

Technical Datasheet



ZHM CI Series

Gear Flow Meters
for Oil and Gas Applications

Overview

With more than 50 years of experience in the flow measurement field and numerous innovative and customer-specific product developments, we are a qualified and competent contact for flow measuring technology and calibration. KEM offers a broad selection of measuring principles for this purpose. We develop, produce, and deliver high quality Gear Flow Meters, Turbine Flow Meters, Helical Flow Meters and Micro Flow Meters as well as Coriolis Mass Flow Meters worldwide. Specific accessories complement the product range.

This document provides information, technical details and typical applications concerning the ZHM CI Gear Flow Meter Series.

Series	Application	Process Medium	Attributes
ZHM ST	Flow measurement	Polyol + isocyanat, glue, epoxy resins Abrasive, less lubricating Medium/high viscosity	Stainless steel body Tungsten carbide sleeve bearing Bigger tolerances
ZHM KL	Filling processes	Lubricants, oils, grease Lubricating Medium/high viscosity	Stainless steel body Stainless steel ball bearing Bigger tolerances
ZHM MK	Dosing & consumption	Diesel, Skydrol, AdBlue, odorant (Less) lubricating Low viscosity	Stainless steel body Stainless steel ball bearing Small tolerances
ZHA KL	Test bed monitoring (Hydraulics)	Hydraulic fluid, ATF Lubricating Medium viscosity	Aluminum body Stainless steel ball bearing Bigger tolerances
ZHM CT	Dosage control (Paint shops)	Paints, waxes, amine Less lubricating Medium viscosity	Stainless steel body Tungsten carbide sleeve bearing Ball bearing (optional)
ZHM HP	Flow measurement (High Pressure)	Lubricants, coolant, inhibitors Abrasive, less lubricating Medium/high viscosity	Stainless steel body Stainless steel ball bearing Tungsten carbide sleeve bearing (optional)
ZHM CI	Dosage control (Oil & Gas)	Inhibitors, glycol, hydraulic control fluids Abrasive, less lubricating Low/medium viscosity	Stainless steel body Stainless steel ball bearing Tungsten carbide sleeve bearing (optional)

Please contact KEM Sales for additional information on our Flow Meters or for advisory purposes related to your individual application needs. For KEM Sales contact details see the document's last page.



Description

Gear flow meter ZHM CI Series is a dedicated version, which is primarily used in applications for the upstream oil and gas market. Specific and robust design enable our gear flow meters to meet flow metering challenges like high pressure ratings, pulsating flow streams, corrosive media and harsh environment conditions. They perform with outstanding accuracy in oil and gas exploration processes and hydraulic monitoring applications. Their reliability and long-term durability combined with exceptional engineering and production tolerances ensure customers an accurate measurement, efficiency increase and prompt return of investment due to cost reduction in chemicals used for instance.

We work in very close cooperation with our customers to meet their individual measuring requirements. Thanks to our varied manufacturing capabilities, we are able to offer a wide range of flow capacities, connection sizes and exceptional materials of pressure related parts.

In addition, we develop specific designs for onshore installations and offshore fields topside or subsea equipment in conjunction with highest possible chemical compatibility. Optional components and materials like low friction stainless steel ball bearings or tungsten carbide sleeve bearing with nickel binder guarantee high-performance operations.

Principle and Design

Gear flow meters (ZHM) are positive displacement meters. Two precise gears rotate freely inside the measuring chamber.

Sealed cavities are created between the gears and the housing. The measured media causes the rotation of the gears. The flowing medium is distributed evenly in the measuring chamber and causes the rotation of the gears. The gear wheels rotate freely and undamped in the media flow. Their rotational frequency is proportional to the flow rate and is measured by non-intrusive sensors (pickups) through the housing wall.

The sensor system can be variably adjusted to meet the requirements of the application. This allows, for example, providing even very high resolutions or also a signal for determining the direction of flow.

Pulses per unit of volume are available for analysis. The calibration factor (K-factor) of the flow meter describes the exact pulse rate per unit of volume. In order to determine the individual calibration factor of a flow meter, we calibrate each of our meters in house prior to delivery. The operating viscosity specified by the customer is taken into account for calibration. A corresponding calibration certificate is included with every flow meter we supply.

These meters are suitable for accurate measurement of different liquids with viscosities of approximately 1 to 25,000 mm²/s. For low-viscosity media and fuels gear flow meters with ball bearings and reduced tolerances are used.

Thanks to a high output frequency, excellent resolution and short response times, our gear flow meters are outstanding for measuring pulsing flows, for consumption measurement and for dosing of liquids.

Applications

Well Injection

- Chemical Injection
- Gas Dehydration
- De-Icing

Well Control

- Topside
- Subsea

Transmission

- Gas Odorization

Chemical & Petrochemical

- Gas Sweetening
- Blending

Features

- High Resolution
- Short Response Time
- Bi-Directional Flow
- Pressure Shock Resistance
- Large Viscosity Range
- NACE MR0175 Standard
- Low Maintenance
- Stainless Steel Construction
- PED 97/23/EC

Technical Data – Sizes

ZHM Type ¹⁾	Measuring Range (l/min)	K-Factor ⁴⁾ (pulses/l)	Max. Pressure (bar/psi) Standard	Frequency ⁴⁾ (Hz)	Weight (kg)
ZHM 01/3 ²⁾	0.002 to 1.0	40,000	345 [5,000]	1.3 to 330	2.9
ZHM 01/1 ³⁾	0.005 to 2.0	26,500	414 [6,000]	2.2 to 880	2.9
ZHM 01/2	0.02 to 3.0	14,000	414 [6,000]	4.6 to 700	2.9
ZHM 02	0.1 to 7.0	4,200	414 [6,000]	7 to 480	2.9
ZHM 03	0.5 to 25.0	1,740	414 [6,000]	14 to 730	2.9
ZHM 04	0.5 to 70.0	475	414 [6,000]	4 to 560	8.5

Technical Data – General

Measuring Accuracy	Up to 0.1 % ⁵⁾
Repeatability	±0.05 % (under the same conditions)
Linearity	±0.5 % of actual flow (viscosity ≥ 30 mm²/s)
Materials	Housing: as per DIN 1.4404 [AISI 316L] Gears: as per DIN 1.4122, 1.4501 [AISI F55] Bearing: stainless steel ball bearing, tungsten carbide sleeve bearing Seals: FFKM Bolts: Inconel-718
Medium Temperature	-40 °C up to +180 °C [-40 °F up to +356 °F]
Dimensions	See dimensional drawing (page 5)

¹⁾ Exact type designation see ordering code (page 7).

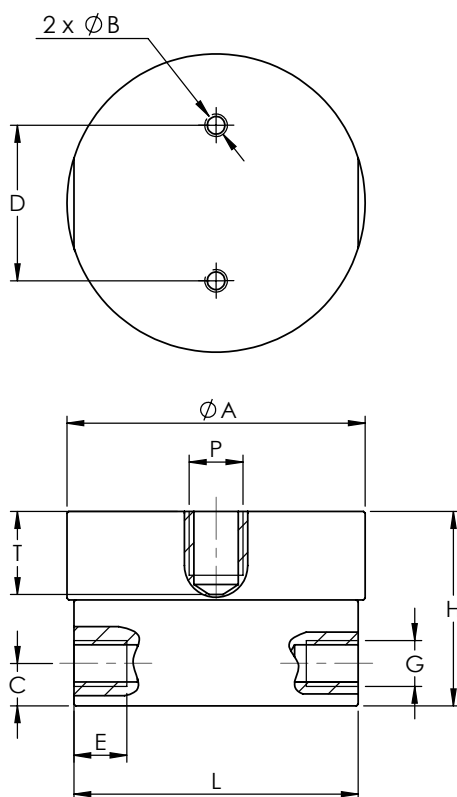
²⁾ Tungsten carbide sleeve bearings not available.

³⁾ Stainless steel ball bearings not available.

⁴⁾ Average values for single sensors, dual pickups and higher resolution available.

⁵⁾ Under laboratory conditions; incl. linearization; viscosity ≥ 30 mm²/s.

Dimensional Drawing – ZHM Standard 01/3 to 04



Type	Ø A	B	C	D	G	H	L	P	T ⁶⁾
ZHM 01/3	84 mm [3.30 in]	M6 ↓ 10	14 mm [0.55 in]	44 mm [1.73 in]	½" NPT F	67 mm [2.64 in]	80.5 mm [3.17 in]	E/Z/B	23.5 mm [0.93 in]
ZHM 01/1	84 mm [3.30 in]	M6 ↓ 10	14 mm [0.55 in]	44 mm [1.73 in]	½" NPT F	67 mm [2.64 in]	80.5 mm [3.17 in]	E/Z/B	23.5 mm [0.93 in]
ZHM 01/2	84 mm [3.30 in]	M6 ↓ 10	14 mm [0.55 in]	44 mm [1.73 in]	½" NPT F	67 mm [2.64 in]	80.5 mm [3.17 in]	E/Z/B	23.5 mm [0.93 in]
ZHM 02	84 mm [3.30 in]	M6 ↓ 10	14 mm [0.55 in]	44 mm [1.73 in]	½" NPT F	67 mm [2.64 in]	80.5 mm [3.17 in]	E/Z/B	23.5 mm [0.93 in]
ZHM 03	84 mm [3.30 in]	M6 ↓ 10	0.55 in [14 mm]	44 mm [1.73 in]	½" NPT F	67 mm [2.64 in]	80.5 mm [3.17 in]	E/Z/B	23.5 mm [0.93 in]
ZHM 04	125 mm [4.92 in]	M6 ↓ 10	17 mm [0.67 in]	60 mm [2.36 in]	¾" NPT F	100 mm [3.94 in]	121 mm [4.76 in]	E/Z/B	30.5 mm [1.20 in]

⁶⁾ Only applies for single pickup holes of type „E“.

Attention: the total installation height is the result of the height (H) and the height of the electronics (dimensions in separate datasheet).

Ordering Code

					ZHM	-	XX	-	XX	-	X	-	X
Measuring Range													
0,002 - 1,0 l/min ⁷⁾							01/3						
0,005 - 2.0 l/min ⁸⁾							01/1						
0.02 - 3.0 l/min							01/2						
0.1 - 7.0 l/min							02						
0.5 - 25 l/min							03						
0.5 - 70 l/min							04						
Meter Attributes													
<i>Housing</i>	<i>Gears</i>	<i>Bearing</i>	<i>Bolts</i>	<i>Thread</i>									
1.4404 [AISI 316L]	1.4122	ball bearing	Inconel-718	NPT							M1		
1.4404 [AISI 316L]	1.4122	sleeve bearing	Inconel-718	NPT							M2		
1.4404 [AISI 316L]	1.4501 [AISI F55]	sleeve bearing	Inconel-718	NPT							M3		
Sensor Ports													
M14x1.5												E	
M14x1.5 6H ExD												Z	
3/8" NPT												B	
Sealing Options													
FFKM (Isolast [®])													I

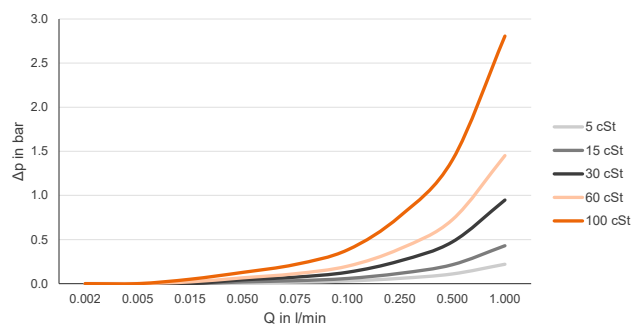


⁷⁾ Tungsten carbide sleeve bearings not available.

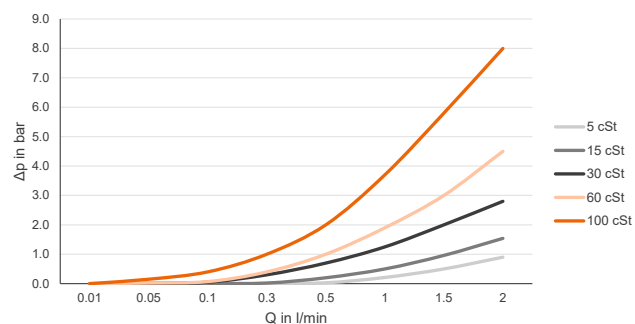
⁸⁾ Stainless steel ball bearing not available.

Pressure Drop Curves

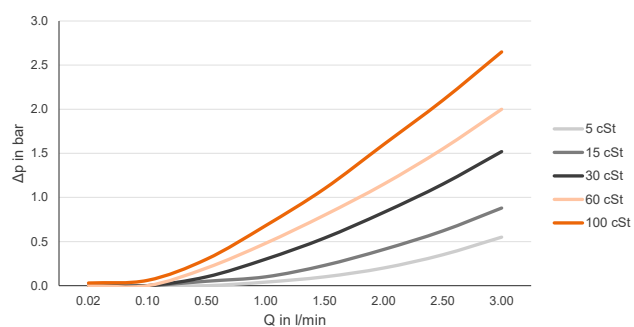
ZHM 01/3



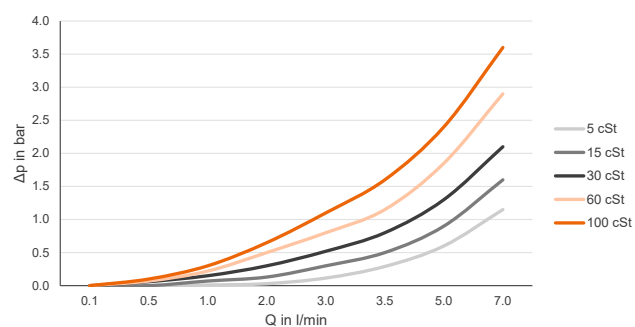
ZHM 01/1



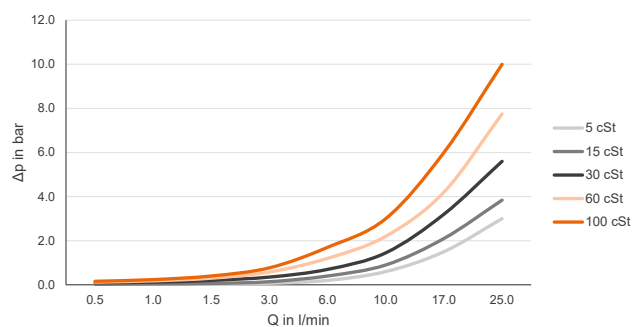
ZHM 01/2



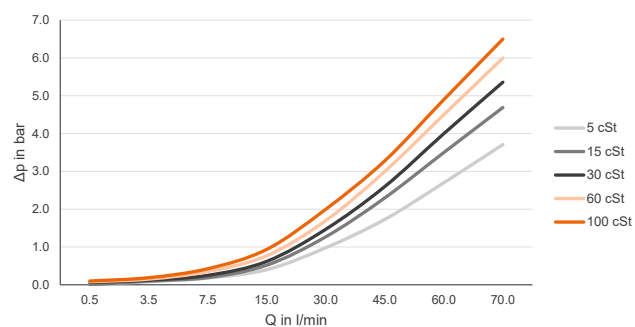
ZHM 02



ZHM 03



ZHM 04



Calibration

In-house calibration is performed on volumetric calibration rigs or at the wishes of the customer in our DAkkS calibration laboratory.

The KEM calibration lab uses a high-precision load cell system. With an accuracy of 0.05 % for the mass and 0.1 % for the volume of flowing liquids, we occupy a leading position worldwide. The German Accreditation Body (DAkkS) has accredited the laboratory with engineers, processes and measuring equipment in accordance with the international standard DIN EN ISO/IEC 17025:2018.

The KEM calibration certificate not only verifies the accuracy of a flow meter, but also guarantees its traceability to national standards as well as ensuring all requirements according to international quality standards are met.

The calibrations are performed with different hydrocarbons. This ensures the optimum simulation of changing operating conditions in density and viscosity even when temperatures change. This way the primary viscosity for the use of the flow meter can be specifically taken into account when viscosity fluctuations occur in a customised application.

The calibration result is the specified calibration factor (K-factor) in pulses per litre. This K-factor accordingly applies only at a certain flow velocity or a certain flow rate.

The calibration factor varies only very slightly at different volume flow rates. The individual measuring points provide the calibration curve of the flow meter from which the average K-factor is determined. The average calibration factor applies to the entire measuring range.

The linearity error specification (percentage deviation) refers to the average K-factor. To further increase the measurement accuracy in onsite use, the specific K-factors can be used to calculate the flow rate. For this, KEM also supplies optional special electronics.

Calculation of volume flow

The flow is directly dependent on the measured frequency and the associated calibration factor:

$$Q = \frac{f \cdot 60}{K} \text{ l/min}$$

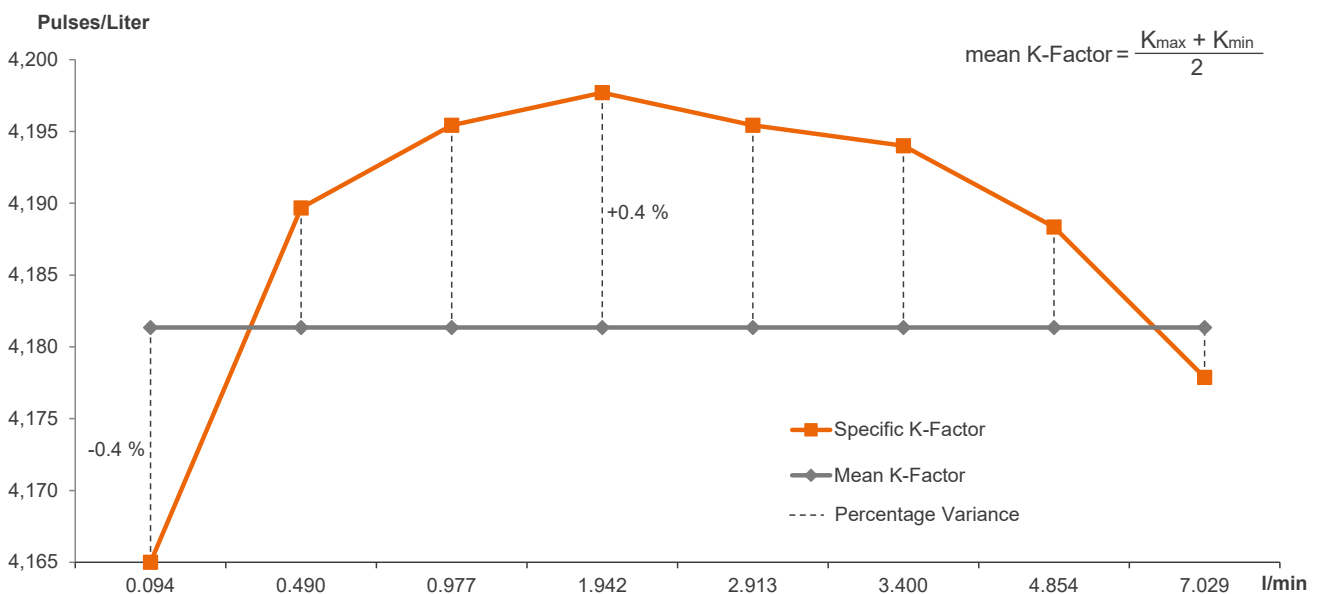
Q = Volume Flow

f = Measuring frequency

K = Specific K-Factor

Calibration protocol

Example: ZHM 02 CI (0.1 to 7 l/min)





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