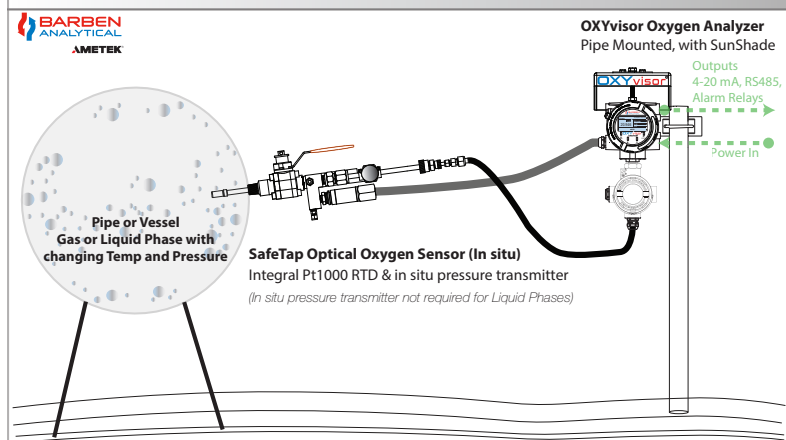


Installation, Operation & Maintenance Manual

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.



BOS SAFETAP II Optical Oxygen Sensor

Optical O₂ Products (BOSx)



Operation & Maintenance Manual

BOS SAFETAP II Optical Oxygen Sensor

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Receiving & Storage



WARNING!! DO NO 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.

Safety Instructions



Read complete manual to understand operation BEFORE Install & 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.

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.

Operation & Maintenance Manual

BOS SAFETAP II Optical Oxygen Sensor

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	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															
BOS2	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															
BOS3	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	Viton O-ring seals - Standard														
	E	EPDM O-ring seals														
	K	FFKM (perfluoroelastomer) O-ring seals														
		Body Material (wetted metalics)														
		1	316 Stainless Steel (Standard)													
		2	Titanium													
		3	Hastelloy													
		4	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	SafeTap - 1.0"												
			F15/G15	SafeTap - 1.5"												
			F20/G20	SafeTap - 2.0"												
			F30/G30	SafeTap - 3.0"												
				Cable Armor												
				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										
					Agency Approval											
					ST	Standard, Integral RTD for SafeTap										
					SN	No integral TC, and Zone 1 (see accessories for external RTD options)										
					Insertion Depth											
					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										
						Fittings & Cal Valves - 316 Stainless Steel										
						N	None - 1/4" T (Open)									
				C		Calibration Valves Included and Fittings										
				Pressure Transmitter - 316 Stainless Steel												
				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												
				Padlock												
				N	None											
		V		Padlock 3/16"												
		H	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																

<--- SafeTap II - Typical Sensor Configuration

Operation & Maintenance Manual

BOS SAFETAP II Optical Oxygen Sensor

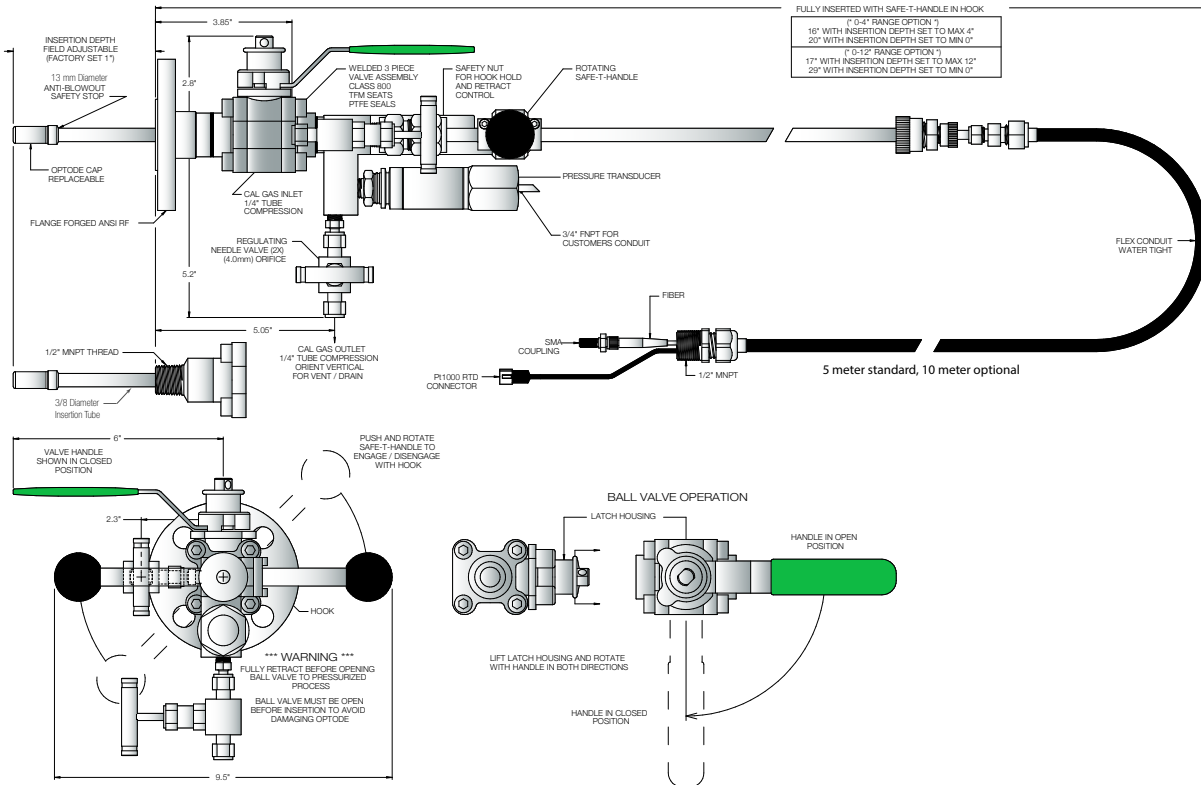
BOS Range Specifications For All Products

BOS1 Sensor Specifications - Liquid Phase / Gas Phase		
	Dissolved Oxygen (DO)	Gas Phase @ 1 atm, 20°C
Measurement Range	0-1.8 mg/L (ppm)	0-4.2 % O ₂ (0 - 41.4 hPa)
Limit of Detection (LOD)	1.0 µg/L (ppb)	0.002 % O ₂ (0.02 hPa)
Resolution @ 20°C and 1013 hPa	±0.30 at 1 µg/L (ppb) ±0.63 at 200 µg/L (ppb)	±0.0007 % O ₂ at 0.002 % O ₂ , ±0.0015 % O ₂ 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 % O ₂ (g), or 3 % of the measured value whichever is greater	
Drift from Photo-decomposition	< 1.0 ppb within 30 days (1 min sample rate)	
Operating Temperature Range	0 to 50°C (32 to 122°F)	
Allowable Sensor Temperature	90°C (194°F) non-continuous	
BOS2 Sensor Specifications - Liquid Phase / Gas Phase		
	Dissolved Oxygen (DO)	Gaseous & Dissolved Oxygen @ 1 atm, 20°C
Measurement Range	0-22 mg/L (ppm)	0-25 % O ₂ (0 - 1013 hPa)
Limit of Detection (LOD)	15 ppb	0.03 % O ₂
Resolution @ 20°C and 1013 hPa	±4.5 at 90 µg/L (ppb) ±0.15 at 23 mg/L (ppm)	±0.01 % O ₂ at 0.21 % O ₂ , ±0.1 hPa at 2 hPa ±0.1 % O ₂ at 20.9 % O ₂ , ±1 hPa at 207 hPa
Response Time (T ₉₀)	< 30 sec.	< 6 sec.
Accuracy @ 20°C	±0.4 % O ₂ at 20.9 % O ₂ , ±0.05 % O ₂ at 0.2 % O ₂	
Drift from Photo-decomposition	< 0.03 % O ₂ within 30 days (1 min sample rate)	
Operating Temperature Range	0 to 50°C (32 to 122°F)	
Allowable Sensor Temperature	90°C (194°F) non-continuous	
BOS3 Sensor Specifications - Liquid Phase / Gas Phase		
	Gas Phase Oxygen @ 1 atm, 20°C	
Measurement Range	0-300 ppm with over-range of 1000 ppm	
Limit of Detection (LOD)	0.5 ppm O ₂	
Resolution @ 20°C and 1013 hPa	10 ±0.5 ppm; 100 ±0.8 ppm; 200 ±1.5 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 (or as partial pressure, ±0.002 hPa)	
Drift from Photo-decomposition	< 1.5 ppm within 30 days (1 min sample rate)	
Operating Temperature Range	0 to 50°C (32 to 122°F)	
Allowable Sensor Temperature	90°C (194°F) non-continuous	
Cross Sensitivity for BOS1, BOS2, BOS3 Sensors Listed above		
No interference or degradation from carbon dioxide (CO ₂), hydrogen sulfide (H ₂ S), ammonia (NH ₃), gaseous sulfur dioxide (SO ₂) or ionic species like sulfide, sulfate, or chloride. Compatible with many hydrocarbons, such as natural gas (with H ₂ S and CO ₂) along with ethylene, propylene and polypropylene. Also compatible with methanol and ethanol mixtures. Incompatible with 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	750 psig (51.7 Bar)	
Insertion / Retraction Pressure Rating	450 psig (31.0 Bar)	
Temperature Rating	0 to 50°C (32 to 122°F) operating, 90°C (194°F) non-continuous	
Internal Seal Options	Viton, EPDM, FFKM (Kalrez)	

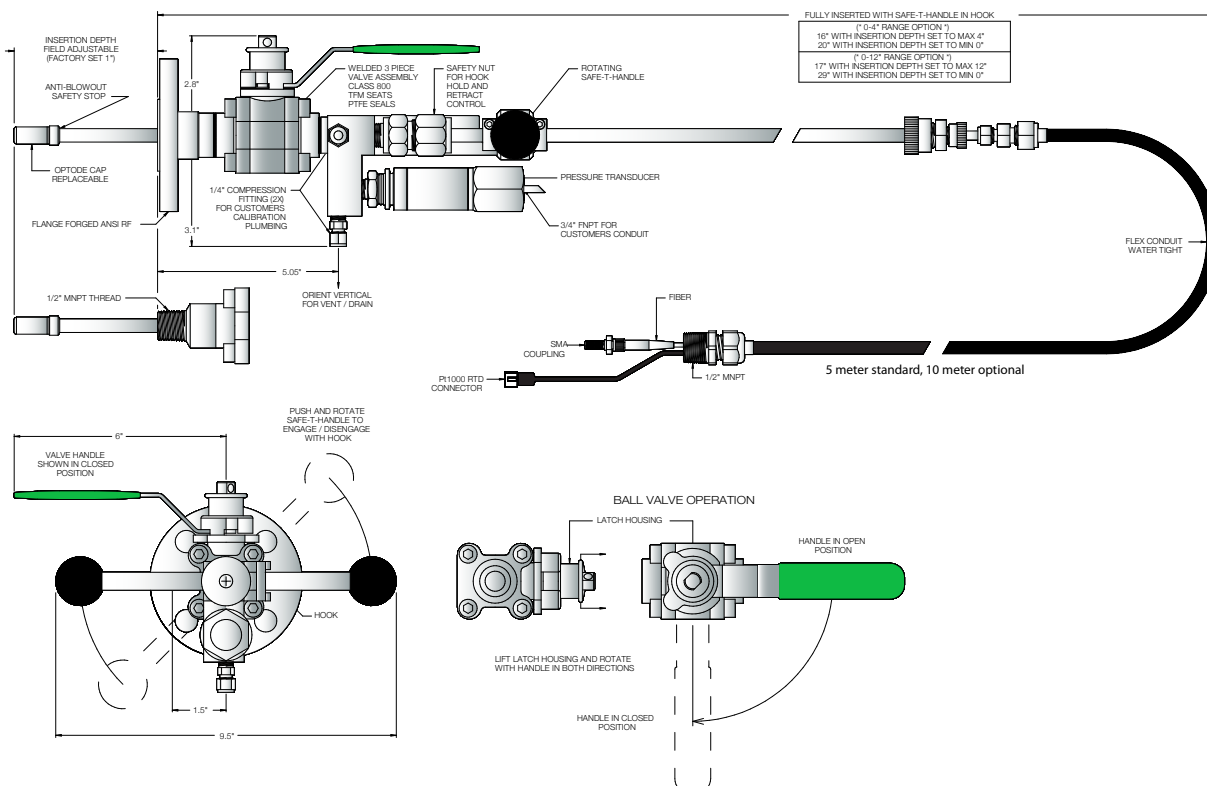
Operation & Maintenance Manual

BOS SAFETAP II Optical Oxygen Sensor

SafeTap II with Manual Calibration Valve Dimension



SafeTap II without Manual Calibration Valve Dimensions



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BOS SAFETAP II Optical Oxygen Sensor

Basic Installation And Replacement Guidelines



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.**

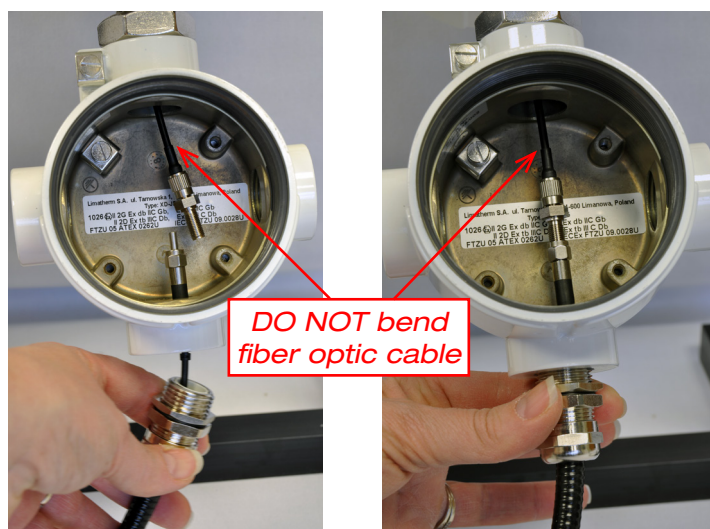


WARNING!! DO NOT OVER TIGHTEN THE SENSOR CAP. The sensor cap should be firmly tightened by hand only. Over tightening the cap may result in damage to the cap housing or to the o-ring on the sensor body. Keep the optical window inside the UV resistant bag until the time of installation.

Installation of New BOS SAFETAP II Sensor - Analyzer End (figure 3)

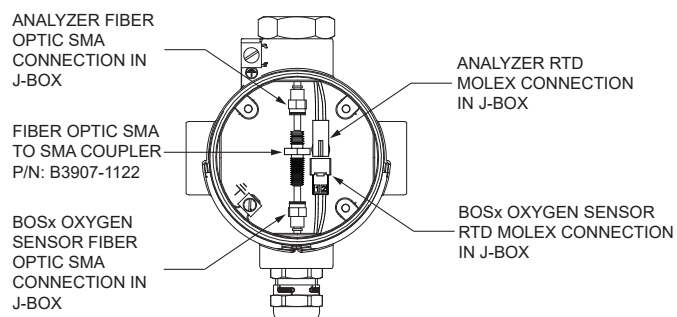
1. Installation of the optical fiber and temperature compensation leads may be done prior to mounting the OXYvisor Oxygen Analyzer.
2. The optical fiber should be threaded onto the fiber connector on the bottom of the OXYvisor Analyzer. The fixed knurled nut provides female threads for the BOS SAFETAP II Gland and should not be turned.
3. Temperature compensation may be provided directly with the BOS SAFETAP II or through a separate Pt1000 RTD temperature sensor. If integral temperature compensation is provided, separate armor jacketing and a gland are provided for the RTD wiring.
4. Refer to OXYvisor manual for sensor menu setup or any wiring that may need to occur.

BOS SAFETAP II - Typical Install at OXYvisor Analyzer

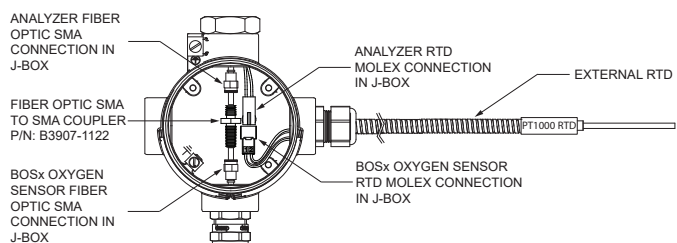


The close-up pictures above show the fiber optic connection must come in from the bottom of the OXYvisor Oxygen Analyzer J-box. The fiber connector protrudes through the middle of the fixed knurled nut. **Finger tighten** the optical fiber to the connector in the middle of the knurled nut. Once the optical fiber is connected, tighten the armored gland into the female threads on the knurled nut.

Figure3



Integral RTD example



External RTD example

Operation & Maintenance Manual

BOS SAFETAP II Optical Oxygen Sensor

Installation of New BOS SAFETAP II Sensor - Process End (figure 4)

1. During initial installation, BOS SAFETAP II valve assembly (#1) should be installed into the process with the compression gland safety nut (#2) and sensor (#3) removed.
 2. Open the valve assembly (#1) (if no process pressure behind the valve).
 3. Use Teflon tape or other suitable sealant on the threads of the safety nut (#2). Ensure all threads are covered with a minimum of four wraps of Teflon tape.
 4. Thread safety nut (#2) into the valve assembly (#1) using the lower wrench flats to tighten the nut.
 5. Once compression gland is installed re-verify that valve is open prior to inserting the sensor assembly (#3).
 6. Slowly push down on the Safe-T-Handle (#4) to insert the tip of the sensor into the process. The Safe-T-Handle can rotate 360 degrees during insertion.
 7. Maneuver the Safe-T-Handle (#4) into the security hook (#5) to prevent accidental retraction when process pressure is applied.
 8. Finger tighten upper nut on the safety nut (#2) then add 1/4 turn using a wrench.
 9. Prior to beginning measurement, a final check should be made that the optical wand (#6) is fully inserted. The optical wand sensor tip must be in contact with the back of the window cap assembly (#7) to ensure full signal strength. Should this need to be adjusted, do the following:
 - Loosen the 1/4" thumb nut (#8) until the wand slides freely within assembly tubing.
 - Slide optical wand forward until it just contacts the back of the window cap assembly.
 - Keep optical wand in contact with the window cap assembly (#7) and tighten the 1/4" thumb nut (#8) HAND-tight.
- NOTE: Avoid swaging or over-tightening the thumb nut.

BOS SAFETAP II - Typical Install at Process



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

- Crescent Wrench (2)
- Thread sealant

Numbered Part List

1. Valve Assembly
2. Safety Nut
3. Sensor Assembly
4. Safe-T-Handle
5. Security Hook
6. Optical Wand
7. Replaceable Window Cap Assembly
8. Small 1/4" thumb nut

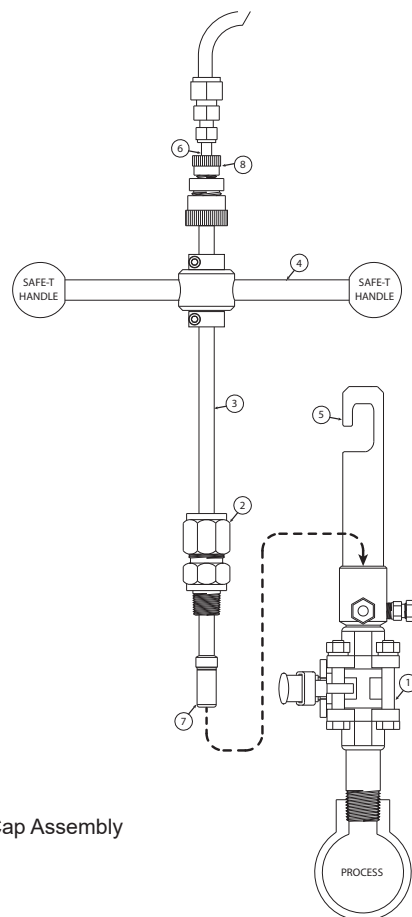


Figure4

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BOS SAFETAP II Optical Oxygen Sensor

Removal of BOS SAFETAP II Sensor (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 make sure that the Safe-T-Handle (#4) is in the security hook (#5) and cannot rotate freely.
2. Loosen the top nut (safety nut) of the compression gland (#2) by 1/4 turn. Push down slowly on the Safe-T-Handle while still within the security hook. 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.
3. Slowly push down on the Safe-T-Handle (#4) until it can turn freely passed the security hook.
4. Maintain a firm grip on the Safe-T-Handle and let the process pressure push the sensor assembly (#3) back until it can no longer retract.
5. Close the valve assembly to isolate the sensor from the process.
6. Residual process pressure can be bled off through the two 1/4" tubing fittings on the valve assembly. Please use proper precautions if hazardous or toxic gases are present. These tubing fittings can also be used for in situ calibration.

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 of the readings from the analyzer.
- Ensure that the window cap assembly of the sensor is secured to the sensor housing. 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, sand paper or other method that may damage the tip of the sensor.**

Replacement of Window Cap Assembly (figure 5)

1. 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.
2. Clean the sensor assembly (#2) with a damp cloth to remove residual process material.
3. Unscrew the sensor window cap (#1) from the tip of the sensor.
4. Inspect the o-ring seal (#3) on the sensor stem for damage. Replace the o-ring if necessary.
5. Loosen the 1/4" thumb nut (#4) until the optical wand (#5) can slide freely inside of the sensor assembly (#2).
6. Slide the optical wand forward, through the sensor assembly (#2), towards the direction of the cap. NOTE: The wand tip should protrude from the open end of the sensor assembly (#2).
7. Hand tighten the replacement window cap assembly (#1) on to the sensor assembly (#2). The cap assembly will contact the optical wand (#5) tip. They should be in contact. "If not in contact, loosen 1/4" thumb nut (#4) to retract or insert forward to ensure wand tip is in contact with sensor window cap assembly.
8. Fasten the sensor window cap "hand-tight". Avoid using pliers or other tools.
9. Keep the optical wand (#5) in contact with the window cap assembly (#1) and tighten the knurled compression fitting (#4) "hand-tight". NOTE: Avoid swaging or over-tightening the 1/4" thumb nut (#4).
10. Carefully reinstall the sensor assembly into the valve assembly. Use care during installation to avoid contact with tip.

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BOS SAFETAP II Optical Oxygen Sensor

BOS SAFETAP II - Window Cap Assembly Replacement

Numbered Part List

1. Replaceable Window Cap Assembly
2. Sensor Assembly
3. O-ring seal
4. Smaller 1/4" thumb nut
5. Optical Wand

Tools Required

- Spare Window Cap Assembly
- Damp Cloth
- O-ring seal

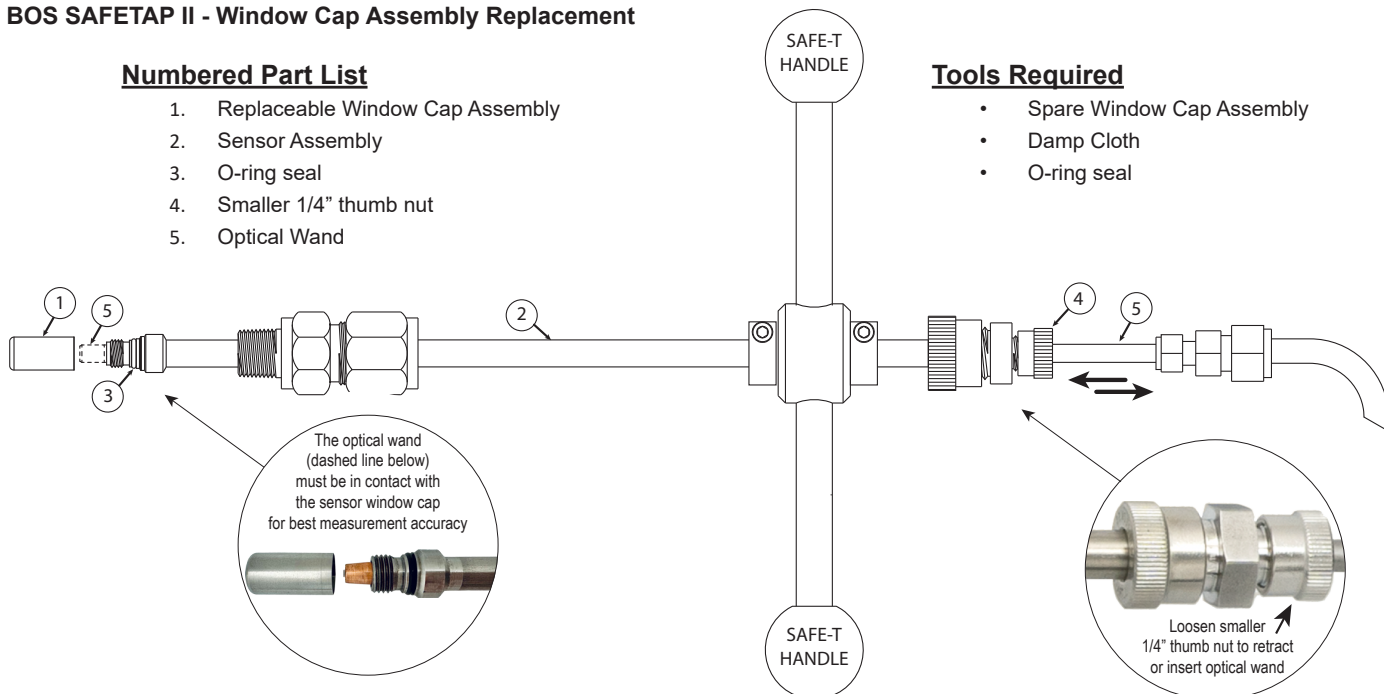


Figure5

BOS SAFETAP II - In situ Purge & Calibration

The valve assembly of the BOS SAFETAP II provides two 1/4" compression fittings. 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.

A typical flow schematic for in situ calibration is shown to the right. Please consult Barben Analytical for additional support for these types of installations.

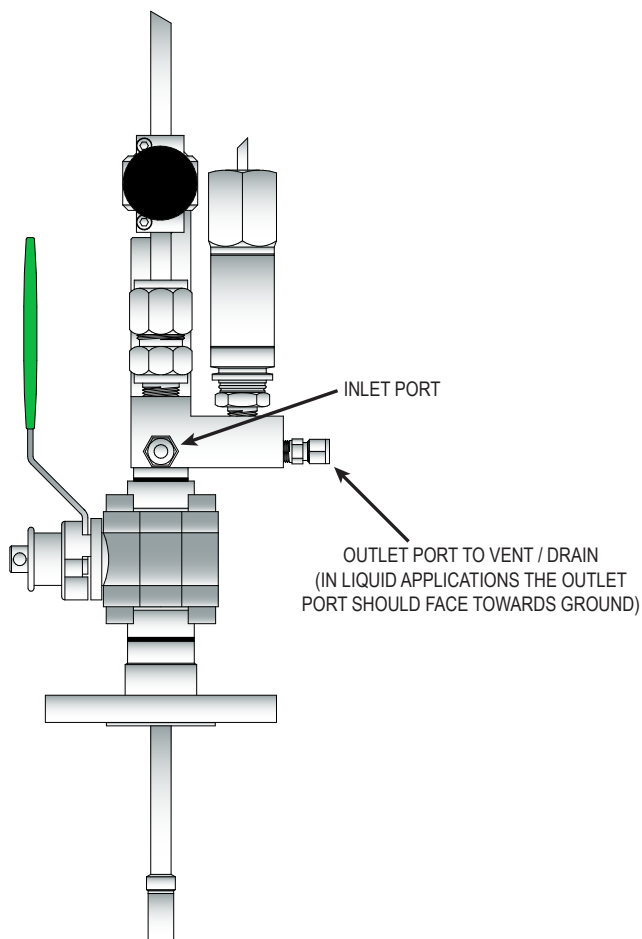


Figure6

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BOS SAFETAP II Optical Oxygen Sensor

Spare Parts

Listed below are the most common recommended spare parts. Replacement window cap assemblies include the lumino-phore 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 (Reference figure 7)			
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

Optional Spare Parts - (Reference figure 7)	
Part #	Description and Materials (wetted)
B4904K-1017	Replacement Seal Kit, Viton Extreme
B4904K-1015	Replacement Seal Kit, EPDM
B4904K-1016	Replacement Seal Kit, FFKM (perfluoroelastomer)
B5102-1000	Lock-out padlock (can be used for Safe-T-Handle or for valve lockout)

*For other material options, please consult factory.

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BOS SAFETAP II Optical Oxygen Sensor

BOS SAFETAP II - Spare Parts

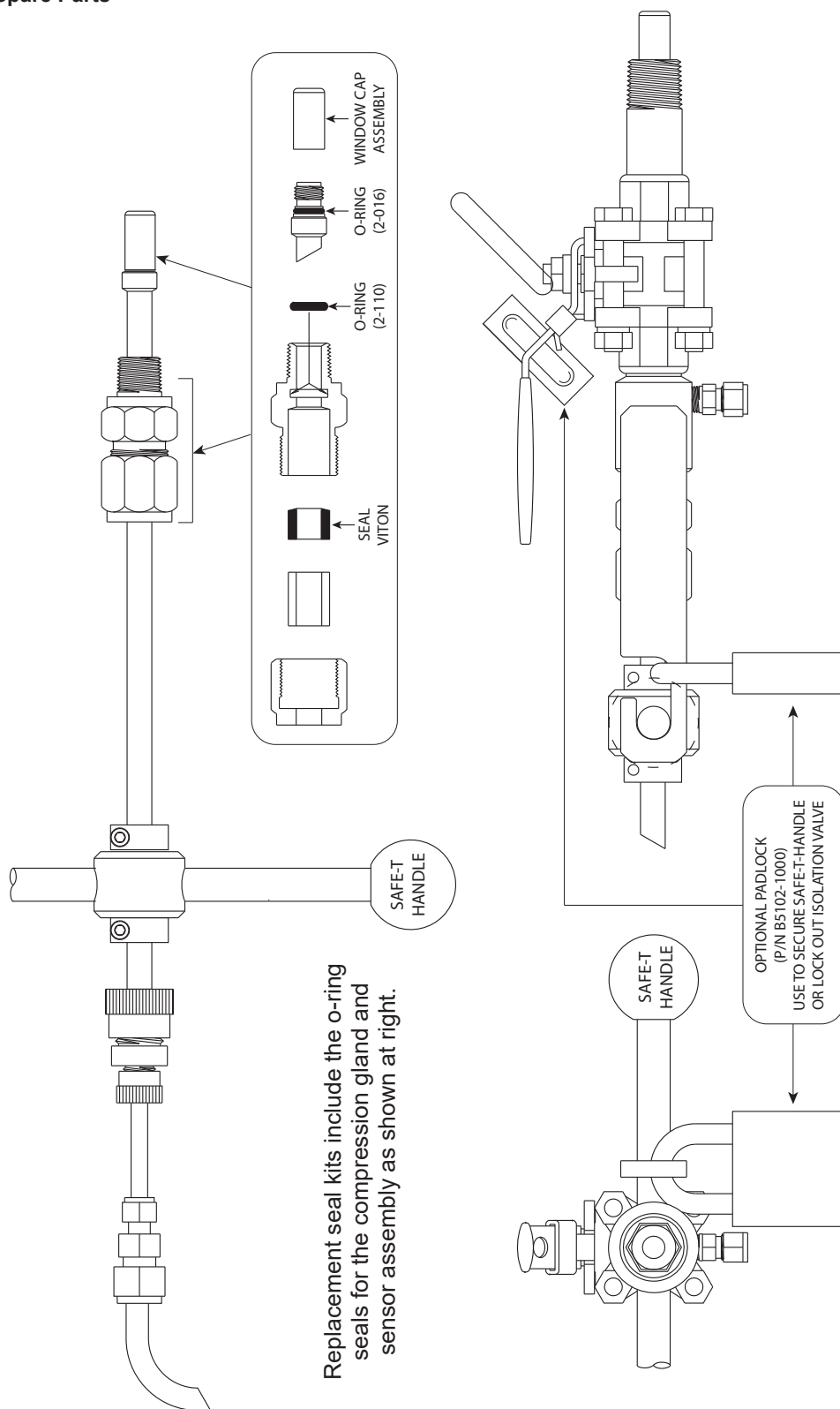
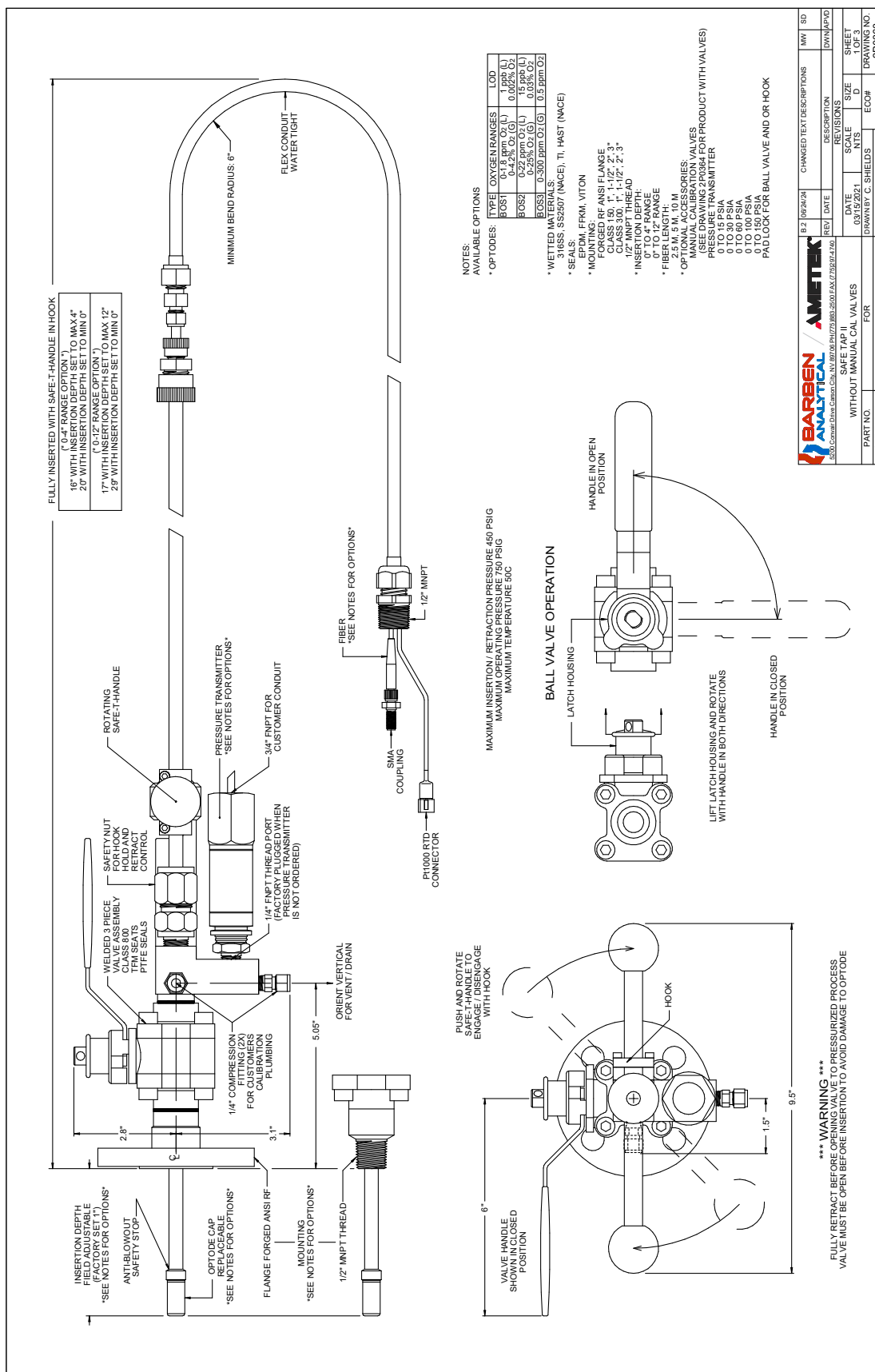


Figure 7

BARBEN
ANALYTICAL

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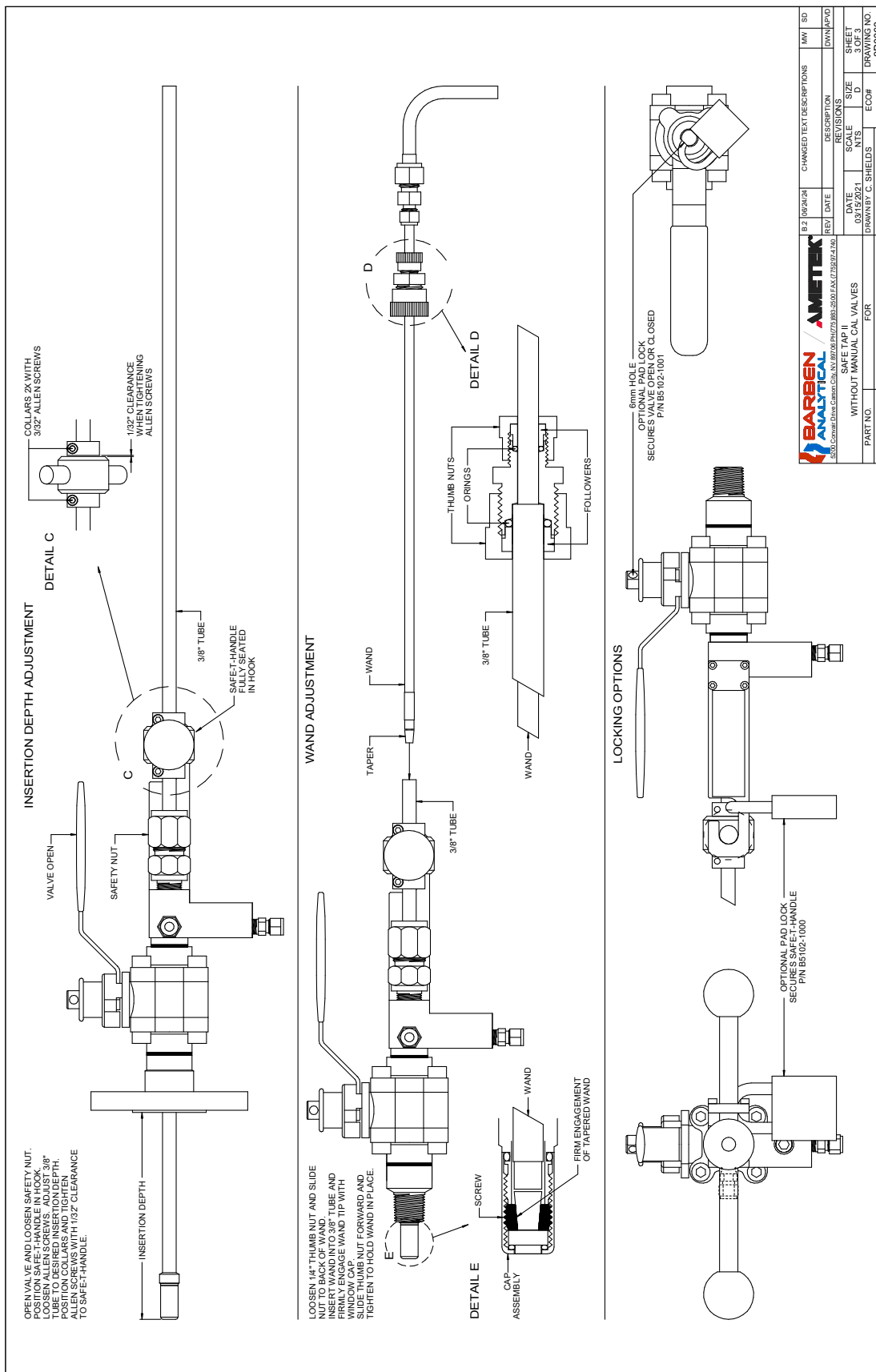
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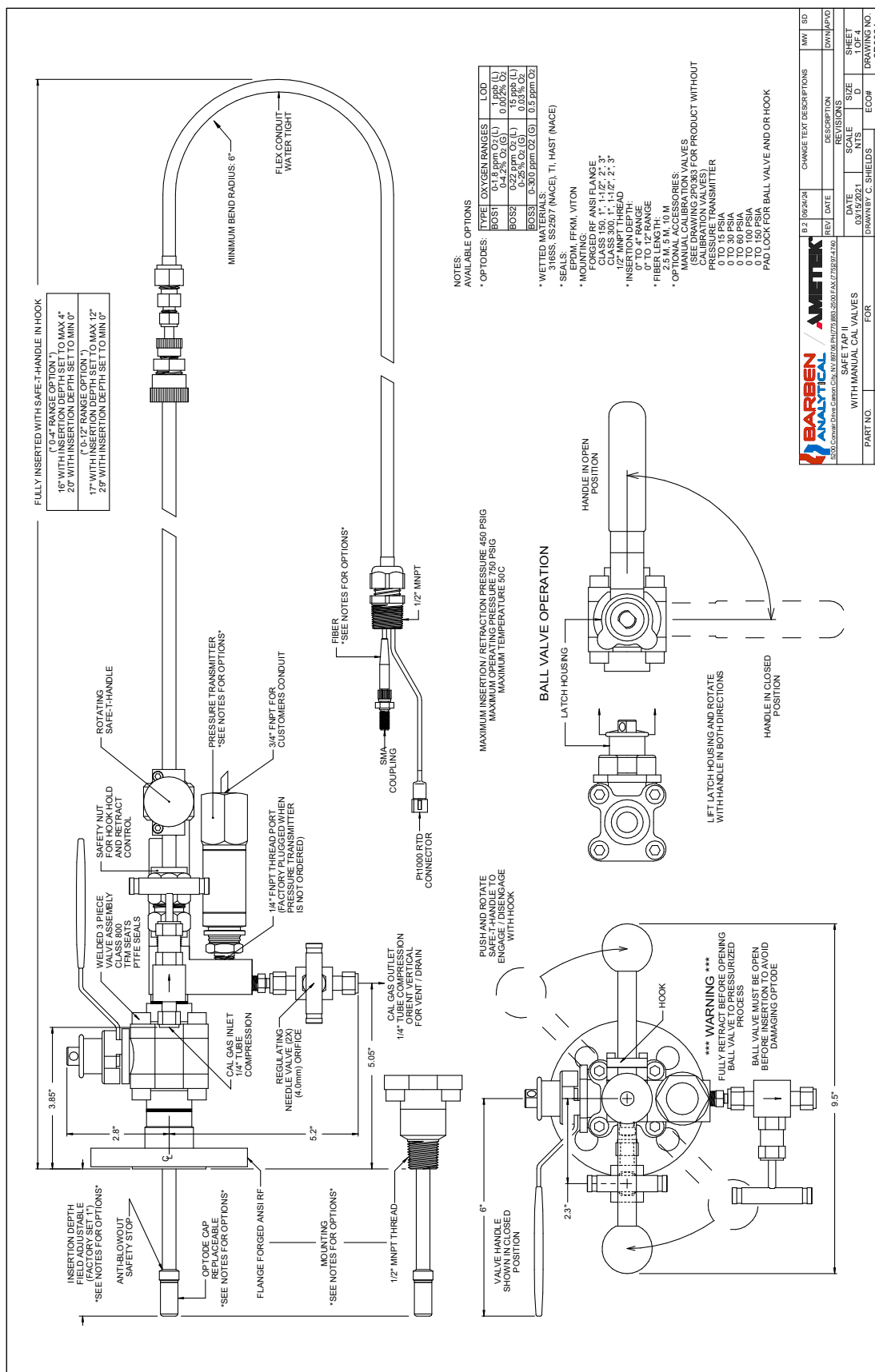


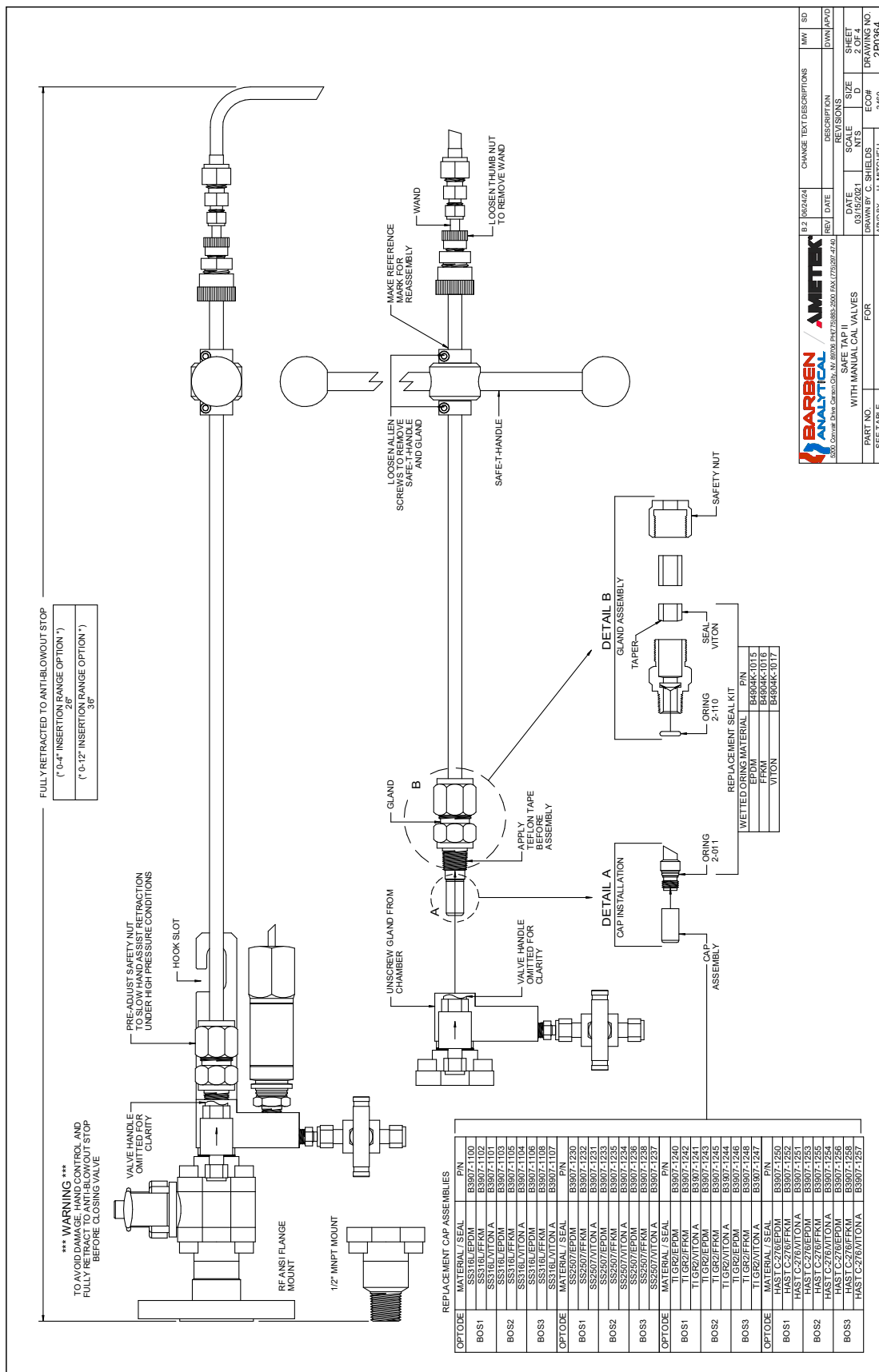
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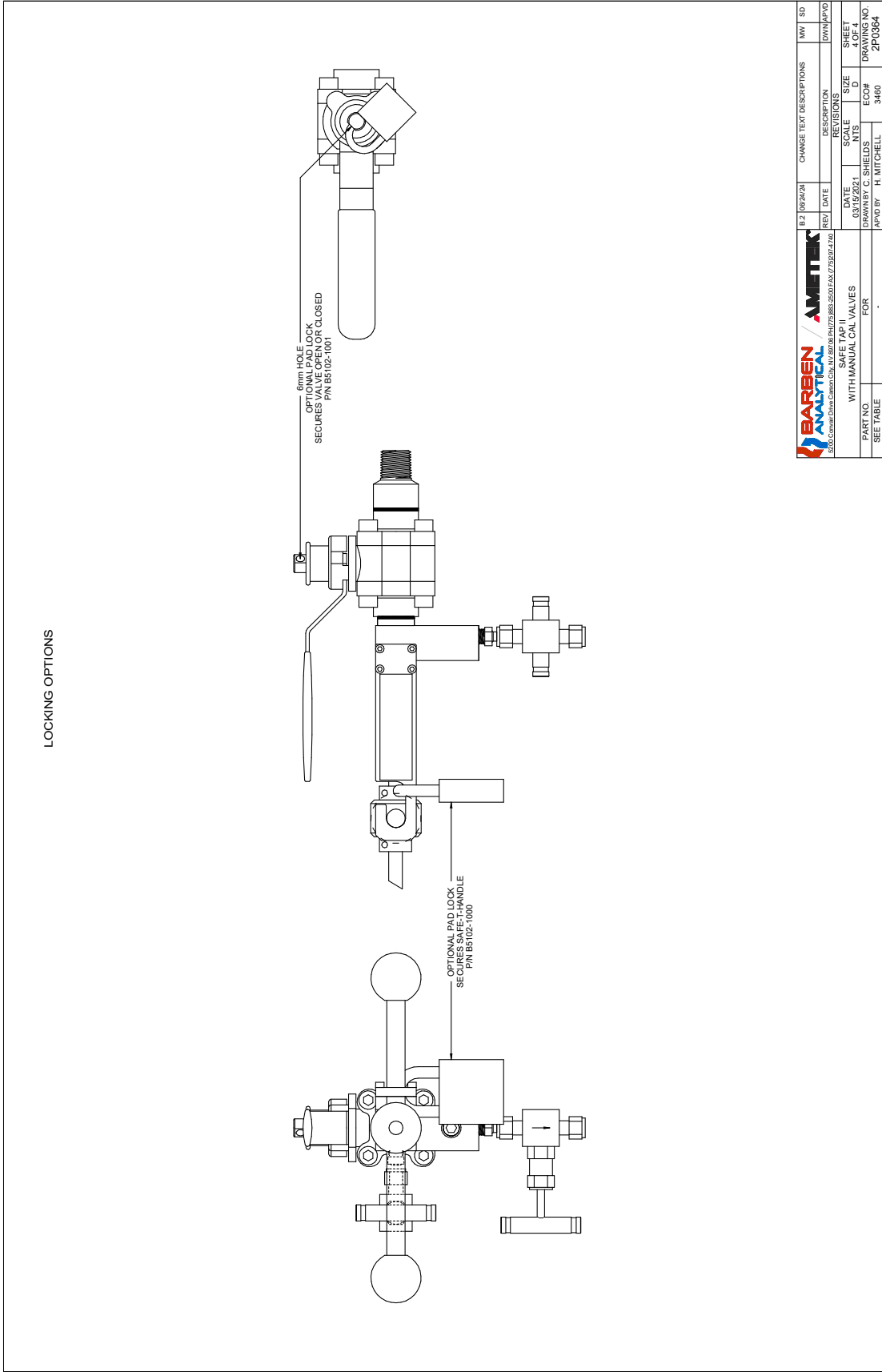


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Contact Us

Barben Analytical is a leading supplier of analytical measurement technology targeting the industrial marketplace. It is a wholly owned subsidiary of AMETEK.

AMETEK has nearly 14,000 colleagues at over 120 manufacturing locations around the world. Supporting those operations are more than 80 sales and service locations across the United States and in more than 30 other countries around the world.

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