



## BM 500 Technical Datasheet

Potentiometric Level Transmitter for hygienic liquid applications

- Compact, food compatible, hygienic design
- Unaffected by adhesive media
- Configurable measuring range



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## 1.1 Level meter for hygienic applications

The level meter **BM 500** utilises the potentiometric measuring principle and can be used in all media that have a minimum conductivity of 50  $\mu\text{S}/\text{cm}$ .

The device is ideal for measurements in small vessels with tough, pasty or strong adhesive media, such as ketchup, honey, and toothpaste. The integrated electronics provide a 4...20 mA output.

The device has automatic recognition of top/bottom mounting position. Even angled installation is possible.

A version with remote electronics is available for applications where the ambient temperature at the measuring point exceeds +60°C / +140°F. Due to the high temperature limit the device is well suitable for CIP and SIP processes.

The hygienic installation is guaranteed by using one of the hygienic weld-in sleeves. For more data, refer to the "Order information" chapter.

### Highlights

- Process temperature: -20...+140°C / -4...+284°F
- Insensitive to build up or foam
- Not affected by adhesive media
- LED level monitoring
- Empty tank detection
- Configurable measuring range
- Ideal for small tanks

### Industries

- Food & Beverage
- Pharmaceuticals
- Cosmetics

### Typical applications

- Level detection of mustard
- Level detection of ketchup

## 1.2 Options and variants

### LED level monitor

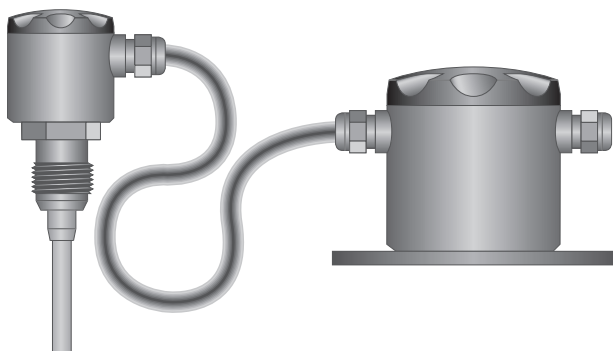


The level meter can be mounted from the top or the bottom of the tank. Delivered from the factory, the 4 mA output corresponds to the tip of the rod, the 20 mA value to the end of the cylindrical part of the rod.

Measuring range of the customer can be calibrated by pressing one of the two set points keys for more than 3 seconds. The relevant LED will show a steady light. With these two buttons any empty/ full level can be configured on the entire length of the rod.

Factory setting will be valid again by pressing both keys for more than 3 seconds.

### Remote version



The remote version is available for applications where the ambient temperature exceeds  $+60^{\circ}\text{C}$  /  $+140^{\circ}\text{F}$ .

### 1.3 Measuring principle

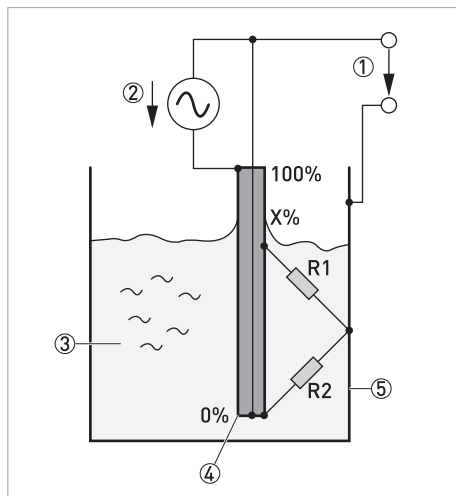


Figure 1-1: Measuring principle

- ①  $U_{out}$  to amplifier
- ②  $U_{gen}$
- ③ Medium
- ④ Tube
- ⑤ Tank

The liquid is stored in a tank, connected to ground. The immersed measuring rod is a low resistance rod where the ends are powered by an AC generator operating in the lower kilohertz frequency range.

Between the rod and the tank wall is an endless amount of high level resistances. Since they connect to the same potential (the tank wall) they can be shown as two equivalent resistances, R1 and R2 connected to an imaginary center point. A high resistance input amplifier is connected between the generator and the tank wall.

Since the generator is supplying a high range current it will create a significant voltage drop across the low resistance rod. The resistances R1 and R2 form a voltage divider in range of the immersed part of the rod. Output from this divider will indicate half the level of the liquid. The amplifier then calculates the actual level of liquid from 0 to 100%.

The formula is:

$$U_{out} = 1/2 \times \text{media level (\%)} \times U_{gen}$$

$$\text{Media level (\%)} = U_{out}/U_{gen} \times 2$$

The level measurement is insensitive to adhesion.

*It is very essential that the media conductivity is homogeneous. Otherwise R1 will not be equal to R2 and the output voltage will be influenced.*

## 2.1 Technical data

- *The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.*
- *Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).*

### Measuring system

Measuring principle	Potentiometric, low resistive
Application range	Level detection of all media with the minimum conductivity of 50 $\mu\text{S}/\text{cm}$ in tanks.

### Design

Options	Remote version for applications with ambient temperature above +60°C / +140°F
Accessories	Comprehensive range of adapters and process connections for hygienic installation. Please refer to the chapter "Order information".

### Measuring accuracy

Accuracy	$\pm 0.5\%$ of full measuring length
Repeatability	$\pm 0.1\%$

### Operating conditions

<b>Temperature</b>	
Ambient temperature (compact)	-20...+60°C / -4...+140°F
Ambient temperature (remote)	-20...+100°C / -4...+212°F
Process temperature	-20...+140°C / -4...+284°F
Medium conductivity	$\geq 50 \mu\text{S}/\text{cm}$
Min. measuring range	50 mm / 2", configurable by push-buttons
<b>Pressure</b>	
Ambient pressure	Atmospheric
Process pressure	$\leq 16 \text{ bar} / 232 \text{ psi}$
<b>Other conditions</b>	
Ingress protection (acc. to EN 60529)	IP67 equivalent to NEMA 4X

### Installation conditions

Installation	Installation from top or bottom (automatic position detection)
Probe length	200...3000 mm / 0.6...10 ft
Cable length	1000...5000 mm / 3.3...16.4 ft (only for remote version)
Dimensions and weights	For more data, refer to the "Dimensions and weights" chapter.

## Materials

Probe	Stainless steel 1.4404 / AISI 316 L
Housing	Stainless steel 1.4301 / AISI 304
Process connection	Stainless steel 1.4404 / AISI 316 L
Sensor insulation	PEEK, FDA conform
Electrical connection	M16 cable glands: Plastic
	M12 plug: Nickel-plated brass

## Process connections

Standard	Hygienic G 1
Other	For other hygienic process connections, e.g. Tri-Clamp®, DIN 11851, VARIVENT® – refer to the "Order information" chapter.

## Electrical connections

Power supply	18...36 VDC; max. 200 mA
Resolution, input	15 bit
Output	4...20 mA; max. load 500 ohms
Status signal, "dry"	2.4 mA
Status signal, "full"	21.6 mA
Response time	$T_{66} < 10$ ms
Cable entry	M16 cable glands, M12 plug

## Approvals and certifications

CE	This device fulfils the statutory requirements of the EC directives. The manufacturer certifies successful testing of the product by applying the CE marking.
<b>Other standards and approvals</b>	
Electromagnetic compatibility (EMC)	EN 61326-1 (2006)
Vibration resistance	IEC 60068-2-6, GL test 2
Hygiene	3A, FDA conform materials

2.2 Dimensions

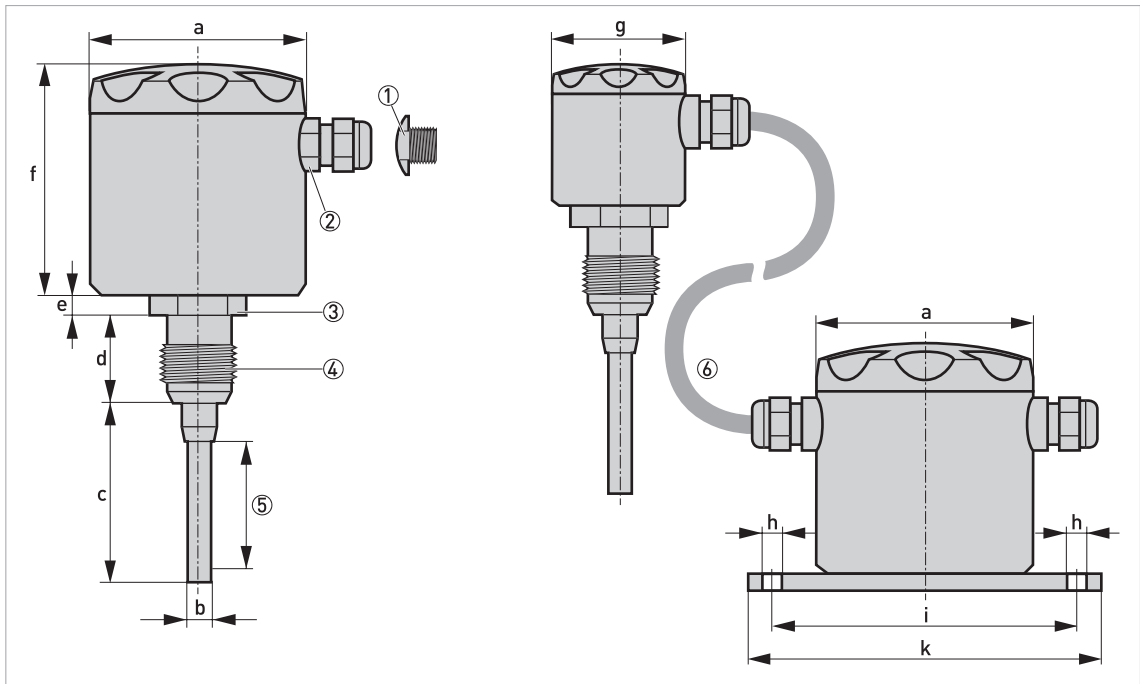


Figure 2-1: Dimensions of compact (left) and remote (right) version

- ① M12x1 plug
- ② M16x1.5 cable gland
- ③ WS 36
- ④ G 1
- ⑤ Active zone
- ⑥ Connecting cable (please specify length on ordering (min.: 1 m / 3.3 ft; max.: 5 m / 16.4 ft))

Dimensions in mm

	a	b	c	d	e	f	g	h	i	k
BM 500	89	10	L ①	33	8	92	55	8	125	145

① Ordered rod length

Dimensions in inches

	a	b	c	d	e	f	g	h	i	k
BM 500	3.5	0.49	L ①	1.30	0.31	3.62	2.17	0.31	4.92	5.71

① Ordered rod length



### 3.1 Intended use

*Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.*

*The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.*

The potentiometric level meter **BM 500** is designed solely for measuring continuously the level of liquids and pasty and sticky products.

The device is particularly suitable for measuring low levels in the range of 50...1000 mm / 2...39.4". Thanks to the principle involved, this potentiometric measuring system is independent of sticky deposits and varying product properties. All it needs is a minimum conductivity of 50  $\mu\text{S}/\text{cm}$ .

### 3.2 General notes on installation

*Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.*

*Do a check of the packing list to make sure that you have all the elements given in the order.*

*Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.*

### 3.3 Installation requirements

- Be sure that the measuring rod has the correct depth of immersion when placing your order. The sensor **cannot** be shortened subsequently!
- Use only the recommended sleeves or adapters. If other systems are used, no guarantee can be given for proper functioning or leak-tightness.
- The connection thread must have electrical contact with the metal vessel. If this is not possible, use a separate grounding cable to meet this condition.
- Do not use Teflon or paper gaskets.
- The tightening torque for the sleeve should be 20...30 Nm.
- If the vessel is electrically non-conductive (e.g. plastic tank), the frame potential can be established via an additional ground electrode, which is electrically connected to the connection thread. E.g. a standard LS 7200 without electronics. Consult your local contact for ordering assistance.
- Make absolutely sure that the measuring rod cannot come into contact with the wall of the vessel. Also take into consideration the possibility of rod deflection caused by moving product.
- For distances of less than 100 mm / 3.9" (e.g. when installed in vertical pipe runs) the sensor rod should be located parallel to the wall, otherwise conditions of non-linearity can occur. For large distances non-parallelity of the rods can be allowed.
- The level meter measures linearly over the full rod length.  
**Lower dead zone:** approx. 8 mm / 0.3" of the lower end of the measuring rod  
**Upper dead zone:** approx. 44 mm / 1.73" of the upper end of the measuring rod (at the lower end of the conical part of the rod)

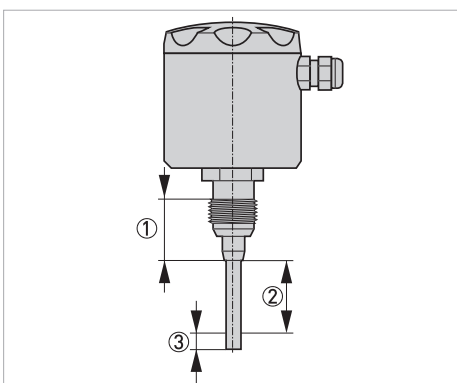


Figure 3-1: Upper and lower dead zone at measuring rod

- ① Upper dead zone: approx. 44 mm / 1.73"
- ② Active measuring range
- ③ Lower dead zone: approx. 8 mm / 0.3" immersed in the liquid

Please be aware of the active measuring zone of the rod (refer to the following drawing).

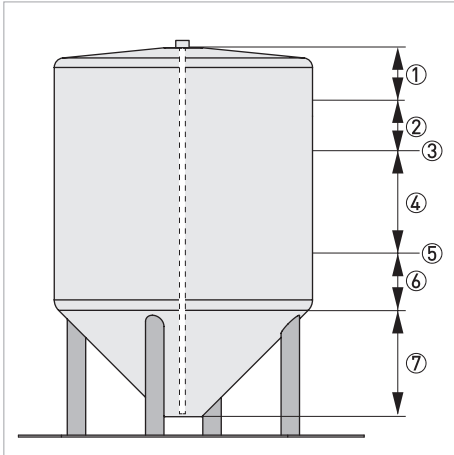


Figure 3-2: Measuring zone and output settings

- ① 21.6 mA
- ② 21.6...20 mA
- ③ Set point 100% = 20 mA
- ④ 20...4 mA
- ⑤ Set point 0% = 4 mA
- ⑥ 4...2.4 mA
- ⑦ 2.4 mA

The BM 500 tracks level outside its normal 4...20 mA measuring range; up to 21.6 mA and down to 2.4 mA.

- Above 21.6 mA, the unit will freeze output at 21.6 mA.
- Below 2.4 mA level, the unit will freeze output to 2.4 mA.

### 3.4 Process connection

The hygienic 1" process sleeve is easy to weld into tanks or pipes. This kind of assembly allows installation in conformity with standards of hygiene such as FDA. The G1 connections can be mounted in any counter thread acc. to ISO 228.

Various hygienic adapter sleeves are available for fitting to other process connections. For more information refer to chapter "Appendix" or data sheet "Hyg. accessories".

The level meter can be installed either from top or bottom.

### 3.5 Mounting of 3A marked products

The 3A mark is valid only when the product is mounted in a 3A marked counterpart and installed acc. to the installation manual. Use also a 3A marked O-ring or gasket if relevant.

The 3A marked products conform to the 3A sanitary standards criteria. Materials and surfaces fulfill the FDA demands.

EPDM O-rings supplied with 3A marked products are conform to sanitary standards class II (8% milk fat).

- ① Use only 3A approved counterparts.
- ② The inspection hole should be visible and drained. Face it downwards so that possible leaking can be observed.
- ③ Mount the device in a self-drained position.
- ④ Level the inner surface of the pipe with the counterpart.
- ⑤ Weld from the inside of the tank, if possible. Welds shall be free from cracks, crevices and grooves. Weldings should be grinded to  $R_a = 0.8 \mu\text{m}$ .
- ⑥ The level meter can be installed on the side of the tank with a bent measuring probe.
- ⑦ The level meter can be installed from the bottom of the tank.

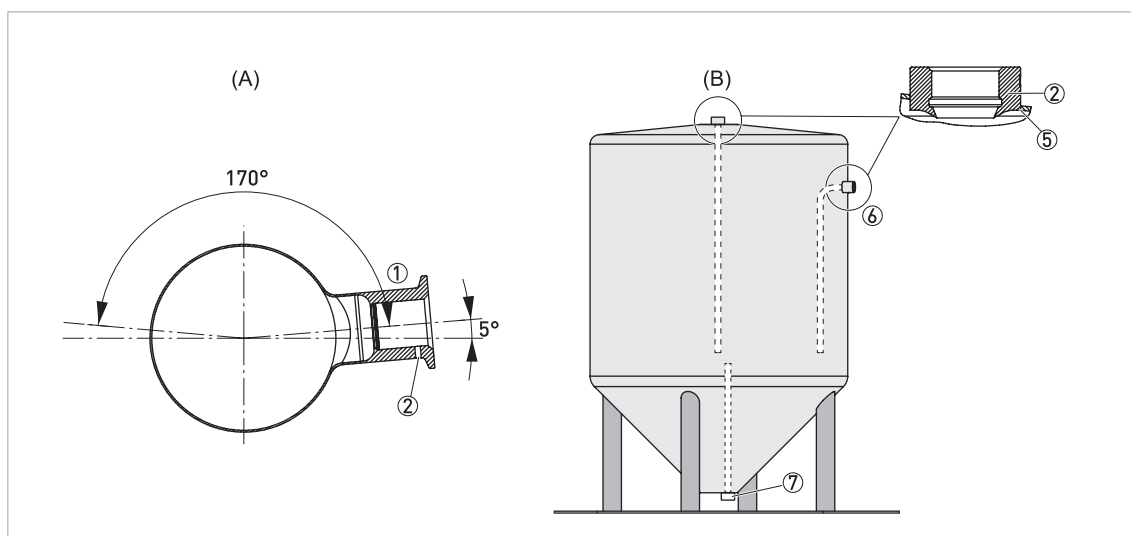


Figure 3-3: Mounting of 3A products in pipe installations (A) or tank installations (B)

## 4.1 Safety instructions

*All work on the electrical connections may only be carried out with the power disconnected. Take note of the voltage data on the nameplate!*

*Observe the national regulations for electrical installations!*

*For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.*

*Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.*

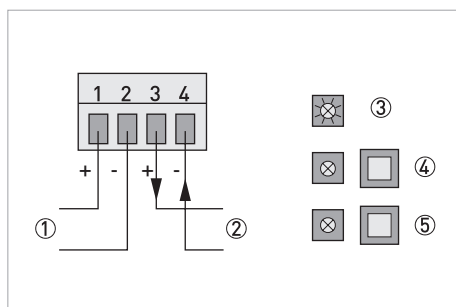
*Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.*

## 4.2 Electrical connection diagrams

Terminals 1 (+) and 2 (-) are used for supplying a DC voltage of 18...36 V. Terminal 2 is connected to the housing via a protective diode.

The maximum power consumption is 200 mA. This value should be taken into account in connection with the recommended use of a fuse.

An active, galvanically isolated 4...20 mA current output is provided at terminals 3 and 4. Please consider the applicable wiring regulations.



**Figure 4-1: Electrical connection and LED indication for setpoints for M16 cable gland**

- ① 18...36 VDC
- ② 4...20 mA
- ③ LED is flashing at correct measurement
- ④ Push button > 3 seconds to set point for 100%, 20 mA
- ⑤ Push button > 3 seconds to set point for 0%, 4 mA

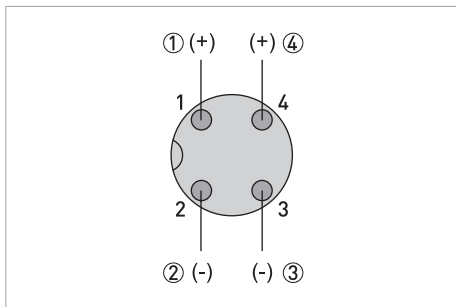


Figure 4-2: Electrical connection of M12 plug

- ① 18...36 VDC (+)
- ② 4...20 mA (-)
- ③ 18...36 VDC (-)
- ④ 4...20 mA (+)

- Pin 1: brown
- Pin 2: white
- Pin 3: blue
- Pin 4: black

## 5.1 Order code for BM 500

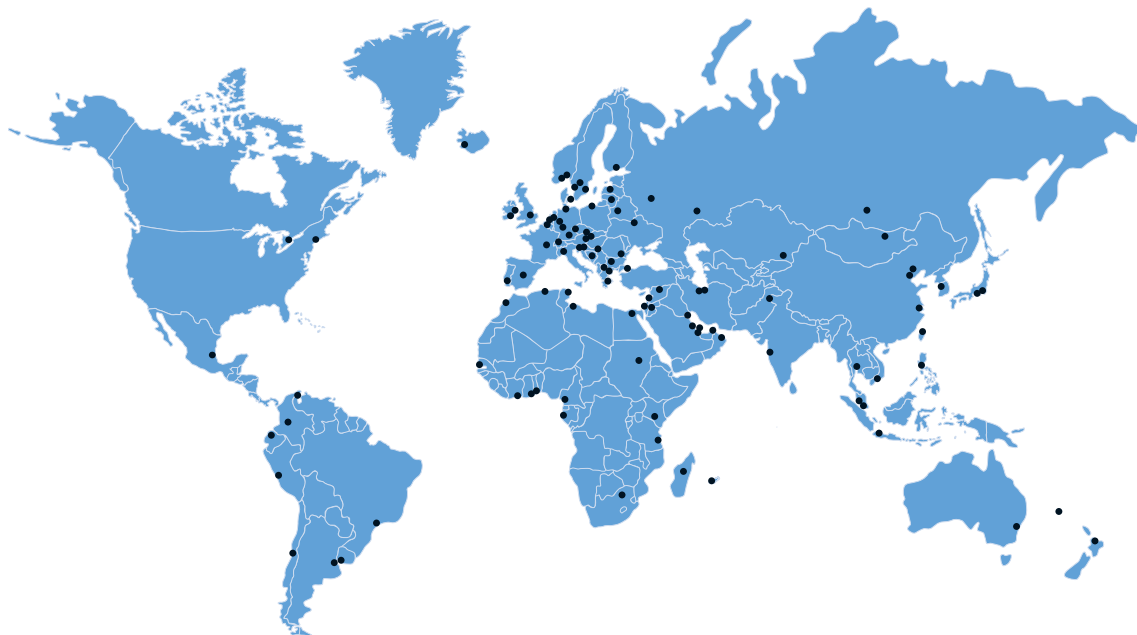
The characters of the order code highlighted in light grey describe the standard.

VGP3	4	1	BM 500: compact version (stainless steel housing – IP67 (equiv. NEMA 4X))				
		2	BM 500: remote version (stainless steel housing – IP67 (equiv. NEMA 4X))				
	G	<b>Insertion length of measuring rod</b>					
		Specify measuring probe length in mm increments; Minimum insertion length: 200 mm; Maximum insertion length: 3000 mm					
	G	<b>Electrical connection</b>					
		1	M16, plastic cable gland included / second entry with M16 plastic blind plug				
		2	M12, 4-pin connector plug / second entry with plastic blind plug				
	G	<b>Accessories</b>					
		1	Potted electronics				
	VGP3	4	G	1	0	0	0

## 5.2 Order code for process connections

The characters of the order code highlighted in light grey describe the standard.

VGP7	0	0	0	<b>Process connection type</b>					
				0	Without				
				1	Weld-in sleeve; HWN 500				
				8	DRD – DN50 sanitary connection; HMM 550				
				B	DIN 11851 – DN50 conical nozzle, including rotating union nut and gasket; HMT 550				
				C	VARIVENT® flange type N – DN40/50, including O-ring; HVF 550				
				D	2" Tri-Clamp®, DN50 – DIN 32676; 51 mm ISO 2852; including EPDM seal; HTC 550				
				U	DIN 11851 – DN40 conical nozzle, including rotating union nut and gasket; HMT 540				
				V	1½" Tri-Clamp®; DN25/40 DIN 32676; 25/38 mm ISO 2852; including EPDM seal; HTC 540				
				W	SMS adapter 1145 / 2", including union nut; HSM 551				
				Z	Allen screw blanking plug; HST 500				
				G	<b>Surfaces</b>				
					0	Standard			
				G	1	Inside electro-polished			
				VGP7	0	0	0	0	0



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