**INSTALLATION MANUAL** Shaft Grounding Assembly: Series 2

PART #: EZDP-2035





THE INFORMATION CONTAINED HEREIN IS CONFIDENTIAL AND PROPRIETARY TO CUTSFORTH INC. AND SHALL NOT BE REPRODUCED OR DISCLOSED INWHOLE OR PART FOR ANY DESIGN OR MANUFACTURE WITHOUT THE WRITTEN AUTHORIZATION OF CUTSFORTH INC.

© Cutsforth Inc. 2022 | Cutsforth.com/Support Document #: EZDP-2035 Rev G

THE POWER OF INNOVATION<sup>m</sup>

## **Table of Contents**

1. About Cutsforth	. З
1.1. Cutsforth Products	. З
1.2. Cutsforth Field Services	. З
1.3. Cutsforth Automation and Control Services	. З
1.4. Cutsforth Electrical Contracting Services	. 4
2. Legal Information	. 5
2.1. Limited Warranty	. 5
2.2. Copyright	. 6
2.3. Patents	. 6
3. Safety Information	. 7
3.1. Safety Conventions	. 7
3.2. General Safety Instructions	. 7
4. The Cutsforth Shaft Grounding Assembly	. 9
4.1. Components	. 9
4.2. Required Tools	10
4.3. Installation Prerequisites	10
5. Installation Strategies	11
5.1. Positioning the Cutsforth Shaft Grounding Assembly	11
5.2. Total HFD Wire Run Length Must Be Under 4 ft 6 in	11
6. Installation Procedure	13
6.1. Installation Overview	13
6.2. Installing the Attachment Arm	14
6.2.1. Place the Shaft Grounding Assembly	14
6.2.2. Attach the Connector Plate	15
6.2.3. Insert the Elbow Assemblies	16
6.2.4. Insert the Attachment Arm	16
6.2.5. Secure Position and Remove the Attachment Arm	17
6.2.6. Weld Seams	18
6.2.7. Position the Shaft Grounding Assembly	19
6.2.8. Secure the Shaft Grounding Assembly	20
6.3. Securing the Rope Guide	20
6.4. Installing the High-Frequency Drain	22
7. Installing and Removing the Shaft Grounding Rope	23
7.1. Inserting a Rope	24
7.2. Removing a Rope	27
8. Inspecting the Shaft Grounding Assembly	31
9. Glossary	32

THE POWER OF INNOVATION<sup>M</sup>

# 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, 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 the best-inclass products and services—Cutsforth is the Power of Innovation.

Cutsforth, Inc. started back in 1991 as a small company focused primarily on making replacement brush holders for generators and exciters. Today, after 25+ 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<sup>®</sup> Brush Condition Monitoring
- Cutsforth Shaft Grounding Systems
- Rotor Flux Monitoring
- Electro-Magnetic Interference Monitoring

### 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<sup>™</sup> integration, DCS logic, engineered drawings and much more. This further complements our turnkey monitoring system installations.



### 1.4. Cutsforth Electrical Contracting Services

In addition to our Field Service installation services, Cutsforth offers turn-key services including the electrical contractor scope of work as an additional service in select regions within the US. With this service offering, Cutsforth can greatly simplify the process of monitoring product installation from beginning to end.

THE POWER OF INNOVATION<sup>M</sup>

# 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

Under the copyright laws, this publication may not be reproduced or transmitted in any form, electronic or mechanical, including photocopying, recording, storing in an information retrieval system, or translating, in whole or in part, without the prior written consent of Cutsforth. Cutsforth respects the intellectual property of others, and we ask our users to do the same. Cutsforth software is protected by copyright and other intellectual property laws. Cutsforth software is only licensed to be run on the intended hardware for which it was purchased. Reproduction of software or written materials is prohibited unless Customer has obtained a license for that express purpose.

### 2.3. Patents

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

THE POWER OF INNOVATION<sup>M</sup>

# 3. Safety Information

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. Safety Conventions



### 3.2. 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.

THE POWER OF INNOVATION<sup>M</sup>



#### **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.



#### WARNING

Cutsforth recommends that workers do not change Shaft Contact Assembly (SCA) meter ropes while the generator is energized and/or operational. It is recommended that meter ropes be inspected and if necessary, changed during outages when the generator has been secured. Since the SCA is generally installed in relatively close proximity to the collector/brush gear (energized equipment) and or other rotating hazards in this area of the generator, it may pose a risk to workers that may include but are not limited to the following:

- Risk of entanglement or rotational injury attempting to remove/insert a meter rope.
- Risk of electrical shock.
- Risk of creating a short circuit between energized parts and ground.

These conditions and limitations are to be carefully considered at the time of installation. It is recommended that procedures and policies be implemented by the end user so as to realize the full function of the monitoring system but avoid potential hazards. These conditions generally do not apply to the Shaft Grounding Assembly (SGA) equipment installation.

# 4. The Cutsforth Shaft Grounding Assembly

This manual describes the installation of the Cutsforth Shaft Grounding Assembly.

If this system is replacing an OEM system, see the documentation that came with the OEM system for instructions on how to remove it.

### 4.1. Components

The following parts are included in the Shaft Grounding Assembly installation package:



 $\mathsf{T} \mathsf{H} \mathsf{E} \mathsf{P} \mathsf{O} \mathsf{W} \mathsf{E} \mathsf{R} \mathsf{O} \mathsf{F} \mathsf{I} \mathsf{N} \mathsf{N} \mathsf{O} \mathsf{V} \mathsf{A} \mathsf{T} \mathsf{I} \mathsf{O} \mathsf{N}^{\mathsf{M}}$ 

### 4.2. Required Tools

- Welder, TIG preferred
- 1/2 in hex wrench socket
- 9/16 in socket wrench
- 1/4 in hex key wrench
- 3/16 in hex key wrench
- Drill
- 5/16 in-18 tap
- Letter F drill bit
- Wire cutters
- Wire strippers
- Wire crimpers
- Tape, banding, and/or clamps

### 4.3. Installation Prerequisites

- The shaft must be fully coupled.
- The generator and turbine bearing caps in the load compartment must be fully installed.
- The condition of the shaft at the Shaft Grounding Assembly installation location must be documented by photo or video. If the shaft is still rotating, use a strobe to capture a video of the shaft condition. To facilitate a robust electrical contact for the shaft grounding system, make sure that the shaft surface is free of grooving, pitting, oxidation, and contamination.



#### **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.

#### CUTSFORTH THE POWER OF INNOVATION™

# 5. Installation Strategies

Determine the best component locations for your installation by applying the following strategies.

### 5.1. Positioning the Cutsforth Shaft Grounding Assembly

The Cutsforth Shaft Grounding Assembly is installed on the same portion of exposed shaft as the previous grounding equipment. The Shaft Grounding Assembly must be installed on the "uphill" side of the shaft rotation. Installing on this side of the shaft ensures that the rope does not bunch up or bind up inside the rope guide. The following illustration shows the correct orientation on the left.

Verify that there is adequate spacing on all dimensions of the SGA and/or SCA assemblies including the support arm and mounting point. Consider both the hot and cold operational conditions, and account for thermal expansion when installing in narrow clearance locations. Factors such as generator type may affect the clearances needed to account for thermal expansion.





### 5.2. Total HFD Wire Run Length Must Be Under 4 ft 6 in

To maximize the effectiveness of the High-Frequency Drain (HFD), the wire run length must be minimized. The 12 AWG, chemical resistance wire will run from the Rope Guide Assembly, to a resistor



encapsulated inside a heat sink, then to unit case ground. Cutsforth requires that the total run length of the HFD wiring (from the Rope Guide Assembly, to the heat sink, then to unit case ground) to be under 4 ft 6 in.

 $\mathsf{T} \mathsf{H} \mathsf{E} \mathsf{P} \mathsf{O} \mathsf{W} \mathsf{E} \mathsf{R} \mathsf{O} \mathsf{F} \mathsf{I} \mathsf{N} \mathsf{N} \mathsf{O} \mathsf{V} \mathsf{A} \mathsf{T} \mathsf{I} \mathsf{O} \mathsf{N}^{\mathsf{M}}$ 

## 6. Installation Procedure

Before installation, remove all original/OEM shaft grounding system equipment and clean the shaft of any surface defects, rust, and other contaminants. Review the documentation for the original/OEM shaft grounding system to plan its removal.

#### 6.1. Installation Overview

The following figure shows the Shaft Grounding Assembly installed. The installation consists of these main parts:

- Rope guide (A). The portion of the Shaft Grounding Assembly that lays over the shaft and holds the grounding and metering ropes.
- Attachment arm (B). A pipe that connects the Shaft Grounding Assembly to the unit housing. In the figure, the attachment arm is concealed by the High-Frequency Drain resistor (C), which is mounted on the attachment arm.
- High-Frequency Drain (C). An alternate ground path for high-frequency voltage spikes that includes a resistor wired in series. In the figure, it is mounted on the attachment arm.



 $\mathsf{T} \mathsf{H} \mathsf{E} \mathsf{P} \mathsf{O} \mathsf{W} \mathsf{E} \mathsf{R} \mathsf{O} \mathsf{F} \mathsf{I} \mathsf{N} \mathsf{N} \mathsf{O} \mathsf{V} \mathsf{A} \mathsf{T} \mathsf{I} \mathsf{O} \mathsf{N}^{\mathsf{M}}$ 

These are the main tasks in the installation procedure:

- 1. **Installing the attachment arm.** The length of the attachment arm varies with each installation, so you must temporarily place the Shaft Grounding Assembly on the shaft in order to measure the required length of the attachment arm. The attachment arm is then cut to size, inserted into the mounting hardware, and locked in position with set screws. The attachment arm and Shaft Grounding Assembly are then removed from the unit so that the attachment arm can be welded into the proper angled position. After welding, the entire Shaft Grounding Assembly is secured to the unit.
- 2. **Securing the rope guide.** The rope guide must be precisely positioned to match the contour of the shaft. This is accomplished by tightening bolts at the top of the rope guide.
- 3. Installing the High-Frequency Drain. THe HFD resistor must be mounted and wired.

The following procedures provide detailed installation instructions.

### 6.2. Installing the Attachment Arm

#### 6.2.1. Place the Shaft Grounding Assembly

- 1. Place the 1/16 in thick rope guide spacer (A) over the shaft (B) (the arrow indicates the shaft rotation direction).
- 2. Set the Shaft Grounding Assembly (C) on the rope guide spacer as shown the following figure. Orient the Shaft Grounding Assembly such that the mid-point of the rope guide is at the 12 o'clock position.
- 3. Temporarily attach the assembly to the shaft using hands, clamps, tape, banding, or a wooden frame.





#### 6.2.2. Attach the Connector Plate

The location of the connector plate (A) that mounts to the unit may vary, but it must be within 30 inches of the attachment arm connection point (B) on the Shaft Grounding Assembly.

- 1. Using the connector plate as a template, drill and tap four holes (5/16 in-18 x 3/4 in deep) for mounting to the unit.
- 2. Attach the connector plate to the mounting location using the provided 5/16 in-18 x 3/4 in hex bolts and Nordlock washers.





#### 6.2.3. Insert the Elbow Assemblies

Insert one elbow assembly into the connector plate and one into the adapter located on the Shaft Grounding Assembly. Position the elbow assemblies (A) so they face each other, as shown in the following figure.



#### 6.2.4. Insert the Attachment Arm

- 1. To determine the length of the attachment arm (stainless steel tubing), measure the exact distance between the flanges on each elbow assembly (A), as shown in the following figure.
- 2. Cut the attachment arm to the measured length and install it (B).





#### 6.2.5. Secure Position and Remove the Attachment Arm

- Using a 5/32 in hex key wrench, tighten the three fasteners around the end of each elbow half (A) to 100 in lbs. Use the 5/32 in hex key wrench to tighten the center pivot fastener of each elbow to 70 ft lbs. Do not yet tighten the set screws between the elbows and attachment arm pipe.
- 2. Remove the four hex bolts from the connector plate (B) and the two bolts from the attachment arm adapter connecting to the rope guide. Carefully remove the attachment arm assembly and Shaft Grounding Assembly, while taking care not to disturb the elbow assemblies, as this will cause misalignment.





 $\mathsf{T} \mathsf{H} \mathsf{E} \mathsf{P} \mathsf{O} \mathsf{W} \mathsf{E} \mathsf{R} \mathsf{O} \mathsf{F} \mathsf{I} \mathsf{N} \mathsf{N} \mathsf{O} \mathsf{V} \mathsf{A} \mathsf{T} \mathsf{I} \mathsf{O} \mathsf{N}^{\mathsf{M}}$ 

#### 6.2.6. Weld Seams

The attachment arm is made of 300 series stainless steel. TIG welding is the preferred welding method. If a weld filler is needed, AWS E/ER 308, 308L, or 347 are acceptable.



#### NOTE

The customer must provide a qualified welder to perform support arm welding.

#### To weld the attachment arm

1. Begin by tack or stitch welding at the marks. The goal is a "stitch" or "fuse" weld. No additional welding material needs to be added at this time. The arm joints simply need to be locked in place by the tacks.



#### CAUTION

If the tacking step is overlooked and the welder commences to weld the seam, the attachment arm positioning will be compromised, resulting in a distorted arm, which is unusable and must be replaced.

2. After tack welding, proceed to weld all of the seams as indicated with the red lines shown in the illustration below. Weld both ends and follow accepted welding practices to minimize distortions that would compromise proper alignments.



3. Return the fully welded arm to the Cutsforth technician for final assembly on the generator.

#### 6.2.7. Position the Shaft Grounding Assembly

- 1. After assembling the attachment arm, place the Shaft Grounding Assembly back onto the shaft, over the rope guide spacer.
- 2. Connect the attachment arm to the Shaft Grounding Assembly by tightening the two screws (A) shown in the following figure. Torque to 110 in lbs.
- Make any needed fine-tuning adjustments to the orientation to the Shaft Grounding Assembly before locking the rope guide ball and socket joint in place by tightening the three 1/4 in-28 socket head cap screws (B) shown in the following figure. Tighten these bolts by first getting each one snug, then torquing each bolt to 110 in lbs.

#### 6.2.8. Secure the Shaft Grounding Assembly

- 1. Check the gap between the shaft and the contact points on the rope guide to make sure there are no misalignments.
- 2. Torque all four of the 5/16 in-18 x 3/4 in hex bolts (A) with Nordlock washers to 240 in lbs.



### 6.3. Securing the Rope Guide

- 1. Adjust each rope guide section so that the contact points (A) are touching the 1/16 in rope guide spacer.
- 2. Tighten all the 5/16 in-18 x 5/8 in bolts (B) on the rope guide starting closest to the attachment arm side of the assembly, and then work around from there. Torque all the bolts to 220 in lbs.

#### CUTSFORTH THE POWER OF INNOVATION

3. When all rope guide bolts are torqued and the rope guide is secured, remove the rope guide spacer.



### 6.4. Installing the High-Frequency Drain

This procedure describes how to install the High-Frequency Drain. The purpose of the High-Frequency Drain is to combat the effects of impedance on the ground wire. The High-Frequency Drain does this by dissipating the high-frequency transient voltage spikes through a short ground run with an inline 1  $\Omega$  resistor.

#### To install the High-Frequency Drain

- 1. Find a structure to which the resistor heat sink can be secured. The following example shows the resistor heat sink secured to the attachment arm connector pipe (A).
- Trim a short section of the 12 AWG HFD wire to run from one end of the resistor to the rope guide (B). Connect it to the rope guide assembly using the supplied female disconnect terminal.
- 3. Trim another section of the 12 AWG HFD wire to run from the other end of the resistor to unit case ground (C).



# 7. Installing and Removing the Shaft Grounding Rope

This topic describes the installation and removal of the Shaft Grounding Rope.

The ground rope (left) is connected to the 8 AWG ground conductor.



0

When changing ropes online, always have one rope installed in the Rope Guide Assembly to maintain proper ground.

In the following figure, the bold paths show the flow of ground current depending on the ropes installed.



NOTE





Both ropes installed

Meter rope only

Ground rope only

Document #: EZDP-2035 Rev G

THE POWER OF INNOVATION<sup>m</sup>

## 7.1. Inserting a Rope

1. Insert the rope into the rope guide (A), as shown in the following figure.



2. With the rope fully inserted into the rope guide, push down on the rope grip (**B**) until it is fully seated in the Rope Guide Assembly (**C**).











 $\mathsf{T} \mathsf{H} \mathsf{E} \mathsf{P} \mathsf{O} \mathsf{W} \mathsf{E} \mathsf{R} \mathsf{O} \mathsf{F} \mathsf{I} \mathsf{N} \mathsf{N} \mathsf{O} \mathsf{V} \mathsf{A} \mathsf{T} \mathsf{I} \mathsf{O} \mathsf{N}^{\scriptscriptstyle \mathsf{M}}$ 

## 7.2. Removing a Rope

1. Lift the rope grip by the handle tab (A), and then pull the rope away from the shaft (B).









- $\mathsf{T} \ \mathsf{H} \ \mathsf{E} \quad \mathsf{P} \ \mathsf{O} \ \mathsf{W} \ \mathsf{E} \ \mathsf{R} \quad \mathsf{O} \ \mathsf{F} \quad \mathsf{I} \ \mathsf{N} \ \mathsf{N} \ \mathsf{O} \ \mathsf{V} \ \mathsf{A} \ \mathsf{T} \ \mathsf{I} \ \mathsf{O} \ \mathsf{N}^{\scriptscriptstyle\mathsf{M}}$ 
  - 2. Continue pulling the rope away from the Rope Guide Assembly **(C)**, while maintaining control of the rope until it has been completely removed.



THE POWER OF INNOVATION<sup>m</sup>

# 8. Inspecting the Shaft Grounding Assembly

To ensure that the Shaft Grounding Assembly is in proper working condition, make the following inspections frequently:

- · Check for any cracking or breakage of components
- When installing or removing the rope, check the "snap in" pressure .
- Confirm that the rope guide is not contacting the shaft. There should be approximately 1/16 in between rope guide and the face of the shaft.
- Inspect the integrity of the rope guide and attachment arms.
- Inspect the shaft condition for any visible signs of wear, pitting, grooving, contaminants, and so forth.
- Inspect ropes for wear and contaminants.
- Inspect clearances and tightness of SGA/SCA arms to ensure there is no loosening over time, which could result in rubs and/or interference from thermal expansion.

THE POWER OF INNOVATION<sup>m</sup>

# 9. Glossary

attenuation	The reduction of the amplitude of a signal due to excessive cable length.
AWG	American Wire Gauge
FEP	Fluorinated Ethylene Propylene (high-temperature cable jacket material)
ground conductor	An 8 AWG ground conductor that runs from the Shaft Grounding Assembly to the junction box, then to unit case ground.
ground current	The electrical current between the shaft and the unit case ground through the ground conductor.
ground rope	The left rope in the shaft grounding assembly, which provides the primary path to unit case ground through the 8 AWG ground conductor.
impedance	The resistance to change in the current of a circuit.
LOTO	Lock-out, tag-out
meter rope	The right rope in the shaft grounding assembly, which provides a shaft contact point at which shaft voltage readings are taken. It also provides a secondary path to unit case ground through the High-Frequency Drain.
Shaft Contact Assembly (SCA)	A Cutsforth product designed to provide a secondary shaft contact point at which shaft voltage can be measured.
Shaft Grounding Assembly (SGA)	A Cutsforth product designed to provide a best-in-class ground connection, as well as a shaft contact point at which shaft voltage can be measured.
shaft voltage	The voltage potential between the shaft and the unit case ground as measured by the metering rope.
signal cable	A shielded, twisted-pair cable that carries voltage signals from the Shaft Grounding Assembly to the junction box and the Assurance Monitoring System.
unit	The equipment being monitored by the Cutsforth monitoring system.



unit case ground

The lower half of the turbine case, generator case, or coupler case near the Shaft Grounding Assembly to which the shaft can be grounded.