

ملحق رقم (4): مواصفات مختبر وأجهزة التحقق لعدادات المياه
المواصفات الفنية المطلوبة

Water Meter Laboratory Requirements

Detailed Requirements:

Flooring

All the rooms shall have suitable flooring for industrial application and shall have good slip resistance preferably stoncor stonhard coating on the surface. The floor shall be resilient and comfortable to walk on with long term durability and ease of cleaning. Expansion joints need to be provided on the floor wherever necessary.

Ceiling

All the rooms shall be provided with an Acoustic false ceiling made of 600mm x 600mm tiles. All the room walls shall be covered with white ceramic tiles (Make: Knauf or equivalent). It should be suitable for standard lightweight dry wall constructions and are used as the cladding component.

The ceiling suspension system should be used where the grid is not visible and specifically designed for metal tiles. It should comprise a 'spring T' or 'A spring' that supports the tiles. Associated accessories should include cross tee, main tee and L angle. Gypsum tiles shall be non-combustible laminated with special fire-resistant vinyl finishes with aluminum foil of paper backing on premium quality gypsum board which is best quality. Gypsum tiles shall conform to BS 1230.

Additionally, all steel structures need to be covered with fire rated gypsum boards. All MEP works should be done above the false ceiling. A height of 4 mtrs to be maintained for false ceiling from the FFL.

Windows

Windows to have powder coated aluminium profiles with gaskets, brush and other related accessories of make: gulf extrusions or equivalent.

Doors

The rooms shall be provided with fire rated steel doors (45mm thick) with 2 hours fire rating as per BS 476. This is applicable for all doors including pump room and exit doors. Fire Doors shall be provided of make: Al Khaleej or equivalent. Door frame shall be manufactured with 1.2 mm thick galvanized steel sheet and leafs shall be manufactured from 1.0 mm thick



galvanized steel sheet. Door infill shall be honeycomb or rock wool with lead liners and steel stiffeners. To suit the requirements of bigger openings or rooms for placing heavy machineries the doors shall be provided with the option of removable Transo panel. Sectional overhead dock doors shall be provided for automatic operation in case of fire. Make: Omintec or equivalent. It should be motorized with electric isolator and control panel below, with a provision to connect a fire cable with IP 65 rating.

Scope for MEP works

Air Conditioning Units

Ducted air conditioner with split outdoor units shall be provided in all the rooms. All the outdoor units shall be with top discharge. The refrigerant used shall be R410A or equivalent so as to have an EER of up to 12.2 Btu/hr/W for a low electricity consumption. R40 has no ozone depletion potential. Duct liner of 32 kg/m³ density and of 12mm thickness shall be used. Fiber glass insulation with 24 kg/m³ density and 25mm thickness for internal ductwork shall be used. In addition all necessary galvanized steel duct work, vibration rubbers, volume control dampers, flexible ducts, and copper piping shall be provided. Thermostats shall be provided for all the room as per the system requirements.

Lighting System

All lights shall be installed as per the lighting lux level calculations and approved drawings. Luminaire schedule need to be prepared and based on that only the no. of light fittings could be considered and installed.

Fittings shall be 595 mm x 595 mm LED with True White Technology and color temperature of 4000K suitable for T-bar lay-in grid ceiling. Mounting type should be recessed. The number of luminaires used in each room should achieve lighting level of 350 Lux average.

Electrical Works

The existing electrical load capacity needs to be verified and additional load to be applied if required.

Data Connection

Data connection shall be provided for the Test Bench computer. ONT box for pulling CAT 6 cables, junction/pulling boxes shall be provided as required. IT rack with fibre optic cable connection. Associated accessories such as CAT 6 cables, RJ 45 socket outlets, patch panel and patch cords to be provided as well.

Water supply works



All the pipe networks in the room shall be concealed in the wall. 1" portable water outlet connection with isolating valve for test bench reservoir to be provided. Booster pump shall be provided in the water inlet line incase if the pressure inlet to the reservoir is less than 6 bar..1/2" potable water outlet near chiller should be provided to fill water in the chiller tank.

Drainage System

2 nos. of 150 x 150 mm floor drains with SS covers should be provided for cleaning and draining water from the test bench floor. 6" gully trap required in the line outside. Proper drainage should be available outside the building.

Details and specifications of drainage piping system and clamps for plumbing pipes highlighted in Annexure -3 need to be adhered to.

Fire Fighting and Fire Alarm System

FACP panel, heat and smoke detectors, fire-fighting sprinkler system, and emergency exit lights should be provided for the Water Meter Test Lab as per the Civil Defence regulations. Fire extinguishers shall be provided based on the requirements of NFPA.

SPECIFICATION FOR DN15 to DN50 WATER METER TEST BENCH

General:

The Test Bench shall be designed in accordance with IEC standards for use under the service condition prevailing in KSA. The service conditions shall be considered as minimum design values.

The Test Bench shall operate without loss of accuracy or life duration under the following conditions:

Reference Voltage - 3X230/400 Volts

Reference Frequency - 60 Hz

Voltage Tolerance at 400 Volts - $\pm 10\%$

Temperature – Water operating range – (5 C to 60 C)

Relative Humidity - 100%

Transport and Storage Temperature range - 70 C

Environmental Conditions:

The Test Bench shall be suitable for operation under the following conditions, as a minimum.

Ambient Temperature: - 60 C

Maximum mean over 24 hours: - 50 C



Mean in the year: - 35 C
Minimum Temperature: - 0.1 C
Relative Humidity: - 100%
Water Temperature: - 5 C to 85 C

Quantity:

1 test bench with 20 meter capacity.

Technical specifications:

Automatic Water Meter Test Bench (Made in Europe/Japan/USA) should be suitable for testing of all types of mechanical, ultrasonic, electromagnetic and other types of electronic water meters of size DN 15, 20, 25, 32, 40 and 50, sizes. The test procedure and accuracy of the Test Bench shall comply with the requirements of relevant ISO / EN / OIML standards. The Test Bench shall be of compact design and operate without the availability of an external water supply source.

The bidder shall include a description of the maximum required dimensions of the place of installation and shall also include the required power supply. The Test Bench shall be suitable for gravimetric /volumetric test methods/any other new methods. The Test Bench shall be designed to perform flying start and stop and standing start and stop with weighing method and master meter method of operation using pulse compensation, optical heads for automatic, semi-automatic and manual testing.

Pulse compensation system must be capable to compensate pulses from tested meter by two different methods. First method is triggering from master meter pulses. Second is using time pulses. System must be capable to work with meter generating only 5 pulses during the test. (e.g. meter generating 1 pulse per liter, testing volume 5 liters). The measurement error tests should cover the test flow rates at Q1, Q2, Q3 and Q4 with water meters of ratio Q3/Q1 to 1600 and also at Qmin Qt, Qn, Qmax for metrological class A, B, C, D and range meters (As per old ISO4064). The test equipment shall also be programmed to repeat the tests at flow rates from Q1,Q2,Q3,Q4 and from Q4,Q3,Q2,Q1 and repeat the same up to 15 times or more as required. Minimum number of testing flowrates is 15 (to cover the whole range R 1600). System must be capable to defined measuring cycles with definition from 1 flowrate to 15 flowrates.

The test bench should have complete provision to carryout static pressure tests, intrinsic error tests, water temperature tests, water pressure tests, flow reversal tests, pressure loss tests, flow disturbance tests and endurance tests as per ISO and OIML standards for all sizes of meters specified will be preferred. Test rig shall be equipped with three types of flow disturber for following sizes DN 15, 20, 25, 32, 40 and 50. Pipes for placing each disturber and each size to following distance will be part of the assembly. Required distances of the disturber from the meter: 0xDN, 3xDN, 5xDN, 10xDN 15xDN. The test bench shall be suitable for pressure loss tests in accordance with ISO / OIML standard for one meter. For sizes DN 15, 20, 25, DN 32, DN 40 and DN 50, the connecting pipes will have pressure tapings

according to ISO standard. Pressure difference meter shall be part of the testing table. There shall be minimum two or more test lines, where meters in group, in serial, can be tested and verified simultaneously or independently and also one meter at a time. The system should be suitable for adjustment of meters one by one or more meters at a time displaying on the screen.

Minimum number of meters tested in each line DN 15 10 meters length up to 190 mm, DN 20 10 meters length up to 190 mm, DN 25, 6 meters length upto 320mm, DN 32, 6 meters length upto 320 mm, DN40, 3 meters length up to 320 mm, DN 50, 2 meters, length upto 320 mm for thread and flanged connection for DN 50. Total number of meters for two lines DN 15 – 20 nos; DN 20 – 20 nos; DN 25 – 12 nos; DN 32 – 12 nos; DN 40 – 6 nos; DN 50 – 4 nos.

For reference conditions test DN 15 3 meters length 210 mm, DN 20 3 meters length 210 mm, DN 25, 3 meters length 320mm, DN 32, 3 meters length 320 mm, DN40, 2 meters length 320 mm, Spacers for reference condition test shall have preheated construction using water. Straighteners shall be supplied for each position. Each meter will be equipped with straight pipe having 5 x DN for meter DN 15 to DN 50 additional 13 x DN for meter DN 15 to DN 50 with heated clamping pieces (pipe in pipe) for reference conditions test with limited number of tested meters. The bidder shall submit best options of uncertainty with master flow meters, weighing system and base measurement uncertainty.

Test rig shall be capable be working continuously 24 hours a day. The Test Bench will be occupied mostly to test and verify Static meters (ultrasonic, electromagnetic and other electronic water meters) for sizes DN 15 to DN 50, threaded/flanged/wafer type connection with metric/ imperial gallons registers. In addition to this there will be mechanical meters, flow meters and Coriolis mass flow meters.

The System shall be able to work with frequency or pulse output from 0.01 Hz to 5 kHz for each tested meter. System shall be able to work also with short pulses from 0.2 ms typical for smart meters. Special pulse time filter shall be applied for avoiding double pulses for some types of meters. Filters level must be adjustable. The Test Bench shall be designed for universal adaptation of all types of threaded or flanges for sizes DN 15, DN 20, DN25, DN 32, DN 40 and DN 50 of meters with different lengths ISO short body/long body and any other length of meters. Spacers to clamp meters of required sizes and applicable regulations of length compensation shall be provided by the supplier.

The meter under test shall be installed on the test bench and clamped by means of pneumatic and/or hydraulic clamping system. Supports and design of the clamping pieces shall ensure ergonomic and easy clamping and removing the meters. There shall be safety measures to avoid crushing of the meter while loading. Meter clamping section should be provided with security clamping device and hard glass protection from bursts. There shall be blocking function when the protection shield is not closed. There shall be safety features of

blocking of the function of starting up with water meters being non-clamped, blocking of opening the clamping device while there is pressure in the testing line.

The whole line of meters shall be turnable (meters upside down) up to meters size DN 32 for better air purging from the small meter test line. Vacuum nozzle shall be provided to eliminate the residual air present in meters in the small meter test line up to DN 50. Water filter shall be provided to prevent clogging and unacceptable impact on the measurement results and the meters and other equipment. Control valves on the test equipment shall be high quality stainless steel valves equipped with leakage detectors shall be considered. An additional line for automatic testing the meters in vertical and incline in any position along with pneumatic clamping shall be considered for sizes DN 15 to DN 50 for one meter of each size.

There shall be provision for operating the complete test equipment manually in case of system failures. An alternate option/computer should be available to replace the main computer for manual operation. The test bench shall be equipped with mushroom type emergency stop buttons to stop the equipment completely on emergency. Minimum 4 buttons shall be accessible from all sides of the test equipment. The complete meter test equipment shall be fabricated with high quality stainless steel AISI 316L for all components in contact with water and AISI 304 for components not in contact with water to avoid corrosion, rigid and stable, incentive towards shocks and vibrations and should not allow any impact on the accuracy of the measurement. The system shall be equipped with all accessories, viz. cables for voltage and current systems, quick connectors etc. required to conduct the complete tests successfully. There shall be connectors for convenient modification of the testing table and to avoid connecting wrong cable to the connector. The contractor shall provide sufficient number of 20 nos of optical heads and sufficient handheld units, portable/remote keypad, standard and 3D barcode readers, meter holders, meter carrying trolleys etc., which are necessary and applicable for the full operation of the test equipment, as required by SASO.

Measurement principle shall be weighing method with precision digital balances of suitable weight range and resolution with high accuracy. Maximum expand uncertainty (exp. Factor 2) of the calibration with the Test Bench using balance operating mode shall be not more than 0.03% for water temperature to 30 °C and to 0.05% above 30 °C. The bidder shall provide uncertainty analyze and calculation of B type uncertainty to prove these numbers.

Each balance shall be provided with collection tanks with suitable capacity for higher volume testing. Outlet valve of the collection tank must be connected without any mechanical connection between bridge and surroundings during weighing process. The balances should be equipped with weighing terminal with auto-diagnosis system connection to the PC system. Measuring principle of the balance must be based on electromagnetic compensation and the system must be equipped with calibration weight for internal calibration. The weighing system offered shall be METTLER TOLEDO or better alternative product.



Master meters should be minimum 2 nos of Electromagnetic meters and minimum 1 no of Coriolis meter. The master flow meters offered shall be of suitable flow range with high accuracy. Maximum expand uncertainty (exp. Factor 2) of the calibration with the Test Bench using master flow meters (comparative measuring system) shall be less than 0.2%. The electromagnetic master flow meters must have ceramic liner. The electromagnetic master flow meters offered shall be KROHNE or better alternative product. The Coriolis master flow meter shall be Emerson or better alternative product. The system shall automatically calibrate the electromagnetic master meters and the program shall inform the needs of calibration to the operator. The operator should also be able to select the calibration period. Calibration curves of electromagnetic master meters must store in the memory and the history of calibration curves must be archived. Minimum points of calibration curve is 10 in the testing flowrate range. Minimum 3 curves for different temperatures must be stored for each master meter. At the temperatures between 2 curves, the correction is calculated using linear interpolation between 2 corresponding correction curves at different temperatures. Periodical verification of the balances should be done using weights as reference and automatic loading of weights should be possible. Weights accuracy / class must be suitable for calibration of weighing machines of 2nd class (OIML). Correction curves of the balances should be stored in the system memory. Reference weights shall be included for verification of the balances. Intervention of the user or dismounting any part of the bench should not be necessary for this process. Reference weights must have capacity of the maximum balance capacity. Distribution of weights must ensure minimum 10 points calibration of all weighing system. The error of the meters under test shall be calculated by the program running on the PC. The program shall be equipped with error calculator displaying error for all meters. Each meter test position and electromagnetic master meter shall be equipped with its own error calculator with display of at least 4 digits after the decimal point and the number of digits shall be adjustable, this should be made available on the software.

The manufacturer/supplier will be responsible for yearly verification, calibration and certification of the complete test equipment including the weighing system, balances, weights, flow meters, temperature sensors, pressure sensors, density sensors and all other devices on the test bench and the Coriolis meters by a third party metrological institute for a minimum period of 3 years from the date of commissioning of the test bench which will be covered under warranty to maintain the accuracy of the test equipment.

The minimum flow rate shall be equal to or less than 1 l/h and maximum flow rate shall be more than 80 m³/h (upto 40 m³/hr using gravimetric method and above 40m³/hr using master meter method) with automatic flow regulation, computer controlled. The bidder shall offer better improved flow rate options for SASO selection.

Depending on the introduced test parameters, the test program shall define the minimum required test volumes to ensure the accuracy. An appropriate flow diversion system should

be installed on each of the collecting tank according to ISO standard. The bidder should specify the flow diversion offered and also the time elapsed during the switch process.

Material of the diverter and the water tanks provided shall be of high quality stainless steel AISI 316L. Diverters must be equipped with sensors capable to monitor and store the diversion process and system must be able to visualize the diverting curve. The starting and stopping point of the measurement for must be electronically adjustable. An appropriate set of pumps with frequency converter should be controlling the complete water circulation between the reservoirs, collecting tanks of the balances and the recycling water tank. The pumping system shall be of high quality stainless steel AISI 316 Small flowrates below 200 l/h for meters below DN 50 must be reachable by using constant head tank. Additional vibration compensation system must be installed for medium flowrates for reaching smooth flowrate.

The system shall be provided with an automatic flow rate regulation operated by electronic control unit. The flow regulation shall be done using electronically/pneumatically operated valves with electrical positioning control, with feeding selection and with frequency converter. Stability of the flowrate must comply with ISO OIML. The stability of the flowrate must be measured and evaluated during all measurements. The bidder shall specify their best option for the uncertainty of the water temperature sensors, accuracy of pressure sensors and differential pressure sensors, resolution of the diversion switch communication time etc. for SASO selection.

Test lines must be equipped with inlet and outlet pipes with heated construction (pipe in pipe) to reach the required temperature stability. During the test at any flowrate the temperature changes in the test line must be below 1deg C. Temperature difference between inlet and outlet of the test line must be below 2degC at any flowrate at any temperature up to 85degC.

For data acquisition and control of Test Bench an updated PC with 1Tb hard disc, DVD driver and USB shall be provided. The system shall also include a 20" LCD/Touch screen Monitor, laser jet color Printer A4 size and all other required items for complete operation of the Test Bench. Test software shall be user friendly to use, in Windows 10 format or higher. All tests parameters shall be selectable from clearly defined tables, where each one could be saved on the internal memory with appropriate code, which can be retrieved when the same type of meters to be tested. Software must work with database for storing testing data and results. The test results should be ready to be printed on test reports and to be stored on internal memory, parallel on the network and backup on the DVD also should be possible. Test report format shall be as per relevant ISO / OIML standards. The program shall be capable to print at least two types of fixed result protocols and more flexible protocol which can be modified by the Test Bench Administrator. Export to Excel format which can be modified by the Test Bench Administrator. The software should be integrated with our website (Platform) via API so the reports can be reflected directly to it. The software can reflect the results in SASO forms that will provide later.



Retrieval of the test reports should be possible by any of the following variables:

- Meter manufacturer
- Meter type
- Meter class
- Meter serial number
- Date / Month / Year
- Test type

The software will also manage:

- Automatic electromagnetic master flow meter calibration process, done against the balances as reference.
- Automatic balances verification, done against the weights.
- Automatic flow regulation, according to the pre-programmed test tables.
- Meter error calculation procedure
- Type test selection.

• Error flag function - highlighting minimum of 15 types of possible measuring error e.g. Flow stability, flow range, temperature stability temp range, diverter malfunction, pressure range, ambient conditions, pulse irregularity, deviation of two methods.

The software should have a master mode to be used by SASO Test Bench administrator only or the manufacturer's Engineers to have access to the direct actuation over all the functionality and the equipment devices with SASO permission. It should also register a log file where it can be accessed with administration permission to stored events, alarms and all the relevant data of every run and every meter. The software shall have provision for remote assistance from the manufacturer to provide optimal technical support in case of emergencies with SASO permission.

Test bench manufacturer should have ISO9001 certification. The test bench should have a manufacturer's warranty of 3 years. The supplier should also provide 3 year maintenance and calibration for the test bench. The supplier should provide complete spares parts required for the smooth working of the test bench for a period of 3 years from the date of commissioning. The test bench manufacture should have an experience in supplying at least 20 test benches worldwide.

Specification for communication test setup and should be integral part of the stationary bench:

The test bench should be capable of communication test for wired MBus meters and wireless Mbus meters on 433 Mhz T1 mode. The following test should be possible to be carried out on the test bench

- Leakage alarm test

To trigger and test the leak alarm the following test method has to followed

For DN 15 and DN 20 meter

30 ltrs/hr of steady flow required for 24 hrs



For DN 25 and DN 32 meters

100 ltrs/hr of steady flow required for 24 hrs

For DN 40 and DN 50 meters

100 ltrs/hr of steady flow required for 24 hrs

On completion of the time period results should be collected and the test results should be displayed on the PC screen.

- Overload flow alarm test

To trigger and test the overload flow alarm on the water meter the following test method has to be followed

For DN 15 meter

4 m³/hr of steady flow required for 15 min

For DN 20 meter

6 m³/hr of steady flow required for 15 min

For DN 25 meters

8.5 m³/hr of steady flow required for 15 min

For DN 32 meters

15 m³/hr of steady flow required for 15 min

For DN 40 meters

25 m³/hr of steady flow required for 15 min

For Dn 50 meters

55 m³/hr or 90 m³/hr of steady flow required for 15 min

On completion of the time period results should be collected and the test results should be displayed on the PC screen.

- Reverse Flow Alarm test

To trigger reverse flow on the water meter

Without changing the direction of the meter the flow direction on the bench should be reversed. Flow test should be performed on each meter size at Q1 flow rate

On completion of the time period results should be collected and the test results should be displayed on the PC screen.

- Air in pipe or empty pipe alarm test

To trigger the air in pipe alarm on the water meter

Air has to be introduced to the pipe to trigger the Air in pipe alarm

On completion of the time period results should be collected and the test results should be displayed on the PC screen.

- Mbus protocol verification test

To test the Mbus protocol string sent from the meters on the test. The test bench should flow at Q3 for each size for a period of 5 min. The results should be displayed on the PC and a report should be generated.

