on training records and deletion of word 'primary'. New section on zoned drawings	To reflect SW specifications

Authorised by



Brian Spencer

Signature