



BURNS[®]
ENGINEERING

Temperature Measurement Experts

**AUTOCCLAVE
SUPPLEMENT**



Series S

Autoclave Sensor Supplement



SAC | Sanitary Autoclave Classic

Specifications

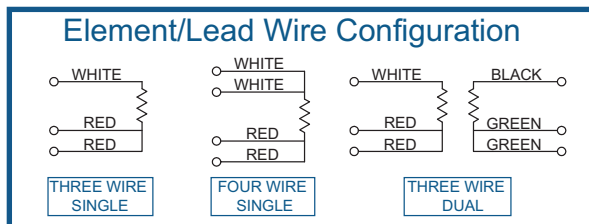
The SAC is a precision sensor in a lightweight package ideally suited for smaller autoclave applications or “walk-in” applications where the sensor will experience minimal handling stress. The completely waterproof design is built to withstand the harsh, repeated steam/vacuum cycling of the autoclave process while maintaining the highest levels of accuracy and repeatability. This classic Burns design has over a decade of field-proven performance.

Features and Benefits:

- Application: Chamber or load probe
- Accuracy: Standard or precision
- Sheath: 316 stainless steel in 0.25" or 0.188" diameter
- Element/Lead Wire Configuration: Single 3 or 4 wire and dual 3 wire
- Cable: Twisted Teflon[®] insulated wires with Teflon[®] jacket
- Through-Wall Installation: Designed for elastomer compression fitting
- Cleanability: 316 stainless steel sheath and Teflon[®] cable construction

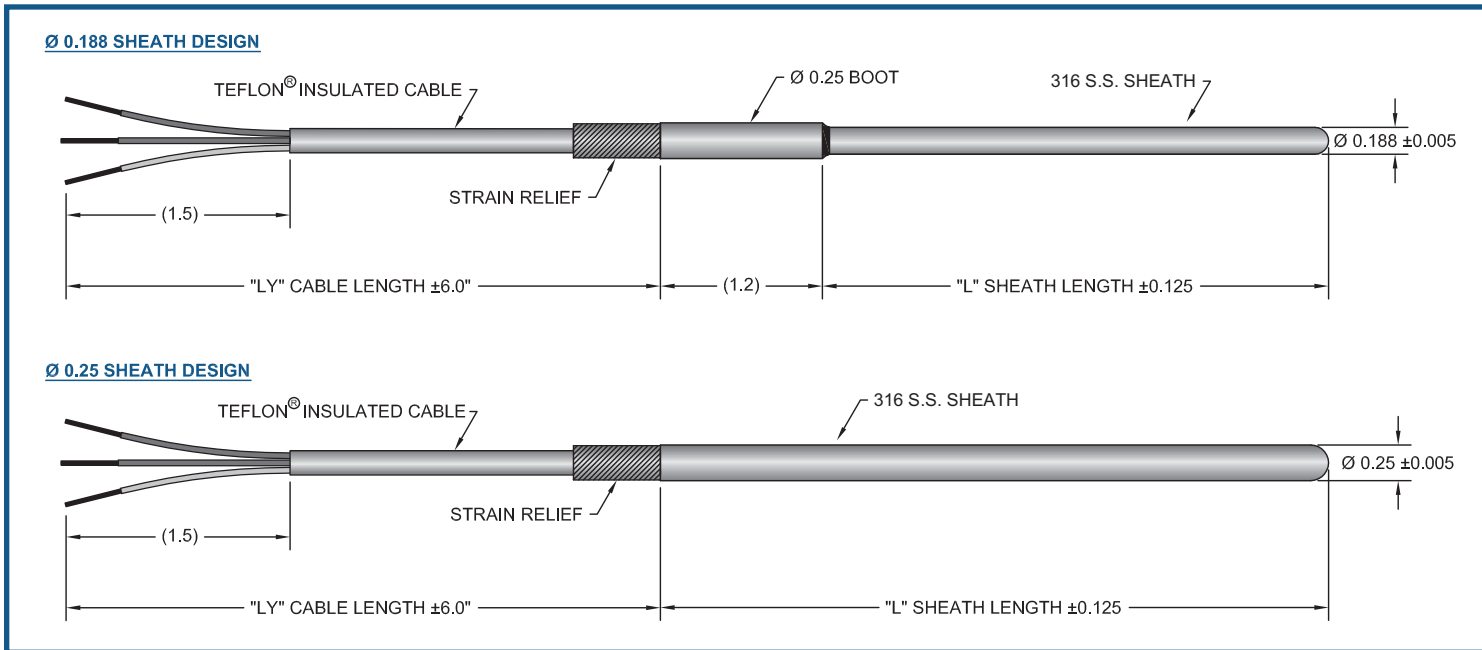
Specifications:

- Element Configuration: Single or Dual element, 100 ohms at 0°C, 0.00385 ohm/ohm/°C nominal alpha
- Temperature Range: -50°C to 200°C
- Transition Fitting and Cable Temperature Limits: -50°C to 200°C continuous
- R0 Interchangeability: R0 ±0.10 ohms or R0 ±0.05 ohms
- Short-Term Repeatability and Hysteresis: ±0.025°C (0.01 ohms) maximum change at 0°C over any 5 consecutive thermal cycles from -38°C to 135°C
- Repeatability: ±0.025°C (0.01 ohms) maximum shift at 0°C after 10 cycles between -38°C and 200°C
- Stability: ±0.05°C (0.02 ohms) maximum shift at 0°C after 1000 hours at 135°C
- Pressure: 1 psia to 35 psia
- Insulation Resistance: 100 megohms minimum at 100 VDC at room temperature



SAC | Sanitary Autoclave Classic

Ordering Information



All dimensions in inches

Accuracy options

- 10 Standard RTD +/-0.10% of resistance at 0 degrees C
- 05 Precision RTD +/-0.05% of resistance at 0 degrees C

Element / Wire Configuration and Sensor Diameter

- A3 *Three wire single element, 0.188 Dia. sensor sheath
- A4 *Three wire single element, 0.25 Dia. sensor sheath
- B3 Four wire single element, 0.188 Dia. sensor sheath
- B4 Four wire single element, 0.25 Dia. sensor sheath
- C4 *Three wire dual element, 0.25 Dia. sensor sheath

"L" Sensor Sheath Length

- 035 3.5 inch sensor length
- 040 4.0 inch sensor length
- 050 5.0 inch sensor length
- 060 6.0 inch sensor length

"LY" Cable Length

- 060 60.0 inch cable length
 - 120 120.0 inch cable length
 - 180 180.0 inch cable length
 - 240 240.0 inch cable length
- Specify cable length in inches, 12 inch increments

SAC

* For all Three Wire sensors – please specify **actual "installed" cable length** as certain lengths cannot be shortened upon installation without impacting sensor accuracy. Visit burnsengineering.com and type in keyword: SAC, SAL, SAH or SAX for the specification drawing with cable length criteria; or contact Burns Customer Service for more information.

SAL | Sanitary Autoclave Load

Specifications

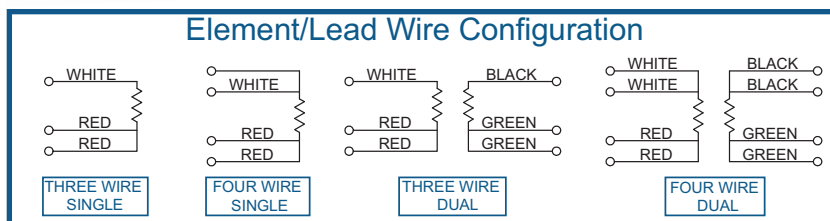
Originally designed for the pharmaceutical and biotechnology world; the SAL's waterproof design extends from the sheath through the sealed transitions to the extruded lead wires preventing capillary action during pressure cycling, which can force water into the cable jacket and up into the sensor causing premature failure. Built to withstand the harsh, repeated steam/vacuum cycling of the autoclave process in a compact 0.125" sheath design makes this an ideal choice for use in load monitoring applications such as vials and sample cells.

Features and Benefits:

- Application: Load probe
- Accuracy: Standard or precision
- Sheath: 316 stainless steel in 0.125" diameter; straight or 90° bend; sharp or rounded tip
- Element/Lead Wire Configuration: Single 3 or 4 wire and dual 3 or 4 wire
- Cable: Teflon[®] insulated wires in highly flexible round silicone rubber jacket
- Through-Wall Installation: Designed for elastomer compression fitting, round cable design optimizes sealing of the compression fitting (vs. twisted wire cable)
- Cleanability: 316 stainless steel sheath and silicone cable construction

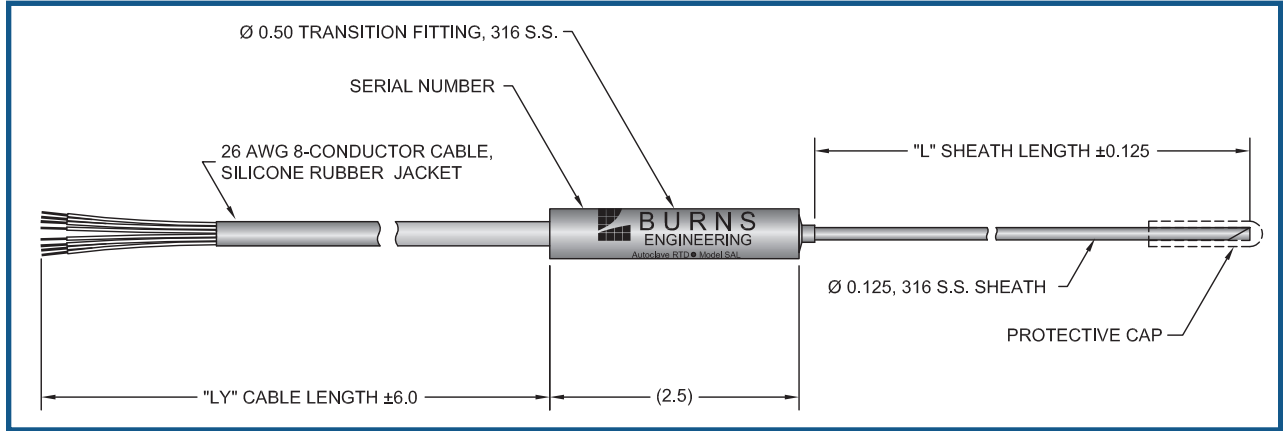
Specifications:

- Element Configuration: Single and dual element, 100 ohms at 0°C, 0.00385 ohm/ohm/°C nominal alpha
- Temperature Range: -40°C to 135°C
- Transition Fitting and Cable Temperature Limits: -40°C to 135°C continuous
- R0 Interchangeability: R0 ±0.10 ohms or R0 ±0.05 ohms
- Short-Term Repeatability and Hysteresis: ±0.025°C (0.01 ohms) maximum change at 0°C over any 5 consecutive thermal cycles from 0°C to 135°C
- Repeatability: ±0.05°C (0.02 ohms) maximum shift at 0°C after 20 cycles between 21°C and 135°C
- Stability: ±0.05°C (0.02 ohms) maximum shift at 0°C after 1000 hours at 135°C
- Pressure: 1 psia to 35 psia
- Insulation Resistance: 500 megohms minimum at 100 VDC at room temperature



SAL | Sanitary Autoclave Load

Ordering Information



All dimensions in inches

Accuracy options

- 10 Standard RTD +/-0.10% of resistance at 0 degrees C
- 05 Precision RTD +/-0.05% of resistance at 0 degrees C

Element / Wire Configuration

- A *Three wire single element
- B Four wire single element
- C *Three wire dual element
- D Four wire dual element

"L" Sensor Sheath Length, 3.5 inch minimum, 7.0 inch maximum

- 035 3.5 inches minimum
 - 045 4.5 inch sheath length
 - 060 6.0 inch sheath length
 - 070 7.0 inch sheath length
- Specify sheath length in inches, 0.5 inch increments, (3.5 min., 7.0 max.)

Tip Configuration (see detail below)

- S Sharp tip
- R Rounded tip

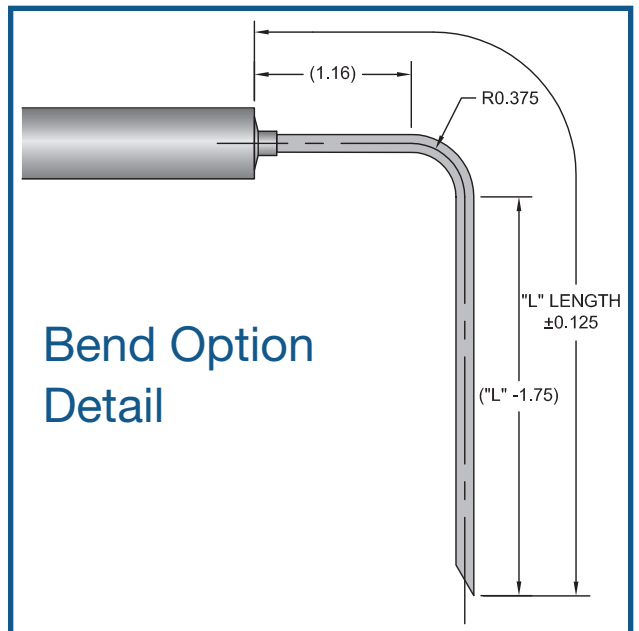
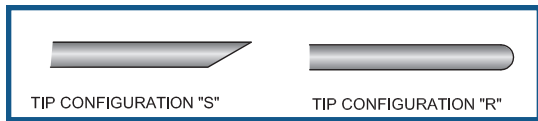
90 Degree Bend Option

- S Straight - no bend
- B 90 degree bend - see detail below

"LY" Cable Length

- 060 60.0 inch cable length
 - 120 120.0 inch cable length
 - 180 180.0 inch cable length
- Specify cable length in inches, 12 inch increments

SAL



Bend Option Detail

All dimensions in inches

* For all Three Wire sensors – please specify **actual "installed" cable length** as certain lengths cannot be shortened upon installation without impacting sensor accuracy. Visit burnsengineering.com and type in keyword: SAC, SAL, SAH or SAX for the specification drawing with cable length criteria; or contact Burns Customer Service for more information.

SAH | Sanitary Autoclave Heavy-Duty

Specifications

The SAH is designed for applications where a more rugged sensor and cable combination is required. The completely waterproof design easily handles the harsh, repeated steam/vacuum cycling of the autoclave process and incorporates an EDPM protective jacket to minimize sensor/cable separation and failure during rough handling or accidental stretching/extension. The continuous one-piece, low-profile design with “ruggedized” shock-resistant sensor is an excellent choice and provides an extra measure of protection when used in larger “walk-in” chambers where movement of carts or repeated handling and accidental “abuse” may occur.

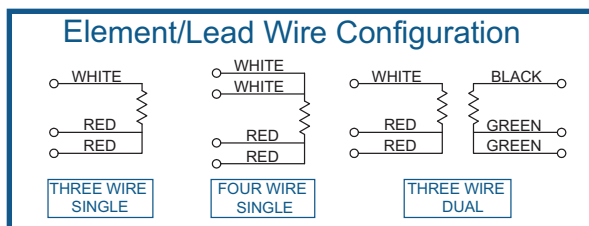
Features and Benefits:

- Application: Chamber probe
- Accuracy: Standard*
- Sheath: 316 stainless steel in 0.25" diameter
- Element/Lead Wire Configuration: Single 3 or 4 wire and dual 3 wire
- Cable: Twisted Teflon® insulated wires with integrated flexible EDPM fiber reinforce protective jacket
- Through-Wall Installation: Sanitary port
- Cleanability: 316 stainless steel and Teflon®/EDPM cable construction

*Accuracy of 0.2°C can be achieved via matching sensor with transmitter

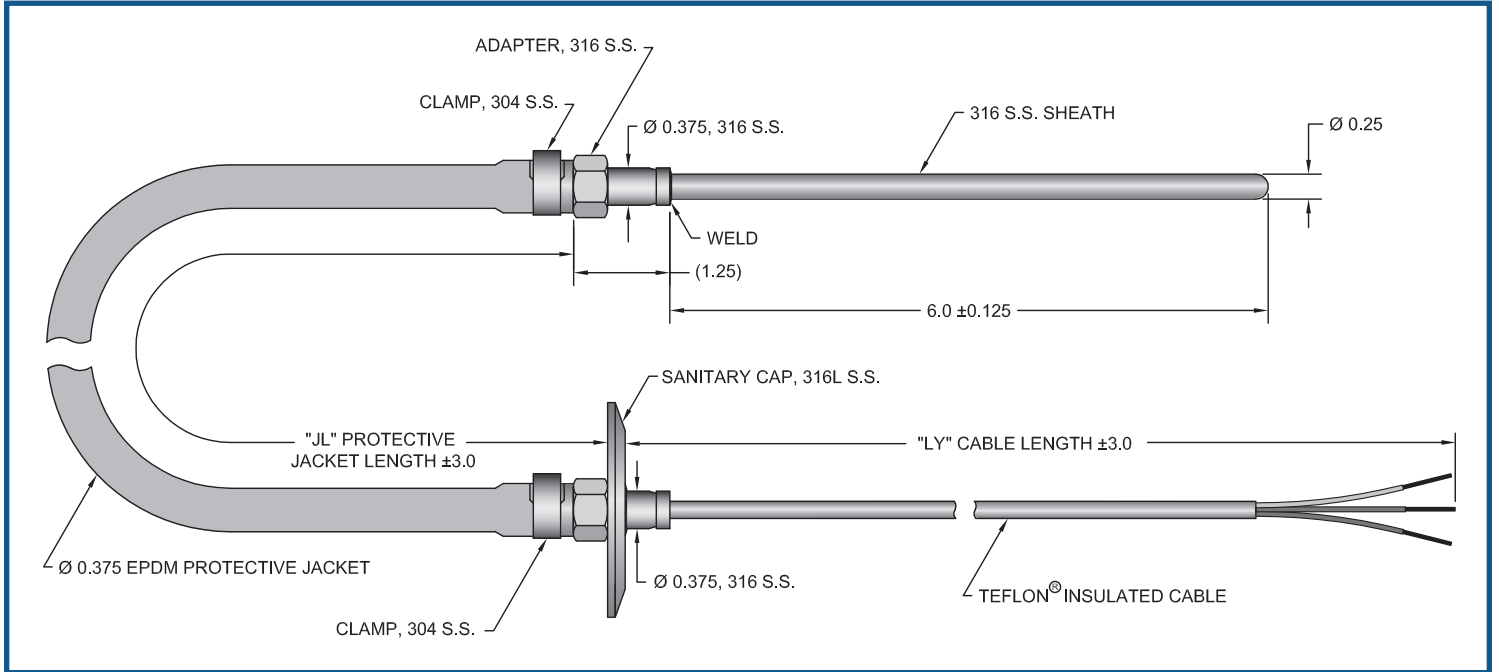
Specifications:

- Element Configuration: Single or dual element, 100 ohms at 0°C, 0.00385 ohm/ohm/°C nominal alpha
- Temperature Range: -50°C to 200°C
- Transition Fitting and Cable Temperature Limits: -50°C to 200°C continuous
- R0 Interchangeability: R0 ±0.10 ohms
- Short-Term Repeatability and Hysteresis: ±0.025°C (0.01 ohms) maximum change at 0°C over any 5 consecutive thermal cycles from 0°C to 135°C
- Repeatability: ±0.10°C (0.04 ohms) maximum shift at 0°C after 10 cycles between -50°C and 200°C
- Stability: ±0.26°C (0.10 ohms) maximum shift at 0°C after 1000 hours at 200°C
- Pressure: 1 psia to 35 psia
- Insulation Resistance: 100 megohms minimum at 100 VDC at room temperature



SAH | Sanitary Autoclave Heavy-Duty

Ordering Information



All dimensions in inches

Accuracy

-10 Standard RTD +/-0.10% of resistance at 0 degrees C

Element / Wire Configuration

- A *Three wire single element
- B Four wire single element
- C *Three wire dual element

"JL" Protective Jacket Length, 72.0 inch minimum length

- 120 120 inch protective jacket length
 - 180 180 inch protective jacket length
 - 240 240 inch protective jacket length
 - 300 300 inch protective jacket length
- Specify protective jacket length in inches, 12 inch increments

"LY" Cable Length Beyond Protective Jacket, 12.0 minimum length

- 120 120.0 inch cable length
 - 180 180.0 inch cable length
 - 240 240.0 inch cable length
 - 300 300.0 inch cable length
- Specify cable length in inches, 12 inch increments

Cap Size

- 15 1.5 inch
- 20 2.0 inch
- 25 2.5 inch
- 30 3.0 inch
- 40 4.0 inch

SAH [] [] [] [] [] []

* For all Three Wire sensors – please specify **actual "installed" cable length** as certain lengths cannot be shortened upon installation without impacting sensor accuracy. Visit burnsengineering.com and type in keyword: SAC, SAL, SAH or SAX for the specification drawing with cable length criteria; or contact Burns Customer Service for more information.

SAX | Sanitary Autoclave Xtreme-Duty

Specifications

The SAX is designed for extreme autoclave applications where the most rugged sensor and cable combination is needed. The completely waterproof design easily handles the harsh, repeated steam/vacuum cycling of the autoclave process and incorporates an armored protective jacket to virtually eliminate sensor/cable separation and failure during rough handling or accidental stretching/extension. The SAX's "ruggedized" shock-resistant sensor and ultra flexible steel-braid armored jacket provide the ultimate in protection for large "walk-in" chambers where movement of carts and equipment or repeated handling and accidental "abuse" often occur. The SAX utilizes a replaceable sensor to minimize downtime and cost of ownership.

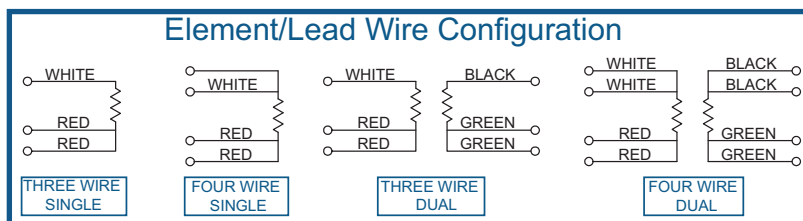
Features and Benefits:

- Application: Chamber probe
- Accuracy: Standard*
- Sheath: 316 stainless steel in 0.25" diameter (0.375" diameter for dual 4 wire design)
- Element/Lead Wire Configuration: Single 3 or 4 wire and dual 3 or 4 wire
- Cable: Twisted Teflon® insulated wires on sensor; Armored jacket (silicone cover over a 304 stainless steel braid, over fiberglass braid welded to an inner PTFE tube). Jacket is fully vacuum and high pressure rated, meets 3A, USP Class VI and FDA 21CFR177.1550.
- Through-Wall Installation: Sanitary feedthru, order separately (reference SFX)
- Cleanability: 316 stainless steel (sheath and fittings) and Teflon®/silicone cable construction
- User Replaceable Sensor: Armored jacket can be left in place (installed) and sensor can be removed and a new one easily installed (reference SAX drawing)

*Accuracy of 0.2°C can be achieved via matching sensor with transmitter

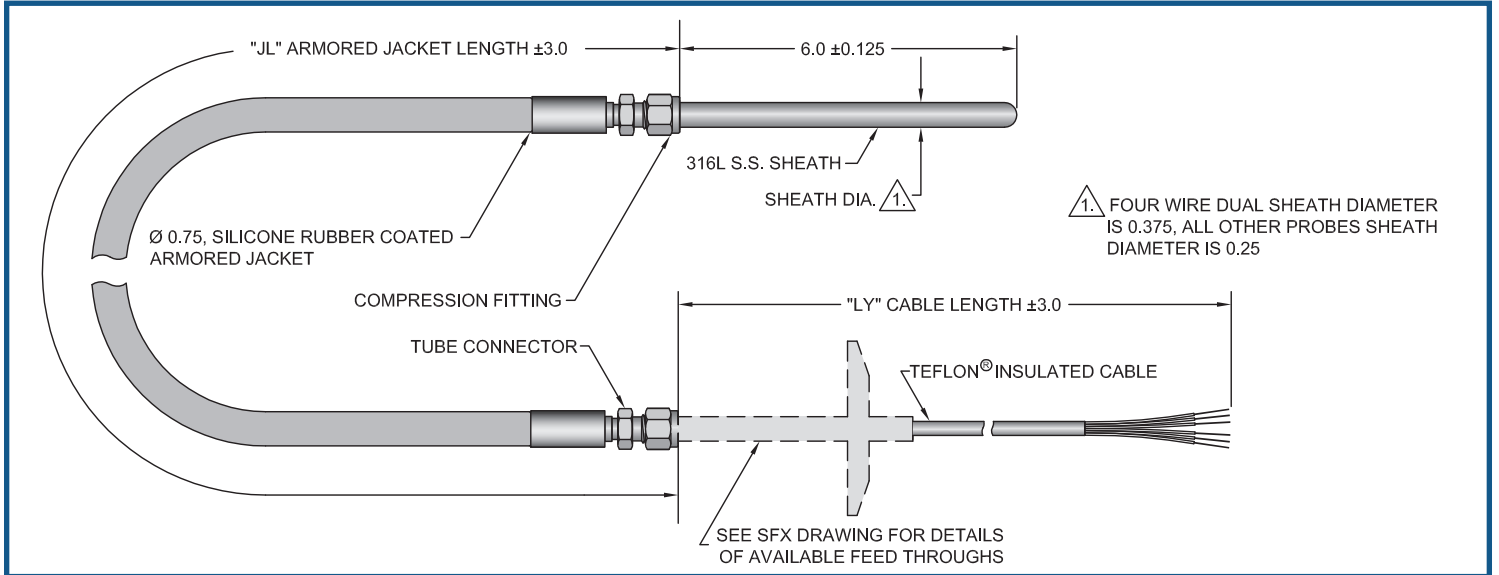
Specifications:

- Element Configuration: Single or dual element, 100 ohms at 0°C, 0.00385 ohm/ohm/°C nominal alpha
- Temperature Range: -50°C to 200°C
- Transition Fitting and Cable Temperature Limits: -50°C to 200°C continuous
- R0 Interchangeability: R0 ±0.10 ohms or R0 ±0.05 ohms
- Short-Term Repeatability and Hysteresis: ±0.025°C (0.01 ohms) maximum change at 0°C over any 5 consecutive thermal cycles from 0°C to 135°C
- Repeatability: ±0.10°C (0.04 ohms) maximum shift at 0°C after 10 cycles between -50°C and 200°C
- Stability: ±0.26°C (0.10 ohms) maximum shift at 0°C after 1000 hours at 200°C
- Pressure: 1 psia to 35 psia
- Insulation Resistance: 100 megohms minimum at 100 VDC at room temperature



SAX | Sanitary Autoclave Xtreme-Duty

Ordering Information



All dimensions in inches

Accuracy

-10 Standard RTD +/-0.10% of resistance at 0 degrees C

Element / Wire Configuration and Sensor Diameter

- A *Three wire single element, 0.25 Dia. sensor sheath
- B Four wire single element, 0.25 Dia. sensor sheath
- C *Three wire dual element, 0.25 Dia. sensor sheath
- D Four wire dual element, 0.375 Dia. sensor sheath

"JL" Armored Jacket Length, 72.0 inch minimum length

- 120 120 inch armored jacket length
- 180 180 inch armored jacket length
- 240 240 inch armored jacket length

Specify armored jacket length in inches, 12 inch increments

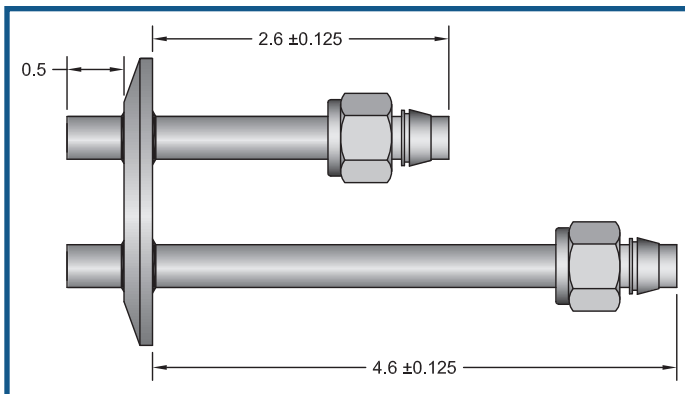
"LY" Cable Length Beyond Armored Jacket, 12.0 inch minimum length

- 060 60.0 inch cable length
- 120 120.0 inch cable length
- 180 180.0 inch cable length

Specify cable length in inches, 12 inch increments

SAX [] [] [] [] [] []

SFX | Sanitary Feedthru Xtreme-Duty



(2 port configuration shown. See the SFX drawing for full details.)

Cap Size

- 15 1.5" Cap (1 Port configuration only)
- 20 2.0" Cap (1 Port configuration only)
- 25 2.5" Cap
- 30 3.0" Cap
- 40 4.0" Cap

Number of Ports

- 1 1 Port
- 2 2 Ports
- 3 3 Ports
- 4 4 Ports

SFX [] [] [] []

* For all Three Wire sensors – please specify **actual "installed" cable length** as certain lengths cannot be shortened upon installation without impacting sensor accuracy. Visit burnsengineering.com and type in keyword: SAC, SAL, SAH or SAX for the specification drawing with cable length criteria; or contact Burns Customer Service for more information.

Resistance vs Temperature

RTD Reference Table

R vs T °C

Resistance of 100 ohm RTD Degrees C

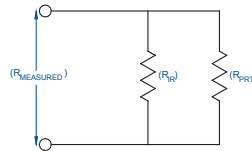
	0	1	2	3	4	5	6	7	8	9
200	175.86	176.22	176.59	176.96	177.33	177.69	178.06	178.43	178.79	179.16
190	172.17	172.54	172.91	173.28	173.65	174.02	174.38	174.75	175.12	175.49
180	168.48	168.85	169.22	169.59	169.96	170.33	170.70	171.07	171.42	171.80
170	164.77	165.14	165.51	165.89	166.26	166.63	167.00	167.37	167.74	168.11
160	161.05	161.43	161.80	162.17	162.54	162.91	163.29	163.66	164.03	164.40
150	157.33	157.70	158.07	158.45	158.82	159.19	159.56	159.94	160.31	160.68
140	153.58	153.96	154.33	154.71	155.08	155.46	155.83	156.20	156.58	156.95
130	149.83	150.21	150.58	150.96	151.33	151.71	152.08	152.46	152.82	153.21
120	146.07	146.44	146.82	147.20	147.57	147.95	148.33	148.70	149.08	149.46
110	142.29	142.67	143.05	143.43	143.80	144.18	144.56	144.94	145.31	145.69
100	138.51	138.88	139.26	139.64	140.02	140.40	140.78	141.16	141.54	141.91
90	134.71	135.09	135.47	135.85	136.23	136.61	136.99	137.37	137.75	138.13
80	130.90	131.28	131.66	132.04	132.42	132.80	133.18	133.57	133.95	134.33
70	127.08	127.46	127.84	128.22	128.61	128.99	129.37	129.75	130.13	130.52
60	123.24	123.63	124.01	124.39	124.78	125.16	125.54	125.93	126.31	126.69
50	119.40	119.78	120.17	120.55	120.94	121.32	121.71	122.09	122.47	122.86
40	115.54	115.93	116.31	116.70	117.08	117.47	117.86	118.24	118.63	119.01
30	111.67	112.06	112.45	112.83	113.22	113.61	114.00	114.38	114.77	115.15
20	107.79	108.18	108.57	108.96	109.35	109.73	110.12	110.51	110.90	111.29
10	103.90	104.29	104.68	105.07	105.46	105.85	106.24	106.63	107.02	107.40
0	100.00	100.39	100.78	101.17	101.56	101.95	102.34	102.73	103.12	103.51

	0	-1	-2	-3	-4	-5	-6	-7	-8	-9
0	100.00	99.61	99.22	98.83	98.44	98.04	97.65	97.26	96.87	96.48
-10	96.09	95.69	95.30	94.91	94.52	94.12	93.73	93.34	92.95	92.55
-20	92.16	91.77	91.37	90.98	90.59	90.19	89.80	89.40	89.01	88.62
-30	88.22	87.83	87.43	87.04	86.64	86.25	85.85	85.46	85.06	84.67
-40	84.27	83.87	83.48	83.08	82.69	82.29	81.89	81.50	81.10	80.70
-50	80.31	79.91	79.51	79.11	78.72	78.32	77.92	77.52	77.12	76.73

Insulation Resistance (IR) ~ Influence on the Resistance Measurement:

IR refers to the electrical resistance between the sensing circuit and the metallic sheath of a PRT. It is important for the sensing element circuit to be insulated from the sheath because electrical leakage can cause an error when measuring the resistance of the sensing element. Any error in measured resistance will translate to an error in the indicated temperature.

$$R_{\text{Measured}} = \frac{[R_{\text{PRT}} \times R_{\text{IR}}]}{[R_{\text{PRT}} + R_{\text{IR}}]}$$



For more information on Insulation Resistance please refer to The Burns Engineering Document "Error Sources That Effect Platinum Resistance Thermometer Accuracy Part 2 – Insulation Resistance".

(Available online at <http://www.burnsengineering.com/document/pdf/a080211.pdf>)

Resistance vs Temperature

RTD Reference Table

R vs T °F

Resistance of 100 ohm RTD Degrees F

	0	1	2	3	4	5	6	7	8	9
400	177.49	177.69	177.90	178.10	178.30	178.51	178.71	178.92	179.12	179.32
390	175.45	175.65	175.86	176.06	176.26	176.47	176.67	176.88	177.08	177.29
380	173.40	173.61	173.81	174.02	174.22	174.43	174.63	174.83	175.04	175.24
370	171.35	171.56	171.76	171.97	172.17	172.38	172.58	172.79	172.99	173.20
360	169.30	169.51	169.71	169.92	170.12	170.33	170.53	170.74	170.94	171.15
350	167.24	167.45	167.66	167.86	168.07	168.27	168.48	168.68	168.89	169.09
340	165.18	165.39	165.60	165.80	166.01	166.21	166.42	166.63	166.83	167.04
330	163.12	163.33	163.53	163.74	163.95	164.15	164.36	164.57	164.77	164.98
320	161.05	161.26	161.47	161.67	161.88	162.09	162.29	162.50	162.71	162.91
310	158.98	159.19	159.40	159.61	159.81	160.02	160.23	160.43	160.64	160.85
300	156.91	157.12	157.33	157.53	157.74	157.95	158.15	158.36	158.57	158.78
290	154.83	155.04	155.25	155.46	155.66	155.87	156.08	156.29	156.49	156.70
280	152.75	152.96	153.17	153.38	153.58	153.79	154.00	154.21	154.42	154.62
270	150.67	150.88	151.08	151.29	151.50	151.71	151.92	152.13	152.33	152.54
260	148.58	148.79	149.00	149.21	149.41	149.62	149.83	150.04	150.25	150.46
250	146.49	146.70	146.91	147.11	147.32	147.53	147.74	147.95	148.16	148.37
240	144.39	144.60	144.81	145.02	145.23	145.44	145.65	145.86	146.07	146.28
230	142.29	142.50	142.71	142.92	143.13	143.34	143.55	143.76	143.97	144.18
220	140.19	140.40	140.61	140.82	141.03	141.24	141.45	141.66	141.87	142.08
210	138.08	138.29	138.51	138.72	138.93	139.14	139.35	139.56	139.77	139.98
200	135.97	136.19	136.40	136.61	136.82	137.03	137.24	137.45	137.66	137.87
190	133.86	134.07	134.28	134.50	134.71	134.92	135.13	135.34	135.55	135.76
180	131.74	131.96	132.17	132.38	132.59	132.80	133.01	133.23	133.44	133.65
170	129.62	129.84	130.05	130.26	130.47	130.68	130.90	131.11	131.32	131.53
160	127.50	127.71	127.93	128.14	128.35	128.56	128.78	128.99	129.20	129.41
150	125.37	125.59	125.80	126.01	126.22	126.44	126.65	126.86	127.08	127.29
140	123.24	123.46	123.67	123.88	124.09	124.31	124.52	124.73	124.95	125.16
130	121.11	121.32	121.53	121.75	121.96	122.18	122.39	122.60	122.82	123.03
120	118.97	119.18	119.40	119.61	119.82	120.04	120.25	120.47	120.68	120.89
110	116.83	117.04	117.26	117.47	117.68	117.90	118.11	118.33	118.54	118.76
100	114.68	114.90	115.11	115.33	115.54	115.76	115.97	116.18	116.40	116.61
90	112.53	112.75	112.96	113.18	113.39	113.61	113.82	114.04	114.25	114.47
80	110.38	110.60	110.81	111.03	111.24	111.46	111.67	111.89	112.10	112.32
70	108.23	108.44	108.66	108.87	109.09	109.30	109.52	109.73	109.95	110.17
60	106.07	106.28	106.50	106.71	106.93	107.15	107.36	107.58	107.79	108.01
50	103.90	104.12	104.34	104.55	104.77	104.98	105.20	105.42	105.63	105.85
40	101.74	101.95	102.17	102.39	102.60	102.82	103.04	103.25	103.47	103.69
30	99.57	99.78	100.00	100.22	100.43	100.65	100.87	101.09	101.30	101.52
20	97.39	97.61	97.83	98.04	98.26	98.48	98.70	98.91	99.13	99.35
10	95.21	95.43	95.65	95.87	96.09	96.30	96.52	96.74	96.96	97.17
0	93.03	93.25	93.47	93.69	93.91	94.12	94.34	94.56	94.78	95.00

	0	-1	-2	-3	-4	-5	-6	-7	-8	-9
0	93.03	92.82	92.60	92.80	82.16	91.94	91.72	91.50	91.29	91.07
-10	90.85	90.63	90.41	90.19	89.97	89.75	89.54	89.32	89.10	88.88
-20	88.66	88.44	88.22	88.00	87.78	87.56	87.34	87.13	86.91	86.69
-30	86.47	86.25	96.03	85.61	85.59	85.37	85.15	84.93	84.71	84.49
-40	84.27	84.05	93.83	83.61	83.39	83.17	82.95	82.73	82.51	82.29
-50	82.07	81.85	81.63	81.41	81.19	80.97	80.75	80.53	80.31	80.09
-60	79.86	76.64	79.42	79.20	78.98	78.76	78.54	78.32	78.10	77.88

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