

## Laboratory for calibration and verification of volumetric and mass flow meters

The laboratory for calibration and verification of volumetric and mass flow meters at the Sisak Terminal is a facility serving for calibration and verification of volumetric and mass flow meters of up to 2500 m<sup>3</sup>/h or 2500 t/h respectively. The facility consists of a stable prover tank of 10 000L, and a closed prover loop with unidirectional pipe prover of the nominal volume of 10 000 L. The calibrated prover tank of 10 000 L has a role of calibrating the pipe prover loop as well as of calibrating and verifying the volumetric and mass flow meters.

The calibration and verification of volumetric flow meters are made using four (4) liquid products of different viscosities (3-150 cSt) at different flow rates of up to 2500 m<sup>3</sup>/h.

Produkt Product	Diesel	HD13	L-AN 46 Machine Oil	P-150 OIL
Viskozitet [mm <sup>2</sup> /s] @ 40°C Viscosity [mm <sup>2</sup> /s] @ 40°C	3,3	7,3	43,9	135,0
Standardna gustoća [kg/m <sup>3</sup> ] @ 15°C Standard density [kg/m <sup>3</sup> ] @ 15°C	844,3	845,7	865,2	878,6

Sustav s cijevnim etalomom Pipe prover system	Cijevni etalon 20" Prover loop 20"
Volumni protok Volume flowrate	do 2500 m <sup>3</sup> /h up to 2500 m <sup>3</sup> /h
Maseni protok Mass flowrate	do 2500 t/h up to 2500 t/h
Tlak Pressure	do 12 bar up to 12 bar
Temperatura Temperature	0-35°C
Dimenzije mjerila protoka Flow meters dimensions	6", 8", 10", 12" Flanges 150 to 600 ANSI

The laboratory owns the volumetric reference standards of 100 and 500 L. The standards are of overflow type and completely automated. The laboratory is also authorised for calibration and verification of volumetric and mass flow meters using its own portable cascade prover tank of 1000 and 3000L.

Etalonska mjera obujma Volumetric reference standard	Nominalni obujam [L] Nominal capacity [L]	Mjerna nesigurnost [L] Measurement uncertainty [L]
Pomična etalonska mjera obujma Portable reference standard	100	0,0065
Pomična etalonska mjera obujma Portable reference standard	500	0,030

Pomična etalonska mjera obujma <i>Portable reference standard</i>	1000 / 3000	0,3519 / 0,5129
Fiksirana etalonska mjera obujma <i>Fixed reference standard</i>	10 000	0,8375

The master meter is *PD meter*, a measuring instrument of good repeatability that serves for transfer of the reference standard to the pipe prover.

Usporedno mjerilo protoka <i>Master Meter</i>	PD meter
Točnost <i>Accuracy</i>	±0,1%
Ponovljivost <i>Repeatability</i>	±0,01%
Radni tlak <i>Working pressure</i>	10 barg
Područje protoka <i>Flow rate range</i>	200 – 2400 L/min

#### **HRN EN ISO/IEC 17020:2012**

The HRN EN ISO/IEC 17020:2012 Standard prescribes the requirements that the inspection bodies need to satisfy in order to ensure the confidence in their inspection activities. The confirmation that the requirements of the ISO/IEC 17020 Standard are satisfied is the accreditation procedure to be conducted by the accreditation bodies. In Croatia, the accreditation procedure is conducted by the Croatian Accreditation Agency (HAA).

In 2013, JANAF Plc. became accredited in accordance with the HRN EN ISO/IEC 17020:2012 Standard, type "C", and became authorised for performing the activities of verification of the volumetric and mass flow meters on the territory of the Republic of Croatia.

The verification is performed by the Authorised Inspection Body no. 22, JANAF Plc., in the Laboratory for calibration and verification of volumetric and mass flow meters and directly at the metering station if technically possible. Upon the verification completed, at the request by the user, the Authorised Inspection Body shall issue the Certificate of Verification.

The preparation of legal measuring instruments for verification is performed in the Authorised Body for preparation of legal measuring instruments for verification no. 390 of JANAF Plc.

Scope of accreditation according to HRN EN ISO/IEC 17020:2012 Standard

<b>Br.</b> <i>No.</i>	<b>Mjerna veličina</b> <i>Measurand</i>	<b>Mjerno područje</b> <i>Measurement range</i>	<b>Etalonska i pomoćna oprema</b> <i>Reference standards and equipment</i>
1.	Protok / <i>Flow</i>	do/to 180 m <sup>3</sup> /h	Pomična etalonska posuda 1000 / 3000 L <i>Portable reference standard 1000 / 3000 L</i>
2.	Protok / <i>Flow</i>	do/to 600 m <sup>3</sup> /h	Fiksna etalonska posuda 10 000 L <i>Fixed reference standard 10 000 L</i>
3.	Protok / <i>Flow</i>	do/to 2500 m <sup>3</sup> /h	Cijevni etalon 10 000 L <i>Pipe prover 10 000 L</i>
4.	Maseni protok / <i>Mass Flow</i>	do/to 180 t/h	Pomična etalonska posuda 1000 / 3000 L <i>Portable reference standard 1000 / 3000 L</i>
5.	Maseni protok / <i>Mass Flow</i>	do/to 2500 t/h	Cijevni etalon 10 000 L <i>Pipe prover 10 000 L</i>

## HRN EN ISO/IEC 17025:2007

HRN EN ISO/IEC 17025:2007 entitled *General requirements for the competence of testing and calibration laboratories* is the standard that specifies the requirements that the laboratories need to satisfy. The standard specifies the general requirements for the competence to carry out tests and/or calibrations, including sampling and it is applicable to all organisations performing tests and calibrations regardless of the types of testing and calibrations, organisation size and scope of testing and calibration.

The accreditation issued by the Croatian Accreditation Agency is recognised in the EU Member States and other countries signatories of the mutual recognition agreements in the field of accreditation, which is the main reason of introducing such standard in the JANAF system.

Scope of accreditation according to HRN EN ISO/IEC 17025:2007 Standard

<b>Br.</b> <i>No.</i>	<b>Mjerna veličina / Mjerilo</b> <i>Measurand / Calibration item</i>	<b>Mjerno područje</b> <i>Measurement range</i>	<b>Mjerna sposobnost</b> <i>Calibration and measurement capability (CMC)</i>	<b>Metode umjeravanja</b> <i>Calibration methods</i>	<b>Napomene</b> <i>Remarks</i>
1.	Protok / <i>Flow</i>  Obujamska mjerila protoka / <i>Flow meters</i>	do/to 2500 m <sup>3</sup> /h	$2,73 \cdot 10^{-4} \cdot V$	<b>RUP-UM-01</b> <b>Izdanje 01 /</b>  <b>Issue 01;</b> <b>2018-06-28</b>	Tekući ugljikovodici pomoću cijevne etalonske petlje nominalnog obujma 10 m <sup>3</sup> /  <i>Hydrocarbon products using prover loop of 10 m<sup>3</sup> nominal volume</i>
2.	Maseni protok / <i>Mass flow</i>  Masena mjerila protoka / <i>Mass flow meters</i>	do/to 2500 t/h	$2,92 \cdot 10^{-4} \cdot m$	<b>RUP-UM-02</b> <b>Izdanje 01 /</b>  <b>Issue 01;</b> <b>2018-06-28</b>	Tekući ugljikovodici pomoću cijevne etalonske petlje nominalnog obujma 10 m <sup>3</sup> , koristeći laboratorijski gustomjer za određivanje referentne gustoće /  <i>Hydrocarbon products using prover loop of 10 m<sup>3</sup> nominal volume, using laboratory densitometer for reference density measurement</i>

3.	Protok / <i>Flow</i>  Obujamska mjerila protoka / <i>Flow meters</i>	do/to 10 000 L/min	$2,4 \cdot 10^{-4} \cdot V$	<b>RUP-UM-03</b> <b>Izdanje 01 /</b>  <b>Issue 01;</b> <b>2018-06-28</b>	Voda i tekući ugljkovodici pomoću stabilne etalonske posude nominalnog obujma 10 m <sup>3</sup> /  <i>Hydrocarbon</i> <i>products using</i> <i>prover tank of 10 m<sup>3</sup></i> <i>nominal volume</i>
4.	Protok / <i>Flow</i>  Obujamska mjerila protoka / <i>Flow meters</i>	do/to 3000 L/min	0,03 % · V	<b>RUP-UM-04</b> <b>Izdanje 01 /</b>  <b>Issue 01;</b> <b>2018-06-28</b>	Tekući ugljikovodici pomoću pokretne etalonske posude nominalnog obujma 1 m <sup>3</sup> i 3 m <sup>3</sup> /  <i>Hydrocarbon</i> <i>products using</i> <i>prover tank of</i> <i>1 m<sup>3</sup> and 3 m<sup>3</sup></i> <i>nominal volume</i>
5.	Maseni protok / <i>Mass flow</i>  Masena mjerila protoka / <i>Mass flow meters</i>	do/to 3000 kg/min	0,03 % · m	<b>RUP-UM-05</b> <b>Izdanje 01 /</b>  <b>Issue 01;</b> <b>2018-06-28</b>	Tekući ugljikovodici pomoću pokretne etalonske posude nominalnog obujma 1 m <sup>3</sup> i 3 m <sup>3</sup> , koristeći laboratorijski gustinomjer za određivanje referentne gustoće /  <i>Hydrocarbon</i> <i>products using of</i> <i>1 m<sup>3</sup> and 3 m<sup>3</sup></i> <i>nominal volume,</i> <i>using laboratory</i> <i>densitometer for</i> <i>reference density</i> <i>measurement</i>
6.	Obujam / <i>Volume</i>  <i>Prover tanks by</i> <i>liquid method</i>	100 do/to 10000 L	0,0319 % · V	<b>RUP-UM-06</b> <b>Izdanje 01 /</b>  <b>Issue 01;</b> <b>2018-06-28</b>	Voda pomoću etalonske posude nominalnog obujma 100 L /  <i>Water using prover</i> <i>tank of 100 L</i> <i>nominal volume</i>
7.	Obujam / <i>Volume</i>  <i>Prover tanks by</i> <i>liquid method</i>	500 do/to 25000 L	0,0118 % · V	<b>RUP-UM-07</b> <b>Izdanje 01 /</b>  <b>Issue 01;</b> <b>2018-06-28</b>	Voda pomoću etalonske posude nominalnog obujma 500 L /

					<i>Water using prover tank of 500 L nominal volume</i>
8.	<p>Obujam / <i>Volume</i></p> <p><i>Prover loop by master meter method</i></p>	do/to 25000 L	0,03 % · V	<p><b>RUP-UM-08</b> <b>Izdanje 01 /</b></p> <p><b>Issue 01;</b> <b>2018-06-28</b></p>	<p>Voda pomoću usporednog mjerila maksimalnog protoka 2400 L/min /</p> <p><i>Water using master meter with maximum flow rate of 2400 L/min</i></p>

All equipment in the JANAF laboratory at Sisak, all calibration methods and personnel are available to the clients who wish to calibrate their flow meters or prover tanks and volumetric provers of up to 25000 L.

The calibration methods are adjusted to the ISO 4267-2, ISO 7278 and ISO 8222 Standards, while the expression of the measurement uncertainty complies with EA-04/2.

The calibration of volumetric flow meters is conducted by direct comparison with a pipe prover loop of a known volume.

The calibration of mass flow meters is conducted by an indirect method by which, besides the volume, the density is also laboratory determined from the sample taken from the liquid prover by which the testing is conducted.

The stated method of the laboratory density determination is also confirmed by the Croatian Accreditation Agency (HAA) for the purpose of calibration of the mass flow meters.

Please see below for the other services that we can offer in the laboratory:

- Technical support in the development of new flow meters (ultrasonic flow meters, etc.)
- Development of efficiency calculation of flow straightener (laminator)
- Analysis of wave forms of signals from flow meters during calibration
- Measurement of pressure drops for PD-meters and turbine flow meters
- Testing of flow meters and computers
- Service and maintenance of flow meters
- Diagnostics of flow meter operation accuracy
- Testing of meter endurance
- Standard testing in accordance with OIML
- Preparation of calculation regarding measurement uncertainties of meters and measuring systems
- Preparation of calculation of polynomials whose described change of MF coefficient depends upon  $\log Q/v$
- Printing of calculations, polynomials coefficient, Q-v tables and curves
- Long-term monitoring of meter changes in accordance with ISO 4124 Standard
- *Other specific requirements from the field of legal, technical and scientific metrology*