

General Specifications

Model RAKD Small Metal Rotameter

A float is guided concentrically in a conic metal tube. The position of this float is magnetically transmitted to the indicator. The short-tube Rotameter is used for measurement of low flow rates of liquids and gases. Its special application is in troubled, opaque or aggressive mediums and under high pressure. The instrument is mounted in a vertical pipeline with flow direction upwards.

When the process conditions are changed the scale needs to be replaced by a new one of which the values should be calculated.

FEATURES

- Different process connections like internal threads and flanges
- With fine control valve (horizontal connection) and without valve (vertical connection)
- All wetted parts of stainless steel AISI 316Ti (1.4571)
- Accuracy class 4 acc. VDI/VDE 3513
- Round industrial standardized stainless steel housing with degree of protection IP 65
- Light, guided floats resulting in low pressure loss and stable float movement
- Maximum flow range 1-250 l/h water resp. 40-8000 l/h air, portioned in 13 flow ranges with a relation of 1:10
- Pressure controller (normal up to 25 bar at 20°C) for a maximum flow of 100 l/h water resp. 3.250 l/h air (only in combination with valve)
- Electric μ P-controlled transmitter with linearized output
- Electrical connection by fast connection technique (Quickon)
- Limit switches, also available as "Fail Safe" version
- Connection of common transformer isolated barriers and transmitter power supplies possible
- Alignment possibility of the electric transmitters with additional tuner (Service Box)
- Intrinsically safe version (Ex-i) (ATEX, CSA, SAA, NEPSI)



Fig. 1a Indicator RAKD with tube without valve



Fig. 1b Tube RAKD with valve

CONTENTS

Features	page 1
Standard Specification	page 2
Controller (/R1, /R3)	page 3
Hazardous Area Specifications	page 3
Installation	page 4
Temperature Specification	page 6
Model and Option Specifications	page 6
Dimensions	page 12
Connection Types	page 15
Installation Lengths depending on Connection Type and Size..	page 15
Weights	page 15
Planning Hints	page 15

STANDARD SPECIFICATIONS

The responsibility with respect to the suitability and according application of our flowmeter is only situated by the customer.

METERING TUBES

Materials of wetted parts	: Stainless steel AISI 316Ti (1.4571) other materials on request
Fluids to be measured	: Liquid or gas
Measuring range	: see flow table
Measuring range ratio	: 10:1
Process connections	:
- Inner thread	: G 1/4; 1/4 NPT; G 3/8; 3/8 NPT
- Cutting ring	: 6 mm; 8 mm; 10 mm; 12 mm
- Cutting ring (Swagelok)	: 6 mm; 8 mm; 10 mm; 12 mm
- Nozzle	: 6 mm; 8 mm
- Flange	: - acc. EN 1092-1 DN15 and DN25 PN40; - acc. ASME B 16.5 1/2" and 1" 150lbs, 300lbs
Process pressure	: depends on process connection; see model code
Process temperature	: without valve -25°C to 250°C with valve -25°C to 150°C See also fig. 6. Lower temperatures on request.
Accuracy	: class 4 acc. VDI/VDE 3513 ±4% f.s.
Installation	:
- Installation position	: vertical
- Flow direction	: upwards
- Face to face length	: 125 mm (with flange 250 mm)
Weight	: see table 9
Process-/ Ambient temperature	: see fig. 6

LOCAL INDICATOR

(Indicator/Code -T)

Principle	:
The indication is made by magnetic coupling of a magnet enclosed in the float and a magnet in the indication unit, which follows the movements of the float.	
Indication scale	: Flow units
Housing	:
- Material	: Stainless steel AISI 304 (1.4301)
- Protection	: IP65
Transportation and storage condition	: -40°C to +110°C

ELECTRONIC TRANSMITTER

(Indicator/Code -E)

Temperature range	: -25°C to 65°C
Transportation and storage condition	: -40°C to +70°C
Power supply	: 13.5-30 V DC
Load resistance	: (U-13.5V)/20mA
Analog output	: 4-20 mA
Linearity	: ≤ ± 0.25% f.s.
Hysteresis	: ≤ ± 0.15% f.s.
Repeatability	: ≤ ± 0.16% f.s.
Influence of power supply	: ≤ ± 0.1% f.s.
Temp. coefficient of analog output	: ≤ ± 0.5% /10 K f.s.
AC-part of analog output	: ≤ ± 0.15% f.s.
Long time stability	: ≤ ± 0.2% / year
Maximum output current	: 21.5 mA

Output current in case of failure

	: ≤ 3.6 mA (NAMUR NE 43)
Response time (99%)	: appr. 1 s
Electrical connection	: QUICKON
- Cable diameter	: 4-6 mm
- Cable cross section	: 0.34 to 0.75 mm ²
Pulse output (Option /CP)	: Electronic switch with galvanic isolation acc. EN 60947-5-6 (NAMUR)
- Pulse length	: 200 ms
- Max. frequency	: 4 Hz
- Pulse rate	: Q _{max} ≤ 1 → 0.0001 : 1 < Q _{max} ≤ 10 → 0.001 etc. e.g.. Q _{max} = 1 m ³ /h → 1 Puls = 0.0001 m ³ = 0.1 l

POWER SUPPLY FOR ELECTRONIC TRANSMITTER (Option /U__)

Type	: power supply with galvanically separated input and output SINEAX B811
Supply voltage	: 24 V to 60 V AC/DC 85 V to 230 V AC
Maximum load	: 750 Ω
Output signal	: 0/4 mA - 20 mA

LIMIT SWITCHES IN STANDARD VERSION

(option /K1 to /K3)

Type	: Inductive proximity switch SC2-NO acc. DIN EN 60947-5-6
Nominal voltage	: 8VDC
Output signal	: ≤ 1 mA or ≥ 3 mA
Hysteresis	: < 0.5mm

LIMIT SWITCHES IN FAIL SAFE VERSION

(option /K6 to /K8)

Type	: Inductive proximity switch SJ2-SN acc. DIN EN 60947-5-6
Nominal voltage	: 8VDC
Output signal	: ≤ 1 mA or ≥ 3 mA
Hysteresis	: < 0.5mm

POWER SUPPLY FOR LIMIT SWITCHES

(Option /W__)

Type	: Transmitter relay acc. DIN EN 50227 (NAMUR) - KFA6-SR2-Ex1-W (230 V AC) - KFA5-SR2-Ex1-W (115 V AC) - KFD2-SR2-Ex1-W (24 V DC)
Power supply	: - 230 V AC ± 10%, 45-65Hz - 115 V AC ± 10%, 45-65Hz - 24 V DC ± 25%
Relay output	: 1 or 2 potential-free changeover contact(s)
Switching capacity	: max. 250V AC, max. 2 A

SWITCHING LEVELS FOR LIMIT SWITCHES

Table 1

Function	Pointer	SC 2-NO		SJ 2-SN		
		Switch	Signal	Switch	Signal	Fail safe
MAX	above GW	on	1mA	on	1mA	1mA
	below GW	off	3mA	off	3mA	
MIN	above GW	off	3mA	off	3mA	1mA
	below GW	on	1mA	on	1mA	

GW = limit

T1.EPS

CONTROLLER (Option /R1 and R3)

Differential pressure controller for a constant flow at fluctuations of the process pressure.

These are no valves to reduce the pressure.

- **Controller /R1** for liquids with variable inlet or outlet pressure and for gases with variable inlet pressure and constant back pressure.

- **Controller /R3** for gases with fluctuations of the back pressure.

Max. liquid flow : 100 l/h

Max. gas flow : 3250 l/h

Max. pressure : 25 bar

Recommended differential pressure
: >400 mbar

Temperature range : -25°C to +80°C

Materials

	Housing	Diaphragm	Springs
R1 / R3	CrNi-Steel	PTFE	CrNi-Steel

T5.EPS

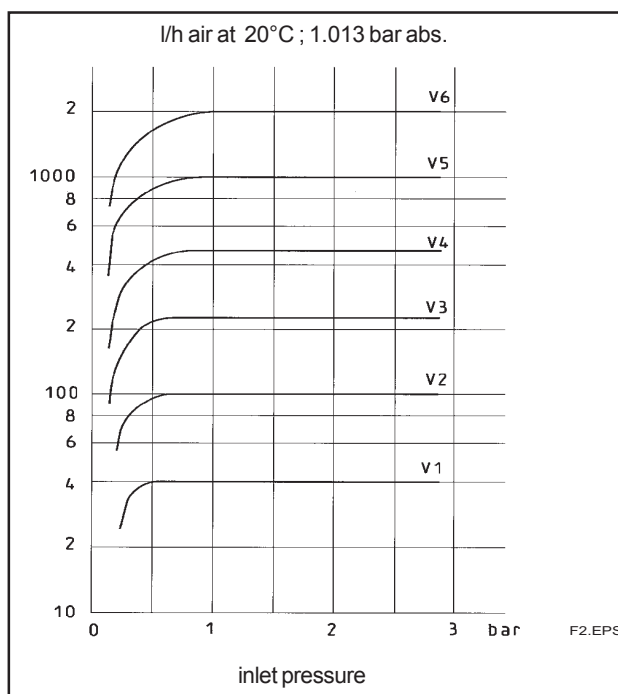


Fig. 2 Diagram controller characteristic

HAZARDOUS AREA SPECIFICATIONS**RAKD with ATEX- certification "intrinsic safe"**

(option /KS1)

Certificate :

KEMA 00ATEX 1037X

Output signal :

4-20 mA

Explosion proof :

EEx ia IIC T6; group II ; category 2G

Entity parameter :

Table 2

	Analog output	Puls output	Limit switch Type 2	Limit switch Type 3
Ui [V]	30	16	16	16
Ii [mA]	100	20	25	52
Pi [mW]	750	64	64	169
Li [mH]	0.73	0	0.15	0.15
Ci [nF]	2.4	0	150	150

Tex1.EPS

Temperature specification :

Version 1: RAKD with indicator "T" and limit switch type 2 :

Table 3

Temperature class	T6	T5	T5	T4	T4
Max. ambient temperature	65°C	80°C	59°C	100°C	73°C
Max. process temperature	65°C	80°C	100°C	100°C	135°C

Tex2.EPS

Version 2: RAKD with indicator "T" and limit switch type 3:

Table 4

Temperature class	T6	T5	T5	T4	T4	T4
Max. ambient temperature	24°C	37°C	34°C	57°C	54°C	48°C
Max. process temperature	65°C	80°C	100°C	80°C	100°C	135°C

Tex3.EPS

Version 3 : RAKD with indicator "E" and with or without limit switch type 2 :

Table 5

Temperature class	T6	T5	T5	T4
Max. ambient temperature	65°C	50°C	45°C	38°C
Max. process temperature	65°C	80°C	100°C	135°C

Tex4.EPS

Version 4 : RAKD with indicator "E" with limit switch type 3:

The smaller environmental temperature must be found according to the available temperature class and the maximum process temperature from table 4 and 5.

RAKD "non incendive" (option /KN1)

Type "n" (non incendive) acc. EN 60079-15.

Explosion proof :

EEx nL IIC T6 protection „nL“; group II ; category 3G

Dust proof :

EEx II 3D; group II ; category 3D

Max. surface temperature : 80°C

Entity parameter :

table 6

	Analog output	Pulse output /CP	Limit switch SC2-NO, /K1...3	Limit switch SJ2-SN, /K6...8
Ui [V]	30	16	20	20
Ii [mA]	100	20	25	25
Pi [mW]	750	64	64	64
Li [μH]	730	0	150	100
Ci [nF]	2,4	0	150	30

T12.EPS

RAKD with NEPSI- certification “intrinsic safe” (China) (option /NS1) :**Certificate :**

GYJ05153

Output signal :

4–20 mA

Explosion proof :

Ex ia IIC T6

Max. Tamb. :

65°C

Entity parameter of electronic transmitter :

see ATEX in table 2

Limit switches :

option /K1 to /K8

Entity parameter of limit switches :

see certificate NEPSI GYJ06542X

Intrinsically safe and dust proof limit switches with ATEX-certification (only for indicator T with option /K1 .. /K8) (option /KS2) :**Certificate :**

- PTB 99 ATEX 2219X (SC2-NO)

- PTB 00 ATEX 2049X (SJ 2-S.N)

- ZELM 03 ATEX 0128X (for dust proof)

Explosion proof :

EEx ia IIC T6, group II category 2G

Dust proof:

Ex iaD 20 T 108 °C, group II category 1D

Max. surface temperature : T108°C

Entity parameter :

see certificate of conformity

Intrinsically safe limit switches with SAA-certification (Australia)(only for indicator T with option /K1 .. /K8) (option /SS1) :**Certificate :**

AUS Ex 02.3838X

Explosion proof :

Ex ia IIC T1 ... T6

Entity parameter :

see certificate of conformity

Intrinsically safe limit switches with CSA-certification (USA + Canada) (only for indicator T with option /K1 .. /K8) (option /CS1) :**Certificate :**

1007121 (LR 96321-2)

Explosion proof :

Cl. I, Div. 1, Grp A, B, C, D

Cl. II, Div. 1, Grp. E, F, G

Cl. III, Div. 1

or

Class I, Zone 0, Gp. IIC T6 (Ta = 60°C)

Entity parameter :

see FM-control drawing 116-0165b

Power Supply for the intrinsically safe electronic transmitter (option /U__)**Type**: Intrinsically safe power supply with galvanically separated input and output
- SINEAX B811**Certificate**

: PTB 97 ATEX 2083

Supply voltage: - 24 V to 60 V AC/DC
- 85 V to 230 V AC**Maximum load impedance**

: 750 Ω

Output signal

: 0/4 mA - 20 mA

Control circuit

: Intrinsically safe [EEx ia] IIC group II, category (1)G

Entity parameters

: see fig 5 or certificate

Power supply for intrinsically safe limit switches (option W__)**Type**: - KFA6-SR2-Ex1-W (230 V AC)
- KFA5-SR2-Ex1-W (115 V AC)
- KFD2-SR2-Ex1-W (24 V DC)**Certificate**: - PTB 00 ATEX 2081 (115/230 V AC)
- PTB 00 ATEX 2080 (24 V DC)**Control circuit**

: [EEx ia] IIC; group II ; category (1)GD

Entity parameter

: see fig 3 or certificate

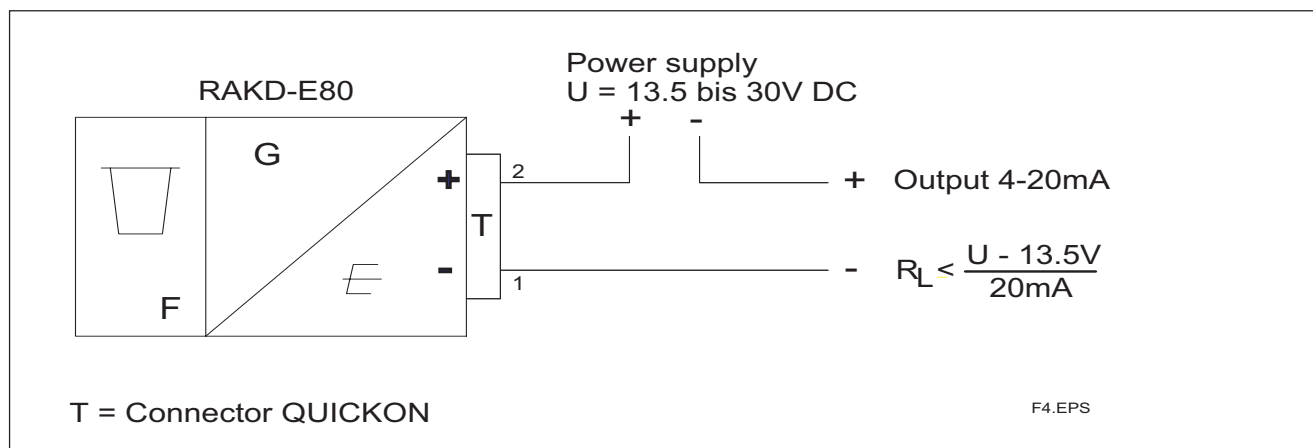
INSTALLATION

Fig. 3 RAKD with electronic transmitter

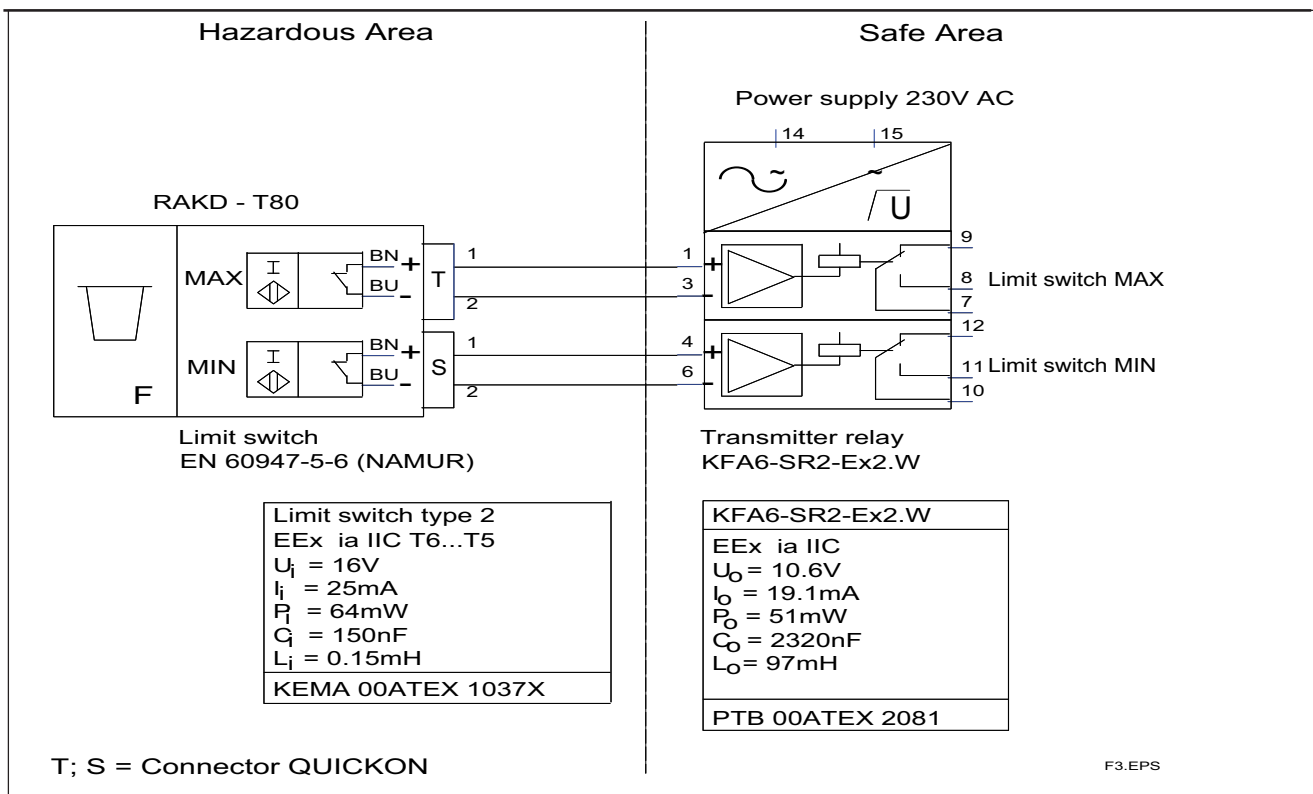


Fig. 4 Ex-version of RAKD with 2 limit switches in combination with transmitter relay

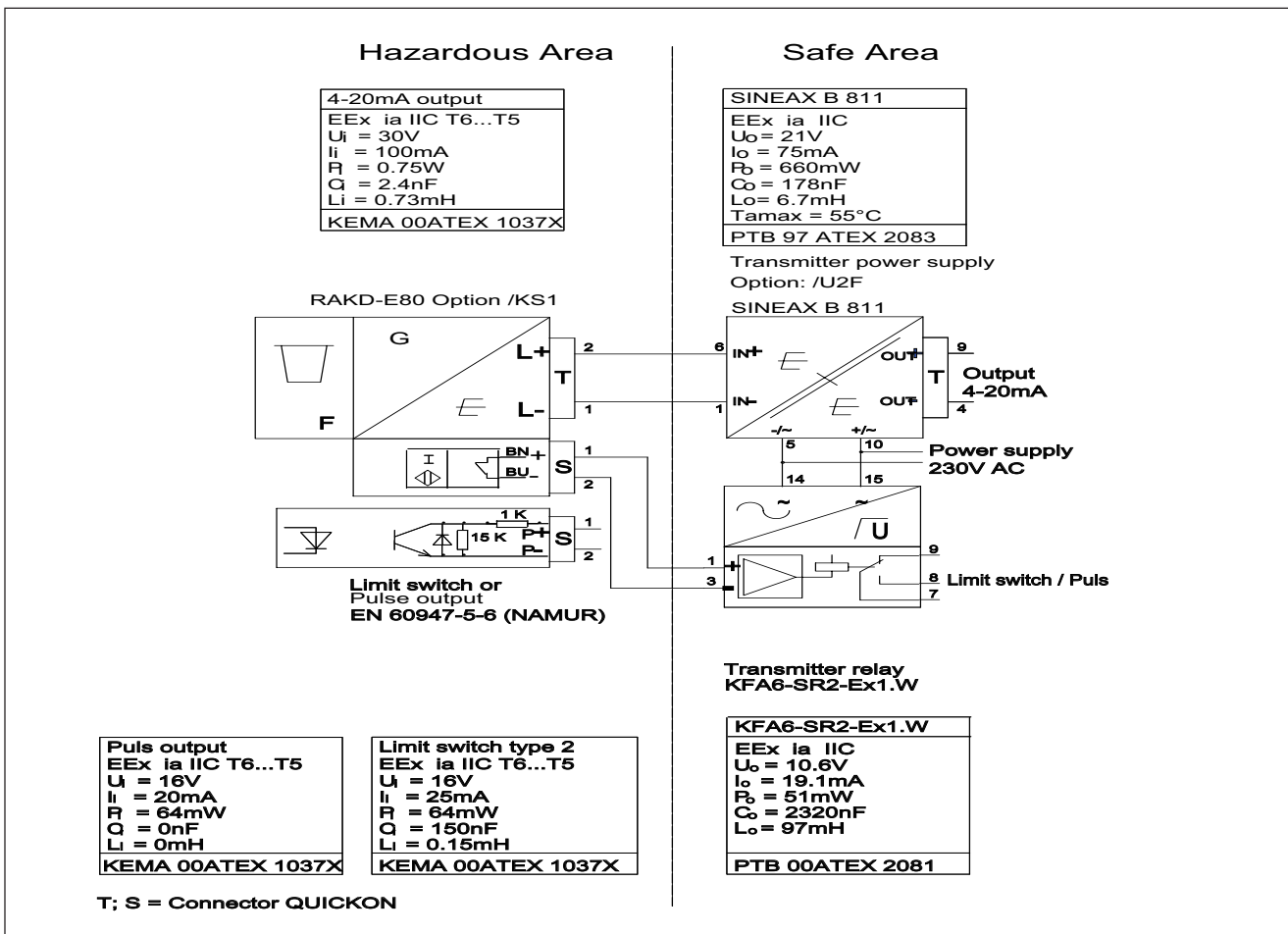


Fig. 5 Ex-version of RAKD with electronic transmitter with power supply and limit switch or pulse output in combination with transmitter relay

TEMPERATURE SPECIFICATION

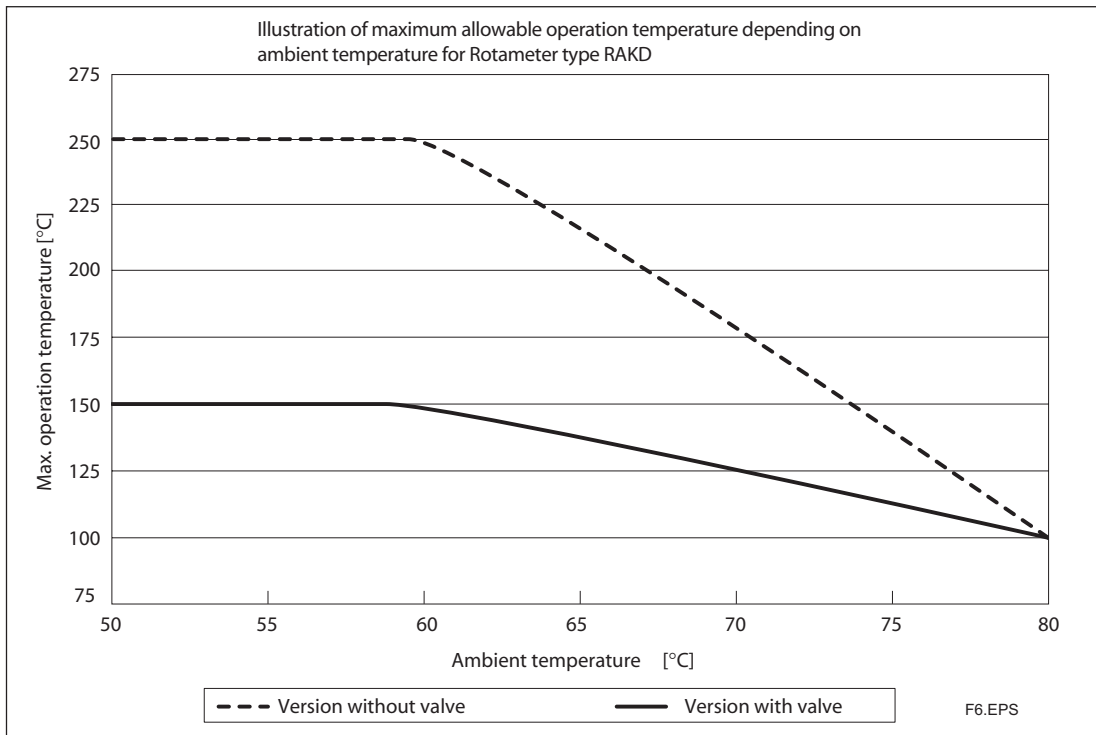


Fig.6

For option /KS1, /KS2 or /KN1 (Ex-version) the maximum values for ambient and process temperature according to the respective temperature class mentioned in fig. 5 and tables 2 to 5 must be regarded.

The minimum ambient temperature is -25°C. Lower temperatures on request.

MODEL AND OPTION SPECIFICATIONS

Please make your decision in this order :				
1. Option controller	with controller	without controller	without controller	without controller
2. Version	with valve	with valve	without valve	without valve
3. Max. Flow	1.0 - 100 l/h Water 40 - 3250 l/h Air 31 - 51	1.0 - 250 l/h Water 40 - 8000 l/h Air 31 - 53	1.0 - 100 l/h Water 40 - 3250 l/h Air 31 - 51	160 - 250 l/h Water 5000 - 8000 l/h Air 52 - 53
4. Process connection	Inner thread Cutting ring Cut. ring (Swagelok) Nozzle	Inner thread Cutting ring Cut. ring (Swagelok) Nozzle	Inner thread Cutting ring Cut. ring (Swagelok) Nozzle Flange	Inner thread Cutting ring Cut. ring (Swagelok) Flange
Specify the model code according the mentioned page	Page 7	Page 8	Page 9	Page 10

Ordering instructions

Standard:

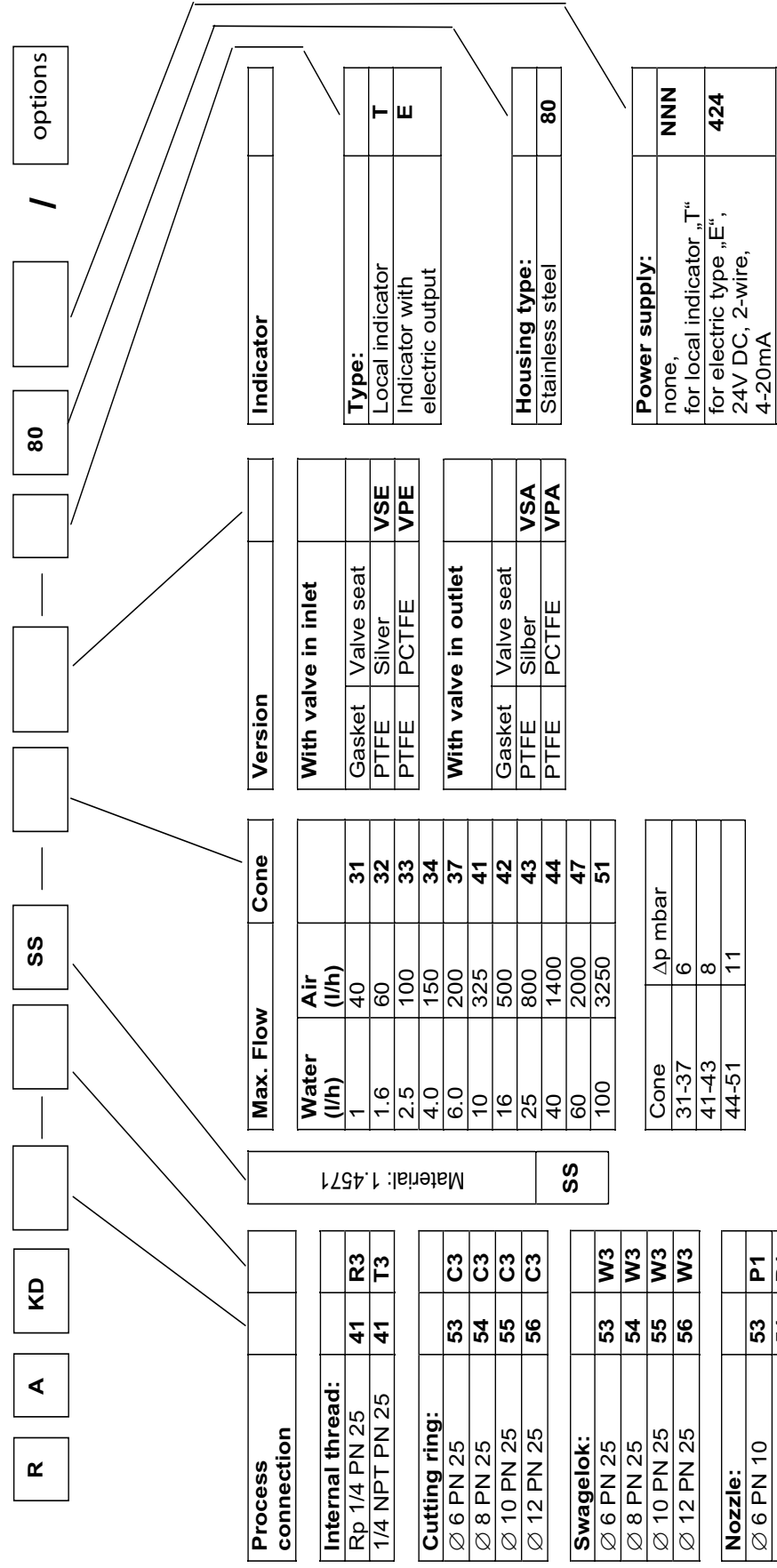
- a: Model, suffix and option code
- b: Flow conditions
- c: Temperature
- d: Pressure
- e: Viscosity
- f: Density

For gases: cross reference of the scale

Option/B□ : customer specification notes

T10.EPS

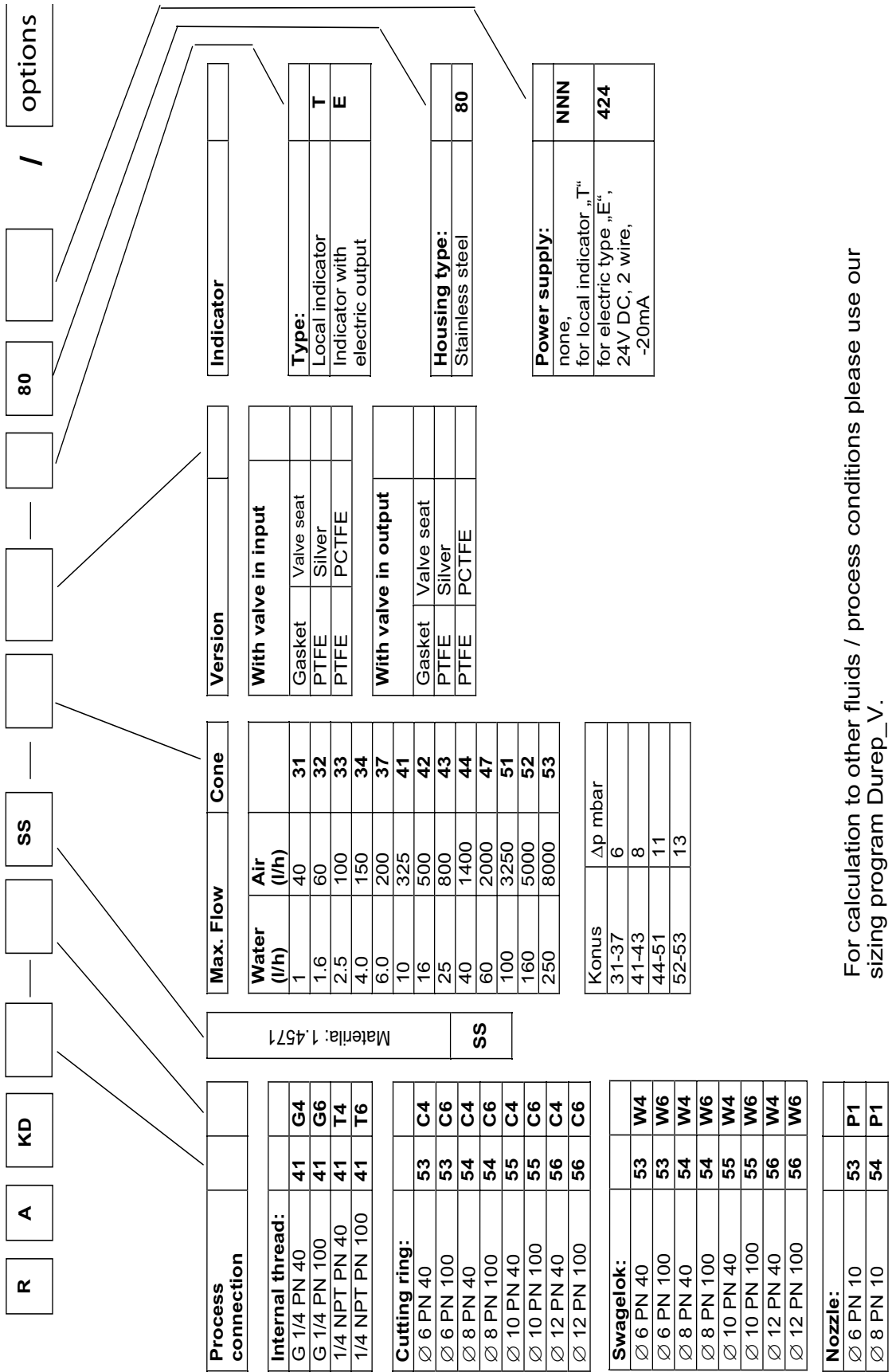
RAKD with valve and controller (option /R1 and /R3) 1.0 - 100 l/h water / 40 - 3250 l/h air:



For calculation to other fluids / process conditions please use our sizing program Durep_V.

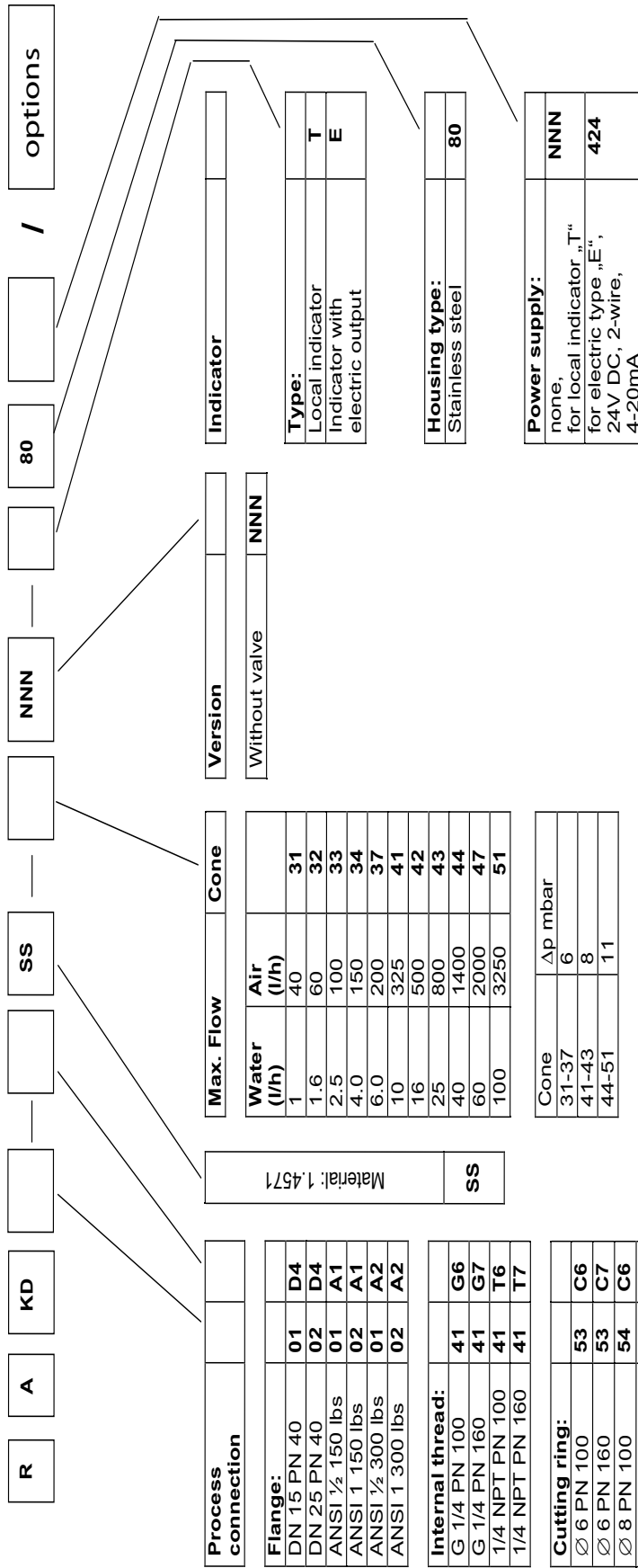
T6.EPS

RAKD with valve 1.0 – 250 l/h water / 40 – 8000 l/h air:



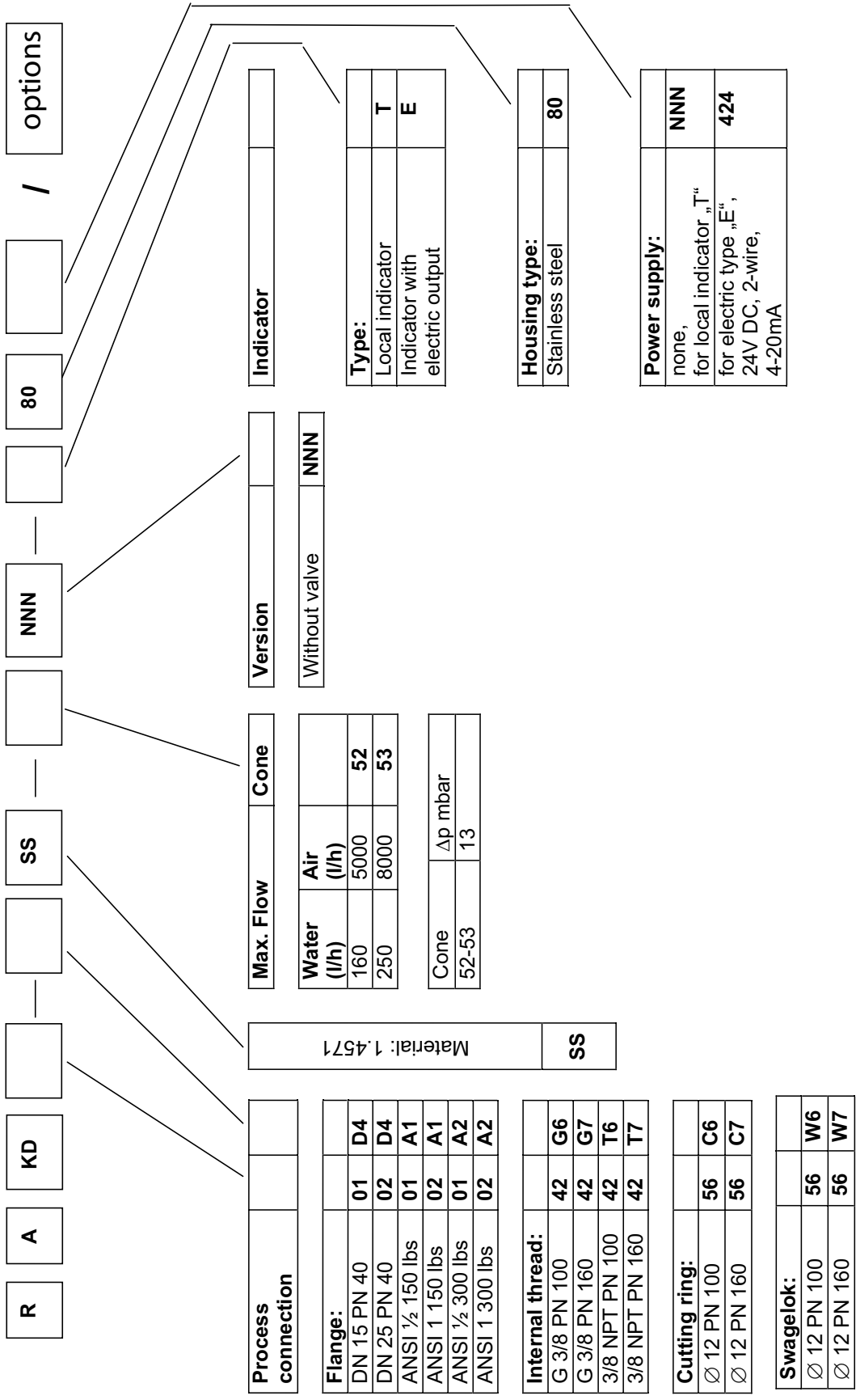
For calculation to other fluids / process conditions please use our sizing program Durep_V.

RAKD without valve 1.0 – 100 l/h water / 40 – 3250 l/h air:



For calculation to other fluids / process conditions please use our sizing program Durep_V.

RAKD without valve 160 – 250 l/h water / 5000 – 8000 l/h air:



For calculation to other fluids / process conditions please use our sizing program Durep_V.

OPTIONS

Options	Option code	Description	Restrictions
Indicator	/A12	US-engineering units	Only for indicator E
Marking	/B1 /B4 /B8 /BG /BD	Tag plate (SS) fixed by wire and marking on scale Neutral version Customer provided marking on label Customer specific notes on scale Dual Scale	Plate 12 x 40 mm; max. 45 digits Not with option /P6 and Ex-proof type Max. 45 digits Adjustment only possible for 1 fluid
Limit switches	/K1 /K2 /K3 /K6 /K7 /K8	MIN-contact MAX-contact MIN-MAX-contact MIN-contact "Fail Safe"- version MAX-contact "Fail Safe"- version MIN-MAX-contact "Fail Safe"- version	Only for indicator T Only for indicator T
Pulse output	/CP	Pulse output, acc. NAMUR EN50227	Only for indicator E; not with limit switches
Ex-proof type	/KS1 /KS2 /KN1 /CS1 /SS1 /NS1	ATEX intrinsically safe "ia" ATEX gas and dust proof limit switches, category 2G 1D ATEX category 3G "nL" / 3D CSA intrinsic safe approval for limit switches (US+CAN) SAA approval for limit switches (Australia) NEPSI approval (China)	Not for indicator T without limit switches Only for indicator T with limit switches Not for indicator T without limit switch Only for indicator T with limit switches Only for indicator T with limit switches Not for indicator T without limit switches
Test and certificates	/PP /P2 /P3 /P6 /PM1 /PM4 /PM5	Pressure test report measuring system Certificate of Compliance with the order acc. to EN 10204: 2004- 2.1 As /P2 +Test report acc. to EN 10204: 2004- 2.2 Material certificate acc. to EN 10204: 2004- 3.1 PAMI test (1 test point : metering tube) PAMI test (4 test points : metering tube, connection heads, sealing plug) PAMI test (5 test points : metering tube, connection pieces, slip on flanges)	Only for tube, connection heads, screw sealing plug Only for models with valve Only for models with process connection D4, A1, A2
GOST approvals	/QR1 /QR2	Russian GOST approval Kasachian GOST approval	
Controller	/R1 /R3	Pre pressure controller 1.4571 (only with valve in inlet; for gas with variable pre pressure and liquids with variable pre and back pressure) Back pressure controller 1.4571 (only with valve in outlet; for gas with variable back pressure)	Only for process connection R3, T3, C3, W3, P1; only with valve Only for process connection R3, T3, C3, W3, P1; only with valve
Power supply for electronic transmitter	/U2F /U3F	SINEAX B811, 85 - 250 V AC, EEx i SINEAX B811, 24 V AC/DC, EEx i	Only for indicator E Only for indicator E
Power supply for limit switch(es) (transmitter relay)	/W1A /W1B /W2A /W2B /W2E /W4A /W4B /W4E	KFA5-SR2-Ex1.W / 115 V AC, 1 channel KFA5-SR2-Ex2.W / 115 V AC, 2 channels KFA6-SR2-Ex1.W / 230 V AC, 1 channel KFA6-SR2-Ex2.W / 230 V AC, 2 channels KHA6-SH-Ex1 / 230 V AC, 1 channel, Fail Safe KFD2-SR2-Ex1.W / 24 V DC, 1 channel KFD2-SR2-Ex2.W / 24 V DC, 2 channels KHD2-SH-Ex1 / 24 V DC, 1 channel, Fail Safe	Only for limit switches /K1 + /K2 + /K3 Only for limit switches /K1 + /K2 + /K3 Only for limit switches /K1 + /K2 + /K3 Only for limit switches /K1 + /K2 + /K3 Only for limit switches /K6 + /K7 + /K8 Only for limit switches /K1 + /K2 + /K3 Only for limit switches /K1 + /K2 + /K3 Only for limit switches /K6 + /K7 + /K8
Instruction manuals	/IE n /ID n /IF n	Quantity of instruction manuals in English Quantity of instruction manuals in German Quantity of instruction manuals in French	n = 1 to 9 selectable *) n = 1 to 9 selectable *) n = 1 to 9 selectable *) *) if no instruction manual is selected, only a CD with instruction manuals is shipped with the flowmeter

DIMENSIONS

Note : The dimensions a ; b ; c ; L1 ; L2 ; L3 are listed in table 7 and 8.

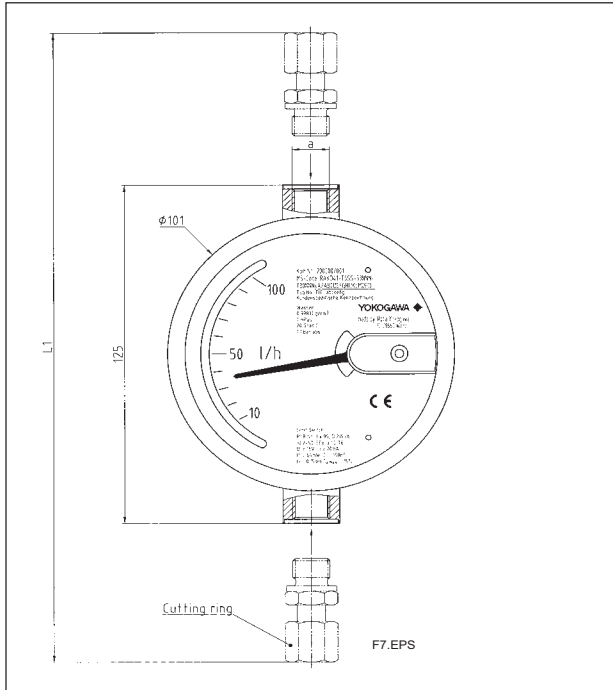


Fig. 7 Version without valve

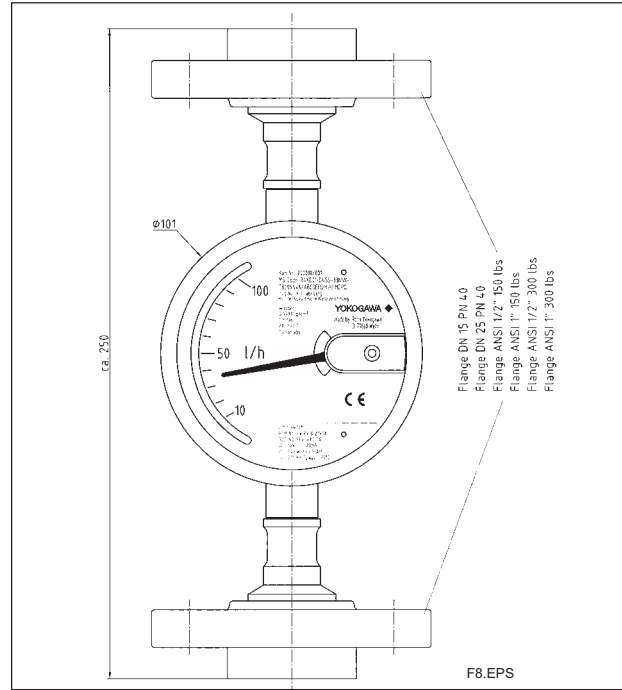


Fig. 8 Version with flange connection

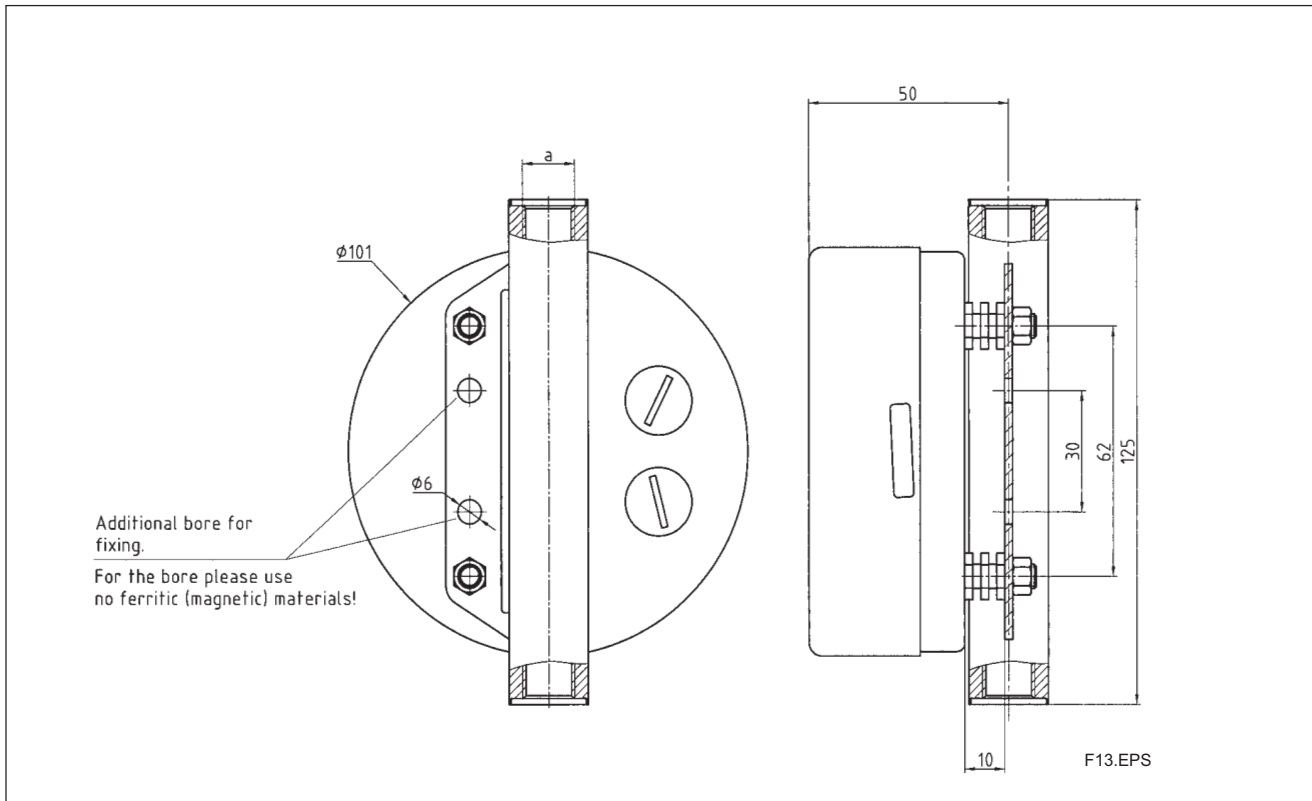


Fig. 9 Back view with mounting

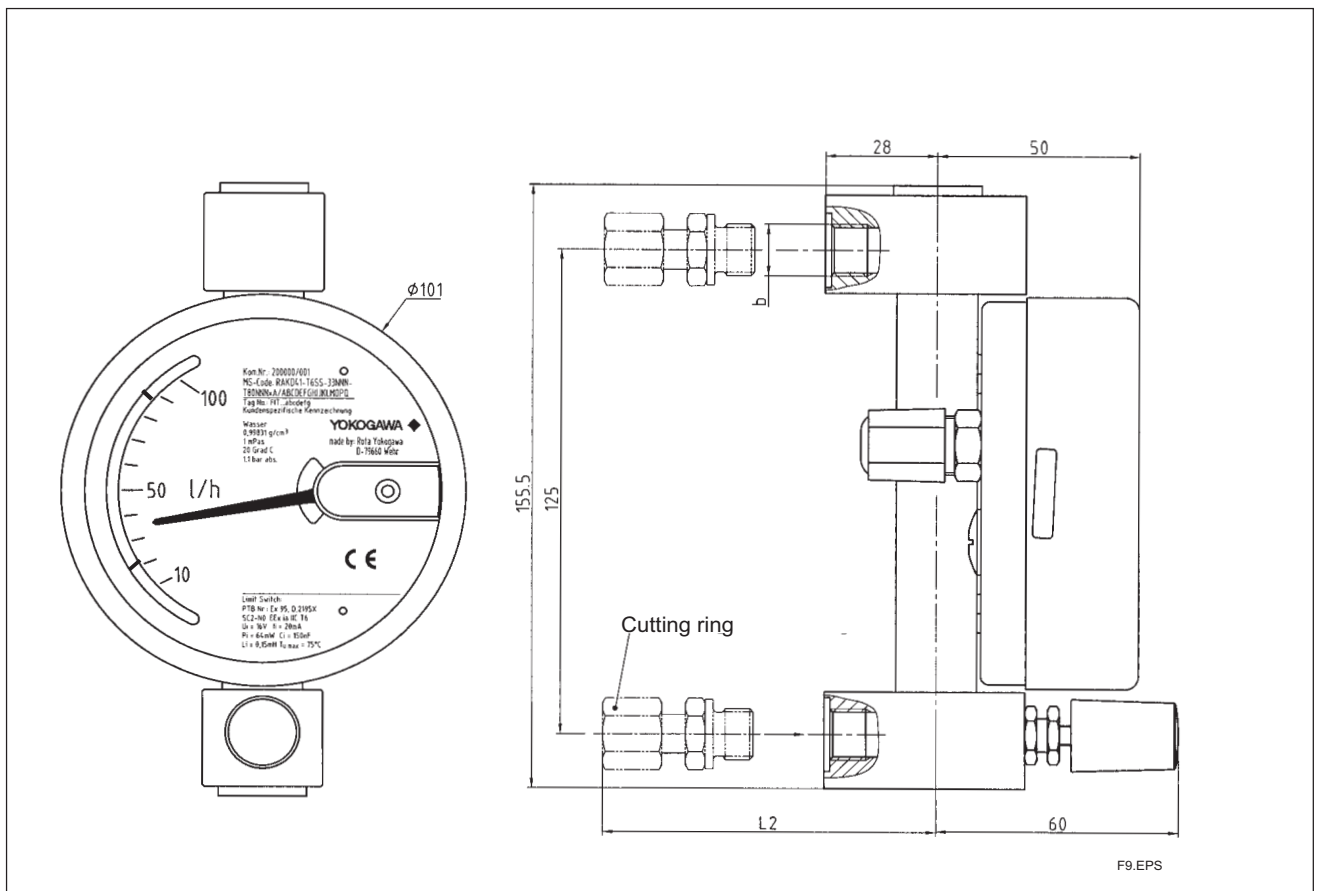


Fig. 10 Version with inlet valve

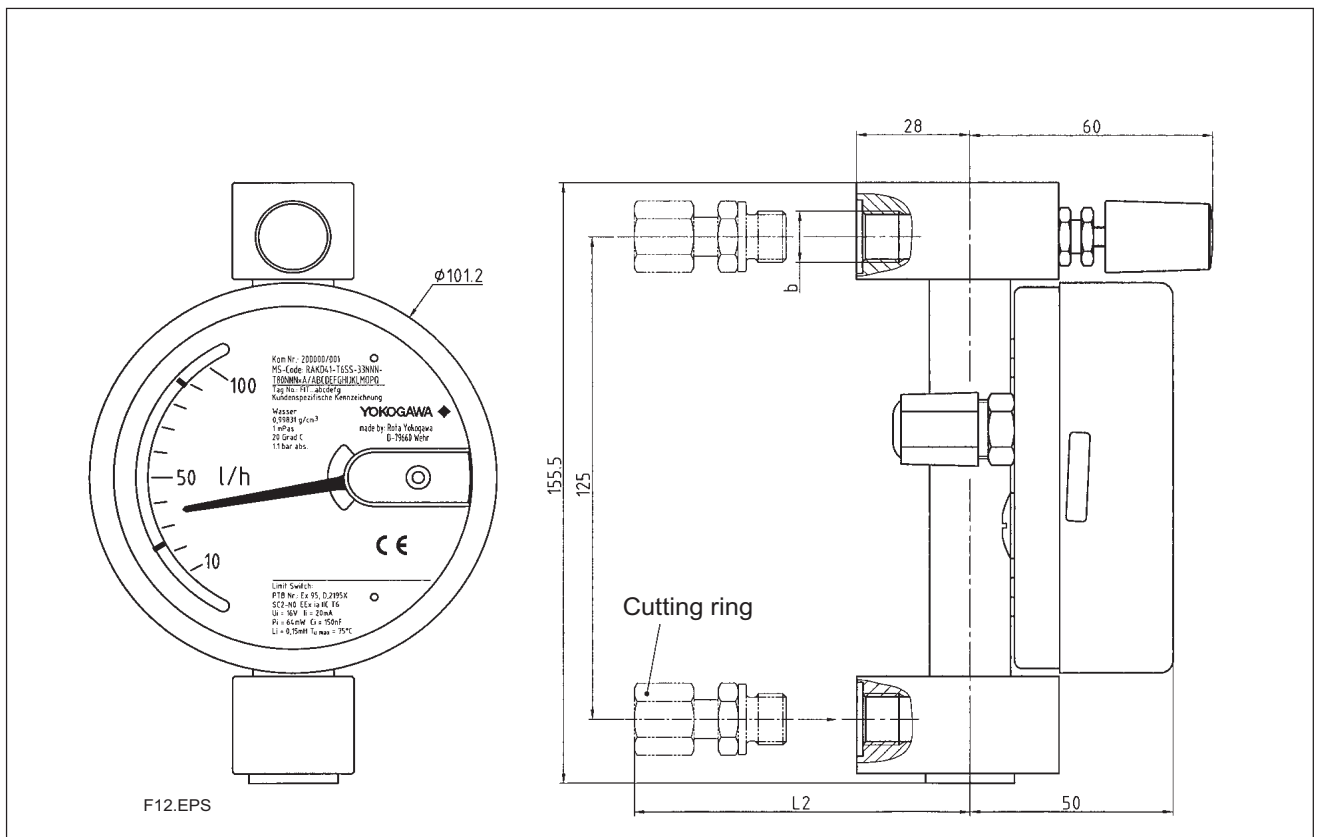


Fig. 11 Version with outlet valve

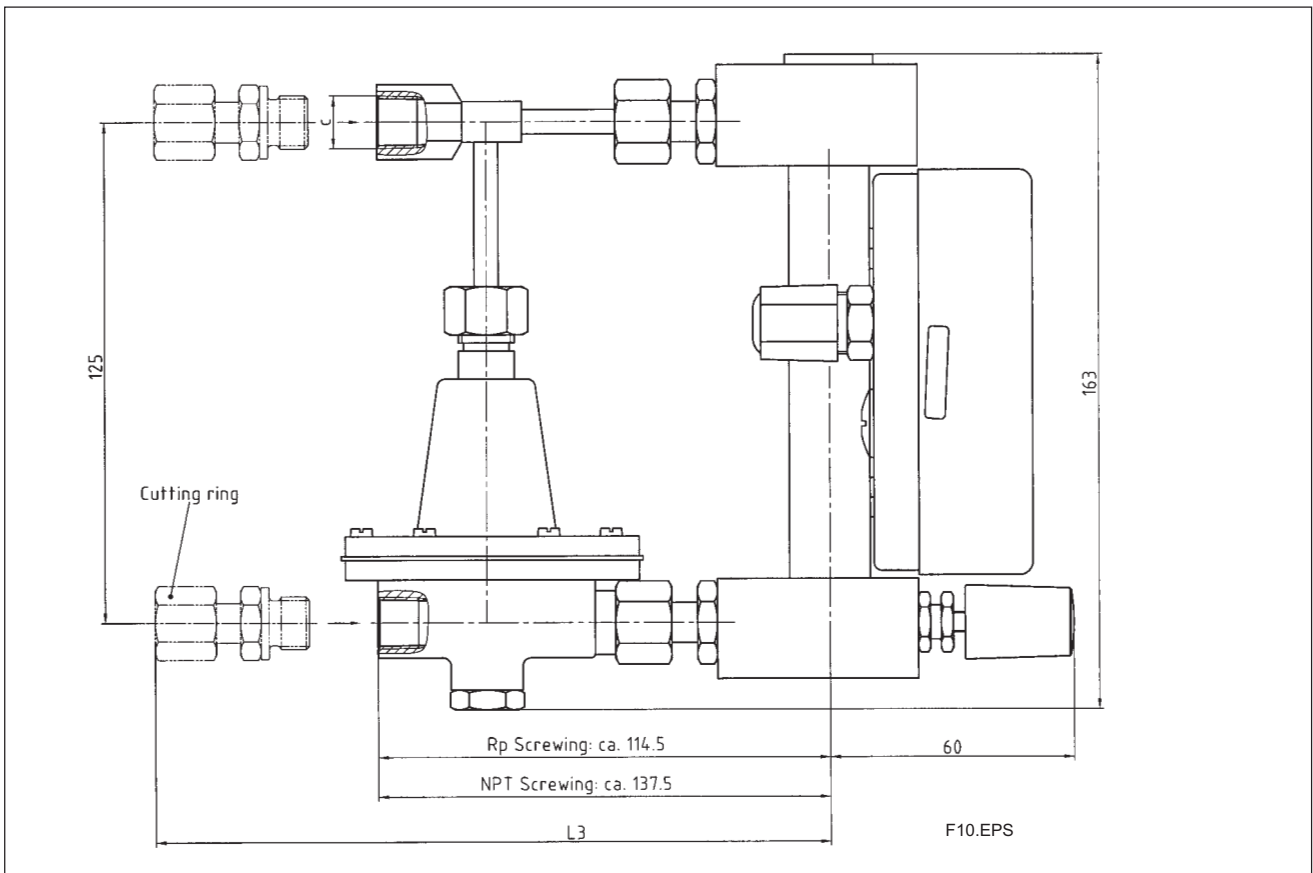


Fig. 12 Version with inlet valve and inlet controller

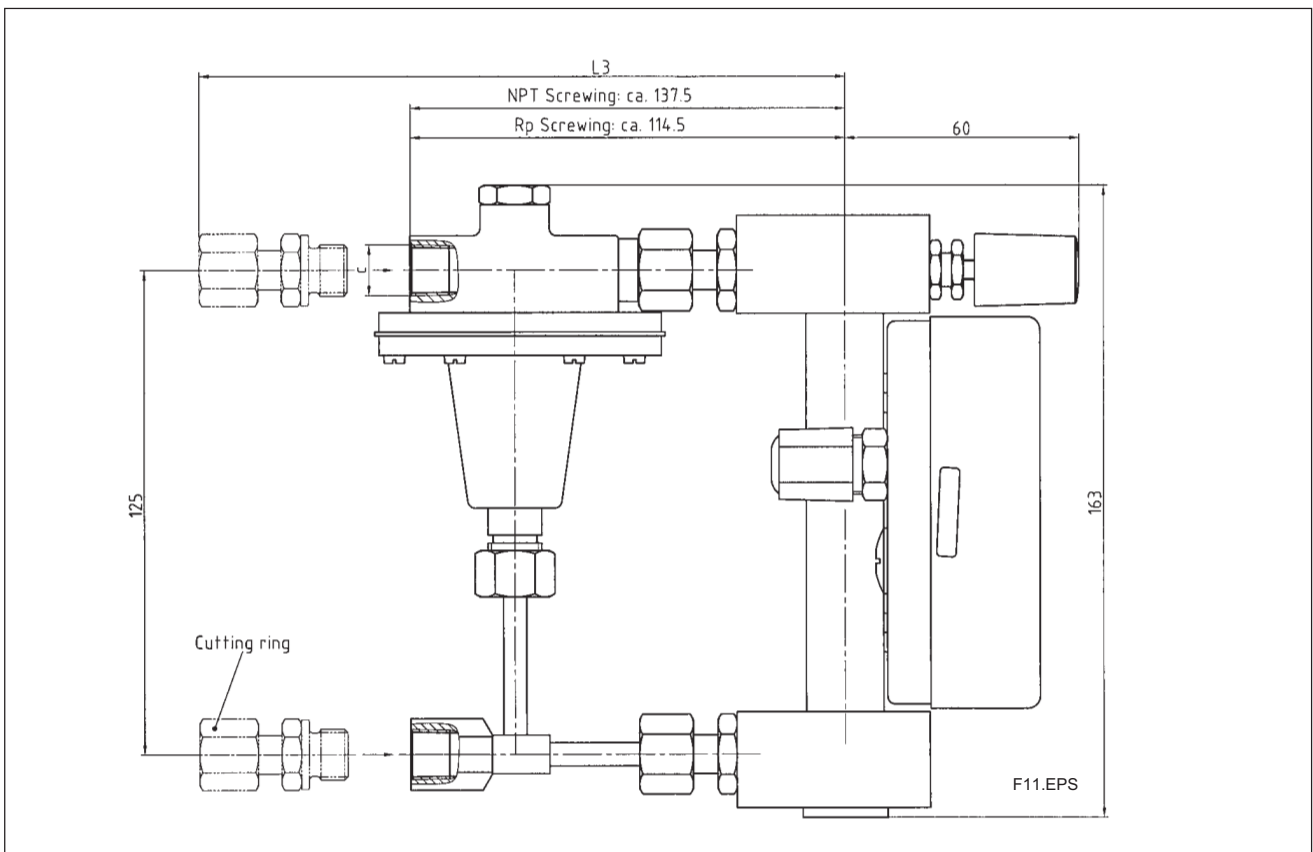


Fig. 13 Version with outlet valve and back pressure controller

CONNECTION TYPES

Table 7

Size	a		b	c
	Cone 31-51	Cone 52-53	Cone 31-53	Cone 31-51
Thread	G 1/4	G 3/8	G 1/4	Rp 1/4
	1/4 NPT	3/8 NPT	1/4 NPT	1/4 NPT

T2.EPS

INSTALLATION LENGTHS DEPENDING ON CONNECTION TYPE AND SIZE

Table 8

Size		L1		L2	L3
Process connection	NW	Cone 31-51	Cone 52-53	Cone 31-53	Cone 31-51
Cutting ring	6 mm	178 mm	----	54.5 mm	142.5 mm
	8 mm	172 mm	----	51.5 mm	139.5 mm
	10 mm	174 mm	----	52.5 mm	140.5 mm
	12 mm	174 mm	177 mm	52.5 mm	140.5 mm
Nozzle	6 mm	182 mm	----	56.5 mm	144.5 mm
	8 mm	182 mm	----	56.5 mm	144.5 mm

T3.EPS

WEIGHTS

Table 9

	without valve	with valve	with controller
Weight	approx. 600g	approx. 1000g	approx. 1800g

T4.EPS

PLANNING HINTS

- The real working pressure has to be less than the specified pressure limit of the Rotameter.
- Make sure that the wetted material is resistant to the medium.
- Ambient and operation temperature has to be less than the specified maximum value.
- If dirt accumulation is to be expected we recommend to install a bypass pipe.
- To avoid float bouncing in case of gas application notice the recommendations of VDI/VDE 3513 Sheet 3.
- To avoid mutual magnetic influence in case of a parallel design of several Rotameters take care that the distance between the tube middle axes is not less than 120 mm. The distance to other ferric materials should not be less than 60 mm.
- The strength of external magnetic fields close by the Rotameter should be approximately 0mT.

YOKOGAWA HEADQUARTERS
 9-32, Nakacho 2-chome,
 Musashinoshi
 Tokyo 180
 Japan
 Tel. (81)-422-52-5535
 Fax (81)-422-55-1202
 E-mail: webinfo@mls.yokogawa.co.jp
www.yokogawa.com

YOKOGAWA EUROPE B.V.
 Databankweg 20
 3821 AL AMERSFOORT
 The Netherlands
 Tel. +31-33-4641 611
 Fax +31-33-4641 610
 E-mail: info@nl.yokogawa.com
www.yokogawa.com/eu

YOKOGAWA CORPORATION OF AMERICA
 2 Dart Road
 Newnan GA 30265
 United States
 Tel. (1)-770-253-7000
 Fax (1)-770-251-2088
 E-mail: info@yca.com
www.yca.com

YOKOGAWA ELECTRIC ASIA Pte. Ltd.
 5 Bedok South Road
 Singapore 469270
 Singapore
 Tel. (65)-241-9933
 Fax (65)-241-2606
 E-mail: webinfo@yas.com.sg
www.yokogawa.com.sg

Yokogawa has an extensive sales and distribution network. Please refer to the European web-site (www.yokogawa-europe.com) to contact your nearest representative.



YOKOGAWA ◆