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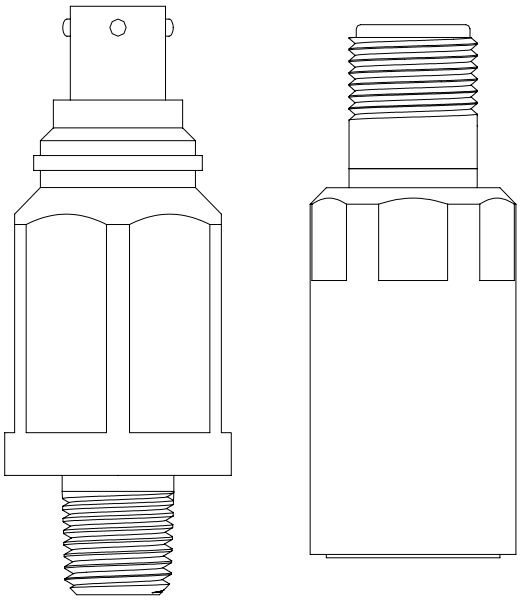
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Operation Manual

Bently Nevada™ Asset Condition Monitoring



330500 Velomitor® Sensor, 330525 Velomitor XA Sensor, 330530 Radiation Resistant Velomitor Sensor

imagination at work

Part Number 100076-01
Rev. H (08/07)

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Additional Information

Notice:

This manual does not contain all the information required to operate and maintain the product. Refer to the following manuals for other required information.

3500/42M Proximitor®/Seismic Monitor Operation and Maintenance Manual (Part Number 143489-01)

3300/55 Dual Velocity Monitor Operation Manual

(Part Number 130747-01)

3300/55 Dual Velocity Monitor Maintenance Manual

(Part Number 130748-01)

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1. Operating Information

1.1 Application

Velocity sensors measure machinery casing vibration and are used on machines where using eddy current proximity transducers are not practical. Typical applications include pumps, electric motors, compressors, and fans.

The 330525 Velomitor® XA Sensor is designed for applications where a transducer housing is either unnecessary or not desired.

The 330530 Radiation-Resistant Velomitor® Sensor is designed for applications requiring a resistance to the effects of gamma-radiation.

Application Alert: Casing measurements may not be appropriate for some machinery protection applications.

If you measure the velocity of casing vibration to protect machinery, evaluate the usefulness of the measurement for each application. Most common machine malfunctions, such as unbalance or misalignment, occur on the rotor and originate as an increase (or at least a change) in rotor vibration. In order for any casing measurement alone to be effective for overall machine protection, the machine must faithfully transmit a significant amount of rotor vibration to the machine casing or mounting location of the sensor.

Exercise care when physical installing of the sensor on the bearing housing or machine casing. Section 2 tells how to install the sensor.

Application Alert: Improper installation may result in a decrease in the velocity sensor's amplitude and frequency response and/or generate false signals that do not represent actual vibration.

1.2 Principle of Operation

The Velomitor® Sensor is a piezoelectric velocity sensor. The sensing element of the device is a piezoelectric ceramic shear-mode element and electronics. When subjected to machinery vibration, this system exerts a force on the piezoelectric ceramic, which generates a signal proportional to that force. The sensor internally amplifies and integrates this signal to produce a low-noise output signal that is proportional to velocity.

Application Advisory: A sudden mechanical impulse may cause the piezoelectric velocity sensor to generate a low frequency signal that does not represent actual machinery vibration. This signal may change the state of alarm and/or danger relays.

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The Velomitor® Sensor is designed to monitor vibration in frequencies ranging from:

- 330500: 4.5 Hz to 5 kHz
- 330525: 4.5 Hz to 2 kHz
- 330530: 4.5 Hz to 5 kHz

The sensor has a calibrated sensitivity of 100 mV/in/s (4 mV/mm/s) and some of the sensors can measure velocities up to 50 in/sec pk (1270 mm/s pk) – see the specification section for details. The stainless steel casing protects the Velomitor® Sensor in highly corrosive environments. The operating temperature range is from -67°F to 250°F (-55°C to 121°C).

Traditional velocity sensors consist of either a moving wire coil surrounding a fixed magnet or a fixed wire coil surrounding a moving magnet. The Velomitor® Sensor is more accurate than traditional velocity sensors. Because the Velomitor® Sensor contains no moving parts, it is also more durable and less sensitive to transverse motion than traditional seismic transducers. Its piezoelectric sensing element and solid-state circuitry let the Velomitor® Sensor withstand years of continuous use.

The Velomitor® Sensor is a two-wire device that requires an external power supply. The power supply must provide a DC voltage of 22 to 30 Volts and a current of 10 mA. A constant current diode must be used to limit the current to the sensor to 2.5 to 6 mA. Figure 1-1 shows a simple block diagram of the Velomitor® Sensor system.

(1) Velomitor® Sensor
(2) Pin A
(3) Pin B
(4) Shielded cable
(5) “A” white
(6) “B” black
(7) “SHLD”
(8) Constant current source
(9) DC voltage supply

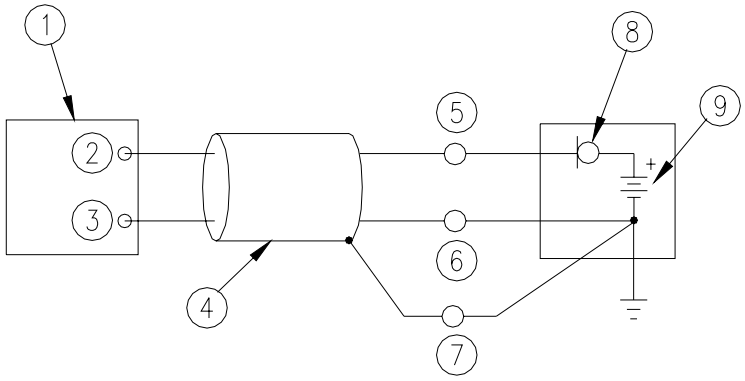


Figure 1-1.

The Velomitor® Sensor internal circuitry automatically sets the DC output bias when a constant current is supplied. The DC bias and AC signal appears between pins "A" and "B".

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Application Alert: Use a constant current diode or other current-regulating circuitry to provide power to the Velomitor® Sensor. Failure to do so may result in damage to the device and/or improper operation.

Compatible Bently Nevada monitoring systems provide the power required by the Velomitor® Sensor without the need for additional external circuitry.

1.3 Ordering Options and Accessories

1.3.1 Velomitor® Sensor Options

When ordering a Velomitor® Sensor you may choose from the following list of options.

Table 1-1 Ordering Information

Part Number	Options		Description	
330500	AA	BB		
	01		1/2 - 20 UNF	P/N: 89409-01
	02		M8 X 1	P/N: 89410-01
	03		1/4 - 28 UNF	P/N: 89411-01
	04		1/4 - 20 UNC	P/N: 89412-01
	05		1/4 - 18 NPT	P/N: 89413-01
	06		5/8-18 UNF	P/N: 04300015
	07		3/8-16 UNC	P/N: 165025-01
	08		1/2-13 UNC	P/N: 161191
		00	No Approvals	
		04	Multiple Approvals	

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Part Number	Options	Description
330525	**AA**	
	00	No Approvals
	01	CSA Approvals
	02	ATEX Approvals

Part Number	Options	Description	
330530	**AA**		
	01	1/2 - 20 UNF	P/N: 89409-01
	02	M8 X 1	P/N: 89410-01
	03	1/4 - 28 UNF	P/N: 89411-01
	04	1/4 - 20 UNC	P/N: 89412-01
	05	1/4 - 18 NPT	P/N: 89413-01
	06	5/8-18 UNF	P/N: 04300015
	07	3/8-16 UNC	P/N: 165025-01
	08	1/2-13 UNC	P/N: 161191

1.3.2 Mounting Adapters — Option AA

The base of the 330500 and 330530 Velomitor® Sensor are machined with a 3/8-24 internal thread that will accommodate a variety of purchased or customer-manufactured mounting studs. Bently Nevada offers the 7 adapter studs listed in Table 1-1. You can order one stud with each transducer or purchase the studs separately. Table 1-1 also lists Bently Nevada part numbers used for ordering separate adapter studs.

The base of the 330525 Velomitor® Sensor is machined with a 1/4-18 NPT external thread.

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1.3.3 Agency Approvals — Option BB

Consult your local Bently Nevada sales representative for information regarding hazardous area approvals.

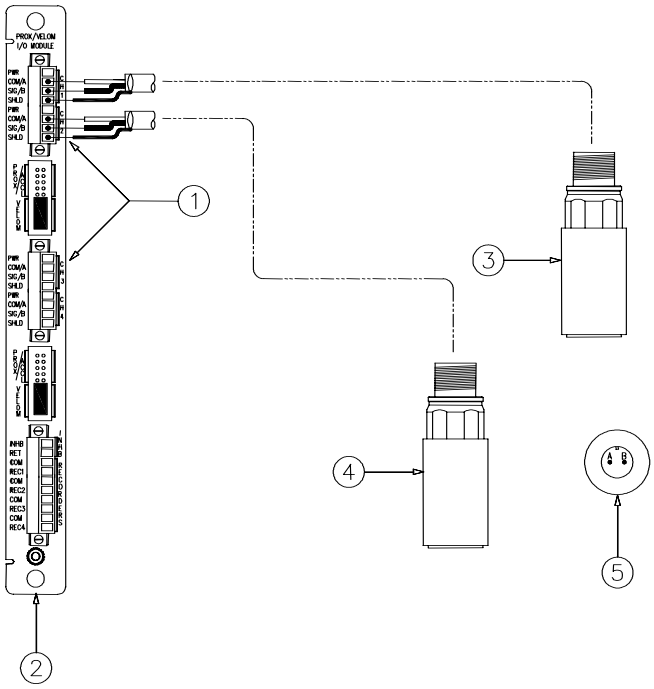
1.4 Compatible Monitoring Systems and Connections

The Velomitor® Sensor is compatible with the Bently Nevada 3500/42 Proximitor®/Seismic Monitor and 3300/55 Dual Velocity Monitor.

For more information on the 3500/42 and 3300/55 please refer to Bently Nevada data sheets 143694-01 and 141516-01, respectively.

Connections to the "A" and "B" terminals of the Velomitor® Sensor are made through the terminal connector of the interconnect cable. At the monitor end of the cable, connect the cable "A" lead to the "A" terminal on the monitor and the "B" lead to the "B" terminal. The terminal connections appear in Figures 1-2 through 1-4. Refer to the 3500/42 and 3300/55 Monitor Manuals (P/N's 143489-01, 130747-01 and 130748-01, respectively) for further information.

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(1) 3500/42 Prox/Velom I/O Module with internal terminations, Velomitor® Sensor input.

(2) Wiring shown for Channels 1 and 2. Wiring typical for Channels 3 and 4.

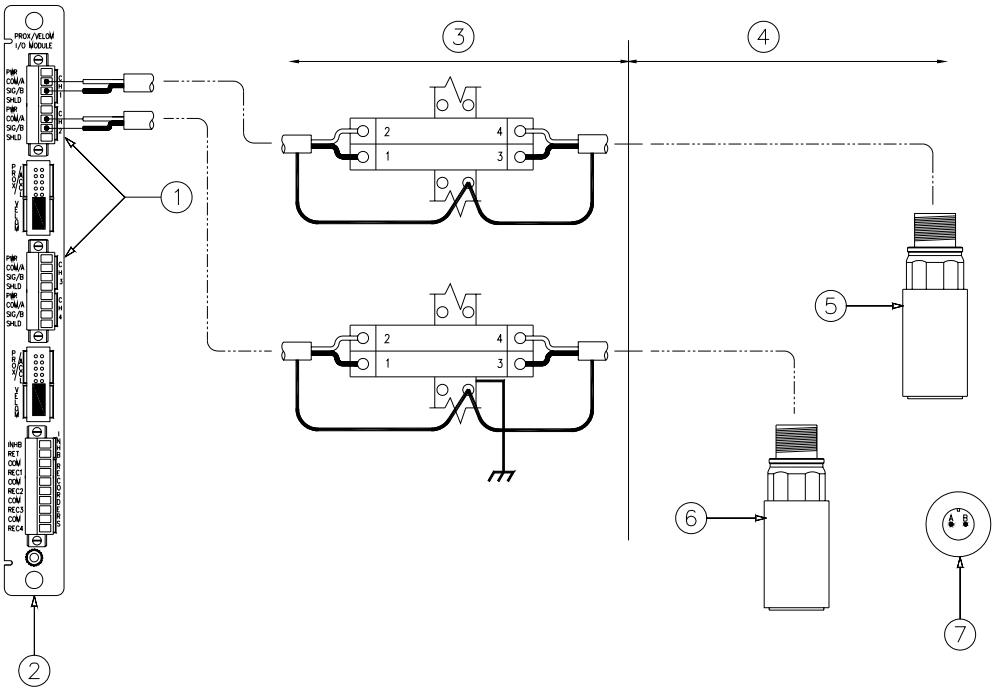
(3) Channel 1 Velomitor® Sensor

(4) Channel 2 Velomitor® Sensor

(5) Velomitor® Sensor top view

Figure 1-2. 3500/42 Monitor with Prox/Velom I/O Module

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(1) Wiring shown for Channels 1 and 2. Wiring typical for Channels 3 and 4.

(2) 3500 Prox/Velom I/O Module with internal terminations, Velomitor® Sensor input with external barriers.

(3) Safe area or Zone 2, Division 2

(4) Hazardous area

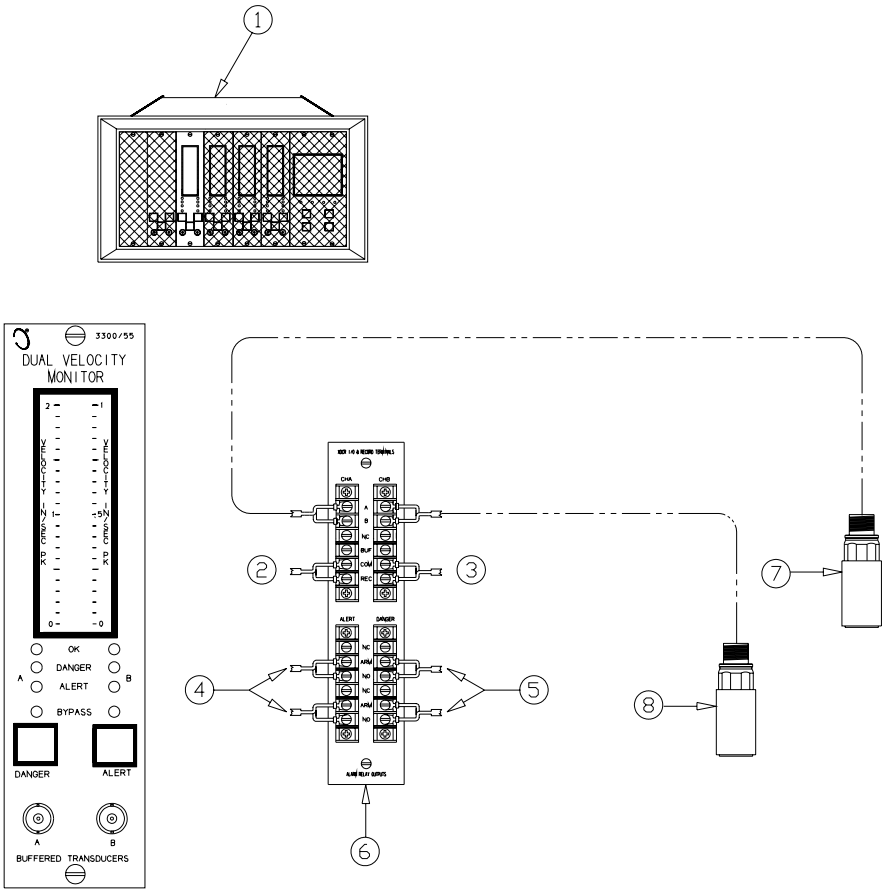
(5) Channel 1 Velomitor® Sensor

(6) Channel 2 Velomitor® Sensor

(7) Velomitor® Sensor top view

Figure 1-3. 3500/42 Monitor with Prox/Velom I/O Module with External Barriers

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(1) Signal input relay module location

(2) Channel A recorder output

(3) Channel B recorder output

(4) Alert relay contacts

(5) Danger relay contacts

(6) Signal input relay module, dual relays

(7) Channel A Velomitor® Sensor

(8) Channel B Velomitor® Sensor

Figure 1-4. 3300 System Connections (3300/55 Monitor)

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1.5 Cable Options

The Velomitor® Sensor requires a two-conductor cable. We recommend using shielded cable to minimize noise interference. Table 1-2 describes the Bently Nevada cables used with the 330500 Velomitor® Sensor, Table 1-3 describes the cables used with the 330525 Velomitor® Sensor, and Table 1-4 describes the cables used with the 330530 Radiation Resistant Velomitor® Sensor. Figures 1-5 through 1-9 show the configuration of the cable and connector for each of the sensors.

Table 1-2. 330500 Velomitor® Sensor Interconnect Cable and Accessories

APPLICATION	P/N	CABLE DESCRIPTION
Standard Temperature Unarmored Cable	9571-AA	Shielded 22 AWG cable with moisture-resistant female socket connector at transducer end, ring lugs at monitor end.
Standard Temperature Armored Cable	84661-AA	Same as 9571-AA but with flexible stainless steel armored cable.
Cable for use with weather-proof housing	89477-AA	Two-conductor shielded cable with a connector adapted for use with the 21128 Velocity Transducer Housing Assembly.
Bulk Cable	02173006	Two-conductor shielded 18 AWG bulk cable. Specify number of feet.
Spare Connector	00531061	Velomitor® Sensor Cable Connector
Spare Connector Clamp	00530574	Connector Clamp

Table 1-3. 330525 Velomitor® Sensor Interconnect Cable and Accessories

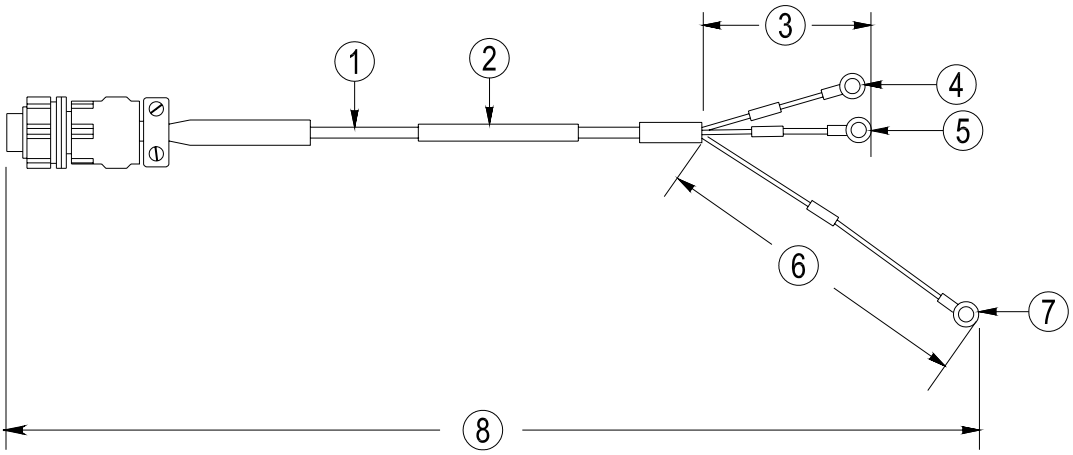
APPLICATION	P/N	CABLE DESCRIPTION
Standard Temperature Armored Cable	106765-AA	Flexible Stainless Steel Armored Cable
Bulk Cable	02173007	Two-conductor shielded 22 AWG bulk cable. Specify number of feet.
Spare Boot	03839144	Fluorosilicone Elastomer Boot
Spare Boot Clamps	03839142	Bottom Clamp
	03839143	Top Clamp

Table 1-4. 330530 Velomitor® Sensor Interconnect Cable and Accessories

APPLICATION	P/N	CABLE DESCRIPTION
Standard Temperature Unarmored Cable	330533-AA	Shielded 18 AWG cable with moisture-resistant female socket connector at transducer end, ring lugs at monitor end.
Bulk Cable	175873	Two-conductor shielded 18 AWG bulk cable. Specify number of feet.
Spare Connector	00531061	Velomitor® Sensor Cable Connector

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PART NUMBER 9571 - AXX (SEE NOTE)



NOTE

ORDER IN INCREMENTS OF 1.0 FOOT (0.30 m)

EXAMPLE:

0 2 2 FEET (0.61 m)

2 5 25 FEET (7.6 m)

MINIMUM LENGTH = 2 FEET (0.61 m)

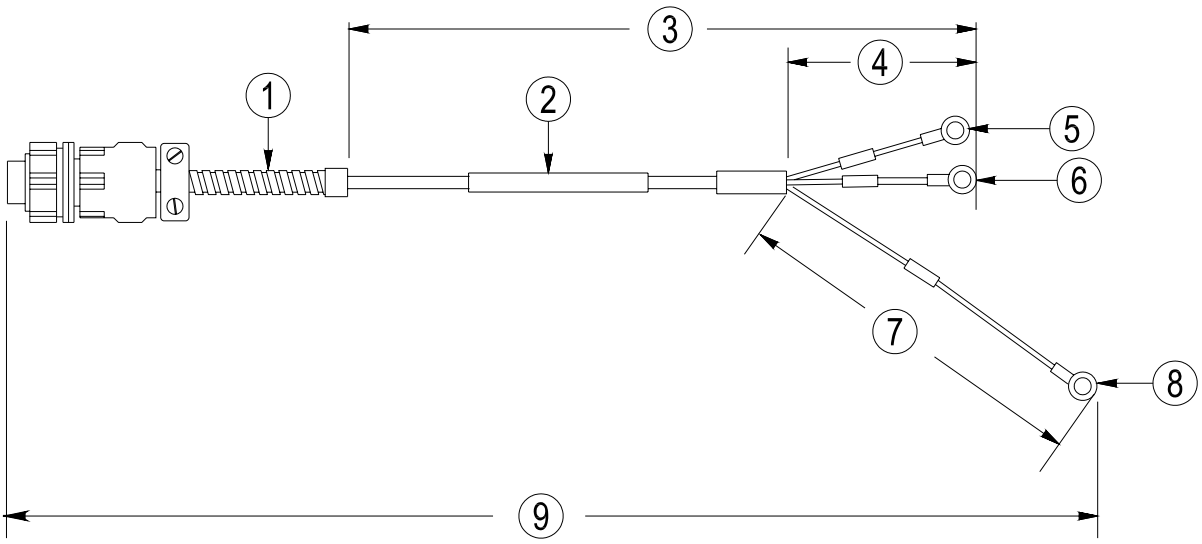
MAXIMUM LENGTH = 99 FEET (30 m)

(1) Cable 2-22 AWG conductor shielded, Teflon insulated
(2) Clear shrink tubing, 63.5 mm (2.5 in)
(3) 51 mm ± 13 mm (2.00 in ± 0.5 in)
(4) “A”, white
(5) “B”, black
(6) 126 mm ± 13 mm (5.00 in ± 0.5 in)
(7) SHLD, green
(8) Overall length ± 150 mm (± 6.0 in)

Figure 1-5. 9571 Cable for use with 330500 Velomitor® Sensor

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PART NUMBER 84661 - AXX (SEE NOTE)



NOTE

ORDER IN INCREMENTS OF 1.0 FOOT (0.30 m)

EXAMPLE:

0 3 3 FEET (0.91 m)

2 5 25 FEET (7.6 m)

MINIMUM LENGTH = 3 FEET (0.91 m)

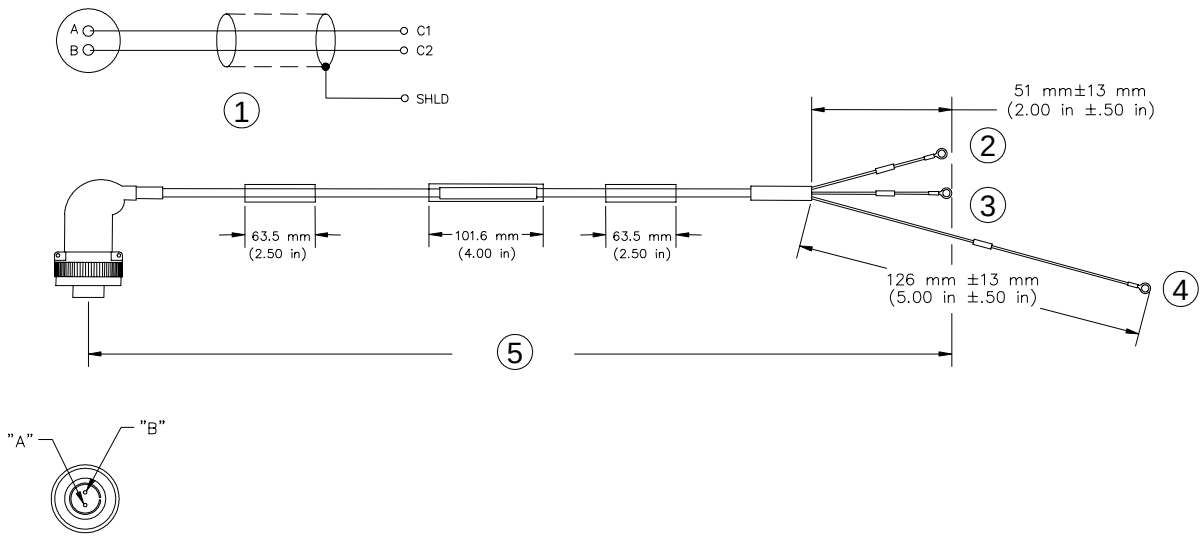
MAXIMUM LENGTH = 96 FEET (29 m)

(1) Stainless steel armor over cable
(2) Clear shrink tubing, 63.5 mm (2.5 in) typical
(3) 635 mm ± 76 mm (25.0 in ± 3.00 in)
(4) 51 mm ± 13 mm (2.00 in ± 0.5 in)
(5) “A”, white
(6) “B”, black
(7) 126 mm ± 13 mm (5.00 in ± 0.5 in)
(8) SHLD, green
(9) Overall length ± 150 mm (± 6.0 in)

Figure 1-6. 84661 Cable for use with 330500 Velomitor® Sensor

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PART NUMBER 89477 - AXX (SEE NOTE)



NOTE

ORDER IN INCREMENTS OF 1.0 FOOT (0.30 m)

EXAMPLE:

1 2 12 FEET (3.7 m)

2 5 25 FEET (7.6 m)

MINIMUM LENGTH = 2 FEET (0.61 m)

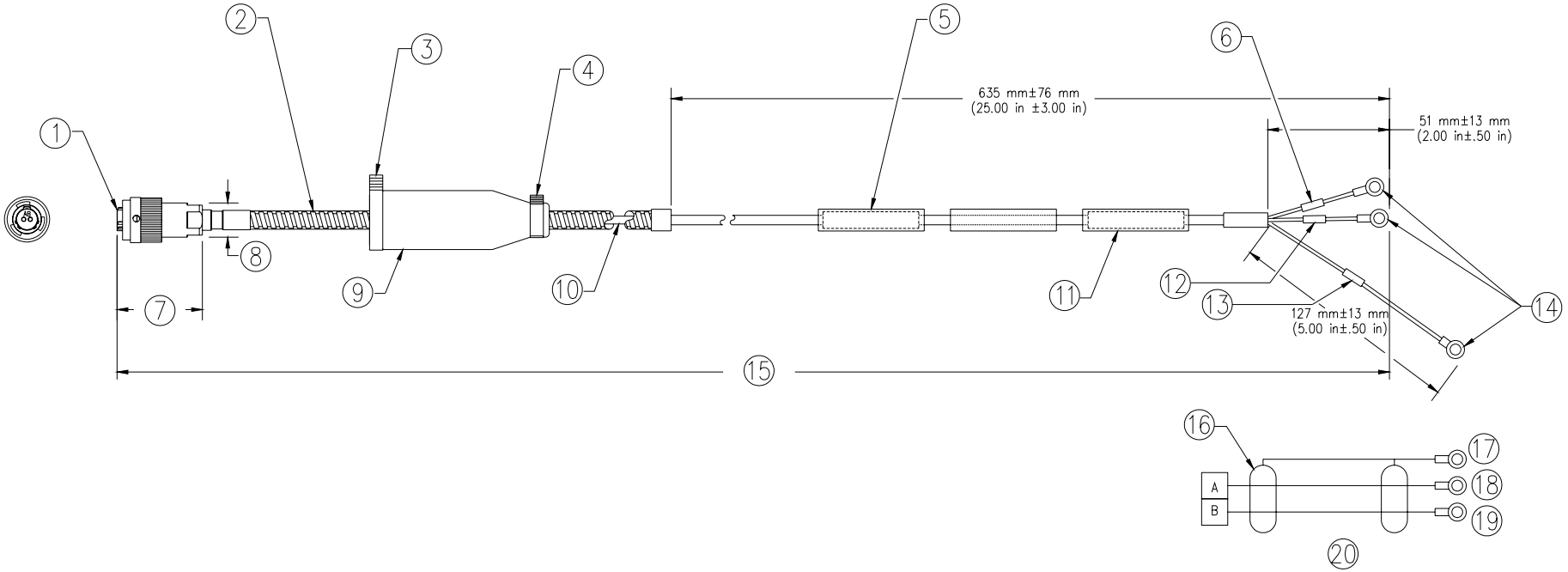
MAXIMUM LENGTH = 99 FEET (30 m)

(1) Schematic
(2) “A”, white
(3) “B”, black
(4) SHLD, green
(5) Overall length ± 150 mm (± 6.0 in)

Figure 1-7. 89477 Cable for use with 330500 Velomitor® Sensor

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PART NUMBER 106765 - AXX (SEE NOTE)



1. 2-pin connector	8. 14.5 mm (0.57 in) maximum	15. Overall length ± 150 mm (± 6 in)
2. Stainless steel armor, FEP coated	9. Fluorosilicone elastomer oil-resistant boot	16. Shield
3. 7/8" single snap-grip hose clamp	10. 2-conductor shielded and jacketed cable	17. Green
4. 15/32" single snap-grip hose clamp	11. Approvals label	18. White
5. BN part number and serial number label	12. "B", black	19. Black
6. "A", white	13. "SHLD", green	20. Figure B, Wiring Diagram
7. 38.1 mm (1.50 in) maximum	14. Nickel-plated copper Teflon insulated ring terminal (size #6 stud) typical, 3 places	

Figure 1-8. 106765 Cable for use with 330525 Velomitor® Sensor

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NOTE

ORDER IN INCREMENTS OF 3.0 METER (9.8ft)

EXAMPLE:

1 0 10 METER (33 ft)

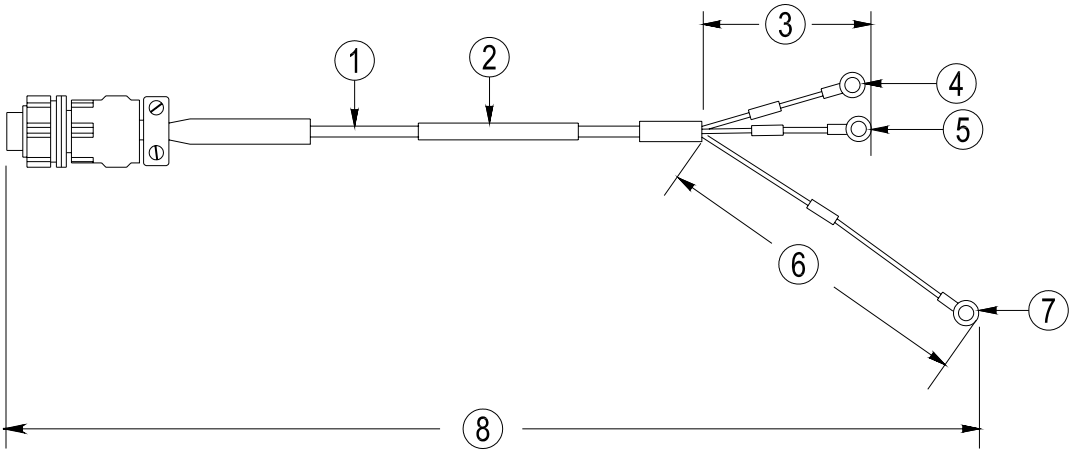
2 5 25 METER (82 ft)

MINIMUM LENGTH = 1 METER (3.3 ft)

MAXIMUM LENGTH = 25 METER (82.0 ft)

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PART NUMBER 330533 - AXX (SEE NOTE)



NOTE

ORDER IN INCREMENTS OF 1.0 FOOT (0.30 m)

EXAMPLE:

0 2 2 FEET (0.61 m)

2 5 25 FEET (7.6 m)

MINIMUM LENGTH = 2 FEET (0.61 m)

MAXIMUM LENGTH = 99 FEET (30 m)

(1) Cable 2-18 AWG conductor shielded, Tefzel insulated

(2) Clear shrink tubing, 63.5 mm (2.5 in)

(3) 51 mm ± 13 mm (2.00 in ± 0.5 in)

(4) “A”, white

(5) “B”, black

(6) 126 mm ± 13 mm (5.00 in ± 0.5 in)

(7) SHLD, green

(8) Overall length ± 150 mm (± 6.0 in)

Figure 1-9. 330533 Cable for use with 330530 Velomitor® Sensor

Application Advisory: This cable is not like most other Velomitor cables in that the shield and drain wire are connected to the sensor’s connector. The sensor is connected to the machine that should be correctly grounded. So the sensor is the primary shield grounding point. See the special installation details in the section below.

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1.6 Transducer Accessories

ACCESSORY		BENTLY NEVADA PART NO.
Velocity Transducer Housing Assembly	Requires a 1/2 - 20 UNF Velomitor® Sensor adapter stud.	**21128**
Quick Connect Semi-permanent mounting method using permanently mounted bolts. Several bolts can be mounted and a single velocity transducer carried from bolt to bolt to measure vibration.	Requires a 1/2 - 20 UNF Velomitor® Sensor adapter stud.	**46122-01**
Super Mag 100 Quick temporary method for mounting a velocity transducer.	Requires a 1/4 - 28 UNF Velomitor® Sensor adapter stud.	**46000-01**
Junction Boxes Weather proof or explosion proof housing for making electrical connections to interconnect cables.		**03818016 (Body and Cover)** **03818022 (Cavity extension)** **03818065 (1/2 inch Conduit)** **(1.27 cm)** **03818066 (3/4 inch Conduit)** **(1.91 cm)**
Flexible Conduit 1/2 in. (1.27 cm) **3/4 in. (1.91 cm)** A convenient way to protect cables from moisture and abrasion.		**14847 - AA** **14848 - AA** AA - Specifies required length

(See Bently Nevada Catalog or your local Bently Nevada Sales Representative for details.)

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2. Installation

2.1 Receiving Inspection

Inspect the components of the your order as soon as you receive them for any shipping damage. Keep all shipping forms and invoices. If you discover any shipping damage, file a claim with the carrier and submit a copy to Bently Nevada LLC. Include all model numbers and serial numbers with the claim. We will either repair or replace damaged parts according to the terms and conditions of the sale.

The velocity sensor is shipped in a protective package and the connector will be protected with a plastic cap. The Velomitor® Sensor is a sensitive instrument and these precautions help to prevent damage during shipping.

Application Alert: Leave the protective cap on the connector until the final field wiring connection is made. This will prevent foreign debris from contaminating the connector possibly causing performance issues.

2.2 Installing the Transducer

2.2.1 Positioning the Sensor

For optimum performance and accurate measurements, place the velocity sensor at a position on the machine casing that is most responsive to vibration. Proper placement is often dependent on the application. Bently Nevada offers Machinery Diagnostic Services, which can help determine the best place to mount the sensor for your application.

2.2.2 Mounting

Follow these steps to install the Velomitor® Sensor:

Applies to the 330500 and 330530 Velomitor® Sensors:

Step 1. Verify that the ambient temperature and the temperature of the installation surface are within the temperature rating of the transducer.

Step 2. Verify that the mounting site is flat, clean, and dry. The sensor requires a flat surface at least 1.25 inches in diameter. For the best results the roughness of the mounting surface should be no more than 32 micro-inch RMS and its flatness should be at least .0008 inches Total Indicator Reading (TIR).

Step 3. Determine if the sensor requires a protective housing for the sensor. We recommend using the Velocity Transducer Housing Assembly (P/N 21128) if maintenance operations will expose the Velomitor® Sensor or its connecting cable to possible physical damage or if the sensor will operate in an environment containing solvents, corrosives, or excessive moisture.

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Step 4. Drill and tap the mounting hole to the dimensions required by the adapter stud. Drill the hole so that the sensitive axis of the transducer will be perpendicular to a tangential plane on the machine casing. For the best results the hole should be within ±6 minutes of perpendicular.

Step 5. Apply one drop of Loctite® 242 brand or an equivalent adhesive to both ends of the mounting stud.

Step 6. Apply a small portion of Sperry Multi-Purpose Ultrasonic Couplant (P/N 04567900) to the mounting surface.

Step 7. With the adapter stud tightened to the Velomitor® Sensor torque the sensor to the machine case to 40 in-lb (4.5 N-m).

Applies to 330525 Velomitor® Sensor:

Step 1. Verify that the ambient temperature and the temperature of the installation surface are within the temperature rating of the transducer.

Step 2. Verify that the mounting site will be suitable for drilling and tapping a hole for a 1/4-18 NPT thread. Consider the hole depth and casing thickness when selecting a mounting site for the transducer.

Step 4. Drill and tap the mounting hole to the dimensions required by the 1/4-18 NPT stud. Standard drill size and depth is 7/16-inch and 0.90 inch, respectively. Drill the hole so that the sensitive axis of the transducer will be perpendicular to a tangential plane on the machine casing. For the best results, the holes should be within ±30 minutes of perpendicular. When hand tight, the mounting stud of the transducer will have 2 or 3 threads exposed.

Step 5. Using a Crescent® or socket wrench, tighten the 330525 Velomitor® Sensor to the mounting site ¼ to ½ turn past hand tight engagement. This corresponds to a mounting torque of approximately 400 in-lb.

2.3 Installing Connecting Cable

Application Alert: Improper routing of cables through conduit can fray the wiring, which may result in a short or loss of signal.

Application Alert: If the sensor field wiring is reversed, then the bias voltage of Velomitor® Sensor output will be within the monitor's OK limits, but the unit will not generate a vibration signal. The product specification lists the valid voltage bias limits for the different Velomitor® Sensors. The sensor must be within these limits to have a valid output signal.

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Application Advisory: When routing the cable, consider protecting the cable from exposure to RF (radio frequency) energy by shielding the cable via grounded metal surfaces when possible. The product has been design to tolerate this interference, but careful routing of the cable can improve signal quality.

2.3.1 Routing Cable (for Velomitor® Sensor 330500)

Bently Nevada LLC supplies connecting cables with ring lugs or military-type circular connectors. The cable connector must be compatible with the Velomitor® Sensor connector.

Route the connecting cable away from the moving components of the machine and avoid sharp corners during installation. To minimize noise, avoid routing cables in the same cable tray with high voltage power lines. Tie the cable to a stationary part of the machine to prevent it from whipping and premature failure. Prevent the cable from bending sharply, twisting, kinking, knotting, or straining. To prevent physical damage route the cable through conduit. Before pulling cable through conduit, wrap the connector or terminals with tape or a similar covering to protect them from damage. Ensure that the cable does not rub against rough or sharp surfaces.

2.3.2 Routing Cable (for Velomitor® Sensor 330525)

Bently Nevada LLC supplies connecting cables with military-type circular connectors. The cable connector must be compatible with the 330525 Velomitor® Sensor connector. The 106765-AA cable assembly includes a quick connect/disconnect connector and clamps to secure and seal the splash-resistant boot.

The cable assembly comes with the top clamp secured in position and the bottom clamp looped around the boot. Use a small screwdriver to open the clamps by prying the teeth of the clamps apart. Slide the boot back to reveal the connector. This will allow the cable assembly to easily install on the transducer. Once the connector is engaged, slide the boot down over the connector assembly and top of the transducer. The groove on the inside bottom of the boot should fit neatly over the lip above the hex flats. The grooves on the outside of the boot at the top and bottom indicate the placement of the clamps. Secure the clamps with pliers.

2.3.3 Routing Cable (for Velomitor® Sensor 330530)

Bently Nevada LLC supplies connecting cables with ring lugs or military-type circular connectors. The cable connector must be compatible with the Velomitor® Sensor connector.

Route the connecting cable away from the moving components of the machine and avoid sharp corners during installation. To minimize noise, avoid routing cables in the same cable tray with high voltage power lines. Tie the cable to a stationary part of the machine to prevent it from whipping and premature failure. Prevent the cable from bending sharply, twisting, kinking, knotting, or straining. To

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prevent physical damage route the cable through conduit. Before pulling cable through conduit, wrap the connector or terminals with tape or a similar covering to protect them from damage. Ensure that the cable does not rub against rough or sharp surfaces.

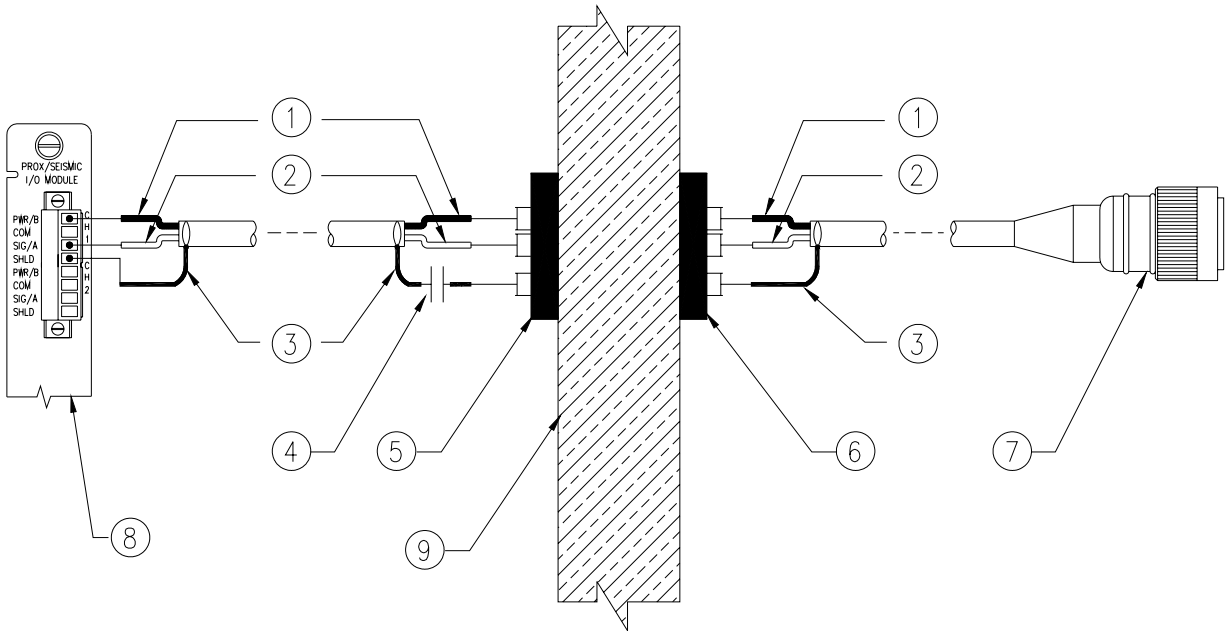
The radiation resistant cable 330533 is built from materials that are tolerant to gamma-radiation, but the life of the cable can be extended, if during installation, the cable should be routed in a manner to shield or keep the maximum distant between the cable and the radiation sources.

One possible installation scenario involves piping which the fluid has radioactive material floating in it. In this instance you should not strap the cable to the piping, but instead try to route the cable away from the radiation source as soon as the cable leaves the sensor's connection interface.

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Special installation instruction for 330530's cable (330533) and installation in nuclear environments

This cable has the shield and drain wire connected at the sensor's connector. The sensor should be correctly grounded on the machine and so this becomes the primary shield grounding point inside containment. Our best practice says that only one point should be used to connect to the cable's shield and so to keep with this practice, an isolation capacitor needs to be installed, see diagram for our recommendation.



(1) "B", black

(2) "A", white

(3) SHLD

(4) Capacitor, 0.01uF to 0.05, minimum of 300 V

(5) Feed-through Terminal Block, Outside Containment

(6) Feed-through Terminal Block, Inside Containment

(7) Velomitor® Sensor Connector

(8) Typical Monitor

(9) Wall of Containment

Figure 2-1. Recommendations for 330533 Cable Hook-up

Application Advisory: The capacitor is required to prevent ground loops. If the case of the machine that the 330530 is mounted to is not at the same voltage potential as the monitor's common, a current will flow through the shield of the interconnect cable. This low level current could cause false readings or trips. At high levels, this current could destroy the monitor if the capacitor is not used.

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2.3.4 Routing Armored Cable

If you will not route the cable inside conduit, use armored cable and secure it to supporting surfaces with clips or similar devices. Route the cable through protected areas to reduce the chance of damage. Connect one end of the armor directly to the enclosure or other structure in which the monitor is mounted. Rigidly connect the other end of the armor to a structure near the Velomitor® Sensor. The recommended minimum bend radius for armored cable is 1.5 inches (38.1 mm).

2.3.5 Sealing the Connecting Cable

When conduit-enclosed cable is routed through oil or gaseous environments, seal the ends of the conduit to prevent leakage into the protected enclosure. Table 2-1 describes the strategies for sealing conduit and the differential pressures for which they apply.

Table 2-1. Conduit Sealing Techniques

Differential Pressure	Seal Type
Less than one atmosphere	ZY5 cable seal similar to Bently Nevada P/N 10076-AA or duct seal putty.
Greater than one atmosphere	Special interconnecting cable. (Contact Bently Nevada for details.)

Bently Nevada cable seals protect against splash and abrasion but they do not protect against immersion. Contact Bently Nevada if greater protection is required.

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3. Maintenance

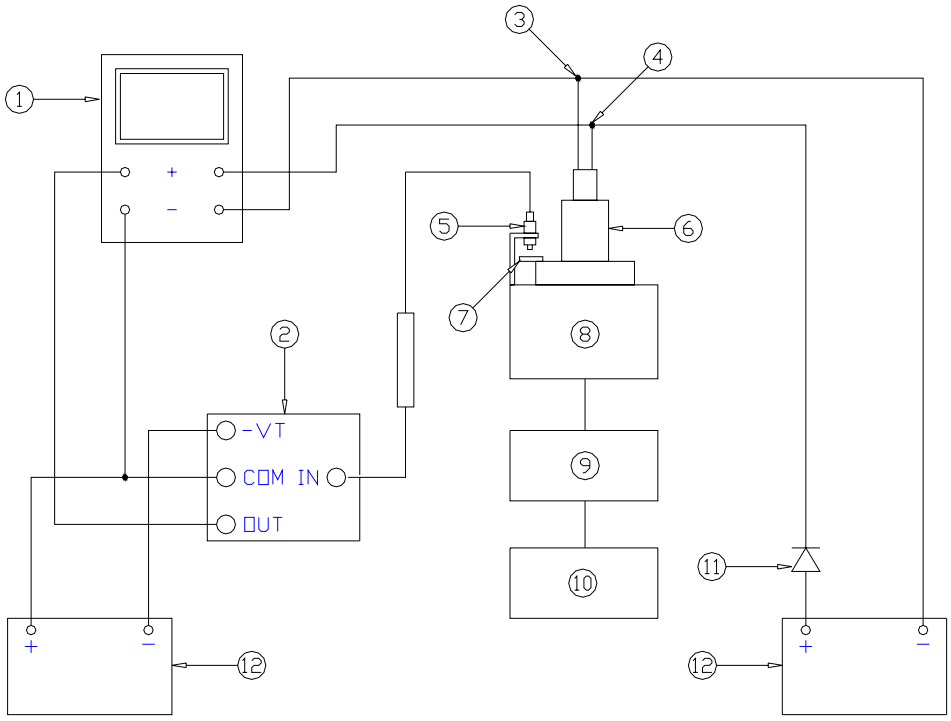
This section shows how to check the performance of the Velomitor® Sensor. Table 3-1 lists the recommended maintenance equipment. If the required equipment is not available, contact the nearest Bently Nevada LLC field office, or a testing laboratory for testing.

Table 3-1. Recommended Maintenance Equipment

Recommended Equipment	Specification
MB Dynamics	
Model PM50 Exciter Shake Table	
MB Dynamics, Model 2250 Power Amplifier	
Krohn-Hite Model 1200A Function Generator (Bently Nevada P/N 02280852)	
Bently Nevada LLC	
Model 330180-50-00 Proximitor® Sensor	
Model 330101-00-08-10-02-00 Probe	
Model 330130-040-00-00 Extension Cable	
Power Supply, Bently Nevada TK15	-24.0 Vdc with minimum output current of 20 mA and less than 5 mV peak-peak noise
AISI 4140 Steel Target Material	0.030 inch (0.762 mm) thick, 0.85 inch (21.6 mm) diameter, 16 µin pp (0.41 µm pp)
3 mA (Motorola P/N 1N5309) current diode Bently Nevada P/N 00643485	

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3.1 Test Setup



(1) Oscilloscope

(2) Proximitor® Sensor

(1) Pin B (black)

(2) Pin A (white)

(3) Probe

(4) Velomitor® Sensor

(5) Target

(6) Shake table

(7) Power amplifier

(8) Signal generator

(9) 3 mA current diode

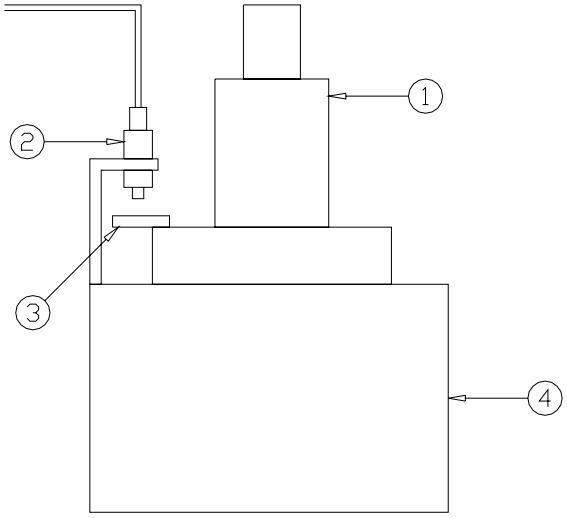
(10)24Vdc TK-15

Figure 3-1

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Step 1. Connect test equipment as shown in Figure 3-1.

Step 2. Mount the 4140 steel target to the shake table so that it is rigidly attached to the moving armature as shown in Figure 3-2.



(1) Velomitor® Sensor

(2) Probe

(3) Target

(4) Shake table base

Figure 3-2

Step 3. Mount a 3300 XL 8mm, 1 meter probe (P/N 330101) such that it is isolated from the motion of the shake table.

Step 4. Connect the probe to a four meter extension cable (P/N 330130-040-00-00) and Proximitor® Sensor (P/N 330180-50-00).

Step 5— Apply -24 Vdc power to the Proximitor® Sensor and monitor the output with a voltmeter or oscilloscope.

Note: The accuracy of the system can be improved by mounting the probe and target on the same axis as the sensitive axis of the Velomitor® Sensor and by verifying that there is no mechanical resonance in the probe or target fixture at the frequency of calibration (100 Hz).

Step 6. Mount the velocity sensor to be checked on the shake table and tighten by hand.

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Step 7. Adjust the probe-to-target gap so that the Proximitor® Sensor output is at midrange, -10.0 ± 0.5 Vdc.

Step 8. Connect the velocity transducer to the oscilloscope or voltmeter as shown in Figure 3-1.

3.2 Performance Test Procedure

Step 1. Set the signal generator to 100 ± 1 Hz and adjust the power amplifier gain so that the Proximitor® Sensor output is .318 ± .003 volts peak-to-peak (0.112 ± 0.001 Vrms). This signal corresponds to a peak-to-peak displacement of 0.00159 inches (0.0404 mm) and a peak-to-peak velocity of 1.0 inch per second (25.4 mm/s).

Step 2. Verify that the output of the velocity sensor is between .095 and .105 volts peak-to-peak (.0336 to .0371 Vrms). If the output is not in this range, return the unit to the factory.

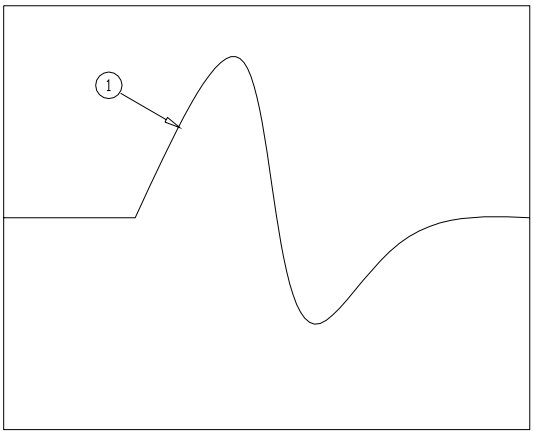
3.3 Polarity Test Procedure

Use this test to verify the proper phase response. Any out-of-phase response will adversely affect machinery balancing.

Step 1. Connect the cable as shown in the setup in Figure 3-1.

Step 2. Set the time base on the oscilloscope to 20 milliseconds/division.

Step 3. Hold the velocity sensor in hand and tap the bottom. Verify that the waveform on the oscilloscope first goes positive as shown in Figure 3-3. If it goes negative first, return the unit to the factory for replacement.



(1) Display goes positive

Figure 3-3

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3.4 Installation Note

Verify that the connector and the mating part of the sensor both are free of any foreign debris. If required, clear out material before connecting parts to prevent shorting out of the signal.

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4. Field Testing and Troubleshooting

Use the following procedure to test an installed Velomitor® Sensor and isolate a suspected malfunction. The Velomitor® Sensor is a hermetically sealed unit with no adjustments or field repairable components. If you determine that the Velomitor® Sensor is not functioning properly, return it to a factory authorized repair center for further evaluation and disposition.

When the Velomitor® Sensor is used with a Bently Nevada monitoring system, the system indicates a sensor fault when the monitor's OK LED goes OFF. A fault may be due to a sensor malfunction or a malfunction in the field wiring. Before troubleshooting a suspected problem: first check to make sure that the sensor has been correctly installed, all connections are secured and in the proper locations. If the sensor is properly installed, use the following steps to help identify the problem.

4.1 Fault Indication #1 Cause/Solution

Bently Nevada Monitor OK LED is off

Monitor Power is off.
Check that the monitor power supply is plugged in and power is on.

Interconnect cable is disconnected, connected loosely, or connected to the wrong monitor.
Verify that the sensor is connected to the correct monitor and to the correct monitor terminals. Check that the screws are tight.

Interconnect cable is not connected, connection is loose at the sensor, or sensor is open/shorted.
Verify that the sensor is connected either visually or by measuring the DC bias voltage between terminals “A” and “B” on the monitor (with the cable connected to the sensor and monitor). The absolute value should be 12±3 Vdc. If the measured DC bias voltage is not within the values indicated and the interconnect cable has been verified not to be a problem (by using the next two steps), then the sensor may be damaged.

Interconnect Cable is Damaged: Shorted
Visually inspect the interconnect cable for apparent damage. Disconnect the interconnect cable at both ends and measure the resistance between the two conductors, "A" to "B". If the measurement is intermittent or shorted, then replace the cable.

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Interconnect Cable is Damaged: Open

Disconnect the interconnect cable at both ends. Then short the two conductors together at one end and measure the resistance of the cable at the other end. If the cable is open circuited, replace the cable.

4.2 Fault Indication #2 Cause/Solution

Unusually low vibration with non-machine related low level, broadband noise.

Sensor signal is not isolated, is shorted to the case or has noise coupled to the signal.

Use the following procedure:

Step 1: Measure the resistance between the "A" terminal pin and the sensor case. Repeat the resistance measurement from the "B" terminal pin to the sensor case. Resistance should be 1MΩ or greater.

Step 2: Inspect and/or clean sensor connector to remove foreign debris.

Step 3: Repeat resistance measurement of step 1. Replace sensor if resistance is not 1MΩ or greater.

4.3 Fault Indication #3 Cause/Solution

Monitor is indicating transducer is OK (not-OK indicator is off), but there is no vibration signal.

Sensor wiring is mis-wired or faulty Velomitor® Sensor.

Use the following procedure:

Step 1: Measure the bias voltage of the sensor at the monitor terminals. Normally the voltage should be around 12 volts reference to the "B" terminal. If the voltage is outside the specification limits (like 7 volts for the 330530) the transducer wiring is most likely reversed.

Step 2: At the monitor input terminal reverse the wiring connection between "A" terminal and "B" terminal.

Step 3: Retest the sensor as described in Step 1. If the voltage level is still outside the specification limits then the Velomitor® Sensor is most likely at fault.

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5. Specifications

5.1 Standard Use Specifications (330500, 330525)

Parameters are specified at 77° F (25° C) unless otherwise indicated.

	330500 Velomitor® Sensor	330525 Velomitor® XA Sensor
5.1.1 Electrical		
Sensitivity	4 mV/mm/s (100 mV/in/s) ±5% at 100 Hz	
Frequency Response	±0.9 dB, 6.0 Hz to 2.5 kHz ±3.0 dB, 4.5 Hz to 5.0 kHz	±0.9 dB, 6.0 Hz to 1.0 kHz ±3.0 dB, 4.5 Hz to 2.0 kHz
Velocity Range	1270 mm/s (50 in/s), peak	
Transverse Sensitivity	<5% of axial sensitivity	
Amplitude Linearity	±2% to 6.0 in/s, peak	
Mounted Resonant Frequency	12 kHz, minimum	
Power Requirements	DC Voltage: -22 to -30 Vdc Bias Current: 2.5 to 6.0 mA	
Output Bias Voltage	-12.0±3.0 Vdc, Over Temperature Referenced to pin A	
Dynamic Output Impedance	<2400 Ω	
Broadband Noise Floor	< 0.004 mm/s (160 μin/s)	
Grounding	Case Isolated	
Maximum Cable Length	305 m (1000 ft) with no signal degradation	
5.1.2 Environmental		
Operating Temperature Range	-55° C to 121° C (-67° F to 250° F)	
Shock Limit	5000 g's, peak	
Humidity Limit	100% Relative (hermetically sealed)	
5.1.3 Mechanical		
Weight	150 g, (5.3 oz), typical	
Dimensions	See Figures 5-1	See Figures 5-1
Case Material	304L Stainless Steel	316L Stainless Steel

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Connector	2 pin Mil-C-5015, hermetically sealed, 304 stainless steel shell	2 pin Mil-C-26482, hermetically sealed, 304 stainless steel shell
Mounting Torque	4.5 N-m (40 in-lbs)	45.3 N-m (400 in-lbs)
Polarity	Pin A goes positive with respect to Pin B when the sensor case motion is toward the connector.	
Note: Operation outside the specified limits will result in false readings or loss of machine monitoring.		

5.2 Nuclear Use Specifications (330530)

Parameters are specified at 77° F (25° C) unless otherwise indicated.

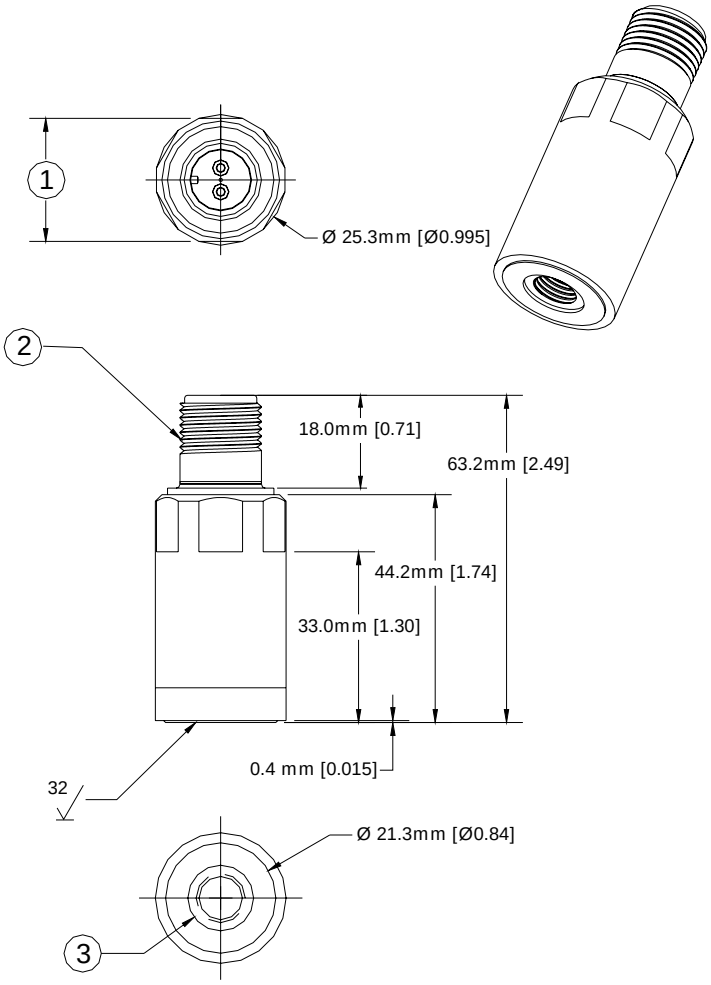
	330530 Velomitor® Sensor (Pre-Radiation)	330530 Velomitor® Sensor (Post Radiation)
5.2.1 Electrical		
Sensitivity	4 mV/mm/s (100 mV/in/s) ±5% at 100 Hz	4 mV/mm/s (100 mV/in/s) ±10% at 100 Hz
Frequency Response	±0.9 dB, 6.0 Hz to 2.5 kHz ±3.0 dB, 4.5 Hz to 5.0 kHz	±1.0 dB, 6.0 Hz to 2.5 kHz ±3.0 dB, 4.5 Hz to 5.0 kHz
Velocity Range	635 mm/s (25 in/s), peak	420 mm/s (16.5 in/s), peak
Transverse Sensitivity	< 5% of axial sensitivity	
Amplitude Linearity	± 2% to 6.0 in/s, peak	
Mounted Resonant Frequency	12 kHz, minimum	
Power Requirements	DC Voltage: -22 to -30 Vdc Bias Current: 2.5 to 6.0 mA	
Output Bias Voltage, referenced pin B to pin A	-12.0±1.0 Vdc, Room Temp -12.0±3.45 Vdc, Over Temp Referenced to pin A	-12.0±2.0 Vdc, Room Temp -12.0±3.7 Vdc. Over Temp Referenced to pin A
Dynamic Output Impedance	< 2400 Ω	
Broadband Noise Floor	< 0.008 mm/s (320 μin/s)	
Grounding	Case Isolated	
Maximum Cable Length	305 m (1000 ft) with no signal degradation	

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5.2.2 Environmental		
Operating Temperature Range	-55° C to 121° C (-67° F to 250° F)	
Shock Limit	5000 g's, peak	
Humidity Limit	100% Relative (hermetically sealed)	
Radiation Dosage	3 Mrads, maximum guarantee, See White-paper for test summary	
5.2.3 Mechanical		
Weight	150 g, (5.3 oz), typical	
Dimensions	See Figures 5-1	
Case Material	304L Stainless Steel	
Connector	2 pin Mil-C-5015, hermetically sealed, 304 stainless steel shell	
Mounting Torque	4.5 N-m (40 in-lbs)	
Polarity	Pin A goes positive with respect to Pin B when the sensor case motion is toward the connector.	
Note: Operation outside the specified limits will result in false readings or loss of machine monitoring.		

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5.3 Mechanical Drawing (330500, 330530)



(1) 25.4 mm [1.00] hexagonal

(2) MIL-C-5015 stainless steel receptacle, 2-pin, 5/8 – 24 UNEF-2A

(3) 3/8 – 24 UNF-2B x .25 DP, minimum, C-bore .50 x .03 DP

Notes:

1. Dimensions are in millimetres [inches]
2. Finished machine surfaces 64
3. Tolerances:

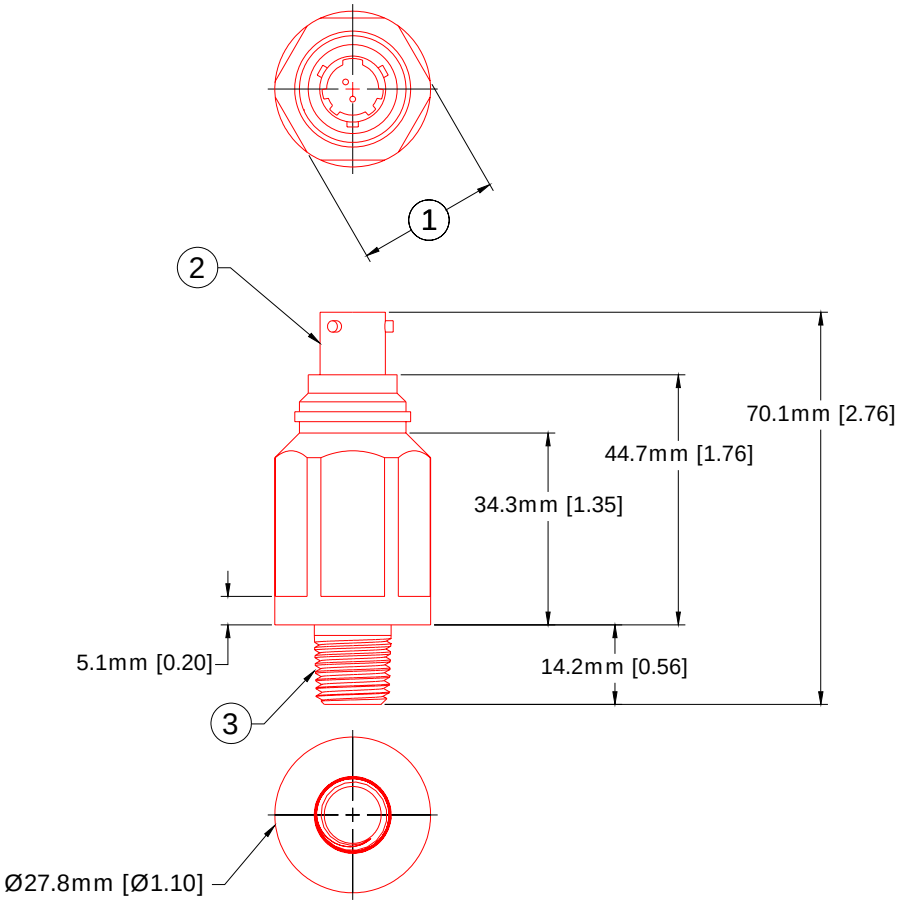
   Decimal .XX = ±0.3 mm [0.01]

   .XXX = ±.13 mm [.005]

Figure 5-1

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5.4 Mechanical Drawing (330525)



(1) 25.4 mm [1.00] hexagonal

(2) MIL-C-26482 stainless steel receptacle, 2-pin

(3) 1/4 – 18 NPT

Notes:

1. Dimensions are in millimetres [inches]
2. Finished machine surfaces 64
3. Tolerances:

   Decimal .XX = ±0.3 mm [0.01]

   .XXX = ±.13 mm [.005]

Figure 5-2

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