

JOHANNESBURG WATER (SOC) Ltd.
BULK WASTEWATER

PARTICULAR SPECIFICATION
VOLUME 21 : LOAD CELLS



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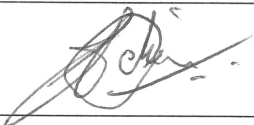


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21 **LOAD CELLS**

21.1 **Scope**

- 21.1.1 This specification covers the supply and installation of Load Cells, complete with sensors, transmitters, indicators, panels, etc. used for process monitoring and control applications at Johannesburg Water wastewater sites.

21.2 **Abbreviations**

- 21.2.1 In this specification the following abbreviations will apply :-

BS	: British Standards
PLC	: Programmable Logic Controller
I/O	: Input/Output
CPU	: Central Processing Unit
UPS	: Uninterruptible Power Supply
MCC	: Motor Control Centre
MCB	: Miniature Circuit Breaker
SPD	: Surge Protection Device
FJB	: Field Junction Box
SSO	: Switched Socket Outlet
SPDT	: Single Pole Double Throw (refers to relay or switch contact arrangements).
LCD	: Liquid Crystal Display
LED	: Light Emitting Diode
O&M	: Operating And Maintenance

21.3 **Standards**

- 21.3.1 The supply and installation of all Load cells and associated cabling, panels and any other equipment shall be subject to the latest amendments and editions of the following standard specifications:-

SANS 10142-1	: National Standards for the wiring of premises.
SANS 1091:2004	: National Colour Standard.
SANS 1274-2005	: Coatings applied by the powder-coating process.
BS 381C:1980	: Paint colour chart.

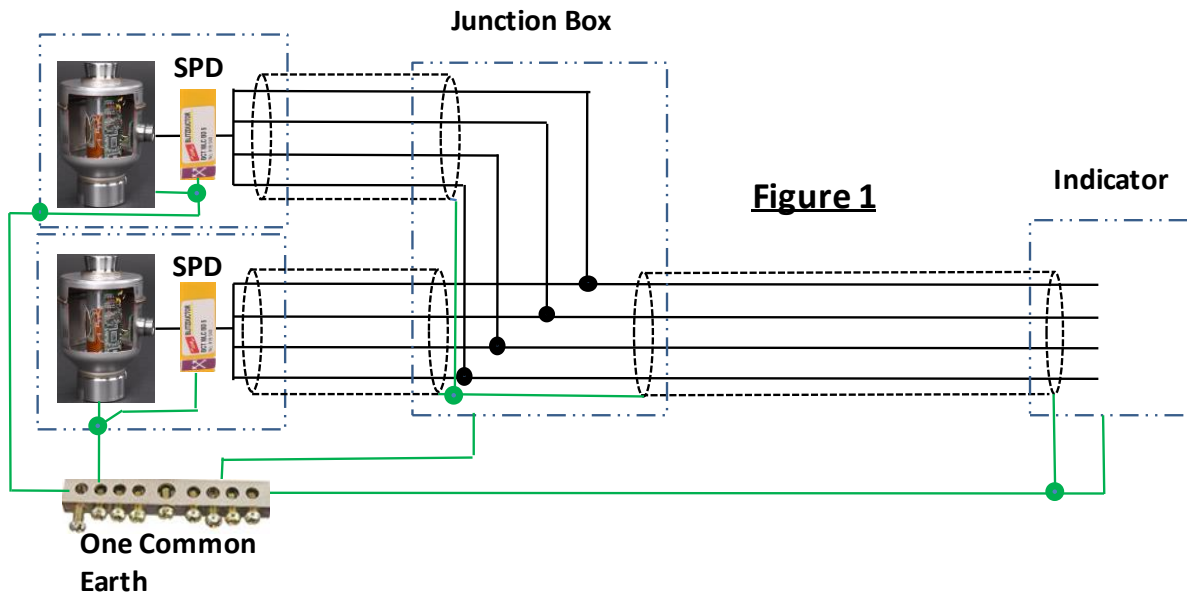
21.4 General Requirements

- 21.4.1 This specification must be read in conjunction with the following specifications:-
- 21.4.1.1 PLC Panels Specification (Volume 3 of the Automation And Control Standards).
 - 21.4.1.2 Clean Power And Surge Protection Specification (Volume 5 of the Automation And Control Standards).
 - 21.4.1.3 Cabling Specification (Volume 6 of the Automation And Control Standards).
 - 21.4.1.4 Field Junction Boxes And Panels (Volume 19 of the Automation And Control Standards).
 - 21.4.1.5 Labelling (Volume 25 of the Automation And Control Standards).
- 21.4.2 Where cables are exposed to physical damage (including damage from rodents) armoured cables must be used or un-armoured cables must be run in steel conduit.
- 21.4.3 All power supply cables to instruments must have a black outer sheath, while all control cables (such as digital and analogue signals to PLCs) must have an orange outer sheath as specified in the Cabling Specification (Volume 6 of the Automation And Control Standards).
- 21.4.4 FJBs and as far as practically possible all instrument sensors and transmitters, must be mounted such that all equipment, wiring, numbers, terminations, etc. are readily accessible and can be viewed clearly. No equipment may be mounted such that it becomes a hazard or dangerous to view or gain access to such equipment.
- 21.4.5 Where sensors and/or transmitters cannot be mounted where they are readily accessible, the installation must be done in such a way that the sensor or transmitter can easily be moved to a safe and convenient position for testing, maintenance, replacement, etc. (e.g. by using hinged brackets, telescopic brackets, etc.).
- 21.4.6 Where transmitters can be exposed to the elements (wind, rain, ultra violet, etc.) such transmitters must be installed inside the FJB. Where transmitters are protected from the elements (i.e. inside buildings) but they are exposed to potentially harmful conditions like moisture from splashing or equipment being hosed down, or the sensor is in such a position that the transmitter display is not clearly visible from floor level, without the need to climb onto ladders or structures to access it, the transmitter must also be installed inside the FJB. Only where transmitters are not exposed to the elements or any other harsh or potentially harmful conditions and where the displays on such transmitters are clearly legible by an average person standing on the ground or the normal walking surface (e.g. grating above ground level), can the transmitter be mounted outside the FJB.
- 21.4.7 FJBs must be mounted against a wall or structure or on a sturdy pedestal such that the top of the FJB enclosure is no higher than 1.8 m from the floor and easily accessible from the front.
- 21.4.8 All instrument installations must be done in accordance with the manufacturer's requirements and recommendations for proper operation. It is the tenderer's responsibility to ensure that he/she is familiar with both the requirements of the

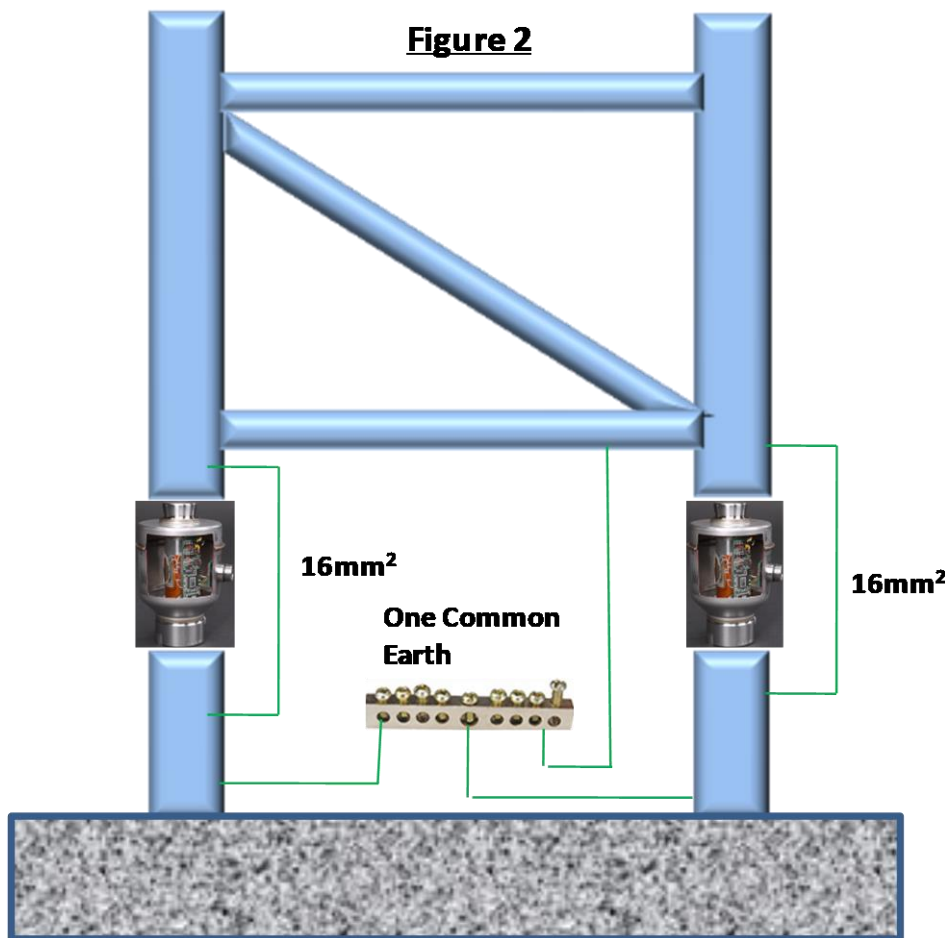
manufacturer as well as the installation requirements, in terms of location, site conditions, materials, equipment or substances to be measured (e.g. hot liquids, acids, abrasive material, etc.) and to ensure that if there are potential problems, they can be pointed out and rectified before orders for equipment are placed.

- 21.4.9 Costs incurred for alterations required to ensure proper operation of instruments, after orders have been placed, will be for the tenderer's account. For example, if instruments have been ordered and it is found there is insufficient space to install the instrument, or lifting equipment cannot be inserted to fit the instrument, or the instrument is interfered with by mechanical structures, or the safe loading capacity of the instrument is exceeded, or there is incorrect eccentric or concentric loading on a load cell, or the sensor does not have a suitable range of measurement, etc. alterations or replacements required to rectify such problems will be for the tenderer's account if the Engineer finds that the tenderer was negligent in his/her assessment of the installation.
- 21.4.10 It is the express responsibility of the tenderer to guarantee that this instrument will work correctly for this application and that it will not require regular maintenance (i.e. more frequently than once in 6 months) under normal operation conditions. If the instrument does not work correctly or if regular maintenance is required for it to work properly, the tenderer will be required to replace the instrument with one that does work correctly, and the cost of such replacement (including the cost for another instrument, labour and material) will be for the tenderer's account.
- 21.4.11 Each instrument which is a 2-wired, 24V DC, loop powered device must be equipped with a suitably sized fuse in a latched fuse holder, connected to the power supply of the instrument, to enable local isolation in case of repairs or replacement.
- 21.4.12 Each instrument which is a 230V AC powered device must be equipped with a 2-pole circuit breaker, connected to the power supply of the instrument, to enable local isolation in case of repairs or replacement.
- 21.4.13 The supplier of the instrument must be present for the installation, testing and commissioning of the instrument on site. Due allowance must be made for this in the tender sum.
- 21.4.14 The tenderer must supply a complete and detailed set of documentation for the installation, connections, terminations, power supply, technical details, setting up, calibration, testing, etc. of the instrument for inclusion in a final O&M manual.
- 21.4.15 Completed data sheets are required as part of the returnable documents of each tender. Failure to complete these data sheets, supplied at the end of this specification, will lead to disqualification of the tender.

21.5 Screening, Earthing And Surge Protection



- 21.5.1 Each instrument and its associated equipment must be suitably protected against surges from induced voltages, switching of equipment, lightning strikes, etc. as detailed in the Clean Power And Surge Protection Specification (Volume 5 of the Automation And Control Standards).
- 21.5.2 The power supply to the instrument must be equipped with suitable surge protection, both at the instrument and at the source of the power supply (i.e. at the distribution board, MCC, PLC panel, etc.), as detailed in the Clean Power And Surge Protection Specification (Volume 5 of the Automation And Control Standards).
- 21.5.3 Both the digital and analogue signals between the instrument and other remote devices (such as the PLC), must be equipped with suitable surge protection, both at the instrument and at the remote device as detailed in the Clean Power And Surge Protection Specification (Volume 5 of the Automation And Control Standards).
- 21.5.4 All load cells, junction boxes, SPDs, indicators, etc. must be equipped with good earthing connections.



- 21.5.5 Avoid earth current loops by:
- Earthing cable screens at one end only (see Figure 1)
 - Using one common earth point, instead of multiple earths (see Figure 1 and Figure 2)
 - Grounding the load cell and the SPD at the same point (see Figure 1)
- 21.5.6 When welding is done, put the earth clamp as close as possible to the point of welding and avoid high currents running through the load cell.
- 21.5.7 When welding is done, and the load cell cannot be removed, at least disconnect the load cell cables.

21.6 Load Cells And Their Installation

- 21.6.1 The design and manufacturing of the vessel to be weighed by load cells must be done in conjunction with the supplier of the load cells to ensure that all factors such as wind forces, asymmetrical loading, maintenance, number of load cells, brackets for load cells, etc. have been taken into consideration. Where wind forces, asymmetrical loading, etc. can cause the vessel to be lifted from one or more of the load cells, it has to be ensured that the brackets used provide protection against the

vessel being lifted off a load cell.

- 21.6.2 It must be ensured that the load cell can move freely, without obstruction from external systems or devices such as chutes, brackets, supports, pipes, cables, etc.
- 21.6.3 The vessel must be designed to avoid impact forces which can lead to overloading and subsequent damage to the load cells.
- 21.6.4 Pipe connections, cable connections, etc. must be done via extremely flexible connections to avoid interference with mass measurement.
- 21.6.5 A flexible, multi-strand, copper conductor of not less than 16mm² must be connected to the structure on either side of the load cell to ensure that harmful currents from surges, welding, etc. are diverted across the load cell.
- 21.6.6 The structure design and load cell selection must be such that load cells can be removed for maintenance or replacement, without overloading other load cells on the same vessel. Dummy load cells must be provided for fitting during construction (before the actual load cells are installed) or for fitting during replacement.
- 21.6.7 The number and location of load cells must be such that each load cell will bear the same amount of weight. I.e. situations where one load cell can bear virtually no weight must be avoided by proper installation measures (such as shimming) during commissioning and setting up.
- 21.6.8 Pivot weighing (i.e. where half the vessel is weighed by load cells while the other half is supported on dummy load cells or flexure beams acting as pivots) can only be done where symmetrical vessels containing liquids are weighed and where it can be ensured that the pivot system will not introduce friction which can lead to false weight readings.

21.7 Load Cells Measuring Criteria

- 21.7.1 The measuring range of the load cell must be suitable for the application (see items 21.4.8 and 21.4.9 of this specification).
- 21.7.2 Each load cell must be manufactured from stainless steel or from tool steel which is Electroless Nickel ("EN") plated and painted to SANS 1274-2005, and must be hermetically sealed to IP68.
- 21.7.3 Since these load cells are not used in "Scales For Trade", only medium accuracy load cells are required. Each load cell must have a combined error of no greater than 0.2% of the measured range. The overall system error (including the mechanical installation) must not be greater than 0.5% of the measured range.
- 21.7.4 Each load cell must have a temperature operating range of at least -10°C to +45 °C.

21.8 Load Cell Junction Box And Indicator

- 21.8.1 Each system must be supplied, complete with a local junction box where all the load cell cables are connected in parallel to provide a single output related to the weight being measured.
- 21.8.2 Each system must also be supplied, complete with a local indicator. There must be a

single multi-core cable wired from the local junction box to the local indicator.

- 21.8.3 Each local indicating unit must be equipped with a means of calibrating and performing tare functions. These functions however must only be available to suitably qualified personnel. I.e. there must be a means of preventing unauthorised people from performing these functions (such as password protection, a lock-out key, etc.).
- 21.8.4 The local indicating unit must be equipped with an isolated, active, 4 – 20mA output for mass, which will be connected to a maximum 500 ohm load.
- 21.8.5 The local indicating unit must have a potential-free relay contact for a collective failure on the system as well as change-over relay contacts for at least three programmable threshold limits. Each contact must be suitable for switching 500mA at 230V AC,
- 21.8.6 The local indicating unit must be suitable for a 230V AC, $\pm 10\%$, power supply.
- 21.8.7 The local indicating unit must have at least a 5-digit display.
- 21.8.8 The local indicating unit and the local junction box must have a protection rating of not less than IP 65 and it must comply with the requirements of the Field Junction Boxes Specification (Volume 19 of the Automation And Control Standards) if it is a free-standing enclosure. If it (the local junction box and/or the local indicator) is mounted inside another field junction box (i.e. the field junction box containing the cabling to the PLC and/or the MCC), it can be manufactured of poly-carbonate or similar material and need only have a protection rating of not less than IP 54.
- 21.8.9 The local indicating unit and the local junction box, with all electronic and indicating instrumentation, must have a temperature operating range of at least -10°C to $+45^{\circ}\text{C}$.

21.9 Spares And Manufacturer/Authorised Distributor Requirements

- 21.9.1 The tenderer will be required to provide a recommended spares list for three years maintenance. This item must be completed so that spares may be ordered as part of the capital contract. Tenderers ignoring this condition may be disqualified.

21.10 Data Sheets

- 21.10.1 All data sheets in the attached Appendix 1 must be completed.
- 21.10.2 Where terms and conditions apply to warranties or guarantees, these should be clearly stated in the data sheets in the section where "Guarantee period" is requested.

APPENDIX 1

DATA SHEET – LOAD CELLS

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