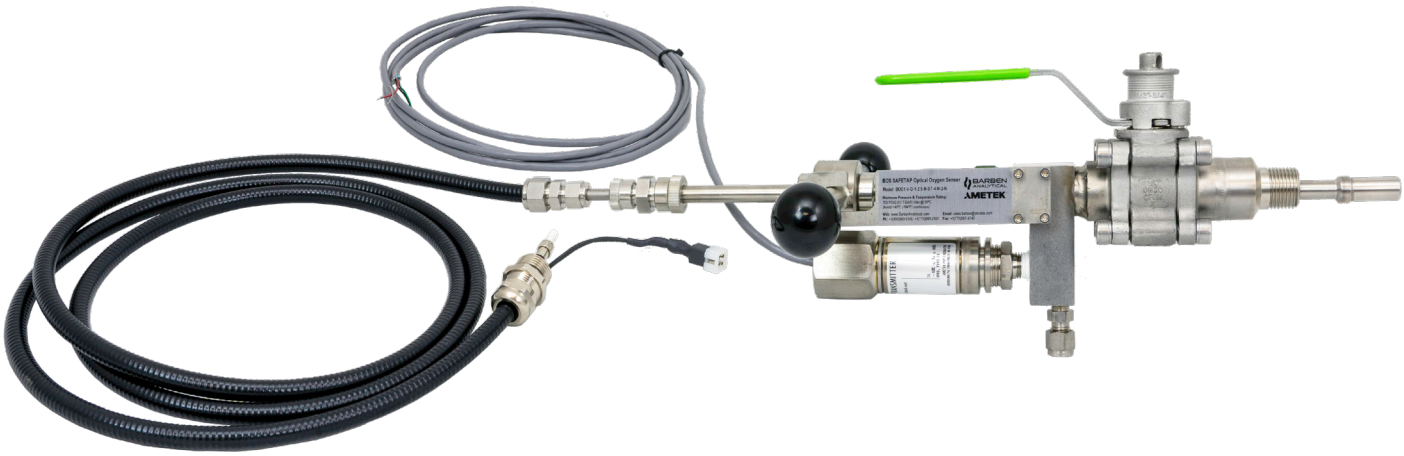
BARBEN ANALYTICAL

AMETEK®

Installation, Operation & Maintenance Manual

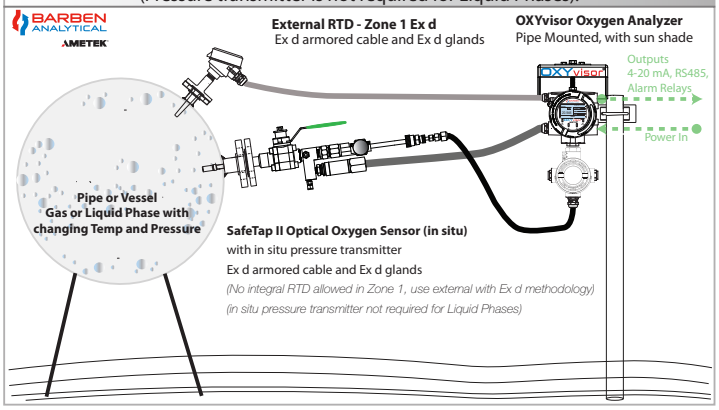
BOS SAFETAP II

Optical Oxygen Sensor - Optical O_2 Products (BOSx)



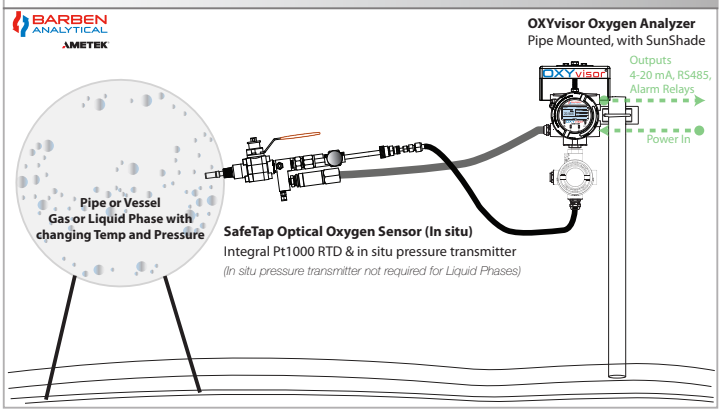
Typical Zone 1 - installation in a pipe or vessel.

The O_2 sensor, via SafeTap II, installed in situ within process line. The RTD and pressure transmitter are permitted connection to OXYvisor, using Ex d methodology. (Pressure transmitter is not required for Liquid Phases).



Typical Zone 2 and Class 1 Div 2 - installation in a pipe or vessel.

The pressure transmitter (not required for Liquid Phase) and RTD are integrated to the SafeTap II flow cell and rated for Zone 2 and Class 1 Div 2 locations.



AMETEK®

Operation & Maintenance Manual
BOS SAFETAP II Optical Oxygen Sensor

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SECTION 1.0: INTRODUCTION AND SAFETY

1.1 Receiving and Storage

WARNING!! DO NOT DISCARD UV PACKAGING.

Barben oxygen sensors are light sensitive devices. Avoid prolonged exposure to UV light, as this will minimize the effectiveness of the luminophore dye, leading to limited life or failure of the sensor.
Carefully inspect the products immediately upon arrival. If there are missing or damaged items contact the factory or shipping insurance company immediately.

Storage: The storage location should be protected from the elements. Although all components provided are designed to resist corrosion, additional protection from heat (>140°F/ 60°C) and humidity is recommended. Store the sensor caps in factory supplied UV resistant packaging when not in use.

1.2 Safety Instructions

Read the complete manual BEFORE installation and operation. Please consult factory support for any questions.

WARNING: Always wear protective equipment (e.g. face shield, gloves and other protective clothing) and follow safety rules when clearing the line, installing or removing sensor.

WARNING!! ALWAYS WEAR PERSONAL PROTECTION EQUIPMENT (PPE)
Use appropriate safety equipment before working on the sensor. Have the proper tools laid out before performing any work.

WARNING!! KEEP THE OPTICAL WINDOW CLEAN. DO NOT TOUCH
Do not introduce dirt, debris, condensate or other foreign contaminants on to the optical window.
The Luminophore and optical isolation on the optical window are delicate. **DO NOT SCRATCH OR DAMAGE THE OPTICAL WINDOW.**

WARNING!! DO NOT OVER TIGHTEN THE SENSOR CAP
The sensor cap should be firmly tightened by hand only. Over tightening the cap may result in damage to the cap housing or to the O-ring on the sensor body. Keep the optical window inside the UV resistant bag until the time of installation.

ATTENTION! MINIMUM BEND RADIUS OF WAND ASSEMBLY CABLE IS 8 INCHES
During installation of the SafeTap II, depending on angle of insertion, the wand assembly cable may require additional support to prevent damage to the internal fiber optic cable.

1.3 Products Covered in this Manual

This product manual provides information about Barben Analytical's BOS SAFETAP II oxygen sensor and the replaceable oxygen window cap assembly, series B3907. The series B3907 cap assemblies include a pre-assembled replacement cap and an O-ring replacement for the BOS SAFETAP II optical oxygen sensor. The scope of this manual also covers the installation and replacement for the B3907 series replacement cap assemblies.

SECTION 2.0: TECHNICAL SPECIFICATIONS

2.1 Product Nomenclature and Specifications

Sensor Range	Sensor & Seals	Body Material	Process Connection	Cable Armor	Sensor Length	Lead Length	Agency Approval	ID	FC	PT	Padlock
BOSx Sensor Element / Range (optode selection)											
BOS1 BOS2 BOS3	Mid Range Sensor: Gas Phase: 0-5.0 % O_2, 0-50 hPa with LOD 20 ppm O_2 and/or Liquid Phase Dissolved Oxygen: 0-1.8 ppm with LOD of 1 ppb High Range Sensor: Gas Phase: 0-25.0 % O_2, 0-250 hPa with LOD 300 ppm O_2 and/or Liquid Phase Dissolved Oxygen: 0-22 ppm with LOD of 15 ppb Trace Range: Gas Phase: 0-300 ppm with 1000 ppm over-range, with LOD of 0.5 ppm O_2 (0.0005 hPa) [Dissolved O_2 reading not avail. for this sensor]										
	Sensor & Seals (wetted elastomers)										
	V E K	Viton O-ring seals - Standard EPDM O-ring seals FFKM (perfluoroelastomer) O-ring seals									
		Body Material (wetted metalics)									
		1 2 3 4	316 Stainless Steel (Standard) Titanium Hastelloy Stainless Steel 2507 Super Duplex								
			Sensor Type & Process Connection								
			D	SafeTap: 1/2” MNPT Nipple for Process Connect, Insert/retract with 1/2” MNPT BV, Class 800, Vacuum = 10^{-6} Torr, Nace MR0175							
			F = 150#/G = 300# RF Flange, Process Connect, Insert/retract with 1/2” Full Port BV, Class 800, Vacuum = 10^{-6} Torr, Nace MR0175							
			F10/G10 F15/G15 F20/G20 F30/G30	SafeTap - 1.0” SafeTap - 1.5” SafeTap - 2.0” SafeTap - 3.0”							
				Cable Armor							
				1	Armor Jacketing Protection						
					BOS Sensor Overall Length (Refer to “OXYvisor Oxygen Analyzer & BOS Sensors Datasheet”)						
					2.5 5.0 10 X	2.5 m (8.2’) 5 m (16.4’) 10 m (32.8’) (BOS1 & BOS2 Sensors only) 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				
							Agency Approval				
							ST SN	Standard, Integral RTD for SafeTap No integral TC, and Zone 1 (see accessories for external RTD options)			
								Insertion Depth			
								4 F X	Std SafeTap Insertion Depth = up to 4” past end of nipple or Flange SafeTap insertion depth = up to 12” past end of nipple or Flange Customer defined insertion depth		
									Fittings & Cal Valves - 316 Stainless Steel		
									N C	None - 1/4” T (Open) Calibration Valves Included and Fittings	
										Pressure Transmitter - 316 Stainless Steel	
										N 1 2 3 4 5 X	None - Plug 1/4” NPT 0-15 psia - Pressure Transmitter 0-30 psia - Pressure Transmitter 0-60 psia - Pressure Transmitter 0-100 psia - Pressure Transmitter 0-150 psia - Pressure Transmitter >200 psia - Pressure Transmitter - consult factory
											Padlock
											N V H	None Padlock 3/16” Padlock 5/16”
	Seals	Body MTL	Sensor Type	Cable	Length	Cut	Agency	ID	FC	PT	P	
BOS3	**V**	**1**	**D**	**1**	**2.5**	**N**	**ST**	**4**	**N**	**N**	**N**	**<--- SafeTap II - Typical Sensor Configuration**

2.2 BOS Range Specifications for All Products

BOS1 Sensor Specifications - Liquid Phase / Gas Phase		
	Dissolved O_2 (DO)	**Gaseous and Dissolved O_2 @ 1 atm, 20 °C**
Measurement Range	0 - 2 ppm	0 - 4.2% (over-range of 5%) O_2
Limit of Detection	1 ppb	0.002% O_2 (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_2 (± 0.0015% at 0.02% O_2) ± 0.007 hPa at 0.023 hPa (± 0.015 hPa at 2.0 hPa)
Response Time (T_{90})	< 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_2 (DO)	**Gaseous and Dissolved O_2 @ 1 atm, 20 °C**
Measurement Range	0 - 45 ppm	0 - 25% (over-range of 100%) O_2
Limit of Detection (LOD)	18.1 ppb	0.03% O_2
Resolution @ 20 °C and 1013 hPa	± 4.5 at 90 ppb ± 0.15 at 23 ppm	± 0.01% at 0.21% O_2 (± 0.1 hPa at 2 hPa) ± 0.1% at 20.9% O_2 (± 1 hPa at 207 hPa)
Response Time (T_{90})	< 30 sec.	< 6 sec.
Accuracy @ 20 °C	±290 ppb or ±2 % at 15 ppm O2, whichever is greater (l)	± 0.4% at 20.9% O2 and ± 0.05% at 0.2% O2
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	

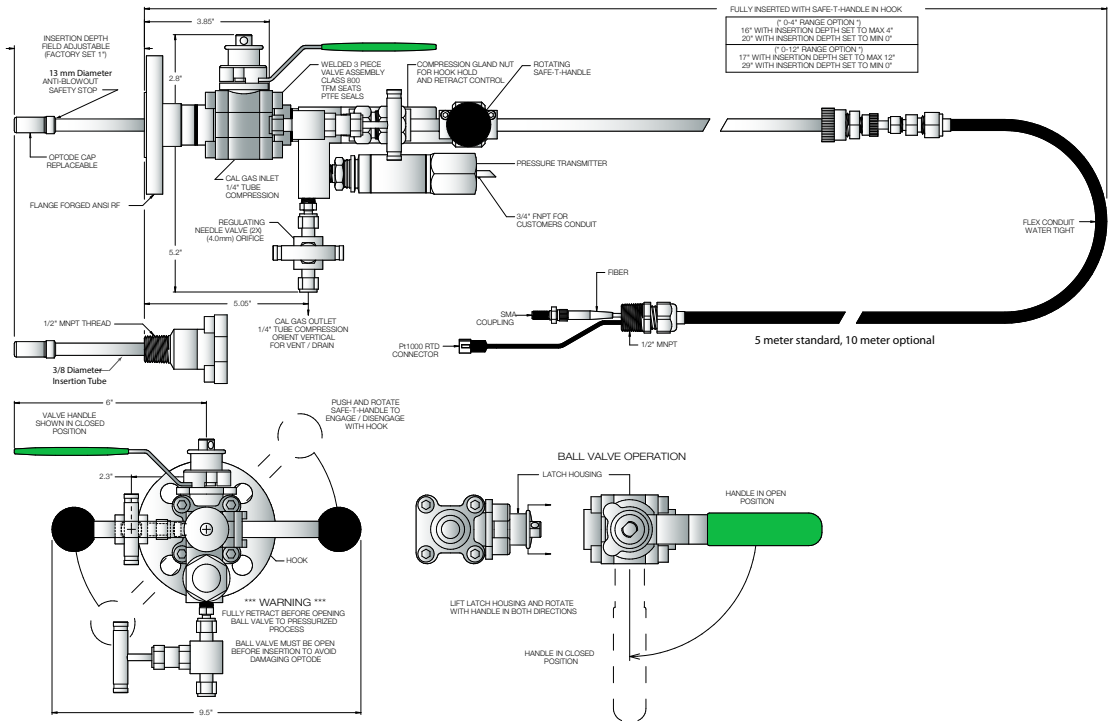
BOS3 Sensor Specifications - Gas Phase Only	
	Gaseous O_2 @ 1 atm, 20 °C
Measurement Range	0 - 300 ppm (over-range of 1000 ppm)
Limit of Detection (LOD)	0.5 ppm
Resolution @ 20 °C and 1013 hPa	± 0.5 at 10 ppm; ± 0.8 at 100 ppm; ± 1.5 at 200 ppm
Response Time (T_{90})	< 3 sec. based on 0 - 300 ppm measurement 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_2), hydrogen sulfide (H_2S), ammonia (NH_3), gaseous sulfur dioxide (SO_2), 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_2)

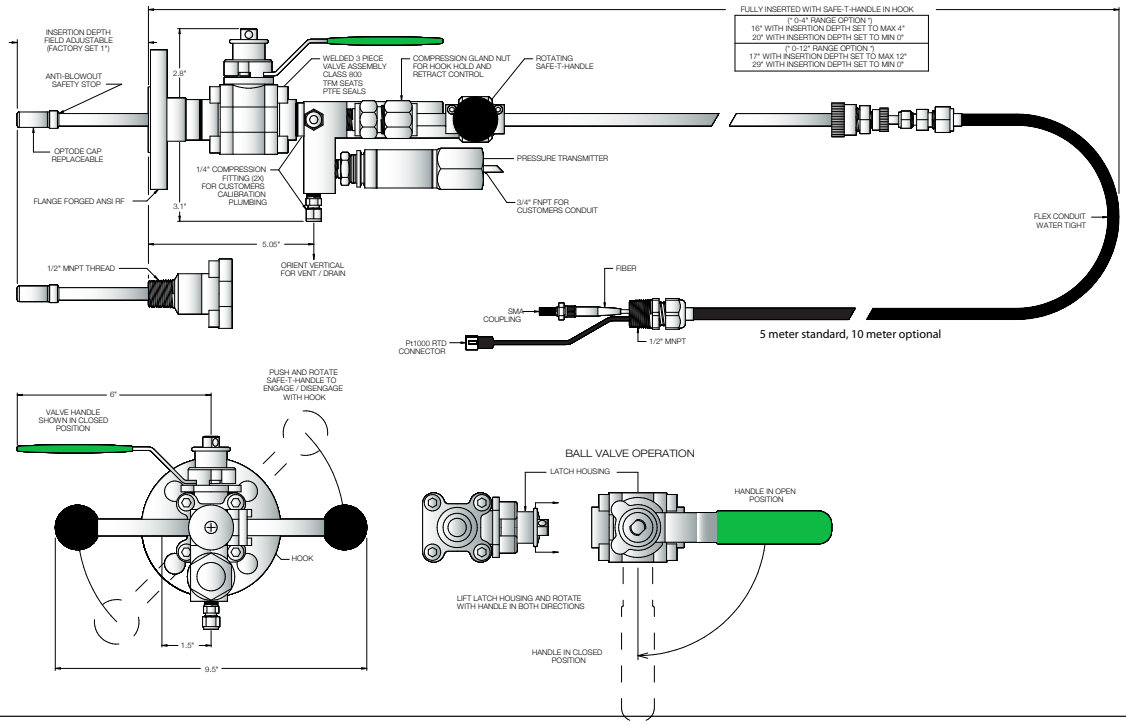
BOS SAFETAP Retractable Optical Oxygen Sensor Specifications	
Valve Options	316 stainless steel ball valve W.O.G., Optional 29" Hg full vacuum NACE MR0175 certified ball valve
Operating Pressure Rating	Up to 750 psig (51.7 barg)
Insertion / Retraction Pressure Rating	Up to 450 psig (31.0 barg) **Note: 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)

2.3 BOS SafeTap II Dimensions

SafeTap II with Manual Calibration Valve Dimension



SafeTap II without Manual Calibration Valve Dimensions



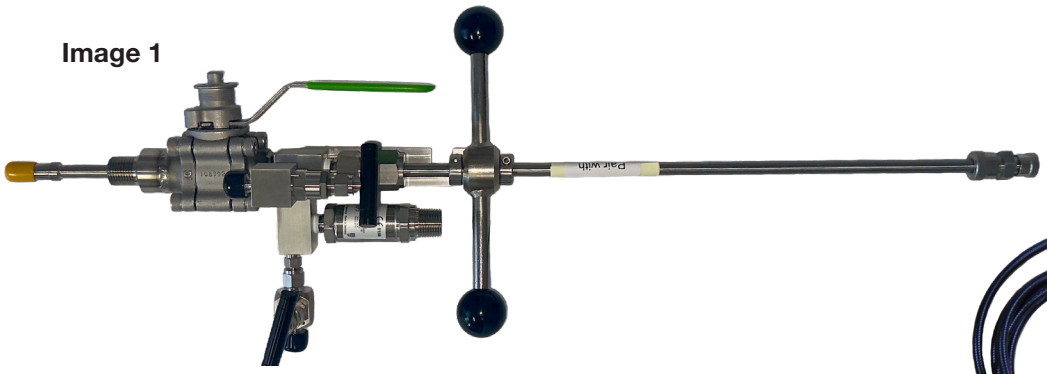
SECTION 3.0: INSTALLATION PROCEDURES

3.1 Basic Installation and Replacement Guidelines

The SafeTap II will ship in two parts:

- Valve body (with sensor body assembly. see Image 1)
- Optical wand assembly (see Image 2)

Image 1



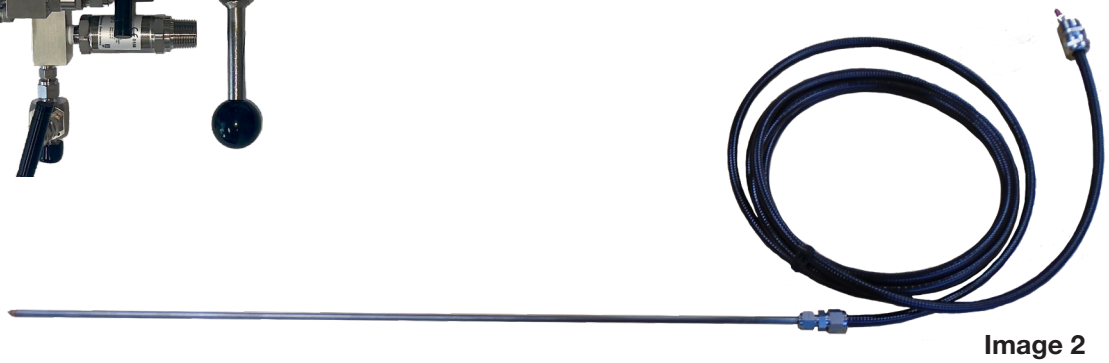
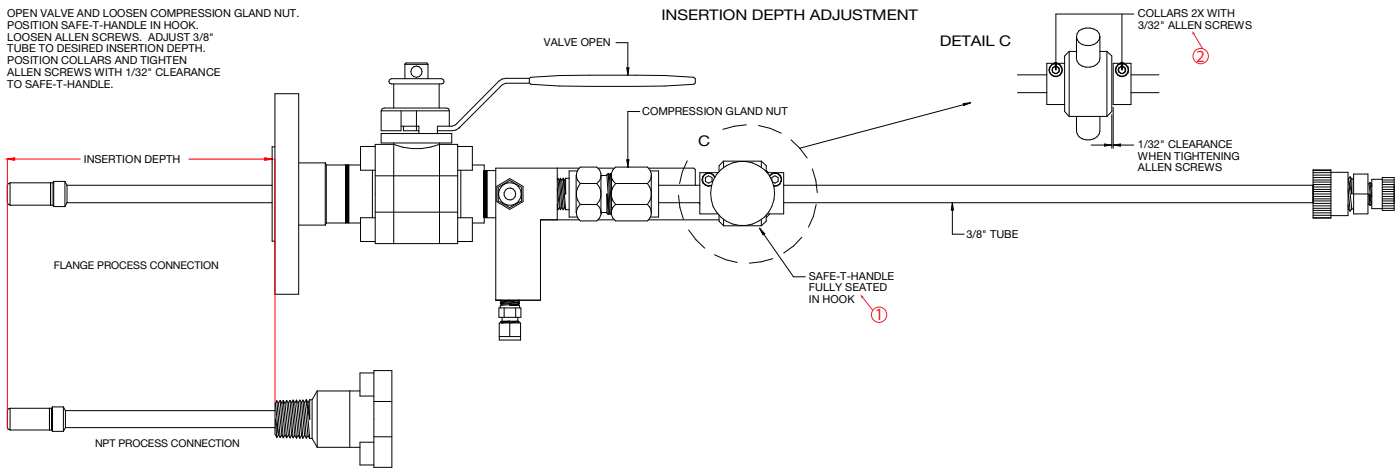


Image 2

Installation of the valve body (Image 1) should be done first (see Section 3.3), then connect optical wand assembly (Image 2) to the OXYvisor (see Section 3.4) before inserting optical wand into the sensor body rear 1/4" thumb nut (see Section 3.5). Step by step instructions are provided in detail.

Image 3



3.2 Insertion Depth Verification

The face of window cap should be just inside of process pipe wall or vessel not extending into the middle of the process stream (see Image #3).

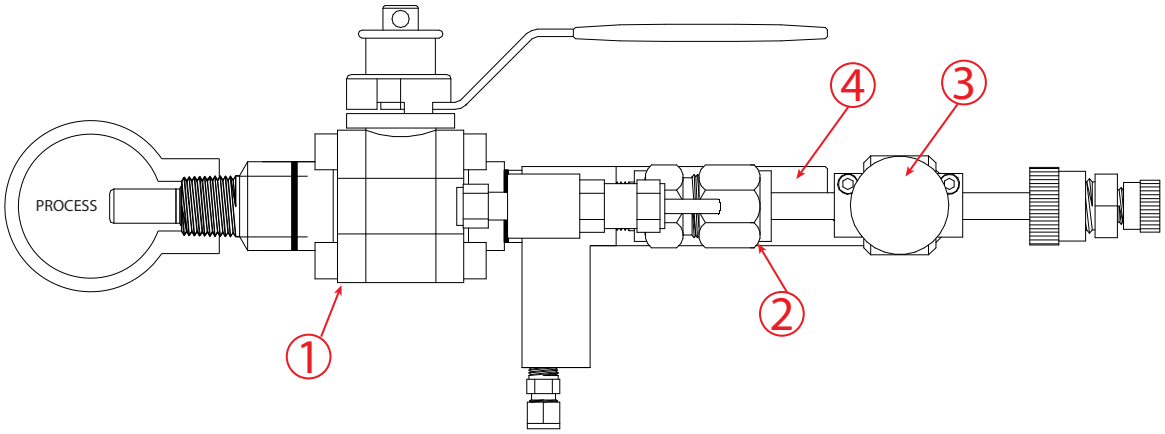
1. With the Safe-T-Handle set in the security hook (#1), measure from the end of the NPT threaded nipple or flange face to the face of the window cap
2. If necessary, adjust the stop collars (#2) of the safe-t-handle (#1) to achieve required insertion depth

3.3 Installation of New SafeTap II - Valve Body (Figure 1)

Follow facility / site-specific specification and safety guidelines for installation at the selected connection point (nipple or flanged connections) of pipe or vessel.

1. Verify process is not flowing or under pressure during installation
2. Loosen compression gland nut (#2)
3. Push forward and turn to remove safe-t-handle (#3) from security hook (#4)
4. Fully retract by pulling safe-t-handle (#3) in opposite direction of ball valve (#1) until physically stopped
5. Close ball valve (#1)
6. Install at selected location (verify and implement site-specific torque specs, gaskets, etc., as applicable). Note that bolts and flange gaskets are not provided with the flanged SafeTap II variation, as each site may have different requirements
7. Open SafeTap ball valve (#1). DO NOT insert sensor assembly with window cap into closed valve, as this may damage the window
8. Push forward on safe-t-handle (#3) to reseat in security hook (#4)
9. Tighten the compression gland nut (#2) to a snug fit with a crescent wrench (should be secure but not overly tight)

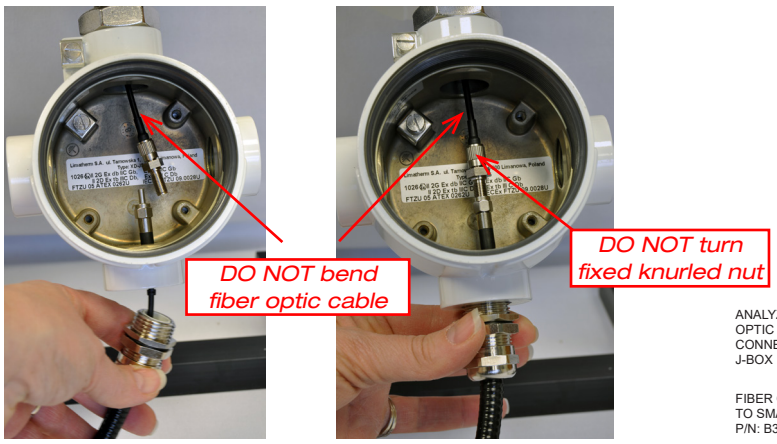
Figure 1 - SafeTap II Valve Body with Sensor Assembly



3.4 Installation of Wand Assembly - Analyzer End (Figure 2)

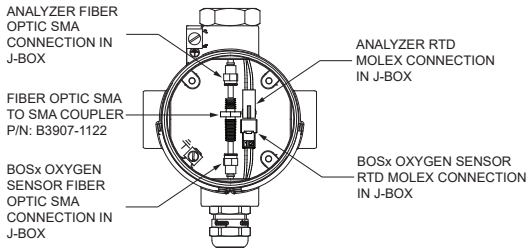
1. Installation of the optical fiber and temperature compensation leads are recommended to be done (see Figure 2) prior to installing the wand assembly into the SafeTap body so as to mitigate torsion to the fiber optic cable. BOSx sensor must come in from the bottom of the J-box, and the 1/2" conduit gland threaded into the J-box entry before connecting smaller SMA connections within J-box (may need to line up SMA connection to coupler first--see images below in Figure 2)
2. Inside J-box, FINGER-TIGHTEN the nut of the BOSx Sensor SMA connection to the bottom of the SMA coupler via the bottom entry of the OXYvisor to avoid bending, which may cause damage. Do not turn the fixed knurled nut of Analyzer SMA connection
3. Temperature compensation may be a Molex-connection RTD integrated with the BOSx SafeTap II wand assembly, a Molex-connection external (separate) RTD, or external RTD wired into the back of the analyzer (see OXYvisor IOM for wiring). Area classifications determine which RTD installation method is required
4. Refer to OXYvisor manual for sensor menu setup or any wiring that may need to occur

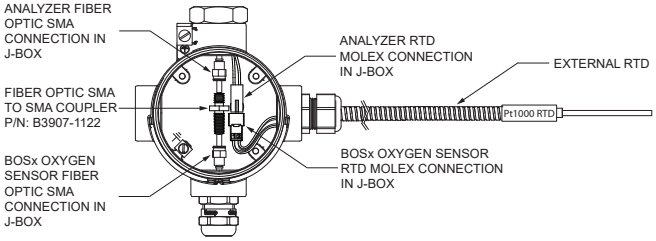
Figure 2 - BOS SAFETAP II - Typical Install at OXYvisor Analyzer



The fiber optic connection must come in from the bottom of the OXYvisor Oxygen Analyzer J-box, as shown in the above photos. Finger-tighten the BOSx Oxygen Sensor Fiber Optic SMA connector nut to the bottom of the SMA Coupler.

Integral RTD example





External RTD example

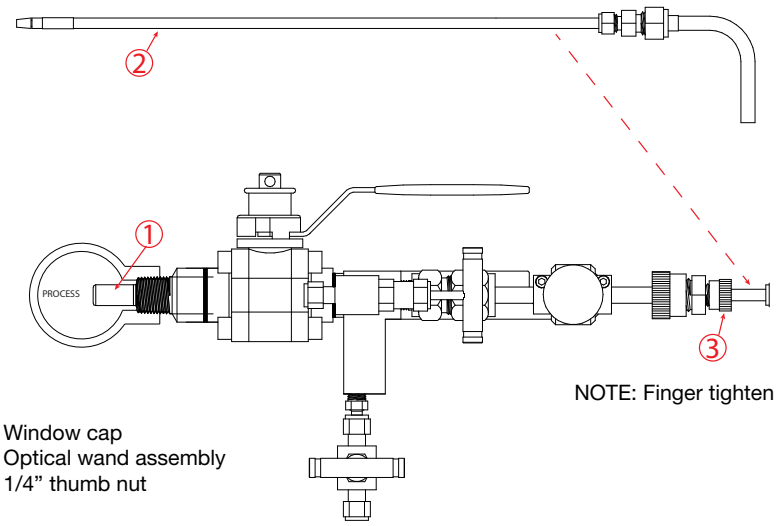
3.5 Installation of Optical Wand Assembly - Process End (Figure 3)

1. Loosen 1/4” thumb nut (#3)
2. Carefully insert metal tip of optical wand assembly (#2) into thumb nut (#2) until tip contacts back of window cap (#1)
3. While holding wand in (will have slight resistance due to O-rings), finger tighten 1/4” thumb nut onto wand.
4. The optical wand sensor tip must be in contact with the back of the window cap (#1) to ensure full signal strength. Should this need to be adjusted, do the following:
   - Loosen the 1/4” thumb nut (#3) until the wand slides freely within assembly tubing (to release any back pressure, loosen thumb nut all the way to let out trapped air before tightening down on wand)
   - Carefully push optical wand (#2) forward until it just contacts the back of the window cap
   - Keep optical wand in contact with the window cap (#1) and tighten the 1/4” thumb nut (#3) finger-tight

NOTE: Check that the wand is fully inserted (against / touching back of window cap) prior to beginning measurement

NOTE: Avoid swaging / over-tightening the thumb nut

Figure 3 - SafeTap II Installation - Process End



1. Window cap
2. Optical wand assembly
3. 1/4” thumb nut

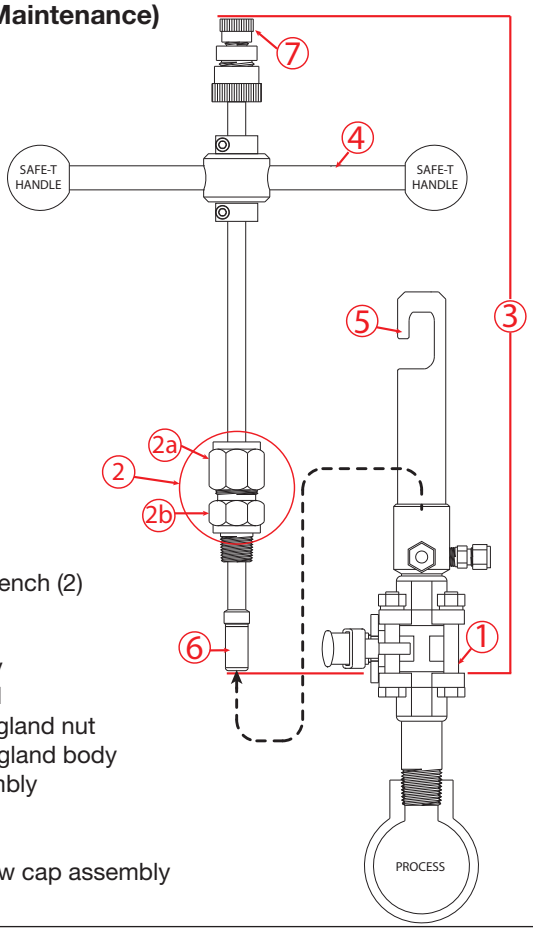
SECTION 4.0: MAINTENANCE AND SERVICE

4.1 Regular Maintenance

- Ensure that the sensor is clean and free of debris. Clean the sensor window cap assembly with clean water (tap or distilled). Heavier accumulations can be cleaned by soaking the sensor in water and cleaning with a cotton swab
- Ensure that the soft, black portion of the window cap assembly is free of damage. Damage to the cap may render the sensor inoperable or may affect the accuracy
- Ensure that the replacement window cap assembly of the sensor is secured (hand-tightened) to the sensor assembly tip. An accumulation of moisture inside the sensor may create errors
- DO NOT attempt to clean the window cap assembly with the use of a wire brush, screwdriver, sandpaper or other mechanical or abrasive methods that may damage the tip of the sensor

Figure 4 - BOS SAFETAP II - Removal of Sensor Body Assembly (for Maintenance)

The Safe-T-Handle fully inserted and turned into the security hook can be seen above. Once the handle is lodged in the hook, the top nut (safety nut) of the compression gland (seen below it) should be tightened to provide additional security against high pressure.



Tools Required

- 1/2" or crescent wrench (2)

Numbered Part List

1. Ball valve assembly
2. Compression gland
   - 2a. Compression gland nut
   - 2b. Compression gland body
3. Sensor body assembly
4. Safe-T-handle
5. Security hook
6. Replaceable window cap assembly
7. 1/4" thumb nut

4.2 Removal of Sensor Body Assembly (Figure 4)

The BOS SAFETAP II Sensor may be periodically removed from the process for cleaning, calibration or window cap assembly replacement. The sensor can be retracted while under pressure by following the steps below. Please remember to use personal protection equipment (PPE) while performing any work on the sensor.

1. Prior to sensor removal, ensure that the Safe-T-Handle (#4) is in the security hook (#5) and cannot rotate freely
2. Loosen 1/4" thumb nut (#7) just enough to remove optical wand (see Figure 3, #1) prior to removal of sensor body assembly (#3), and lay aside in a protected space
3. Loosen the compression gland nut (#2a) 1/2 turn. Push in slowly on the Safe-T-Handle (#4) while still within the security hook (#5). Process pressure can push the handle back into the hook. This test provides the operator with an understanding of the force needed to ease the sensor out of the process. If a lock-out padlock is used, it should be removed prior to this stage
4. Slowly push in on the Safe-T-Handle (#4) until it can rotate freely passed the security hook (#5)
5. While maintaining a firm grip on the Safe-T-Handle, allow process pressure to push the sensor assembly (#3) back until it can no longer retract
6. Close the ball valve (#1) to isolate the retracted sensor from the process
7. Bleed off residual process pressure through the two 1/4" tubing fittings (or optional 1/4" needle valves)--see Figure 7. Please use proper precautions if hazardous or toxic gases are present
8. Remove sensor assembly using a wrench on compression gland body (#2b) to back out the compression seal gland (#2) and sensor assembly (#3) from ball valve assembly (#1)

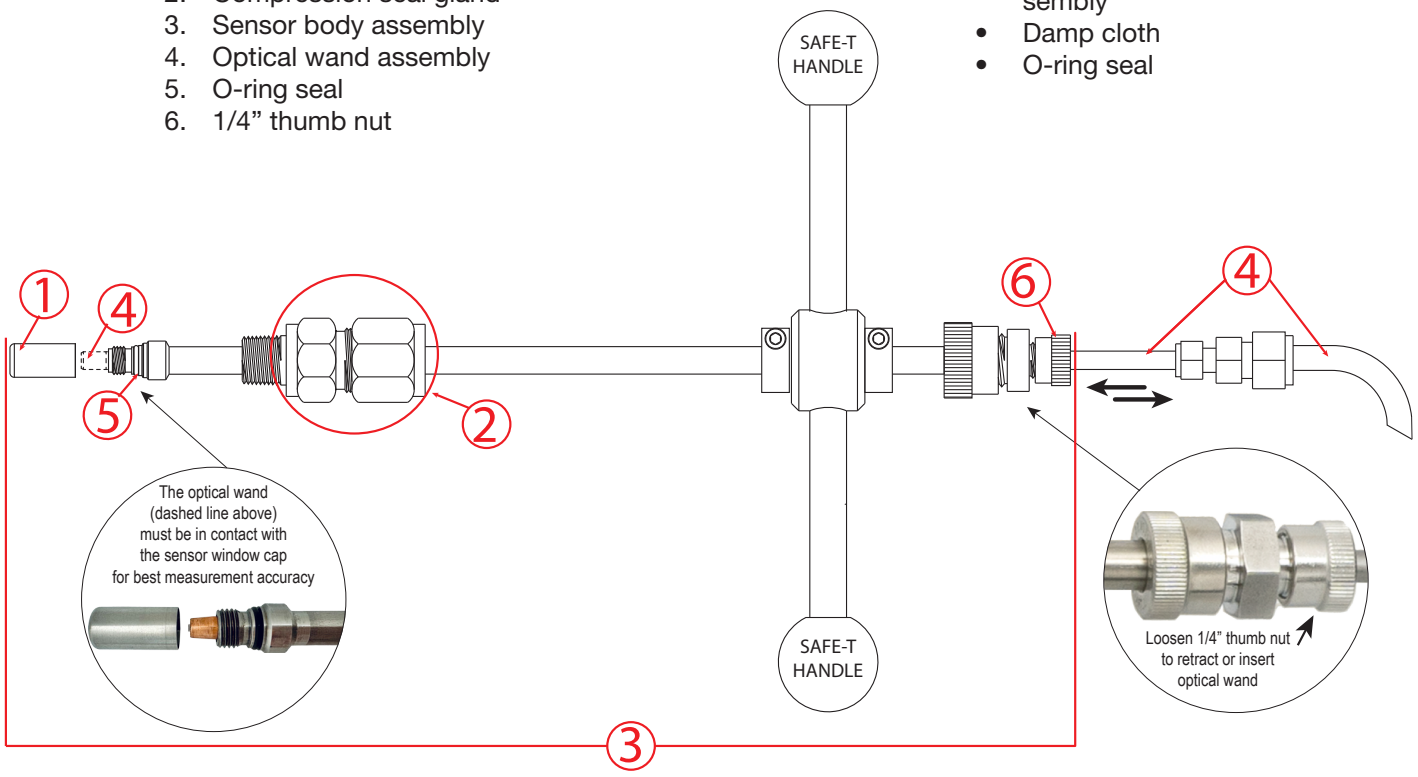
Figure 5 - BOS SAFETAP II - Window Cap Assembly Replacement

Numbered Part List

1. Replaceable window cap assembly
2. Compression seal gland
3. Sensor body assembly
4. Optical wand assembly
5. O-ring seal
6. 1/4” thumb nut

Tools Required

- Spare window cap assembly
- Damp cloth
- O-ring seal



4.3 Replacement of Window Cap Assembly (Figure 5)

1. **Begin with Section 4.2** to remove optical wand assembly (#4 then sensor body assembly (#3) to access window cap assembly.
2. Inspect the sensor window cap (#1). Look for visible damage (e.g. deformation, cuts, corrosion) on the metal housing of the cap. Inspect the optical luminophore on the tip of the sensor for damage (e.g. scratches) to ensure the integrity of the reading
3. Clean process exposed areas with a damp cloth to remove residual process material
4. Unscrew the sensor window cap (#1) from the tip of the sensor
5. Inspect the O-ring seal (#5) on the sensor assembly stem for damage. If necessary, replace the O-ring
6. Loosen the 1/4” thumb nut (#6) until the optical wand (#4) can slide freely inside of the sensor assembly (#3)
7. Slide the optical wand (#4) forward, through the sensor assembly (#3), towards the direction of the cap. NOTE: The wand tip should protrude slightly from the open end of the sensor assembly (#3)
8. Hand tighten the replacement window cap assembly (#1). Avoid using pliers or other tools
9. See Section 4.4 for returning to process

4.4 Installation / Reinstallation of Sensor Body Assembly (Figure 6)

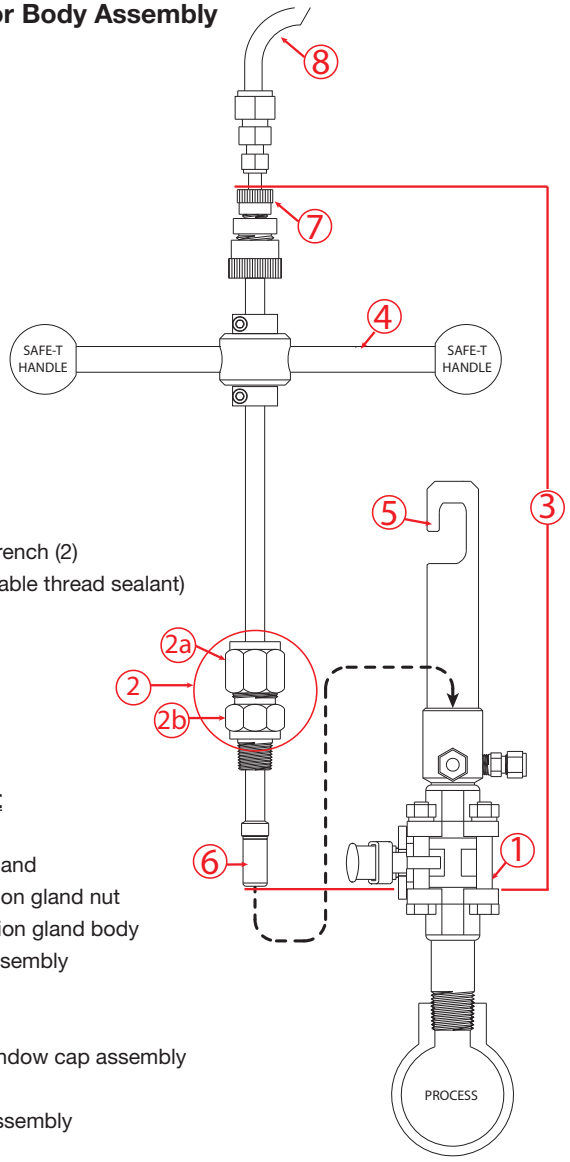
1. Remove any Teflon tape left on the threaded end of compression gland seal (#2) threads and re-wrap with 1/2" Teflon tape (at least 4 wraps clockwise with the threaded end facing you)
2. Reinstall the compression gland seal (#2) and sensor body assembly (#3) snuggly with a wrench. Do not over tighten
3. Open ball valve, push sensor body assembly (#3) back into process, ensuring safe-t-handle is seated in security hook
4. Firmly hand-tighten compression gland nut (#2a)
5. Refer to Section 3.5 "Installation of SafeTap II Optical Wand Assembly - Process End" above to reinsert wand assembly (#8) into sensor assembly

Figure 6 - BOS SAFETAP II - Installation / Reinstallation of Sensor Body Assembly

The Safe-T-Handle fully inserted and turned into the security hook can be seen above. Once the handle is lodged in the hook, the top nut (safety nut) of the compression gland (seen below it) should be tightened to provide additional security against high pressure.

Tools Required

- 1/2" or crescent wrench (2)
- Teflon tape (or suitable thread sealant)



Numbered Part List

1. Valve assembly
2. Compression gland
   - 2a. Compression gland nut
   - 2b. Compression gland body
3. Sensor body assembly
4. Safe-T-handle
5. Security hook
6. Replaceable window cap assembly
7. 1/4" thumb nut
8. Optical wand assembly

SECTION 5.0: CALIBRATION

5.1 In Situ Purge and Calibration

The valve assembly of the BOS SAFETAP II provides two 1/4" compression fittings or 1/4" needle valves (optional). When the sensor assembly is retracted from the process, these fittings may be used to expose the luminophore sensing window to external (customer supplied) purge and calibration gas without removal of the sensor assembly.

In situ calibration should be done with the sensor assembly fully retracted and the isolation valve closed. Calibration gas should be run for several minutes to purge the valve assembly of any residual oxygen from the process. In liquid applications, orientation of the outlet port should allow for residual process liquid to drain prior to calibration. Refer to OXYvisor IOM manual Section 5 for calibration procedure.

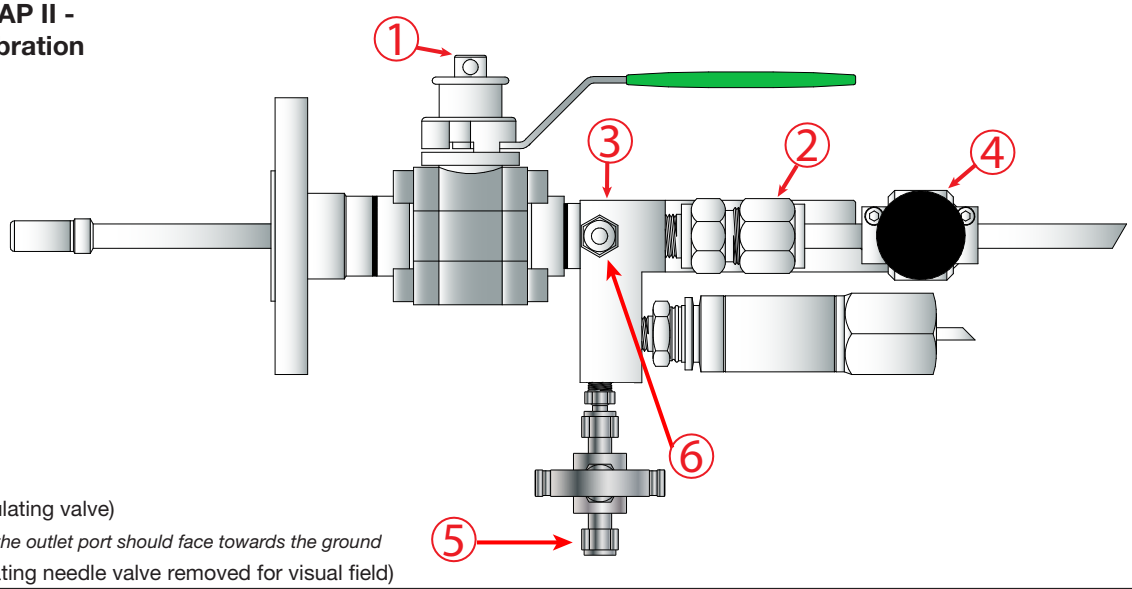
A typical schematic for in situ calibration is shown (Figure 7). Please consult Barben Analytical for additional support for these types of installations.

5.1.1 Retraction and Isolation from Process (Figure 7)

1. Loosen the compression gland nut (#2) 1/2 turn. Push in slowly on the Safe-T-Handle (#4) while still within the security hook
   a. Process pressure can push the handle back into the hook. This test provides the operator with an understanding of the force needed to ease the sensor out of the process
   b. If a lock-out padlock is used, it should be removed prior to this stage
2. Slowly push in on the Safe-T-Handle (#4) until it can rotate freely passed the security hook
3. While maintaining a firm grip on the Safe-T-Handle (#4), fully retract the assembly all of the way (window cap should be within the flow cell block (#3))
4. Close the ball valve (#1) to isolate the retracted sensor from the process
5. Bleed off residual process pressure through outlet port 1/4" tubing fitting (or optional 1/4" needle valve) (#5) on the valve assembly. Please use proper precautions if hazardous or toxic media are present
6. Calibration gas should be connected to the Inlet port 1/4" tubing fitting (or optional 1/4" needle valve) (#6) as suitable for installation area (non-oxygen permeable tubing or 316SS tubing recommended)
7. SafeTap II is now isolated for calibration, refer to OXYvisor IOM manual for calibration steps

NOTE: Calibration gas flow or pressure must overcome atmosphere ingress (0.5-2.0 slpm) or outlet return pressure
NOTE: Check that the wand is fully inserted against back of window cap if unable to zero during calibration

Figure 7 - BOS SAFETAP II - In Situ Purge and Calibration



Numbered Part List

1. Ball valve
2. Compression gland nut
3. Flow cell block
4. Safe-T-handle
5. Outlet port (optional regulating valve)
   Note: In liquid applications, the outlet port should face towards the ground
6. Inlet port (optional regulating needle valve removed for visual field)

5.2 Insertion into Process

1. Open ball valve (#1), push sensor back into process, ensuring safe-t-handle (#4) is seated in security hook
2. Tighten the compression gland nut (#2) to a snug fit with a 1/2" or crescent wrench (should be secure but not overly tight)

NOTE: Ensure ball valve (#1) is open before reinsertion
NOTE: Check that the wand is fully inserted prior to beginning measurement

SECTION 6.0: SPARE PARTS AND ACCESSORIES

6.1 Spare Parts

Listed below are the most common recommended spare parts. Replacement window cap assemblies include the luminophore sensing element and can be ordered as new with the part numbers listed below. Call factory support for additional details on other spare parts that may be required for your installation.

Recommended Spare Parts - Replacement Window Cap Assembly			
Part #	Optode	Body Material (Wetted)*	O-ring Seals (Wetted)
B3907-1101	BOS1	316 Stainless	Viton
B3907-1100	BOS1	316 Stainless	EPDM
B3907-1102	BOS1	316 Stainless	FFKM (perfluoroelastomer)
B3907-1104	BOS2	316 Stainless	Viton
B3907-1103	BOS2	316 Stainless	EPDM
B3907-1105	BOS2	316 Stainless	FFKM (perfluoroelastomer)
B3907-1107	BOS3	316 Stainless	Viton
B3907-1106	BOS3	316 Stainless	EPDM
B3907-1108	BOS3	316 Stainless	FFKM (perfluoroelastomer)

Recommended Spare Parts - Calibration Valves and Fittings (Reference page 5)	
Part #	Description (Wetted Metallics)*
B4954-1094	Adapter 1/4" Stub 316 Stainless
B4955-1169	Valve Straight 316 Stainless
B4955-1170	Valve 90° 316 Stainless
B4954-1092	Adapter 1/4" Stub Ti GR4
B4955-1173	Valve Straight Ti GR4
B4955-1174	Valve 90° Ti GR4
B4954-1093	Adapter 1/4" Stub Hastelloy C-276
B4955-1175	Valve Straight Hastelloy C-276
B4955-1176	Valve 90° Hastelloy C-276
B4954-1091	Adapter 1/4" Stub Stainless 2507
B4955-1171	Valve Straight Stainless 2507
B4955-1172	Valve 90° Stainless 2507

**For other material options, please consult factory.*

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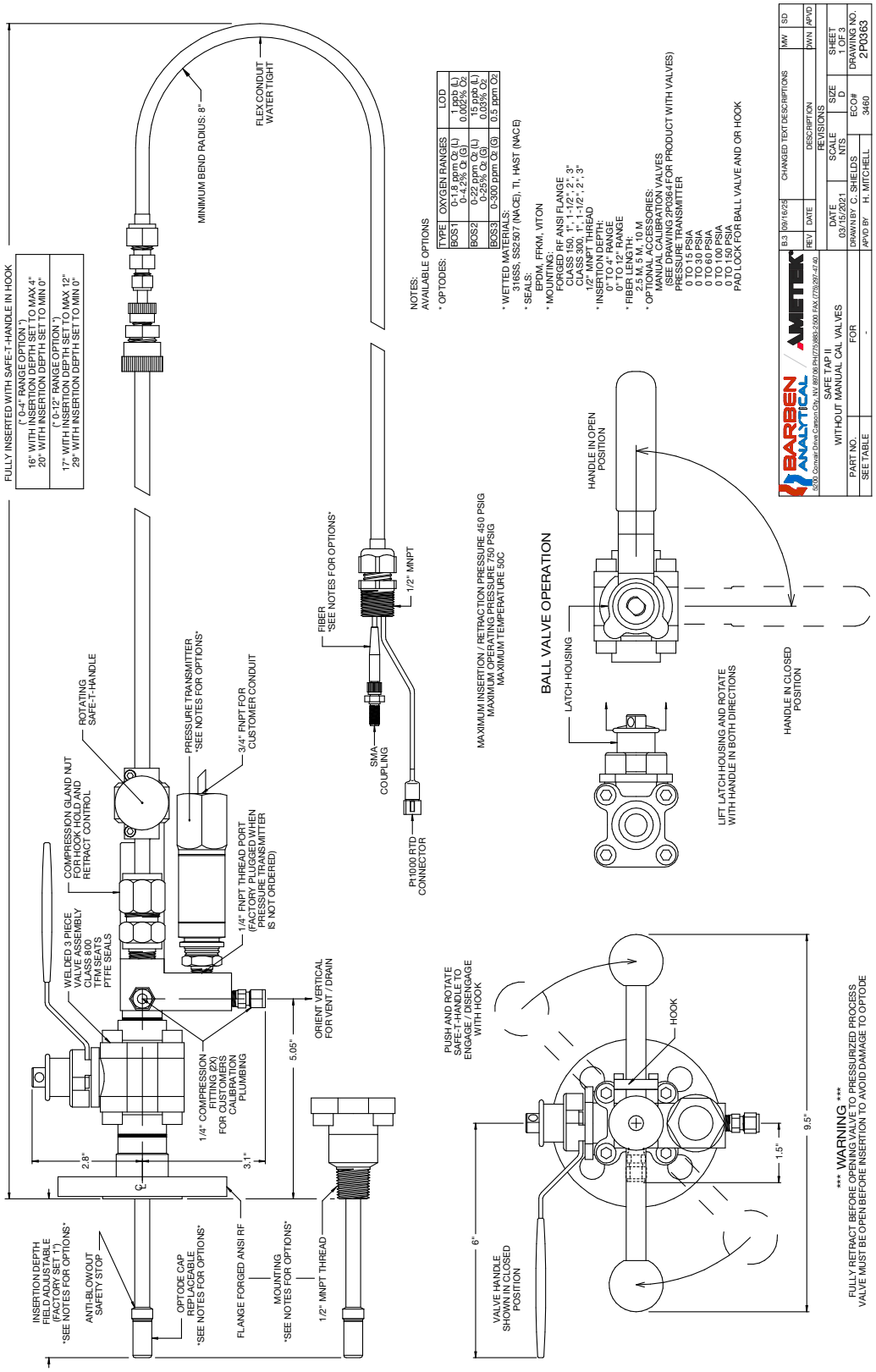
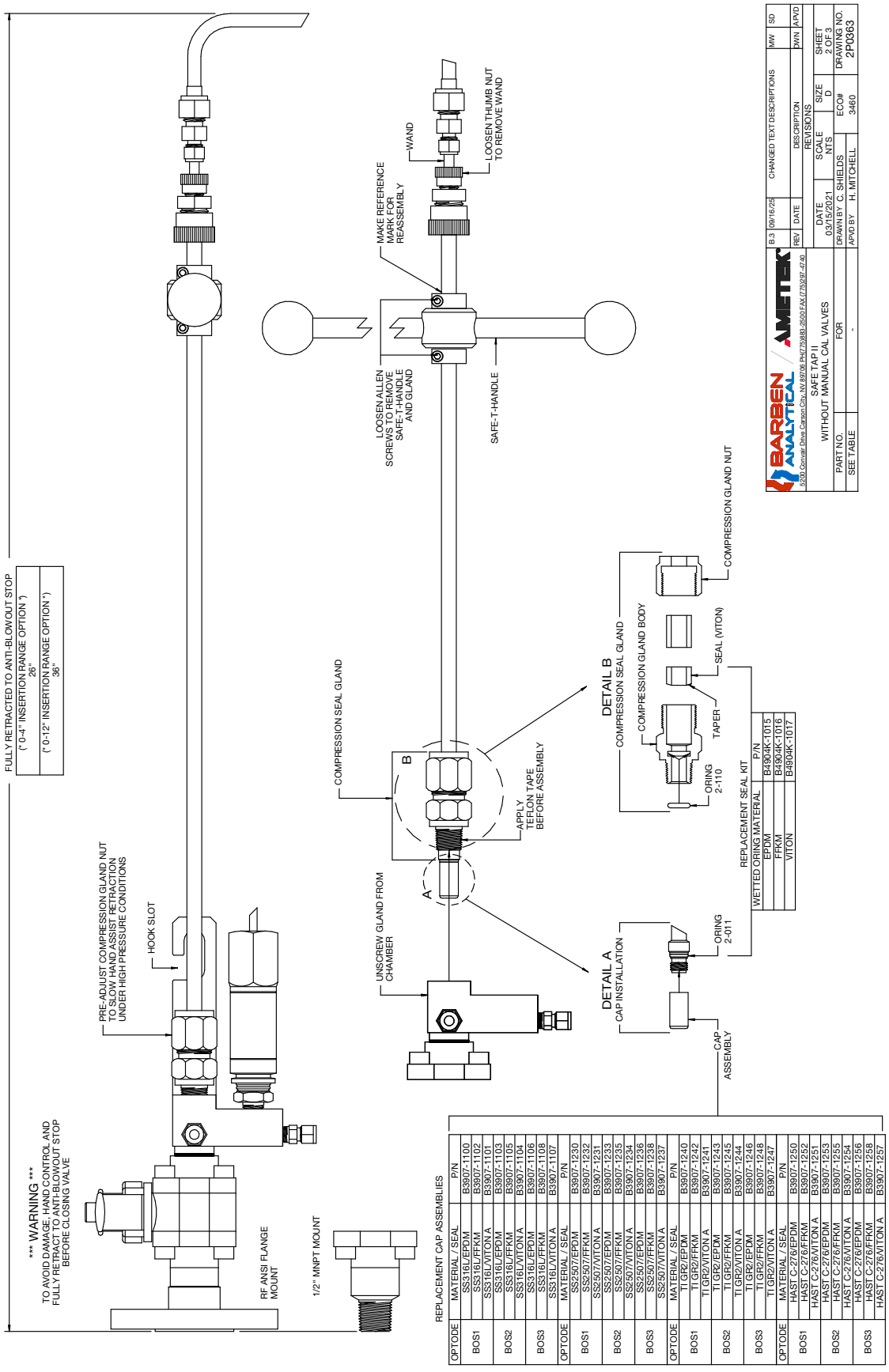
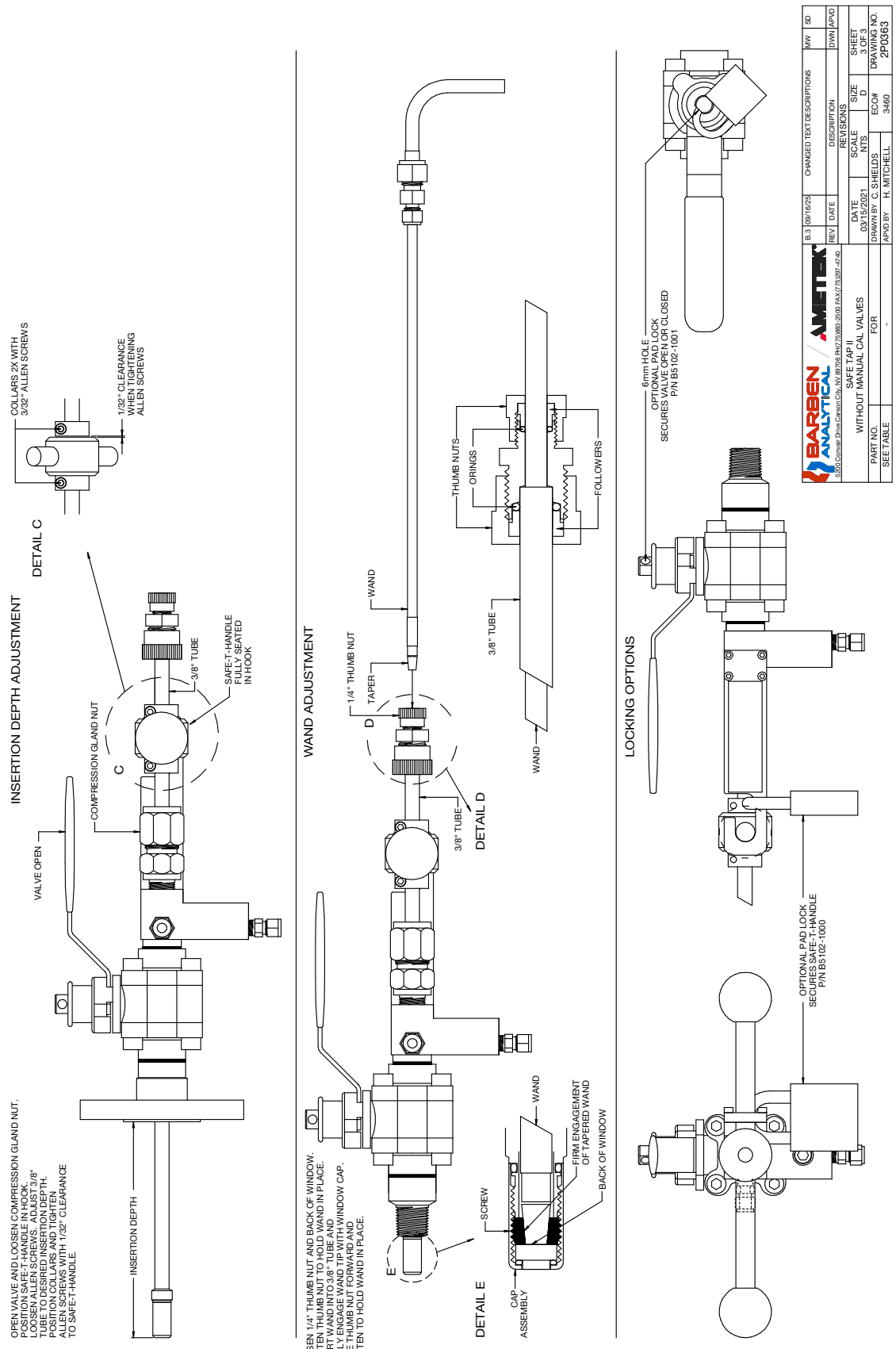
SECTION 7.0: MECHANICAL DRAWINGS

7.1 Drawing 2P0363 - BOS SafeTap II without Manual Calibration Valves




FULLY RETRACTED TO ANTI-BLOWOUT STOP
(* 0-4" INSERTION RANGE OPTION *) 26"
(* 0-12" INSERTION RANGE OPTION *) 36"
*** WARNING ***
TO AVOID DAMAGE, HAND CONTROL AND FULLY RETRACT TO ANTI-BLOWOUT STOP BEFORE CLOSING VALVE
PRE-ADJUST COMPRESSION GLAND NUT TO SLOW HAND ASSIST RETRACTION UNDER HIGH PRESSURE CONDITIONS
HOOK SLOT
RF ANSI FLANGE MOUNT
1/2" MNPT MOUNT
UNSCREW GLAND FROM CHAMBER
COMPRESSION SEAL GLAND
APPLY TEFLON TAPE BEFORE ASSEMBLY
LOOSEN ALLEN SCREWS TO REMOVE SAFE-T-HANDLE AND GLAND
MAKE REFERENCE MARK FOR REASSEMBLY
WAND
LOOSEN THUMB NUT TO REMOVE WAND
SAFE-T-HANDLE
DETAIL A
CAP INSTALLATION
DETAIL B
COMPRESSION SEAL GLAND
COMPRESSION GLAND BODY
ORING 2-110
TAPER
SEAL (VITON)
COMPRESSION GLAND NUT
ORING 2-011
CAP ASSEMBLY
REPLACEMENT SEAL KIT
WETTED ORING MATERIAL
P/N
EPDM B4904K-1015
FFKM B4904K-1016
VITON B4904K-1017
REPLACEMENT CAP ASSEMBLIES
OPTODE MATERIAL / SEAL P/N
BOS1 SS316L/EPDM B3907-1100
SS316L/FFKM B3907-1102
SS316L/VITON A B3907-1101
BOS2 SS316L/EPDM B3907-1103
SS316L/FFKM B3907-1105
SS316L/VITON A B3907-1104
BOS3 SS316L/EPDM B3907-1106
SS316L/FFKM B3907-1108
SS316L/VITON A B3907-1107
OPTODE MATERIAL / SEAL P/N
BOS1 SS2507/EPDM B3907-1230
SS2507/FFKM B3907-1232
SS2507/VITON A B3907-1231
BOS2 SS2507/EPDM B3907-1233
SS2507/FFKM B3907-1235
SS2507/VITON A B3907-1234
BOS3 SS2507/EPDM B3907-1236
SS2507/FFKM B3907-1238
SS2507/VITON A B3907-1237
OPTODE MATERIAL / SEAL P/N
BOS1 TI GR2/EPDM B3907-1240
TI GR2/FFKM B3907-1242
TI GR2/VITON A B3907-1241
BOS2 TI GR2/EPDM B3907-1243
TI GR2/FFKM B3907-1245
TI GR2/VITON A B3907-1244
BOS3 TI GR2/EPDM B3907-1246
TI GR2/FFKM B3907-1248
TI GR2/VITON A B3907-1247
OPTODE MATERIAL / SEAL P/N
BOS1 HAST C-276/EPDM B3907-1250
HAST C-276/FFKM B3907-1252
HAST C-276/VITON A B3907-1251
BOS2 HAST C-276/EPDM B3907-1253
HAST C-276/FFKM B3907-1255
HAST C-276/VITON A B3907-1254
BOS3 HAST C-276/EPDM B3907-1256
HAST C-276/FFKM B3907-1258
HAST C-276/VITON A B3907-1257
BARBEN ANALYTICAL / AMETEK
5300 Convair Drive Carson City, NV 89706 PH:(775)883-2500 FAX:(775)297-4740
SAFE TAP II
WITHOUT MANUAL CAL VALVES
PART NO. FOR
SEE TABLE -
REV DATE CHANGED TEXT DESCRIPTIONS MW SD
B.3 09/16/25 DWN APVD
DESCRIPTION
REVISIONS
DATE 03/15/2021 SCALE NTS SIZE D SHEET 2 OF 3
DRAWN BY C. SHIELDS ECO# 3460 DRAWING NO. 2P0363
APVD BY H. MITCHELL


INSERTION DEPTH ADJUSTMENT
OPEN VALVE AND LOOSEN COMPRESSION GLAND NUT.
POSITION SAFE-T-HANDLE IN HOOK.
LOOSEN ALLEN SCREWS. ADJUST 3/8" TUBE TO DESIRED INSERTION DEPTH.
POSITION COLLARS AND TIGHTEN ALLEN SCREWS WITH 1/32" CLEARANCE TO SAFE-T-HANDLE
VALVE OPEN
COMPRESSION GLAND NUT
C
3/8" TUBE
SAFE-T-HANDLE FULLY SEATED IN HOOK
INSERTION DEPTH
DETAIL C
COLLARS 2X WITH 3/32" ALLEN SCREWS
1/32" CLEARANCE WHEN TIGHTENING ALLEN SCREWS
WAND ADJUSTMENT
LOOSEN 1/4" THUMB NUT AND BACK OF WINDOW.
TIGHTEN THUMB NUT TO HOLD WAND IN PLACE.
INSERT WAND INTO 3/8" TUBE AND FIRMLY ENGAGE WAND TIP WITH WINDOW CAP.
SLIDE THUMB NUT FORWARD AND TIGHTEN TO HOLD WAND IN PLACE.
WAND
1/4" THUMB NUT
TAPER
D
3/8" TUBE
DETAIL D
E
SCREW
CAP ASSEMBLY
DETAIL E
THUMB NUTS
ORINGS
FOLLOWERS
3/8" TUBE
WAND
FIRM ENGAGEMENT OF TAPERED WAND
BACK OF WINDOW
LOCKING OPTIONS
6mm HOLE
OPTIONAL PAD LOCK
SECURES VALVE OPEN OR CLOSED
P/N BS102-1001
OPTIONAL PAD LOCK
SECURES SAFE-T-HANDLE
P/N BS102-1000
BARBEN ANALYTICAL
5300 Convair Drive Carson City, NV 89706 PH(775)883-2500 FAX(775)507-4740
AMETEK
SAFE TAP II
WITHOUT MANUAL CAL VALVES
PART NO.
SEE TABLE
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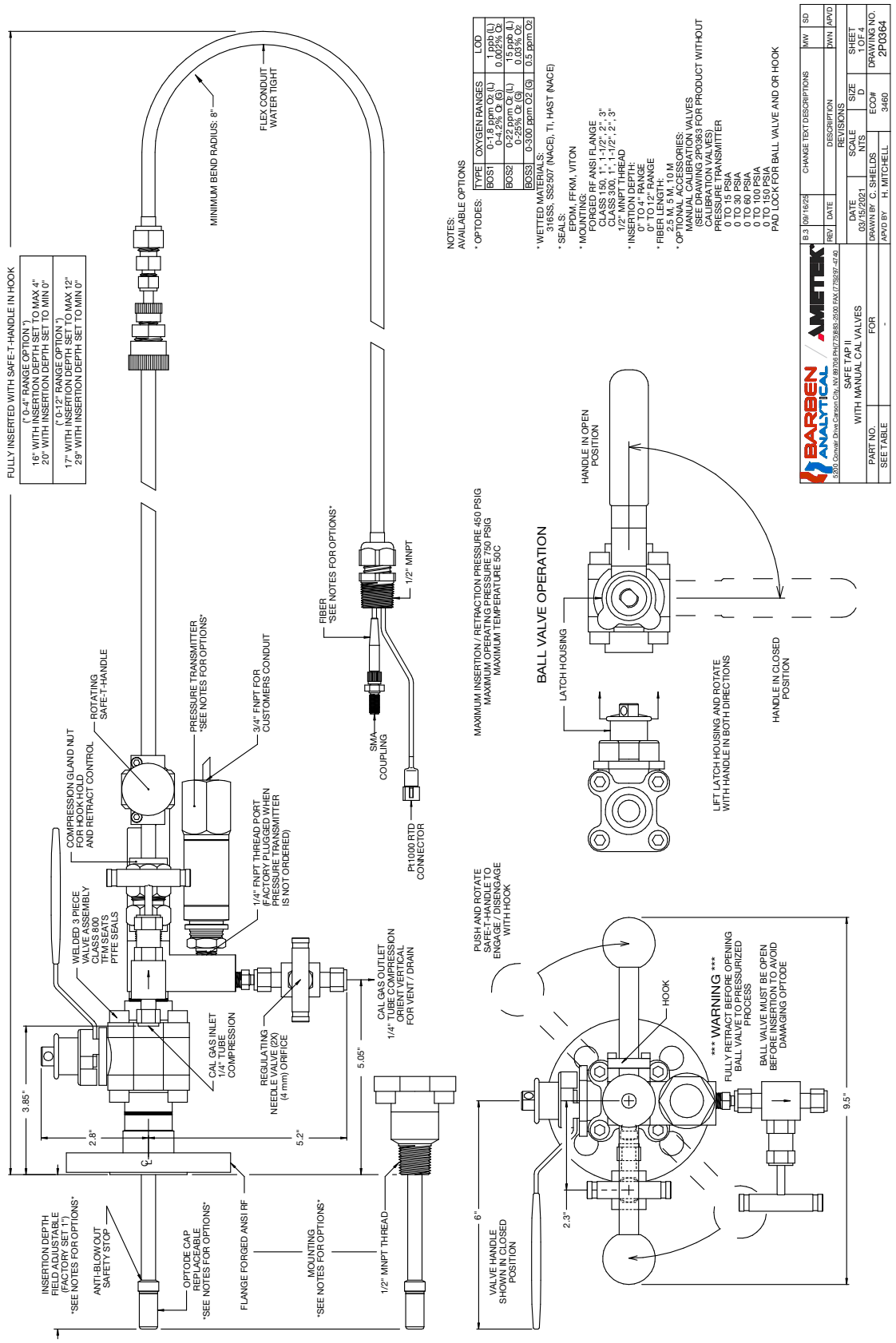
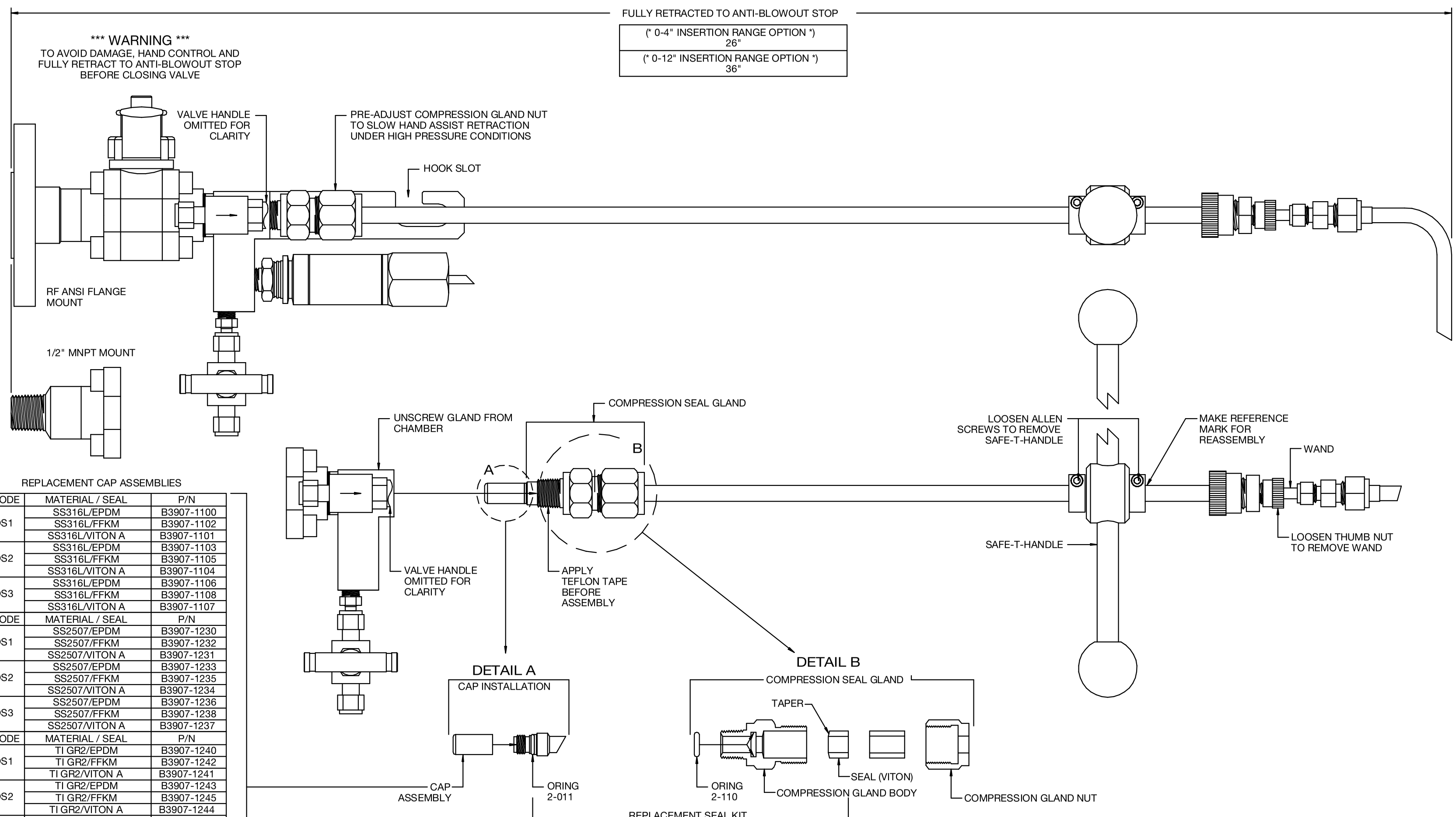
B.3
DATE
09/16/25
DESCRIPTION
CHANGED TEXT DESCRIPTIONS
DWN
MW
APVD
SD
REVISIONS
DATE
09/15/2021
DRAWN BY
C. SHIELDS
APVD BY
H. MITCHELL
SCALE
NTS
SIZE
D
ECO#
3460
SHEET
3 OF 3
DRAWING NO.
2P0363

7.2 Drawing 2P0364 - BOS SafeTap II with Manual Calibration Valves





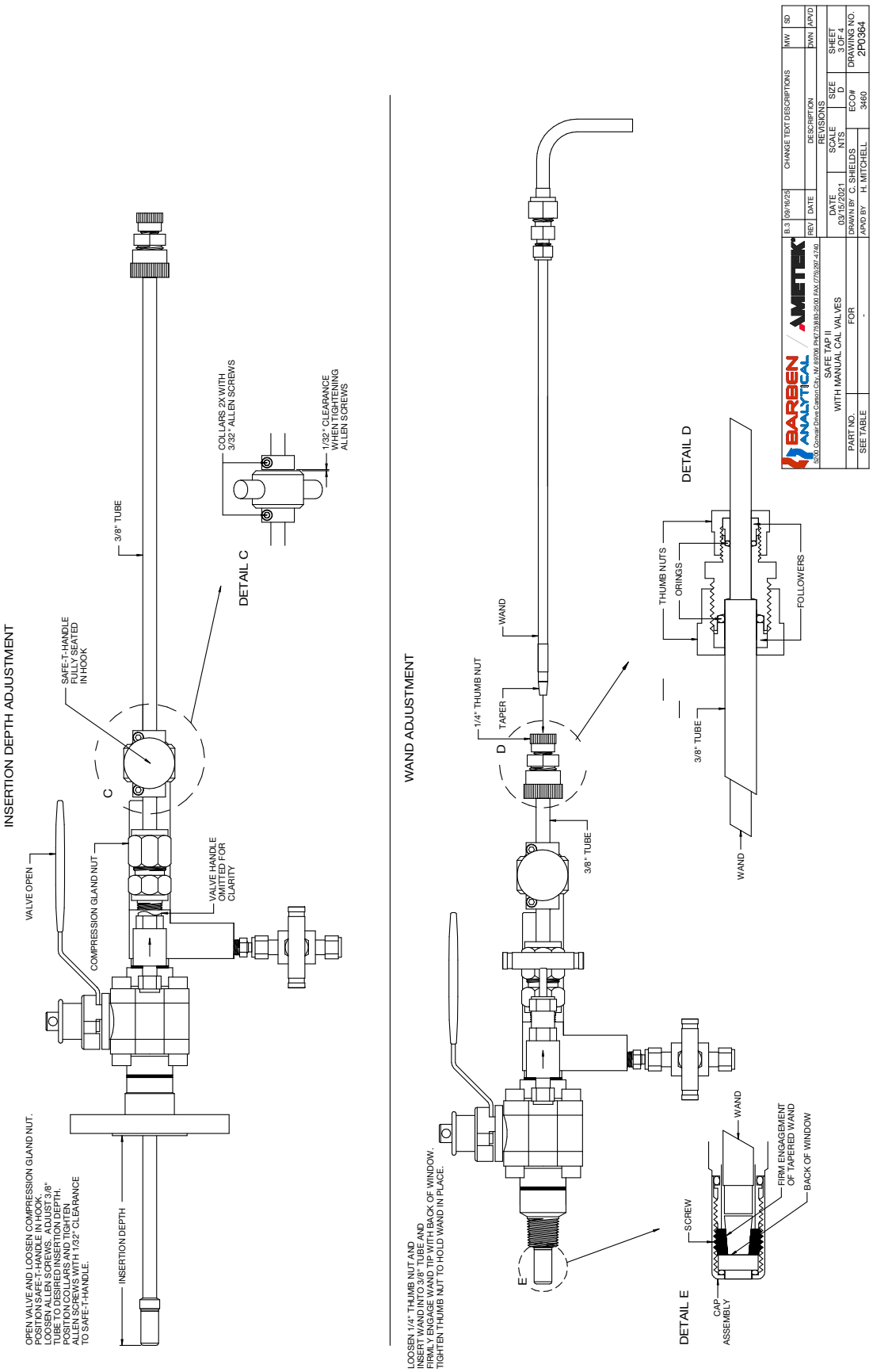
REPLACEMENT CAP ASSEMBLIES

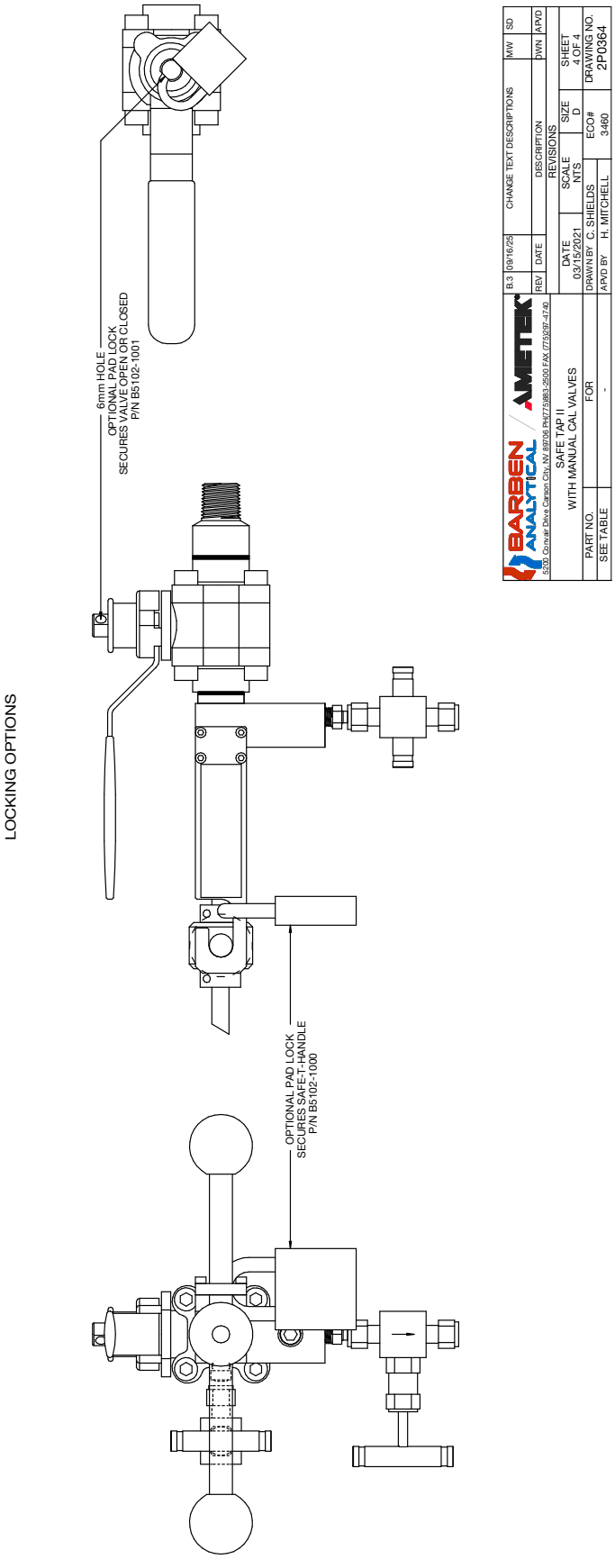
OPTODE	MATERIAL / SEAL	P/N
BOS1	SS316L/EPDM	B3907-1100
	SS316L/FFKM	B3907-1102
	SS316L/VITON A	B3907-1101
BOS2	SS316L/EPDM	B3907-1103
	SS316L/FFKM	B3907-1105
	SS316L/VITON A	B3907-1104
BOS3	SS316L/EPDM	B3907-1106
	SS316L/FFKM	B3907-1108
	SS316L/VITON A	B3907-1107
OPTODE	MATERIAL / SEAL	P/N
BOS1	SS2507/EPDM	B3907-1230
	SS2507/FFKM	B3907-1232
	SS2507/VITON A	B3907-1231
BOS2	SS2507/EPDM	B3907-1233
	SS2507/FFKM	B3907-1235
	SS2507/VITON A	B3907-1234
BOS3	SS2507/EPDM	B3907-1236
	SS2507/FFKM	B3907-1238
	SS2507/VITON A	B3907-1237
OPTODE	MATERIAL / SEAL	P/N
BOS1	TI GR2/EPDM	B3907-1240
	TI GR2/FFKM	B3907-1242
	TI GR2/VITON A	B3907-1241
BOS2	TI GR2/EPDM	B3907-1243
	TI GR2/FFKM	B3907-1245
	TI GR2/VITON A	B3907-1244
BOS3	TI GR2/EPDM	B3907-1246
	TI GR2/FFKM	B3907-1248
	TI GR2/VITON A	B3907-1247
OPTODE	MATERIAL / SEAL	P/N
BOS1	HAST C-276/EPDM	B3907-1250
	HAST C-276/FFKM	B3907-1252
	HAST C-276/VITON A	B3907-1251
BOS2	HAST C-276/EPDM	B3907-1253
	HAST C-276/FFKM	B3907-1255
	HAST C-276/VITON A	B3907-1254
BOS3	HAST C-276/EPDM	B3907-1256
	HAST C-276/FFKM	B3907-1258
	HAST C-276/VITON A	B3907-1257

REPLACEMENT SEAL KIT

WETTED ORING MATERIAL	P/N
EPDM	B4904K-1015
FFKM	B4904K-1016
VITON	B4904K-1017

BARBEN ANALYTICAL / AMETEK		B.3	09/16/25	CHANGE TEXT DESCRIPTIONS		MW	SD
5200 Convair Drive Carson City, NV 89706 PH(775)883-2500 FAX (775)297-4740		REV	DATE	DESCRIPTION		DWN	APVD
		REVISIONS					
SAFE TAP II WITH MANUAL CAL VALVES		DATE 03/15/2021		SCALE NTS	SIZE D	SHEET 2 OF 4	
PART NO.	FOR	DRAWN BY C. SHIELDS			ECO#	DRAWING NO.	
SEE TABLE	-	APVD BY H. MITCHELL			3460	2P0364	


INSERTION DEPTH ADJUSTMENT
OPEN VALVE AND LOOSEN COMPRESSION GLAND NUT.
POSITION SAFE-T-HANDLE IN HOOK.
LOOSEN ALLEN SCREWS. ADJUST 3/8" TUBE TO DESIRED INSERTION DEPTH.
POSITION COLLARS AND TIGHTEN ALLEN SCREWS WITH 1/32" CLEARANCE TO SAFE-T-HANDLE.
INSERTION DEPTH
VALVE OPEN
COMPRESSION GLAND NUT
VALVE HANDLE OMITTED FOR CLARITY
SAFE-T-HANDLE FULLY SEATED IN HOOK
3/8" TUBE
C
DETAIL C
COLLARS 2X WITH 3/32" ALLEN SCREWS
1/32" CLEARANCE WHEN TIGHTENING ALLEN SCREWS
WAND ADJUSTMENT
LOOSEN 1/4" THUMB NUT AND INSERT WAND INTO 3/8" TUBE AND FIRMLY ENGAGE WAND TIP WITH BACK OF WINDOW. TIGHTEN THUMB NUT TO HOLD WAND IN PLACE.
1/4" THUMB NUT
TAPER
D
WAND
3/8" TUBE
E
DETAIL D
THUMB NUTS
ORINGS
FOLLOWERS
3/8" TUBE
WAND
DETAIL E
SCREW
WAND
FIRM ENGAGEMENT OF TAPERED WAND
BACK OF WINDOW
CAP ASSEMBLY
BARBEN ANALYTICAL / AMETEK
6300 Connair Drive Carson City, NV 89706 PH(775)883-2500 FAX (775)297-4740
SAFE TAP II
WITH MANUAL CAL VALVES
PART NO.
FOR
SEE TABLE
-
REV
DATE
DESCRIPTION
B.3
09/16/25
CHANGE TEXT DESCRIPTIONS
MW
SD
REVISIONS
DWN
APVD
DRAWN BY
C. SHIELDS
APVD BY
H. MITCHELL
DATE
03/15/2021
SCALE
NTS
SIZE
D
ECO#
3460
SHEET
3 OF 4
DRAWING NO.
2P0364


LOCKING OPTIONS
6mm HOLE
OPTIONAL PAD LOCK
SECURES VALVE OPEN OR CLOSED
P/N B5102-1001
OPTIONAL PAD LOCK
SECURES SAFE-T-HANDLE
P/N B5102-1000
BARBEN ANALYTICAL / AMETEK
5200 Convair Drive Carson City, NV 89706 PH(775)883-2500 FAX (775)297-4740
SAFE TAP II
WITH MANUAL CAL VALVES
PART NO.
FOR
SEE TABLE
DATE 03/15/2021
DRAWN BY C. SHIELDS
APVD BY H. MITCHELL
SCALE NTS
SIZE D
ECO# 3460
DRAWING NO. 2P0364
SHEET 4 OF 4
REVISIONS
REV DATE DESCRIPTION DWN APVD
B.3 09/16/25 CHANGE TEXT DESCRIPTIONS MW SD

Operation & Maintenance Manual
BOS SAFETAP II Optical Oxygen Sensor

Contact Us

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AMETEK, Inc. is a leading global provider of industrial technology solutions serving a diverse set of attractive niche markets with annual sales of approximately $7.5 billion.

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Web: BarbenAnalytical.com