BAYLAN
WATER METERS

Model	: BTB – 11
Connection Range	: DN50 – DN100
Maximum Flowrate	: 125 m^3 / h

1. GENERAL INFORMATION

Lengths(mm)	Numbe of Meter Connections	Q3 (m3/h)	Nominal Diameter
200	3	25	DN50
200	3	40	DN65
225	2	63	DN80
250	2	100	DN100
410	1	25	DN50
410	1	40	DN65
500	1	63	DN80
565	1	100	DN100

2. TEST BENCH COMPONENTS

Figure 1

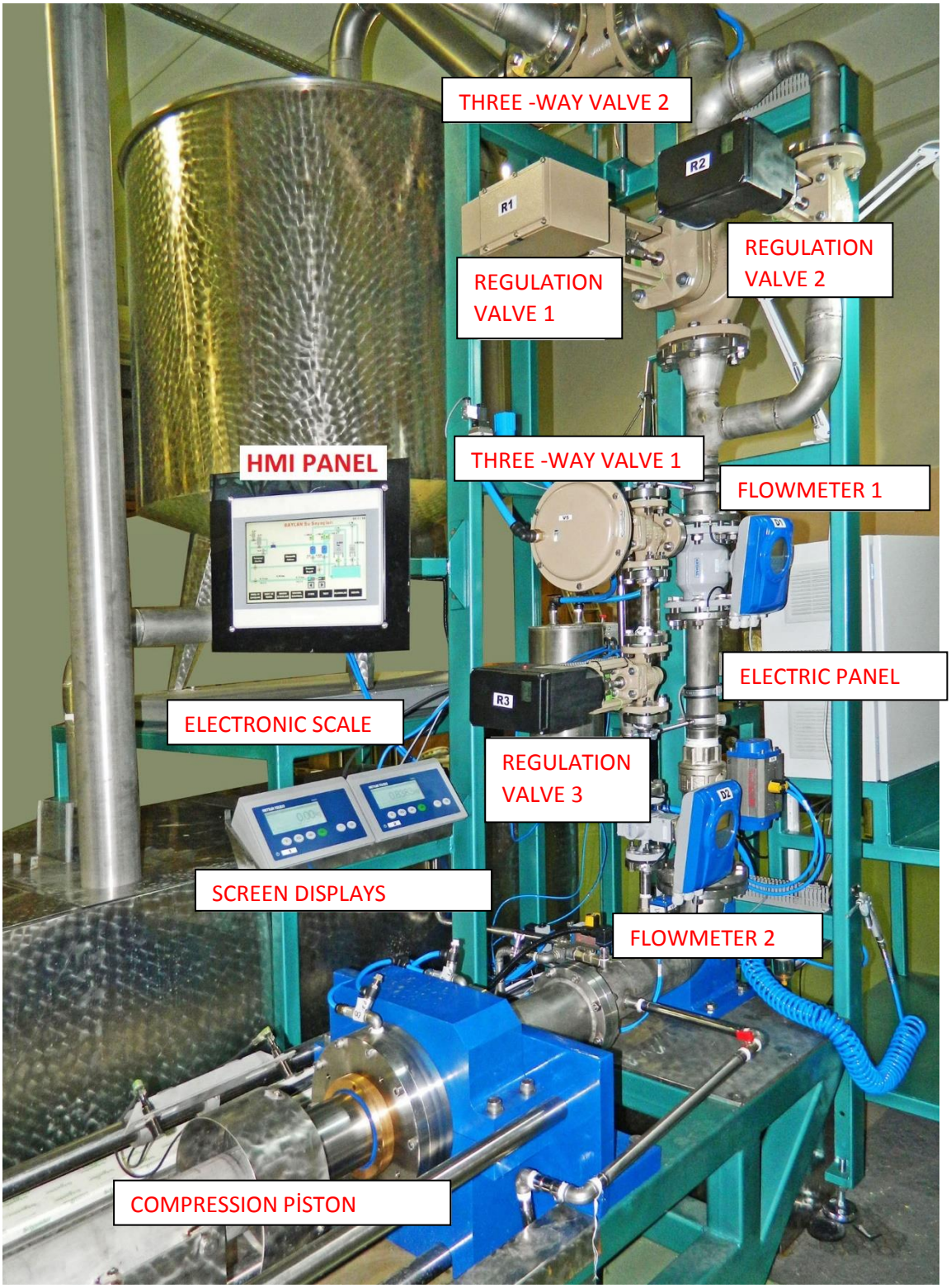


Figure 2

"Due to continuous development of our products, we reserve the right to modify our product design or construction without prior notice."

Figure 3

Figure 4

3. WORKING PRINCIPLES

The working principle of fully automatic woltman test panels is the gravimetric system based on the calibrated scales system. The scale verification is used because it can be easily done with the etalon weight.

The water passing through the meters flows through the bypass line to the main water tank via the 3-way valve (diverter) until the desired test flow is reached and the automatic test starts. When the automatic test begins, the 3-way valve changes position and starts to flow to the scale tank and start to receive data from the optical sensors.The water is collected in the scales tank on the scale. When the self-test is over, the 3-way valve changes position again, stopping the water flow to the tank on the scale and ending the data transfer from the sensors.

The instantaneous error values are reflected on the operator PLC screen while performing the self-test. These error values, which are observed on the PLC screen during the test, are the result of comparing the pulse values calculated by the optical sensors with the electromagnetic flow meters. After the end of the test, the amount of water collected on the scale is taken as basis and the actual volume of the water is calculated by the data from the temperature sensors and compared with the data from the optical sensor, the actual error value is find. Interpolation method is used for fast and more accurate calculation. The error values are observed on the PLC screen and are also reported on the computer screen at the same time. The report can be saved in word or excel or pdf format, printable from the printer.

In the manual test, the diverter system always carries the water flow into the scale, and the meter data is entered with the hand terminal.

The mass of water collected by the temperature sensor is converted to volume by the specific mass formula. The table and calculation system used for the specific mass is calculated by the following formula as specified in article 3.2.4 of ISO 4064-1, which is internationally accepted. [SOURCE: ISO/IEC Guide 99:2007|OIML V 2-200:2012 (VIM), 2.16]

$$ERROR = \frac{(Vi - Va)}{Va} x100\%$$

The BTB-11 fully automatic woltman test bench performs the following recommended text, standard and directive error curve tests.

Recommended	OIML R49 E13
Standard	TS EN ISO 4064 E2015
Directive	2014/32/EC (MID) MI-001

3.1. General Specificaitons

1) The water meters test stand allows testing according to OIML R49, TS EN ISO 4064, 2017/32 / EC (MID) MI-001 standards and regulations.
2) All pipes, tanks, main water tanks etc. that have passed through water. parts are AISI 304 stainless steel.
3) Test panel construction structure is ST-37 and painted with epoxy paint.
4) Tests of counters between DN-50 and DN100 are carried out on the test bench. According to this;
   a) It is suitable to carry out tests on 125m3 / h to 0.085m3 / h.
   b) There are 3 frequency controlled pumps in the system.
   c) There is a filter system between the main water tank and the pump.
   d) There are 2 electromagnetic flowmeters that allow testing within the specified flow rate ranges.
   e) There are 3 electrically actuated regülatör valves that allow testing within the specified flow rate range.
5) For the fast calculation system, there are 3 pieces 24V DC optical laser sensors in the system.
6) There is a colorful, HMI operator panel in the system with 10 "screen size where temperature, pressure, error value and test information can be observed and all settings can be made.
7) There are two scales and scale tank of 1000 kg (readability 50 gr) and 60 kg (readability 0.1 gr) which are suitable for data transfer for rapid calculation in the system. While the tests of the high flow such as Q3 and Q4 are carried out with a large scale, the tests of the low flow, such as Q2 and Q1, take place on a small scale.
8) In the test case, there are pressure transducers (0-40 bar) and temperature sensors (0-60^{0}C) at the inlet and outlet of the meter test line.
9) The capacity of the main water tank is 3 tons. There are filters and check valves between the pump connection line and the pumps.
10) There is a compressor in the system that provides the necessary air pressure.
11) The water passing through the meters is collected on the scales on the scale tank. With the temperature from the temperature sensor, the appropriate intensity value in the temperature-intensity table is taken. With the intensity value taken from the table, the mass of water in the scale tank is converted to real volume. The error value of the meter is calculated by comparing the actual volume with the pulse value obtained with the laser sensors via the meters (ISO 4064 and OIML R49). The error value and serial number of the meter can be output by the software.

$$\rho = \frac{m}{V}$$

ρ: density (kg/m^3)

m: mass (kg)

V: volume (m^3)

12) There is an additional submersible pump and reservoir for draining water under the meter. This pump returns to the main tank.
13) Pressure difference can be calculated in the system.
14) For verification of the test table scale, there is a calibrated 50 kg of mass with mass M1.
15) The regulation and pneumatic actuated valves in the system are operating automatically. In addition, it is installed in the manual manual valve for safety purposes.
16) To prevent accidents in test bench;
    - Buoy preventing overflow on the scale tank,
    - In the main water tank, the float will stop the system in order to prevent the pump from burning in the event of water depletion,
    - Pressure switches which stop the operation of the system when the air pressure drops by acting as a switch,
    - Emergency buttons at locations where the operator can reach,
    - There is a grounding cable with IP44 connection..
17) After the meters are connected, there is a vacuum generator that vacuums the air inside the system before the test is passed.

3.2. Hardware of Test Bench Computer

The test board is provided with the software program, computer, keyboard, mouse, printer, Windows operating system.

- CPU Brand: Intel CPU
- CPU Technology: Core i3 or higher
- CPU Number: 4170 or 6100 (3.6 / 3.7 GHz)
- Harddisk: 500 GB
- Ram: 4Gb Ram
- Graphics Card: Onboard graphics card
- Monitor: LCD screen with 1920x1080 resolution
- Windows and Office original version
- Keyboard and Mouse: Windows compatible keyboard and mouse
- Printer: USB printer with color output

3.3. Software of Test Bench (PC Program And PLC Unit)

- Pump frequency, pneumatic and proportional valves can be controlled by HMI and computer program. Calculation can be done via HMI. Fault values, pressure, temperature, pressure loss, instantaneous flow rate, test done, test setting information are available on the screen. All test related data can be entered and deleted from this screen.
- If desired, tests can be performed on the HMI without using a computer. Tests made via HMI can automatically adjust debuggers and valves and automatically calculate error values even if the transition between debuggers is not automatic.
- The air in the system before the test can be vacuumed.
- Manual tests can be performed. The handheld terminal can work with the system to enter the data.
- The flow rate can be set automatically by the computer. Switching between different tests can be done automatically and all test results can be seen on the computer screen.
- The software should be capable of outputting test results and graphs.
- System and software operation;

The air inside the meters is evacuated with a vacuum before testing. It will be ensured that the inside of the counters is 100% water by passing water through it. During the test, the water passing through the meters is collected on the scales. During the test, the volume data from the flow meter is used to calculate. At the end of the test, the mass of the water collected in the scale tank with the temperature sensor is converted to the volume via formula. The table or calculation system used for the specific mass is as defined in ISO 4064-1, item 3.2.4, the internationally accepted standard; (Source: ISO / IEC Guide 99: 2007 OIML V 2-200: 2012 (VIM), 2.16)

Density Standard of Water

The density of the standard ocean water with removed solved salts and gases under the pressure of 101325 Pa. İs shown in the following table. Standard ocean water has high purity and it is a sample of known isotropic compounds of water. The correction methods for various isotropic compounds are discuessed as reference. The following table was rewritten with the permision of IUPAC. The temperature scale is IPTS-68.

REFERENCE

Marsh, K. N., Ed., *Recommended Reference Materials for the Realization of Physicochemical Properties,* Blackwell Scientific Publications, Oxford, 1987.

	r/kg m^{-3}									
t_{68}/°C	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	999.8426	8493	8558	8622	8683	8743	8801	8857	8912	8964
1	999.9015	9065	9112	9158	9202	9244	9284	9323	9360	9395
2	999.9429	9461	9491	9519	9546	9571	9595	9616	9636	9655
3	999.9672	9687	9700	9712	9722	9731	9738	9743	9747	9749
4	999.9750	9748	9746	9742	9736	9728	9719	9709	9696	9683
5	999.9668	9651	9632	9612	9591	9568	9544	9518	9490	9461
6	999.9430	9398	9365	9330	9293	9255	9216	9175	9132	9088
7	999.9043	8996	8948	8898	8847	8794	8740	8684	8627	8569
8	999.8509	8448	8385	8321	8256	8189	8121	8051	7980	7908
9	999.7834	7759	7682	7604	7525	7444	7362	7279	7194	7108
10	999.7021	6932	6842	6751	6658	6564	6468	6372	6274	6174
11	999.6074	5972	5869	5764	5658	5551	5443	5333	5222	5110
12	999.4996	4882	4766	4648	4530	4410	4289	4167	4043	3918
13	999.3792	3665	3536	3407	3276	3143	3010	2875	2740	2602
14	999.2464	2325	2184	2042	1899	1755	1609	1463	1315	1166
15	999.1016	0864	0712	0558	0403	0247	0090	9932*	9772*	9612*
16	998.9450	9287	9123	8957	8791	8623	8455	8285	8114	7942
17	998.7769	7595	7419	7243	7065	6886	6706	6525	6343	6160
18	998.5976	5790	5604	5416	5228	5038	4847	4655	4462	4268
19	998.4073	3877	3680	3481	3282	3081	2880	2677	2474	2269
20	998.2063	1856	1649	1440	1230	1019	0807	0594	0380	0164
21	997.9948	9731	9513	9294	9073	8852	8630	8406	8182	7957
22	997.7730	7503	7275	7045	6815	6584	6351	6118	5883	5648
23	997.5412	5174	4936	4697	4456	4215	3973	3730	3485	3240
24	997.2994	2747	2499	2250	2000	1749	1497	1244	0990	0735
25	997.0480	0223	9965*	9707*	9447*	9186*	8925*	8663*	8399*	8135*
26	996.7870	7604	7337	7069	6800	6530	6259	5987	5714	5441
27	996.5166	4891	4615	4337	4059	3780	3500	3219	2938	2655
28	996.2371	2087	1801	1515	1228	0940	0651	0361	0070	9778*
29	995.9486	9192	8898	8603	8306	8009	7712	7413	7113	6813
30	995.6511	6209	5906	5602	5297	4991	4685	4377	4069	3760
31	995.3450	3139	2827	2514	2201	1887	1572	1255	0939	0621
32	995.0302	9983*	9663*	9342*	9020*	8697*	8373*	8049*	7724*	7397*
33	994.7071	6743	6414	6085	5755	5423	5092	4759	4425	4091
34	994.3756	3420	3083	2745	2407	2068	1728	1387	1045	0703
35	994.0359	0015	9671*	9325*	8978*	8631*	8283*	7934*	7585*	7234*
36	993.6883	6531	6178	5825	5470	5115	4759	4403	4045	3687
37	993.3328	2968	2607	2246	1884	1521	1157	0793	0428	0062
38	992.9695	9328	8960	8591	8221	7850	7479	7107	6735	6361
39	992.5987	5612	5236	4860	4483	4105	3726	3347	2966	2586
40	992.2204									

* The leading figure decreases by 1.

4. THE TEST PANEL NEEDS TO BE COVERED BY THE BUYER FOR:

- 380V, 50Hz and 30 amp electrical input
- Preparing the place to be constructed according to the measurements to be given before installation,
- The necessary staff members who can use the computer during assembly and training are identified and ready to be trained on specified dates.

5. INSTALLATION AND TRAINING

- The installation of the test table is carried out by the contractor in accordance with the layout plan.
- During assembly, test board assembly training, parts specifications and maintenance are explained,
- After the installation test panel is given working principle and practical training.
- Trainings will be prepared assuming that the personnel to be trained are basic mathematics and computer knowledge.

6. Component Spefications

Test line installation (borings, T elbows, elbows, reductions, fasteners);

Specifications	
Material Type	AISI 304 Stainless Steel / Brass
Pressure Resistant	PN 16

Scale Tank and Main Water Tank

Specifications	
Material Type	AISI 304 Stainless Steel
Main Water Tank	3000 liter
Scale Tank (Big Scale)	1000 liter
Scale Tank (Small Scale)	60 liter

6.1. Flowmeters

There are two electromagnetic flowmeters on the test stand that allow testing at flow rates between 0.15 m3 / h and 130 m3 / h.

Specifications	1	2
Flowmeter Type	Electromagnetic	Electromagnetic
Nominal Diameter	DN 65 mm/ 2-1/2 inch	DN 10 mm/ 3/8 inch
Measurement Range	3 m^3/h - 130 m^3/h	0,15 m^3/h - 3 m^3/h
IP Class	IP67	IP67
Pressure Resistant	PN16	PN40
Power	24 V DC	24 V DC
Communication Protocol	RS 485 Modbus + Basic IO	RS 485 Modbus + Basic IO

6.2.Pressure Transmitters

At the input and output of the test line, there are two pressure transmitters with a working range of 0-40 bar which transfer data to the HMI and the calculation unit.

Specifications	
Pressure Measurement Range	0-40 Bar
Control Signal	4-20mA

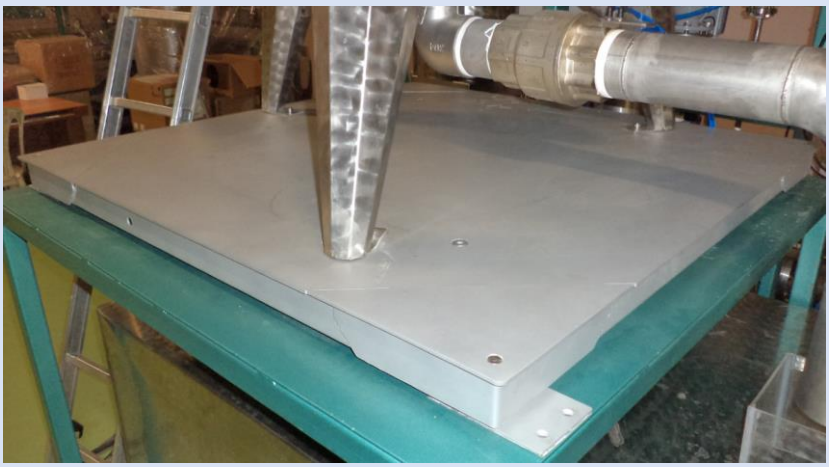
6.3. Temparature Sensors

At the input and output of the test line, there are two temperature sensors with 0-60 °C operating range which transfer data to the HMI and the calculation unit.

Specifications	
Temperature Measurement Range	0-60 °C
Control signal	4-20mA

6.4 Electronic Scales

- **Big Scale**

Specifications	
Model	KF1500
Platform Size	1300x1300 mm
Capacity	1000 kg
Resolution	50 g
IP Class	IP67
Working Prenciple	Analogue loadcell working prencible
	
Scale Display Specifications	
Brand	METTLER TOLEDO
Model	ICS425 Analogue
IP Class	IP65
Connecitons	RS 232C

- **Small Scale**

Specifications	
Brand	METTLER TOLEDO
Model	PBK989-AB60
Platform Size	280x350 mm
Capacity	60 kg
Resolution	0,1 g
IP Class	IP67
Working Principle	Magnetic force compensation (digital loadcell)
	
Scale Display Specifications	
Brand	METTLER TOLEDO
Model	ICS425i (IDNET)
IP Class	IP65
Connection	RS 232C

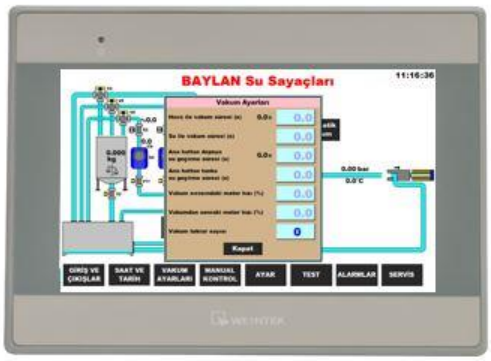
6.5. Laser Sensors

The fully automated Woltman test bench features 3 optical laser sensors that provide accurate display of error values during the test by taking precise pulses on the meter.

Specifications	
Class	1
Output	PNP ve NPN
Cover Material	ABS
IP Class	IEC IP67; NEMA 6
Voltage	24V

6.6. PLC Screen (HMI)

It is PLC controlled operator screen where test related regulations are made, settings are entered and results are displayed.



Specifications	
Display Size	10”
Display Type	Colourful
Control Type	Touch Screen
Connection Type	USB + Ethernet

6.7.Water Pumps

There are 3 pumps which meet the required flow rate.

PUMP-1	Specifications
Brand	GRUNDFOS
Nominal Diameter	DN40
Pressure Resistance	PN16
Maximum Flowrate	12,1 m^3/h
Head Max	44,2 m
Maximum Temparature	120°C
Power	2,2 kW
Frequency	50 Hz
IP Class	IP55

PUMP-2	Specifications
Brand	GRUNDFOS
Nominal Diameter	DN65
Pressure Resistance	PN16
Maximum Flowrate	36 m^3/h
Head Max	57,2 m
Maximum Temparature	120°C
Power	7,5 kW
Frequency	50 Hz
IP Class	IP55

PUMP-3	Specifications
Brand	GRUNDFOS
Nominal Diameter	DN100
Pressure Resistance	PN16
Maximum Flowrate	125 m^3/h
Head Max	85,7 m
Maximum Temparature	120°C
Power	22 kW
Frequency	50 Hz
IP Class	IP55

6.8. Regulator Valves

There are 3 regulator valves which set the test to desired test values for the automatic test.

Specifications	
Brand	SAMSON
Pressure Resistance	PN16
Voltage	24 V
Working Range	30 mm
Working Velocity	0,25/0,5 mm/s
Frequency	50 Hz
IP Class	IP54 / IP65

Regulator Valve 1

Regulator Valve 2

Specifications	
Brand	SAMSON
Pressure Resistance	PN16
Voltage	24 V
Working Range	30 mm
Working Velocity	0,25/0,5 mm/s
Frequency	50 Hz
IP Class	IP54 / IP65

Specifications	
Brand	SAMSON
Pressure Resistance	PN16
Voltage	24 V
Working Range	30 mm
Working Velocity	0,25 mm/s
Frequency	50 Hz
IP Class	IP54 / IP65

Regulator Valve 3

6.9. Compressor

The fully automatic woltman test bench has a motorized compressor with a capacity of 100 liters to meet the ready-to-use air requirement.

Specifications	
Brand	PROTER
Model	V-0.25/8
Capacity	100 litre
Pressure	8 bar
Power	3 HP
Voltage	220 V
Frequency	50 Hz