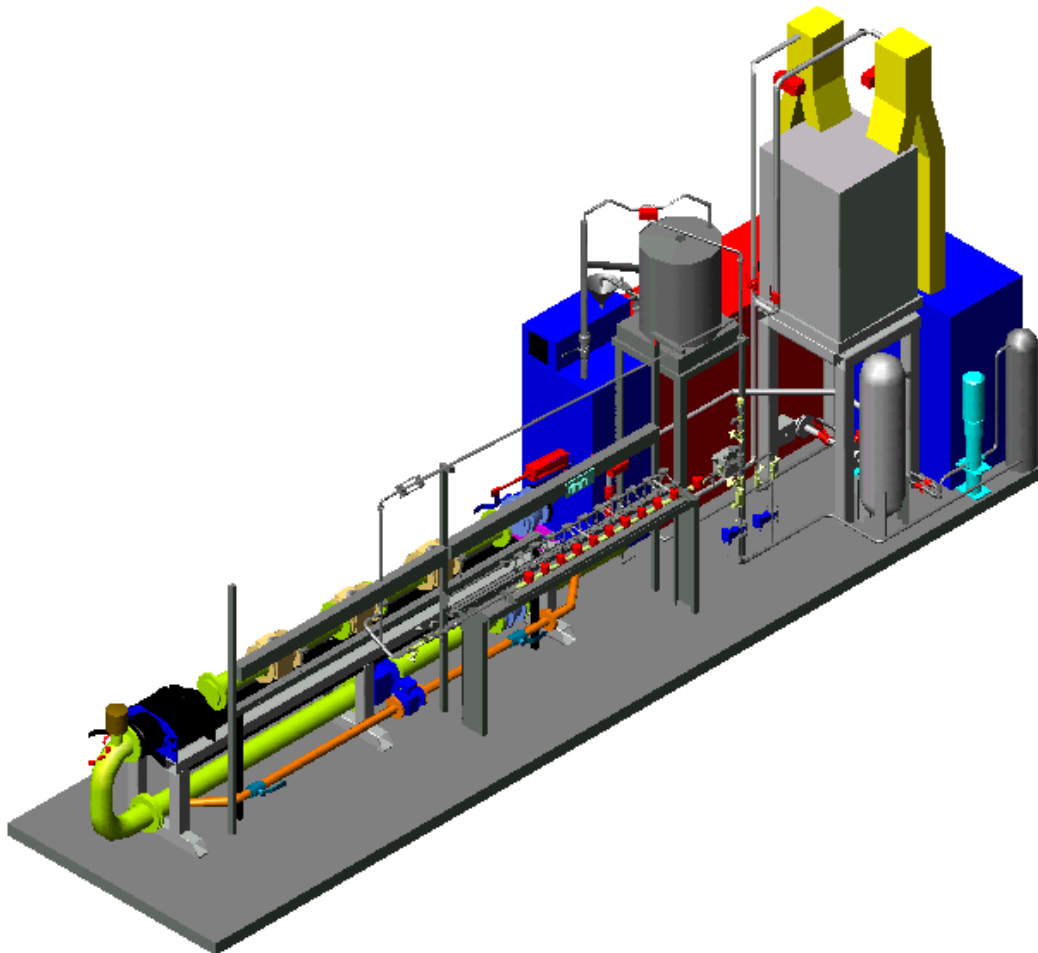


TESTING BENCHES

for watermeters



Testing benches are designed by Tepso Ltd. for using in calibration laboratories and also in watermeter production during the watermeters initial verification.

These testing benches are successfully used in Estonian, Latvian and Russian firms in the production and calibration of watermeters, particularly for *Minol Messtechnik GmbH* watermeters.

Present development of testing best is specially projected for export and there are compactly combined two testing benches from TEPSO Ltd. production:

- EP-20 for sizes of watermeters DN15, DN20 (cold and hot water)
- EP-100 for sizes of watermeters DN25, DN32, DN40, DN50, DN65, DN80, DN100 (cold and hot water)

Design features of the testing bench are:

- the application of contemporary technical solutions
- a high measurement accuracy
- universality
- a high productivity
- an automatic control by computer.

Our own TEPSO Ltd. Calibration Laboratory of Watermeters and Heatmeters is the first laboratory in Estonia, which has been accredited according to ISO/IEC 17025:1999 demands. It ensues that every produced or calibrated watermeter corresponds to all demands of normative documents concerning watermeters.

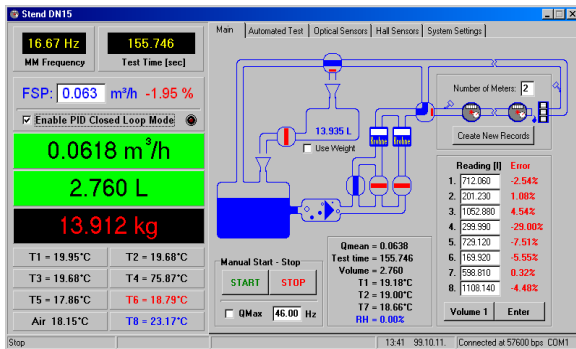
The main basic component parts of the testing bench are:

- Storage tank of cold water, 350 litres, for measuring line DN15, DN20
- Storage tank of cold water, 1200 litres, for measuring line DN25...DN100
- Storage tank of hot water, 1200 litres, for measuring lines DN15, DN20 and DN25...DN100
- Heating system for storage tank of hot water (max +75 °C)
- Cooling system for storage tank of cold water 350 litres (for example +18.0±0.5 °C)
- Measuring line for the installation of controlled watermeters DN15, DN20 with all installation clamps for tested watermeters
- Measuring line for the installation of controlled watermeters DN25...DN100 with all installation clamps for tested watermeters
- Two water flow stabilizers

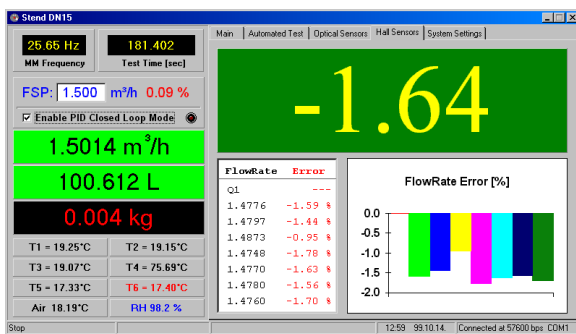
- Two pumps WILO
- Two frequency inverters SIEMENS for the control of the speed of the pumps (water flow) in measuring lines
- Magnetic valves BÜRKERT for choice (Q_n , Q_t and Q_{min}) of the water flow
- Bypasses and valves for the water flow turning away from the measuring line
- Diverters for turning the water flow to the weights or for turning away from the weights
- Three local water cleaning systems in every storage tanks
- Two weighing systems (max 150 kg, max 600 kg) METTLER TOLEDO as the reference standards of the testing bench. The weights must be calibrated by the regional Standards Organization of Mongolia to insure traceability of the measuring process (mass, volume).
- Four electromagnetic master flowmeters KROHNE for the initial adjusting of the water flow and for the using in a quick calibration and an adjustment of watermeters in production process. Master flowmeters as the working standards of the testing bench, must be calibrated every day against reference standard (weights).
- Automatic distribution box (wall-mounted) for microprocessor blocks providing connection between the computers and the system of management and measurement of the testing bench
- Power distribution box (wall-mounted)
- Automatic microprocessor blocks providing connection between the computer and the system of management and measurement of the whole testing bench
- Optical pulse readout systems SUNX for the quick testing of watermeters. During this process the testing disk of the counter of the watermeter under control is used.
- *Hall* sensor pulse readout systems for reading water volume pulses directly from hydraulic assembly of the watermeter under control (without counter system).
- Adjusting keys for the adjustment of watermeters
- Air compressor for the air system of pneumatic valves
- Two computers with local network and installed software STEND (the base of software is DELPHI 5). UPS power supply.
- Printer

The software STEND provides:

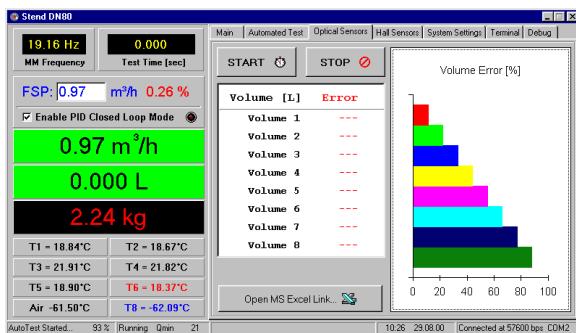
- Manual control under the whole testing bench by using only the computer mouse:



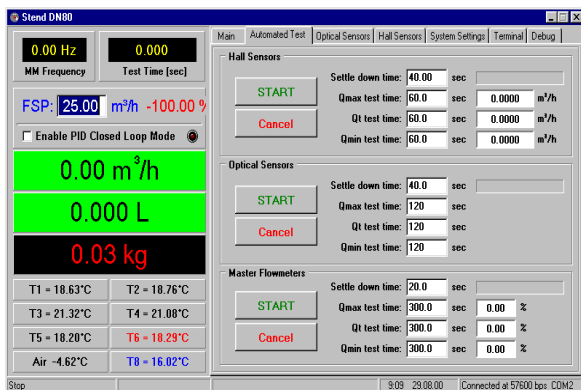
- Control under the testing bench calibration process by flow:



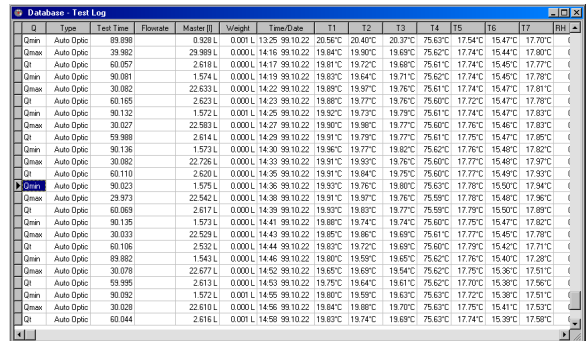
and by volume:



- Automatic calibration watermeters and master flowmeters:

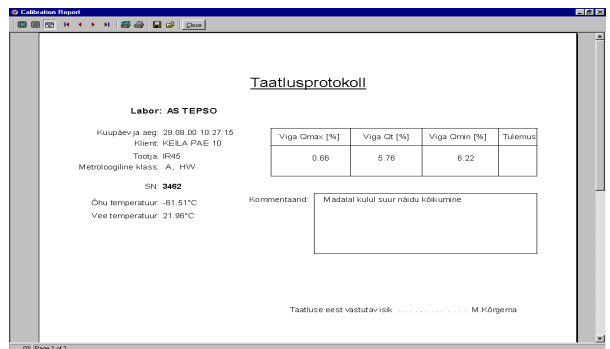


with independent saving results to archiving files:

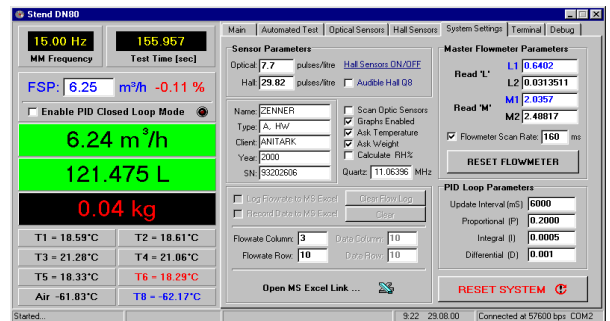


Q	Type	Test Time	Flowrate	Master II	Vweight	Time/Date	T1	T2	T3	T4	T5	T6	T7	T8
Qmin	Auto Optic	63.190	0.330 L	0.000 L	12.25	99.10.22	20.56°C	20.40°C	20.37°C	75.62°C	75.54°C	15.47°C	17.70°C	
Qmax	Auto Optic	39.982	29.989 L	0.000 L	14.16	99.10.22	19.84°C	19.90°C	19.93°C	75.62°C	75.74°C	15.44°C	17.80°C	
Qt	Auto Optic	60.057	2.618 L	0.000 L	14.17	99.10.22	19.81°C	19.72°C	19.88°C	75.61°C	75.74°C	15.45°C	17.77°C	
Qmin	Auto Optic	30.081	1.574 L	0.000 L	14.19	99.10.22	19.83°C	19.84°C	19.71°C	75.62°C	75.74°C	15.45°C	17.78°C	
Qmax	Auto Optic	30.982	22.533 L	0.000 L	14.22	99.10.22	19.89°C	19.87°C	19.97°C	75.67°C	75.74°C	15.47°C	17.81°C	
Qt	Auto Optic	60.105	2.623 L	0.000 L	14.23	99.10.22	19.88°C	19.77°C	19.76°C	75.60°C	75.72°C	15.47°C	17.78°C	
Qmin	Auto Optic	30.132	1.572 L	0.000 L	14.25	99.10.22	19.92°C	19.73°C	19.79°C	75.61°C	75.74°C	15.47°C	17.83°C	
Qmax	Auto Optic	30.027	22.583 L	0.000 L	14.27	99.10.22	19.80°C	19.86°C	19.77°C	75.60°C	75.76°C	15.45°C	17.83°C	
Qt	Auto Optic	59.989	2.614 L	0.000 L	14.29	99.10.22	19.81°C	19.79°C	19.77°C	75.61°C	75.77°C	15.47°C	17.85°C	
Qmin	Auto Optic	30.136	1.573 L	0.000 L	14.30	99.10.22	19.86°C	19.77°C	19.82°C	75.62°C	75.76°C	15.48°C	17.82°C	
Qmax	Auto Optic	30.082	22.726 L	0.000 L	14.33	99.10.22	19.81°C	19.93°C	19.76°C	75.60°C	75.77°C	15.48°C	17.97°C	
Qt	Auto Optic	60.110	2.620 L	0.000 L	14.35	99.10.22	19.81°C	19.84°C	19.84°C	75.67°C	75.77°C	15.49°C	17.83°C	
Qmin	Auto Optic	30.023	1.575 L	0.000 L	14.36	99.10.22	19.83°C	19.76°C	19.80°C	75.67°C	75.77°C	15.50°C	17.94°C	
Qmax	Auto Optic	29.973	22.542 L	0.000 L	14.38	99.10.22	19.81°C	19.97°C	19.76°C	75.59°C	75.78°C	15.48°C	17.96°C	
Qt	Auto Optic	60.069	2.617 L	0.000 L	14.39	99.10.22	19.83°C	19.83°C	19.77°C	75.59°C	75.79°C	15.50°C	17.89°C	
Qmin	Auto Optic	30.135	1.573 L	0.000 L	14.41	99.10.22	19.88°C	19.74°C	19.74°C	75.60°C	75.75°C	15.47°C	17.82°C	
Qmax	Auto Optic	30.033	22.529 L	0.000 L	14.43	99.10.22	19.85°C	19.86°C	19.86°C	75.61°C	75.77°C	15.45°C	17.78°C	
Qt	Auto Optic	60.106	2.532 L	0.000 L	14.44	99.10.22	19.82°C	19.72°C	19.89°C	75.60°C	75.79°C	15.42°C	17.71°C	
Qmin	Auto Optic	89.882	1.543 L	0.000 L	14.46	99.10.22	19.80°C	19.99°C	19.85°C	75.62°C	75.76°C	15.40°C	17.28°C	
Qmax	Auto Optic	30.078	22.677 L	0.000 L	14.52	99.10.22	19.85°C	19.89°C	19.54°C	75.62°C	75.75°C	15.36°C	17.51°C	
Qt	Auto Optic	59.995	2.613 L	0.000 L	14.53	99.10.22	19.75°C	19.64°C	19.61°C	75.62°C	75.78°C	15.38°C	17.56°C	
Qmin	Auto Optic	30.082	1.572 L	0.000 L	14.55	99.10.22	19.80°C	19.99°C	19.63°C	75.63°C	75.77°C	15.38°C	17.51°C	
Qmax	Auto Optic	30.028	22.610 L	0.000 L	14.56	99.10.22	19.84°C	19.88°C	19.70°C	75.63°C	75.75°C	15.41°C	17.53°C	
Qt	Auto Optic	60.044	2.616 L	0.000 L	14.58	99.10.22	19.83°C	19.74°C	19.69°C	75.63°C	75.74°C	15.39°C	17.59°C	

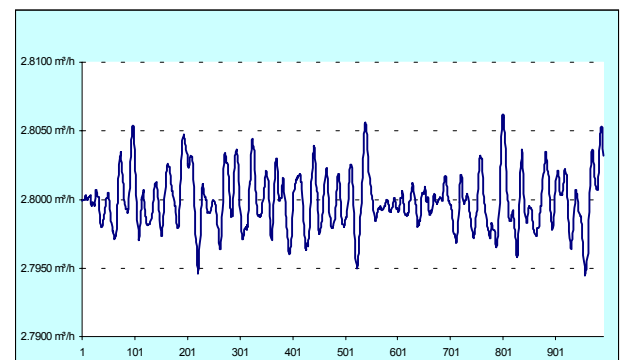
- Automatic printing of the watermeter test reports:



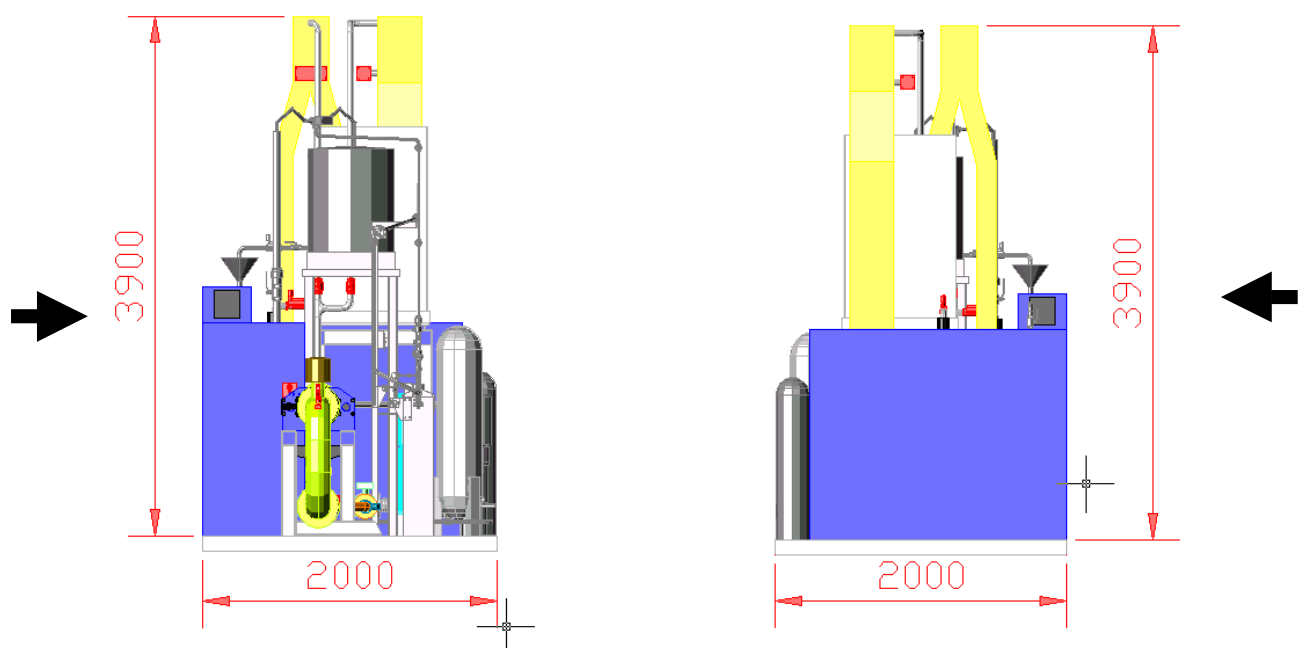
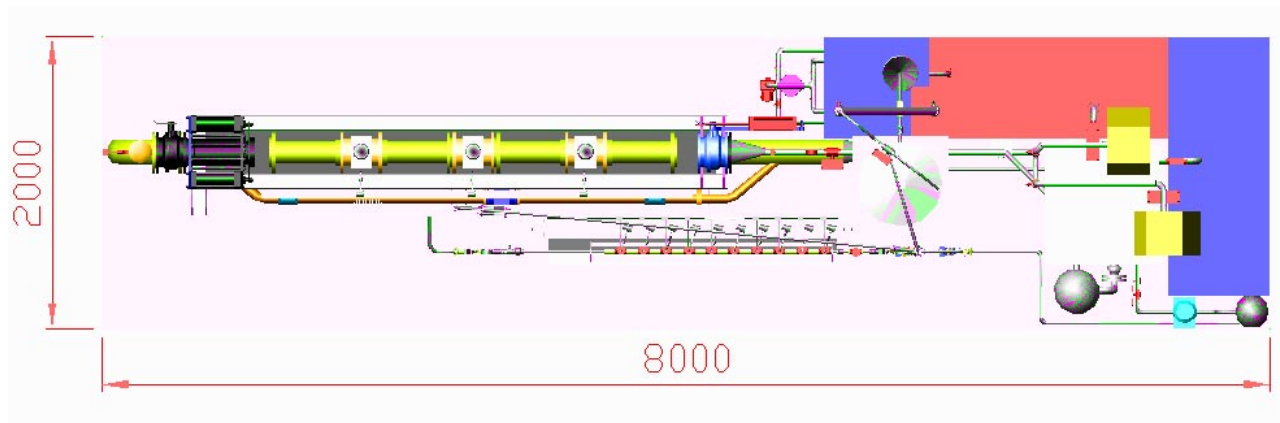
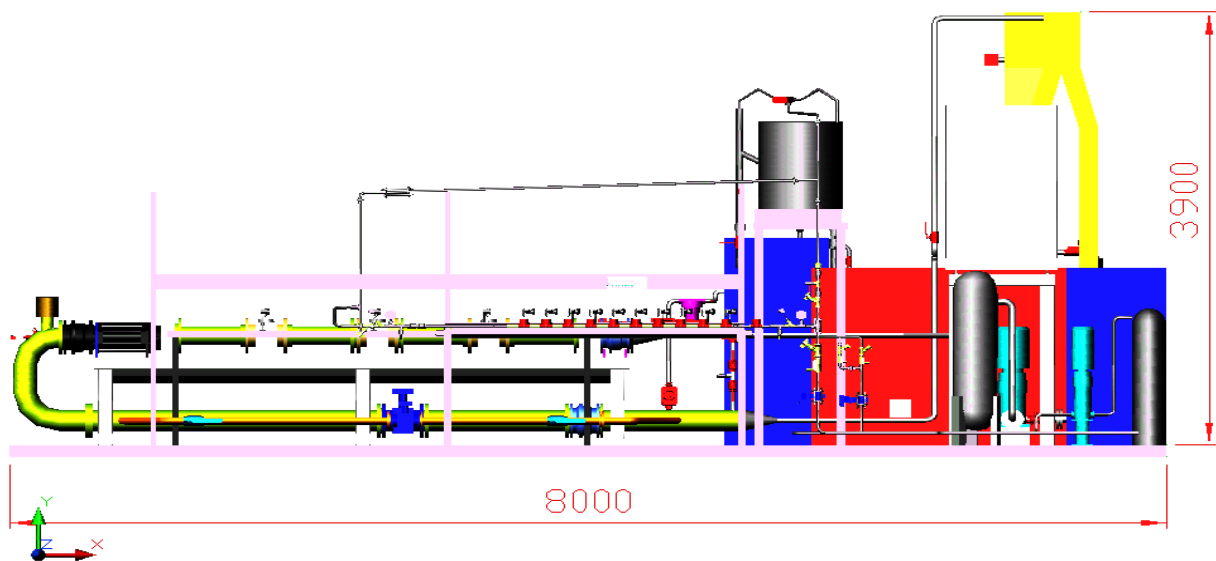
- Available for all types of watermeters:



- Graphic representation of the water flow instability during the calibration process:



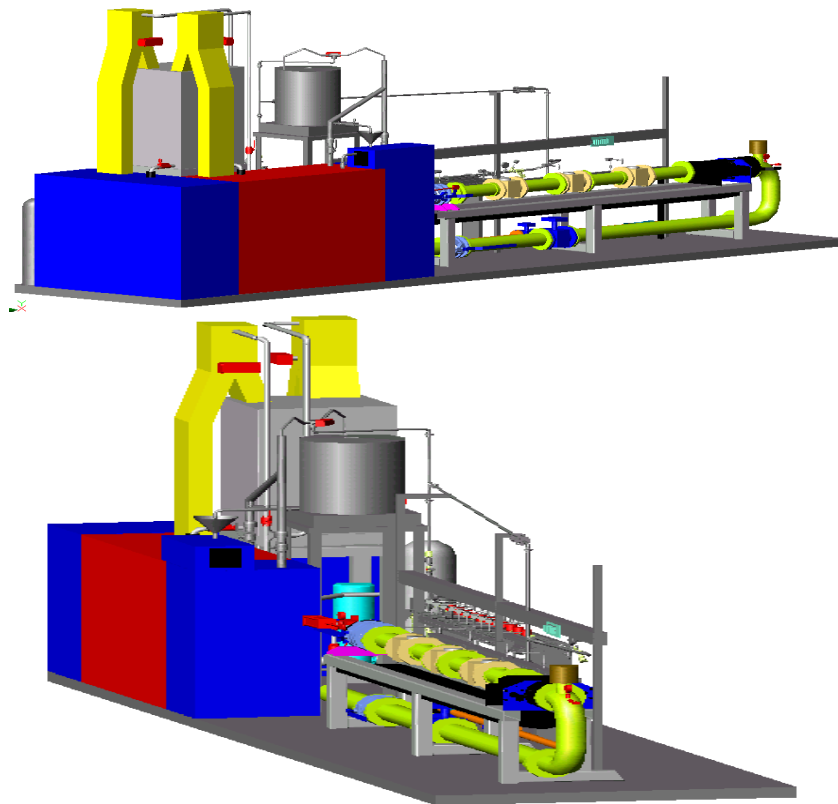
- Automatic water flow stability holding during the calibration process (PID system is used);
- Protection from the operator's mistakes.

Overall dimensions of testing bench

Views of testing bench

Offered bench

View from the side of measuring line DN25...DN100

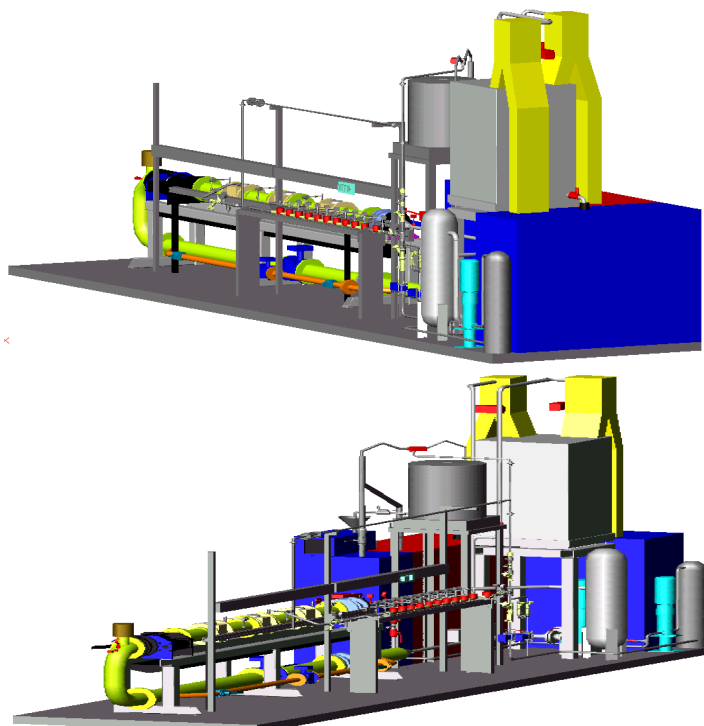


Analogue bench EP-100 in Tallinn with one measuring line only for cold water



Offered bench

View from the side of measuring line DN15, DN20



Analogue bench EP-20 in Riga



The testing bench provides calibration and production of watermeters according to European standards demands:

- OIML R 49 Cold water meters
- OIML R 72 Hot water meters
- OIML R 4 Installation and storage conditions for cold water meters
- OIML R 2 The evaluation of flow standards and facilities used for testing water meters
- Document *Council Directive 79/830/EEC on the approximation of the laws of Members States relating hot-water meter.*
- Document *Council Directive 75/33/EEC on the approximation of the laws of Members States relating cold-water meter.*
- ISO 4064–1: 1993 Measurement of fluid flow in closed conduits - Meters for cold potable water- Part I: Specification
- ISO/DIS 4064–2: 2000 Measurement of fluid flow in closed conduits – Meters for cold potable water - Part II: Installation requirements
- ISO 4064–3: 1999 Measurement of fluid flow in closed conduits – Meters for cold potable water - Part III: Test Methods and equipment

The testing bench is produced and uncertainty of measurement is estimated according to standards demands:

- ISO 4185:1980 Measurement of liquid flow in closed conduits. Weighing method
- ISO 9368-1: Measurement of liquid flow in closed conduits by the weighing method. Procedures for checking installation. Part 1. Static weighing systems

Technical data

Maximum flow rate, m^3/h	50.0																		
Minimum flow rate, m^3/h	0.015																		
Stability of water flow in setting point, %	± 0.25																		
Maximum measuring ranges of weights, kg	150; 600																		
Relative uncertainty of water volume measurement, %	± 0.10																		
Relative uncertainty of water flow measurement, %	± 0.25																		
Temperature of bench water for cold water meters, $^{\circ}C$ (setting point available from 15.0 to 25.0 $^{\circ}C$)	20.0 ± 0.5																		
Temperature of bench water for hot water meters, $^{\circ}C$ (setting point available from 30.0 to 55.0 $^{\circ}C$)	50 ± 1																		
Metrological class of water meters under test by 79/830/EEC and 75/33/EEC	A, B, C, D																		
Ambient temperature, $^{\circ}C$	20 ± 5 $^{\circ}C$																		
Pressure in air system for pneumatic actuators, MPa	0.5 – 0.8																		
Sizes, m , no more than:	8.0 x 2.0 x3.9																		
Mass of test bench, kg , no more than:	2800																		
Working time, years, no less than:	12																		
Supply AC	380 V, 50 Hz																		
Power of supply, kW , no more than:	30																		
The maximum number of watermeters under testing in the same time, pc	<table> <tr><td>DN15</td><td>10</td></tr> <tr><td>DN20</td><td>10</td></tr> <tr><td>DN25</td><td>6</td></tr> <tr><td>DN32</td><td>6</td></tr> <tr><td>DN40</td><td>4</td></tr> <tr><td>DN50</td><td>3</td></tr> <tr><td>DN65</td><td>3</td></tr> <tr><td>DN80</td><td>3</td></tr> <tr><td>DN100</td><td>3</td></tr> </table>	DN15	10	DN20	10	DN25	6	DN32	6	DN40	4	DN50	3	DN65	3	DN80	3	DN100	3
DN15	10																		
DN20	10																		
DN25	6																		
DN32	6																		
DN40	4																		
DN50	3																		
DN65	3																		
DN80	3																		
DN100	3																		
Duration of the one cycle of calibration in automated condition, minutes	5																		
Warranty time, months	18																		

Used wares

- Platform weights RAUTE PRECISION Ltd. or METTLER-TOLEDO GmbH
- Pumps WILO GmbH
- Electromagnetic master-flowmeters KROHNE MESSTECHNIK GmbH&Co, KG
- Frequency inverters SIEMENS
- Ball valves with pneumatic actuators PIMATIC
- Magnetic valves ASCO JOUCOMATIC
- Ball valves GIACOMINI
- Balancing valves HYDRONICS
- Circular pumps of local water cleaning systems SALMSON
- Water flow check valves ESBE
- Heating water system STARLEVEL
- Cooling water system DANFOSS
- Computers min 600 MHz, 10 Gb HD, 64 Mb RAM
- Installation, initial verification and software TEPSO Ltd.
- In producing the whole testing bench stainless steel and some plastic tubes are used.

Demands to a locality

- A maximum safety device AC 32 A (380 V)
- A water supply and sewerage systems needed
- Air temperature every season of the year in the laboratory rooms (20±5) °C
- Minimal sizes of the place are caused by the testing bench sizes and an additional place for the service room (if needed)

Additional information:

- There is no need of the spare parts during 3 years of exploitation if the requirement of service are carried out. The right actions of the bench service are given in document *Testing benches for watermeters. Technical description and operating manual. EE10091883 TO1-01.*
- The testing bench supplied with *Calibration Certificate* with determination of the uncertainty of measurement.
- By request of customer the calibration process of testing bench may be traced with presence of representatives of customer
- As since the testing bench is a precision measurement equipment, the installation of the testing bench will be carried out only under control by specially trained employees of Tepso Ltd. After installation full operating instructions, technical drawings, diagrams and charts will be delivered to customer, which are necessary to provide the correct watermeters calibration operations and bench facilities.
- The original language of software *STEND* is English. The software will be translated to other languages in case of request of customers. The customer will get all new versions of software by *Internet* during next 3 years.
- A delivery time of the testing bench is 16 weeks, installation time is 1 week by Tepso Ltd. employees