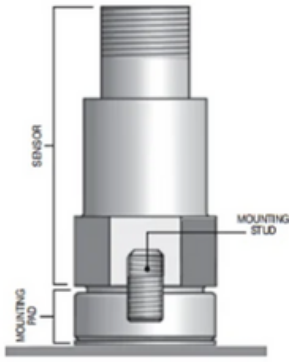
Wireless Vibration Sensor Installation Procedure EZDP-2146 Rev A



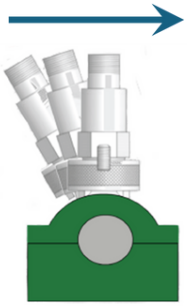


Table of Contents

1. About Cutsforth

Cutsforth specializes in developing innovative new technologies and services to support the power generation industry. Cutsforth's patented EASYchange® brush holder design, online truing service, InsightCM™ condition monitoring software, and patented shaft grounding and monitoring systems have been installed across the globe in generators of all sizes and in nearly every industry application, including nuclear, natural gas, coal, wind, and hydroelectric.

Cutsforth's knowledge and commitment to excellence drives our innovative solutions for the changing needs of the power industry. Whether it is a quick response to a critical situation or a new way of solving an old problem, our commitment to quality ensures that our customers receive best-in-class products and services—Cutsforth is the Power of Innovation.

Cutsforth started back in 1991 as a small company focused primarily on making replacement brush holders for generators and exciters. Today, after 30+ years in business, Cutsforth's experience and innovative designs have brought its best-in-class excitation brush holder and shaft grounding replacements and collector ring services to some of the world's largest power companies.

1.1. Cutsforth Products

- EASYchange® Removable Brush Holders
- EASYchange® Brush Condition Monitoring
- Cutsforth Shaft Grounding Systems
- Rotor Flux Monitoring
- Electro-Magnetic Interference Monitoring
- InsightCM™ Condition Monitoring Software

1.2. Cutsforth Field Services

Cutsforth provides comprehensive product installations for all product offerings as well as on-site training after the installation. We work efficiently during your outage to ensure a smooth upgrade to our innovative solutions such as Product Installations, Online Collector Ring and Commutator Truing, Spiral Groove Restoration, and Consulting and Emergency Services.

1.3. Cutsforth Automation and Control Services

Cutsforth provides comprehensive Automation and Control services which include data historian integration, InsightCM™ integration, DCS logic, engineered drawings and much more. This further complements our turnkey monitoring system installations.

2. Legal Information

2.1. Limited Warranty

This document is provided 'as is' and is subject to being changed, without notice, in future editions. Cutsforth reviews this document carefully for technical accuracy; however, CUTSFORTH MAKES NO EXPRESS OR IMPLIED WARRANTY AS TO THE ACCURACY OF THE INFORMATION WITHIN THIS MANUAL AS IT RELATES TO SPECIFIC INSTALLATION. THE CUSTOMER IS RESPONSIBLE FOR VERIFYING INSTALLATION AND OPERATING CONDITIONS AT EACH INSTALLATION LOCATION AND FOR EACH GENERATOR TYPE. Cutsforth warrants that its hardware products will be free of defects in materials and workmanship that cause the product to fail to substantially conform to the applicable Cutsforth published specifications for one (1) year from the date of invoice.

For a period of ninety (90) days from the date of invoice, Cutsforth warrants that (i) its software products will perform substantially in accordance with the applicable documentation provided with the software, and (ii) the software media will be free from defects in materials and workmanship. If Cutsforth receives notice of a defect or non-conformance during the applicable warranty period, Cutsforth will, in its discretion: (i) repair or replace the affected product, or (ii) refund the fees paid for the affected product. Repaired or replaced hardware will be warranted for the remainder of the original warranty period or ninety (90) days, whichever is longer. If Cutsforth elects to repair or replace the product, Cutsforth may use new or refurbished parts or products that are equivalent to new in performance and reliability and are at least functionally equivalent to the original part or product. You must obtain an RMA number from Cutsforth before returning any product to Cutsforth. Cutsforth reserves the right to charge a fee for examining and testing hardware not covered by the Limited Warranty.

This Limited Warranty does not apply if the defect of the product resulted from improper or inadequate maintenance, installation, repair, or calibration performed by a party other than Cutsforth; unauthorized modification; improper environment; use of an improper hardware or software key; improper use or operation outside of the specification for the product; improper voltages; accident, abuse, or neglect; or a hazard such as lightning, flood, or other act of nature.

THE REMEDIES SET FORTH ABOVE ARE EXCLUSIVE AND THE CUSTOMER'S SOLE REMEDIES, AND SHALL APPLY EVEN IF SUCH REMEDIES FAIL OF THEIR ESSENTIAL PURPOSE.

WARNING REGARDING USE OF CUTSFORTH SHAFT MONITORING EQUIPMENT: CUSTOMER IS ULTIMATELY RESPONSIBLE FOR VERIFYING AND VALIDATING THE SUITABILITY AND RELIABILITY OF THE PRODUCTS WHENEVER THE PRODUCTS ARE INCORPORATED IN THEIR SYSTEM OR APPLICATION, INCLUDING THE APPROPRIATE DESIGN, PROCESS, AND SAFETY LEVEL OF SUCH SYSTEM OR APPLICATION. PRODUCTS ARE NOT DESIGNED, MANUFACTURED, OR TESTED FOR USE IN LIFE OR SAFETY CRITICAL SYSTEMS, OR ANY OTHER APPLICATION IN WHICH THE FAILURE OF THE PRODUCT OR SERVICE COULD LEAD TO DEATH, PERSONAL INJURY, SEVERE PROPERTY DAMAGE OR ENVIRONMENTAL HARM (COLLECTIVELY, "HIGH-RISK USES"). FURTHER, PRUDENT STEPS MUST BE TAKEN TO PROTECT AGAINST FAILURES, INCLUDING PROVIDING BACK-UP AND SHUT-DOWN MECHANISMS. CUTSFORTH EXPRESSLY DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY OF FITNESS OF THE PRODUCTS OR SERVICES FOR HIGH-RISK USES.

CUTSFORTH DOES NOT WARRANT, GUARANTEE, OR MAKE ANY REPRESENTATIONS REGARDING THE USE OF OR THE RESULTS OF THE USE OF THE PRODUCTS IN TERMS OF CORRECTNESS, ACCURACY, RELIABILITY, OR OTHERWISE. CUTSFORTH DOES NOT WARRANT THAT THE OPERATION OF THE PRODUCTS WILL BE UNINTERRUPTED OR ERROR FREE. INCIDENTAL AND CONSEQUENTIAL DAMAGES, INCLUDING LOSS OF USE, ARE SPECIFICALLY EXCLUDED FROM THIS WARRANTY; THE MAXIMUM VALUE OF A WARRANTY CLAIM CANNOT EXCEED THE ORIGINAL VALUE OF THE ASSEMBLY OR COMPONENT.

2.2. Copyright

2.3. Patents

Please send patent information requests to patents@cutsforth.com.

3. Safety Information

3.1. Safety Information [English]

Following is important safety information. For safe installation and operation of this equipment, be sure to read and understand all cautions and warnings.

3.1.1. Safety Conventions

NOTE:

Additional information.

ELECTRICAL DANGER

Indicates an action or specific equipment area that can result in personal injury or death from an electrical hazard if proper precautions are not taken.

CAUTION

Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury or equipment damage.

WARNING

Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

ROTATING PART CAUTION

Indicates possible injury from rotating parts.

DANGER

Indicates a hazardous situation that, if not avoided, will result in death or serious injury.

3.1.2. General Safety Instructions

ELECTRICAL DANGER

Only qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid injury should work with Cutsforth products. Among the many considerations are the following:

- Avoid contact with energized circuits.
- Avoid contact with rotating parts.
- Never install any component that appears not to be functioning in a normal manner.
- Always ensure proper installation of the holder assembly and shaft grounding rope.

ELECTRICAL DANGER

Before working on the generator, de-energize, lock out, and tag out all power sources to the generator, shaft, and accessory devices. Electric shock and death may result due to failure to heed this warning.

ROTATING PART CAUTION

High-voltage and rotating parts can cause serious or fatal injury. Installation, operation, and maintenance of this product must be performed only by qualified personnel, in accordance with all applicable safety regulations and guidelines.

3.2. Consignes de Sécurité [Français]

Les informations qui suivent sont essentielles afin d'assurer la sécurité de l'utilisateur lors de l'installation et de l'opération de l'équipement. Assurez-vous de bien lire et de comprendre tous les avertissements et mises en garde qui suivent.

3.2.1. Conventions de Sécurité

NOTE:

Informations supplémentaires.

RISQUES DE CHOC ÉLECTRIQUE

Indique que l'action ou la partie de l'équipement concernée peut mener à des blessures par électrisation ou à la mort par électrocution si les précautions adéquates ne sont pas prises.

MISE EN GARDE

Indique la présence d'une situation dangereuse qui, si elle n'est pas évitée, pourrait mener à des blessures mineures à modérées ou à des dommages matériels.

AVERTISSEMENT

Indique la présence d'une situation dangereuse qui, si elle n'est pas évitée, pourrait mener à des blessures sévères ou à la mort.

MISE EN GARDE : PIÈCE ROTATIVE

Indique la présence de pièces d'équipement rotatives pouvant causer des blessures.

DANGER

Indique la présence d'une situation dangereuse qui, si elle n'est pas évitée, pourrait mener à des blessures sévères ou à la mort.

3.2.2. Consignes de Sécurité Générales

RISQUES DE CHOC ÉLECTRIQUE

L'utilisation des produits Cutsforth n'est recommandée qu'aux professionnels qualifiés qui savent comment reconnaître la présence de risques de choc électrique ainsi que les consignes de sécurité à suivre pour éviter les blessures liées à ces risques. Lesdites consignes de sécurité incluent, sans s'y limiter :

- Éviter tout contact avec des circuits alimentés;
- Éviter tout contact avec des pièces d'équipement rotatives;
- Ne jamais installer de composante ne paraissant pas fonctionner normalement;
- Toujours s'assurer que la structure de soutien et le câble de terre de l'arbre de la génératrice sont correctement installés.

RISQUES DE CHOC ÉLECTRIQUE

Avant de travailler sur la génératrice, désalimentez, cadenassez et étiquetez toutes les sources d'énergies liées à la génératrice, à l'arbre et aux appareils accessoires. L'opérateur s'expose à des risques de chocs électriques pouvant causer la mort s'il ne tient pas compte de cet avertissment.

MISE EN GARDE : PIÈCE ROTATIVE

Les pièces d'équipement rotatives et sous haute tension peuvent causer des blessures sévères ou fatales. L'installation, l'opération et la manutention de ce produit ne doivent être faites que par des professionnels qualifiés et en respectant toutes les règles et consignes de sécurité applicables.

4. Wireless Accelerometer Mounting and Installation Guide

4.1. Introduction

This document focuses on wireless accelerometer installation techniques. It includes stud mounting, adhesive mounting, and magnetic mounting. The document describes the tools and materials required, and best practices for sensor location.

There are four objectives when mounting accelerometers:

- Minimize the mass (weight) added to the machine
- Maximize the surface area contact between the accelerometer and the machine
- Maximize stiffness of the mount
- Locate the sensor mount close to the source of vibration (bearing housing)

Stud mounting and adhesive mounting provide the best repeatability of vibration data collection. Both techniques provide higher frequency ranges, often to the full useful range of the sensor. However, adhesive and stud mounting require more time and care compared to magnetic mounting.

Proper permanent installation of vibration sensors will maximize frequency response, maximize data quality, and ensure long-term adhesion to the machine. To ensure long-term, it is necessary to use proper surface preparation and use materials compatible with the machinery environment.

4.2. Choosing Accelerometer Mounting Location

Vibration sensors should be mounted on the bearing housing, or as closely as possible and oriented in a horizontal, vertical, or axial direction. The top-dead-center position is preferred for permanent online monitoring. Locations with high temperature variations or significant air flow velocities should be avoided if possible. See Figure 1 for location orientation. For triaxial accelerometers, the vertical position is preferred.

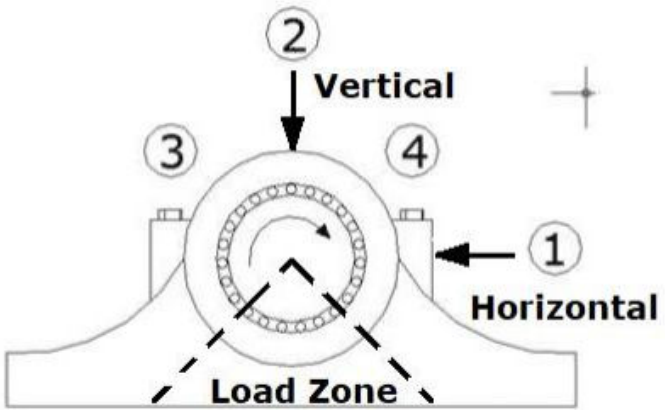


Figure 1. Mounting location priority (image courtesy of STI Vibration Monitoring)

Figure 2. Triaxial sensors mounted in the horizontal position of a horizontally oriented motor and vertically on a vertically oriented motor

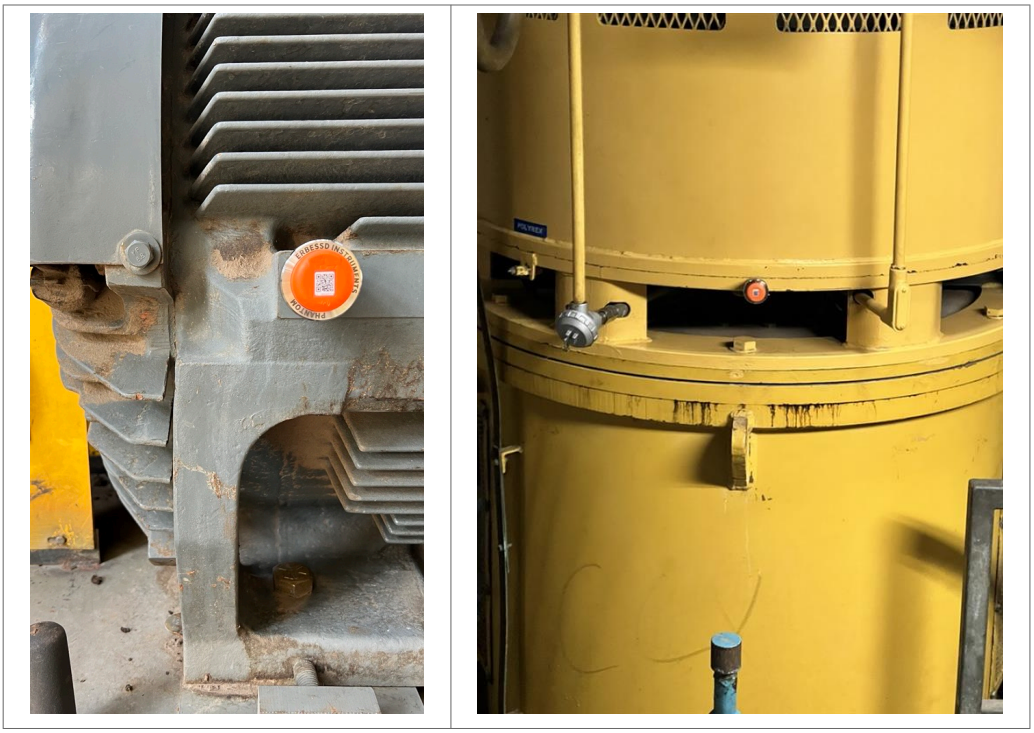


Figure 3. Triaxial sensors mounted in the vertical position of the motor and input bearing of the pump

4.3. Common Tools for Accelerometer Mounting

Figure 4 depicts common tools used for accelerometer mounting.

For adhesive mounting, a spot facing tool, file, and wire brush are useful along with (not shown) fine-grit sandpaper (e.g., 400–600 grit) or a Scotch-Brite pad to lightly abrade the surface. Additionally, lint-free cloth soaked in a solvent like isopropyl alcohol (IPA) or acetone to remove oils and grease.

When stud mounting, additional tools are used including a pilot drill bit, taps, tap handle, and center punch. Stud mounting is the preferred method.

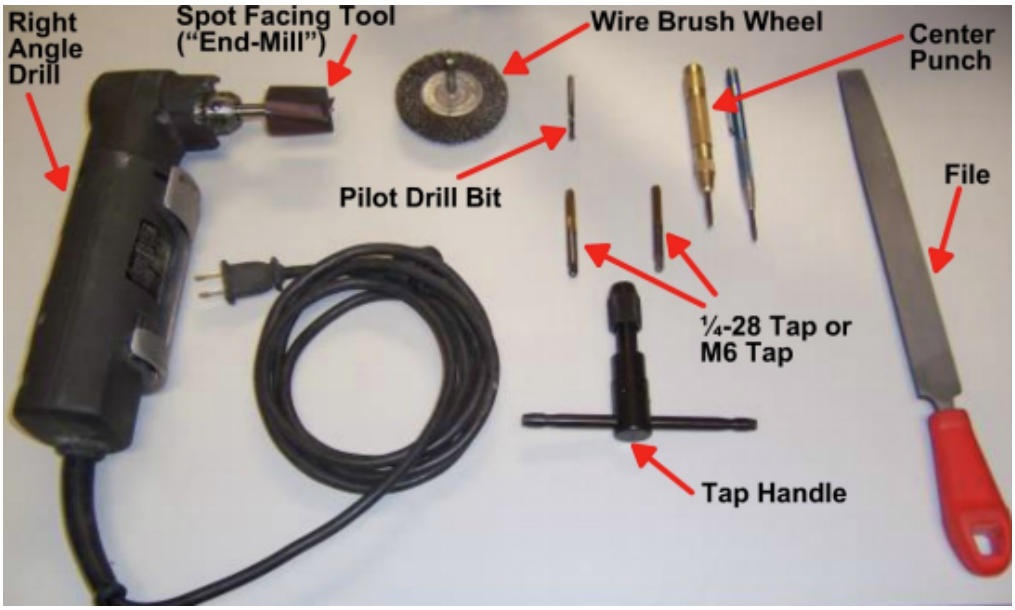


Figure 4. Common Tools for accelerometer mounting (image used courtesy of Connection Technology Center, Inc.)

5. Stud mount

Whenever possible, it is best to drill a hole in the object and fix the sensor to the device under test (DUT) with a screw.

Stud mounting provides a stiff mechanical connection and is capable of transferring the high-frequency vibrations of the object to the sensor.

Stud mounting best meets intrinsically safe requirements since the case of the sensor is grounded to the machinery.

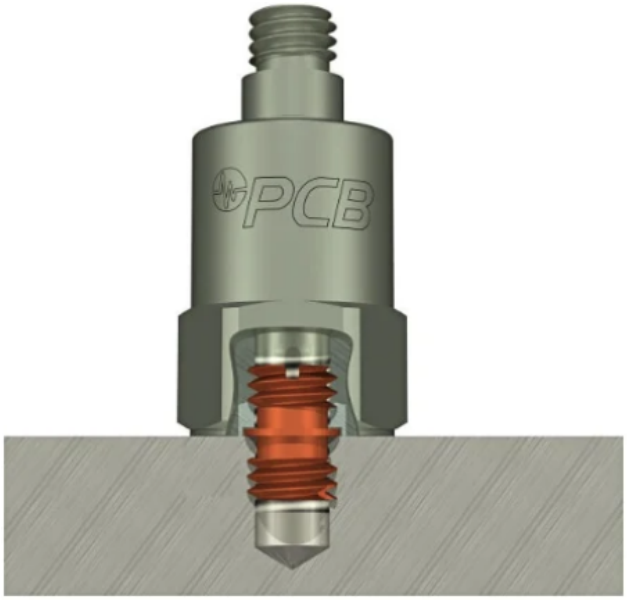


Figure 5. An example of a stud-mounted piezoelectric accelerometer (image used courtesy of PCB Electronics)

5.1. Part Numbers for Stud Mount

- MH108-4B — 1/4-28 Mounting Stud, Stainless Steel, 0.5" (13 mm) Length

> Mounting stud is not needed with Erbessd Phantom wireless because Erbessd Phantom sensors are shipped with a stud installed

5.2. Stud Mounting Procedure

1. Recommend using an ultrasonic thickness gauge. Recommended minimum thickness of 0.250" to 0.300".
2. Choose a spot face diameter that has the same diameter as the surface of the sensor.
3. Choose the tap that matches the sensor mounting stud. Choose an appropriate pilot hole diameter, allowing the tap to create threads for the mounting stud.
4. Create a flat spot on the surface of the machinery. Apply even pressure to insure flatness. Surface should be 0.001 inches or better. Surface finish should be 65 or better.
5. Drill a pilot hole in the center of the flat spot that is slightly deeper than the length of the mounting stud. The pilot hole is to be perpendicular to the machine surface. Ensure a stop collar is installed on the pilot bit, to ensure the bit does not penetrate through the housing.
6. Tap the pilot hole with the appropriate tap set. Start using the "starter tap". Finish using the "bottom tap" which will cut threads to the bottom of the hole.
7. Clean the surface of the mounting location.
   - Initial Cleaning:
     - Remove loose debris: Use a brush or compressed air to clear dust and particles.
     - Degrease: Wipe the surface with a lint-free cloth soaked in a solvent like isopropyl alcohol (IPA) or acetone to remove oils and grease.
8. Apply a thread locker such as Loctite 243 to the threads of the stud to prevent loosening from shock and vibration.
9. Screw and tighten the sensor in place, tightening to a range of 2 to 5 foot-pounds (2.7 to 6.8 Nm).
10. Paint any exposed metal on the surface of the machine to prevent corrosion.

6. Adhesive mount

Sometimes it is not possible to drill a hole into the structure, or the design of some accelerometers does not allow us to use stud mounting. In these cases, we can use an adhesive to secure the sensor to the monitored object.

Epoxy pads are also frequently used for permanent mounting of sensors where drilling and tapping are not permitted or possible. Properly installed epoxy pads can transmit high-frequency data (10 kHz or 600,000 CPM) very well and therefore can be used effectively for monitoring many gearbox and bearing faults. Avoid using them in cooling towers or other aggressive environments that could interfere with the bonding of the adhesive.

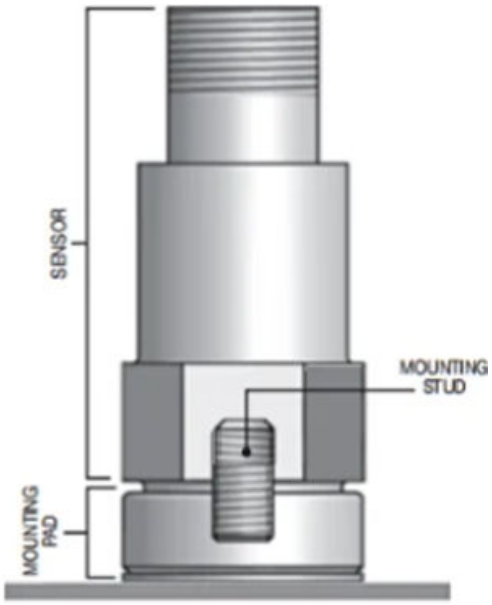


Figure 6. An example of using an adhesive mounting base to mount an accelerometer (image used courtesy of Condition Monitoring Analytics)

6.1. Part Numbers for Adhesive Mount

- MH130-1A — Mounting Disk with 1/4-28 Blind Tapped Hole, 1.0 in. (25.4 mm) Diameter — base/mounting pad that can be epoxied onto surface of the asset
- MH108-4B — 1/4-28 Mounting Stud, Stainless Steel, 0.5" (13 mm) Length

> Mounting stud is not needed with Erbessd Phantom wireless because Erbessd Phantom sensors are shipped with a stud installed

- Adhesive recommendations for adhesive mount:
  - Purchased separately when ready to install
  - Epoxy: Loctite AA330
  - Activator: Loctite 7387
  - The above is easy to apply, the attenuation is minimal, it is very forgiving and adheres to almost every surface. Our team has tried several other epoxies and the Loctite combo above is the best performance that the team has used.
  - Industrial adhesives have a shelf life/expiration date. As with all adhesives, order what you need when you need it and be cognizant of ambient temperature for cure times.

6.2. Adhesive Mounting Procedures Milled Surface

1. Choose a spot face diameter that has the same diameter as the surface of the sensor.
2. Create a flat spot on the surface of the machinery. Apply even pressure to insure flatness. Surface should be as flat as practical.
3. Clean the surface of the mounting location.
   - Initial Cleaning:
     - Remove loose debris: Use a brush or compressed air to clear dust and particles.
     - Degrease: Wipe the surface with a lint-free cloth soaked in a solvent like isopropyl alcohol (IPA) or acetone to remove oils and grease.
   - Surface Preparation:
     - Smooth the surface: Use fine-grit sandpaper (e.g., 400–600 grit) or a Scotch-Brite pad to lightly abrade the surface. This increases surface area for better adhesion.
     - Clean again: After abrasion, clean the surface again with IPA to remove any residue or particles.
4. Apply a thin layer of Loctite 330 to the pad. Make sure the adhesive is compatible with all the environmental factors, including chemicals, moisture, and heat.
5. Spray Loctite activator to the surface the pad is being adhered to.
6. Hold the pad in place for 30 seconds.
7. Tape the pad in place until the adhesive cures (see data Loctite 330 data sheet). Consider curing times of 3 to 6 hours, with 24 hours prior to applying any weight to the pad.
8. Apply a thread locker such as Loctite 243 to the threads of the stud to prevent loosening from shock and vibration.
9. Screw and tighten the sensor in place, tightening to a range of 2 to 5 foot-pounds (2.7 to 6.8 Nm).
10. Paint any exposed metal on the surface of the machine to prevent corrosion.

7. Magnetic mount

A final (third) method for mounting an accelerometer is magnetics. Magnetic mounting can be used when the object being monitored has a ferromagnetic surface. This method is preferred for flexible temporary use.

In the case of non-magnetic or rough surfaces, you can weld or epoxy a steel pad to accept the magnetic base.

Figure 7. Example of a magnetically mounted accelerometer (image used courtesy of Wilcoxon)

7.1. Part Numbers for Magnetic Mount

- MH114-3A — recommended magnetic (mag) mount

7.2. Magnetic Mounting Procedure

1. Determine the mounting location for the accelerometer.
2. Apply a thread locker such as Loctite 243 to the threads of the stud to prevent losening from shock and vibration.
3. Screw and tighten the sensor to the magnet, tightening to a range of 2 to 5 foot-pounds (2.7 to 6.8 Nm).
4. "Rock" the sensor/magnet combination onto the selected location as shown in Figure 8.

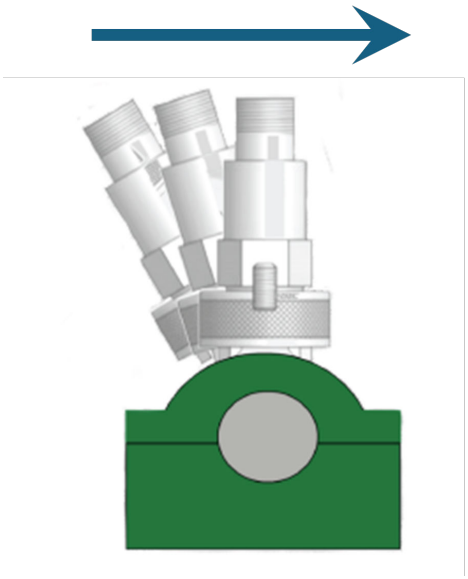


Figure 8. "Rocking" motion for magnetically mounting an accelerometer (image courtesy of Connection Technology Center)