

### SafeTap II™



SafeTap II - BOSx Oxygen Sensor

### PRODUCT OVERVIEW

The Barben Analytical SafeTap II is a retractable or “hot tap” Optical Oxygen Sensor. It is used with the OXYvisor Oxygen Analyzer for in situ sampling methods. Designed for use in liquids and dry or wet gases, the SafeTap II can be manually inserted and retracted from the process line. The SafeTap II provides the capability of in situ installation of a selectable BOSx Oxygen sensor ranges into the process pipe or vessel.

### FEATURES & BENEFITS

- Uses optical quench luminescent technology, no cross-sensitivity to CO<sub>2</sub>, SO<sub>2</sub>, NH<sub>3</sub>, and H<sub>2</sub>S, not affected by high O<sub>2</sub> levels and moisture, as compared to an E-Chem sensor
- Eliminates sample handling conditioning systems typical in extractive sampling methods. Lowers installation costs, complexity and maintenance.
- Adjustable BOSx sensor insertion length for variety of process pipe diameters
- RTD integrated at sensor tip for accurate temperature measurement and compensation
- Optional pressure transmitter allows for automatic compensation for accurate in-line measurements
- T-Handle and safety hook prevents blow-outs in case of unplanned overpressure and ensures safe operation during insertion and retraction
- Replaceable BOSx sensor cap—simple and quick sensor cap service replacement design
- Approved for Hazardous Location installations
  - Fiber Optic O<sub>2</sub> light energy is certified “op is” (optically inherently safe)
  - RTD is simple apparatus for C1D2 or Zone 2 and carries OXYvisor specifications\*\*
  - RTD in Zone 1, requires special Exd considerations

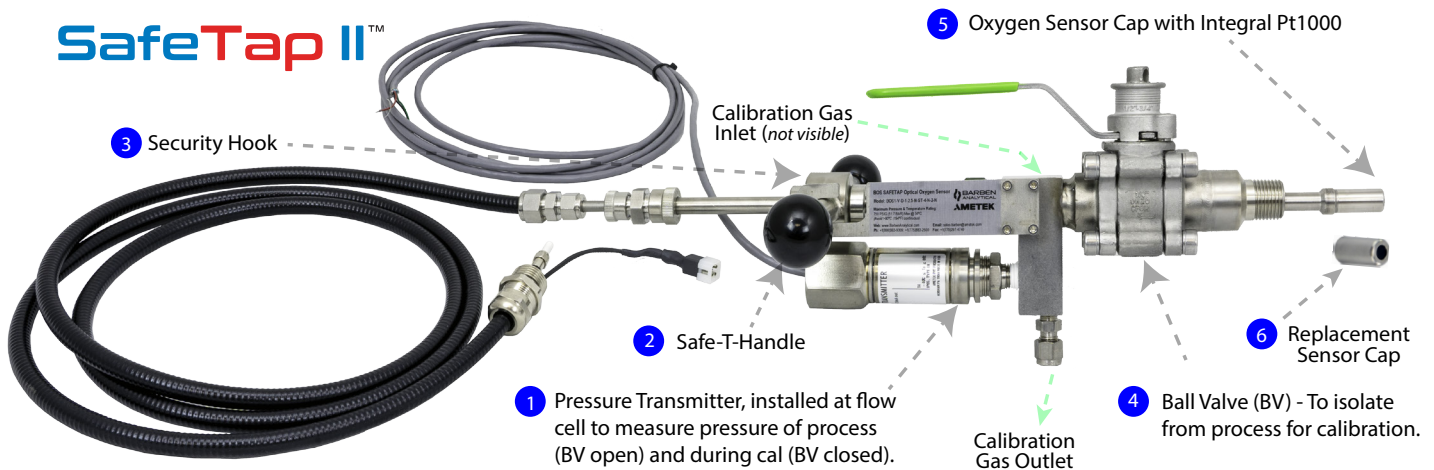
\*\* See OXYvisor datasheet or drawings for hazardous location

BOSx Oxygen Sensor Ranges		
BOS1 Oxygen Range	0 % to 4.2 % (gas)*	0 ppb to 1.8 ppm (liquid)
BOS2 Oxygen Range	0 % to 25 % (gas)	0 ppb to 22 ppm (liquid)
BOS3 Oxygen Range	0 to 300 ppm with 1000 ppm over range (gas)	

\* With over-range to 5 % O<sub>2</sub>

### TYPICAL APPLICATIONS

- Biogas - wet digester gas. 100 % compatible with typical stream compositions CH<sub>4</sub>, CO<sub>2</sub>, H<sub>2</sub>O, H<sub>2</sub>S, N<sub>2</sub>, O<sub>2</sub>, NH<sub>3</sub> & H<sub>2</sub>
- Biogas - H<sub>2</sub>S removal/sweetening, amines or bio scrubber
- Renewable Natural Gas (RNG) - upgraded biomethane trace O<sub>2</sub> (ppm) measurement for transmission quality pipeline gas
- Carbon capture processes in CO<sub>2</sub> (trace and % level O<sub>2</sub>)
- EOR - Enhanced Oil Recovery - Waterflood PPB Dissolved O<sub>2</sub> for seawater down hole injection
- General replacement of E-Chem (electrochemical / fuel) cells for Trace O<sub>2</sub> ppm to % level measurement.
  1. Not affected by typical e-chem poisons (H<sub>2</sub>S, CO<sub>2</sub>, H<sub>2</sub>)
  2. Measurement accuracy independent of flow rate
  3. Not affected with exposure to air or high O<sub>2</sub>
  4. Accurate measurement in particulate (dirty) streams



**Figure 1**  
BOS SAFETAP II, retractable or “hot-tap” Optical Oxygen Sensor

## PRINCIPAL OF OPERATION

Figure 1 above illustrates the SafeTap II assembly with optional pressure transmitter (1) installed on the flow cell for continuous measurement of pressure in the process line and during calibration process for gas phase measurements. The BOS SafeTap II oxygen sensor comes standard with integral Pt100 RTD (5) temperature sensor suitable for Class 1 Div 2, or without using an external RTD for Zone 1. The SafeTap II is rated up to pressures of 750 psig (51.7 Bar). Built in tubing ports are included as part of the welded retraction housing so that purge and complete in situ calibration, in normal process operating conditions, and 450 psig (31.0 Bar) during Insertion and Retraction of the SafeTap II, may be performed without removal of the oxygen sensor.

For inserting and retracting, the free rotating Safe-T-Handle (2) provides a secure gripping surface to manually insert and retract the optical sensor assembly into the process. The SafeTap II includes a security hook (3) that catches the safe-T-handle to prevent unintended retraction. The 316SS Ball Valve (4) eliminates the need for a secondary isolation valve for retracting or maintenance of the sensor. Optional calibration gas inlet and outlet 316SS needle valves provide ease of manual calibration.

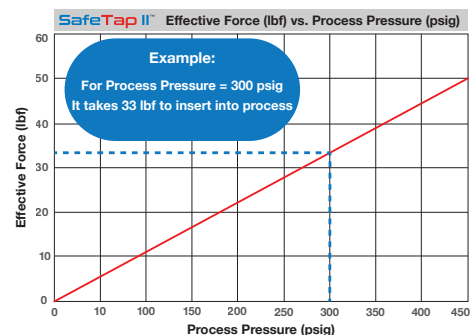
The SafeTap II is supplied with a replaceable luminophore window sensor cap (6), making sensor service simple and low cost. When sensor cap replacement is required, the removable luminophore tip can be retracted through the ball valve (4), which is used to isolate the sensor from the process. The sensor cap can be simply unscrewed with your fingers or hand and the replacement screwed back on hand tight, do not use any tools.

For a more thorough and detailed process on inserting, retracting the sensor assembly, calibration, and sensor cap replacement, please review the SafeTap II Oxygen Sensor Manual.

## EFFECTIVE FORCE VS PROCESS PRESSURE

The SafeTap II utilizes a 3/8” insertion rod for insertion/retraction. The small diameter rod helps to significantly reduce the force required during normal operation, insertion /retraction or during process upsets.

For example, Figure 2, shows the Effective Force (lbf) required to insert the sensor into process with various Process Pressure (psig).

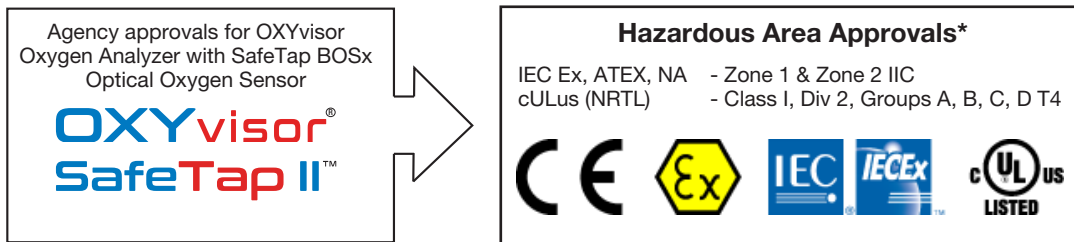


**Figure 2**

## INSTALLATION EXAMPLES

This section references hazardous location installation examples (see Figure 3 and 4) with measurements for liquid or gas phases. The OXYvisor oxygen analyzer with SafeTap II has agency approvals for Zone 1, Zone 2, and Class 1 Div 2 installation locations, see below for listed approval agencies. The SafeTap II is rated up to pressures of 750 psig (51.7 Bar) in normal process operating conditions, and 450 psig (31.0 Bar) during insertion and retraction of the SafeTap II.

OXYvisor Analyzer is shown in both Figure 3 and 4 are mounted in a hazardous location with the pipe mount kit and optional sunshade accessory. The recommended cable length is 5 meters with options to 10 meters (for greater lengths please consult the factory). For all installation requirements, review the OXYvisor and SafeTap II manuals mentioned in the Standard Documentation section.



\*For complete list of agency approvals, refer to the OXYvisor Datasheet.

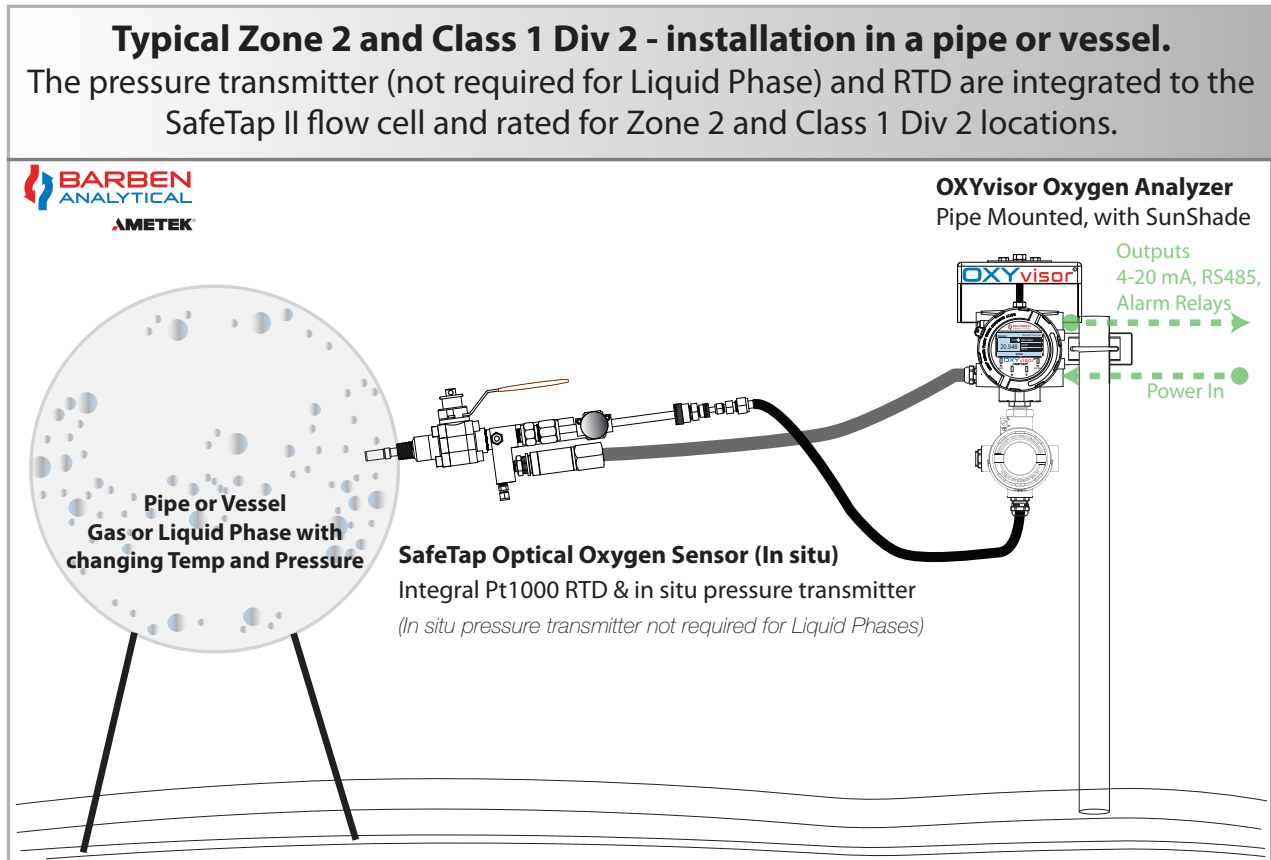


Figure 3: Zone 2 and Class 1 Div 2 Installation Examples

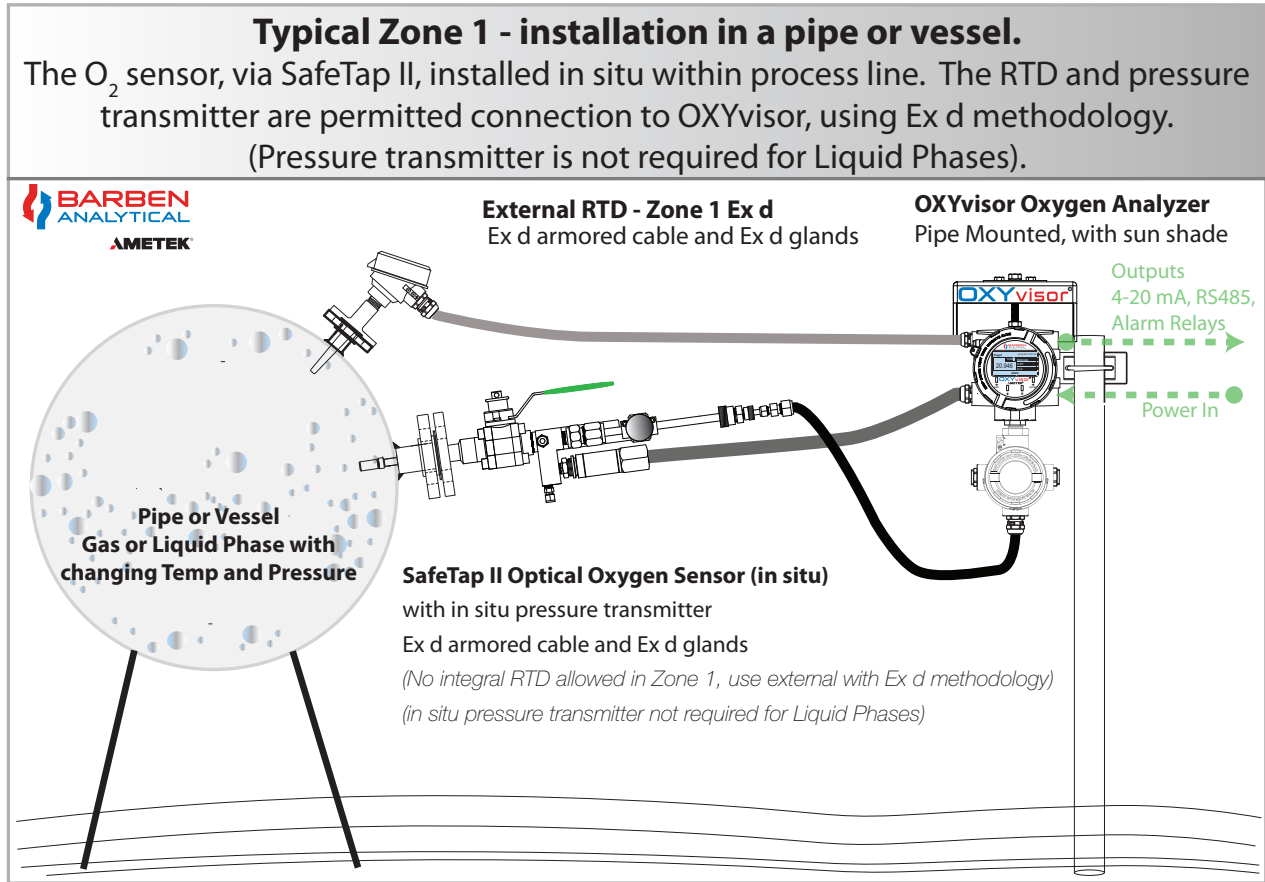


Figure 4: Zone 1 Installation Example

## STANDARD DOCUMENTATION

Table 1 references our standard documentation for the OXYvisor oxygen analyzer and BOS SafeTap II optical oxygen sensor. Barben recommends referring to our standard documentation as it serves as a comprehensive resource in providing detailed product information, installation, and guidelines for best practices. If you encounter any specific questions, please call us +1-775-883-2500 or visit our website: <https://www.barbenanalytical.com/>

Document	Document Type	Description
BA-DAT-OXY	OXYvisor Datasheet	Technical overview of OXYvisor Oxygen Analyzer
BA-MAN-OXY-IM	OXYvisor Installation Manual	Installation, operation & maintenance information for the OXYvisor Oxygen Analyzer
BA-MAN-OXY-SW	OXYvisor Software Manual	Provides setup, configuration, data logging, calibration, diagnostics and more via PC software
BA-MAN-BOSST-IM	SafeTap II Installation Manual	Installation, operation & maintenance information for the SafeTap II

Table 1: Standard Documentation

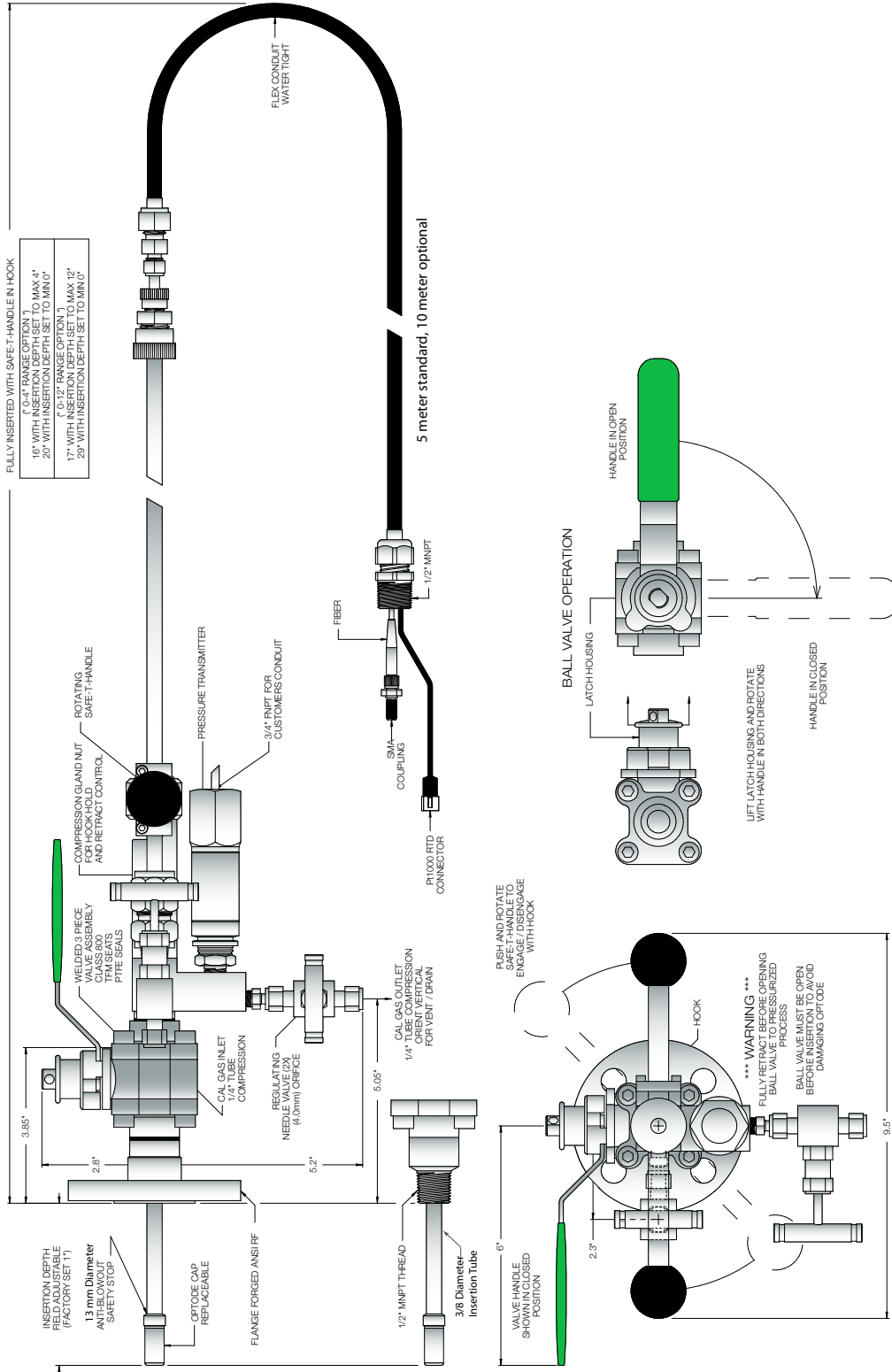
## PRODUCT NOMENCLATURE

Sensor Range	Sensor & Seals	Body Material	Process Connection	Cable Armor	Sensor Length	Lead Length	Agency Approval	ID	FC	PT	Padlock
<b>BOSx Sensor Element / Range (optode selection)</b>											
BOS1	Mid Range Sensor: Gas Phase: 0-5.0 % O <sub>2</sub> , 0-50 hPa with LOD 20 ppm O <sub>2</sub> and/or Liquid Phase Dissolved Oxygen: 0-1.8 ppm with LOD of 1 ppb										
BOS2	High Range Sensor: Gas Phase: 0-25.0 % O <sub>2</sub> , 0-250 hPa with LOD 300 ppm O <sub>2</sub> and/or Liquid Phase Dissolved Oxygen: 0-22 ppm with LOD of 15 ppb										
BOS3	Trace Range: Gas Phase: 0-300 ppm with 1000 ppm over-range, with LOD of 0.5 ppm O <sub>2</sub> (0.0005 hPa) [Dissolved O <sub>2</sub> reading not avail. for this sensor]										
<b>Sensor &amp; Seals (wetted elastomers)</b>											
V Viton O-ring seals - Standard											
E EPDM O-ring seals											
K FFKM (perfluoroelastomer) O-ring seals											
<b>Body Material (wetted metallics)</b>											
1 316 Stainless Steel (Standard)											
2 Titanium Grade 2											
3 Hastelloy C-276											
4 Stainless Steel 2507 Super Duplex											
<b>Sensor Type &amp; Process Connection</b>											
D SafeTap: 1/2" MNPT Nipple for Process Connect, Insert/retract with 1/2" MNPT BV, Class 800, Vacuum = 10 <sup>-6</sup> Torr, Nace MR0175											
<b>F = 150#/G = 300# RF Flange, Process Connect, Insert/retract with 1/2" Full Port BV, Class 800, Vacuum = 10<sup>-6</sup> Torr, Nace MR0175</b>											
F10/G10 SafeTap - 1.0"											
F15/G15 SafeTap - 1.5"											
F20/G20 SafeTap - 2.0"											
F30/G30 SafeTap - 3.0"											
<b>Cable Armor</b>											
1 Armor Jacketing Protection											
BOS Sensor Overall Length (Refer to "OXYvisor Oxygen Analyzer & BOS Sensors Datasheet")											
2.5 2.5 m (8.2')											
5.0 5 m (16.4')											
10 10 m (32.8') (BOS1 & BOS2 Sensors only)											
X Special Length (If > 10 m, consult factory) (BOS1 & BOS2 sensors only)											
PVC Jacket Length, Select "N" for BOS SafeTap Sensors.											
N Standard - direct connect to OXYvisor Analyzer											
<b>Agency Approval</b>											
ST Standard, Integral RTD for SafeTap											
SN No integral TC, and Zone 1 (see accessories for external RTD options)											
<b>Insertion Depth</b>											
4 Std SafeTap Insertion Depth = 4" past end of nipple or Flange											
F SafeTap insertion depth = 12" past end of nipple or Flange											
X Customer defined insertion depth											
<b>Fittings &amp; Cal Valves - 316 Stainless Steel</b>											
N None - 1/4" T (Open)											
C Calibration Valves Included and Fittings											
<b>Pressure Transmitter - 316 Stainless Steel</b>											
N None - Plug 1/4" NPT											
1 0-15 psia - Pressure Transmitter											
2 0-30 psia - Pressure Transmitter											
3 0-60 psia - Pressure Transmitter											
4 0-100 psia - Pressure Transmitter											
5 0-150 psia - Pressure Transmitter											
X >200 psia - Pressure Transmitter - consult factory											
<b>Padlock</b>											
N None											
V Padlock 3/16"											
H Padlock 5/16"											
	Seals	Body MTL	Sensor Type	Cable	Length	Cut	Agency	ID	FC	PT	P
<b>BOS3</b>	<b>V</b>	<b>1</b>	<b>D</b>	<b>1</b>	<b>2.5</b>	<b>N</b>	<b>ST</b>	<b>4</b>	<b>N</b>	<b>N</b>	<b>N</b>
<b>&lt;--- SafeTap II - Typical Sensor Configuration</b>											

## PRODUCT SPECIFICATIONS

BOS1 Sensor Specifications - Liquid Phase / Gas Phase		
	Dissolved O <sub>2</sub> (DO)	Gaseous and Dissolved O <sub>2</sub> @ 1 atm, 20 °C
Measurement Range	0 - 2 ppm	0 - 4.2% (over-range of 5%) O <sub>2</sub>
Limit of Detection	1 ppb	0.002% O <sub>2</sub> (0.02 hPa)
Resolution @ 20 °C and 1013 hPa	± 0.30 at 1 ppb ± 0.63 at 200 ppb	± 0.0007% at 0.002% O <sub>2</sub> (± 0.0015% at 0.02% O <sub>2</sub> ) ± 0.007 hPa at 0.023 hPa (± 0.015 hPa at 2.0 hPa)
Response Time (T <sub>90</sub> )	< 30 sec.	< 6 sec.
Accuracy @ 20 °C	± 1 ppb (l), 0.002%(g) or ± 3% of the respective concentration; whichever is higher	
Drift from Photo-decomposition	< 2 ppb within 30 days (60 sec. sample interval)	< 0.0042% within 30 days (60 sec. sample interval)
Operating Temperature Range	0 to 50 °C (32 to 122 °F) [continuous up to 70 °C, consult factory for special conditions and considerations]	
Allowable Sensor Temperature	up to 90 °C (194 °F) non-continuous	
BOS2 Sensor Specifications - Liquid Phase / Gas Phase		
	Dissolved O <sub>2</sub> (DO)	Gaseous and Dissolved O <sub>2</sub> @ 1 atm, 20 °C
Measurement Range	0 - 45 ppm	0 - 25% (over-range of 100%) O <sub>2</sub>
Limit of Detection (LOD)	18.1 ppb	0.03% O <sub>2</sub>
Resolution @ 20 °C and 1013 hPa	± 4.5 at 90 ppb ± 0.15 at 23 ppm	± 0.01% at 0.21% O <sub>2</sub> (± 0.1 hPa at 2 hPa) ± 0.1% at 20.9% O <sub>2</sub> (± 1 hPa at 207 hPa)
Response Time (T <sub>90</sub> )	< 30 sec.	< 6 sec.
Accuracy @ 20 °C	±290 ppb or ±2 % at 15 ppm O <sub>2</sub> , whichever is greater (l)	± 0.4% at 20.9% O <sub>2</sub> and ± 0.05% at 0.2% O <sub>2</sub>
Drift from Photo-decomposition	< 24 ppb within 30 days (60 sec. sample interval)	< 0.03% (60 sec. sample interval)
Operating Temperature Range	0 to 50 °C (32 to 122 °F) [continuous up to 70 °C, consult factory for special conditions and considerations]	
Allowable Sensor Temperature	90 °C (194 °F) non-continuous	
BOS3 Sensor Specifications - Gas Phase Only		
	Gaseous O <sub>2</sub> @ 1 atm, 20 °C	
Measurement Range	0 - 300 ppm (over-range of 1000 ppm)	
Limit of Detection (LOD)	0.5 ppm	
Resolution @ 20 °C and 1013 hPa	± 0.5 at 10 ppm; ± 0.8 at 100 ppm; ± 1.5 at 200 ppm	
Response Time (T <sub>90</sub> )	< 3 sec. based on 0 - 300 ppm measurement range	
Accuracy @ 20 °C	± 2 ppm or ± 5% of measured value; whichever is greater (± 0.002 hPa)	
Drift from Photo-decomposition	< 1.5 ppm within 30 days (60 sec. sample interval)	
Operating Temperature Range	0 to 50 °C (32 to 122 °F) continuous	
Allowable Sensor Temperature	90 °C (194 °F) non-continuous	
Cross Sensitivity for BOS1, BOS2, BOS3 Sensors Listed above		
No cross-sensitivity for carbon dioxide (CO <sub>2</sub> ), hydrogen sulfide (H <sub>2</sub> S), ammonia (NH <sub>3</sub> ), gaseous sulfur dioxide (SO <sub>2</sub> ), no cross-sensitivity to pH (1-14), ionic species like sulfide, sulfate or chloride. Usable in methanol, ethanol-water mixtures, and in pure methanol & ethanol. Avoid organic solvents like benzene, chloroform, toluene, acetone, and methylene chloride along with any strong oxidizers such as gaseous chlorine (Cl <sub>2</sub> )		
BOS SAFETAP Retractable Optical Oxygen Sensor Specifications		
Valve Options	316 stainless steel ball valve W.O.G., Optional 29" Hg full vacuum NACE MR0175 certified ball valve	
Operating Pressure Rating	Up to 750 psig (51.7 barg)	
Insertion / Retraction Pressure Rating	Up to 450 psig (31.0 barg) Note: physical insertion / retraction may become more difficult over 300 psig	
Temperature Rating	0 to 50 °C (32 to 122 °F) operating, 90 °C (194 °F) non-continuous	
Internal Seal Options	Viton, EPDM, FFKM (Kalrez)	

## PRODUCT DIMENSIONS - SAFE TAP II WITH MANUAL CALIBRATION VALVE



## PRODUCT DIMENSIONS - SAFETAP II WITHOUT MANUAL CALIBRATION VALVE

