RUBIN
Hot water

Applications

RUBIN hot water meters operate according to the flowrate measuring principle using a Woltman turbine and are designed for high-volume water measurement. The complete modular system covers a wide measuring range in all areas of water supply management or as flow meter or flow sensor for energy measurement systems.

Features

- High overload capacity
- Symmetrical control for high accuracy in both directions (optional)
- Register unit to IP 68 (protected against continuous immersion)
- The hydrodynamic counter-pressure generated by the special geometry of the WPDH helps to ensure a floating, low-friction turbine bearing

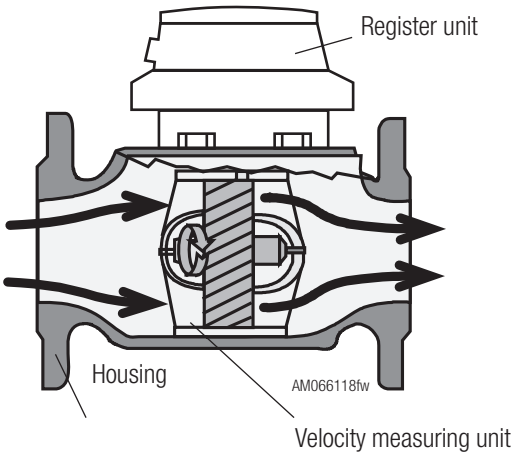
Your benefits

- The register unit can be rotated through 360° to provide the best reading position
- Optional local and/or remote display
- The hermetically encapsulated roller counter can be retrofitted with up to 3 pulsers without destroying seals
- The measuring units can be removed and certified

VD 2-301 e 06.2009

Parts and materials

RUBIN WPDH

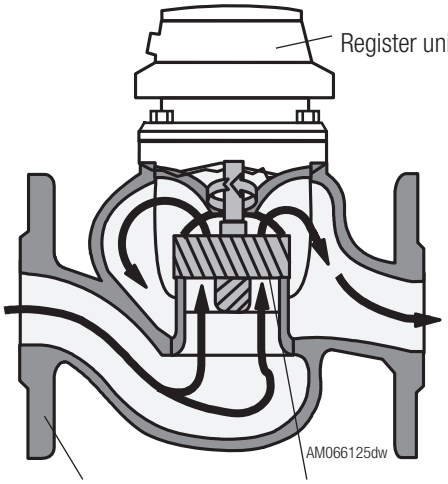


Part	Material
Housing assembly	
Housing	GG 25
Velocity measuring unit screws	stainless steel
Velocity measuring unit assembly	
Complete turbine	
Turbine	PPS
Cap jewel	sapphire
Bearing bushing for turbine	PPS
Complete regulating device	
Regulating ring	PPS
Push rod	stainless steel
Regulating bolt	brass
O-ring for regulating bolt	EPDM
Locking screw	brass
Complete velocity measuring unit body	
Head seal	EPDM
Cover flange	tinned brass
Basic body of unit	PPS
Moulded seal	EPDM
Protecting tube	PPS
Bearing ring	stainless steel
Bearing bushing for transmission shaft	PPS
Transmission shaft	PPS/stainless steel
Gear wheel for transmission shaft	PPS
Magnetic coupling	PPS/hard ferrite
Water flow stabiliser	PPS
Bearing bolt	stainless steel
Baffle plate	PPS
Register unit assembly	
Circular gasket, lip seal	EPDM
Filler plug, centring ring, conversion ring	PPO
Sealing plate	brass
Sealing plug	PPS
Sliding ring	PC
Mechanism	glass/copper
Nameplate	PV film
Cover	POM

Explanation of abbreviations

GG	Grey cast iron
PPS	Polyphenylene sulphide
PPO	Polyphenylene oxide
POM	Polymethylene oxide
PA	Polyamide
PC	Polycarbonate
EPDM	Ethylene/propylene diene rubber
PV	Plyvinyl

RUBIN WSDH

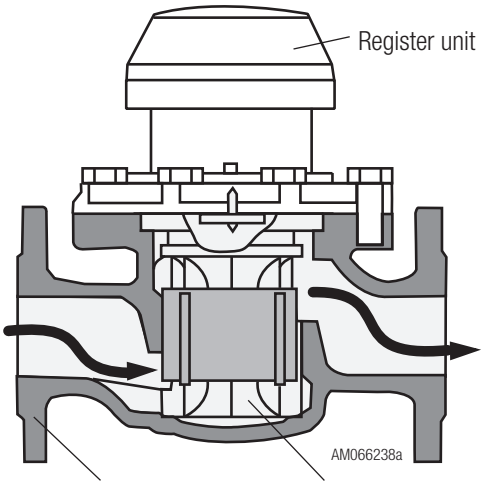


Part	Material
Housing assembly	
Housing	GG 25
Velocity measuring unit screws	stainless steel
Velocity measuring unit assembly	
Complete turbine	
Turbine / turbine shaft	PPS
Pin	hard metal
Washer, bushing	stainless steel
Bearing plate and locating ring	sapphire
Bearing sleeve, clip	brass
Magnet	hard ferrite
Complete regulating device	
Regulating vane	PPS
Push rod, threaded pin, bolts	stainless steel
O-ring	EPDM
Complete velocity measuring unit body	
Base pin, washer, hexagonal nut	stainless steel
Pin	hard metal
Upper section of unit	PPS
Lower section of unit	PPS
Bushing	stainless steel
Register unit assembly	
Circular gasket, lip seal	EPDM
Filler plug, centring ring, conversion ring	PPO
Sealing plate	brass
Sealing plug	PPS
Sliding ring	PC
Mechanism	glass/copper
Nameplate	PV film
Cover	POM

Explanation of abbreviations

GG	Grey cast iron
PPS	Polyphenylene sulphide
PPO	Polyphenylene oxide
POM	Polymethylene oxide
PC	Polycarbonate
EPDM	Ethylene/propylene diene rubber
PV	Polyvinyl

RUBIN SMQ



Part	Material
Housing assembly	
Housing	GS
Velocity measuring unit screws	stainless steel
Velocity measuring unit assembly	
Complete turbine	
Turbine	PEEK
Bearing bushing	sapphire
Bearing pin	hard metal
Magnet	ferrite
Complete velocity measuring unit body	
Velocity measuring unit	PEEK
Clips	stainless steel
Regulating unit	PEEK/stainless steel
Sealing plate	stainless steel
Flat seal	Novapress
Register unit assembly	
Transmission gear wheels	PPS
Bottom plate of mechanism	PPS
Bearings	sapphire/PPS
Upper housing of mechanism	PPS
Numbered roller indicators, gear wheels	PPS
Cover	PC

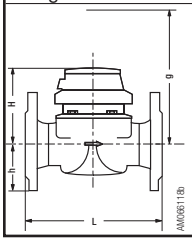
Explanation of abbreviations

GS	Cast steel
PPS	Polyphenylene sulphide
PC	Polycarbonate
PEEK	Polyetheretherketone
Novapress	Aramide rubber

Range

RUBIN WPDH

- Woltman turbine meters with dry-type register units, IP 68
- Approvals:
  - 79/830/EWG classe B (better than EN 1434 classe2)
  - Swiss domestic approval ZW115 (flow sensor), measurement error limits according to OIML R75
  - Swiss domestic approval 310 (hot water meter), measurement error limits according to OIML R72
- For horizontal or vertical installation; a length of straight pipework of 3 x DN is recommended upstream of the meter
- Powder-coated grey cast iron housing with flange connections
- Flanges according to EN1092, PN 16
- Max. temperature: 130 °C

Nominal size		**DN**	**mm**	**40**	**50**	**65**	**80**	**100**	**125**	**150**	**200**	**250**	**300** [2]
			inches	1 1/2	2	2 1/2	3	4	5	6	8	10	12
Article No.				92483	92493	92494	92495	92496	92497	92498	92524	180536	180536
Maximum flowrate	(± 2 %)	Qmax [1]	m^3/h	20	30	60	90	140	200	300	500	1000	1200
Nominal flow	(± 2 %)	**Qn**	**m^3/h**	**10**	**15**	**25**	**45**	**70**	**100**	**150**	**250**	**500**	**600**
Transitional flowrate	(± 2 %)	Qt	m^3/h	1.8	1.8	2	3.2	4.8	8	12	20	45	50
Minimum flowrate	(± 5 %)	Qmin	m^3/h	0.6	0.6	1.0	1.4	2.0	3.5	4.5	8	20	25
Starting flow at approx.			m^3/h	0.25	0.25	0.3	0.35	0.6	1.1	1.7	2.0	10	15
According to EEC type approval class B [3]													
Maximum flowrate	(± 3 %)	Qmax	m^3/h	-	30	50	80	120	200	300	500	800	1200
Nominal flowrate	(± 3 %)	**Qn**	**m^3/h**	**-**	**15**	**25**	**40**	**60**	**100**	**150**	**250**	**400**	**600**
Transitional flowrate	(± 3 %)	Qt	m^3/h	-	2.25	3.75	6	9	15	22.5	37.5	60	90
Minimum flowrate	(± 5 %)	Qmin	m^3/h	-	0.6	1	1.6	2.4	4	6	10	16	24
Flowrate at $\Delta p = 1$bar		Q	m^3/h	82	94	101	330	460	570	1050	2500	6200	11200
Pressure loss at Qn		Δp (Qn)	bar	0.032	0.018	0.02	0.025	0.03	0.05	0.02	0.03	0.008	0.016
Weight		approx. kg		7.5	8	10	14	18	21	36	51	72	99
		Overall length	L	220	200	200	225	250	250	300	350	450	500
			h	69	73	85	95	105	118	135	162	194	226
			H	120	120	120	150	150	160	177	206	231	256
			g	200	200	200	270	270	280	356	441	466	491
		Outer diameter		150	165	185	200	220	250	285	340	405	460
		Bolt circle diameter		110	125	145	160	180	210	240	295	355	410
		Diameter of holes		4x18	4x18	4x18	8x18	8x18	8x18	8x22	12x22	12x26	12x26

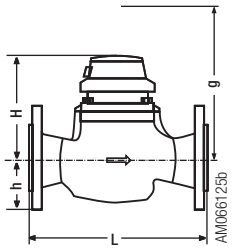
1) During a maximum total of 24 h
2) Supplied on request
3) EEC type approval of model: D22.16 96.01 class B; the values shown are those taken from the official verifications

Reed pulsers	**RD 02/RD 022**										
Pulse value (low)	l/pulse	100	100	100	100	100	100	1000	1000	1000	1000
Pulse frequency at Qmax	Hz	0.055	0.083	0.167	0.250	0.389	0.556	0.083	0.139	0.278	0.333
Pulse value (high)	l/pulse	250	250	250	250	250	250	2500	2500	2500	2500
Pulse frequency at Qmax	Hz	0.011	0.033	0.067	0.100	0.156	0.222	0.033	0.056	0.111	0.133
Optoelectronic pulsers	**OD AM**										
Pulse value	l/pulse	1	1	1	1	1	1	10	10	10	10
Pulse frequency at Qmax	Hz	5.555	8.333	16.67	25.00	38.89	55.56	8.333	13.89	27.78	33.33
Pulse frequency at Qmin	Hz	0.167	0.167	0.278	0.389	0.556	0.972	0.125	0.222	0.694	0.833
	OD 04										
Pulse value	l/pulse	10	10	10	10	10	10	100	100	100	100
Pulse frequency at Qmax	Hz	0.017	0.833	1.667	2.500	3.889	5.556	0.833	1.389	2.778	3.333
Pulse frequency at Qmin	Hz	0.555	0.017	0.028	0.039	0.056	0.097	0.013	0.022	0.069	0.083

Pressure loss curves
(see page 14)

RUBIN WSDH

- Woltman turbine meters with dry-type register units, IP68
- Approvals:
  - 79/830/EWG classe A (better than EN 1434 classe2)
  - Swiss domestic approval ZW115 (flow sensor), measurement error limits according to OIML R75
  - Swiss domestic approval 310 (hot water meter), measurement error limits according to OIML R72
- For horizontal installation; a length of straight pipework of 3 x DN is recommended up stream of the meter
- Powder-coated grey cast iron housing with flange connections
- Flanges according to EN1092, PN 16
- Max. temperature: 130 °C

Nominal size		**DN**	**mm**	**50**	**65**	**80**	**100**	**150**
			inches	2	2 1/2	3	4	6
Article No.				92379	92380	92381	92382	180529
Maximum flowrate	(± 2 %)	Qmax [1]	m^3/h	30	60	85	125	300
Nominal flow	(± 2 %)	**Qn**	**m^3/h**	**15**	**25**	**40**	**60**	**150**
Transitional flowrate	(± 2 %)	Qt	m^3/h	1.5	2.5	2.5	4	12
Minimum flowrate	(± 5 %)	Qmin	m^3/h	0.25	0.30	0.30	0.50	0.80
Starting flow at approx.			m^3/h	0.06	0.07	0.1	0.15	0.5
According to EEC type approval class A [2]								
Maximum flowrate	(± 3 %)	Qmax	m^3/h	30	50	80	120	300
Nominal flowrate	(± 3 %)	**Qn**	**m^3/h**	**15**	**25**	**40**	**60**	**150**
Transitional flowrate	(± 3 %)	Qt	m^3/h	3	5	8	12	30
Minimum flowrate	(± 5 %)	Qmin	m^3/h	1.2	2	3.2	4.8	12
Flowrate at $\Delta p = 1$bar		Q	m^3/h	60	98	138	195	400
Pressure loss at Qn		Δp (Qn)	bar	0.065	0.068	0.09	0.102	0.18
Weight		approx. kg		14	18	20	33	92
		Overall length	L	270	300	300	360	500
			h	80	100	100	115	180
			H	171	171	171	211	311
			g	291	311	311	381	581
		Outer diameter		165	185	200	220	285
		Bolt circle diameter		125	145	160	180	240
		Diameter of holes		4x18	4x18	8x18	8x18	8x22

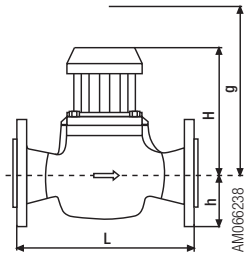
1) During a maximum total of a few minutes
2) EEC type approval of model: D22.16 96.03 class A; the values shown are those taken from the official verifications

Reed pulsers	**RD 02 / RD 022**					
Pulse value (low)	l/pulse	100	100	100	100	1000
Pulse frequency at Qmax	Hz	0.083	0.167	0.236	0.347	0.083
Pulse value (high)	l/pulse	250	250	250	250	2500
Pulse frequency at Qmax	Hz	0.033	0.067	0.094	0.139	0.033
Optoelectronic pulsers	**OD AM**					
Pulse value	l/pulse	1	1	1	1	10
Pulse frequency at Qmax	Hz	8.333	16.67	23.61	34.72	8.33
Pulse frequency at Qmin	Hz	0.069	0.083	0.083	0.139	0.022
	OD 04					
Pulse value	l/pulse	10	10	10	10	100
Pulse frequency at Qmax	Hz	0.833	1.667	2.361	3.472	0.833
Pulse frequency at Qmin	Hz	0.007	0.008	0.008	0.014	0.002

Pressure loss curves
(see page 14)

RUBIN SMQ

- Woltman turbine meters with dry-type register unit
- Approvals:
  - Better than metrological cl. A acc. to the directive 79/830/EWG or cl. 2 acc. to EN1434
  - Swiss domestic approval ZW115 (flow sensor), measurement error limits according to OIML R75
  - Swiss domestic approval 310 (hot water meter), measurement error limits according to OIML R72
- For horizontal installation; a length of straight pipework of 3 x DN is recommended up stream of the meter
- Powder-coated cast iron housing with flange connections
- Flanges according to EN1092, PN 40
- Max. temperature: 200 °C

Nominal size		**DN**	**mm**	**50**	**80**	**100**
			inches	2	3	4
Article No.				92490	92491	92492
Maximum flowrate	(± 2 %)	Qmax [1]	m^3/h	25	70	100
Nominal flow	(± 2 %)	**Qn**	**m^3/h**	**15**	**40**	**60**
Transitional flowrate	(± 2 %)	Qt	m^3/h	2.25	6	9
Minimum flowrate	(± 5 %)	Qmin	m^3/h	0.7	1.6	2.4
Starting flow at approx.			m^3/h	0.25	0.35	0.4
According to EEC type approval class A						
Maximum flowrate	(± 3 %)	Qmax	m^3/h	25	70	100
Nominal flowrate	(± 3 %)	**Qn**	**m^3/h**	**15**	**40**	**60**
Transitional flowrate	(± 3 %)	Qt	m^3/h	2.25	6	9
Minimum flowrate	(± 5 %)	Qmin	m^3/h	0.6	1.6	2.4
Flowrate at Δp = 1bar		Q	m^3/h	60	138	195
Pressure loss at Qn		Δp (Qn)	bar	0.065	0.09	0.102
Weight		approx. kg		19.7	27.6	52.7
		Overall length				
			L	270	300	360
			h	80	100	110
			H	195	205	235
			g	325	345	385
		Outer diameter		165	200	235
		Bolt circle diameter		125	160	190
		Diameter of holes		4x18	8x18	8x22

1) During a maximum total of a few minutes

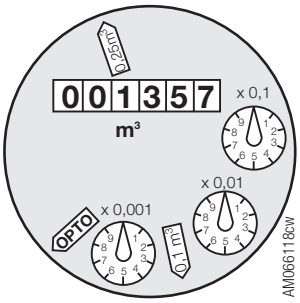
Reed pulsers	**K 02**			
Pulse value (low)	l/pulse	100	100	100
Pulse frequency at Qmax	Hz	0.069	0.194	0.278
Pulse value (high)	l/pulse	250	250	250
Pulse frequency at Qmax	Hz	0.028	0.078	0.111
Induktive pulsers	**K 05**			
Pulse value	l/pulse	10	10	10
Pulse frequency at Qmax	Hz	0.694	1.944	2.778
Pulse frequency at Qmin	Hz	0.017	0.044	0.067
	K 06			
Pulse value	l/pulse	1	1	1
Pulse frequency at Qmax	Hz	6.944	19.444	27.778
Pulse frequency at Qmin	Hz	0.167	0.444	0.667

Pressure loss curves

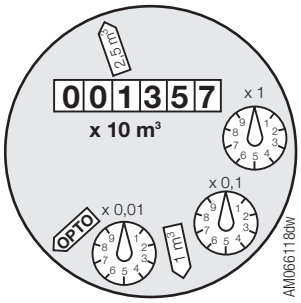
(see page 15)

Roller counters

WPDH 40...125 and WSDH 50...100



WPDH 150...300 and WSDH 150



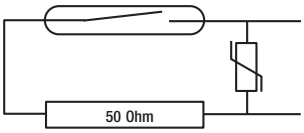
SMQ 50...100

Pulsers

WPDH and WSDH

The Reed and optoelectric pulsers can be retrofitted without destroying the seals. The Reed pulser can be installed in two positions with different pulse values as indicated on the dial.

Reed pulsers RD 02



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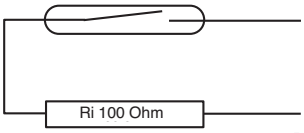
RD 022 Reed pulser



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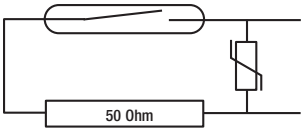
Switch type	• Reed contact tube protected with an inert gas filling; plug-in design
Contact protection	• RD 02: with protective resistor (50 Ω) and varistor • RD 022: with protective resistor (100 Ω)
Switch voltage	• RD 02: max. 48 VAC or DC • RD 022: max. 125 VAC or DC
Switch current	• RD 02: max. 200 mA • RD 022: max. 35 mA
Quiescent current	• Contact open
Switch power	• RD 02: max. 4 W • RD 022: max. 2 W
Pulse duration	• independent of the flowrate; continuous contact is possible
Ambient temperature	• -10 ... +70 °C
Protection class	• IP 68 to IEC 144
Connection	• Fixed mounting cable, length: 3 m
Article No. RD 02	• 93748
Article No. RD 022	• 93749

Optoelectronic pulsers OD AM and OD 04

Switch	• IR reflex light barrier to DIN 19234, plug-in design
Switch voltage	• 8.2 VDC
Switch current	• <1.2 mA
Quiescent current	• >2.1 mA
Forward/reverse flow	• This is integrated in OD 04 by means of an additional current recognition threshold at 1.5 mA • OD AM has an integrated forward/reverse flow recognition feature and it only emits forward flow pulses (jitter surppression)
Ambient temperature	• -10 ... +70 °C
Protection class	• IP 68 to IEC 144
Connection	• Fixed mounting cable, length: 3 m
Article No. OD AM	• 93751
Article No. OD 04	• 93753

SMQ

Reed pulsers K02



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Switch	• Reed switch with plug-in design
Contact protection	• with protective resistor and varistor
Switch voltage	• max. 48 VAC or DC
Switch current	• max. 200 mA
Quiescent current	• Contact open
Switch power	• max. 4 W
Pulse duration	• depends on flowrate; continuous contact is possible
Ambient temperature	• -10 ... +60 °C
Protection class	• IP 66 to IEC 144
Connection	• Cable, length: 2.5 m
Pulse values	• 100 litres / 250 litres (2 installation positions)
Article No.	• 93715

Inductive pulsers K05/K06

Switch	• HF inductive control head to DIN 19234, as slot proximity switch for a plug-in socket (easy to change)
Switch voltage	• 8 VDC
Power consumption	• gap open ≥3 mA (internal resistance ≈1 kΩ) • gap closed ≤1 mA (internal resistance ≈7 kΩ) Changes in the internal resistance are used to control auxiliary transistor relays.
Pulse duration	• depends on flow, continuous contact is possible
Ambient temperature	• -10 ... +60 °C
Protection class	• IP 54 to IEC 144
Connection	• Cable, length: 2.5 m
Polarity	• Brown lead (+) / blue lead (-) to EN 50044
Article No. K05	• 93722
Article No. K06	• 93754

Applications for WPDH and WSDH

Reed pulsers RD 02 / RD 022 (passive)
- Remote transmission, remote display
- Input signal for control and management systems
- Data logging
- As a pulser for the flow sensor of heat measuring points
- Input signal for the AMBUS® IS module with M-Bus output signal

Optoelectronic pulser OD AM (small pulse value)
- As a pulser for the flow sensor of heat measuring points where maximum accuracy is required
- Standard application for all heat measuring points with calculating units and NAMUR-compatible pulse inputs
- To form instantaneous values
- For cooling measurements
- For automatic correction of pulses due to hydraulic oscillations (jitter)

Optoelectronic pulser OD 04 (large pulse value)
- As a pulser for the flow sensor of heat measuring points
- Suitable for auxiliary devices which, by means of an integrated forward/reverse flow detector, can generate the correct volume total when the direction of flow changes

Applications for SMQ

Reed pulsers K 02 (passive)
- Remote transmission, remote display
- Input signal for control and management systems
- Data logging
- As a pulser for the flow sensor of heat measuring points
- Input signal for the AMBUS® IS module with M-Bus output signal

Inductive pulsers K 06 (small pulse value)
- As a pulser for the flow sensor of heat measuring points where maximum accuracy is required
- Standard application for all heat measuring points with calculating units and NAMUR-compatible pulse inputs
- To form instantaneous values
- For cooling measurements

Inductive pulsers K 05 (large pulse value)
- As a pulser for the flow sensor of heat measuring points
- Application for all heat measuring points with calculating units and NAMUR-compatible pulse inputs

Activation, selection and evaluation

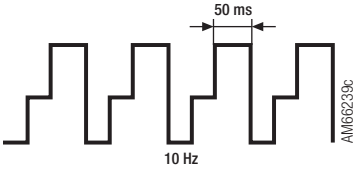
Power supply for pulsers
All pulsers require some form of activating device. The optoelectronic (OD) and inductive pulsers (K05 / K06) are powered by the heat calculating unit or by means of a suitable frequency converter.
For remote totalization or display of the measured volume flow, passive (Reed) pulsers are also available (RD,K02). The pulser must be supplied with voltage from an auxiliary device. In the case of passive pulsers, battery-powered devices are another possibility.

Choice of a suitable pulser
The choice of a suitable pulser and of an adequate pulse value depends on the application. For instantaneous flow values, analogue signals and for use as a flow sensor for heat energy totalizers, pulsers with small pulse values should generally be selected (such as the OD AM optoelectronic pulser or the K06 inductive pulser with pulse values of 1 litre). For remote totalization, large pulse values are usually preferable (for example, Reed RD 02 pulser with a pulse value of 250 litres up to DN 125). For evaluation devices powered by battery, it is only possible to use Reed pulsers.

Requirements of the activating devices

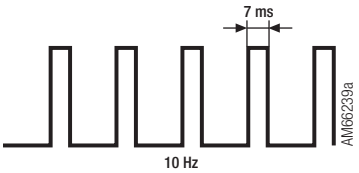
With most pulsers, the duration of the pulse depends on the flowrate (except for OD AM pulsers). In these cases continuous contact may occur if there is zero flow. For this reason, the activating device must be able to tolerate a continuous load; if this is not the case, provision should be made for a protective device.

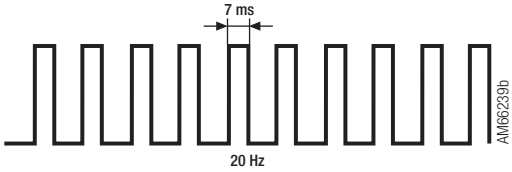
Example: with the OD 04 pulser, the pulse length depends on the flowrate since the active / passive ratio is always the same. During forward flow the rising flank of the pulse features an additional current threshold or step at 1.5 mA. During reverse flow, the current threshold is located on the falling flank of the pulse.



Correct pulse evaluation

When the flow is interrupted, oscillations of the liquid column may occur in the installation (hydraulic vibration with slightly alternating forward / reverse flows, known as jitter). This may give rise to pulses which will be exclusively registered as forward flow by the auxiliary device. Pulses of this sort are not disruptive as regards forming the instantaneous value, since the frequency is very low. However, when a metering function is being controlled with the pulser (as is the case with all heat metering points), the OD AM optoelectronic pulser should be selected as it can filter out the pulses generated by the forward / reverse fluctuations with the help of suitable electronic circuitry. The pulse width of the OD AM pulser is always constant. It is based on the maximum frequency of approximately 70 Hz, corresponding to about 7 ms for all pulse frequencies. Rising and falling pulse flanks are always identical, and no reverse flow pulses are emitted.





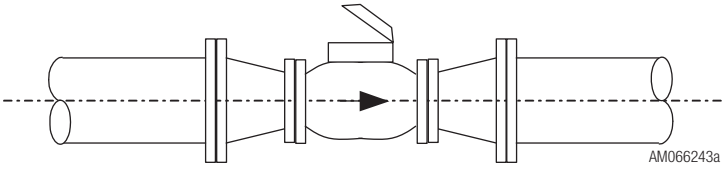
Note

When using the OD AM pulser in conjunction with the CALEC® calculating unit, it is important to remember that the bounce filter (normally used for passive Reed pulsers) must not be set when programming this unit. The NAMUR 200 Hz input on the calculating unit must be used.

Installation notes

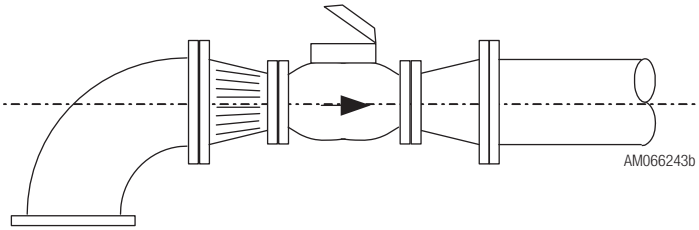
Nominal sizes: pipes, meters and pipe reducers

The choice of the nominal meter size should not automatically be based on the nominal size of the pipe. The decisive factor is the highest flowrate that occurs continuously in the pipe - this determines the nominal flowrate Qn of the meter.



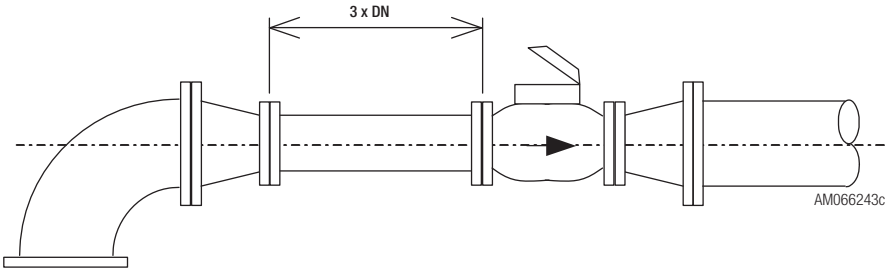
Pipe bends and flow straighteners

The flow profile is modified by the pipe bend to such an extent that it alters the incoming flow to the meter turbine. As a result, measuring accuracy is impaired which can be prevented by suitable constructural precautions. For these purposes, flow straighteners which regularize the profile can be used, these being installed directly downstream of the pipe bend. If there is enough space, additional "smoothing" sections should be added. Flow straighteners also exist in combination with pipe reducers.



Inlet and outlet sections

Woltman meters attain maximum accuracy if adequate inlet and outlet sections are included in the design of the measuring point. The inlet section should be at least 3 x DN or a flow straightener should otherwise be installed. The requirements for the outlet section are less strict since the only essential requirement is to avoid abrupt changes of cross-section directly after the meter.



Mounting height

RUBIN Woltman meters have exchangeable velocity measuring units which can be tested and calibrated independently of the housing. For this purpose, the old units are removed upwards. When designing the installation, it is important to ensure that there is adequate space above the meter for removal.

Installation position / vertical pipes

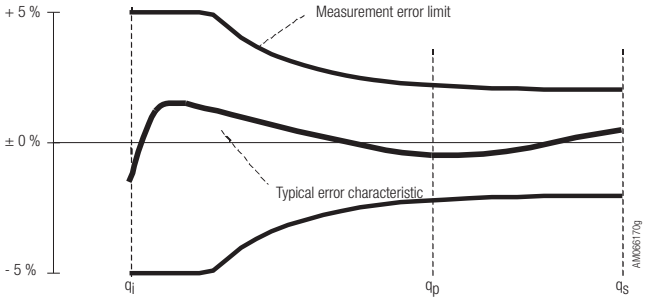
Note: with vertical pipes, you must always use a RUBIN Woltman meter of type WPDH (but if a WSDH has to be fitted specific to the installation, we would remind you that the metrological approval requirements will not be satisfied with the meter installed in this position). Meters must not be installed upside-down as then the metrological approval requirements will not be met.

Electrical installation

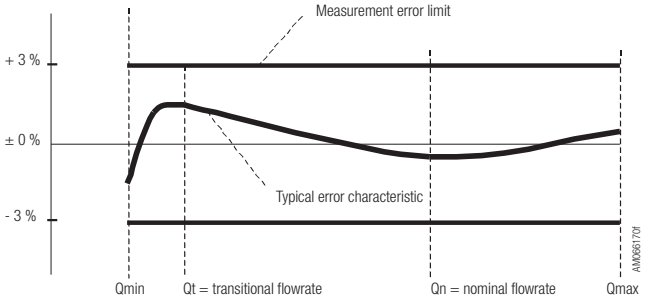
Electrical cables and installation must be carried out by a specialist in accordance with legal requirements.

Measurement error limits

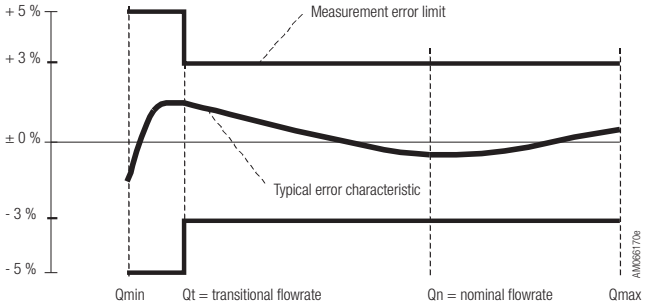
Measurement error limits according to EN 1434 for flow sensors
Measurement error limits for the flow sensor part of a heat meter



Measurement error limits according to OIML R72 and R75 Standards for flow sensors (Qn >3 m³/h)
Measurement error limits for the flow sensor part of a heat meter where Qn >3 m³/h

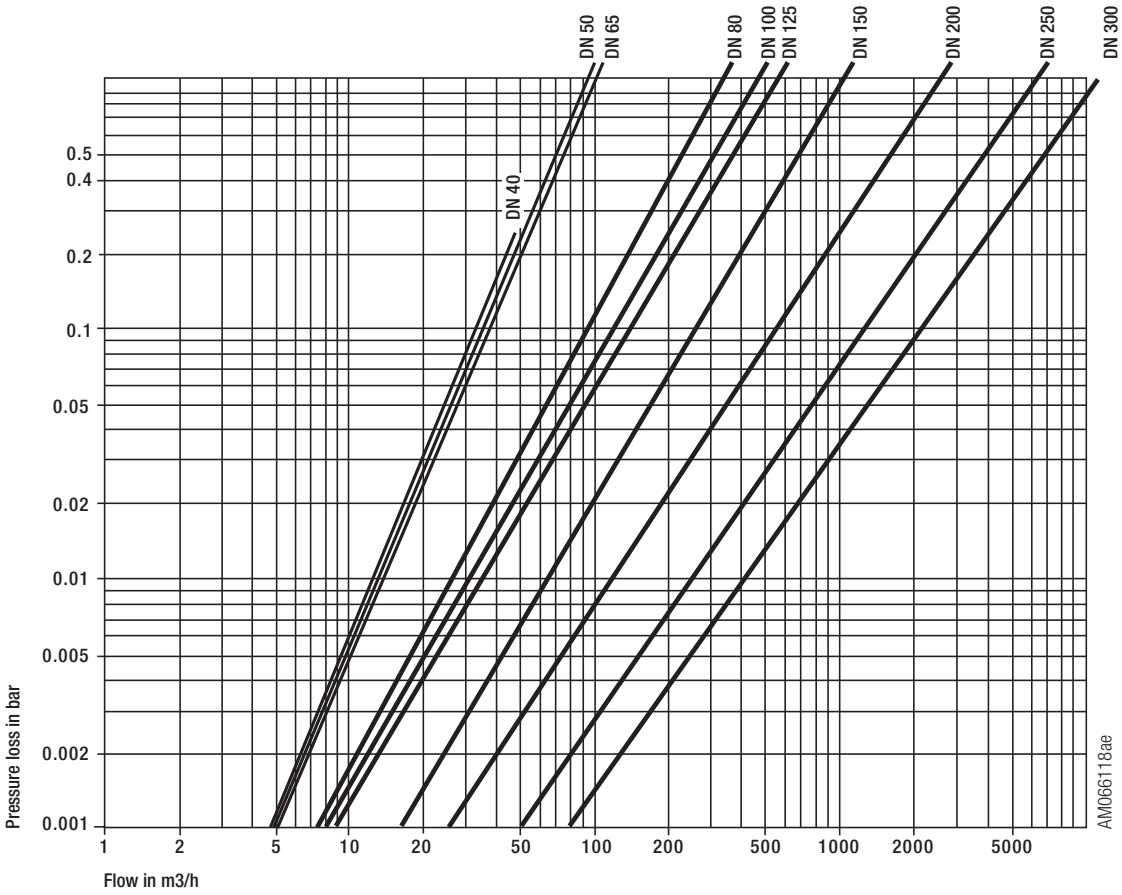


Measurement error limits according to OIML R72 Standards and to Directive 79/830/EEC for hot water meters
Measurement error limits for hot water meters according to OIML R72 as defined by the 79/830/EEC Directive.

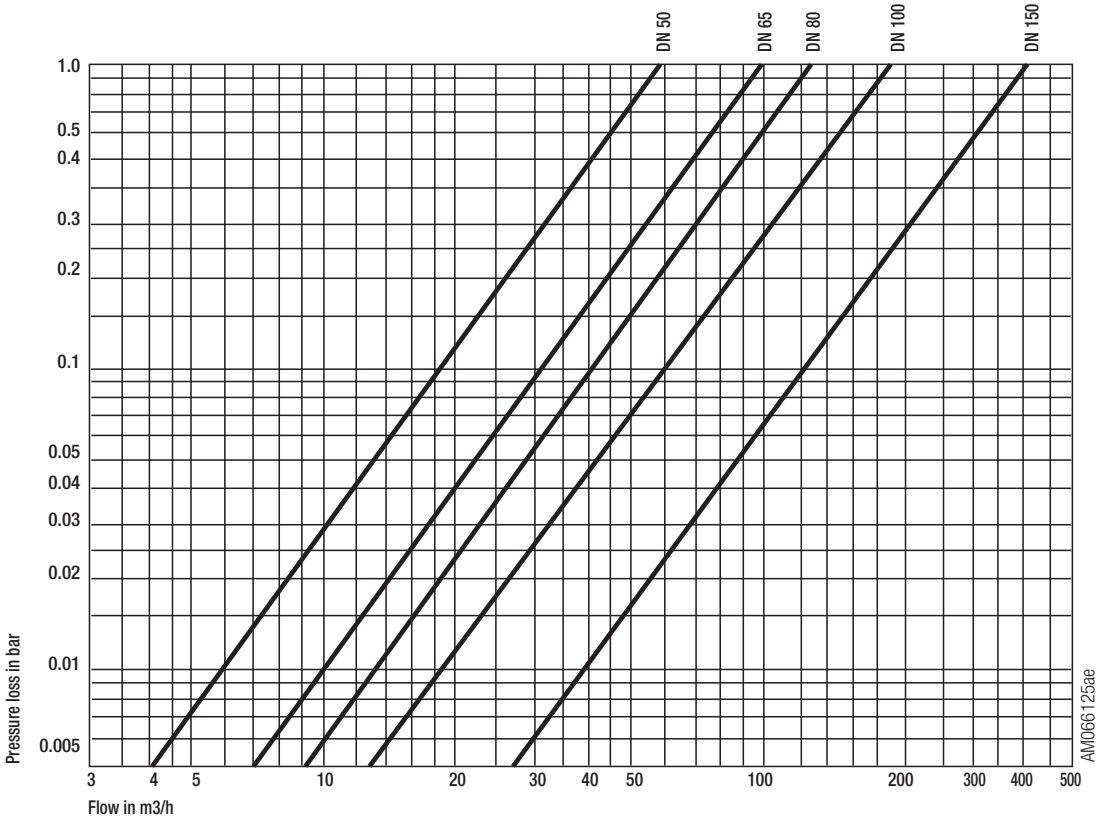


Pressure loss curves

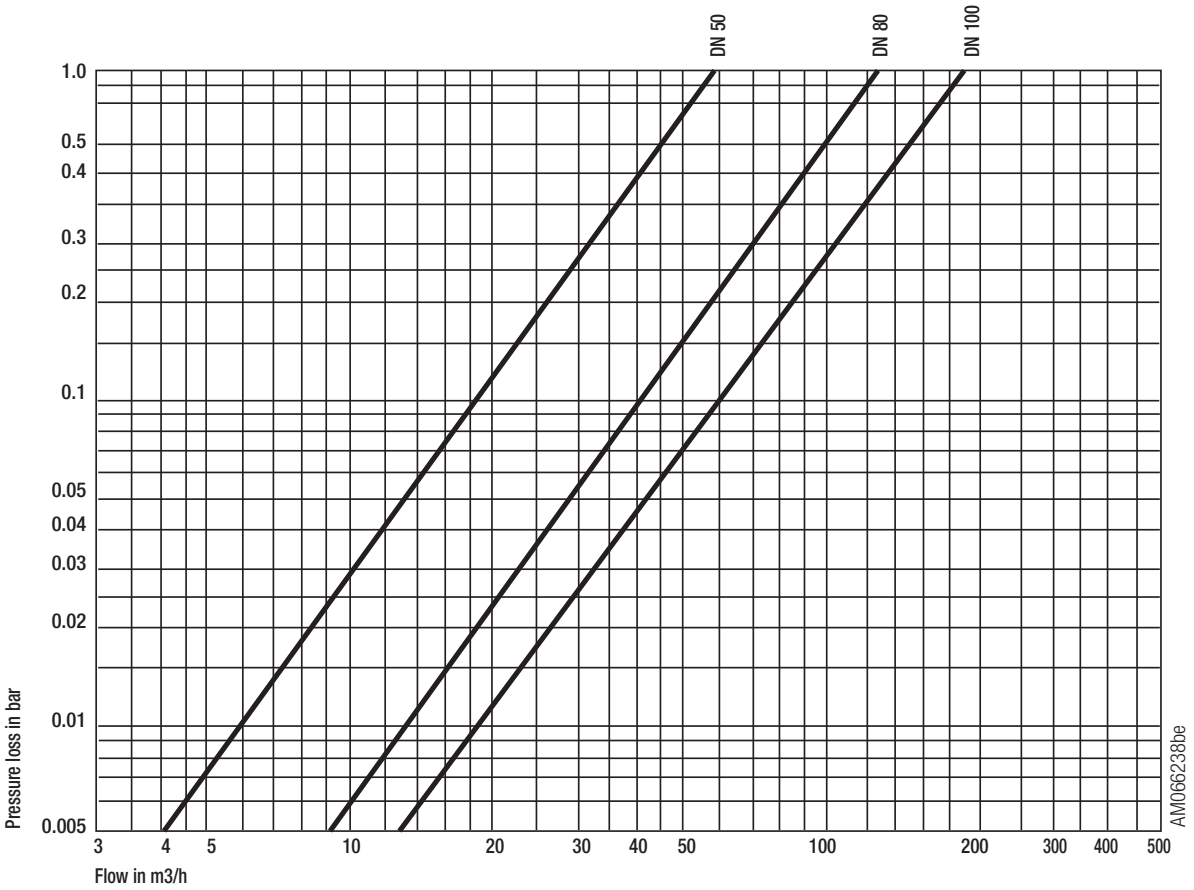
WPDH



WSDH



SMQ


DN 50
DN 80
DN 100
1.0
0.5
0.4
0.3
0.2
0.1
0.05
0.04
0.03
0.02
0.01
0.005
Pressure loss in bar
3
4
5
10
20
30
40
50
100
200
300
400
500
Flow in m3/h
AM066238be

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