

Viscosity measurement unit

VMU-1

**TECHNICAL
DESCRIPTION**



Since 2014, ErichHahn has been designing and supplying equipment for the production, storage, and transportation of viscous and solidifying fluids. Our cumulative knowledge and experience allow us to be a provider of advanced industrial solutions on both regional and global levels. We deliver pumping equipment to the suppliers of bitumen for road construction, including terminals for storage and transportation of viscous and solidifying fluids, mobile and stationary modular plants, and units designed in accordance with individual customer requirements.



ErichHahn VMU-1 is an automated viscosity measurement unit designed for in-line monitoring of the rheological properties of viscous petrochemical products within existing process units. The system performs controlled batch measurements at a specified temperature without manual sampling and without interrupting the technological process. VMU-1 ensures stable product quality control and can be easily integrated into existing production lines thanks to its compact modular design.

ErichHahn's mission is to apply our technology and engineering expertise to improve our customers' production processes.

We strive to be a driving force behind our customers' process improvements, business development and production culture, following the principles of innovation, customer focus, reliability, safety and competence.

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Scope and Functional Description

ErichHahn VMU-1 Viscosity Measurement Unit (hereinafter VMU-1) is designed for automatic in-line slipstream batch measurement of rheological characteristics of viscous petrochemical products as part of operating process units, based on the industrial viscometer Marimex ViscoScope, and represents a high-performance industrial solution for continuous viscosity monitoring in production processes. The unit ensures high measurement accuracy, which makes it possible to promptly respond to changes in product properties and maintain optimal conditions for its processing.

VMU-1 provides automatic sampling of a specified portion of product from the main process system without disrupting the continuity of the process operation. The sampled product stream is transferred by an integrated pump station to the internal recirculation loop of the unit,

where it undergoes controlled cooling in the integrated cooling module to the specified measurement temperature. After the required temperature conditions are achieved, viscosity parameters are measured, after which the product is automatically returned to the process system.

All stages—sampling, circulation, cooling, measurement, and product return—are performed in fully automatic mode and are controlled by the built-in controller of the VMU-1 unit.

The following parameters are set by the user:

- measurement temperature setpoint;
- sampling frequency;
- operating modes of the pump station and the cooling system.

The VMU-1 unit is installed in close proximity to process equipment and is connected to the process pipelines through which the feedstock and/or finished product is transported. The unit provides automatic in-line batch measurement of quality parameters without the need for manual sampling and without the constant presence of operating personnel, ensuring stability and repeatability of measurement results.

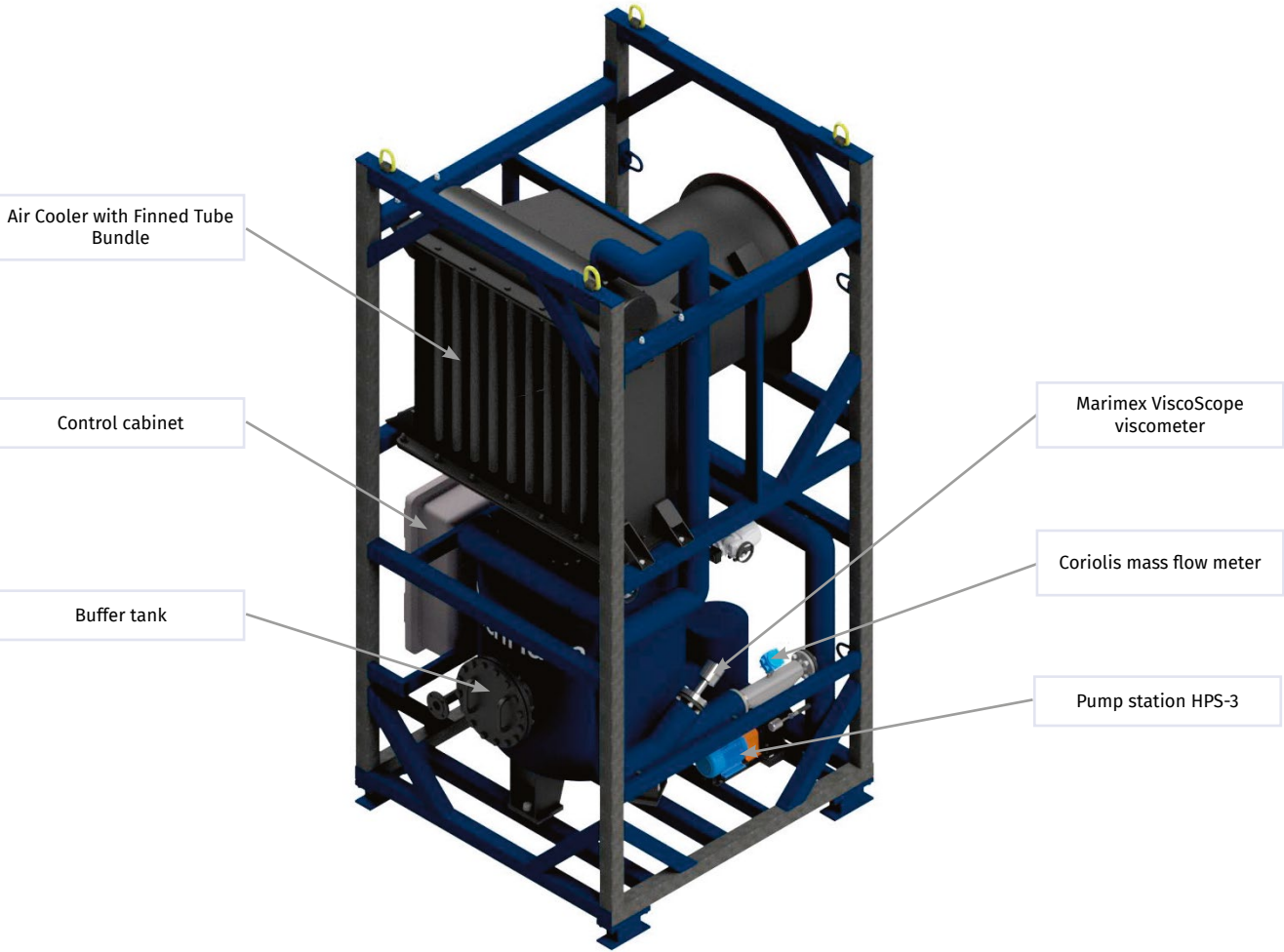
The VMU-1 unit is of fully factory-assembled package unit and is equipped with electrical and pumping equipment, shut-off and control valves, instrumentation, and a control cabinet.

Main Technical Characteristics of the Unit

Process medium	Viscous product
Climatic conditions	Temperate climate
Ambient temperature, °C	-25 to +40
Maximum operating product temperature, °C	Up to 135...300 ¹⁾
Operating pressure, MPa	0.6
Heat transfer capacity during cooling, kW	220
Installed electrical power, kW	5
Length, L, mm	2000
Width, W, mm	1960
Height, H, mm	4300
Total unit weight, maximum, kg	3300
Service life, not less than, years	10
Country of manufacture	Turkey

Note:
1) The operating temperature is determined by the temperature at which viscosity measurement is required.

The unit includes:



Electrical equipment, instrumentation, and automation components may be installed in an explosion-proof design. The explosion protection marking shall be Explosion protection rating: Ex d IIB T4, EPL Gb (or higher) (VMU-1EX).

Advantages of the ErichHahn VMU-1

- High measurement accuracy: the VMU-1 unit provides high measurement accuracy, enabling users to monitor processes viscosity-dependent processes.
- Wide measurement range: the VMU-1 unit is capable of measuring viscosity over a wide range, which makes it a versatile tool for various industries (petrochemical, paint and coatings, food, pharmaceutical, etc.).
- Ease of integration: the VMU-1 unit is easily integrated into existing production lines and automation systems, which minimizes downtime and installation costs.
- Automated process: the VMU-1 unit enables automation of the viscosity monitoring process, thereby reducing the human factor.
- Compact design.

Technical Description of the Main Equipment

Marimex ViscoScope viscometer

The Marimex ViscoScope VA300 viscometer is a industrial process viscometer designed for measuring the viscosity of liquids. The viscometer operates based on measuring the time required for a liquid to pass through a dedicated capillary or measuring chamber, which enables accurate determination of its dynamic viscosity. The instrument is provides a wide measurement range, making it a versatile tool for various types of liquids.

The viscometer requires regular calibration to ensure measurement accuracy. The instrument is equipped with equipped with automatic calibration functions. The instrument is also fitted with a Pt100 temperature sensor for measuring the process temperature.



Characteristics of the Marimex ViscoScope VA300 Viscometer

Material	Stainless steel
Operating temperature, °C	-40...+450
Operating pressure, bar	from vacuum up to 450 bar
Sensor type	L: large cylinder M: small cylinder H: sphere X: mini-sphere
Probe dimensions	L: Ø 32 × 190 mm M: Ø 32 × 165 mm H: Ø 32 × 130 mm X: Ø 32 × 115 mm
Viscosity measurement range (measurement range depending on probe type), mPa·s·g/cm³	L: 0.1...2,500 M: 1...25,000 H: 10...250,000 X: 100...2,500,000
Measurement accuracy, %	±2 % of reading
Degree of protection	IP65
External input	0/4...20 mA or 0/2...10 V DC
Outputs	RS232 on the front panel, MODBUS RTU (standard)

Coriolis mass flow meter (optional)

At the Customer's request, the VMU-1 unit may be equipped with a Coriolis mass flow meter for advanced monitoring of the physicochemical characteristics of the measured medium.

When a Coriolis flow meter is installed, the VMU-1 unit control system performs automatic calculation of kinematic viscosity based on the measured values of dynamic viscosity and density using a built-in algorithm.

Flow meters of the Emerson Micro Motion series or equivalent equipment with equivalent technical specifications may be used.

Основные характеристики расходомера

Model	Emerson G200 or equivalent
DN	50
Measurement accuracy, % (mass)	±0.1



Temperature sensor

The VMU-1 unit is equipped with one built-in Pt100 temperature sensor installed directly in the viscosity measurement zone. The sensor ensures accurate determination of the process medium temperature at the time of measurement, which guarantees the correctness and repeatability of results taking into account the temperature dependence of the product's rheological properties. The sensor signal is used to record the actual measurement temperature and to archive data in the unit's control system.

Pump station HPS-3

The **HPS-3 pump station** is intended for supplying the unit with the required product stream for quality control and for providing recirculation through the air cooler and the buffer tank. The station ensures stable pressure and liquid flow rate, which is important for maintaining optimal operating conditions of the equipment. After measurements and quality control at the required temperature are completed, the pump station transfers the product back to the process system. The main components of the HPS-3 include a gear pump, a motor-gear unit, and a filter for product filtration. The gear pump (Victor Pumps R40 or equivalent) with internal gearing ensures uniform delivery of the pumped product without pulsations, thereby reducing vibration levels of the pump station and reducing product aeration and foaming.

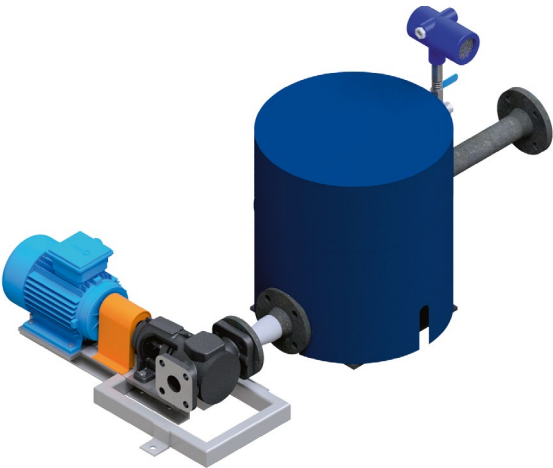
Main Characteristics of the R40 Pump

Capacity, m³/h	4.5
Operating pressure, bar	6

The filter is intended for removing mechanical impurities from the product, which contributes to extending equipment service life and improving the quality of the final product.

Main Characteristics of the Filter

Nominal diameter (DN), mm	50
Filter element mesh size, mm	8



The motor-gear unit is intended to transmit rotational motion to the gear pump via a flexible coupling.

Main Characteristics of the Motor-Gear Unit

Output shaft speed, rpm	960
Voltage, V	400
Electric motor power, kW	1.5
Degree of protection	IP55
Insulation class	F

Buffer tank

The measurement accuracy of the Marimex ViscoScope viscometer is ensured in the absence of air and with minimal pressure and flow fluctuations. This is achieved through the use of a **buffer tank**. The buffer tank not only prevents the formation of air bubbles, but also contributes to the stability of temperature and pressure during recirculation, which is critical for obtaining reliable measurement results.

Main Characteristics of the Buffer Tank

Volume, m³	0.8
Design temperature, °C	300
Design pressure, MPa	0.6

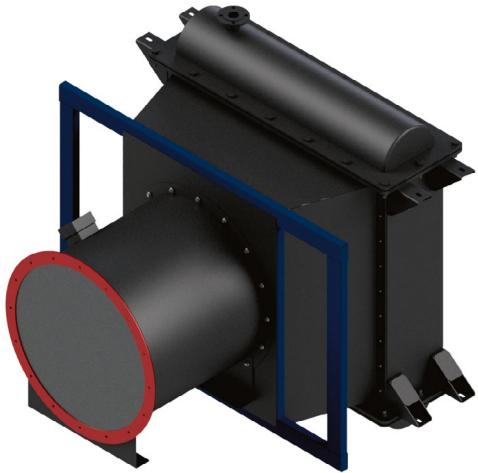
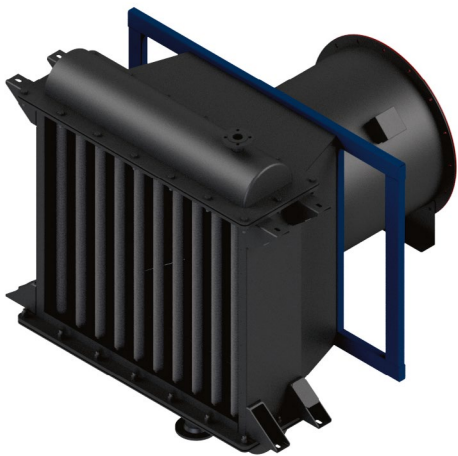


Air cooler with finned tube bundle

The **air cooler with finned tube bundle** is designed to reduce process fluid temperature to the value required for viscosity measurements. The finned structure of the tubes increases the effective heat transfer surface area, which allows more efficient heat transfer from the liquid to the surrounding environment. During operation, the cooled liquid passes through the finned tubes, where enhanced convective heat transfer occurs, promoting rapid cooling. To achieve stable viscosity measurement results, it is important to maintain

a constant liquid temperature, since viscosity can vary significantly depending on temperature.

For viscous petroleum products, viscosity is typically standardized at 135 °C. This is due to the fact that at this temperature the product reaches a stable state, allowing correct assessment of its flowability and behavior during transportation and processing.



Main Characteristics of the Air Cooler with Finned Tube Bundle

Total heat duty, kW	220
Product temperature drop, °C	Up to 100
Heat exchanger surface area, m²	85
Finned tube	- Fin height (h), mm: 12.5 - Number of fins per inch: 10 FPI (or 393 fins per 1 m) - Fin thickness (t), mm: 0.4
Tube length, m	1,4
Fan	- Diameter, m: 0.9 - Air flow rate, m³/s: 6.5 - Electric motor power, kW: 2.2
Overall dimensions	1850x1960x1990

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