



## HM Series Turbine Flow Meters Operating Instructions

### General

The measuring medium passes through the turbine flow meter in axial direction rotating the wheel. The RPM of the wheel is in proportion to the mean flow velocity. Our pickups in the flow meter detect the RPM of the wheel through the body of the turbine. The output signal of the pickups is an alternating voltage. The frequency of the voltage (pulses per litre) is proportional to the instantaneous flow rate.



The voltage is amplified and modified. Pulses per time unit will finally serve the evaluation of measurements (in addition, an analogue signal 4 to 20 mA is available when using the local display unit VTM).

The *K-factor* (calibration factor) of the turbine flow meter defines the exact pulse rate per litre. We calibrate our flow meters to determine their K-Factors considering customer's viscosities and specifications as far as possible.

### Evaluation

Among others, our calibration records include these specifications:

- *max. measuring error* referring to the instantaneous flow rate
- *max./min. frequency* with corresponding flow values
- *K-factors* for different flow rates
- *average K-factor* valid for the entire flow range

Please adjust your evaluation equipment considering the above specifications.

The following equation applies:

$$Q = \frac{f \times 60}{K}$$

Q = flow rate in ltr. per min  
F = frequency in Hz  
K = K-factor in pulses per litre

### Start up

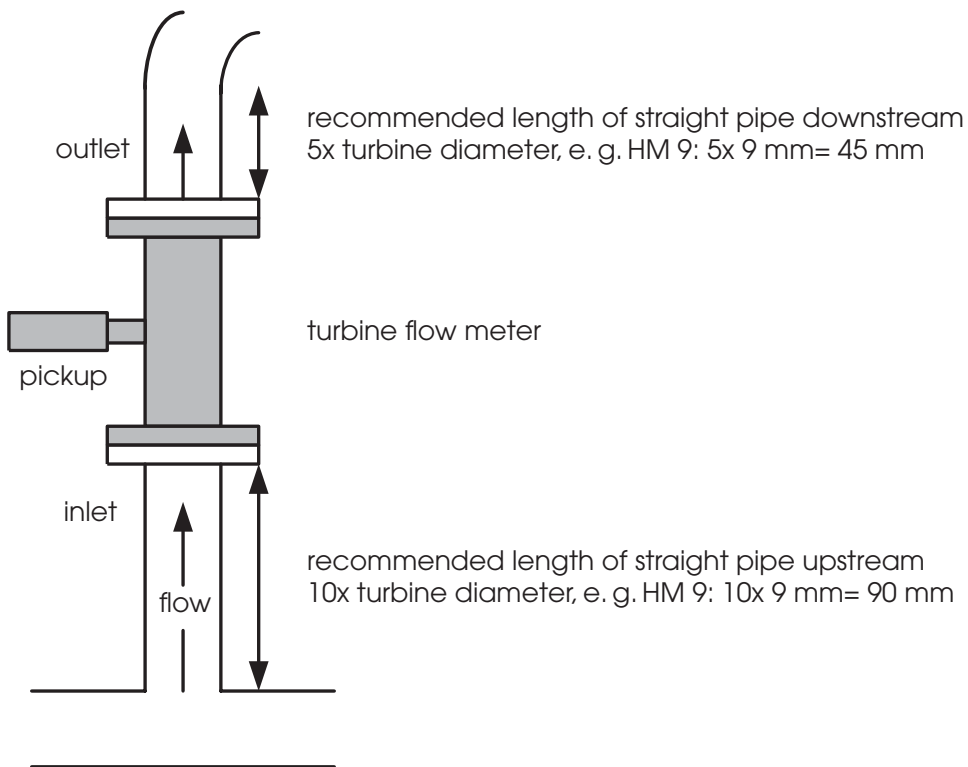
Mechanical and electrical installations, start up and maintenance shall only be effected by qualified and authorised personnel. Make sure the measuring range of the meter cannot be exceeded by more than 20%. Please purge your pipe system before installing the turbine. Fibrous contamination in particular must not enter the turbine.

Turbines HM 9 EP and HM 9 RP require filtration with 20 to 40 micron. We recommend the following filtration for all other types:

turbine's diameter	filtration
3 - 9 mm	...100 micron
9 - 50 mm	...300 micron
50 - 250 mm	...500 micron

### Installing the Turbine Flow Meter

- Choose a straight part of the pipe for installation in flow direction (arrow). The small turbines HM 9 EP and HM 9 RP must be installed in vertical position with outlet up. Furthermore, a backpressure of  $\frac{1}{2}$  m is necessary here. All other turbines will work in every position. However, K-Factors might slightly change horizontal position as we calibrate turbines below 50 mm dia. in a vertical position.
- Keep distance from sharp bends, T-pieces, valves, pumps by allowing a sufficient length of straight pipe up- and downstream of the meter.



- **Pipe connections**

Pipe connections and turbine have to be of identical diameters.

When deviations occur due to high-pressure connections the pipe connections should have an internal diameter slightly smaller than the turbine's nominal diameter.

- **Pipe reducers**

Please use only cone types with an angle of 22° or 30°.

Gaskets must not protrude into the nominal bore diameter.

## Sources of Interference

- **Turbulence and other flow disturbances**

close to the meter will falsify measuring results. Under extreme conditions they might also damage the turbine. Laminar flow rectifiers (2.5 x turbine's nominal diameter long) fitted on both sides of the meter will eliminate problems.

- **Magnetic fields and similar sources of interference**

close to the meter might affect the pickups. Especially inductive pickups type IF\* could react like an antenna.

- **Vibrating pipes**

can have a resonance effect on the pickups. You may prevent this by:

- fitting the pickup properly (see p. 4) to avoid metallic contact of the pickup tip and the bottom of the pickup bore in the turbine body.
- fitting anti-vibration joints or flexible pipes before or after the flow rectifiers (see graphic p. 2).

- **Gas bubbles in the system**

Please ensure that pipes are filled with liquid. Bubbles, air pockets or gas will falsify your measuring results. Turbine flow meters detect the total volume passing through regardless of whether it is completely liquid or containing gas or air. Meters installed in hazardous areas must only be operated completely filled with measuring medium.

- **Cavitation** (especially with measuring liquidised gases)

Always ensure a minimum downstream contra pressure to prevent cavitation:

$$\begin{aligned} & 2x \text{ pressure drop of the turbine flow meter} \\ & + \text{ vapour pressure of the measuring medium} \\ & = \text{ minimum downstream static pressure} \end{aligned}$$

## Maintenance

Adhering to the above instructions, standard turbine flow meters are free of maintenance.

Calibration values should be checked after approx. 8,000 hours of permanent operation.

## Pickups

### Fitting the pickup

This is how you avoid a metallic contact of the pickup tip and the bottom of the pickup bore:

- screw in pickup handtight without using force
- slacken pickup by a 1/4 turn
- tighten lock nut


### Connecting pickups, amplifiers, electronics

Please use only screened cables, preferably braidscreen types. For separated versions IF\* and VIEG 2.5 m maximum cable length between pickup and amplifier. Connections are as follows:

<i>pickup/amplifier</i>	<i>pin or terminal connection</i>	<i>application</i>
• VTE*/P Carrier-Frequency Amplifier	pin 1	UB +7 to 29 V/DC
	pin 2	push pull
	pin 3	0 V/mass
	pin 4	open collector
	pin 5	open collector (emitter)
• VTM* Local Display Unit	pin 1	UB +7 to 29 V/DC
	pin 2	frequency out 3-wire
	pin 3	0 V
	pin 4	-Iout
	pin 5	+Iout
	pin 6	shield
• IF*HT/K Inductive Coil and VIEG Inductive Amplifier:	pins A,C	signal
	terminal 1	UB +7 to 29 V/DC
	terminal 2	0 V/mass
	terminal 3	NPN/PNP out, active/passive, 2-wire
	terminal 4	shield
	terminal 5	IF*HT coil A
	terminal 6	IF*HT coil C
		high medium temperature up to +240°C/+350°C

For details refer to separate datasheets for pickups and amplifiers.

## Ex Protection ATEX 100a

KEM electronics are available in Ex-protected design, ATEX 100a  II 2 G EEx ia IIC T6/T4, and with the intrinsically safe power supplies type EWS. Turbine flow meters can be operated within Ex zone 1.

## Spare Parts for Turbine Flow Meters

Pickups, amplifiers and repair kits are available as spare parts.

A repair kit includes:

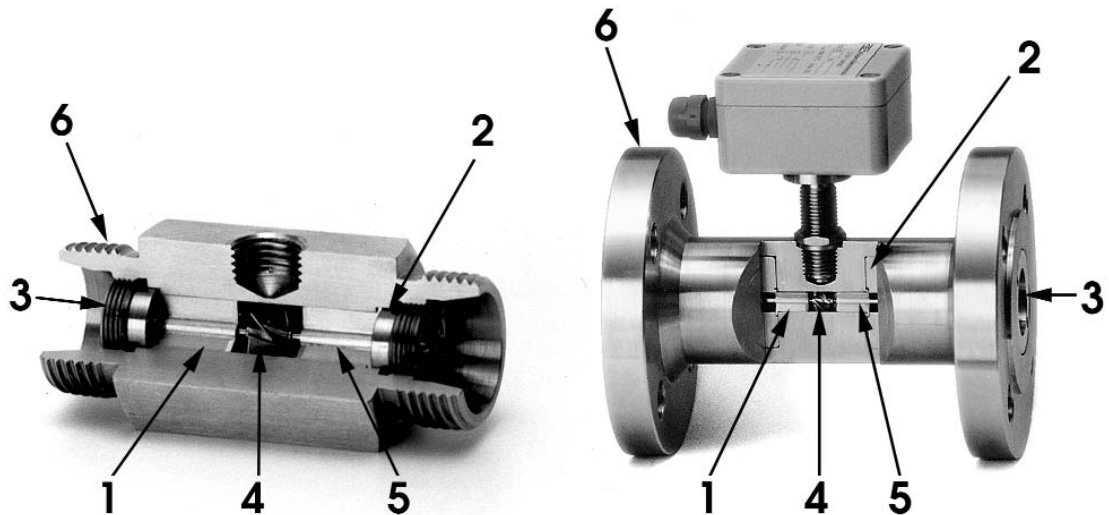
- **Two flow rectifiers with bearings**

located by projections to groove inside the housing. The projections are wedged between spacers (Ermeto turbines) or inlet cones (flange turbines) and a recess in the body. The spacers are fixed by ring nuts (3).

Ball bearings inside the rectifier bores absorb the axial forces.

- **One turbine wheel with shaft**

the wheel is placed between the rectifiers. The shaft goes inside the bearing holes of the rectifiers.



### Turbine with Ermeto fittings

- 1 = flow rectifier with bearing
- 2 = spacers
- 3 = ring nut
- 4 = turbine wheel with shaft
- 5 = ball bearing inside
- 6 = Ermeto fitting

### Turbine with flanges

- 1 = flow rectifier with bearing
- 2 = inlet cone
- 3 = ring nut
- 4 = turbine wheel with shaft
- 5 = ball bearing inside
- 6 = flange

## Disassembly of the Repair Kit

If you intend to reinstall the old parts, please place them exactly in their original positions later on. Mark the rectifiers and the wheel with a suitable pen to prevent confusion about entry- and outlet- side for re-assembly.

### 1. Remove the ring nuts

- with flange-typed meters use a pin wrench
- with Ermeto-typed meters use a screwdriver
- with larger nominal sizes please make up a suitable steel sheet tool to unscrew the rings

### 2. Remove the distance rings (Ermeto turbines) or inlet cones (flange turbines)

### 3. Pull out the flow rectifiers

subsequently from both sides by means of pointed pliers or pincers.  
Please be careful: The ball bearings must not drop out of the holes.

### 4. Please purge the turbine housing. Ensure that no sediments remain in the housing.

## Assembly or Re-assembly of the Repair Kit

In case you received a complete a complete spare repair kit from KEM, please consider that a new calibration record is part of delivery. Adjust your instrumentation in accordance with the new record.

The rectifiers and the wheel must be mounted in the same position as delivered.  
Flow directions as indicated by an arrow must be the same on the repair kit and the turbine body.

Place »E«-signed parts towards the entry  
Place »A«-signed parts towards the outlet

### 1. Insert the flow rectifiers

Please be careful: The ball bearings must not drop out of the holes.

### 2. Move the spacers into the turbine body and fix them with the ring nuts.

### 3. Torque for the ring nuts

Up to 9 mm dia.: 15 Nm • from 9 mm dia. on: 25 Nm • from 19 mm dia. on: 35 Nm

### 4. Test

On completed assembly check the meter to tightness and pressure resistance as per EC directive 97/23/EC.

The calibration data of the new repair kit are now applicable. Please adjust your evaluation electronics correspondingly.

