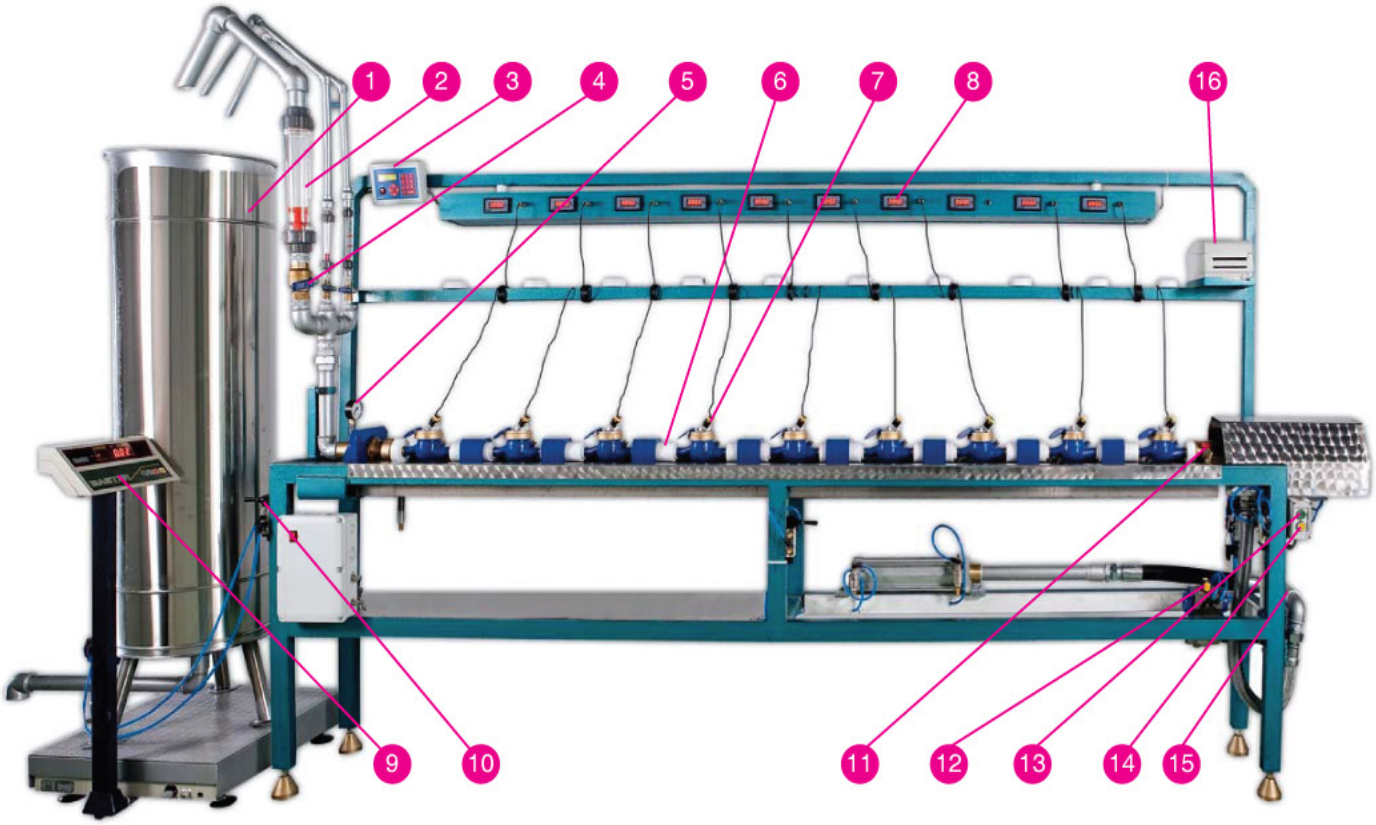
BAYLAN
TEST BENCH BTB-7

The test bench carries out the performance tests of the residential watermeters. Gravimetric system is used as the measurement system. The tests and calibrations of the watermeters are applied by means of the water tank placed on a weighing scale. In the gravimetric system, the water passed through the water meter is collected in the water tank and its weight are measured by the weighing scale placed under the tank. The measurement error percentage is calculated by comparing the value of volume taken from the watermeter display and his value taken from the weighing scale. Maximum working pressure is between 10bar and 16bar as optional.



The test bench main frame is consist of, steel skeleton and stainless sheet metal combination. Steel skeleton is plated with wet epoxy paint. There is a pneumatic regulator for providing constant air pressure. Space connecting pipes is made of P.O.M. and protected against shock and bending.

1- Water collecting tank
2- Flowmeters
3- Control Unit
4- Flowmeter gates
5- Water pressure manometer
6- Watermeter connections
7- Sensors
8- Digit indicators
9- Weighing scale
10- Water collection tank discharge controller.
11- Measuring section water discharge gate.
12- Water supply valve controller
13- Incarcerate button.(There is a safety valve for prevent fastened clamp against opening if there is an air interruption)
14- Loosening button

2. Qualifications of Test Bench

On this test bench, it is possible to calibrate cold watermeters having nominal diameters DN15 to DN25. It is possible to test watermeters at flowrates of 10 l/h to 10.000 l/h.

LENGHT mm	PIECE	Qn (m³/h)	DN
110	11	1,5	G 1B or G 3/4B
165	9	1,5	G 3/4B
190	9	1,5	G 1B
190	9	2,5	G 1B
260	5	3,5	G 1 ¼B

Flowmeter

The test bench has three lines in order to adjust the flowrate between 10 l/h and 10.000 l/h. On big flowmeter 1000 l/h and 10.000 l/h, on middle flowmeter 1000 l/h and 100 l/h, on small flowmeter 10 l/h and 100 l/h flowrates are adjustable.
They are entirely made of shock-proof plastic materials. They also suited for operation with corrosive liquids such as caustic soda or hydrochloric acid. Measurement tubes are made of PVC. The float in the measurement tubes are made of AISI 316 stainless steel. Float stops are made of polypropylene. Maximum working temperature is 60°C. It has a accuracy of ± 2 %.

3. Weighing Scale

It has a maximum measurement capacity of 200kg. It has five-digit display. Its resolution is 20gr. It works on 220 VAC, 50HZ voltage. (it does not effected of voltage reductions down to 170 VAC)
Before starting the scale, the water balance scale shall be adjusted by turning the lever with four screws. The air bubble shall be placed on the centre as shown below. Therefore the weighing scale is on the balance.

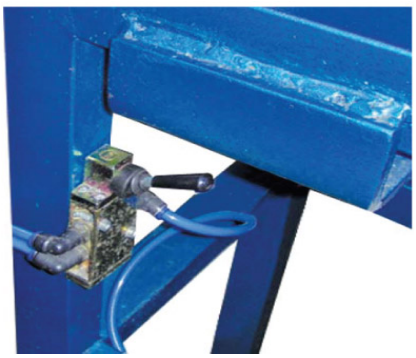
Weighing Scale

1- ZEROIZE 2- TARE 3- TOTAL 4- RECORD 5- ON - OFF KEY

When the tank is being discharge, the scale will go on indicating and will also indicate negative numbers. At this situation, for beginning a new test, switch of and on the scale by on-off key (5) and wait several seconds until display shows zero. Close the tank discharge valve and start new test process.

4. Water Collecting Tank

The height of the collecting tank on the calibrated weighing scale is 1500mm and diameter is 500mm. Its maximum volume capacity is approximately 285 lt. It is discharged with a discharge valve pneumatically actuated. Water tank is made of AISI 316 stainless steel.



Water Tank Discharge Valve Controller

5. Manometer

The working pressure is 0-25 bar. Movable part is made of brass. Pressure element is made of CuSn8 tin soldered. Case is made of steel, front ring made of abs plastic. Manometer connection is R1/8" brass. The accuracy is 2,5 %. The working temperature is between -25°C and +60°C.

Manometer

PULSE NUMBER OF A WATER METER

Pulse number is the number of meter gives pulses per 100 liter passes. It is determined by calculating the ratio of the gears between the one liter indicator and flow indicator.

Calculate multiplication of tooth number of the one liter indicator gear (contact with the next gear through flow indicator – Gear 3 – big diameter), and tooth number of the middle gear (contact with gear of flow indicator Gear 2 – big diameter). (N3. N2)

Calculate multiplication of tooth number of the middle gear (contact with one liter indicator gear – small diameter), and tooth number of the flow indicator gear (contact with the middle gear – Gear 1 – small diameter) (n2.n1) Then calculate division of two above multiplications. That is the number of the round of flow indicator per liter.

Finally calculate multiplication of round number of flow indicator per liter and the wing number of flow indicator (k).

Pulse = [(N3. N2) / (n2.n1)] . k.100 or, Pulse = [(N3 / n2) * (N2 / n1)] * k*100

Example:

Gear 1 : 9 / 32 tooth
Gear 2 : 8 / 28 tooth
Gear 3 : 7 / 27 tooth
Wings : 4

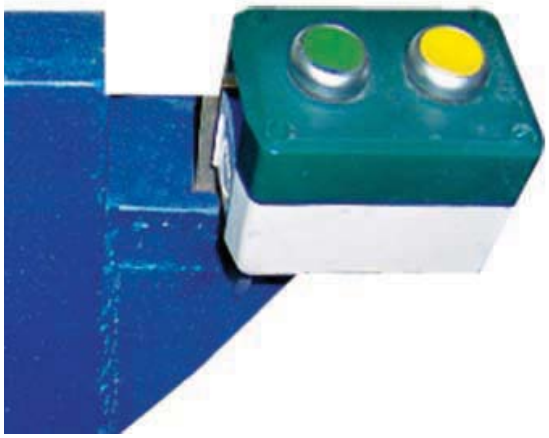
Pulse number: [(27 / 8) * (28 / 9)] * 4*100 = 4200 pulse / 100 litter

WATER METER CALIBRATION PROCESS

1- Place apparatus with suitable connection diameters on test bench.

2- Ensure that the connection point o-rings are robust.

3- Water meters shall be installed on the test rig as serial, and according to their flow direction. (If there is gap existing, additional pipes may be used. There shall be certain lengths of pipes on inlet and outlet of the meters.)



Piston Button

4- Open pneumatic valve and incarcerate the meters by pushing the button. (Indication device must locate at the position of top and with 90°). Ensure that there is no looseness on the connections. Adjusting plugs shall be tightened.

5- First open the big flowmeters gate slightly, and open the water supply carefully. Control the test rig against any leakage. If there is no leakage, open the flowmeters gates respectively, and drain all the air in the test rig. When there is no air in the test rig (see it on flowmeters), close the flowmeters and stop water flow. (Working water temperature shall be between 0°C and 38°C)

6- Drain the collecting tank by opening the drain gate. Read the first index for index reading test. Fix the sensors by sensor reading test. (Open water flow at suitable flowrate for fixing the sensors correctly)
Visible laser beam for diffuse sensing: Class 1 laser sensor, and excellent optical performance throughout sensing range. Best sensing performance between 20mm and 50mm distance. Easy to read operating status indicators, with 8 segment bargraph display. 10 to 30V dc, 35 mA max current, exclusive of load. Protected against reverse polarity, ovar voltage and transient voltages.

7- Segment red bargraph: Signal strength relative to switch-point.
Green LED: Power ON
Yellow LED: Output conducting.
For programming the sensor, install the water meter on the rig, and fix the sensor on water meter. Start water flow of approximately 90 l/h flowrate. Push (+) button and hold. When 7 and 8 Leds are flashing, release button. If accepted, one Led flashes to show relative contrast, and sensor returns to run mode with new settings.

If unaccepted, 1, 3, 6, 8 flashes to show fail, repeat the steps again.
After programming, leds will be flash from one side to other side. Programming should be applied for only once. It's not necessary to apply programming for each test.
For fixing the sensors correctly, there should be water flow of 80-100 l/h flowrate. If leds are flashing one side to other side, reaching the last led on both sides, sensor is on the best performance. But flashing between 3 and 6 leds is enough to correct operation.

8- For index reading test, start flow from the suitable flowmeter for the test flowrate, and adjust the desired flowrate. For sensor reading test, before starting the flow, the meter type and test flowrate shall be selected on the electronic device and the sensors shall be zeroized. (When adjusting the flowrate, there shall be no surge and flowrate shall rich the desired magnitude fastly)

Optical Sensor

9- When desired water magnitude for the test has been passed, close the flowmeter gate and stop test process. Qmax, Qn, Qt and Qmin flowrates of watermeters and minimum water volume that shall be passed for each test shown at table below.

		CLASS B		CLASS C	
Qn (l/h)	Qmax (l/h)	Qmin=0,02Qn (l/h)	Qt=0,08Qn (l/h)	Qmin=0,01Qn (l/h)	Qt=0,0,15Qn (l/h)
1500 (60)	3000 (80)	30 (6)	120 (15)	15 (6)	22,5 (15)
2500 (70)	5000 (100)	50 (6)	200 (15)	25 (6)	37,5 (15)
3500 (100)	7000 (100)	70 (10)	280 (25)	35 (6)	52,5 (15)

10- For index reading test, read the last index from the watermeter and record the actual water magnitude collected in the tank from calibrated indicator.
Calculate the actual volume by dividing actual magnitude (kg) and density of the water according to the temperature.
Determine error of watermeter depending on difference between actual volume and the volume indicated by watermeter.
[(Last index – First index) – Actual Volume]*100 / Actual Volume
Density of water according to temperature shall be taken into account for very sensitive tests.

WATER TEMPERATURE – DENSITY

Temperature (°C)	Density (kg/l)	Temperature (°C)	Density (kg/l)
4	1	30	0,995718
6	1	32	0,995124
8	0,9999	40	0,9923
16	0,999	50	0,988
18	0,998702	60	0,9832
20	0,998303	70	0,9777
22	0,997805	80	0,9716
28	0,996314	90	0,9652

Example
First index from watermete : 346,85 l
Last index from watermeter : 422,15 l
Magnitude from scale : 75,60 kg.
Actual volume passed in the meter : 75,60 l
Volume that watermeter indicates : 422,15 – 346,85 = 75,30 l
Error of watermeter : (75,30 – 75,60)*100 / 75,60 = % - 0,39

For Very Sensitive Measurements:
Water temperature : 18°C
Read density on table : 0,998702 kg/l
Actual volume : 75,60 / 0,998702 = 75,698 l
Volume that watermeter indicates : 422,15 – 346,85 = 75,30 l
Error of watermeter : (75,30 – 75,698)*100 / 75,698 = % - 0,51

For sensor reading test, press the test ending button on electronic device, and read error of watermeter from digital indicators.

11- Discharge the collecting tank.
12- Calibrete watermeters from their adjusting device according their calculated error. Repeat the test for checking calibration.
13- After calibration, watermeter shall be tested for flowrates of Qmax or Qn, Qt and Qmin and the erros for these flowrates shall be determine.
14- After calibration and tests, at first close water supply. Open pressure relief gate and close it. Ensure there is no water pressure on the rig. Press loosening button and remove watermeters from the rig.

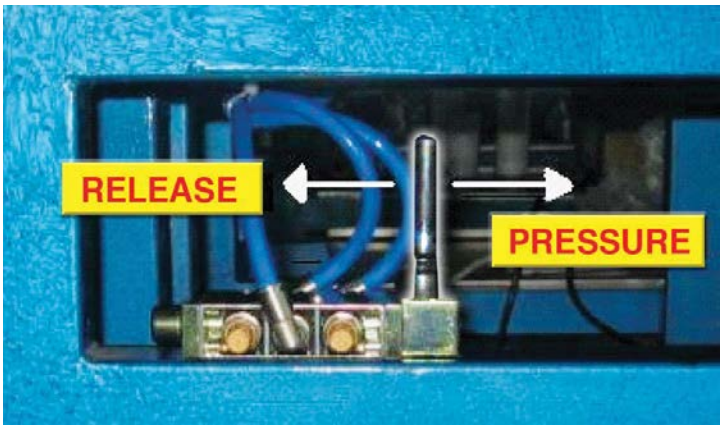
NOTE: For absolute test results, test conditions shall comply with conditions specified below:

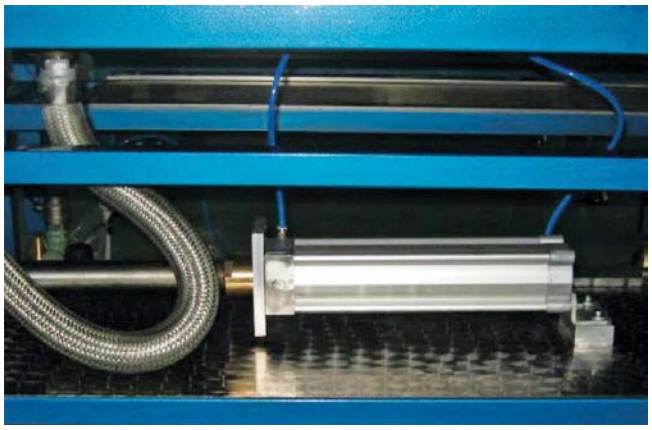
Ambient relative humidity range : 45 % to 75 %
Ambient atmospheric pressure range: 86 kPa to 106 kPa (0,86 bar to 1,06 bar)
Ambient temperature range : 15°C to 25°C
Test bench section shall not be dusty or unclean.

During each test, the temperature and relative humidity shall not vary more than 5°C or 10 % respectively.

STATIC PRESSURE TEST

There is a pressure piston for static pressure test. It's controlled by a pneumatic controlling stick. Before starting the static pressure test, open water flow and wait until there is no air in the system (check on flowmeters). When there is no air, close flowmeter valves (pic1/7) and water inlet valve (pic1/16or17). Keep pneumatic water valves open. After that, push the pneumatic control stick to right way slowly. See pressure increasing on the manometer when you push the stick.
Picture 7





Push the stick until the pressure reaches your test pressure. Then leave the stick and wait the time of test with static pressure. When the test time is okay, push the stick to left and release the pressure. Close pneumatic water inlet valve before opening the system, and also open the system pressure release valve(pic1/18) and see on the system manometer there is no pressure.

PROSSIBLE QUESTIONS – ANSWERS

Question 1. Sensors doesn't read correctly, whas is the reason?
Answer 1. Sensors may not placed on meters correctly. Remove and replace these sensors on meters, check sensors read by looking leds. If sensors are still not reading, check cable connections.

Question 2. There is a leakage from collection tank during the test, what is the reason?
Answer 2. Pneumatic tank discharge valve is defective, shall be repaired.

Question 3. Incarceration piston does not work, what is the reason?
Answer 3. Pneumatic pressure is under 5 bar or piston is defective.

Question 4. There is water leakage on the bench when water supply is open, what is the reason?
Answer 4. The connection o-rings are decrepit or connections are not straightly, or pneumatic piston is defective and releasing.

BIBLIOGRAPHY: 1- ISO 4064-3 2- Directive 75/33/EEC