

# Meter calibration – general conditions

PERN S.A. Team of Measurement Systems



Accurate measurement is vital, whether the purpose is custody transfer, allocation or process control, and measuring system calibration reduces measurement uncertainty.

A number of specific methods are recognized for the measuring system calibration. Due to fact that influence factors such as temperature, pressure, viscosity and density are related to meter performance characteristic, more and more often calibrations are performed under meter's working conditions.

PERN S.A. in 2015 extended its range of services to flow/mass meter calibration and flow/mass meter verification performed with our participation by local metrological authorities and notified bodies as part of external audit.

#### METROLOGICAL EXPERTISE CERTIFICATE

In 2016 Polish Central Office of Measures issued the metrological expertise certificate of PERN S.A. mobile compact prover that:

proves reliability of the calibration and verification performed PERN S.A. Team of Measurement Systems and its compliance with applicable local regulations, as defined in item 23 of the "Scope of technical equipment of a verification point depending on the type of the verified measuring instrument" which is Annex to the Regulation of the Minister of Economy and Labour of 12 January 2005 on the establishment of verification points (Journal of Laws No. 15, item 126),

confirms that the results of calibration are related to national measurement standards,

states the possibility of using the mobile compact prover for meter verification for flow rates of up to 6,000 dm<sup>3</sup>/min.

#### **TYPES OF MEASURING SYSTEM**

Types of measuring system that can be calibrated by PERN S.A. Team of Measurement Systems:

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measuring systems on pipelines for constant and dynamic measurement of the volume of liquid, except for cryogenic liquids, of a flow rate not exceeding 12,000 dm<sup>3</sup>/min (6,000 dm<sup>3</sup>/min – as part of external metrological audit),

measuring systems for (un)loading ships and rail and road tankers, except for liquefied petroleum gas and cryogenic liquids, of a flow rate not exceeding 12,000 dm<sup>3</sup>/min (6,000 dm<sup>3</sup>/min – as part of external metrological audit).

### PRODUCTS

PERN S.A. Team of Measurement Systems can perform calibration of measuring system for crude oil, diesel, gasoline, aviation fuel, heating oil and other liquids of the following properties:

density: from 300 kg/m<sup>3</sup> to 1300 kg/m<sup>3</sup>,

dynamic viscosity at 20°C: from 0.4 mPa\*s to 50 mPa\*s.

## **CALIBRATION CONDITIONS**

Measuring system calibration or verification should be performed under meter rated operating conditions defined in:



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type approval decision for measurement systems approved for marketing or use based on a type approval decision,

EU-type examination certificate (module B), or certificate of conformity (module G) for measurement systems approved for marketing or use after conformity assessment.

Ambient temperature limits:

- lower temperature limit: -20°C,
- **↓ upper temperature limit:** +40°C.

Measuring system calibration or verification must not to be performed during storm or gusty wind. Mechanical environments: class M2.

Electromagnetic environments: class E2.

Flow limits:

- . flow: from 0.794 m<sup>3</sup>/h to 720 m<sup>3</sup>/h (from 13.25 dm<sup>3</sup>/min to 12,000 dm<sup>3</sup>/min),
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- product temperature: from -10°C to +50°C,
- System pressure: from 0 bar to 63 bar.

#### **PROVER SPECIFICATION**

#### Prover specification:

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**expanded uncertainty:** 0.052% (at a level of confidence of ca. 95% and coverage factor k = 2),

nominal base volume: 120 dm<sup>3</sup>,

flow tube diameter: DN450.

#### **TRUCK SPECIFICATION**

The Compact Prover is installed on the truck (permissible maximum mass - 11,990 kg). The car is driven with a two-axle trailer with a GVM of 3500 kg on which connection hoses are transported. The length of the whole set - 17.5 meters.



#### **PIPE ARRANGEMENT**

Mobile prover has to be connected in series with the calibrated measuring system to ensure that the entire volume of the product that flows through the system also flows through the prover.

3 most common ways of connecting the mobile prover with the measuring system are shown in the pictures below.

<sup>ψ</sup><sup>ψ</sup><sup>ψ</sup> Connecting the mobile prover with the measuring system through appropriate valve arrangements (measuring system with DBB valve or other solution providing liquid passing system and prover):



 $\dot{\psi}$  Connecting the mobile prover with the measuring system at the beginning or end of the pipe system (e. g. loading arm):



 $d^{0}$  Connecting the mobile prover with the measuring system by a removable piping section:



#### Legends:

	PAVED GROUND (min. 11 m × 3,5 m)	M	HOSE
	MEASUREMENT SYSTEM		TANK OR RAIL OR ROAD TANKER
$\bowtie$	VALVE		ELECTRICAL OUTLET
Ż	DBB VALVE OR OTHER SOLUTION PROVIDING LIQUID PASSING SYSTEM AND PROVER	J4	REMOVABLE PIPING SECTION
			PIPELINE
			VOLTAGE CABLE
Т	PIPE CONECTOR WITH DRAIN CONNECTION		SIGNAL CABLE

A strainer of proper size should be installed upstream of the prover to protect it from the introduction of foreign material.

The prover is equipped with a cone strainer [1/8" (3 mm) perforations with 40 × 40 mesh inner lining].

Prover connecting system specification is shown in the table below.

Voltage plug: 32A/5 or 16A/5.

#### **PROVER DRAINING**

Compact Prover draining system consists of:

- ⊘ drain connections,
- pipe connectors with drain connections,
- oraining pump.

After finishing calibration or verification the liquid form the prover can be drained to a residual system/tank/road tanker/rail tanker.

Draining pump specification:

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- efficiency: 40 dm<sup>3</sup>/min,



downstream pressure: 12 bar.

#### **CUSTOMIZATION**

In case of lack of a proper connecting facility or drain facility there is a possibility of customization of the existing connection equipment to the Client's specific requirements.

#### REFERENCES

PERN S.A. Team of Measurement Systems in 2015-2022 has performed several dozen calibrations of PERN Inc. flow meters.

PROVER	CONECTOR	HOSE	CONECTOR	CONECTOR WITH DRAIN CONNECTION
	н	MM	н	Ι
	-	DN150 FLANGES PN63 L=5m (2 items)	PIPING SECTION, FLANGE DN150 PN63 (2 items)	KNIEE PIPE 45° FLANGE DN150 RZ PN63 (2 items)
			-	
			-	FLANGE DN150 PN63 / FLANGE DN100 PN10 (2 items)
FLANGE DN150 PN63 (2 items)	FLANGE DN150 PN63/ FLANGE DN100 PN10 (2 items)	DN100 FLANGES PN10 L=6m (2 items)	-	DN100 FLANGE PN10 / API FEMALE (1 item)
			-	DN100 FLANGE PN10 / API MALE (1 item)
	FLANGE DN150 PN16 (CONECTION FOR PN63) FLANGE DN200 PN16 (CONECTION FOR PN63) (2 items)	DN200 FLANGES PN16 L=5m (2 items)	FLANGE DN150 PN16 (CONECTION FOR PN63) FLANGE DN200 PN16 (CONECTION FOR PN63) (2 items)	-

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