Instrumentation & Controls Standards

Document Number AM 2832

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Document Control

Rev	Date	Revision Details	Clause	Author	Approved
0	13/08/20	The EIC committee had reviewed various sections of this Standard on 5 occasions. We have set revision to rev 0. We have decided to segregate the original AM2714 into separate standards, namely: AM2714 – Electrical Standards • **AM2832 – Instrumentation & Controls Standards (this document)** • AM2847 – Communications Standards • AM2851 – EIC Inspection, Testing & Completions Standards • AM2848 – Approved EIC Equipment List	All	EIC Committee	A. Gabriel C. Paxman
0.1	22/7/2021	Instrument Accessibility	3.9.1	J. Street	EICC Committee

1. General Requirements

1.1 Acronyms and Abbreviations

All abbreviations and acronyms used in additional documentation, shall follow the conventions used through this and other related project documents.

Acronym	*Description*
ABS	Acrylonitrile Butadiene Styrene
AD	Active Directory
AI	Analogue Input
AO	Analogue Output
COTS	Commercial Off The Shelf
Cu	Copper
DI	Digital Input
DIN	German Institute for Standards (Deutsches Institut für Normung)
DNP3	Distributed Network Protocol (version 3)
DO	Digital Output
ELV	Extra Low Voltage
EMC	Electromagnetic Compatibility
FAT	Factory Acceptance Test
FDS	Functional Description Specification
HMI	Human Machine Interface
IEC	International Electrotechnical Commission
iLO	Integrated Lights Out
IO	Input Output
IP	Ingress Protection
ITP	Inspection Test Plan
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LV	Low Voltage
mAHD	Metre Australian Height Datum
NTP	Network Time Protocol
OTDR	Optical Time Domain Reflectometer
P&ID	Process & Instrumentation Diagram
PC	Personal Computer
PLC	Programmable Logic Controller
PSU	Power Supply Unit

PTC	Positive Temperature Coefficient
PVC	Polyvinyl Chloride
RCD	Residual Current Device
RTU	Remote Telemetry Unit
SAL	Site Alarm List
SAT	Site Acceptance Test
SCADA	Supervisory Control And Data Acquisition
SDM	System Design Matrix
SEW	South East Water
SFP	Small Form Pluggable
STP	Sewage Treatment Plant
TBA	To be advised
TBC	To Be Confirmed
TFT	Thin Film Transistor
TTP	Tertiary Treatment Plant
UF	Ultra Filtration
UPS	Uninterruptable Power Supply
UPVC	Unplasticised Polyvinyl Chloride
UV	Ultra Violet
VLAN	Virtual Local Area Network
VPN	Virtual Private Network
VSD	Variable Speed Drive
WAN	Wide Area Network

1.2 Scope

This specification outlines South East Water's minimum standards for the selection, fabrication, delivery, installation and testing of instrumentation and controls equipment, associated items used at new or renewed water and sewerage infrastructure sites.

Excluded from the scope of this specification are:

a. South East Water assets not containing water and sewerage infrastructure (e.g., WatersEdge office, depots)
b. Functional or operational requirements relating to electrical assets.
c. Monitoring, protection, control and communication system design, configuration and programming. This is covered by other South East Water standards such as AM2779_Treatment Plant Monitoring and Control Specification.
d. Civil, mechanical arrangements, pump selection, pump performance or hydraulic assessment.
e. Work practices associated with the management of electrical risks during construction and installation works.

1.3 Standards

The following standards shall apply in the given order of preference:

a) Australian Standards or its IEC/ISO equivalent
b) OH&S Regulations 2017 (Victoria)
c) Electricity Safety (Installations) Regulations (Victoria)
d) Victorian Service & Installation Rules
e) Essential Services Commission Electricity Distribution Code
f) Requirements of the Electricity Distribution Company
g) Electricity Safety Act (Victoria)
h) Manufacturer's Guidelines
i) Water Industry Standards, including:
    i. WSA04 Sewage Pumping Station Code Of Australia
    ii. South East Water supplementary manual to WSA04
    iii. South East Water Standard Electrical Drawings
    iv. AM2779_Treatment Plant Monitoring and Control Specification (SEW)
    v. AM2717_Generator Specification (SEW)
    vi. AM2522_O&M Manual Specification (SEW)
    vii. AM2755_Testing, Commissioning and Handover Plan (SEW)
    viii. AM2739_Corrosion Mitigation Specification (SEW)
    ix. AM2727_Covers for Underground Structures (SEW)
    x. AM 2758_Noise Specification (SEW)
    xi. AM2775_Watershed Collection Details (SEW)
    xii. AM2776.3_Air Treatment Unit Specification and Commissioning (SEW)
    xiii. AM2488_2D and 3D Drafting

The order of precedence of documents shall be as follows:

a) Legislated requirements
b) Project specific specifications
c) Project specific drawings
d) South East Water standards
e) South East Water standard drawings
f) Water Industry Standards (WSAA)

1.4 Quality of Workmanship

Please refer to AM2714.

1.5 Materials, Equipment and Component

Please refer to AM2714 and AM2848.

1.6 Labelling

Please refer to AM2775.

1.7 Drawings and Integration

Please refer to AM2714.

1.8 Pre-Construction Submissions

Please refer to AM2714.

2. Installation Requirements

Please refer to AM2714.

All works shall be done by appropriately* qualified, competent, recognised and approved by SEW representative instrument technician/personnel or vendor subject matter expert specific to the task.

*Shall be determined by SEW. Minimum requirements would be to undergo the following Swagelok trainings for instrument fitters:

- Instrument Pipe Work fittings. – technician must have completed Swagelok Tube bending essentials course & Tube Fitting Installation Course.
- Calibration and setup of instruments – must be carried out by qualified Instrument or Instrument/Electrical Technician or Vendor Representative.

3. Instrumentation

3.1 Installation

3.1.1 Arrangement

Instruments shall be arranged so that adjustments can be readily made in the field. Permanent access shall be provided for all field indicators, transmitters, analysers, actuators and points of calibration or challenge testing. Where applicable provide drain and 1/4 inch test points with associated isolation valves for in situ calibration without the requirement to dismantle supports or pipework.

3.1.2 Field Enclosures and cabinets

Mount field instruments within enclosures between 800 and 1500 mm above ground providing the following degree of protection.

- IP 56 minimum for all equipment above the ground
- IP 67 minimum for all equipment in the pits, e.g. valve pits,
- IP 68 for the equipment subject to submergence.

Enclosures shall be constructed from 316 stainless steel construction, powder coated finish. Locking systems to conform to AM2714. Provide adequate ventilation where applicable.

Cabinets shall be:

- G62 river gum in colour unless all equipment around it is not painted.
- Fitted with approved SEW locks refer to AM2714
- Fitted with cross ventilation with vermin/insect protection.
- Fitted with stainless steel or aluminium rain hood.

3.1.3 Instruments within Buildings

Mount instruments collectively on a common panel. Panel material to be non-metallic, 10mm Grey PVC or equivalent.

3.1.4 Instrument Panel Layouts

Instrument panels shall be built as per SEW standard drawings.

3.1.5 Support

Where applicable instruments shall be mounted using brackets as supplied by the manufacturer. No instrument shall be installed dependent only on its impulse piping, process or electrical connection.

3.1.6 Electrical Isolation

Instruments supplied by a voltage equal to or greater than low voltage shall be fitted with a local isolator. Local isolation shall include lockable isolators for hard wired equipment or plug socket combinations.

3.1.7 Instrument Clean Earth

An Instrument Clean Earth shall be installed at the location of each field instrumentation enclosure. The Instrument Clean Earth shall be isolated from the site structure and other metal work. The Instrument Clean Earth shall be bonded to the main electrical earthing system at a single point only. The Instrument Clean Earth shall be labelled accordingly.

Instrument signal cabling containing an earth screen shall be left floating in the field end. It shall be electrically continuous from the field equipment and be connected to the Instrument clean Earth bar in the receiving switchboard.

3.1.8 Piping

Provide pipe unions, isolation valves, test and drain points to enable removal or in situ calibration of in line instruments with threaded connections such as pressure transmitter switches, and gauges, rotameters etc.

All small bore fittings shall be per AM2848 Approved EIC Equipment List e.g., Swagelok gaugeable fitting.

All threaded joints shall be BSP threads. NTP threading, BSB tapered and BSP parallel threading may be required for connection of some components.

All cock valves shall be Swagelok quarter turn ball valves. All needle valves shall be Swagelok screwed bonnet needle valves.

All piping and impulse tubing shall be stainless steel or flexible nylon. Flexible nylon tubing shall be rated to 1.5 times the maximum measurement value and be fitted with Swagelok gaugeable fittings.

Where piping or tube is exposed to the elements or installed in an area with a run greater than 1m shall be stainless steel.

3.1.9 Identification

All equipment and instruments shall be identified by means of 316 stainless steel corrosion resistant tags permanently affixed adjacent to the instrument by means of 316 stainless steel screws or rivets.

3.1.10 Transmission

All instruments shall be capable of transmitting the output signal by loop powered 4-20mA analogue current loop. The output signal shall be linear with a proportional increase in the measured variable. Each transmitter shall be fitted with a configurable local indicator. The indicator shall be integral to the transmitter assembly. The local indicator shall display the measured value in engineering units.

Signal transmission shall be HART protocol compatible. A series resistor of 250 ohms shall be connected within the signal loop located adjacent to the instrument to allow connection of a Hart configurator/ calibrator. Consideration to minimum operating voltage (loop power instruments) and total loop resistance shall be consider when adding series resistance.

NOTE: Burn-in/burn-out or fail-low/fail-high transmitter settings must be documented

3.1.11 Surge Protection

Provide lightning surge protection to instrument loops > 5m installed in field locations. Direct mount the protection device on the instrument or install modular protection enclosed in a cubicle within 1m of the instrument. Provide modular protection at the PLC, RTU, receiving device loop.

Protection: Multi stage 10kA max discharge surge current for an 8/20 micro-second pulse (8 micro-second rise time, 20 micro-second exponential decay time) for line-to-line and line-to-earth transients and arranged to fail to the short circuit condition.

3.2 FLOW METERS

3.2.1 Selection

Flow meters shall be selected from the SEW approved products list from AM2848 - Approved EIC Equipment List.

South East Water M&E Department and Design Team’s approval is required for any deviation from the selected.

3.2.2 Installation: Technician Requirements

All Manufacture Installation Guidelines shall be followed.

All flow meters shall be wired by the Manufacturer representative or Qualified Instrument Technician.

Where practical, the cables may be installed and potted by the supplier before delivery.

Flow meter wiring / conduit shall be installed by a Qualified Electrical or Instrument Technician.

The flowmeter sensor tube shall installed by Civil or Mechanical Tradespeople. If buried, prior to backfill a verification of the flowmeter’s operation shall be performed. Protective wrapping and backfilling shall be witnessed by a Qualified Electrical or Instrument Technician.

3.2.3 Cables

All cables from the sensor to the transmitter shall be continuous in length with no joints.

All connections and approved cable type shall be as per manufacturer's guidelines.

3.2.4 Potting

All sensors must be potted with the manufacture recommended potting mix. Any unused cable glands must be sealed with appropriate o'ring sealed, threaded plastic conduit plugs.

3.2.5 Sensor Location

Position of the flow sensor tube shall factor in disturbances upstream or downstream of the sensor.

Flow sensor shall be installed as per the recommended distances by the manufacture, if not stated the below must be used.

- Straight Pipe after — Minimum 5 x Diameter of pipe before, 2 x Diameter of pipe
- Before a Bend — Minimum 2 x Diameter of pipe
- After a Tee or Valve — Minimum 10 x Diameter of pipe
- After a Tee or Valve — Minimum 10 x Diameter of pipe
- Before a Valve — Minimum 10 x Diameter of pipe
- Before a Control Valve — Minimum 5 x Diameter of pipe
- After a PRV — Minimum 25 x Diameter of pipe(Recommendation to always install before a PRV)
- After a Pump — Minimum 10 x Diameter of pipe

If chemical dosing injection points are installed on the same pipeline then they shall be at least 20 Diameter lengths, of the pipe downstream. Consideration shall be made in the PLC code to reduce the backflow of the chemical by stopping a dosing pump before a fluid transfer pump is stopped.

3.2.6 Sizing / Ranges

Flow meters sizing must be selected for the correct size of the station requirements.

- Sized higher than the sites maximum flow.
- Sized adequately to detect any low flow requirements
- Transmitters must be programmed to the correct flow requirements of the site

3.2.7 Transmitter location

Transmitter must be mounted in the recommend locations below, otherwise approved by SEW representative.

Water & Sewer sites

- If the flow meter signal converter (transducer) resides near a building then the transmitter must be mounted on the internal side wall of the building wall between 1.5m and 1m, with the flow rate programmed onto the site HMI and to SCADA.

- If the site only has a cabinet the transmitter must be mounted either in its own tier/compartment or with station control with the flow rate programmed onto the site HMI and to SCADA.

- Direct Mounting may be allowed as advised by SEW M&E Team, with station control with the flow rate programmed onto the site HMI and to SCADA. This will normally only be considered if the flow meter is indoors and the display can be accessible from the ground.

Treatment Plants

- If the flow meter signal converter (transducer) resides near a building then the transmitter must be mounted on the internal side wall of the building wall between 1.5m and 1m, with the flow rate programmed onto the site SCADA and to Remote SCADA
- If the flow meter signal converter (transducer) is remote it must be installed in a vented S/S or Aluminum River gum enclosure painted G62 Rivergum.
- Direct Mounting may be allowed as advised by SEW M&E team, with station control with the flow rate programmed onto the site SCADA and to Remote SCADA. This will normally only be considered if the flow meter is indoors and the display can be accessible from the ground.

3.2.8 Transmitter Connection to RTU / PLC

All transmitters to be supplied with 4-20mA feedback, Modbus comms or HART Communication unless approved by SEW. Pulse output required in some cases.

3.2.9 Lightning Protection

If available from the manufacturer, lightning protection shall be installed in the flow meter sensor and transmitter. Note: needs to be made at the transmitter to indicate lightning protection is installed at the sensor end for insulation resistance testing of an appropriate voltage.

3.2.10 Transducer Termination

Where multiple cables enter a flow meter sensor, they shall enter via separate glands and be run in separate conduits with a minimum size of 25mm HD conduits.

Conduits must be overlapped onto the sensor cable glands by resin heat shrink or flexible expansion couplings similar to Clipsal F251/25.

Where buried, the final point of connection from conduit to sensor junction box should be of HD corrugated conduit with enough allowance for minor movement or settling of the surrounding area.

Conduits are to be sealed to prevent ingress of moisture.

Terminations to be carried out as per manufacturer's guidelines.

Where the sensor is connected to the transmitter with two or more cables, they shall be installed in separate conduits separated by the width of the trench or a minimum distance of 200mm to prevent cross-talk, particularly on cable runs in excess of 20m. Sensors connected by a single multicore proprietary cable shall be installed in conduits in the centre of the trench.

All sensor cables shall be run away from any other services or cabling systems and where they need to cross, it shall be at right angles to that service.

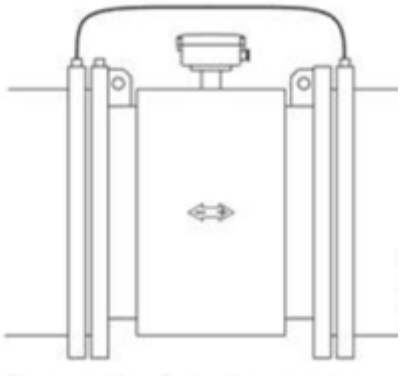
3.2.11 Fasteners

All bolts/ nuts / washers shall be stainless steel 316 coated with nickel-based anti-seize.

3.2.12 Cathodic Protection

All flowmeters installed on a cathodic protected pipeline shall be installed as per manufacturer's guidelines. With the sensor isolated from the cathodic pipe. Installation must include the below:

- Isolating sleeves and washers for all bolts
- Gaskets are to be non-conductive
- Grounding rings to be isolated from the pipe and connected to the flow meter flange only
- Electrode and coils shield to be terminated at the transmitter end only
- Transmitter to be 24V DC and powered from an isolated supply
- Transmitter to be isolated from ground.
- Bypass strap between outside mating flanges



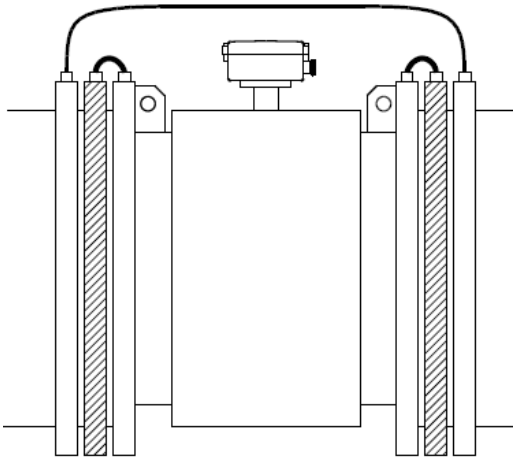
3.2.13 Earthing / Bonding

Sensor tubes shall be bonded between the tube and the adjoining pipe, Bonds shall also be installed from the two adjoining pipes similar to the below. If earthling rings are installed they shall also be bonded.

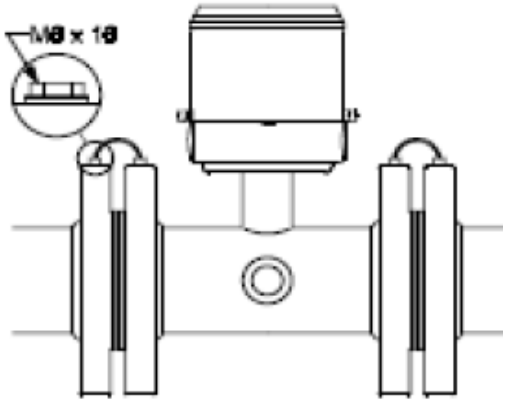
Sensors shall not be connected to grounding spikes.

Earthling rings shall be installed on all plastic or combination of metal/plastic pipelines.

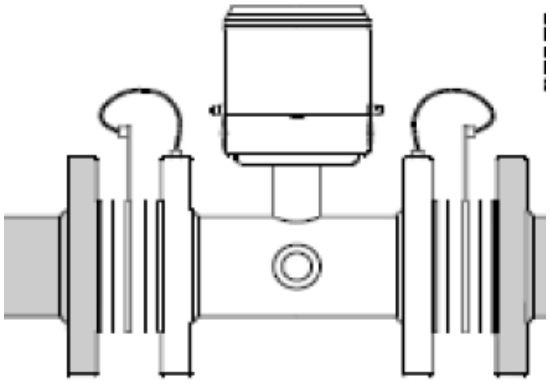
Refer to manufacturer's guidelines.



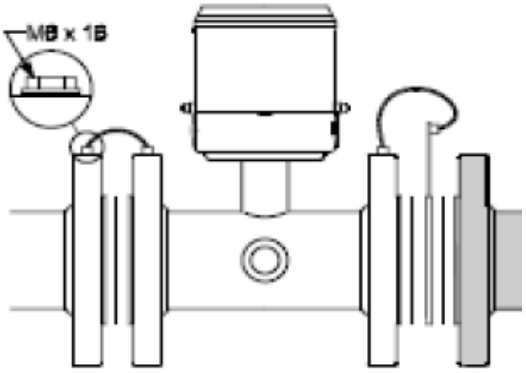
Metal Pipe Bonding Not including Full Bond above



Plastic Pipe Bonding Not including Full Bond above



Combination of Metal and Plastic Pipes Bonding Not including Full Bond above



3.2.14 Bypass Piping

Flowmeters installed at the below locations must have bypass piping installed around the flowmeter with appropriate valving for flow meter isolation, removal and system bypassing.

- Sewer Pump stations - with a PDWF (Peak Dry Weather Flow) of equal to or greater than 25 l/s
- Water Booster Pump stations - All
- Treatment Plants - Critical flow paths lines

Waste Water Treatment Plants including Class-A,C Treatment

Bypass of flow meters where immediate replacement of the flow meter is required and/or where the process flow cannot be readily isolated.

Preference for all flowmeters to be installed in pits.

Potable Water Pumping / Distribution including Class-A,C

Bypass of flow meters where immediate replacement of the flow meter is required and/or where the process flow cannot be readily isolated, e.g., booster pump station

Preference for all flow meters to be direct buried.

Waste Water Pumping / Distribution

Bypass of flow meters where immediate replacement of the flow meter is required and/or where the process flow cannot be readily isolated.

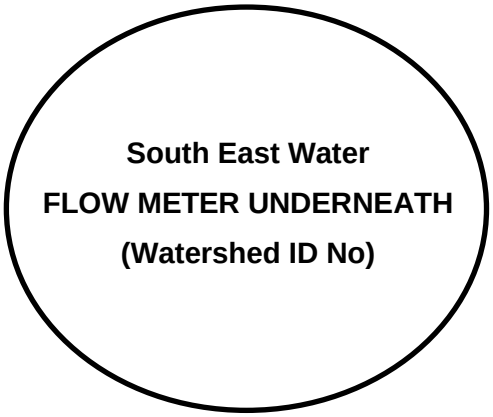
Preference for all flowmeters to be installed in pits.

3.3 Underground

3.3.1 Location

A preference is not to bury flow sensors, pits need to be considered as per requirements in AM2714.

All underground sensors shall have marker 1.5mm x 60mm dia. or greater S/S engraved round plate mounted on the concrete/road or on level buried 300mm x 300mm concrete surrounds. With clear labeling below including its watershed ID. The label shall be fixed using a high quality, single component joint sealant / high adhesive strength such as 'Soudal Fix All High Tack' or 'Sikaflex 11FC'.



3.3.2 Wrap and Backfilling

All Buried flow sensors shall be packed with Denso mastic (400), then wrapped in denso tape (600) followed by Denso PVC overwrap tape (931) or equivalent, ensuring the body and terminal box, flanges and bolts are completely covered.

The void around the sensor and conduit connection shall be backfilled with 3% stabilised sand and in compliance with AM2714. To a height above the top part of the sensor and junction box of not less than 300mm and then covered with a high impact plastic cable marker that extends beyond the flanges of the pipe at either end by 500mm and the sides of the sensor by 100mm or greater before backfilling.

Trenches containing conduits shall also be backfilled with a 300mm layer of washed sand and marked with electrical trench tape.

3.4 Above Ground

3.4.1 Location

If a sensor is installed above ground and the transmitter is fitted directly to sensor. All instrumentation shall be mounted between 800mm to 1400mm to the centre of the display. So it is not accessible by a ladder. If this cannot be accomplished then the transmitter shall be separated from the sensor. The flow meter is required to be labelled with SEW asset number.

Flow converter shall be installed mounted on the wall in an easily accessible waist height. There shall be no obstruction between the instruments. It must be located in accessible locations in the ground.

All transmitters with displays shall be installed outside confined/restricted spaces.

Water:

- Refer to Standard drawings

- Wall mounting in bldg. or cabinet

Sewer:

- Refer to Standard drawings

3.5 Transmitter

3.5.1 Lightning Protection

If available from the manufacturer, lighting protection shall be installed in the flow meter sensor and transmitter.

3.5.2 UV Protection

All transmitters not installed indoors shall be fitted with an aluminium or s/s cabinet refer to AM2714.

If a transmitter is installed directly on the sensor outdoors it shall be fitted with stainless steel or aluminium hinged cover. This cover shall cover the full transmitter height.

3.6 Magnetic Flowmeters

3.6.1 Arrangement

Arrangement of full bore flowmeters, in pits, direct buried, bypassed or non-bypassed shall be considered specific to each application. Where practicable, the preferred location of flowmeters shall be above ground level or within a facility substructure e.g. pump station pump pit. Where not practicable the standard arrangements shall be as follows unless directed otherwise.

3.6.2 Pit Considerations

Considerations to the feasibility of flowmeters installed in pits include.

- Criticality of flowmeter and ease of replacement.
- Size of pit to accommodate flowmeter, reducers, dismantling joints and worker access.
- Water table level.
- Drainage. Immersed flowmeters shall be coated with a petrolatum based mastic.
- Trafficable areas.
- Location to other services.
- Direct buried flowmeters <1.2m depth (measured to flowmeter underside) pit optional.
- Direct buried flowmeters >1.2m depth (measured to flowmeter underside) pit mandatory.

3.6.3 Supply Voltage

The flowmeter supply voltage shall be 24VDC.

3.6.4 Verification

After installation a verification test (wet) and report shall be conducted on each electromagnetic flowmeter. The test shall verify the installation and flowmeter are functioning within defined factory test values to ensure flowmeter accuracy. The verification shall consist of a transmitter test, flowmeter insulation test and flowmeter sensor magnetism test.

3.7 PRESSURE INSTRUMENTS

3.7.1 Gauges

Pressure gauges shall be industrial Bourdon tube gauges, or Scaffer diaphragm gauges, and shall be suitable for the service specified. The scale range shall be approximately twice the normal operating pressure.

Gauges shall have a nominal diameter of 150mm and shall be fitted with a 10mm (3/8 BSP) threaded connection.

3.7.2 Pressure Transmitters

Pressure transmitters shall include but not limited to the following.

- Minimum reference accuracy of ±0.075% of calibrated span.
- Stability ±0.10% of upper range limit for 3 years
- Ability to measure either gage or differential pressure.
- Transmitter output, 4–20 mA dc/Digital HART Protocol
- Process connection 316L SS , 1/2–14 NPT female
- Stainless steel mounting bracket with SS bolts
- 8 x 6 character display. Ability to configure measured value in mWG
- Polyurethane aluminum housing

Pressure transmitter process fittings shall be arranged to either SEW standard drawing E-PRV-STD-005, E-WP-STD-005 or E-WT-STD-005.

Transmitters fitted with a flange connection or flange remote seal in non-potable, solids or viscous applications shall be fitted with a flushing ring to eliminated medium formed deposits or blockages.

3.8 Measurement Units

Instruments, protective devices and indicating devices shall be calibrated in the following metric units.

Parameter	*Unit Name*	*Symbol*
Pressure	Kilopascals	kPa
Pressure (Water Applications)	Metres Water Gauge	mWG
Level	Metres	m
Flow (Site)	Litres/second	l/s
Flow (Telemetry Host)	Mega litres/day	Mld

3.8.1 Accuracy

Unless otherwise specified, all instruments shall have a measuring accuracy of ± 0.5% of range.

3.8.2 Calibration

Conduct calibration of instruments against a reference instrument, test pressure or standard. Calibrate instrument at 0, 25, 50, 75 and 100% of nominated range.

Provide a calibration report for each function indicating instrument uncertainty, error and adjustment.

Calibrated measurements are to be compared against the manufacturer's specification.

Provide manufactures calibration certificates stating the instrument compliance against the instrument specification.

3.8.3 Ranges

Unless otherwise specified the instrument range shall be from zero (0) to 1.5 times the expected maximum measurement value.

3.8.4 Instrument Zero Reading

Provide instrument zero readings referenced to a known relative level. Relative levels include cover level, bottom level, pipe centre line or invert level.

3.9 Temperature Instruments

3.9.1 Themowells

All Temperature sensors installed into the process must be fitted with thermowells to allow for easy removal and verification/calibration. All cables to be long enough to allow removal without disconnection.

3.10 Installation Requirements

3.10.1 General

Installation of all cables shall follow installation standards in this document and AM2714.

The order of precedence of documents shall be as follows;

- Legislative and AS/NZS Standards
- Job specific specifications
- Job specific drawings
- Standard South East Water specifications (This document)
- Other standard South East Water specifications
- Standard drawings

Fibre optic cables and structured copper cabling shall be terminated in a patch panel located either in an existing 19 inch server rack or control cabinet / panel.

All Instruments must be installed in areas that are accessible without requiring technicians / operators to climb under or over structures. Where instruments are installed at heights higher than eye level. Permanent platforms must be installed to service these instruments.

South East Water IT approval is required for any new racks cabinets or patch panels

4. Verification / Documentation

4.1 Verification

All instruments such as flowmeter, etc shall be verified by the manufacturer or by their approved verification device.

If the verification comes back failed it is the contractor's responsibility to excavate (if buried) and rectify the problem

4.2 Documentation

Sensor locations shall marked on site CAD plans.

All underground Sensors shall be GPS marked and locations, cable runs updated on CAD drawings.

All verification certifications shall be set through to SEW.

Output signals shall be setup and recorded on SEW standard calibration sheets and submitted.

Photo evidence shall be submitted for the below

- Location if reference to something in the background not likely to move
- Installed before Wrapping with cable connected
- Transmitter location
- Transmitter Cabinet with doors closed and open showing equipment
- After Sensor is wrapped
- Backfilled with washed sand
- Backfilled and area cleaned up.

The Flowmeter Installation Sheet in **Appendix C** shall be completed and submitted for all flow meter installations.

5. PLC & RTU Installation

The following requirement outlines PLC or RTU installation for both new and retrofit. For retrofit applications the requirement shall be met where practical.

5.1 General

PLC and RTU installations shall meet the following requirements:

- PLCs and RTUs shall be located within a separate compartment of the switchboard which shall contain the programmable devices, relevant I/O, communications interfaces and associated terminal strips and interposing relays. This compartment shall be designed and installed in accordance with section 3 of AM2714.

- Daisy chaining of Ethernet devices is not permitted e.g. between variable speed drives.
- PLC and RTU IO voltages shall nominally be 24 VDC.
- Analogue signal IO shall be 4 - 20mA.
- Space shall be allocated within the PLC and RTU sections of the switchboard to terminate all spare slots (cards).
- A 240VAC double GPO shall be installed within the PLC cabinet. This is to be installed in a location such that the 240VAC cabling will not be run with ELV (24 VDC) control cabling.
- Interposing relays shall be installed for all digital outputs.

5.2 IO Termination

IO shall be terminated as follows:

- Where possible and for all new PLC or RTU installations, IO terminal strips shall be used between field wiring and PLC IO terminals.
- Multicore cable with pre-numbered cores shall be used between PLC IO cards and IO terminal strips, with numbered cable identification at the junction of each core at the IO terminal strip.
- These terminal strips shall be DIN rail mounted.
- Terminal strips are to be labelled and segregated into a) input analogue, b) input digital, c) output analogue, and d) output digital.
- In each terminal strip, order terminals in alphanumerical order in accordance with the wire's unique identification number.
- Digital inputs and outputs shall be individually fused at the IO terminal strip and a test link for the common terminal; each common supplying a group of inputs shall also be separately fused.
- Analogue input and output IO terminal strips shall have a fuse installed on the positive (+) and a test link installed on the negative (-). In addition to this, each analogue IO point shall contain a terminal for the connection of outgoing shield connection.
- Space shall be allocated within the PLC and RTU compartment of the switchboard to terminate all spare slots (cards).
- Wiring colours shall follow AM2714.

5.3 IO Segregation

Where plant or equipment has operational redundancy, the control system IO shall be configured to ensure the plant redundancy is maintained if there is a failure of a control system IO card. In such cases, all PLC IO shall be segregated between IO cards / modules for each piece of redundant plant equipment. E.g. Dosing pumps in a duty / standby arrangement shall have all inputs / outputs for each pump connected to different IO cards in the PLC.

Where plant equipment has further redundancy employed such as redundant paths or redundancy of entire plant processes, the IO should be segregated into different IO racks in separate switchboard compartments that each comprises all of the equipment associated with each redundant plant item.

5.4 IO Surge Protection

All field analogue input cables >5 metres long shall have surge protection both at the instrument and PLC IO card end.

Appendix A – Equipment Identification

Please refer to AM2714.

Appendix B – Instrument Calibration Record

Site ID:	Site Description:	Date:
Instrument Location:		Watershed Tag No:
Instrument Function:		SCADA Tag No:
Make:	Model:	Serial No:
Supplier:		Instrument Supply Voltage:
Calibrated Range to Units		Output to Units
Calibration Check ☐ Re-Range ☐ Verification ☐ Replacement		Instrument Accuracy %
Instrument Datum:	Offset:	Measuring Reference:
CALIBRATION RESULTS		

Input	Desired			Pre Cal			Post Cal		
Span %	Input units	Output units	Units	Output Units	Error %	Units	Output units	Error %	Units
0%									
25%									
50%									
75%									
100%									

PRESSURE SWITCH								
Contacts	M.O.F Value		B.O.F Value		M.O.R Values		Process Units	Electrical Value/units
	Post	Pre	Pre	Post	Pre	Post		

SCADA VALUES		
Tag No	Zero	Full Scale
Office ☐ Plant Computer ☐		

FLOW METER DETAILS		
Flow Sensor Model:	Flow Sensor Serial No:	
Sensor Size:	Cal Factor	Insertion Depth:
Sensor Prom Code Number:	Transmitter Serial No:	Flow Direction Uni. ☐ Bi. ☐

CALIBRATION EQUIPMENT		
Input:	Serial No:	Calibration Date:
Output:	Serial No:	Calibration Date:

CALIBRATED BY		
Technician Name:	Company:	Signature:
Comments:	Pass ☐ Fail ☐ Action Raised ☐ Operator informed ☐	

Appendix C - Flow Meter Installation Details

Flow Meter Installation

Site No _____ **Site Name** _____

Flowmeter New Install ☐ Replacement ☐

Existing Flow Meter

Existing Brand Siemens ☐ ABB ☐ Other _____

Model _____

Type Mag Tube ☐ Insertion Probe ☐ U/Sonic ☐

Other _____

Pipe Size ___ mm **Voltage** 24VDC ☐ 240VAC ☐

Flow Meter Range _____ l/s

Flow Meter GPS Location _____

Brand Siemens ☐ ABB ☐ Model _____

Type Mag Tube ☐ Insertion Probe ☐ U/Sonic ☐

Pipe Size ___ mm **Pipe Material** _____

Voltage 24VDC ☐ 240VAC ☐

Installation

Has Cathodic Protection ☐ Is the Flow Tube Potted ☐ Cable Fitted by Manufacture ☐

Cable Length ____ M Earthing Rings Fitted ☐

Lighting Protection Fitted ☐ 240 V Surge Protection Required ☐

Flow Signal Required Forward ☐ Reverse ☐

Flow Analog to be connected to SCADA ☐

Flow Total Pulse Output to be connected to SCADA ☐

Flow Meter Range _____ l/s

Buried ☐ In a Pit ☐ Above Ground ☐

Location Plan Updated ☐

Completion and Underground Pictures Submitted ☐

Contractor Carrying Out Excavation Works

Company _____ Name _____ Phone _____