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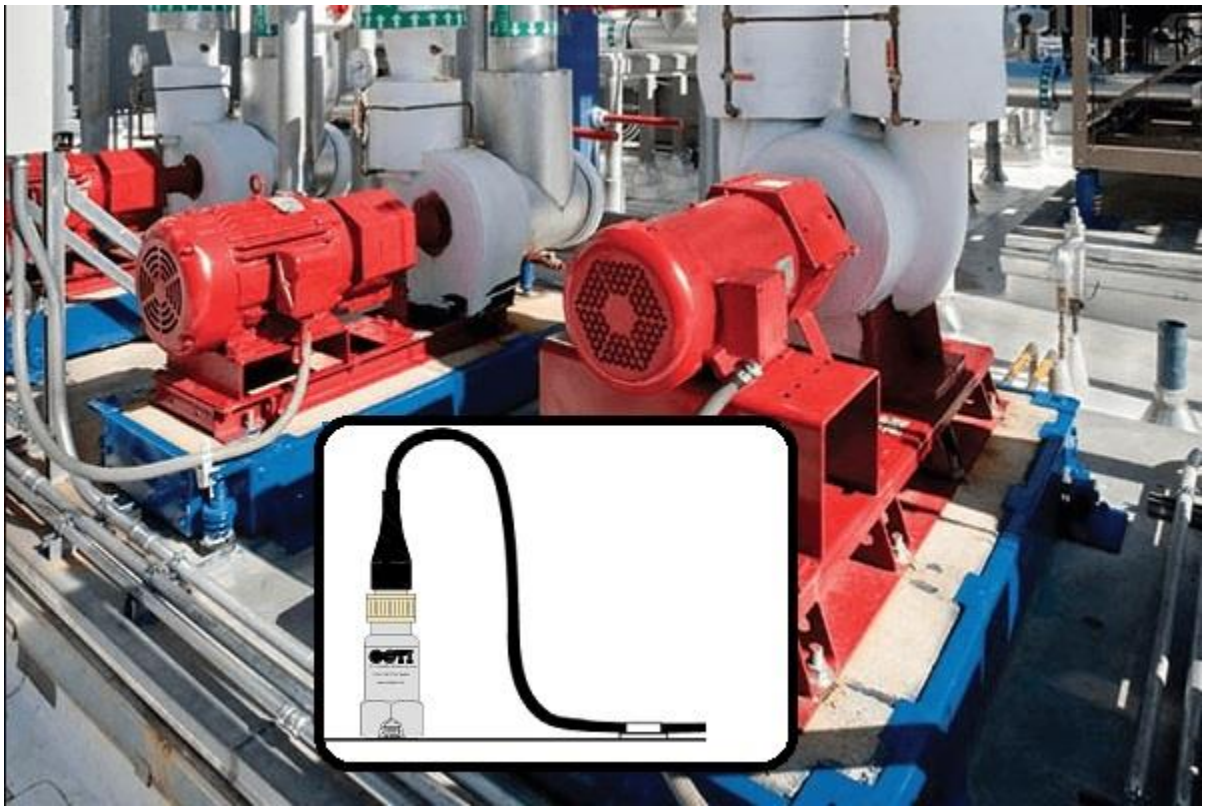
Condition Monitoring Custom Products

Accelerometer Installation Guide



"Surface Preparation is Key"

STI Vibration Monitoring Inc.
1010 East Main Street
League City, Texas 77573

Phone: +(281) 334-0766
Website: https://**stiweb.com**

Contents

Introduction

There are three mounting methods typically used for vibration monitoring applications: stud mounting, adhesive bonding and magnetic mounting.

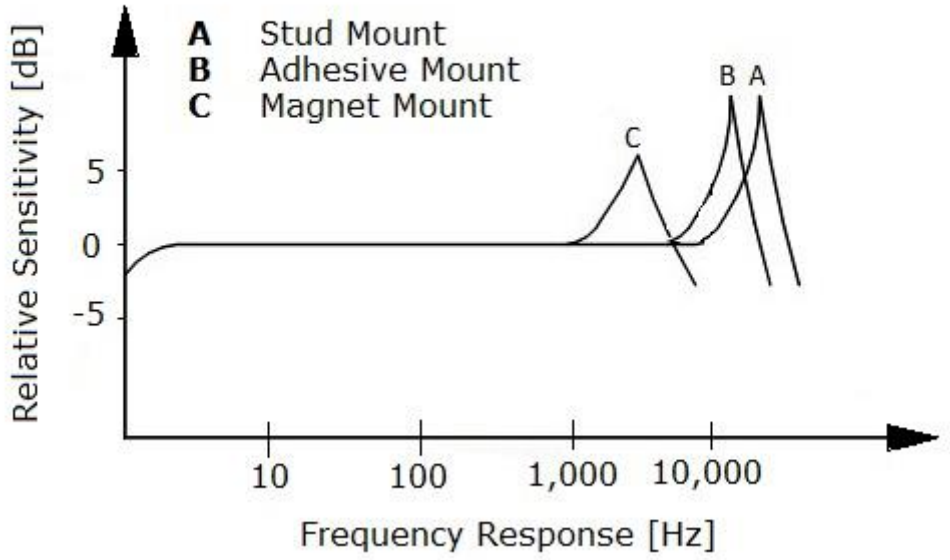
Stud mounting is the preferred method for permanent mounting applications.

Adhesive or glue mounting provides a secure attachment without extensive machining; however, this method will reduce the operational frequency range due to damping. The most important issue for using adhesives is surface cleanliness to assure the adhesive will fully bond to the machine.

The magnetic mounting method is typically used for temporary measurements with a portable data collector or analyzer.

As can be seen in the figure below, the mounting method influences the operating frequency range of an accelerometer. By design, accelerometers have a natural resonance which is 3 to 5 times higher than the advertised high end frequency response. The frequency response range is limited so that a flat response is provided over the operating range. The advertised range is achievable only by stud mounting. Any other mounting method will adversely affect the natural resonance, and in turn the usable frequency response range.

Mounting Resonance Chart



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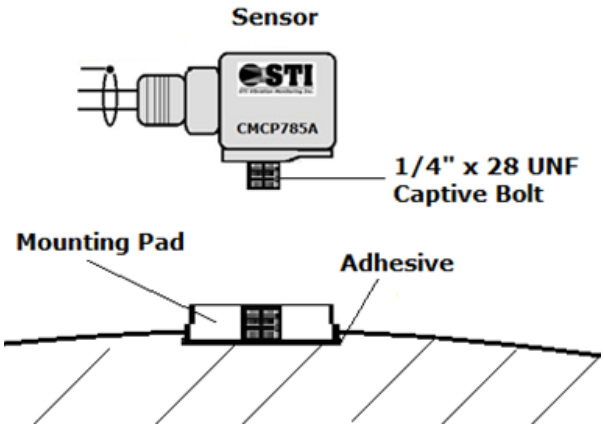
Permanent Application: Stud Mounting

Stud mounting is the preferred method for permanent mounting applications. This method is accomplished by securing the sensor directly to the bearing housing using a mounting stud. This method allows the sensor to measure vibration according to the manufacturer's specifications. The mounting location for the accelerometer should be clean and paint free.

Permanent Application without extensive machining: Adhesive or glue Mounting

When stud mounting is not possible or is not desired, adhesives (epoxy) can be used to install the sensor. We recommend using Accelerometer Mounting Pads to provide a quality surface to mount accelerometers.



Adhesive or glue mounting provides a secure attachment without a lot of machining; however, this method will reduce the operational frequency range since the adhesive will act like a shock absorber, this is also known as damping. The replacement or removal of the sensor is also more difficult than any other mounting method. The most important issue for using adhesives is surface cleanliness, without a clean surface the adhesive will not fully bond to the machine.

Magnet Mounting

This method is not recommended for permanent monitoring. However, magnetic mounts and sometimes probe tips are used in walk-around monitoring programs. The frequency range is drastically reduced when compared to stud or adhesive mounts. Magnetic bases are available with two pole configurations for curved surfaces or with flat surfaces.

- Steel probe tips should only be used when absolutely necessary in hard-to-reach areas and on aluminum motor frames.

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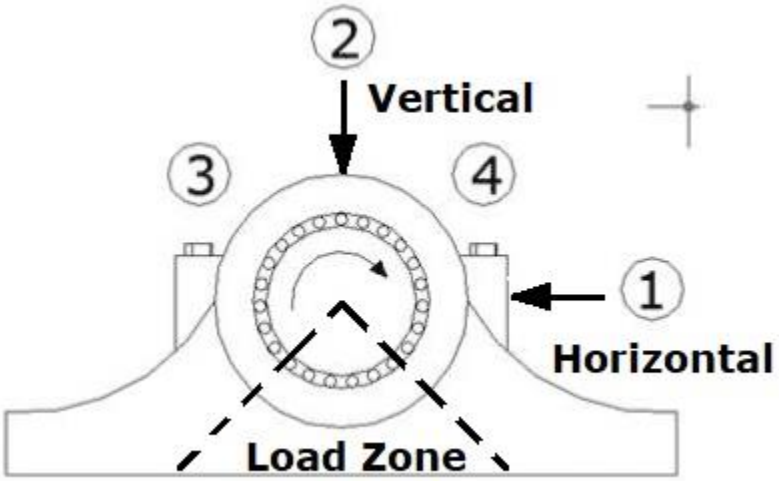
Preferred Mounting Location

Vibration sensors are mounted on the bearing housing as closely to the bearing as possible and oriented in a vertical, horizontal, or axial direction. The radial transducers are pointing towards the machine shaft centerline or gear box center. Horizontal Accelerometers are recommended for Full-Time Vibration Monitoring (Protection) System. Walk Around Data Collector or PdM Programs usually require all three axes (Horizontal, Vertical, Axial) for analysis. When economic decisions must be made to reduce sensor count due to the size or criticality of the asset, horizontal sensors should be installed first as they are closer to the load zone of the bearing and in the direction of freedom of movement. Closest to the load zone is also preferred for measurements with high frequency content like Demodulation or Enveloped Acceleration [gE].

Locations with huge temperature variations, significant windage or air flow velocities upon the accelerometer should be avoided if possible.

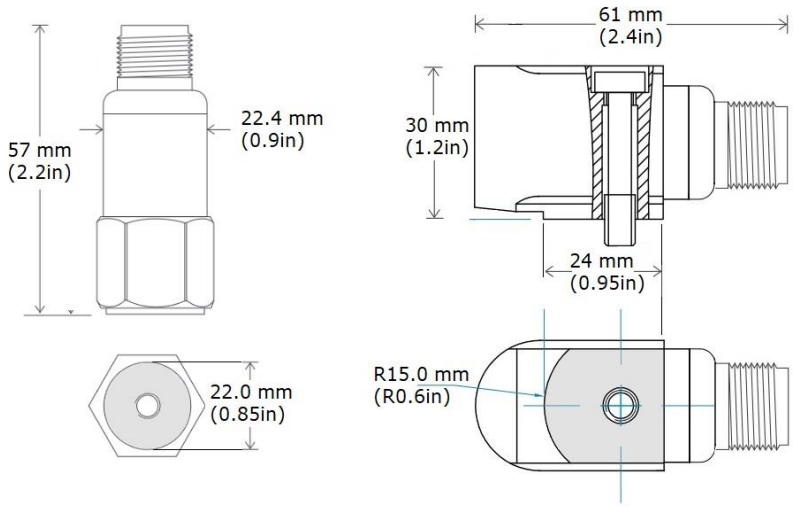


Shown above: Preferred Mounting Locations

Note: Different situations require the accelerometer to be oriented differently. For example, to detect parallel misalignment the accelerometer is usually mounted in the radial direction of the bearings, but to detect angular misalignment the accelerometer needs to be mounted in the axial direction.

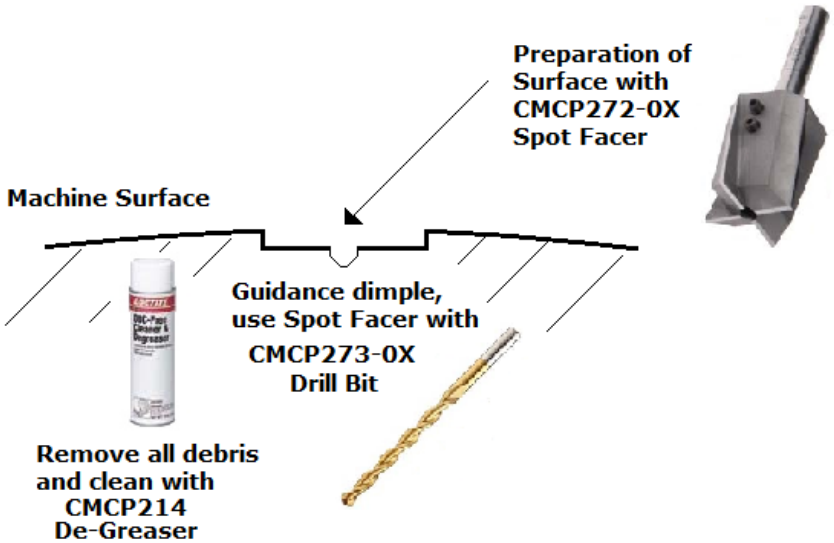
Surface Preparation

First, a clean and smooth surface must be prepared. The mounting surface should be spot-faced to a surface smoothness of 32 microinches (0.8 microns). The diameter of the spot-face should be marginally larger than the sensor mounting base.



Shown above: Mounting base, top exit and side exit Sensor

The mounting base area of a side exit sensor is slightly larger and usually requires a larger Spot Facing Tool (CMCP270L). Nowadays spot facers do not require a separate pilot tool as the drilling and spot facing is done in the same motion. The depth of the hole can be set by simply adjusting the amount the drill bit protrudes from the spot facer, allowing the user to create a small dimple for epoxy mounting pads or a deeper hole for stud mounting pads or sensors.

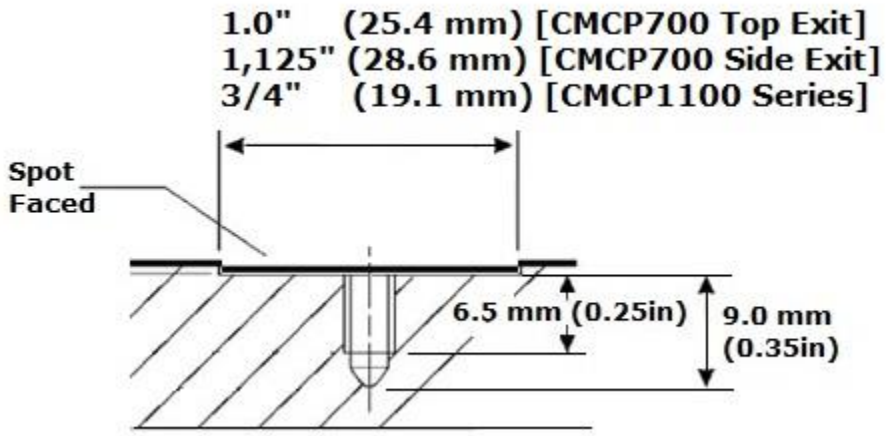


Shown above: Surface Preparation

Any irregularities in the mounting surface preparation will translate into improper measurements or damage to the sensor may occur.

Stud Mounting

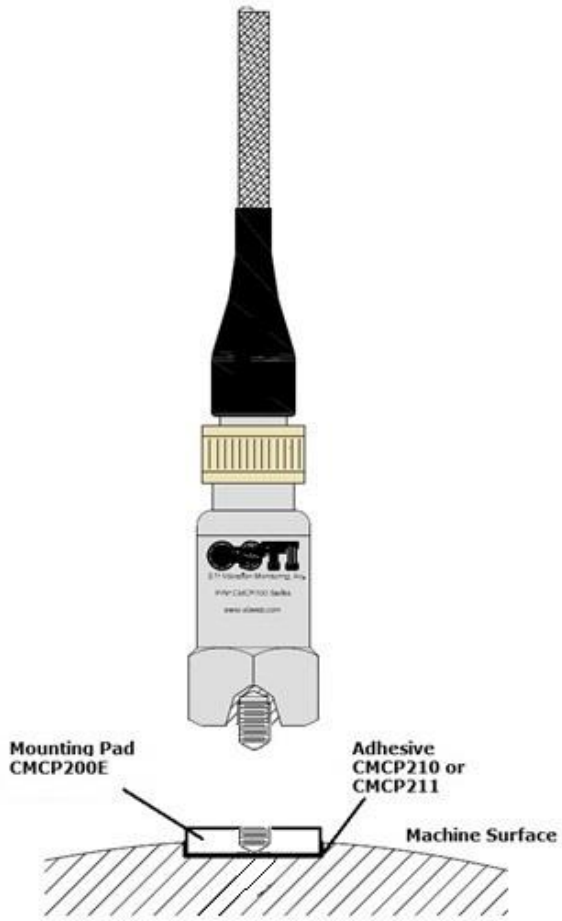
1. Select a relatively flat area in the preferred plane close to the vibration source.
2. Measure and mark the center of the hole.
3. Create a small dimple by using a center punch and hammer.
4. Insert the drill bit into the spot facer so that the bit protrudes about 0.4 in (10 mm). See Chapter 3 for STI Spot facer tool kits
5. At the same time drill hole and spot face perpendicular to within 1 degree of the mounting point.
6. Mark the hole depth on the tap with a piece of tape.
7. Turn the tap in about one full turn at a time and then backing it out 1/2 turn (to break the chips)
8. Continue tapping the hole until there is at least 0.25 in (6.5 mm) of full thread.
9. Remove all debris and clean.
10. Lightly grease contact surface with Silicon Grease (CMCP211).
11. Install mounting stud into tapped hole.
12. Attach Sensor to extruding stud and tighten to manufacturer's specifications (Use 5.9 ft-lbs (8.0 Nm) for STI sensors).
13. Attach and secure the cable assembly to minimize movement.



Shown above: Surface Preparation for Stud Mount

Stud Mount with Mounting Pad and Adhesive

Follow step 1 to 8 for stud mounting
9. Remove all debris and clean with OCC Free Cleaner (CMCP214 De-Greaser)
10. Install ¼-28 x ¾ Mounting Stud (CMCP230-02) into tapped hole.
11. Apply Adhesive to Mounting Pad
12. Screw Mounting Pad onto Mounting Stud.
13. Attach Sensor to extruding stud on top of mounting pad.



Shown above:

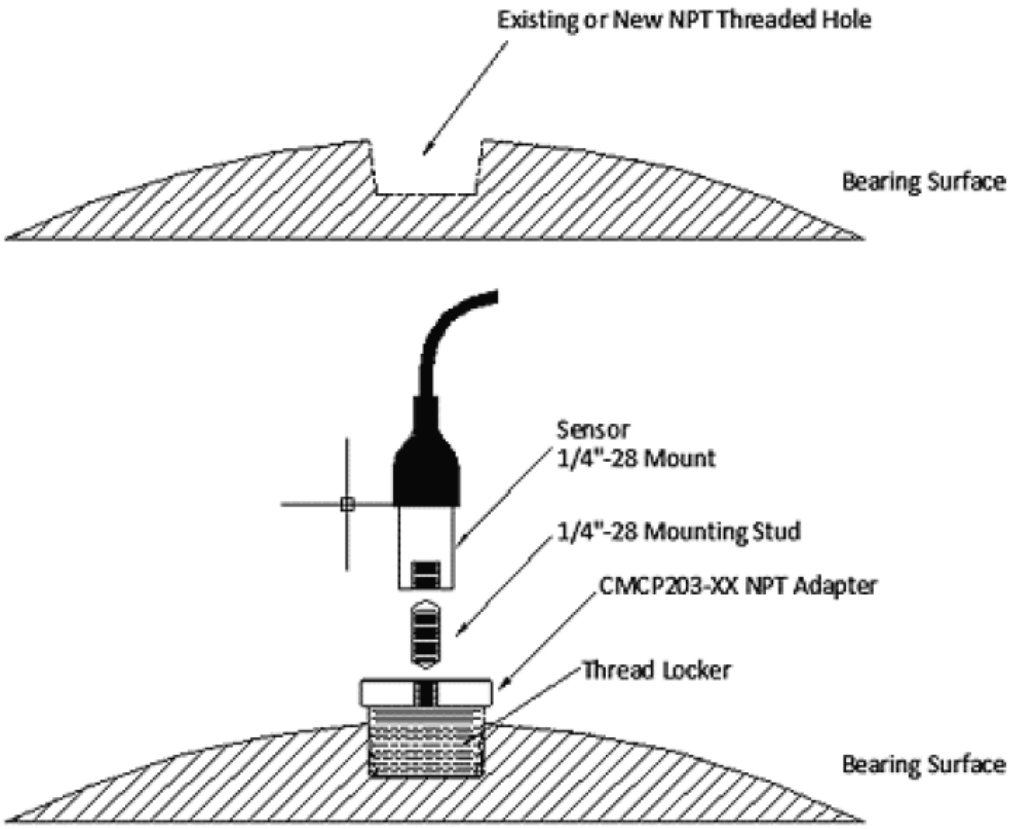
Stud Mount with Mounting Pad

Adhesive Mount with Mounting Pad

NPT Adapter Mount

Applicable Frequency Limit: 6,000 – 10,000 Hz

1. Select Sensor Location
2. If needed drill tap NPT Hole
3. Install CMCP205-XX NPT Adapter using a Thread Locker
4. Thread Mounting Stud into CMCP203-XX
5. Install Sensor on Mounting Stud



Shown above: Sensor Installation with NPT Adapter

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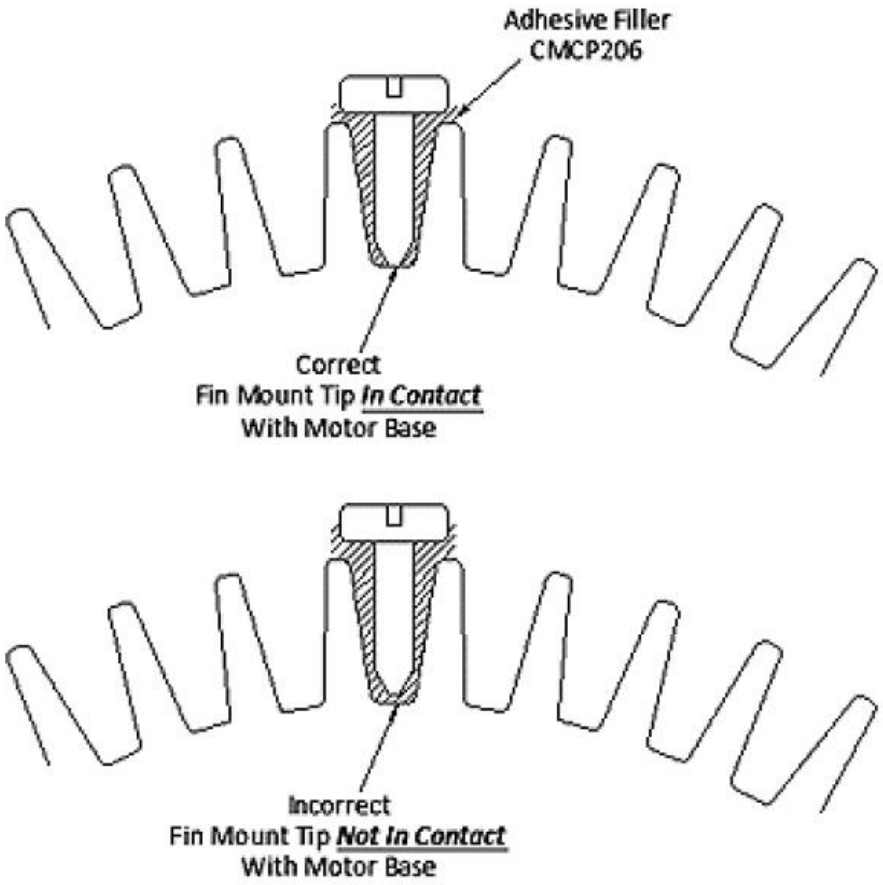
Motor Fin Mount

Applicable Frequency Limit: Up to 4,000 Hz

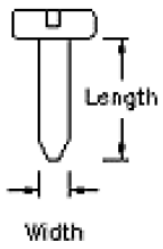
1. Select Sensor Location between Motor Fins
2. Clean Installation Location with an ODC Free Cleaner
3. Insert CMCP205 Fin Mount with the Tip in contact with Motor
4. Fill voids with CMCP206 Adhesive Filler
5. Screw Sensor into CMCP205 after Adhesive has dried.



Shown above: Correct and Incorrect Installation of Motor Mount Fin

Motor Fin Mount Dimensions

CMCP205-01: 1.25”L x 0.50”W (31.8 mm x 12.7 mm)
CMCP205-02: 2.00”L x 0.50”W (50.8 mm x 12.7 mm)
CMCP205-03: 1.75”L x 0.25”W (31.8 mm x 6.35 mm)
CMCP205-04: 1.00”L x 0.25”W (25.4 mm x 6.35 mm)



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Mounting Accessories

Part ID	Description	Application	Picture
CMCP200 Series	**Accelerometer Mounting Pads**	**Ideal Mounting Surface**	
CMCP200-01	1/4"x28 UNF, 316SS, 1/4" Thick, 1" Diameter	Pad for stud plus adhesive Installation	
CMCP200-02	3/8"x28 UNF, 316SS, 3/8" Thick, 1" Diameter	Pad for adhesive mounting	
CMCP200S-01	1/4"x28 UNF, 316SS, 1/4" Thick, 0.75 " Diameter	Smaller Pad for stud plus adhesive Installation	
CMCP200E-01	1/4"x28 UNF, 316SS, 3/4" Thick, 1" Diameter	Pad for adhesive mounting, partially threaded (no thu-hole)	
CMCP203 Series	**Pipe Thread Mounting Adapter**	**For existing NPT threaded holes**	
CMCP203-01	1/2" NPT	NPT Mounting Adapters are finished with a lapped surface and a 1/4 -28 threaded hole	
CMCP203-02	3/4" NPT		
CMCP203-03	3/8" NPT		
CMCP203-04	1/4" NPT		
CMCP230 Series	**¼"-28 UNF Mounting Studs**	**With Allen Head <Pack of 10>**	
CMCP230-01	1/2" (12.7 mm) in Length	Standard. For mounting the accelerometer to the machine or pad	
CMCP230-02	3/4" (19 mm) in Length	For mounting the pad and the accelerometer	
CMCP230-03	3/8" (9 mm) in Length	Smaller length.	

Magnetic Mounting Pads and Targets as well as Metric Mounting Pads and Isolated Mounting Pads are available.

Please click here for the CMCP Mounting Pads and Accessories.

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Installation Tools

Part ID	Description	Application	Picture
CMCP270 Series	**Installation Tool Kit (Standard)**	**1" (25.4 mm) Spot Facer**	
CMCP270-01-0	Spot Facer, Drill Bit, Tap and Allen Wrench without Tap Handle	Recommended for ¼-28 UNF Sensors, like CMCP700 series with **top** exit	
CMCP270-01-T	Spot Facer, Drill Bit, Tap and Allen Wrench, with Tap Handle		
CMCP270-02-0	Spot Facer, Drill Bit, Tap and Allen Wrench without Tap Handle	Recommended for M8x1.25 Sensors, like CMCP700-M8 series with **top** exit	
CMCP270-02-T	Spot Facer, Drill Bit, Tap and Allen Wrench, with Tap Handle		
CMCP270XL Series	**Installation Tool Kit (Large)**	**1.125" (28.6 mm) Spot Facer**	
CMCP270L-01-0	Spot Facer, Drill Bit, Tap and Allen Wrench without Tap Handle	Recommended for ¼-28 UNF Sensors, like CMCP700 series with **side** exit	
CMCP270L-01-T	Spot Facer, Drill Bit, Tap and Allen Wrench, with Tap Handle		
CMCP270L-02-0	Spot Facer, Drill Bit, Tap and Allen Wrench without Tap Handle	Recommended for M8x1.25 Sensors, like CMCP700-M8 series with **side** exit	
CMCP270L-02-T	Spot Facer, Drill Bit, Tap and Allen Wrench, with Tap Handle		
CMCP270XS Series	**Installation Tool Kit (Small)**	**3/4" (19 mm) Spot Facer**	
CMCP270S-0	Spot Facer, Pilot Drill Bit, Tap and Allen Wrench without Tap Handle	Recommended for ¼-28 UNF Sensors, like CMCP1100 series	
CMCP270S-T	Spot Facer, Pilot, Drill Bit, Tap and Allen Wrench, with Tap Handle		

The CMCP271 Series of Spot Facing Tools (End Mills) are the same as the CMCP270 Series but provide replaceable Cutting Tips. Cost effective when installing a larger quantity of sensors. All parts of the Installation Kits are available as spares.

Please click here for the CMCP270 Sensor Installation Tool Kits.

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Adhesives and Sealants

Part ID	Description	Application	Picture
CMCP206	Adhesive Filler, Two Part Epoxy, 1.69 oz. (50 ml)	Anchors the CMCP205 Motor Fin Mounts between the motor cooling fins.	
CMCP207	Adhesive Dispenser	Used to dispense CMCP206 Adhesive Filler	
CMCP208	12 x Mixing Nozzles	Used to mix CMCP206 Two Part Epoxy	
CMCP210	Acrylic Adhesive Bypacs	Two Part Epoxy for easy mounting of 1 or 2 sensors	
CMCP210C	Acrylic Adhesive, 1.42 oz (42 ml) Dispenser Package	Two Part Epoxy for easy mounting of 15 sensors	
CMCP211	Depend 330 and Activator	Two Part Adhesive with Spray Activator for over 10 installations	
CMCP212	Silicone Dielectric 1 Ounce Tube (30 ml) (for 50 to 100 Sensors)	Helps to ensure transmittal of higher frequencies	
CMCP213	Clear Silicone Sealant 3 Ounce Tube (90 ml) Multi-Purpose	Eliminates moisture build-up inside sensor connector by "flooding" the connector	
CMCP214	Loctite 20162 16 oz. Spray	De-Greaser Cleans Mounting Surfaces	

Please click here for the CMCP Adhesives and Sealants.

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Mounting Kits: CMCP220 Accelerometer Adhesive Mounting Kit

The CMCP220 Adhesive Mounting Kits provides all the items necessary for adhesive mounting of 10, 32, 64 or 128 accelerometers. The Kit includes CMCP270 End Mill(s), CMCP200 Mounting Pads, CMCP210 Acrylic Adhesive Bypacs and CMCP212 Silicone Dielectric. This kit is recommended for mounting Accelerometers in wet environments such as Paper Machines. The CMCP212 Silicon Dielectric is used between the Mounting Pad and Accelerometer to improve transmission of energy and frequency response.

Part ID	Ext.	Description	Includes
CMCP220-10		Adhesive Mounting Kit for 10 Accelerometers	10 x CMCP200 Mounting Pads 10 x CMCP210 Bypacs 1 x CMCP212 Dielectric 1 x CMCP270 End Mill Kit
CMCP220-32		Adhesive Mounting Kit for 32 Accelerometers	32 x CMCP200 Mounting Pads 32 x CMCP210 Bypacs 2 x CMCP212 Dielectric 2 x CMCP270 End Mill Kits
CMCP220-64		Adhesive Mounting Kit for 64 Accelerometers	64 x CMCP200 Mounting Pads 64 x CMCP210 Bypacs 3 x CMCP212 Dielectric 3 x CMCP270 End Mill Kits
CMCP220-128		Adhesive Mounting Kit for 124 Accelerometers	128 x CMCP200 Mounting Pads 128 x CMCP210 Bypacs 6 x CMCP212 Dielectric 6 x CMCP270 End Mill Kits
	-01	¼” Thick Mounting Pads	
	-02	3/8” Thick Mounting Pads	

CMCP250 Accelerometer Mounting Kit

The CMCP250 Accelerometer Mounting Kit includes all of the accelerometer mounting accessories required to mount up to 33x Accelerometers on 25x Mounting Pads and 8x Motor Cooling Fin Mounts.

Please click here for the CMCP250 Accelerometer Mounting Kit data sheet.

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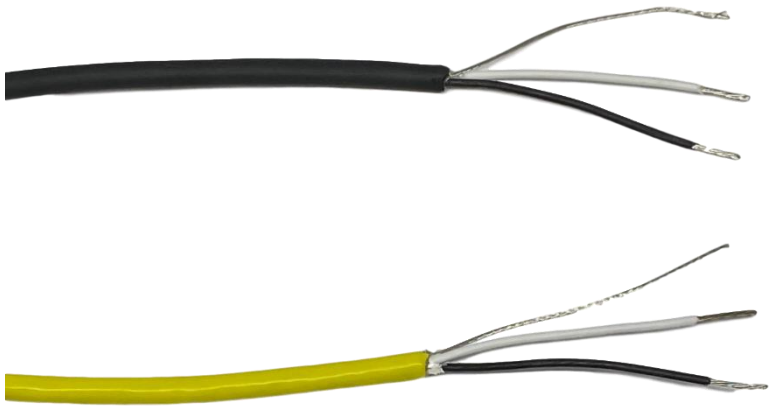
Cabling

Cables and cable assemblies are the most susceptible component in a Condition Monitoring System. The instrument wire from the vibration sensor to its transmitter or monitor should be either a twisted pair or triad cable depending on the sensor's requirement. These cables should be stranded, twisted, individually insulated, shielded and with an overall jacket. The shields or drain wires must be insulated or isolated from each other and the conduit. The use of multi-conductor cable with a single shield is not suggested due to its susceptibility to induced noise and line interference.



Shown above: Twisted Pair Bulk Cables, General and High Temperature (Yellow)

The gauge or thickness of the instrument wire is determined by the distance between the sensor and the transmitter or monitor. Long lengths of cable will deteriorate the signal; this can be a problem when monitoring gear mesh frequencies, blade pass frequencies or rolling element bearing frequencies.

The following table offers a guideline to determine the maximum cable length for different types of sensors. This is based on an ideal installation where the cable is properly grounded and installed in a dedicated conduit system.

Sensor Sensitivity	Maximum Cable Length
100 mV/g	100-150' (30 to 50 m)
500 mV/g	150-500' (50 to 150 m)
4-20 mA Velocity Sensors	>1000' (300 m)

The cables that connect sensors to an on-line system limit both the maximum observable frequency and the cable length. These limitations are due to the cable's impedance, which is a function of both frequency and capacitance.

The maximum sustainable frequency for a given cable is determined by the following three parameters:

- The total line capacitance
- The sensor current
- The desired maximum signal amplitude

The maximum possible cable length for a given frequency and voltage range, and a known cable capacitance can then be calculated.

Interference Sources

Noise or Line Interference can be induced in a Vibration Monitoring System in several ways. However, there must first exist a source for the induced noise. There are numerous noise sources available in an industrial or power generation plant:

- AC Power Transients
- Ground Differentials
- Switching Circuits
- High Voltage Circuits
- Improper Load Balance

Noise can be induced in a Vibration Monitoring System through Electrostatic (Capacitive), Electromagnetic (Inductive) or Conductive Coupling (Direct Connection). All noise will be induced in the monitoring system through one or more of its external connections or Field Wiring.
It is critical that conduit be utilized with the sensor cabling and its associated wiring. The use of conduit greatly reduces the possibility of induced noise or line interference on the signals path. The conduit system shall be dedicated to the monitoring system and no other wiring should be in the same conduit. Also, cable trays, wire ways, or instrument trays are an unacceptable alternative to dedicated conduit. Route the conduit as far as possible from any power cables, relay contact cables and motor control cables. If these cables must be crossed, do so at a 90° angle.

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Cable Assemblies and Connectors for Permanent Installations

The standard MIL spec cable assemblies (CMCP602 and CMCP603 series) are rated for IP68, a high protection against dust and water ingress. The CMCP602 and CMCP603 Cables Assemblies are for both, 2 wire standard and 3 wire multi-parameter Accelerometers in standard and high temperature versions. MS-5015 and M12 Connectors along with Seal Tight Push On and Locking Collar versions are available. Hose and braided armor options are available for installations not using conduit. Cable Assemblies are in stock or can be manufactured quickly for fast delivery.

Considerations

- Connection Type
  - 2 Socket MS
  - 3 Socket MS
  - 4 or 5 Pin M12
  - Multi-Conductor
- Environment
  - General Purpose Cable
  - High Temperature Cable
- Cable Length
  - Signal Type
  - Attenuation
- Anchoring
  - Minimize cable movement
- Grounding
  - Isolated, [Standard] -grounded Instrument side
  - Non-Isolated [-NI], -grounded Machine side

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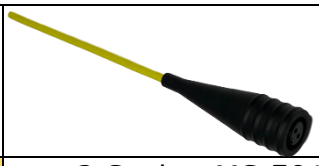
General Purpose Halogen Free 2 Socket MS 5015 Cable Assemblies

CMCP602L and CMCP602LST Series

		
Connector Type	2 Socket MS 5015, Push On Seal Tight	2 Socket MS 5015, Locking Collar
Jacket Material	Black HalGuard TPE (Thermoplastic Elastomer)	
Connector Material	Viton	Viton / Stainless Steel
Conductors	2 Plus Drain/Shield	
Conductor Size	20 AWG/24 AWG Drain	
Cable Diameter	0.19” (4.83 mm)	
Shield Type	Braided Shield	
Capacitance	30 pF/ft	
Temperature	-55 to 120 °C (-67 to 248 °F)	
IP Rating	IP68 (Submersible)	
Part ID (example)	**CMCP602LST**-16-01-01	**CMCP602L**-16-01-01

High Temperature Flame Retardant 2 Socket MS 5015 Cable Assemblies

CMCP602H and CMCP602HST Series

		
Connector Type	2 Socket MS 5015, Push On Seal Tight	2 Socket MS 5015, Locking Collar
Jacket Material	FEP (Fluorinated Ethylene Propylene)	
Connector Material	Viton	Viton / Stainless Steel
Conductors	2 Plus Drain/Shield	
Conductor Size	20 AWG	
Cable Diameter	0.19” (4.83 mm)	
Shield Type	Braided Shield	
Capacitance	30 pF/ft	
Temperature	-55 to 200 °C (-67 to 392 °F)	
IP Rating	IP68 (Submersible)	
Part ID (example)	**CMCP602HST**-16-01-01	**CMCP602H**-16-01-01

Please click here for the CMCP 2 Socket Cable Assemblies.

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Optional Armor Cabling

All cable assemblies are available with an optional 316 Stainless Steel flexible hose armor (top image) or overbraided armor (bottom image).

Please click here for the CMCP Armored Cable Assemblies.

When pre-made cable assemblies are not practical, consider the Crimp On Connector Kits (MS 5015) and Connector Tool Kit (CMCP600C-K)

Please click here for the CMCP Connector Kits and Tool Kit.

For more information and the complete data sheets, please visit us online:

https://www.stiweb.com