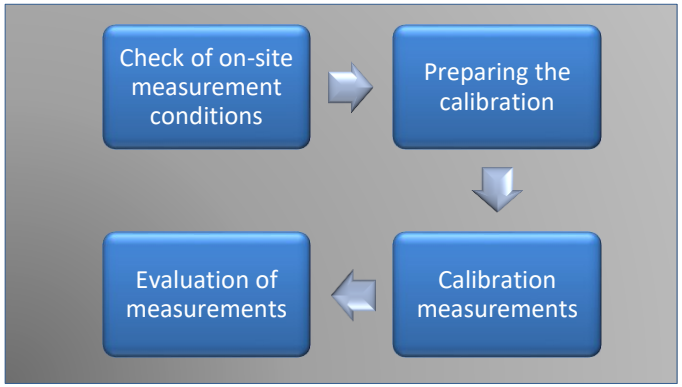
OPTOLUTION

DAkkS Deutsche Akkreditierungsstelle D-K-20427-01-00

On-site calibration of flow sensors
LASER OPTICAL FLOW MEASUREMENT



The calibration process – calibrating flow sensors on-site

Our service for on-site calibration of flow sensors consists of four project stages. The initial step is a preliminary field inspection and review of the local measurement conditions. The main purpose of the first site visit is to find a suitable position for the installation of the optical access and subsequent LDV measurement along the given pipe system. Additionally, the outer pipe diameter is measured to prepare the custom ball valve for the calibration process.

Ensuing the preliminary examination, the customer is advised to prepare the measurement site with all required preparations while OPTOLUTION takes care about production of the custom ball valve. After production is completed, certified partners conduct the instalation of the optical access via hot-tapping. Once the optical access is established, the calibration measurements will be executed by OPTOLUTION on all agreed operating points. During nighttime, remote-controlled measurements are possible. On completion, the measurements will be evaluated.

Concluding the measurements, a certificate and documentation of the results will be delivered to the customer. It is common, but not obligatory, to repeat the calibration process every two to three years.


Prepared optical access (ready for measurement)

Check of measuring situation – Chance for personal consultation on site

1. Specification of the exact position for the optical access based on the flow conditions (inlet and outlet length)
2. Check of the ambient conditions at calibration site for all neccessary preparations (dimensions of pipe-stripping for measurement, installation site of reference flow sensor, weatherproof scaffoldings and equipment-truck parking postitions)
3. Measurement of pipe diameter at calibration site (for preparation of the custom ball valve) => access to pipe (including scaffolding if required) and removal of any pipe cladding is required.
4. Acquiring parameters of the flow sensor (conditions of installation)
5. Agreement on desired operating points (volume flows, temperatures, pressures)
6. Preparation of reference signals for volume flow and temperature (impulse-/current signal)
7. Clarification of required infrastructure (230 V, Light, GSM)
8. Provision of older certificates (calibrations, approvals of legal metrology)
9. Summary of all needed preparation on calibration site.


Mounting tool for optical access


Inside the pipe with a contoured window

Preparation of the measuring site – For efficient measurements (1/2)

1. Provision of the reference signals (volume flow of flow sensor and fluid temperature inside pipe)
   - as impulse-/current signal direct of the sensors and/or
   - as data with high temporal resolution (Δt = 1 s) from the control system (synchronization of time needed)
2. Assurance of temporally stable (around +/- 20 %) volume flow and fluid temperature during the measurements
3. Stripping of pipe segment around the optical access, one meter left and right from the ballvalve (for precise measurements of pipe geometry and mounting of reference ultrasonic flow sensors)
4. Provision of covers on unisulated pipe segments (eg. insulation mats or other insulating material) to keep measurement equipment protected from heat
5. Access to the location of the measuring site (building a weatherproof scaffolding if needed, parking area for the small truck)
6. Access to calibration site between 6 AM up to 10 PM.

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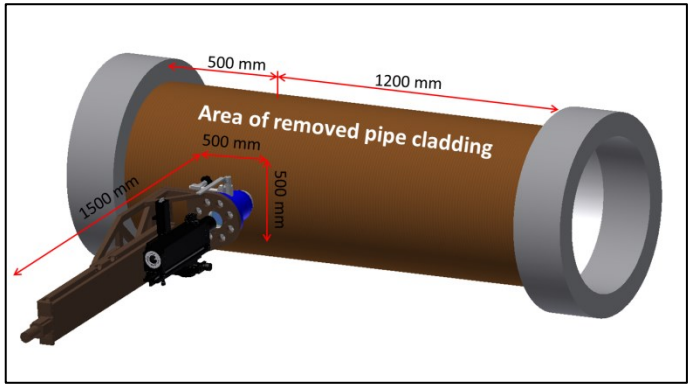
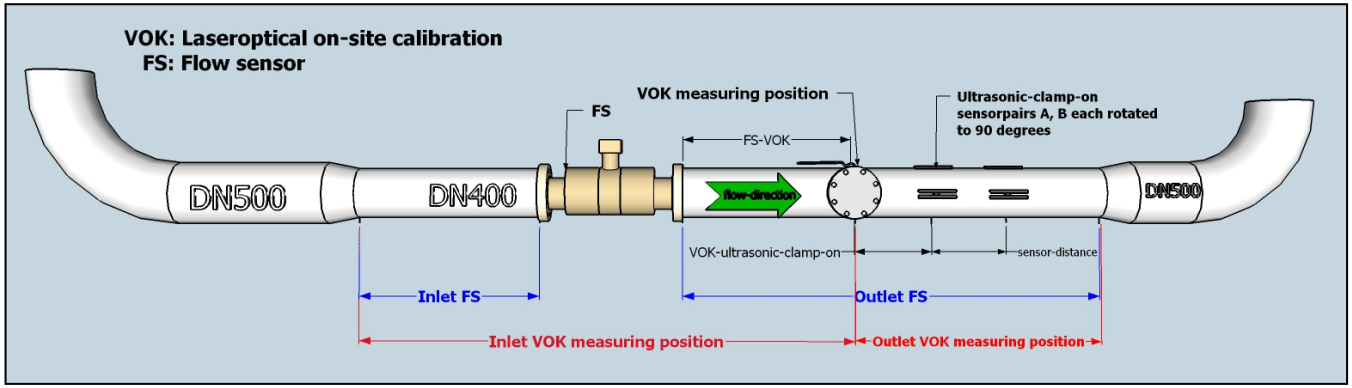
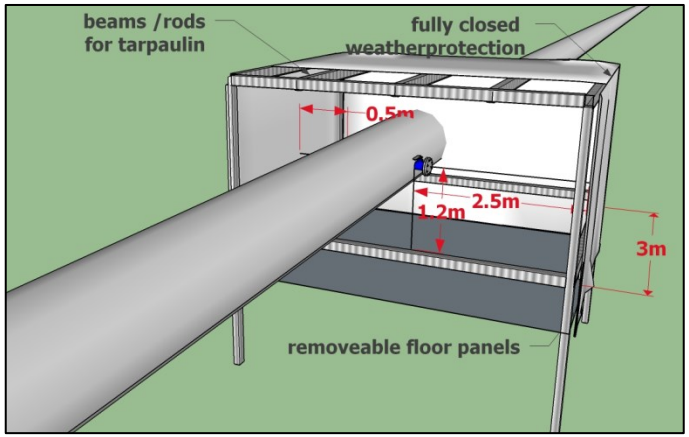




Preparation of the measuring site – For efficient measurements (2/2)

For the hot-tapping process and calibration measurements sufficient free space around the pipe is required. If the pipe is not at ground level, an additional scaffolding is needed. Outdoor measurements require scaffoldings with weatherproof tarpaulins protecting the measuring equipment.



Measurements for calibration – With laseroptical flow measurement

During calibration measurements additional information about the pipe geometry and pipe isometry is gathered. Pipe geometry is measured with a large caliper at various positions of the outside diameter, completed by pipe wall thickness measurements with an ultrasonic device along multiple pipe cross sections.

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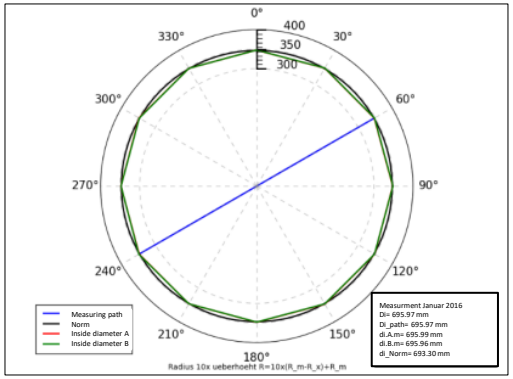
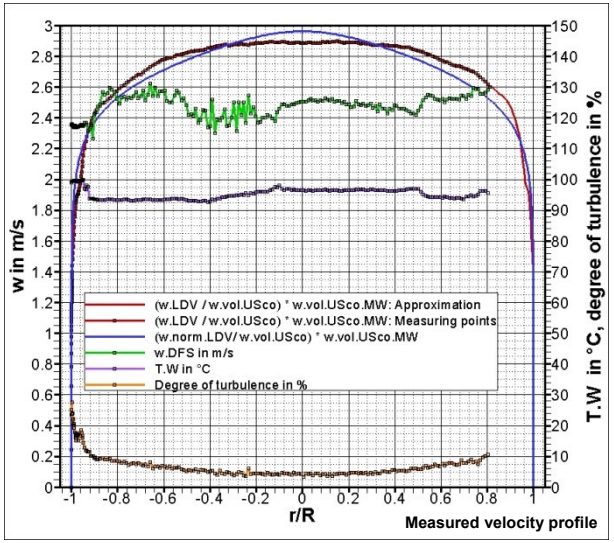


Determined geometry of pipe

Evaluation of measurement results

In the evaluation process the results of multiple partial measurements will be combined into single velocity profiles. Through integration, these cross-section velocity profiles yield the LDV volume flow which is compared to the time averaged values of the flow sensor.



Measured velocity profile

Vor-Ort-Kalibrierlaboratorium für Durchfluss-Sensoren
On-site calibration laboratory for flow sensors

OPTOLUTION
messtechnische lösungen

Akkreditiert als Kalibrierlaboratorium / *accredited as calibration laboratory*
Mitglied im / *member of the*
Deutschen Kalibrierdienst DKD

Kalibrierschein
Calibration certificate

Kalibrierzeichen / *Calibration mark*: 000000 | D-K-20427-01-00 | 2022-08

Gegenstand / *Object*	Ultraschall-inline-Zweipfad DFS
Hersteller / *Manufacturer*	
Typ / *Type*	
Fabrikat/Serien-Nr. / *Serial number*	12345678
Auftraggeber / *Customer*	Fernwärme Muster AG, 12207 Berlin
Auftragsnummer / *Order No.*	00/2022
Anzahl der Seiten des Kalibrierscheines / *Number of pages of the certificate*	4
Datum der Kalibrierung / *Date of calibration*	

Dieser Kalibrierschein dokumentiert die Rückführung auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI). Die DAkkS ist Unterzeichner der multilateralen Übereinkommen der European co-operation for Accreditation (EA) und der International Laboratory Accreditation Cooperation (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine. Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

This calibration certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI). The DAkkS is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates. The user is obliged to have the object recalibrated at appropriate intervals.

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This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature are not valid.

Datum / *Date* | Leiter des Kalibrierlaboratoriums / *Head of the calibration laboratory* | Bearbeiter / *Person in charge*

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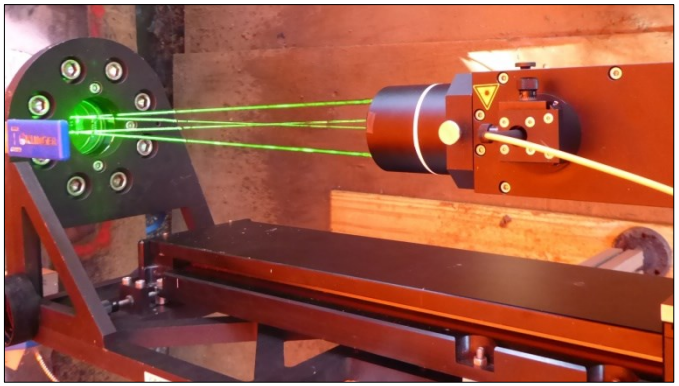
Amtsgericht: Freiburg i. Br., HRB 708803, USt-IdNr.: DE 284 217 029
Geschäftsführer: Dr.-Ing. Ulrich Müller



Conclusion of the measurements

After measurements are completed, the ball valve will be sealed with a blind flange. Once our equipment is disassembled, it is possible to reinsulate the pipe segment and the ball valve. With these precautions, the measurement site is prepared for periodic re-calibrations.

After the final evaluation of the calibration measurements, the customer receives a certificate and documentation of the measurements.

Ball valve sealed with blind flange

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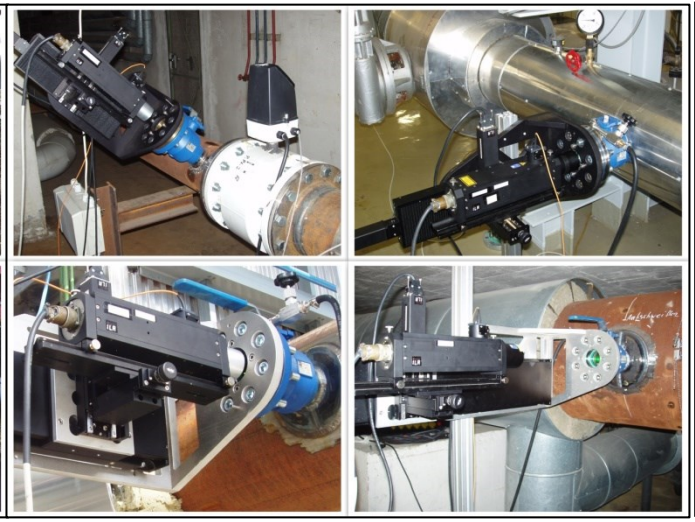
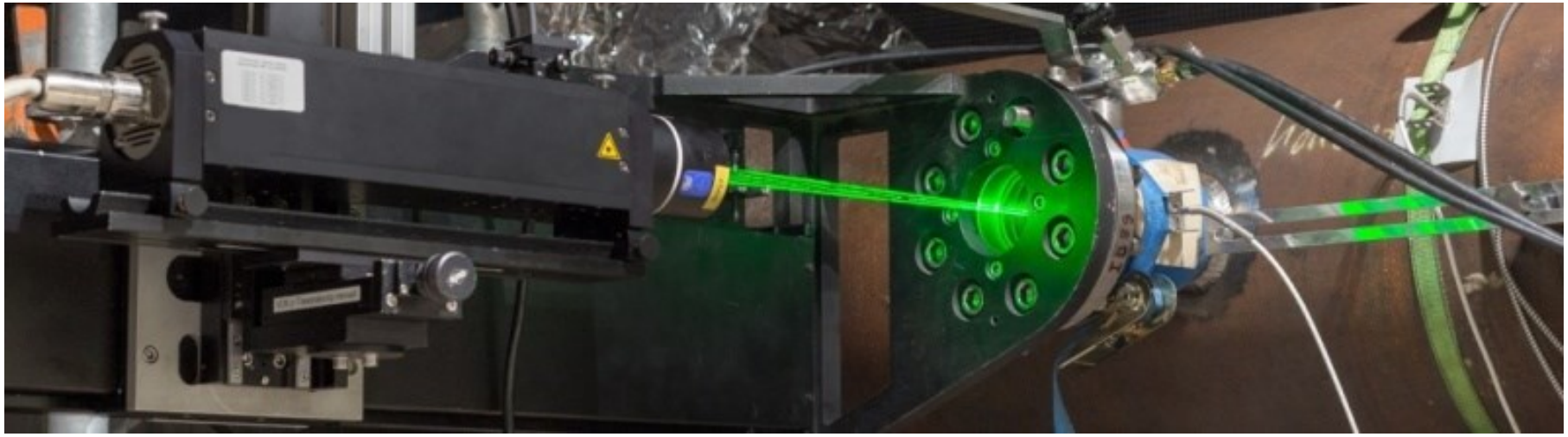
Example – Calibration sites outside



Example - Calibration sites inside

Example – Extraordinary calibration sites



Do you have any further questions? **Do not hesitate to contact us!**

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