

ClampOn DSP PIG Detector

DIGITAL SIGNAL PROCESSING



ClampOn DSP PIG Detector, Ex i and Ex d version with local indicator lamp

ADVANTAGES

- **Non-intrusive**
- **Easy to install**
- **Real-time detection**
- **Local and remote indication**
- **Acoustic & magnetic detection**

BACKGROUND

Pigging is part of day-to-day operations on many offshore and onshore installations. The operator requires a reliable method of confirming a pig has left the launcher, arrived at the receiver, or passed certain locations anywhere along the pipeline.

The ClampOn DSP PIG Detector, based on ClampOn's patented Ultrasonic Intelligent Sensor technology platform, is a compact

and user-friendly instrument. Its fast and simple installation principle is unmatched by any other pig detector available. It provides reliable detection of any type of pig, and is non-intrusive.

OPERATING PRINCIPLE

The ClampOn DSP PIG Detector senses a passing pig using passive acoustic (ultrasonic) technology. The instrument has internal Digital Signal Processing (DSP). As a pig passes the detector's location, the instrument senses and analyses changes in the signal level at multiple frequencies. A pig can be indicated either via an indicator lamp on the instrument, or via a signal output to a control system indicator panel. This signal output can be a "pig passed" signal (i.e. relay contact) or a

RAW-signal output for further processing, and can be sent over RS 485 or 4-20 mA interfaces. By using either a dedicated computer running ClampOn software or sending the output to the MCS, the user can see a graphical representation of the signal received from the PIG Detector.



Ex d detector

INSTALLATION

The ClampOn DSP PIG Detector is non-intrusive and clamped on the outside of the pipe, so no parts are in contact with the flow. All instruments are factory calibrated and tested before delivery. The instrument is available in intrinsically safe and flame proof versions, and can easily be installed on pipes of various dimensions, using the supplied

mounting kit. For installation on already operational pipelines, no hot work permit is required. Detectors can be installed just downstream of a pig launcher, upstream of a receiver, or at any location along the pipe where the operator wants notification that a pig has passed. The instrument filters and adjust for fluctuations in background noise, so changes

in flow velocity that can occur over time will have minimal effect on the measured results. If only the local indicator lamp is used, the instrument requires just a 1-pair cable for power. If a signal output is also required, a minimum of a 2-pair cable is required.



Illustration of sensor installed on pipe



Illustration of pig in pipeline passing pig detector

INDONESIA DISTRIBUTOR



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Illustration of Ex d sensor with open lid and easy access to terminals blocks



KEY SPECIFICATIONS

- Method of operation Ultrasonic (acoustic)
Optional dual detection with magnetic flux gate
 - Processing Intelligent DSP inside the instrument
 - Method of installation Non-intrusive, clamped to pipe surface
 - Detection mode Default: Acoustic
Optional: Magnetic
 - Ambient temperature Ex i: $-40\text{ }^{\circ}\text{C} \leq T_{\text{amb}} \leq +60\text{ }^{\circ}\text{C}$
Ex d: $-50\text{ }^{\circ}\text{C} \leq T_{\text{amb}} \leq +80\text{ }^{\circ}\text{C}$
 - Pipe temperature $-40\text{ }^{\circ}\text{C}$ to $125\text{ }^{\circ}\text{C}$ [$-40\text{ }^{\circ}\text{F}$ to $257\text{ }^{\circ}\text{F}$]
 - Power Consumption Ex i: 1.9W 3.3 W (alarm, light illuminated)
Ex d: 1.2W 1.5 W (alarm, light illuminated)
 - Communication Relay, 4-20 mA, RS-485 (Modbus RTU, ClampOn DSP protocol)
 - Alarm indication Local indicator, remote indicator (via instrument relay), digitally via computer/controller with ClampOn software or in DCS/MCS, or 4-20 mA
 - Weight (sensor only) Ex i: 2.1 kg (4.6 lb),
Ex d: 3.2 kg (7.1 lb)
 - Dimensions (ø x h) Ex i: 80 mm x 135 mm [3.2 in x 6 in]
Ex d: 114 mm x 185 mm [4.5 in x 6.6 in]
 - Sensor material Stainless Steel 316L
 - Mounting bracket material Stainless Steel 316L, carbon steel or duplex
- All specifications are subject to change without notice*



ULTRASONIC INTELLIGENT SENSORS

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Product datasheet

DSP PIG Detector TSE.DS2D.SA0x.E11

1	General	Note
1.1	Model name	ClampOn DSP PIG Detector
1.2	Service description	Non-invasive non-intrusive topside pig detector
1.3	Model number	TSE.DS2D.SA00.E11 (acoustic detection) TSE.DS2D.SA01.E11 (magnetic detection) 1
1.4	Explosion protection principles employed	Flameproof enclosure, Ex d Increased safety, Ex e Intrinsic safety, Ex i
1.5	Serial number	YY-MM-XXXXX 2

2	Physical	
2.1	Dimensions (ø × h)	114 mm × 188 mm [4.5 in × 7.4 in]
2.2	Enclosure material	Stainless steel 316L
2.3	Enclosure protective coating	None by default
2.4	Weight (instrument only)	3.4 kg [7.5 lb]
2.5	Equipment marking	Polyester certification label Stainless steel tag plate where applicable
2.6	Cable entry configuration	2 off M25 × 1.5 ISO metric fitted with brass Ex blanking element
2.7	Cable gland	By client 3
2.8	Cable	By client 3
2.9	Local indicator type	Red LED array visible 360°
2.10	Local reset type	Rotary proximity switch



3	Environmental	
3.1	Maximum installation altitude	2 000 meters [6 562 feet]
3.2	Ingress protection	IP66/IP68 (10 meters [32.8 feet] for 7 days) tested to IEC 60529 and UL Type 4X tested to UL 50E
3.3	Ambient temperature	See Compliance section
3.4	Storage and transportation temperature	-20 °C to +40 °C
3.5	Storage and transportation humidity	30 % to 70 % (non-condensing)
3.6	Shock (tested to IEC 60068-2-27)	40 g, 6 ms, 100 shocks in each direction
3.7	Vibration (tested to IEC 60068-2-6)	2 Hz to 13.2 Hz (1.0 mm displacement) and 13.2 Hz to 100 Hz (0.7 g acceleration)

4	Operation	
4.1	Rated voltage range, U_{dc}	18 V to 28 V, $U_{nom} = 24$ V (instrument equipped with reverse polarity and transient protection) 4
4.2	Power consumption, at U_{nom}	1.2 W (no alarm/light not illuminated) 1.5 W (alarm, light illuminated)
4.3	Electronics platform/generation	ClampOn DSP II
4.4	Manner of operation	Real-time measurement
4.5	Unit of measurement	Raw value
4.6	Technology (for pig detection)	Passive ultrasonic using piezoelectric transducer and flux sensor for magnetic pig detection
4.7	Technology (for vibration measurement)	3-axis MEMS accelerometer 5
4.8	Processing	Digital signal processing (DSP) in instrument
4.9	Calibration	Instrument is factory calibrated
4.10	Design life	30 years
4.11	Detection mode	Acoustic, magnetic, combined acoustic and/or magnetic 1, 7, 13
4.12	Detection direction	Bidirectional
4.13	Detection algorithm (acoustic)	Fixed over Background (FoB) with trigger level, fallback level, trigger time minimum and trigger time maximum. All parameters are configurable 7, 8
4.14	Detection algorithm (magnetic)	Trigger level in magnetic raw value 1, 7, 8
4.15	Operating limits	The pig detector can detect all types of pig. The pig must be moving with a minimum velocity of 0.3 m/s [1 ft/s], depending on type of pig, pipe configuration and installation point
4.16	Detectable magnetic flux density	Minimum 0.15 mT (1.5 G) at detection point 1
4.17	Repeatability	Better than 1 %
4.18	Flow conditions	Oil, water, gas, multiphase
4.19	Pipe material	All steel alloys 6

5	Signal	7
5.1	Signal types (galvanically isolated)	RS-485, 4-20 mA, relays and reset. Relay 1 and local reset switch are intrinsically safe circuits 15
5.2	RS-485 (half duplex) protocol	Modbus RTU (default) or proprietary DSP
5.3	RS-485 bit rate	2.4 kbps to 115.2 kbps (19.2 kbps default)
5.4	4-20 mA	Type 4 fully isolated 4-wire transmitter in accordance with ISA 50.00.01. Configurable raw value range 0 to 5 000 000 (default 0 to 500 000). 15 mA alarm level when a pig is detected 8
5.5	Relay 1 (for local alarm)	Solid state SPST type, NO in listening mode (closed in alarm mode)
5.6	Relay 2 (for remote alarm)	Electromechanical DPDT latching type with 2 A at 28 V contact rating
5.7	Reset	Either by the integral local switch, by a reset command on RS-485 Modbus RTU, or with a timed automatic reset (duration configurable). When reset, alarms on 4-20 mA and relays are reset to listening mode 8

Product datasheet

DSP PIG Detector TSE.DS2D.SA0x.E11



6 Installation			
6.1	Mounting	Mounting bracket clamped to pipe using stainless steel clamping bands or welded to pipe surface. Collar nut secures instrument in mounting bracket	6, 9
6.2	Terminal block connection data	0.5 mm ² to 2.5 mm ² [AWG 20 to AWG 14] stranded conductor (with ferrule with plastic sleeve) cross section	
7 Compliance			14
7.1	Hazardous area location approval	Zone 1, 2 for ATEX/IECEx installations and Zone 1, 2 or Division 2 for cUL _{us} (NEC/CEC) installations	
7.2	ATEX certificate	UL 20 ATEX 2422X	11
7.3	ATEX marking	Ex II 2 G Ex db eb ib IIB T5...T4 Gb -50 °C ≤ T _{amb} ≤ +55 °C...+80 °C	
7.4	ATEX ambient temperature range	-50 °C ≤ T _{amb} ≤ +55 °C...+80 °C	10
7.5	IECEx certificate	IECEx ULD 20.0023X	11
7.6	IECEx marking	Ex db eb ib IIB T5...T4 Gb -50 °C ≤ T _{amb} ≤ +55 °C...+80 °C	
7.7	IECEx ambient temperature range	-50 °C ≤ T _{amb} ≤ +55 °C...+80 °C	10
7.8	cUL _{us} file number	E363818	
7.9	cUL _{us} marking	Class I Zone 1 AEx db eb ib IIB T5...T4 Gb Ex db eb ib IIB T5...T4 Gb -50 °C ≤ T _{amb} ≤ +55 °C...+80 °C	12
7.10	cUL _{us} ambient temperature range	-50 °C ≤ T _{amb} ≤ +55 °C...+80 °C	10
7.11	CE marking in conformance with	2014/34/EU (ATEX) 2014/30/EU (EMC) 2011/65/EU and 2015/863/EU (RoHS)	
7.12	RCM marking in conformance with	Radiocommunications Act 1992	
7.13	EMC generic standards applied	IEC/EN 61000-6-2, IEC/EN 61000-6-4 and IEC 60533	
	Conducted emissions	CISPR 16-2-1	
	Radiated emissions	CISPR 16-2-3	
	ESD immunity	IEC/EN 61000-4-2	
	Radiated RF disturbance immunity	IEC/EN 61000-4-3	
	Electric fast transient/burst immunity	IEC/EN 61000-4-4	
	Surge immunity	IEC/EN 61000-4-5	
	Conducted RF disturbance immunity	IEC/EN 61000-4-6	
	Power frequency magnetic field immunity	IEC/EN 61000-4-8	
	Power supply failures immunity	IEC/EN 61000-4-11	
	Voltage / frequency variations immunity	IEC/EN 61000-4-11	
	Conducted LF disturbance immunity	IEC/EN 61000-4-16	

Notes

- Magnetic PIG detection is optional and requires add-on electronics during manufacturing.
- Serial number breakdown: YY (year of manufacture), MM (month of manufacture), XXXXX (unique electronics ID).
- Various alternatives available. Cable gland and cable by client in accordance with local and/or national Ex installation regulations that apply.
- The instrument must be powered from a safety extra low voltage (SELV) power supply.
- For vibration measurement details, see instrument datasheet addendum. Vibration output is optional and not activated in instrument by default.
- Sensor waveguide must have metal-to-metal contact with the pipe surface.
- Factory configurable software parameters via RS-485 interface. May also be configured in-field by ClampOn authorised personnel.
- Parameters available for configuration by client via RS-485 interface with *ClampOn PIG Configuration Tool* software.
- Mounting bracket available in stainless steel (standard), carbon steel or duplex. Clamping bands available in stainless steel.
- The ambient temperature (T_{amb}) of -50 °C to +55 °C...+80 °C marked on the instrument refers to the temperature of the immediate surroundings. The instrument will have different T-classes (see Ex certificate) depending on any external source of heating, such as process temperature (T_{pipe}), or direct sunlight. If there is a risk the T_{amb} and T_{pipe} temperature ratings will exceed those listed in the Ex certificate, steps must be taken to mitigate this risk, such as installing a sunshade, insulating the pipe, or moving the instrument to another location.
- See certificate and/or user manual for Specific Conditions of Use.
- Suitable for use in (and additionally marked) Class I Division 2 Groups C, D T5...T4.
- By default, the pig detector uses acoustic detection, but magnetic detection can also be specified as an option. With magnetic detection, the instrument uses a magnetic field sensor to measure changes in the magnetic flux density near the sensor. Magnetic detection is only available over the RS-485 output.
- The instrument may not be marked with all certificates at the same time.
- 4-20 mA and DPDT relay outputs are not available simultaneously. Output type must be specified at time of order so that the correct output can be factory-wired.

Product datasheet

DSP PIG Detector TSE.DS2D.SA0x.E12

1	General	Note
1.1	Model name	ClampOn DSP PIG Detector
1.2	Service description	Non-invasive non-intrusive topside pig detector for separate control station
1.3	Model number	TSE.DS2D.SA00.E12 (acoustic detection) TSE.DS2D.SA01.E12 (magnetic detection)
1.4	Explosion protection principles employed	Flameproof enclosure, Ex d Increased safety, Ex e
1.5	Serial number	YY-MM-XXXXX

2	Physical
2.1	Dimensions ($\varnothing \times h$)
2.2	Enclosure material
2.3	Enclosure protective coating
2.4	Weight (instrument only)
2.5	Equipment marking
2.6	Cable entry configuration
2.7	Cable gland
2.8	Cable
2.9	Local indicator type
2.10	Local reset type

3	Environmental
3.1	Maximum installation altitude
3.2	Ingress protection
3.3	Ambient temperature
3.4	Storage and transportation temperature
3.5	Storage and transportation humidity
3.6	Shock (tested to IEC 60068-2-27)
3.7	Vibration (tested to IEC 60068-2-6)

4	Operation
4.1	Rated voltage range, U_{dc}
4.2	Power consumption, at U_{nom}
4.3	Electronics platform/generation
4.4	Manner of operation
4.5	Unit of measurement
4.6	Technology (for pig detection)
4.7	Technology (for vibration measurement)
4.8	Processing
4.9	Calibration
4.10	Design life
4.11	Detection mode
4.12	Detection direction
4.13	Detection algorithm (acoustic)
4.14	Detection algorithm (magnetic)
4.15	Operating limits
4.16	Detectable magnetic flux density
4.17	Repeatability
4.18	Flow conditions
4.19	Pipe material

5	Signal
5.1	Signal types (galvanically isolated)
5.2	RS-485 (half duplex) protocol
5.3	RS-485 bit rate
5.4	4-20 mA
5.5	Relay 1 (for local alarm on control station)
5.6	Relay 2 (for remote alarm)
5.7	Reset



Product datasheet

DSP PIG Detector TSE.DS2D.SA0x.E12



6 Installation			
6.1	Mounting	Mounting bracket clamped to pipe using stainless steel clamping bands or welded to pipe surface. Collar nut secures instrument in mounting bracket	7, 10
6.2	Terminal block connection data	0.5 mm ² to 2.5 mm ² [AWG 20 to AWG 14] stranded conductor (with ferrule with plastic sleeve) cross section	
7 Compliance			15
7.1	Hazardous area location approval	Zone 1, 2 for ATEX/IECEx installations and Zone 1, 2 or Division 2 for cUL _{us} (NEC/CEC) installations	
7.2	ATEX certificate	UL 20 ATEX 2422X	12
7.3	ATEX marking	Ex II 2 G Ex db eb IIB T5...T4 Gb -50 °C ≤ T _{amb} ≤ +55 °C...+80 °C	
7.4	ATEX ambient temperature range	-50 °C ≤ T _{amb} ≤ +55 °C...+80 °C	11
7.5	IECEx certificate	IECEx ULD 20.0023X	12
7.6	IECEx marking	Ex db eb IIB T5...T4 Gb -50 °C ≤ T _{amb} ≤ +55 °C...+80 °C	
7.7	IECEx ambient temperature range	-50 °C ≤ T _{amb} ≤ +55 °C...+80 °C	11
7.8	cUL _{us} file number	E363818	
7.9	cUL _{us} marking	Class I Zone 1 AEx db eb IIB T5...T4 Gb Ex db eb IIB T5...T4 Gb -50 °C ≤ T _{amb} ≤ +55 °C...+80 °C	13
7.10	cUL _{us} ambient temperature range	-50 °C ≤ T _{amb} ≤ +55 °C...+80 °C	11
7.11	CE marking in conformance with	2014/34/EU (ATEX) 2014/30/EU (EMC) 2011/65/EU and 2015/863/EU (RoHS)	
7.12	RCM marking in conformance with	Radiocommunications Act 1992	
7.13	EMC generic standards applied	IEC/EN 61000-6-2, IEC/EN 61000-6-4 and IEC 60533	
	Conducted emissions	CISPR 16-2-1	
	Radiated emissions	CISPR 16-2-3	
	ESD immunity	IEC/EN 61000-4-2	
	Radiated RF disturbance immunity	IEC/EN 61000-4-3	
	Electric fast transient/burst immunity	IEC/EN 61000-4-4	
	Surge immunity	IEC/EN 61000-4-5	
	Conducted RF disturbance immunity	IEC/EN 61000-4-6	
	Power frequency magnetic field immunity	IEC/EN 61000-4-8	
	Power supply failures immunity	IEC/EN 61000-4-11	
	Voltage / frequency variations immunity	IEC/EN 61000-4-11	
	Conducted LF disturbance immunity	IEC/EN 61000-4-16	

- ### Notes
1. Separate control station by client. ClampOn control station also available.
 2. Magnetic PIG detection is optional and requires add-on electronics during manufacturing.
 3. Serial number breakdown: YY (year of manufacture), MM (month of manufacture), XXXXX (unique electronics ID).
 4. Various alternatives available. Cable gland and cable by client in accordance with local and/or national Ex installation regulations that apply.
 5. The instrument must be powered from a safety extra low voltage (SELV) power supply.
 6. For vibration measurement details, see instrument datasheet addendum. Vibration output is optional and not activated in instrument by default.
 7. Sensor waveguide must have metal-to-metal contact with the pipe surface.
 8. Factory configurable software parameters via RS-485 interface. May also be configured in-field by ClampOn authorised personnel.
 9. Parameters available for configuration by client via RS-485 interface with *ClampOn PIG Configuration Tool* software.
 10. Mounting bracket available in stainless steel (standard), carbon steel or duplex. Clamping bands available in stainless steel.
 11. The ambient temperature (T_{amb}) of -50 °C to +55 °C...+80 °C marked on the instrument refers to the temperature of the immediate surroundings. The instrument will have different T-classes (see Ex certificate) depending on any external source of heating, such as process temperature (T_{pipe}), or direct sunlight. If there is a risk the T_{amb} and T_{pipe} ratings will exceed those listed in the Ex certificate, steps must be taken to mitigate this risk, such as installing a sunshade, insulating the pipe, or moving the instrument to another location.
 12. See certificate and/or user manual for Specific Conditions of Use.
 13. Suitable for use in (and additionally marked) Class I Division 2 Groups C, D T5...T4.
 14. By default, the pig detector uses acoustic detection, but magnetic detection can also be specified as an option. With magnetic detection, the instrument uses a magnetic field sensor to measure changes in the magnetic flux density near the sensor. Magnetic detection is only available over the RS-485 output.
 15. The instrument may not be marked with all certificates at the same time.
 16. 4-20 mA and DPDT relay outputs are not available simultaneously. Output type must be specified at time of order so that the correct output can be factory-wired.

Product datasheet

ClampOn Control Station

1	General	Note
1.1	Model name	ClampOn Control Station
1.2	Service description	Control station with light and reset for ClampOn DSP PIG Detector
1.3	Model number	8150/5-0176-0236-150-3311
1.4	Explosion protection principles employed	Increased safety, Ex e Flameproof enclosure, Ex d
1.5	Serial number	Unique for each unit

2	Physical	
2.1	Dimensions (L × W × H)	242 mm × 182 mm × 150 mm [9.5 in × 7.2 in × 5.9 in]
2.2	Enclosure material	Stainless steel 316L (enclosure: electro-polished, lid: brushed)
2.3	Enclosure protective coating	None by default
2.4	Weight	4 kg [8.8 lb]
2.5	Equipment marking	Polyester certification label Stainless steel tag plate where applicable
2.6	Cable entry configuration (clearance holes)	2 off Ø25 fitted with brass Ex blanking element, and 1 off Ø20 fitted with brass Ex breather drain
2.7	Cable gland	By client
2.8	Cable	By client
2.9	Indicator type	Single high intensity LED
2.10	Reset type	SPST push-to-make (spring return), normally open (NO)



3	Environmental	
3.1	Maximum installation altitude	2 000 meters [6 562 feet]
3.2	Ingress protection	IP66 tested to IEC 60529 and NEMA enclosure type 3, 4, 4x
3.3	Ambient temperature	See <i>Compliance</i> section
3.4	Storage and transportation temperature	Same as ambient temperature
3.5	Storage and transportation humidity	<95 % (non-condensing)

4	Operation	
4.1	Rated voltage range, U_{dc}	18 V to 28 V, $U_{nom} = 24$ V. See <i>Rated voltage range</i> on instrument product datasheet for details
4.2	Power consumption, at V_{nom}	0.3 W in addition to instrument power consumption
4.3	LED light viewing angle	180°
4.4	LED light colour	Red (coloured diffuser lens)
4.5	LED light operating life	100 000 hours
4.6	Push button service life	1 000 000 actuations

5	Signal	
5.1	Signal types	See <i>signal types</i> on instrument product datasheet for details

6	Installation	
6.1	Mounting	Mounting brackets in stainless steel. Entire assembly to be mounted in vertical (upright) position
6.2	Terminal block connection data	0.14 mm ² to 2.5 mm ² [AWG 26 to AWG 14] stranded conductor (with ferrule with plastic sleeve) cross section
6.3	PE connections	Internal: 2 off terminals for 4 mm ² conductor External: M8 stainless steel bolt

Product datasheet

ClampOn Control Station



7 Compliance			4
7.1	Hazardous area location approval	Zone 1, 2 for ATEX/IECEx installations and Zone 1, 2 or Division 2 for cULus (NEC/CEC) installations	
7.2	ATEX certificate	PTB 09 ATEX 1109	
7.3	ATEX marking	Ex II 2 G Ex db eb IIC T5...T4 Gb $-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +60^{\circ}\text{C}$	
7.4	ATEX ambient temperature range	$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +60^{\circ}\text{C}$	3
7.5	IECEx certificate	IECEx PTB 09.0049	
7.6	IECEx marking	Ex db eb IIC T5...T4 Gb $-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +60^{\circ}\text{C}$	
7.7	IECEx ambient temperature range	$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +60^{\circ}\text{C}$	3
7.8	cULus file number	E182378	
7.9	cULus marking	Class I Division 2 Groups A, B, C, D Class I Zone 1 AEx d e IIC T5 $-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +50^{\circ}\text{C}$ T4 $-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +60^{\circ}\text{C}$	
7.10	cULus ambient temperature range	$-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +60^{\circ}\text{C}$	3
7.11	CE marking in conformance with	2014/34/EU (ATEX) 2014/30/EU (EMC) 2011/65/EU (RoHS)	
7.12	EMC standards applied	IEC/EN 61439-1 and IEC/EN 61439-2	

Notes

1. The enclosure, actuator, lens, and terminals are Ex e, while the internal switch and LED are Ex d. The auxiliary components Ex breather drain and Ex blanking element are dual certified Ex d and Ex e.
2. Various solutions available. Cable gland and cable by client in accordance with local and/or national Ex installation regulations that apply.
3. The ambient temperature (T_{amb}) of -55°C to $+60^{\circ}\text{C}$ marked on the equipment refers to the temperature of the immediate surroundings, irrespective of any external source of heating, such as process temperature (T_{pipe}), or direct sunlight. If there is a risk the T_{amb} temperature ratings will exceed those listed in the Ex certificate, steps must be taken to mitigate this risk, such as installing a sunshade, moving the equipment to another location or similar.
4. The equipment may not be marked with all certificates at the same time.