

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with these instructions will result in voiding of the product warranty and may result in personal injury and/or property damage.

WARNING

THIS SYSTEM USES UV-C LIGHT SOURCES THAT ARE INTEGRATED IN THE TIPS OF THE FAN'S AIRFOIL BLADES. INCORRECT INSTALLATION AND/ OR USAGE CAN CAUSE INJURY. NEVER LOOK DIRECTLY INTO UV-C LIGHT SOURCES.

DC-5 overhead fans with Northern Light[®] technology combine engineered air movement with the air cleaning benefit of upper-room UV-C lighting making them the right selection for inactivating airborne pathogens. UV-C has been used for decades and the addition of air movement has been shown to increase UV-C's effectiveness in inactivating airborne pathogens in building environments.

Required Tools

The following tools will be required to complete the installation of every DC-NL fan. Additional tools may be required depending on the application and installation location of the fan.

- Socket Wrench with 7/16 in., 1/2 in., 9/16 in. Sockets
- 7/16 in., 1/2 in., and 9/16 in. Wrenches
- 4mm Hex Key
- 4mm Hex Bit Socket
- Adjustable Wrench
- Torque Wrench (up to 50 ft·lbf)
- Torque Wrench (up to 120 in·lbf)
- Drill and 7/16 in. Drill Bit

- Phillips Screwdriver
- T25 Screwdriver
- Level
- Impact Driver
- #2 Phillips Bit and Driver
- Cable Cutters
- Wire Strippers
- Gloves

NOTE: Model DC-NL fan components can weigh 40 lbs or greater depending upon the fan size and accessories that are provided. A suitable means for lifting the weight of the fan to the mounting point, such as a scissor lift, should be used for all DC-NL fan installations.

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Before You Begin

IMPORTANT: IT IS EXTREMELY IMPORTANT THAT YOU READ AND UNDERSTAND THIS INSTALLATION MANUAL IN ITS ENTIRETY BEFORE USING THE NORTHERN LIGHT® HVLS FAN. INCORRECT USE MAY CAUSE PERSONAL INJURY AS WELL AS DAMAGE TO INVENTORY OR PROPERTY. BEFORE INSTALLATION. IT IS IMPORTANT TO ENSURE THAT YOU UNDERSTAND ALL LOCAL REGULATIONS AND **RESTRICTIONS RELATED TO THE** INSTALLATION OF THE FAN AND UV-C LIGHTING COMPONENTS.

IMPORTANT: THE PURPOSE OF THIS INSTALLATION AND COMMISSIONING MANUAL IS TO ENSURE THAT THE NORTHERN LIGHT® HVLS FAN IS CORRECTLY INSTALLED AND THAT THE UV-C IRRADIATION LEVELS ARE CORRECTLY CALIBRATED AND BELOW THE LIMITS REQUIRED BY APPLICABLE NORMS AND REGULATIONS. IT IS THE SOLE **RESPONSIBILITY OF THE INSTALLER TO** ACTIVATE, CALIBRATE AND COMMISSION THE UV-C SYSTEM.

IMPORTANT: THE UV-C SYSTEM IN THE FAN SHOULD ONLY BE ACTIVATED BY A QUALIFIED INSTALLER WHO IS FAMILIAR WITH THE COMMISSIONING PROCESS FOR UV-C LIGHT SOURCES (REQUIRES A SPECIAL ACCESS CODE). IT IS THEREFORE THE SOLE **RESPONSIBILITY OF THE INSTALLER TO** ENSURE THAT PEOPLE ARE NOT EXPOSED TO EXCESSIVE UV-C IRRADIATION LEVELS WHEN USING THE INSTALLED SYSTEM. ONLY QUALIFIED INSTALLERS WITH THE CORRECT EQUIPMENT AND UNDERSTANDING OF UV-C **IRRADIATION ARE PERMITTED TO PERFORM** THE ASSESSMENT AND CONFIGURATION OF THE UV-C COMPONENTS IN THIS PRODUCT.

IMPORTANT: USE OF THE UV-C SYSTEM CAN RESULT IN DISCOLORATION AND DECOMPOSITION OF NON-UV-RESISTANT MATERIALS OVER TIME. ENSURE THAT THE FAN IS INSTALLED IN A LOCATION WHERE NO SUCH MATERIALS ARE PRESENT ABOVE THE FAN.

IMPORTANT: IT IS THE RESPONSIBILITY OF THE FACILITY OWNER AND OPERATOR TO ENSURE THAT THE IRRADIATION LEVEL OF THE INSTALLED NORTHERN LIGHT[®] HVLS FAN IS REVIEWED AND RECALIBRATED BY QUALIFIED MAINTENANCE PERSONNEL OR THE ORIGINAL INSTALLER IF CHANGES ARE MADE TO THE CEILING (INCLUDING NEW **CEILING-MOUNTED FIXTURES/FITTINGS/ INSTALLATIONS) AND/OR IF A NORTHERN** LIGHT[®] HVLS FAN IS MOVED TO ANOTHER LOCATION.



IMPORTANT: THIS MANUAL MUST BE STORED IN A PLACE WHERE IT IS EASILY AVAILABLE TO USERS, INSTALLERS AND OTHERS WHO MAY NEED TO FIND INFORMATION ABOUT THE USE OF NORTHERN LIGHT® HVLS FANS.

General Information

General Safety Information

IMPORTANT: To reduce the risk of fire, electric shock, or injury to persons, Model DS fans must be installed with a mount assembly, motor assembly and airfoils that are marked (on their cartons) to indicate suitability with this model. Other mounts, motors, and airfoils cannot be substituted.

Only qualified personnel should install this fan. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards. Other considerations may be required if high winds or seismic activity are present. If more information is needed, contact a licensed professional engineer before moving forward.

- Follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electric Code (CEC) in Canada.
- 2. The rotation of the impeller is critical. It must be free to rotate without striking or rubbing any stationary objects.
- 3. Motor must be securely and adequately grounded.
- 4. Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces or chemicals. Replace cord immediately if damaged.
- 5. Verify that the power source is compatible with the equipment.

WARNING

IT IS THE SOLE RESPONSIBILITY OF THE INSTALLER TO ENSURE THAT THE IRRADIATION LEVELS FROM THE INSTALLED NORTHERN LIGHT[®] HVLS FAN(S) IS/ARE MEASURED CORRECTLY BEFORE COMMISSIONING THE UV-C LIGHTING SYSTEM. IT IS THE FACILITY OWNER'S SOLE RESPONSIBILITY TO ENSURE THAT THE IRRADIATION LEVEL IS REVIEWED AND RECALIBRATED IF ALTERATIONS ARE MADE TO THE CEILING (INCLUDING NEW CEILING-MOUNTED FIXTURES/FITTINGS/INSTALLATIONS) AND/OR IF A NORTHERN LIGHT® HVLS FAN IS MOVED TO ANOTHER LOCATION. IN SUCH SCENARIOS, THE OWNER OF THE NORTHERN LIGHT SYSTEM MUST CONTACT QUALIFIED MAINTENANCE PERSONNEL OR THE ORIGINAL INSTALLER.

WARNING

TO AVOID THE RISK OF EXCESSIVE UV-C IRRADIATION LEVELS, ALWAYS ENSURE THAT THE SYSTEM IS DISCONNECTED FROM THE POWER SUPPLY AND IS SECURED WHEN WORKING IN PROXIMITY TO OR ABOVE THE FAN AND ITS AIRFOIL BLADES.

DANGER

RISK GROUP 3 ULTRA VIOLET PRODUCT. THESE LAMPS EMIT HIGH-POWER UV RADIATION THAT CAN CAUSE SEVERE INJURY TO SKIN AND EYES. AVOID EYE AND SKIN EXPOSURE TO UNSHIELDED PRODUCT. USE ONLY IN AN ENCLOSED ENVIRONMENT WHICH SHIELDS USERS FROM THE RADIATION.

WARNING

To reduce the risk of fire, electric shock, or injury to persons, observe the following:

- 1. Use this unit only in the manner intended by the manufacturer. If you have questions, contact the manufacturer.
- 2. Before servicing or cleaning unit, switch power off at service panel and lock the service disconnecting means to prevent power from being switched on accidentally. When the service disconnecting means cannot be locked, securely fasten a prominent warning device, such as a tag, to the service panel.

WARNING

To reduce the risk of fire, electric shock, or injury to persons, observe the following:

- 1. Installation work and electrical wiring must be done by qualified person(s) in accordance with all applicable codes and standards, including fire rated construction.
- 2. When cutting or drilling into wall or ceiling, do not damage electrical wiring and other hidden utilities.

WARNING

This appliance can be used by children aged from 8 years and above and persons with reduced physical, sensory or mental capabilities or lack of experience and knowledge if they have been given supervision or instruction concerning use of the appliance in a safe way and understand the hazards involved. Children shall not play with the appliance. Cleaning and user maintenance shall not be made by children without supervision.

DANGER

Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.

CAUTION

When servicing the fan, motor may be hot enough to cause pain or injury. Allow motor to cool before servicing.

CAUTION

Precaution should be taken in explosive atmospheres.

AVERTISSEMENT

Pour réduire le risque d'incendie, de choc électrique ou de blessure corporelle, respecter ce qui suit :

- 1. Utiliser cet appareil exclusivement comme prévu par le fabricant. En cas de questions, communiquer avec le fabricant.
- Avant tout entretien ou nettoyage de l'appareil, couper l'alimentation sur le tableau de commande et verrouiller le dispositif de sectionnement pour empêcher toute mise sous tension accidentelle. Si le dispositif de sectionnement ne peut pas être verrouillé, attacher un moyen de mise en garde bien visible, tel qu'un panonceau, au tableau de commande.

AVERTISSEMENT

Pour réduire le risque d'incendie, de choc électrique ou de blessure corporelle, respecter ce qui suit :

- La pose et le câblage électrique doivent être effectués par des personnes qualifiées en conformité avec les codes et normes en vigueur, y compris pour la résistance au feu du bâtiment.
- 2. Lors de la découpe ou du perçage de murs ou plafonds, ne pas endommager les câbles électriques et autres conduites masquées.

AVERTISSEMENT

Cet appareil peut être utilisé par des enfants âgés de 8 ans et plus et par des personnes aux capacités physiques, sensorielles ou mentales réduites ou qui manquent d'expérience et de connaissances s'ils sont surveillés ou ont reçu des instructions concernant l'utilisation sécuritaire de l'appareil et comprennent les risques encourus. Les enfants ne doivent pas jouer avec l'appareil. Le nettoyage et l'entretien par l'utilisateur ne doivent pas être effectués par des enfants sans surveillance.

DANGER

Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.

ATTENTION

Lors de toute intervention sur la soufflante, le moteur peut être suffisamment chaud pour provoquer une douleur voire une blessure. Laisser le moteur refroidir avant toute maintenance.

ATTENTION

Faire preuve de précaution dans les atmosphères explosives.

IMPORTANT: Check for transport damage immediately upon receiving the product. This system uses light sources that contain mercury, but it is unlikely that a broken light source will affect your health if identified and disposed of in a timely fashion. If a light source breaks, the room must be ventilated for a minimum of 30 minutes before the broken components are removed. Wear gloves and place the broken parts in a sealed plastic bag to deposit at your local recycling station. Do not use a vacuum cleaner.

Receiving

Upon receiving the product, check to ensure all items are accounted for by referencing the delivery receipt or packing list. Inspect each crate or carton for shipping damage before accepting delivery. Alert the carrier of any damage detected. The customer will note damage (or shortage of items) on the delivery receipt and all copies of the bill of lading which is countersigned by the delivering carrier. If damaged, contact your local representative immediately. Any physical damage to the unit after acceptance is not the responsibility of the manufacturer.

Unpacking

Verify that all required parts and the correct quantity of each item have been received using the component list on pages 7-8. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts. Sometimes it is not possible that all items for the unit be shipped together due to availability of transportation and truck space. Confirmation of shipment(s) must be limited to only items on the bill of lading.

Storage

Fans are protected against damage during shipment. If the unit cannot be installed and operated immediately, precautions need to be taken to prevent deterioration of the unit during storage. The user assumes responsibility of the fan and accessories while in storage. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user.

Indoor - The ideal environment for the storage of fans and accessories is indoors, above grade, in a low humidity atmosphere that is sealed to prevent the entry of blowing dust, rain or snow. Temperatures should be evenly maintained between 30° to 110°F (-1° to 43°C). Wide temperature swings may cause condensation and "sweating" of metal parts. All accessories must be stored indoors in a clean, dry atmosphere.

Remove any accumulations of dirt, water, ice or snow and wipe dry before moving to indoor storage. To avoid "sweating" of metal parts, allow cold parts to reach room temperature. To dry parts and packages, use a portable electric heater to get rid of any moisture build up. Leave coverings loose to permit air circulation and to allow for periodic inspection. The unit should be stored at least 3-1/2 in. (89 mm) off the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Aisles between parts and along all walls should be provided to permit air circulation and space for inspection.

Inspection and Maintenance During Storage

While in storage, inspect fans once per month. Keep a record of inspection and maintenance performed.

If moisture or dirt accumulations are found on parts, the source should be located and eliminated. If paint deterioration begins, consideration should be given to touch-up or repainting. Fans with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventive should be restored to good condition promptly if signs of rust occur. Immediately remove the original rust preventive coating with petroleum solvent and clean with lint free cloths. Polish any remaining rust from surface with crocus cloth or fine emery paper and oil. Do not destroy the continuity of the surfaces. Thoroughly wipe clean with Tectyll[®] 506 (Ashland Inc.) or the equivalent. For hard to reach internal surfaces or for occasional use, consider using Tectyll[®] 511M Rust Preventive, WD-40l[®] or the equivalent.

Removing from Storage

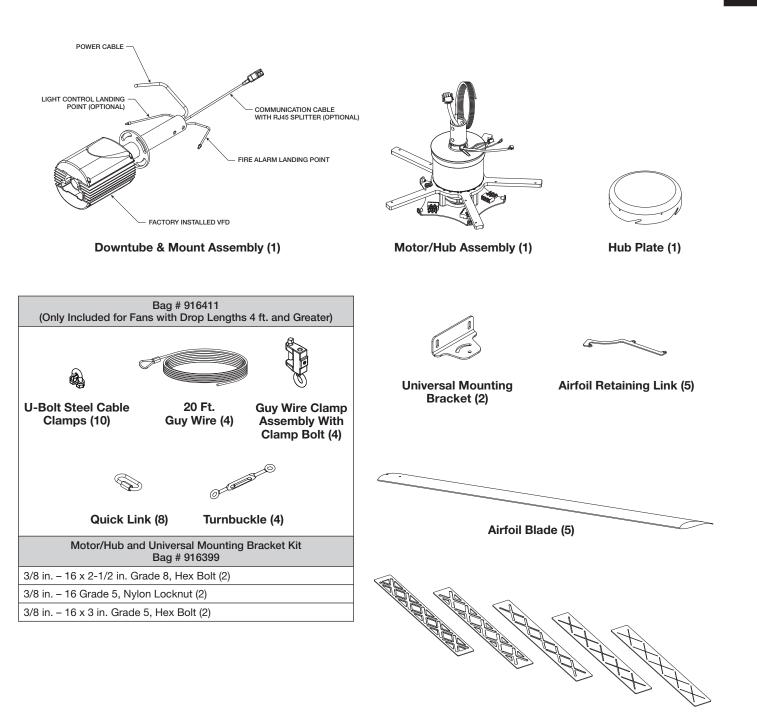
As fans are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion until the fan equipment goes into operation.

Fan Components

Verify that all of the following parts and hardware have been received prior to beginning installation. Contact your local representative or the manufacturer if replacement parts are required.

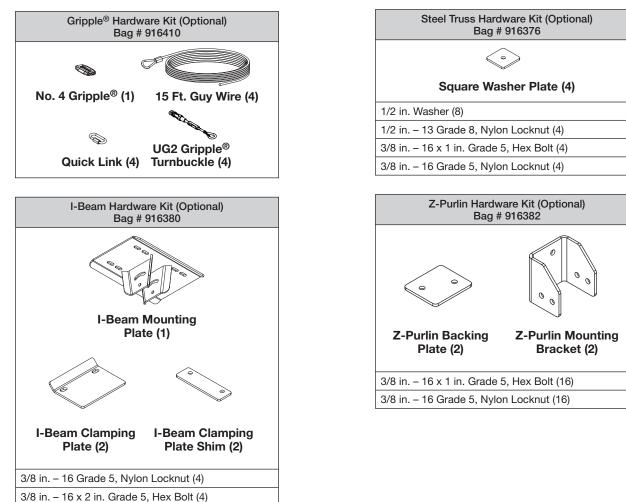
NOTE: Additional parts (provided by others) may be required to complete the fan installation, including additional wiring, steel angle or Unistrut[®] channel, and hardware for connecting the fan mount to the building structure.

NOTE: Hardware quantities listed below indicate what is required to complete installation. Hardware kits may include extra fasteners as a convenience.



UV-C Irradiation Dampers (5 sets of 5, 25 total)

Optional Fan Components



Pre-Installation Checks

IMPORTANT: Consult all applicable national, state and local codes to ensure that all necessary code requirements are met. It is the sole responsibility of the installer to ensure compliance with applicable codes.

Prior to installing the fan, perform each of the following checks:

- 1. Verify that fan components are undamaged. Do not install or operate any damaged fan components, fans, or fan accessories. Failure to comply with this instruction may result in property damage, personal injury and/or death.
- 2. Verify that the fan is to be installed in a location where the airfoils will be a minimum of 10 ft. above the finished floor with a minimum of 3 ft. of clearance to any obstructions.
- 3. Verify that the fan is to be installed in a location where the center of the fan is a minimum of 1.5 fan diameters away from building walls and corners.
- 4. For best performance, the fan must be installed with a two fan diameter minimum clearance to radiant heaters and HVAC system discharges or intakes.
- 5. Check that the fan will not be mounted in a location near overhead doors or other building openings where gusts of wind may occur. Fan should not be installed or operated in locations where wind is present.
- 6. If the building is equipped with a fire sprinkler system, verify that the placement of the fan will not interfere with correct sprinkler operation and that the fan installation complies with all national, state and local codes. For NFPA 13 compliance, fan must be installed in the center of four adjacent sprinklers with at least 3 ft. of vertical clearance between the fan and sprinkler deflectors. Fan must also be interlocked to shut down upon receiving a waterflow signal from the building's alarm system.
- 7. Check to see if the intended placement of the fan is directly below any building lights or skylights. If possible, avoid installing fan directly below a light source to prevent a strobing effect that can be caused by fan rotation.
- 8. If the building has a mezzanine or other elevated spaces that may be occupied by people, verify that no component of the fan can be reached from the highest level or deck. The fan must be positioned so that the tips of the airfoils are a minimum of 3 ft. away from the furthest point that a person could reach or otherwise come in contact, to prevent injury.

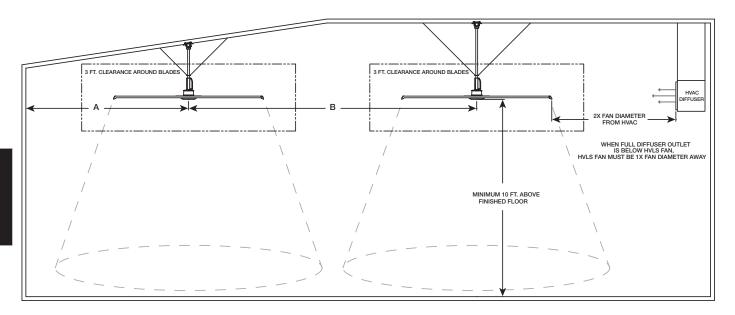
- 9. If the fan is to be mounted in an area where materials or equipment may be elevated into its path, ensure that the floor is marked or painted to alert personnel of the overhead location of the fan(s).
- 10. Before installation, it is important to verify that the mounting surface will bear the operating weight and maximum torque (twisting force) of the unit. The Structural Engineer of Record (SEOR) must perform a thorough evaluation of the mounting structure and determine all final mounting requirements before the fan is installed. It is the sole responsibility of the installer to ensure that the mounting structure and fan installation method are adequate for safe operation of the fan.

DC-5-NL Nominal Fan Size (ft.)	*Max. Fan Weight (Ibs)	Max Torque (ft·lbf)
7	116	13.8
10	130	14.0
14	144	14.1
16	157	14.3

*Maximum weight is shown in pounds and includes all available options, actual fan weight may be less.

- 11. To reduce the risk of reflected irradiation that exceeds acceptable levels, make sure that there are no highly reflective surfaces near the top of the fan's airfoil blades. These include, for example, aluminum, reflective lamps, polished steel surfaces, etc. A complete irradiation assessment is required before commissioning the system.
- 12. Inspect the airfoil blade packaging before handling the airfoil blades to ensure that all UV-C light sources are intact. If there is a risk or suspicion that a light source is broken or otherwise damaged, the light source should be inspected for damage while wearing gloves. Ensure that there is adequate ventilation until you have confirmed that they are undamaged. If in doubt, replace the light sources.
- 13. Installation and maintenance should only be performed by qualified personnel who are familiar with local regulations and are experienced with this type of equipment.

Minimum Spacing Requirements



	Minimum Spacing Fr	om Center of Fan (ft.)
DC-5-NL Nominal Fan Size (ft.)	A	В
7	10.5	21
10	15	30
14	21	42
16	25	50

Mounting Installation

DANGER

Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.

DANGER

Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.

The following mounting installations are covered in this manual. Identify the supplied mounting kit (page 7-8), then locate the appropriate installation instructions within this manual.

- I-Beam Mounting Kit (page 11)
- Steel Truss Mounting Kit (page 12)
- Wood Beam Mounting Kit (page 13)
- Z-Purlin Mounting Kit (page 14)
- Unistrut[®] Mounting Kit (by others, page 15)

I-Beam Mounting Kit (For Flanges up to 7.4 in. Wide)

IMPORTANT: Structural Engineer of Record (SEOR) must perform thorough evaluation of mounting structure and determine final mounting requirements before fan is installed. Manufacturer is not liable for any problems that arise as the result of insufficient structure, including (but not limited to) vibration, noise, or safety hazards. Product warranty will be voided at manufacturer's discretion if structure is deemed insufficient.

Installations must comply with the following requirements at a minimum, but SEOR may require more stringent specifications at their discretion:

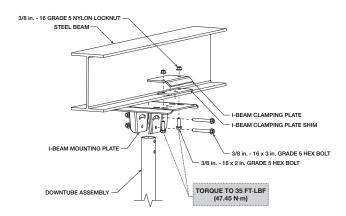
- Do not install HVLS fans on fabricated I-beams.
- □ HVLS fans should only be installed on I-beams that are part of the existing building structure.
- □ I-beam must have a minimum flange width of 5 inch and a minimum flange thickness of 1/2 inch.
- Do not weld HVLS fans to I-beams.
- Do not use I-beam mounting kit on any other type of structure (steel trusses, steel angles, etc.).

Components required from Bag # 916380 and 916399:

- I-Beam Mounting Plate (1)
- I-Beam Clamping Plate (2)
- I-Beam Clamping Plate Shim (2)
- 3/8 in. 16 x 2 in. Grade 5 Hex Bolt (4)
- 3/8 in. 16 x 3 in. Grade 5 Hex Bolt (2)
- 3/8 in. 16 Grade 5 Nylon Locknut (6)

Hardware/Tools Needed (Not Included):

- Torque Wrench
- 9/16 in. Socket and Ratchet
- 9/16 in. Wrench
- Attach I-beam mounting plate to the downtube assembly using supplied (2) 3/8 in. – 16 x 3 in. grade 5 hex bolts and (2) 3/8 in. – 16 grade 5 nylon locknuts. Hand tighten hardware until the I-beam mounting plate is securely attached to the downtube but can still be pivoted from side to side (approximately 1/4 in. of the bolt threads exposed below the nylon locknuts).
- 2. Using appropriate lifting equipment, raise the downtube and mount assembly until the I-beam mounting plate is positioned on the bottom of the I-beam.
- 3. Using the I-beam mounting plate as a guide, identify the appropriate set of mounting slots to use for installation. The I-beam mounting plate can accommodate I-beams with a flange width up to 7.4 in. and a web thickness up to 3/4 in.
- 4. Attach (1) I-beam clamping plate shim and (1) I-beam clamping plate to the I-beam mounting plate using (2) 3/8 in. – 16 x 2 in. grade 5 hex bolts, and (2) 3/8 in. – 16 grade 5 nylon locknuts. Hook the I-beam clamping plate onto one side of the I-beam and tighten hardware until the I-beam mounting plate is snug against the beam but can still be moved (approximately 1/4 in. of the bolt threads exposed beyond the nylon locknut).



- 5. Attach the opposing I-beam clamp plate shim and I-beam clamp plate on to the I-beam mounting plate and I-beam. Hand tighten hardware.
- Center the I-beam mounting plate under the I-beam. Ensure the I-beam clamp plates have maximum engagement on both sides and tighten hardware evenly to 35 ft·lbf (47.45 N·m).
- 7. Turn to page 16 to continue with Motor/Hub to Downtube Installation.

Steel Truss Mounting Kit

IMPORTANT: Structural Engineer of Record (SEOR) must perform thorough evaluation of mounting structure and determine final mounting requirements before fan is installed. Manufacturer is not liable for any problems that arise as the result of insufficient structure, including (but not limited to) vibration, noise, or safety hazards. Product warranty will be voided at manufacturer's discretion if structure is deemed insufficient.

Installations must comply with the following requirements at a minimum, but SEOR may require more stringent specifications at their discretion:

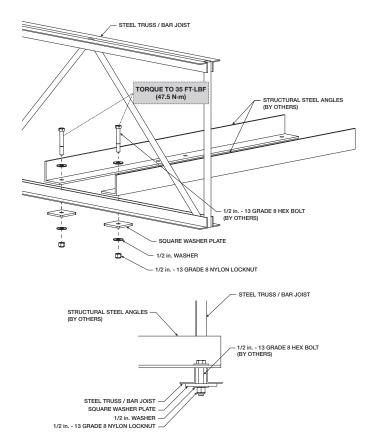
- Do not install HVLS fans on a single steel truss. Structural steel angles must be used to span a minimum of 2 trusses.
- □ Steel trusses must have a minimum chord width of 5 inches.
- Structural steel angle span lengths must not exceed 8 feet. For span lengths up to 8 feet, a minimum of 2 structural steel angles are required.
- □ Size of structural steel angles must be specified by a structural engineer. Angles must be a minimum of 4 x 4 x 1/4 inch thick. Larger angles may be required for span lengths up to 8 feet. Angles shall be sufficiently stiff to avoid harmonic resonance excitation during fan operation (120 RPM; +/- 20%).

Components required from Bag # 916399 and 916376:

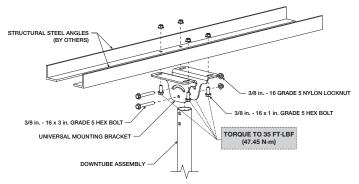
- Universal Mounting Bracket (2)
- Square Washer Plate (4)
- 3/8 in. 16 x 3 in. Grade 5 Hex Bolt (2)
- 3/8 in. 16 x 1 in. Grade 5 Hex Bolt (4)
- 3/8 in. 16 Grade 5 Nylon Locknut (6)
- 1/2 in. 13 Grade 8 Nylon Locknut (4)

Hardware/Tools Needed (Not Included):

- Structural Steel Angles (2)
- 1/2 in. 13 Grade 8 Hex Bolt (4), length determined by truss and steel angle material thickness
- Torque Wrench
- 9/16 in. Socket and Wrench
- 9/16 in. Wrench
- Drill and 7/16 in. Drill Bit
- 1. Size structural steel angles (by others) to fit within steel trusses/bar joists. Size of angle to be determined by structural engineer.
- Mount structural steel angles to steel trusses/ bar joists using (4) 1/2 in. – 13, grade 8 hex bolts (by others to accommodate varying material thickness), and supplied (4) square washer plates, and (4) 1/2 in. – 13 nylon locknuts. Note that the hardware should be installed through the gap in the bottom chord of the steel trusses/bar joists (see drawing below). Torque hardware to 35 ft·lbf (47.45 N·m).



 Attach universal mounting brackets to the downtube assembly using supplied (2) 3/8 in. – 16 x 3 in. grade 5 hex bolts and (2) 3/8 in. – 16 grade 5 nylon locknuts. Hand tighten hardware until the universal mounting brackets are securely attached to the downtube but can still be pivoted from side to side (approximately 1/4 in. of the bolt threads exposed below the nylon locknuts).



- 4. Locate desired fan hanging location. Using the universal mounting brackets as a template, mark and drill (4) 7/16 in. holes in structural steel angles.
- Bolt universal mounting brackets into place using supplied (4) 3/8 in. – 16 x 1 in. grade 5 hex bolts, and (4) 3/8 in. – 16 grade 5 nylon locknuts. Torque to 35 ft·lbf (47.45 N·m).
- 6. Turn to page 16 to continue with Motor/Hub to Downtube Installation.

Wood Beam Mounting Kit (For Beams 6 in. Wide or Greater)

IMPORTANT: Structural Engineer of Record (SEOR) must perform thorough evaluation of mounting structure and determine final mounting requirements before fan is installed. Manufacturer is not liable for any problems that arise as the result of insufficient structure, including (but not limited to) vibration, noise, or safety hazards. Product warranty will be voided at manufacturer's discretion if structure is deemed insufficient.

Installations must comply with the following requirements at a minimum, but SEOR may require more stringent specifications at their discretion:

Do not use the wood beam mounting kit on wood beams that are less than 4-1/2 inch wide. For thinner wood beams, span two or more beams using structural steel angles or unistrut. Refer to steel truss or unistrut mounting kit instructions.

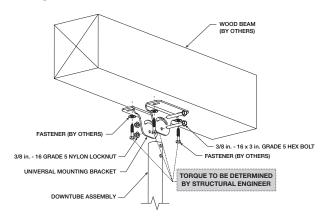
Components required from Bag # 916399:

- Universal Mounting Bracket (2)
- 3/8 in. 16 x 3 in. Grade 5 Hex Bolt (2)
- 3/8 in. 16 Grade 5 Nylon Locknut (2)

Hardware/Tools Needed (Not Included):

- Wood Beam Fasteners (Max Width Diameter 3/8 in.), Specified By Others
- Torque Wrench
- 9/16 in. Socket and Wrench
- 9/16 in. Wrench
- Drill and Appropriate Drill Bit
- Attach universal mounting brackets to the downtube assembly using supplied (2) 3/8 in. – 16 x 3 in. grade 5 hex bolts and (2) 3/8 in. – 16 grade 5 nylon locknuts. Hand tighten hardware until the universal mounting brackets are securely attached to the downtube but can still be pivoted from side to side (approximately 1/4 in. of the bolt threads exposed beyond the nylon locknuts).
- Locate desired fan hanging location. Using the supplied universal mounting brackets as a template, mark and drill (4) holes in the wood beam. Note that the universal mounting brackets can accommodate beam widths 6 in. or greater.

 Attach universal mounting brackets to wood beam using appropriate wood beam fasteners (by others to accommodate varying material properties).
 Wood beam fasteners to be specified by structural engineer.



- 4. Torque wood beam fasteners to value determined by structural engineer.
- 5. Turn to page 16 to continue with Motor/Hub to Downtube Installation.

Z-Purlin Mounting Kit

IMPORTANT: Structural Engineer of Record (SEOR) must perform thorough evaluation of mounting structure and determine final mounting requirements before fan is installed. Manufacturer is not liable for any problems that arise as the result of insufficient structure, including (but not limited to) vibration, noise, or safety hazards. Product warranty will be voided at manufacturer's discretion if structure is deemed insufficient.

Installations must comply with the following requirements at a minimum, but SEOR may require more stringent specifications at their discretion:

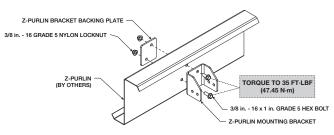
- Do not install HVLS fans on a single z-purlin. Structural steel angles must be used to span a minimum of 2 z-purlins.
- Z-purlins must have a minimum flange width of 2 inch and a minimum material thickness of 12 gauge steel.
- Structural steel angle span lengths must not exceed 8 feet. For span lengths up to 8 feet, a minimum of 2 structural steel angles are required.
- □ Size of structural steel angles must be specified by a structural engineer. Angles must be a minimum of 4 x 4 x 1/4 inch thick. Larger angles may be required for span lengths up to 8 feet. Angles shall be sufficiently stiff to avoid harmonic resonance excitation during fan operation (120 RPM; +/- 20%).

Components required from Bag # 916399 and 916382:

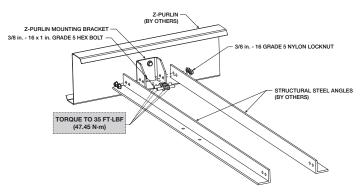
- Universal Mounting Bracket (2)
- Z-Purlin Backing Plate (2)
- Z-Purlin Mounting Bracket (2)
- 3/8 in. 16 x 3 in. Grade 5 Hex Bolt (2)
- 3/8 in. 16 x 1 in. Grade 5 Hex Bolt (16)
- 3/8 in. 16 Grade 5 Nylon Locknut (18)

Hardware/Tools Needed (Not Included):

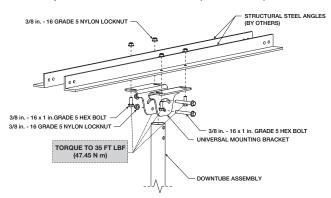
- Structural Steel Angles (2)
- Torque Wrench
- 9/16 in. Socket and Wrench
- 9/16 in. Wrench
- Drill and 7/16 in. Drill Bit
- 1. Locate desired fan hanging location. Using the supplied z-purlin mounting brackets as templates, mark and drill (2) 7/16 in. holes in each z-purlin.
- Mount z-purlin mounting brackets and backing plates using supplied (4) 3/8 in. – 16 x 1 in. grade 5 hex bolts, and (4) 3/8 in. – 16 grade 5 nylon locknuts. Torque hardware to 35 ft·lbf (47.45 N·m).



- Size structural steel angles (by others) to fit within z-purlins and installed z-purlin mounting brackets. Size of angle to be determined by structural engineer.
- Bolt structural steel angles in place using supplied (8) 3/8 in. – 16 x 1 in. grade 5 hex bolts, and (8) 3/8 in. – 16 grade 5 nylon locknuts. Torque hardware to 35 ft·lbf (47.45 N·m).



- Attach universal mounting brackets to the downtube assembly using supplied (2) 3/8 in. – 16 x 3 in. grade 5 hex bolts and (2) 3/8 in. – 16 grade 5 nylon locknuts. Hand tighten hardware until the universal mounting brackets are securely attached to the downtube but can still be pivoted from side to side (approximately 1/4 in. of the bolt threads exposed beyond the nylon locknuts).
- 6. Using the universal mounting brackets as a template, mark and drill (4) 7/16 in. holes in structural steel angles.
- Align the universal mounting brackets and bolt into place using (4) 3/8 in. – 16 x 1 in. grade 5 hex bolts, and (4) 3/8 in. – 16 grade 5 nylon locknuts. Torque hardware to 35 ft·lbf (47.45 N·m).



8. Turn to page 16 to continue with Motor/Hub to Downtube Installation.

Unistrut[®] Mounting Kit (By Others)

IMPORTANT: Structural Engineer of Record (SEOR) must perform thorough evaluation of mounting structure and determine final mounting requirements before fan is installed. Manufacturer is not liable for any problems that arise as the result of insufficient structure, including (but not limited to) vibration, noise, or safety hazards. Product warranty will be voided at manufacturer's discretion if structure is deemed insufficient.

Installations must comply with the following requirements at a minimum, but SEOR may require more stringent specifications at their discretion:

- Do not install Unistrut channels using Unistrut clamps. Unistrut channels must be directly fastened to the building structure with a threaded nut and bolt connection. Apply Loctite adhesive to all hardware connections.
- Do not hang or suspend Unistrut channels from threaded rod or other hanging hardware. Unistrut channels must rest on top of building structure and be directly fastened to the structure with a threaded nut and bolt connection. Apply Loctite adhesive to all hardware connections.
- Unistrut channel span lengths must not exceed 8 ft. For span lengths up to 8 ft., a minimum of 2 Unistrut channels are required.
- Size of Unistrut channels must be specified by a structural engineer. Unistrut channels must be a minimum of 1-5/8 x 1-5/8 in. with a minimum material thickness of 12 gauge steel. Unistrut channels shall be sufficiently stiff to avoid harmonic resonance excitation during fan operation (120 RPM; +/- 20%).

Components required from Bag # 916399:

- Universal Mounting Bracket (2)
- 3/8 in. 16 x 3 in. Grade 5 Hex Bolt (2)
- 3/8 in. 16 Grade 5 Nylon Locknut (2)
- Hardware/Tools Needed (Not Included):
 - Unistrut[®] Channels
 - Unistrut and Fan Installation Hardware
- Size Unistrut channels (by others) to span the required distance between structural members of the building. Size of Unistrut channels and appropriate installation hardware to be determined by structural engineer. Contact Unistrut customer support (www.unistrut.us) for product recommendations and detailed installation instructions for Unistrut products.
- 2. Install Unistrut channels per the manufacturer's recommendations.
- 3. Locate desired hanging location for the fan.

- 4. Attach universal mounting brackets to the downtube assembly using supplied (2) 3/8 in. 16 x 3 in. grade 5 hex bolts and (2) 3/8 in. 16 grade 5 nylon locknuts. Hand tighten hardware until the universal mounting brackets are securely attached to the downtube but can still be pivoted from side to side (approximately 1/4 in. of the bolt threads exposed beyond the nylon locknuts).
- Bolt universal mounting brackets to Unistrut channels with the appropriate hardware as identified by structural engineer. Torque to 35 ft·lbf (47.45 N·m).

Motor/Hub to Downtube Installation

Required components from Bag # 916399:

- Motor/Hub Assembly (1)
- 3/8 in. 16 x 2-1/2 in. Grade 8 Hex Bolt (2)

Hardware/Tools Needed (Not Included):

- 9/16 in. Socket
- Socket Wrench
- Torque Wrench
- Phillips Screwdriver
- Lifting Equipment
- Level
- Cribbing (optional)
- Awl (optional)

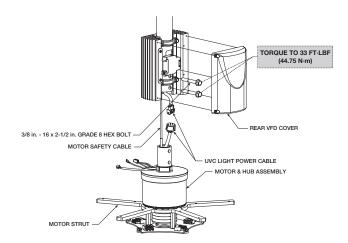
DANGER

Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.

DANGER

Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.

- 1. Using a scissor lift or other suitable lifting device, lift the motor/hub assembly by resting the motor struts on the lift structure or cribbing.
- Feed the safety retention cable that is attached to the motor/hub assembly up through the bottom of the downtube until the loose end of the safety cable is accessible at the top of the downtube. Pull the loose end of the safety retention cable from the top of the downtube until all of the slack is pulled through.
- 3. Connect the male UV-C light power plug (3 pin) in the motor/hub assembly to the corresponding female plug in the downtube.
- 4. Using a Phillips screwdriver, remove the rear VFD cover and set aside.
- 5. Carefully align the motor axle with the downtube opening, making sure that the wires protruding from the motor axle are on the same side as the circuit board of the VFD.



IMPORTANT: Motor/hub assembly must be installed so that the electrical cables protruding from the motor axle are on the same side as the circuit board of the VFD. The motor power, motor ground, and hall sensor cables are not long enough to reach the VFD circuit board from the rear side. If the cables are not properly routed to the front of the VFD, the motor must be uninstalled and rotated 180° so that the cables can be connected.

6. Slowly lift the motor/hub assembly until the motor axle is nested inside the downtube. Take care to align the motor axle holes with the downtube holes.

IMPORTANT: Do not allow safety cable or wiring to be crushed while lifting the motor/hub assembly into the downtube. Safety cable must be kept taut inside the downtube in order to prevent damage. If either the safety cable or the wiring are damaged during installation, contact your local rep or the manufacturer.

 Install the supplied (2) 3/8 in. – 16 x 2-1/2 in. grade 8 hex bolts into the locknuts attached to the downtube. Torque the bolts to a value of 33 ft·lbf (44.75 N·m).

NOTE: When leveling the fan, the level should be moved around the circumference of the downtube periodically to ensure that the fan is level.

 Place a level against the downtube and adjust the angle of the downtube until the fan is level. Tighten the hardware connecting the downtube to the mount and torque to 25 ft·lbf (33.90 N·m).



9. Reinstall the rear VFD cover.

Safety Retention Cable Installation

IMPORTANT: Do not put excessive tension on the safety retention cable during installation. The safety retention cable should be installed with a small amount of slack in the cable to ensure proper functioning. Do not allow the safety retention cable to come in contact with any sharp edges.

IMPORTANT: Failure to install the safety retention cable will result in voiding of the fan warranty.

Standard Steel Cable Clamp

The following instructions apply to standard fan installations. For fans that were supplied with optional Gripple[®] hardware, refer to the instructions on page 18.

Required components from Bag # 916411:

0.188 in. U-Bolt Steel Cable Clamp (2)

Hardware/Tools Needed (Not Included):

- Torque Wrench
- 7/16 in. Socket and Wrench
- Cable Cutters (optional)
- 1. From the top of the downtube, pull the safety retention cable until it is taut inside the downtube.
- 2. Wrap the loose end of the safety cable around the mounting structure. Do not allow the cable to come in contact with any sharp edges.
- 3. Align the loose end of the safety cable (referred to as the dead-end) with the length of cable that is wrapped around the mounting structure (referred to as the live-end).
- 4. Attach the dead-end of the safety cable to the live-

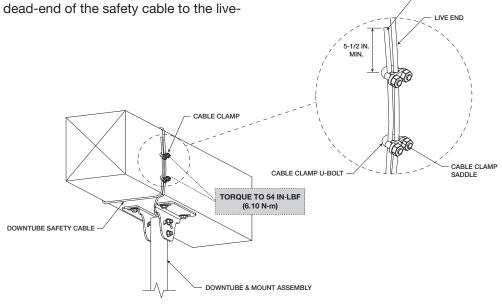
end using the supplied 0.188 in. U-bolt steel cable clamps. Loosely tighten the nuts on the steel cable clamps, leaving enough room for the safety cable to slide through the steel cable clamps.

IMPORTANT: The first steel cable clamp must be installed a minimum of 5-1/2 in. away from the deadend of the safety cable to ensure proper functioning.

IMPORTANT: Steel cable clamps are composed of two parts: the U-bolt and the saddle. Steel cable clamps must be installed with the U-bolt over the dead-end of the safety retention cable and the saddle over the live-end of the safety cable. Failure to install steel cable clamps in this manner may result in unsafe operating conditions. Refer to drawings for correct orientation.

- 5. Pull the dead-end of the safety cable through the steel cable clamps to tighten the cable. The cable should be pulled taut, leaving only a small amount of slack in the cable to ensure proper functioning.
- 6. Tighten the nuts on the steel cable clamps using a 7/16 in. socket and torgue to 54 in lbf (6.10 N·m), alternating between nuts until reaching proper torque.
- 7. Cut or organize excess safety cable to ensure it does not interfere with fan performance. Make sure to leave at least 5-1/2 in. of cable between the dead-end of the cable and the first steel cable clamp to ensure proper functioning.

DEAD END



Gripple[®] Hardware (Optional)

The following instructions apply to fans that were supplied with optional Gripple[®] hardware. For fans that were supplied with standard steel cable clamp hardware, refer to the instructions on page 17.

Required components from Bag # 916410:

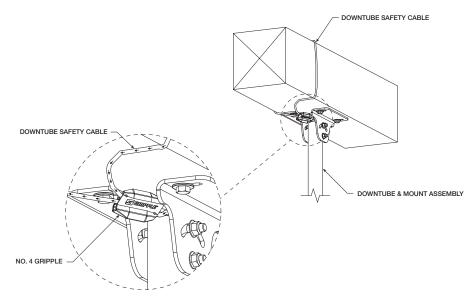
• No. 4 Gripple Connector (1)

Hardware/Tools Needed (Not Included):

- 1/16 in. Allen Wrench (optional)
- Cable Cutters (optional)
- 1. From the top of the downtube, pull the safety retention cable until the cable is taut inside the downtube.
- Insert the loose end of the safety cable into the No.
 4 Gripple connector. Note that the cable will only feed through the Gripple connector in one direction (marked on the Gripple connector with an arrow).
- 3. Slide the No. 4 Gripple connector down the safety cable until it is located near the opening at the top of the downtube.

- 4. Wrap the loose end of the safety cable around the mounting structure. Do not allow the cable to come in contact with any sharp edges.
- 5. Insert the loose end of the safety cable into the open hole of the No. 4 Gripple connector. Note that the cable will only feed through the Gripple connector in one direction (marked on the Gripple connector with an arrow).
- 6. Pull the loose end of the safety cable through the Gripple connector to tighten the cable. The cable should be pulled taut, leaving only a small amount of slack in the cable to ensure proper functioning.
- 7. Cut or organize excess safety cable to ensure it does not interfere with fan performance.

NOTE: If necessary, the safety cable can be loosened by inserting the long end of a 1/16 in. allen wrench into either of the pin holes on the No. 4 Gripple connector and pulling the cable in the opposite direction of the arrow marked on the Gripple connector.



Guy Wire Installation – Drop Lengths 4 ft. and Greater

NOTE: Guy wires are only supplied for fans with drop lengths equal to or greater than 4 feet. Fans with drop lengths up to 3 feet do not require guy wires.

IMPORTANT: Guy wires must be installed for drop lengths equal to or greater than 4 feet. Guy wires must be installed 45° to 60° from vertical to ensure proper functioning.

Standard Steel Cable Clamp

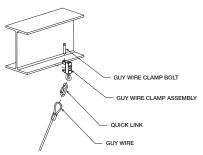
The following instructions apply to standard fan installations. For fans that were supplied with optional Gripple[®] hardware, refer to the instructions on page 20.

Components required from Bag # 916411:

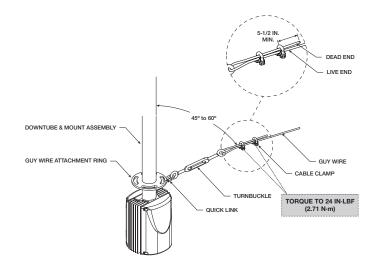
- Guy Wire Clamp Assembly (4)
- Guy Wire Clamp Bolt (4)
- Quick Link (8)
- 20 ft. Guy Wire (4)
- 0.094 in. U-Bolt Steel Cable Clamp (8)
- Turnbuckle (4)

Hardware/Tools Needed (Not Included):

- Level
- Torque Wrench
- 5/16 in. Socket and Wrench
- Adjustable Wrench
- Cable Cutters (optional)
- 1. Secure guy wire clamps to the building structure using the guy wire clamp bolts and an adjustable wrench. Attach guy wires to the eyelets on the guy wire clamp assemblies using the supplied quick links.



- 2. Insert the loose end of each guy wire through the eyebolt on a turnbuckle. Turn the guy wire back onto itself and align the loose end of the guy wire (referred to as the dead-end) with the length of guy wire that is attached to the building structure (referred to as the live-end).
- 3. Attach the dead-end of each guy wire to the liveend using (2) of the supplied 0.094 in. U-bolt steel cable clamps. Loosely tighten the nuts on the steel cable clamps, leaving enough room for the guy wire to slide through the steel cable clamps.



IMPORTANT: The first steel cable clamp must be installed a minimum of 5-1/2 in. away from the deadend of the guy wire to ensure proper functioning.

IMPORTANT: Steel cable clamps are composed of two parts: the U-bolt and the saddle. Steel cable clamps must be installed with the U-bolt over the dead-end of the guy wire and the saddle over the live-end of the guy wire. Failure to install steel cable clamps in this manner may result in unsafe operating conditions. Refer to drawings below for correct orientation.

- Attach all (4) turnbuckles to the guy wire attachment ring located on the downtube using (4) supplied quick links.
- 5. Pull the dead-end of each guy wire through the steel cable clamps until taut.
- Tighten the nuts on the steel cable clamps using a 5/16 in. socket and torque to 24 in·lbf (2.71 N·m), alternating between nuts until reaching proper torque.
- Place a level against the downtube and tighten all
 (4) turnbuckles by hand in a crisscross pattern until the guy wires are tight and the fan is level.

NOTE: When leveling the fan, place the level against the downtube in-between two neighboring guy wires to simplify the leveling process. The level should also be moved around the circumference of the downtube periodically to ensure that the fan is level in all directions.

8. Cut or organize excess guy wires to ensure that they do not interfere with fan performance. Make sure to leave at least 5-1/2 in. of wire between the dead-end of the guy wire and the first wire rope clip to ensure proper functioning.

Gripple[®] Hardware (Optional)

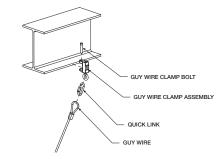
The following instructions apply to fans that were supplied with optional Gripple[®] hardware. For fans that were supplied with standard steel cable clamp hardware, refer to the instructions on page 19.

Components required from Bag # 916410:

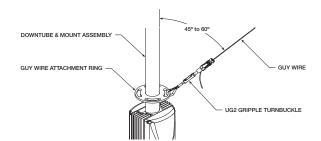
- Guy Wire Clamp Assembly (4)
- Guy Wire Clamp Bolt (4)
- Quick Link (4)
- 15 ft. Guy Wire (4)
- UG2 Gripple With Turnbuckle (4)

Hardware/Tools Needed (Not Included):

- Level
- Adjustable Wrench
- Cable Cutters (optional)
- 1. Secure guy wire clamps to the building structure using the guy wire clamp bolts. Attach guy wires to the eyelets on the guy wire clamp assemblies using the supplied quick links.



- Insert the loose end of each guy wire into the base of UG2 Gripple[®] turnbuckle until a length of wire is pushed through the side of the turnbuckle.
- Clip all (4) UG2 Gripple[®] turnbuckles to the guy wire attachment ring located on the downtube. Pull the loose end of each guy wire through the turnbuckles until each guy wire is taut.



4. Place a level against the downtube and tighten all(4) turnbuckles by hand in a crisscross pattern until the guy wires are tight and the fan is level.

NOTE: When leveling the fan, place the level against the downtube in-between two neighboring guy wires to simplify the leveling process. The level should also be moved around the circumference of the downtube periodically to ensure that the fan is level in all directions.

- 5. Tighten the set screw on each turnbuckle by twisting the plastic knob at the base of the turnbuckle.
- 6. Cut or organize excess guy wires to ensure that they do not interfere with fan performance.

NOTE: If necessary, the guy wires can be loosened by twisting the plastic knob at the base of the turnbuckle until it is loose enough to push the knob inwards and compress the spring-loaded plunger, allowing the cable to slide through the turnbuckle.

Airfoil Blade and Winglet Installation

IMPORTANT: Do not operate fans without the airfoil blades. Failure to comply with this warning will result in voiding of the product warranty and may result in permanent damage to the VFD and motor.

WARNING

To reduce the risk of personal injury, do not bend motor struts, airfoil blades, or airfoil retaining links when installing the airfoil blades, balancing the blades, or cleaning the fan. Damage to these components may result in unsafe operation of the fan, which can lead to property damage, personal injury or death. Contact your local representative or the factory if replacement parts are needed.

WARNING

To reduce the risk of personal injury, do not insert foreign objects in between rotating fan blades.

AVERTISSEMENT

Pour réduire le risque de blessure, ne pliez pas les entretoises moteurs, ailerons ou aile en conservant des liens lors de l'installation des aubes, équilibrez, ou nettoyer le ventilateur. Ces composants peuvent endommager en utilisation dangereuse du ventilateur, qui peut conduire à des dommages matériels, des blessures ou la mort. Ces composants peuvent endommager en utilisation dangereuse du ventilateur, qui peut conduire à des dommages matériels, des blessures ou la mort.

AVERTISSEMENT

Ces composants peuvent endommager en utilisation dangereuse du ventilateur, qui peut conduire à des dommages matériels, des blessures ou la mort.

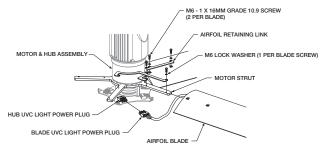
Components required from Bag # 916400:

- Airfoil Retaining Links (5)
- M6 1 x 16 mm Screws (10, Factory-Installed on • Fan Hub)
- M6 Lock Washers (10, Factory-Installed on Fan Hub)

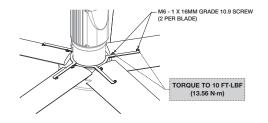
Hardware/Tools Needed (Not Included):

- 4 mm Hex Key
- 4 mm Hex Bit Socket
- Torque Wrench

- 1. Unscrew the (10) factory-installed M6 1 x 16 mm screws and (10) M6 lock washers from the fan hub. Set hardware aside.
- 2. Lift the first airfoil blade into place and slide over the motor strut. Repeat for all remaining airfoil blades. It might be necessary to use two people for this step.
- 3. With the airfoil blades in position on the motor struts, place an airfoil retaining link across the top side of two neighboring blades. Place a second airfoil retaining link across the top side of the next two neighboring blades so that the first and second retaining links overlap as shown in the drawing below. Install (2) M6 - 1 x 16 mm screws and (2) M6 lock washers in the blade where the retaining links overlap. Hand tighten hardware.
- 4. Connect the UV-C light power plug on each airfoil blade to the corresponding UV-C light power plug on the fan hub as shown in the drawing below. Note that light power plugs will only fit in one specific orientation. Do not force plugs.



5. Repeat steps 3-4 on remaining airfoil blades. Torque the (10) installed screws to 10 ft·lbf (13.56 N·m).



Hub Plate Installation

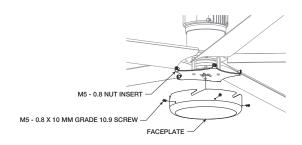
Components required from Bag # 916400:

- Hub Plate (1)
- M5 0.8 x 10 mm Screws (5))

Hardware/Tools Needed (Not Included):

- T25 Screwdriver
- 1. Lift hub plate into place and twist so that trailing edge of each airfoil blade rests in the cutouts on the hub plate.
- 2. Align (5) holes in the hub plate with the (5) nut inserts on the hub retention bracket.

- 3. Insert (1) M5 0.8 x 10 mm screw per hole and hand tighten to ensure all fasteners will engage the nut inserts.
- 4. Hand tighten fasteners using a T25 screwdriver.



Fire System Integration

Fire System Integration (Optional)

DANGER

Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.

DANGER

Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.

NOTE: The following instructions are only applicable to buildings that are equipped with a fire suppression system. If the building does not contain a fire suppression system, leave the crimp connector on the fire alarm landing point (located at the top of the downtube) and continue with the rest of the installation.

IMPORTANT: HVLS fans must be installed with the supplied, normally-closed PAM-1 fire alarm relay or an equivalent electromechanical or reed relay for proper function of the fire alarm emergency stop feature. Solid state relays or other digital switching relays cannot be used.

IMPORTANT: The fire alarm relay should only be installed by qualified personnel who are familiar with the operation of building fire suppression systems. It is the sole responsibility of the installer to ensure correct operation of the fire alarm relay in the event of a fire emergency in the building.

Included Component:

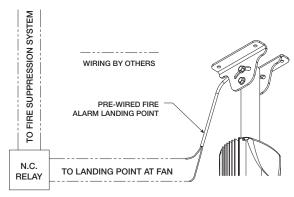
 Low Voltage (24VDC/VAC or 115VAC), Normally Closed Relay (1)

Hardware/Tools Needed (Not Included):

- Standard Screwdriver
- **Cable Cutters**
- Wire Strippers

Fire Relay

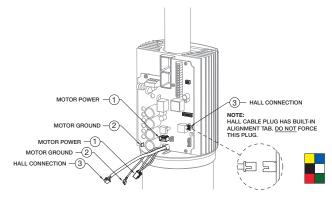
- 1. If the building is equipped with a fire suppression system, remove the crimp connector from the fire alarm emergency stop landing point located at the top of the downtube by snipping the wires directly below the crimp connector.
- 2. Strip the loose wires and wire the supplied normally-closed relay to the fire alarm emergency stop landing point and the building's fire suppression system using the wiring diagram shown.





Electrical Installation

Motor Cable Connection



- 1. Using a phillips screwdriver, remove the black plastic cover on the front side of the VFD and set aside.
- 2. Locate the motor power, motor ground, and hall sensor cables that protrude from the top side of the motor. These cables should have been routed to the front of the VFD during mechanical installation.
- 3. Plug the motor power, motor ground, and hall sensor cables into the VFD circuit board as shown below. The motor power and hall sensor cables are designed to only fit in one orientation. Use the wire color references below to identify the proper orientation and do not force these plugs.

IMPORTANT: The motor power, motor ground, and hall sensor cables are not long enough to reach the VFD circuit board from the rear side. If the cables are not properly routed to the front of the VFD, the motor must be uninstalled and rotated 180° so that the cables can be connected.

Power Wiring

DANGER

Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.

DANGER

Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.

IMPORTANT: Do not connect power until mechanical installation, fire alarm relay installation, communication wiring and fan control installation are complete.

IMPORTANT: Do not apply power to the fan above the rated voltage of the variable frequency drive (VFD). Failure to comply with this warning will result in voiding of the product warranty and may result in permanent damage to the VFD and motor. **IMPORTANT:** To prevent electrical failures, source power must comply with the following power quality requirements. If source power falls outside of these specified tolerances, an external power line filter will be required (by others). If other power quality issues are present, contact the factory for support.

Allowable Voltage Fluctuation	+/- 10% of nominal
Allowable Frequency Fluctuation	+/- 5% of nominal (47-63 Hz)
Area of Use	Do not install fans in electrical environments with Pollution higher than Degree 2 in accordance with UL 61800-5-1
Surge Immunity	Do not install fans in electrical environments above Installation Class 3 in accordance with IEC 61000-4-5

Hardware/Tools Needed:

• Phillips Screwdriver

With Optional Electrical Plug

1. If the fan is supplied with the optional electrical plug for power wiring, refer to the chart for the corresponding receptacle that will be needed (provided by others).

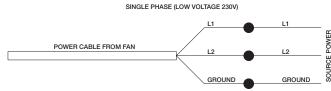
Electrical Plug Reference						
Voltage	Phase	Plug*	Receptacle			
230	1	L6-30P	L6-30R			

*NOTE: Plugs are available from manufacturer. Receptacles must be provided by others.

- 2. Install the receptacle according to all national and local codes for electrical wiring.
- 3. Insert the electrical plug into the receptacle and twist to lock the plug in place.
- 4. Secure any loose power cable to the building structure to ensure it does not interfere with fan performance.

Without Optional Electrical Plug

- 1. If the fan is not supplied with the optional electrical plug, refer to the wiring diagram below to complete power wiring.
- 2. Secure any loose power cable to the building structure to ensure it does not interfere with fan performance.



Disconnect and Fuse Installation

- If provided, mount and wire the optional safety disconnect switch outside of the sweep of the fan's airfoil blades. Installation should be completed per the disconnect manufacturer's recommendation. Be sure to follow all national and local codes for electrical installation.
- Fusing is required by code unless otherwise specified by local authority having jurisdiction (AHJ). Refer to the fuse sizing chart below and install fuses per the manufacturer's recommendation. If the fan was supplied with the optional fused disconnect, the fuses received will match the models shown. Be sure to follow all national and local codes for electrical installation.

IMPORTANT: Warranty may be voided at manufacturer's discretion if correct fuses are not installed.

Fuse Sizing Chart						
DC-5-NL (7 to 16 ft. nominal) 175W Motor						
Motor Voltage	230V/ 1 PH/60 HZ					
Motor Full Load Amps (FLA)*	5A					
Fuse Required**	FRN-R-6					

*FLA is based on worst case system conditions assuming lowest nominal voltage and phase.

** Fuses shown are available as an optional accessory. Fuses provided by others must meet requirements of all national and local codes.

Communication Wiring

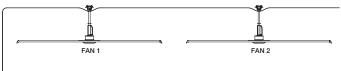
IMPORTANT: DC-NL fans must be installed with the supplied CAT-5e communication cable or shielded CAT-5e (by others) that complies with the following specifications. Cable must be twisted pair, shielded 26 ga. CAT-5e cable with a drain wire and must be compliant with ISO 11801. Cable must use shielded RJ45 connectors with a soldered drain and wiring configuration must follow EIA/TIA T568B wiring pinout. Individual CAT-5e cable lengths must not exceed 200 ft. in order to prevent network communication issues.

NOTE: All communication wiring must be installed in compliance with NEC 800-52 or similar. All communication wiring needs a minimum separation of 2 inches from high voltage unless installed in separate raceways/conduit. When possible, maintain 24 inches of separation.

With Pre-Built CAT-5e Cable

Required Loose Components (Included):

- 100 200 ft. CAT-5e Control Cable (1)
- 1. Plug one end of the shielded CAT-5e control cable into the 2-way RJ45 splitter located at the top of the downtube. The cable can be plugged into any open receptacle on the splitter.
- 2. Identify the desired location for installation of the fan control and run the remainder of the CAT-5e control cable to this location.
- 3. Secure the CAT-5e control cable to the building structure to ensure it does not interfere with fan performance. To prevent communication issues, do not coil excess control cable or route control cable with power wiring.
- 4. If one control source will be used to operate multiple fans, the fans can be daisy-chained together to create a network using the following instructions.



CONTROL

- a. Connect a shielded CAT-5e control cable to the first fan in the daisy-chain using steps 1-3 above.
- b. Plug an additional CAT-5e control cable into the 2-way RJ45 splitter located at the top of the downtube on the first fan. Connect the other end of this CAT-5e cable into the 2-way splitter on the next fan.
- c. Repeat step 4b. for subsequent fans until all fans in the chain are connected in series.
- d. Follow the "Fan Networking" instructions on pages 26-27 to complete network setup for the fans.

With Optional 1,000 ft. Bulk Spool of CAT-5e Cable

Required Loose Components (Included):

- 1,000 ft. Bulk Spool of CAT-5e Control Cable (1)
- Shielded, Pass-Through RJ45 Connectors (25)

Hardware/Tools Needed (Not Included):

- Fan Control (1, optional)
- CAT-5e Termination Tool
- 1. Determine required length of CAT-5e cable run. Unspool appropriate amount of cable and cut to length.

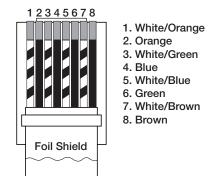
IMPORTANT: Individual CAT-5e cable lengths must not exceed 200 ft. in order to prevent network communication issues.

2. Strip and remove 2 in. of CAT-5e cable jacket leaving the foil shield intact.



- 3. Fold foil shield back over cable jacket and trim foil so that 1/4 in. remains.
- 4. Untwist conductor pairs, straighten and align wires according to EIA/TIA T568B wiring pinout.





NOTE: RJ45 connector in this image is shown with clip pointed away from installer.

5. Trim conductor ends flush leaving 1 in. exposed.



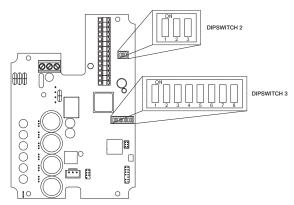
- 6. Fully insert cable into shielded, pass-through RJ45 connectors until foil enters back end of connector. Use only the provided RJ45 connectors.
- 7. Verify that conductors are in the correct wiring scheme order.
- 8. Crimp RJ45 connector with CAT-5e termination tool (not included).
- 9. Repeat on opposite end of CAT-5e cable to complete cable construction.



10. Follow the "With Pre-Built CAT-5e Cable" instructions to complete communication wiring.

Fan Networking

If networking multiple fans to run using a single control source, the dipswitch settings and wiring on each fan's VFD circuit board will need to be adjusted using the following instructions.



First Fan

- 1. Determine the first fan in the network daisychain by identifying the fan that will be directly connected to the control source.
- 2. Dipswitch 2 is used to set parameters that improve network function. Verify that each of the switches on dipswitch 2 are set as follows:
 - Position 1 Off
 - Position 2 On
 - Position 3 On
- Dipswitch 3 is used to set unique Modbus addresses for each fan in the daisy-chain. Adjust positions 1-5 on dipswitch 3 to set the desired Modbus address. A table with all possible Modbus addresses is shown to the right.

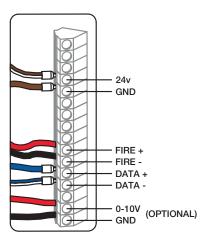
IMPORTANT: Positions 6 - 8 are used to set parameters needed for fan operation and should not be adjusted. Default settings are as follows:

Position 6 – On	
Position 7 – Off	
Position 8 – Off	

4. Verify that the low voltage wiring terminal strip on the VFD circuit board is wired as shown in the diagram on this page. Reinstall the black plastic cover that was previously set aside on the front of the VFD.

	Mo	odbus Ad	dress Set	tings - Dip	oswitch 3				
Fan Number	Modbus Address	Position 1	Position 2	Position 3	Position 4	Position 5	Position 6, 7, 8		
N/A	1	RESE	RESERVED FOR HVLS FAN CONTROLS						
1	2	On	Off	Off	Off	Off			
2	3	Off	On	Off	Off	Off			
3	4	On	On	Off	Off	Off			
4	5	Off	Off	On	Off	Off			
5	6	On	Off	On	Off	Off			
6	7	Off	On	On	Off	Off			
7	8	On	On	On	Off	Off			
8	9	Off	Off	Off	On	Off			
9	10	On	Off	Off	On	Off			
10	11	Off	On	Off	On	Off			
11	12	On	On	Off	On	Off			
12	13	Off	Off	On	On	Off			
13	14	On	Off	On	On	Off	Do Not		
14	15	Off	On	On	On	Off	Modify		
15	16	On	On	On	On	Off			
16	17	Off	Off	Off	Off	On			
17	18	On	Off	Off	Off	On			
18	19	Off	On	Off	Off	On			
19	20	On	On	Off	Off	On			
20	21	Off	Off	On	Off	On			
21	22	On	Off	On	Off	On			
22	23	Off	On	On	Off	On			
23	24	On	On	On	Off	On			
24	25	Off	Off	Off	On	On			
25	26	On	Off	Off	On	On			
26	27	Off	On	Off	On	On			
27	28	On	On	Off	On	On			

FIRST FAN IN SERIES



All Remaining Fans

- 1. Set dipswitch 2 as shown below. Dipswitch 2 is used to set parameters that improve network function and will need to be adjusted for all fans in the network except for the first fan.
 - Position 1 Off
 - Position 2 Off
 - Position 3 Off
- Adjust positions 1 5 on dipswitch 3 so that each successive fan has a unique Modbus address. A table with all possible Modbus addresses is shown to the right.

IMPORTANT: Positions 6 - 8 are used to set parameters needed for fan operation and should not be adjusted. Default settings are as follows:

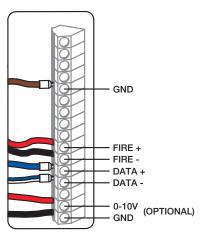
Position 6 – On Position 7 – Off Position 8 – Off

NOTE: It is good practice to use successive Modbus addresses for networked fans, but this is not necessary for proper functioning of the network.

- 3. On the low voltage wiring terminal strip, remove the 24V (white-brown) wire and cap with a wire nut or heat shrink. When complete, verify that the low voltage wiring terminal strip on the VFD circuit board is wired as shown in the diagram on this page.
- 4. Reinstall the black plastic cover that was previously set aside on the front of the VFD.

	M	odbus Ad	dress Set	tings - Dip	oswitch 3		
Fan Number	Modbus Address	Position 1	Position 2	Position 3	Position 4	Position 5	Position 6, 7, 8
N/A	1	RESE	RVED FO	R HVLS F.	AN CONT	ROLS	
1	2	On	Off	Off	Off	Off	
2	3	Off	On	Off	Off	Off	
3	4	On	On	Off	Off	Off	
4	5	Off	Off	On	Off	Off	
5	6	On	Off	On	Off	Off	
6	7	Off	On	On	Off	Off	
7	8	On	On	On	Off	Off	
8	9	Off	Off	Off	On	Off	
9	10	On	Off	Off	On	Off	
10	11	Off	On	Off	On	Off	
11	12	On	On	Off	On	Off	
12	13	Off	Off	On	On	Off	
13	14	On	Off	On	On	Off	Do Not
14	15	Off	On	On	On	Off	Modify
15	16	On	On	On	On	Off	
16	17	Off	Off	Off	Off	On	
17	18	On	Off	Off	Off	On	
18	19	Off	On	Off	Off	On	
19	20	On	On	Off	Off	On	
20	21	Off	Off	On	Off	On	
21	22	On	Off	On	Off	On	
22	23	Off	On	On	Off	On	
23	24	On	On	On	Off	On	
24	25	Off	Off	Off	On	On	
25	26	On	Off	Off	On	On	
26	27	Off	On	Off	On	On	
27	28	On	On	Off	On	On	

ALL OTHER FANS IN SERIES



Operation And Maintenance

Pre-Start-Up Checks

- 1. Disconnect and lock-out all power switches to fan.
- 2. Check all fasteners and set screws on the ceiling mount, mounting kit, impeller, VFD, motor and accessories for tightness.
- 3. Rotate the fan impeller by hand to ensure that it rotates freely and does not come into contact with any obstructions.
- 4. Check all electrical connections for proper attachment.
- 5. Verify that the fan is hanging so that the airfoils and downtube are level and the fan is plumb to the floor. Adjust guy wire tension as necessary (if applicable).
- 6. Verify that UV-C system is safe to operate with occupants present in the room. Refer to UV-C commissioning section on pages 38-45.

Fan Operation

IMPORTANT: If unusual vibration or oscillating movement is observed during fan operation, immediately discontinue use of the fan and contact the manufacturer or a suitably qualified maintenance/repair technician.

- 1. When the fan is started, observe the operation and check for any unusual noise, vibration or overheating. Refer to the Troubleshooting section of this manual if a problem develops.
- 2. With the system in full operation, measure current input to the VFD and compare with the FLA ratings in the tables above to determine if the motor/VFD system is operating under safe load conditions.
- 3. Keep approaches to fan clean and free from obstruction.

Fan Inspection

Operation And

DANGER

Disconnect and secure to the 'OFF' position all electrical power to the fan prior to inspection or servicing. Failure to comply with this safety precaution could result in serious injury or death.

DANGER

Pour écarter les risques de blessure grave ou de mort, débrancher et verrouiller l'alimentation électrique en position « Arrêt » avant tout contrôle ou entretien.

Inspection of the fan should be conducted at the first 30 minute and 24 hour intervals of satisfactory operation.

- 30 Minute Interval Check all fasteners for tightness. Adjust and tighten as necessary.
- 24 Hour Interval Inspect all fan components. Check all fasteners, airfoil retaining ring, the safety

cable, and guy wires (if applicable). Adjust and tighten as necessary.

Fan Maintenance

DANGER

Disconnect and secure to the 'OFF' position all electrical power to the fan prior to inspection or servicing. Failure to comply with this safety precaution could result in serious injury or death.

DANGER

Pour écarter les risques de blessure grave ou de mort, débrancher et verrouiller l'alimentation électrique en position « Arrêt » avant tout contrôle ou entretien.

NOTE: Installation and maintenance are to be performed only by qualified personnel who are familiar with local codes and regulations and have experience with this type of equipment.

Once the fan has been put into operation, a periodic maintenance program should be set up to ensure reliable fan performance. A proper maintenance program will help deliver years of dependable service. Items to be included in this program are as follows:

- 1. Verify that all fasteners are tight and properly torqued.
- 2. Verify that all of the fan's safety systems (safety cable, airfoil retaining ring, and guy wires if applicable) are properly installed. Inspect for signs of damage or failure. Safety cable and guy wire tension should also be checked. Safety cable should be wrapped around the building structure leaving as little slack as possible. Guy wires should be under enough tension to prevent any lateral movement of the motor and downtube (if applicable).
- 3. Inspect the fan for signs of fatigue, corrosion, or wear.
- 4. To ensure performance of UV-C lighting system, airfoil blades must be thoroughly cleaned every six months at a minimum. Remove any accumulated dust and dirt using a damp cloth or mild cleaning solutions. Harsh chemicals should not be used to clean the fan as they may damage the fan's finish or motor.

IMPORTANT: Do not allow water or solvents to enter the motor or UV-C lighting components. Under no circumstances should motors or UV-C light sources be sprayed with steam, water, or solvents.

 UV-C light sources and ballasts must be replaced at regular intervals to ensure consistent UV-C light output. Consult with the manufacturer of the light source and/or ballast to determine how frequently these components should be replaced. The factory-supplied light sources and ballasts are rated for 9,000 hours of use. **IMPORTANT:** To prevent damage to UV-C light sources and/or reduction in UV-C output, do not handle UV-C light sources without wearing gloves.

6. Motor maintenance is generally limited to cleaning. Limit cleaning to exterior surfaces only. Removing

Troubleshooting

DANGER

Disconnect and secure to the 'OFF' position all electrical power to the fan prior to inspection or servicing. Failure to comply with this safety precaution could result in serious injury or death.

DANGER

Pour écarter les risques de blessure grave ou de mort, débrancher et verrouiller l'alimentation électrique en position « Arrêt » avant tout contrôle ou entretien.

General Troubleshooting

dust buildup on motor housing ensures proper motor cooling.

7. Prior to restarting unit, check all fasteners for tightness each time maintenance checks are performed.

Each fan bears a manufacturer's nameplate with the fan's model number and a unique serial number for identification. This information will assist the local representative and the manufacturer in providing service and replacement parts.

IMPORTANT: Do not remove VFD circuit board from aluminum heatsink under any circumstances. Removal of circuit board will result in voiding of the fan warranty.

FIOD	lem: Unknown, Initial Troubleshooting Steps for Installation	ns with	Wired C	Controls.
1	Is supply power turned on at all circuit breakers and fan disconnects?	Yes U	No	No supply power to fans. Turn circuit breakers and disconnects to "on" position.
2	Is there line voltage across L1 and L2 on VFD power terminals?	Yes U	No O	Supply power wiring not connected or fuses damaged/ missing. Connect proper power supply to fan and confirm that fuses are installed/functional. Test and replace fuses if necessary. Refer to wiring diagram and fuse sizing table on pages 23-24.
3	Are line voltage measurements within +/- 10% of nominal voltage across L1 and L2 on VFD power terminals?	Yes U	No	Phase imbalance or incorrect supply power applied to fan. Correct supply power wiring to fan.
4	Were fans and controls installed using only the provided networking components (green shielded CAT-5e cables, black shielded 3-way RJ45 splitters) or components that comply with specifications on page 24?	Yes U	No つ	Networking components may be defective, incorrectly wired, or do not meet required specifications. Replace with provided components or components that comply with specifications on page 24.
5	Are 3-way RJ45 splitters installed with the single-port side connected to black cable inside fan downtube?	Yes U	No	Incorrect splitter orientation. Unplug splitter and reconnect in the proper orientation.
6	Have all CAT-5e cable connections been unplugged and reconnected to ensure that cables are fully seated (will hear a "click" when fully seated)?	Yes U	No C	Loose or misaligned CAT-5e cable connection. Unplug and reconnect all CAT-5e cable connections.
7	Are the dipswitches on all fan VFDs set as shown on pages 26-27?.	Yes U	No つ	Incorrect dipswitch settings on one or multiple VFDs. Adjust dipswitches as shown on pages 26-27. All fans must have a unique Modbus address setting on dipswitch bank 3.
8	Are motor power, motor ground, and hall cables connected to all VFDs?	Yes U	No C	No connection between motor and VFD. Connect motor power, motor ground, and hall cable to VFDs. Refer to instructions on page 23.
9	Have motor power and hall cables been unplugged and reconnected to ensure that they are connected in the proper orientation and fully seated on all VFDs (will hear a "click" when fully seated)?	Yes U	No C	Loose or misaligned motor power or hall cable connection. Unplug and reconnect motor power and hall cables. Refer to page 23 for correct orientation.
10	Does communication wiring on VFD of fan 1 (directly connected to control via shielded CAT-5e cable) match the wiring diagram for fan 1 on page 26?	Yes U	No C	Communication wiring on fan 1 is incorrect. Turn off supply power to fan and correct wiring as shown in wiring diagram on page 26. Then turn supply power on.
11	Does communication wiring on VFDs of all remaining fans match the wiring diagram for all remaining fans on page 27?	Yes U	No D	Communication wiring on one or multiple fans is incorrect. Turn off supply power to fans and correct wiring as shown in wiring diagram on page 27. Then turn supply power on.
12	Do fans operate as expected?	Yes	No	Check detailed troubleshooting steps on the following pages or contact the factory.

1	Is supply power turned on at all circuit breakers and fan disconnects?	Yes U	No つ	No supply power to fans. Turn circuit breakers and disconnects to "on" position.
2	Is there line voltage across L1 and L2 on VFD power terminals?	Yes U	No O	Supply power wiring not connected or fuses damaged/ missing. Connect proper power supply to fan and confirm that fuses are installed/functional. Test and replace fuses if necessary. Refer to wiring diagram and fuse sizing table or pages 23-24.
3	Are line voltage measurements within +/- 10% of nominal voltage across L1 and L2 on VFD power terminals?	Yes U	No	Phase imbalance or incorrect supply power applied to fan. Correct supply power wiring to fan.
4	Are motor power, motor ground, and hall cables connected to all VFDs?	Yes U	No つ	No connection between motor and VFD. Connect motor power, motor ground, and hall cable to VFDs. Refer to instructions on page 23.
5	Have motor power and hall cables been unplugged and reconnected to ensure that they are connected in the proper orientation and fully seated on all VFDs (will hear a "click" when fully seated)?	Yes U	No つ	Loose or misaligned motor power or hall cable connection. Unplug and reconnect motor power and hall cables. Refer to page 23 for correct orientation.
6	Do fans operate as expected?	Yes	No	Check detailed troubleshooting steps on the following pages or contact the factory.

Controls Troubleshooting

Prol	blem: Advanced Touchscreen control will not turn on.			
1	Is the power adapter cable wired into the control panel?	Yes U	No C	No supply power to control panel. Wire the power adapter cable into the control panel as shown in the wiring diagram in the control manual.
2	Is the power adapter connected to a 115V electrical outlet?	Yes	No T	No supply power to control panel. Connect the power adapter to a 115V electrical outlet.
3	Is supply power turned on at the circuit breaker for 115V electrical outlet?	Yes	No	No supply power to control panel. Turn circuit breaker to "on" position.
4	Is the shielded RJ12 cable wired into the control panel?	Yes U	No C	No supply power or communications to touchscreen interface. Wire the shielded RJ12 cable into the control panel as shown in the wiring diagram in the control manual.
5	Is the shielded RJ12 cable connected to the touchscreen interface?	Yes U	No C	No supply power or communications to touchscreen interface. Connect the shielded RJ12 cable to the open port on the back of the touchscreen interface.
6	Has the shielded RJ12 cable been unplugged and reconnected to the touchscreen interface to ensure that it is fully seated (will hear a "click" when fully seated)?	Yes U	No C	Loose or misaligned RJ12 cable connection. Unplug and reconnect shielded RJ12 cable to the open port on the back of the touchscreen interface.
7	Does the screen on the touchscreen interface light up?	Yes	No	Contact factory.
Eve	rything is working properly.	1		

	blem: One or more fans not found by wired control.			
1	Were fans and controls installed using only the provided networking components (green shielded CAT-5e cables, black shielded 3-way RJ45 splitters) or components that comply with specifications on page 24?	Yes U	No C	Networking components may be defective, incorrectly wired, or do not meet required specifications. Replace with provided components or components that comply with specifications on page 24.
2	Does communication wiring on VFD of fan 1 (directly connected to control via shielded CAT-5e cable) match the wiring diagram for fan 1 on page 26?	Yes U	No C	Communication wiring on fan 1 is incorrect. Turn off supply power to fan and correct wiring as shown in wiring diagram on page 26. Then turn supply power on.
3	Are the dipswitches on VFD of fan 1 (directly connected to control via shielded CAT-5e cable) set as shown for fan 1 on page 26?	Yes U	No O	Incorrect dipswitch settings on fan 1. Adjust dipswitches as shown on page 26. All fans must have a unique Modbus address setting on dipswitch bank 3.
4	Is LED 6 on the bottom right side of the VFD on fan 1 blinking?	Yes	No Э	Solid light indicates need to restart VFD. Cycle power to VFD. If solid light persists, contact factory.
5	Is LED 6 on the bottom right side of the VFD on fan 1 blinking approximately one time per second?	Yes U	No C	Blinking faster than one time per second indicates no communication with control. Unplug and reconnect shielded CAT-5e cable connections between control and fan 1 to ensure that cables are fully seated (will hear a "click" when fully seated). If rapid blinking persists, test shielded CAT-5e cables for functionality and replace faulty cables (if applicable). Otherwise, contact factory.
6	Does communication wiring on VFD of fan 2 (directly connected to fan 1 via shielded CAT-5e) match the wiring diagram for "all remaining fans" on page 27?	Yes U	No C	Communication wiring on fan 2 is incorrect. Turn off supply power to fan and correct wiring as shown in wiring diagram on page 27. Then turn supply power on.
7	Are the dipswitches on VFD of fan 2 (directly connected to fan 1 via shielded CAT-5e cable) set as shown for "all remaining fans" on page 27?	Yes U	No D	Incorrect dipswitch settings on fan 2. Adjust dipswitches as shown on page 27. All fans must have a unique Modbus address setting on dipswitch bank 3.
8	Is LED 6 on the bottom right side of the VFD on fan 2 blinking?	Yes	No Э	Solid light indicates need to restart VFD. Cycle power to VFD. If solid light persists, contact factory.
9	Is LED 6 on the bottom right side of the VFD on fan 2 blinking approximately one time per second?	Yes U	No	Blinking faster than one time per second indicates no communication with control. Unplug and reconnect shielded CAT-5e cable connections between fan 1 and fan 2 to ensure that cables are fully seated (will hear a "click" when fully seated). If rapid blinking persists, test shielded CAT-5e cables for functionality and replace faulty cables (if applicable). Otherwise, contact factory.
10	After repeating steps 6-9 for all remaining fans, can all fans be found using autodetect feature on control?	Yes	No •	Contact factory.

Prob	lem: One or more fans not found by wireless bluetooth co	ntrol.		
1	Is bluetooth connectivity turned on in the settings menu of the bluetooth tablet controller?	Yes U	No C	Tap the software version number in the bottom left corner of the screen, then use the tablet settings menu to turn bluetooth connectivity on.
2	Is LED 6 on the bottom right side of the VFD on fan 1 blinking?	Yes	No	Solid light indicates need to restart VFD. Cycle power to VFD. If solid light persists, contact factory.
3	Is LED 6 on the bottom right side of the VFD on fan 1 blinking approximately one time per second?	Yes U	No つ	Blinking faster than one time per second indicates no communication with control. Verify that bluetooth module is fully seated on the VFD circuit board and that coin cell battery is not dead. Replace coin cell battery if needed.
4	Is LED 6 on the bottom right side of the VFD on fan 2 blinking?	Yes	No	Solid light indicates need to restart VFD. Cycle power to VFD. If solid light persists, contact factory.
5	Is LED 6 on the bottom right side of the VFD on fan 2 blinking approximately one time per second?	Yes U	No D	Blinking faster than one time per second indicates no communication with control. Verify that bluetooth module is fully seated on the VFD circuit board and that coin cell battery is not dead. Replace coin cell battery if needed.
6	After repeating steps 4-5 for all remaining fans, can all fans be found using add fan feature on control?	Yes	No	Contact factory.
Ever	ything is working properly.			

Fan Troubleshooting

Prot	blem: One or more fans found by control but will not run.			
1	Have all fault codes been acknowledged and reset on fan control?	Yes U	No O	One or more fans may have experienced a fault. Refer to list of fault codes on page 36 for detailed descriptions. Acknowledge and reset all faults, then cycle power to fans. Fans will only operate when Op Status code is equal to 0. Refer to instructions in the appropriate control manual for accessing Op Status code.
2	Is the control set to a speed greater than 0 and have the fans been turned on via the control's power button?	Yes U	No C	Control is not sending a run command to fans. Set speed to a value between 1-10 and press the control's power button to turn fans on. Control will indicate that fans are on by displaying a green power icon or stating "On".
3	Are motor power, motor ground, and hall cables connected to all VFDs?	Yes U	No C	No connection between motor and VFD. Connect motor power, motor ground, and hall cable to VFDs. Refer to instructions on page 23.
4	Have motor power and hall cables been unplugged and reconnected to ensure that they are connected in the proper orientation and fully seated on all VFDs (will hear a "click" when fully seated)?	Yes U	No C	Loose or misaligned motor power or hall cable connection. Unplug and reconnect motor power and hall cables. Refer to page 23 for correct orientation.
5	Are resistance measurements across U & V, V & W, U & W on the pins of the motor power cable approximately equal?	Yes	No C	Defective motor. Contact factory/sales representative.
6	Are resistance measurements across U & GND, V & GND, W & GND on the pins of the motor power cable open (no resistance)?	Yes U	No C	Defective motor. Contact factory/sales representative.
7	Do fans operate as expected?	Yes	No	Contact factory.
Ever	rything is working properly.			·

Prob	plem: One or more fans attempt to run, but do not rotate co	mplete	y.	
1	Are fan size and blade count set appropriately in the control for all installed fans?	Yes U	No O	Incorrect torque/speed command to fans. Set fan size and blade count using instructions in the appropriate control manual. Fan size and blade count must be set to match physical product.
2	Turn off power and rotate all fans by hand. Can fans rotate freely without any audible rubbing, scraping, or grinding noise?	Yes U	No O	Rubbing components on the fan hub and/or airfoils. Correct any issues that are found.
3	Are motor power, motor ground, and hall cables connected to all VFDs?	Yes U	No C	No connection between motor and VFD. Connect motor power, motor ground, and hall cable to VFDs. Refer to instructions on page 23.
4	Have motor power and hall cables been unplugged and reconnected to ensure that they are connected in the proper orientation and fully seated on all VFDs (will hear a "click" when fully seated)?	Yes U	No C	Loose or misaligned motor power or hall cable connection. Unplug and reconnect motor power and hall cables. Refer to page 23 for correct orientation.
6	Are resistance measurements across U & V, V & W, U & W on the pins of the motor power cable approximately equal?	Yes	No O	Defective motor. Contact factory/sales representative.
7	Are resistance measurements across U & GND, V & GND, W & GND on the pins of the motor power cable open (no resistance)?	Yes U	No O	Defective motor. Contact factory/sales representative.
8	Do fans operate as expected?	Yes	No Э	Contact factory.
Ever	rything is working properly.			

Prob	Problem: One or more fans run, but are making excessive noise/vibrating.						
1	Have all fasteners been torqued to the appropriate values listed in the IOM?	Yes U	No C	Loose fasteners. Torque all fasteners to the appropriate values. Refer to pages 11-22 for torque specifications of each fastener.			
2	Have the factory-provided guy wires been installed on all fans (if applicable)?	Yes	No T	Guy wires are not installed. Refer to pages 19-20 for guy wire installation instructions.			
3	Have the guy wires on all fans been tightened?	Yes	No	Loose guy wires. Refer to pages 19-20 for guy wire installation instructions.			
4	Is the downtube level on all sides for all installed fans?	Yes	No	Fans not installed level. Refer to pages 19-20 for guy wire installation and fan levelling instructions.			
5	Remove the black plastic covers from all fan VFDs and operate fans using the control. Does the noise/vibration continue?	Yes U	No つ	Misaligned VFD cover. Reinstall the black plastic cover on the fan VFD, making sure to align the tabs on the cover with the slots in the VFD heatsink. Plastic cover can make noise when improperly aligned.			
6	Turn off power and rotate all fans by hand. Can fans rotate freely without any audible rubbing, scraping, or grinding noise?	Yes U	No つ	Rubbing components on the fan hub and/or airfoils. Correct any issues that are found.			
7	Has noise/vibration ceased?	Yes	No つ	Contact factory.			
Ever	ything is working properly.	•					

Prob	Problem: One or more fans run intermittently, but will not run consistently with wired control.						
1	Have all fault codes been acknowledged and reset on fan control?	Yes U	No O	One or more fans may have experienced a fault. Refer to list of fault codes on page 36 for detailed descriptions. Acknowledge and reset all faults, then cycle power to fans. Fans will only operate when Op Status code is equal to 0. Refer to instructions in the appropriate control manual for accessing Op Status code.			
2	Are line voltage measurements within +/- 10% of nominal voltage across L1 and L2 on VFD power terminals?	Yes U	No	Phase imbalance or incorrect supply power applied to fan. Correct supply power wiring to fan.			
3	Were fans and controls installed using only the provided networking components (green shielded CAT-5e cables, black shielded 3-way RJ45 splitters) or components that comply with specifications on page 24?	Yes U	No つ	Networking components may be defective, incorrectly wired, or do not meet required specifications. Replace with provided components or components that comply with specifications on page 24.			
4	Have all CAT-5e cable connections been unplugged and reconnected to ensure that cables are fully seated (will hear a "click" when fully seated)?	Yes U	No C	Loose or misaligned CAT-5e cable connection. Unplug and reconnect all CAT-5e cable connections.			
5	Are the dipswitches on all fan VFDs set as shown on pages 26-27?	Yes U	No C	Incorrect dipswitch settings on one or multiple VFDs. Adjust dipswitches as shown on pages 26-27. All fans must have a unique Modbus address setting on dipswitch bank 3.			
6	Do fans operate as expected?	Yes U	No Э	Contact factory.			
Every	ything is working properly.		-				

Prob	Problem: One or more fans run intermittently, but will not run consistently with wireless bluetooth control.						
1	Have all fault codes been acknowledged and reset on fan control?	Yes U	No	One or more fans may have experienced a fault. Refer to list of fault codes on page 36 for detailed descriptions. Acknowledge and reset all faults, then cycle power to fans. Fans will only operate when Op Status code is equal to 0. Refer to instructions in the appropriate control manual for accessing Op Status code.			
2	Are line voltage measurements within +/- 10% of nominal voltage across L1 and L2 on VFD power terminals?	Yes	No C	Phase imbalance or incorrect supply power applied to fan. Correct supply power wiring to fan.			
3	Do fans operate as expected?	Yes	No Э	Contact factory.			
Ever	rything is working properly.						

Problem: One or more fans run, but I don't feel much airflow.						
1	Are fans installed with a minimum of 3 feet of clearance to ceiling structure?	Yes	No	Fan is starved for air. Correct installation to maintain minimum clearance requirements.		
2	Are fan size and blade count set appropriately in the control for all installed fans?	Yes U	No D	Incorrect torque/speed command to fans. Set fan size and blade count using instructions in the appropriate control manual. Fan size and blade count must be set to match physical product.		
3	Is the control set to the maximum fan speed (speed setting of 10)?	Yes U	No C	Fan speed too low. Increase fan speed until desired airflow is achieved. Refer to instructions in the appropriate control manual to increase speed.		
4	Is the control set to forward (downward airflow) operation?	Yes U	No つ	Fan operating in reverse (upward airflow). Refer to instructions in the appropriate control manual to change direction of operation.		
5	Have motor power and hall cables been unplugged and reconnected to ensure that they are connected in the proper orientation and fully seated on all VFDs (will hear a "click" when fully seated)?	Yes U	No C	Loose or misaligned motor power or hall cable connection. Unplug and reconnect motor power and hall cables. Refer to page 23 for correct orientation.		
6	Do fans operate as expected?	Yes	No	Contact factory.		
Eve	rything is working properly.			•		

Prob	Problem: One or more fans not operating at expected RPM (too fast or too slow).						
1	Are fan size and blade count set appropriately in the control for all installed fans?	Yes U	No O	Incorrect torque/speed command to fans. Set fan size and blade count using instructions in the appropriate control manual. Fan size and blade count must be set to match physical product.			
2	Turn off power and rotate all fans by hand. Can fans rotate freely without any audible rubbing, scraping, or grinding noise?	Yes	No C	Rubbing components on the fan hub and/or airfoils. Correct any issues that are found.			
3	Have motor power and hall cables been unplugged and reconnected to ensure that they are connected in the proper orientation and fully seated on all VFDs (will hear a "click" when fully seated)?	Yes U	No C	Loose or misaligned motor power or hall cable connection. Unplug and reconnect motor power and hall cables. Refer to page 23 for correct orientation.			
4	Do fans operate as expected?	Yes	No	Contact factory.			
Ever	rything is working properly.						

Prob	elem: One or more fans not operating after fire suppression	n systen	n testing	y.
1	Has fire alarm been cleared and reset in the building?	Yes	No C	Fans are shutdown due to fire alarm. Clear fire alarm and reset fire suppression system. Fans will not operate during fire alarm as required by NFPA 13.
2	Have all fault codes been acknowledged and reset on fan control?	Yes U	No O	One or more fans may have experienced a fault. Refer to list of fault codes on page 36 for detailed descriptions. Acknowledge and reset all faults, then cycle power to fans. Fans will not operate when Op Status code 5 or "Fire Relay" alarms are active. Refer to instructions in the appropriate control manual for accessing Op Status code.
3	Were fans installed using only the provided fire alarm relays or other electromechanical relays approved by fan manufacturer?	Yes U	No	Fire alarm relays may be defective, incorrectly wired, or do not meet required specifications. Replace fire alarm relays with factory-provided or other approved electromechanical relays. Solid state relays cannot be used.
4	Disconnect fire alarm relay wiring and install jumper wire between FIRE+ and FIRE- terminals on all fan VFDs. Turn fans on using control. Do fans operate as expected?	Yes	No C	Contact factory.
5	Remove jumper wire from FIRE+ and FIRE- terminals on all fan VFDs and reconnect fire alarm relay wiring. Turn fans on using control. Do fans operate as expected?	Yes	No C	Fire alarm relays and/or fire alarm relay wiring are defective. Replace defective components.
Ever	ything is working properly.			

Prob	Problem: One or more fans operated normally for a period of time, but have stopped running.						
1	Have all fault codes been acknowledged and reset on fan control?	Yes U	No O	One or more fans may have experienced a fault. Refer to list of fault codes on page 36 for detailed descriptions. Acknowledge and reset all faults, then cycle power to fans. Fans will only operate when Op Status code is equal to 0. Refer to instructions in the appropriate control manual for accessing Op Status code.			
2	Is supply power turned on at all circuit breakers and fan disconnects? Are fuses installed and functional?	Yes	No C	No supply power to fans. Turn circuit breakers and disconnects to "on" position. Test and replace fuses if necessary.			
3	Are there visible signs of damage on VFD circuit boards (black marks, damaged components, etc.)?	Yes	No O	Damaged or defective VFDs. Contact factory.			
4	Are all LED lights 1-6 on the VFD circuit board lit with a solid light for all fans?	Yes	No •	Contact factory.			
5	Do fans operate as expected?	Yes	No C	Contact factory.			
Eve	rything is working properly.						

UV-C Light Troubleshooting

Prob	Problem: UV-C Light will not turn on.						
1	Is supply power turned on at all circuit breakers and fan disconnects?	Yes	No	No supply power to UV-C lights. Turn circuit breakers and disconnects to "on" position.			
2	Have UV-C lights been selected in the fan control for the appropriate fan?	Yes U	No つ	Control is not sending commands to UV-C lights. Refer to the appropriate control manual for instructions on selecting UV-C lights for the appropriate fan.			
3	Is the UV-C light power (3 pin) plug connected between the downtube and motor/hub assembly of the fan? Note: plug is hidden inside downtube when motor/hub assembly is installed on the fan.	Yes U	No •	Power wiring to UV-C lights is not continuous. Refer to instructions on page 16. Remove motor/hub assembly from affected fans to access UV-C light power (3 pin) plug. Connect the male plug in the motor/hub assembly to the corresponding female plug in the downtube. Reconnect the motor/hub assembly.			
4	Are the UV-C light power (3 pin) plugs connected between the airfoil blades and motor/hub assembly of the fan? Note: plugs are hidden inside the black plastic hub plate when it is installed on the fan.	Yes U	No O	Power wiring to UV-C lights is not continuous. Refer to instructions on page 21. Remove hub plate from affected fans to access UV-C light power (3 pin) plugs. Connect the male plugs in the airfoil blades to their corresponding female plugs in the motor/hub assembly. Reinstall the hub plate.			
5	Do UV-C lights operate as expected?	Yes	No C	Contact factory.			
Ever	ything is working properly.						

Reference

Fault Code Causes and Possible Solutions

Code	Fault	Description	Possible Cause(s)	Solution		
0	No Fault	Fan is operating as expected	-	-		
1	Modbus Timeout	Inconsistent Modbus RTU communication between control and drive resulting in incorrect fan operation	 Loose CAT-5e cable connections Unshielded or damaged CAT-5e cables and RJ45 splitters Incorrect network biasing settings Incorrect low voltage wiring on euro connector Incorrect supply power applied to VFD Supply power phase imbalance 	 Verify that all CAT-5e cable connections are fully seated and secure Replace cables with the provided networking components (green shielded CAT-5e cables and black shielded 3-way RJ45 splitters) or components that comply with specifications on page 24 Refer to Fan Networking instructions on pages 26-27 Refer to Fan Networking instructions on pages 26-27 Verify that supply voltage is within +/- 10% of the VFD's rated voltage Verify that current is consistent across all phases of supply power 		
2	Impact Detection	Unexpected change in fan speed and/or motor torque resulting in fan shutdown	 Fan blades and/or hub are obstructed Motor power and/or hall cables not connected to VFD, not fully seated, or connected in incorrect orientation Incorrect blade count and/or fan size selected in control Fan operating without blades installed 	 Remove any obstructions preventing fan rotation Unplug and reconnect motor power and hall cables, refer to page 23 for proper orientation Set fan size and blade count to match physical product using instructions on in appropriate control manual Install blades on fan 		
3	Motor Over Temperature	Internal motor temperature exceeds maximum value resulting in reduced fan speed or shutdown	Ambient temperature too high at the ceiling	Allow motor to cool before increasing speed or restarting fan		
4	Drive Over Temperature	Internal VFD temperature exceeds maximum value resulting in reduced fan speed or shutdown	Ambient temperature too high at the ceiling	Allow VFD to cool before increasing speed or restarting fan		
5	Bus Over Voltage	Internal VFD voltage is higher than expected resulting in fan shutdown	Incorrect supply voltage	Verify that supply voltage is within +/- 10% of the VFD's rated voltage		
6	Bus Under Voltage	Internal VFD voltage is lower than expected resulting in fan shutdown	 Incorrect supply voltage Rapid power-cycling at circuit breaker 	 Verify that supply voltage is within +/- 10% of the drive's rated voltage After turning power off, wait 30-60 seconds before turning power back on 		
7	Phase Over Current	Current is higher than expected on at least one phase of supply power resulting in fan shutdown	 Incorrect supply power Supply power phase imbalance 	 Verify that supply power meets all power quality requirements on page 23 and that supply voltage is within +/- 10% of the drive's rated voltage Verify that current is consistent across all phases of supply power 		
8	Microcontroller High Temp	Microcontroller temperature exceeds maximum value resulting in reduced fan speed or shutdown	Ambient temperature too high at the ceiling	Allow VFD to cool before increasing speed or restarting fan		
9	Overspeed Fault	Motor speed is greater than maximum allowable speed resulting in reduced fan speed or shutdown	 Incorrect blade count and/or fan size selected in control Wind gusts in building 	 Set fan size and blade count to match physical product using instructions in the control manual Close overhead doors, etc. or relocate fan 		

Modbus Registers List

HVLS fan VFDs are configured for Modbus RTU communication as standard. The Modbus register list is for applications where a building management system (BMS) or field-supplied control are to be used for fan operation. A baud rate of 19200 bps and a device polling delay of 260 ms are recommended for network functionality.

	Register	Name	R/W	Retentive	Signed	Format	Range	Default	Description		Detail
	1	Run Command	R/W			х	0,1,2		0=Stop=clear Fault(s); 1=Reve 99=Reset	erse; 2=F	orward;
	2	Torque Reference	R/W			ххх	1100		Percentage of full torque. Torc fan speed.	que outpi	ut determines
Control	3	Operational Status	R			х	06		1=Comm CRC errors, 2=Drive Faulted, , 4=IGBT temp warning, 5=Drive Inhibited (Fire Input)		
ŏ	4	Light Control	R/W			ххх	0100	0	J5 0-10V Output for Optional Light Control (%)	Resets	to 0 after cycle
	5	External Temperature	R			xxxxx	-4001100		External Temp (°C) (0.1 unit)		off an external 25C NTC tor
	6	Last Fault Code	R	R		xxx				At each	
	7	Second Last Fault	R	R		xxx				shifted	nce, values are to next register
Fault	8	Third Last Fault	R	R		ххх			Integer code representing fault history		current fault ayed in Last
	9	Fourth Last Fault	R	R		ххх			laan motory	Fault C	ode. Values are
	10	Fifth Last Fault	R	R		xxx				retained cycle.	l after power
	11	Firmware Version	R	R		xxxxx	1-500		Incremental Version Count	,	
	12	Operating Hours	R	R		xxxxx	0-65535		Operating hours (driving motor)	MAX 65	535
	13	Motor RPM	R		S	XXX	-300300		Motor RPM (0.1 rpm)		
	14	Voltage, DC Bus	R			XXX	01000		Bus Voltage (Volts) (1 units)		
	15	Voltage, Output RMS	R			ххх	01000		RMS Modulated Output Voltage (Volts) (1 units)		(1 units)
	16	Current, Motor RMS	R			xx.x	0150		RMS Motor current (Amps) (0.1 units)		
ostics	17	Temperature, Capacitor	R		S	xxx.x	-3001100		Capacitor Temp (°C) (0.1 units)		
Diagnostics	18	Temperature, Transistor	R		S	xxx.x	-4001250		Transistor Temp (°C) (0.1 units) Transistor to Heats		or to Heatsink
-	19	Temperature, Ambient	R		S	xxx.x	-3001350		Ambient Temp (°C) (0.1 units)		
	20	Spare	R					0			
	21	Communication Errors	R			xxx	0-65535		Number of errors since last power cycle	0-6553	5
	22	Spare	R/W					0			
	23	Spare	R/W					0			
	24	Spare	R/W					0			
	25	Spare	R					0			
	26	KEEP ALIVE (WatchDog)	R/W	R		xxxxx	0-65535	30	Seconds; 0 = disable	a timeo	ssage resets; if ut occurs, fan o (if running)
										0	1200 bps
										1	2400 bps
_										2	4800 bps
Configuration	27	MODBUS Serial	R/W			v	09	4	Baud Rate Setting	3	9600 bps
gura	21	Speed				х	09	4	(SW2: Pin 7 ON)	4	19200 bps
onfi								5	38400 bps		
O										6	57600 bps
										7	115200 bps
	28	Motor Type	R				02	0	13,70,170	0=13; 1	= 70; 2=170
	29	MODBUS Device ID	R/W	R			1-247	2	New Device ID is set after power cycle		
	30	Spare	R/W					0			

NOTE: Registers 1000-1150 are reserved for internal Diagnostics and Testing.

UV-C System Activation and Commissioning

IMPORTANT: Activation of the UV-C system is protected with an access code. Only qualified installers may activate and adjust the UV-C system before commissioning. Contact the manufacturer after completing fan installation to receive the access code.

General Instructions

UV-C irradiation measurements are required in several cases, including (but not limited to):

- When the Northern Light HVLS fan is first installed
- When installing new UV-C light sources
- When moving the fan to a new position in the room or to a new room
- When making changes or adjustments in the room (for example, adding new ceiling fixtures/fittings/ installations, changes to the placement of walls, changes to ceiling or wall materials, changes to room dimensions, etc.)
- When any kind of report or complaint about possible overexposure has been made

After the measurement, the system must be in compliance with the limit values specified in IEC/ EN 62471, per the formula below. Limit values and a calculation example are documented in Appendix A of this manual.

$$E_{s} \cdot t = \sum_{200}^{400} \sum_{t} E_{\lambda}(\lambda, t) \cdot S_{UV}(\lambda) \cdot \Delta t \cdot \Delta \lambda \leq 30 \qquad J \cdot m^{-1}$$

2

Required Tools (Not Included):

- Slotted screwdriver
- Scissor lift, ladder, or scaffolding
- UV-C meter and sensor(s)
- Tripod
- Measuring tape
- UV-C irradiation measurement form (refer to appendix F)

IMPORTANT: UV-C meter and sensor(s) must have valid calibration certificates at the time of UV-C irradiation measurements being taken. Uncalibrated meters and sensors should not be used.

NOTE: Required measuring equipment, materials and protective equipment are sold separately.

Required Personal Protective Equipment (PPE):

- Safety glasses with closed sides
- Long-sleeved shirt, long trousers/pants and closed-toe shoes
- Protective gloves
- Face mask and hat and/or sunscreen (must contain either zinc oxide or titanium dioxide for face, neck and other areas where skin is exposed)

¹National Institute for Occupational Safety and Health. Atlanta, GA: National Institute for Occupational Safety and Health; 2009. Environmental control of tuberculosis: basic upper-room ultraviolet germicidal irradiation guidelines for healthcare settings.

Activities Prior to Performing the Assessment

Before UV-C irradiation measurements are performed, it is recommended that light sources are burned in for 100 hours, if possible. After the burn-in has been completed, the lamps will be stable and can be considered as a fixed starting point when starting to take the measurements. Failure to complete the 100-hour burnin period may result in higher initial readings. Humans and animals must never be present in the room until all measurements and adjustments have been completed.

- Make sure you have the latest design diagrams including the most recent architectural and electrical plans, simulation calculation report (if performed), list of surface materials and reflective values (APPENDIX B - REFLECTIVITY FACTORS), revision notes from previous assessments (if applicable) to compare with the current situation.
- If a subsequent assessment is to be performed, such as when replacing light sources, check whether the usage of the room (time spent there, primary work areas, etc.) is the same as during the original commissioning. Where there are changes, these must be registered and the measuring points must be adjusted if necessary.
- Look for new objects (hanging from the ceiling or taller objects on the floor) that may affect the UV-C light. If this is the case, these must be registered. Subsequent assessments must be compared with the original documentation.
- Check for nearby objects (smoke alarms, alarms, projectors, wi-fi routers, etc.) that may be of materials or painted with paints that can be degraded by UV-C and advise the customer.
- Clear the room before activating the system and lock doors if possible. Place warning signs at doors.
- Activate the light sources and allow them to stabilize for 10 minutes before starting to take measurements.
- Thoroughly clean the sensor lens according to the instructions provided by the sensor supplier before starting to take measurements.
- Check for standard light sources installed in the ceiling directly in the irradiated area, which could reflect irradiation down into the area where people may be present. It is recommended to remove or relocate these light sources.

Assessment and Measurement

 Create a table with the required number of measuring grid-points. The grid-points should be placed at equal distances from each other. Reference the figure and table below to determine the number of measuring grid-points.

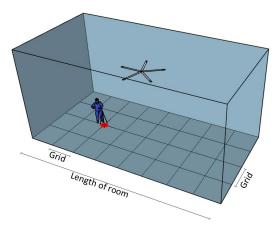


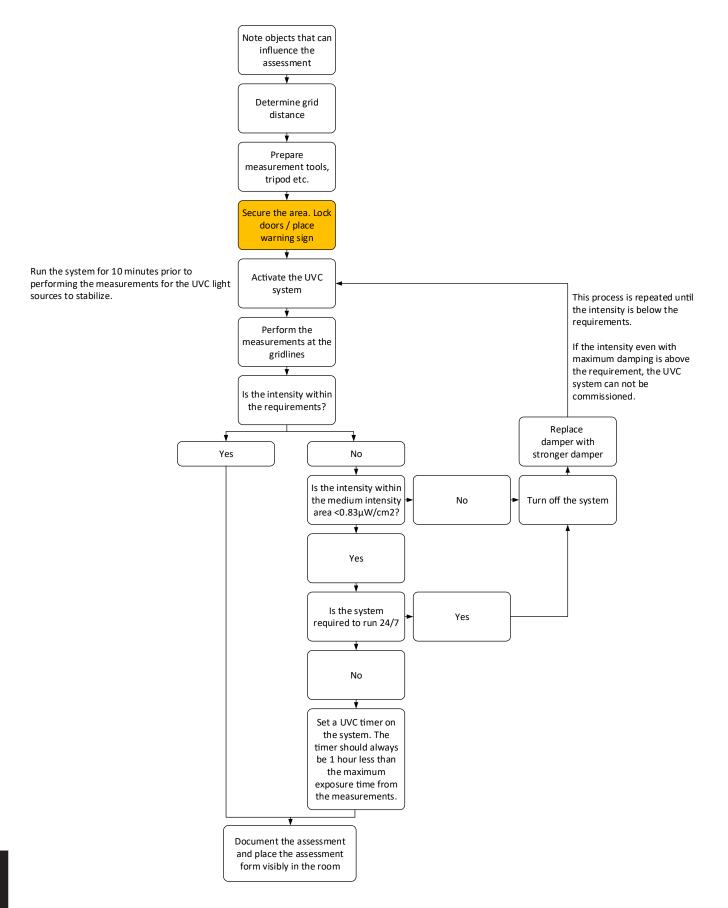
Table 1: Determining Minimum Number of MeasuringPoints

Length of room (ft)	Maximum distance between measuring points [ft]. Height h stated in [ft] ($h \ge 10$ ft)	Minimum number of measuring points
6-24 ft	0.35 * h , max 6 ft	5
25-50 ft	0.45 * h , max 11 ft	8
51-80 ft	0.55 * h , max 16 ft	12
>80 ft	0.65 * h , max 19 ft	16
measuring The higher distance be Grid lines s installed. If there is si should be b The grid dis materials (S	he room area, the greater the di points. the room area's ceiling height, t stween measuring points. hould not coincide if more than mulated irradiation in the room, oased on the simulation. stance should be reduced if high see APPENDIX B - REFLECTIVIT e room, or the room is somewhe	he greater the 1 UV-C system is the grid distance nly-reflective ITY FACTORS) are

- If more than one Northern Light system is installed in the room, both systems must be activated during the survey.
- 3. Set the tripod at a standard 6 ft. (183 cm) or an acceptable height for the tasks that will be performed in the room.
- 4. As the limit values specified in IEC/EN 62471 apply to both skin and eye exposure, the sensor must not be shielded and must be completely exposed during the assessment.

- 5. Each measuring point must have an irradiation hotspot (where the irradiation is of highest intensity). This is determined by rotating the sensor in the room, aiming first at the UV-C system and then around the room to take into account any high-reflective surfaces that may be present. The maximum measured value must always be used to calibrate the system.
- 6. Record the location of all measured points and clearly highlight if a measurement exceeds limit values based on the maximum permitted UV-C guidelines for exposure in Table 2 Limit values for artificial optical irradiation at 254nm.
- 7. The measurement process is illustrated in the figure on page 40.

Flow Chart Illustration of Assessment Procedure



Picture Examples of the Assessment Procedure

Below are picture examples of an assessment procedure with measurement equipment, as well as safety gear in the form of protective equipment.

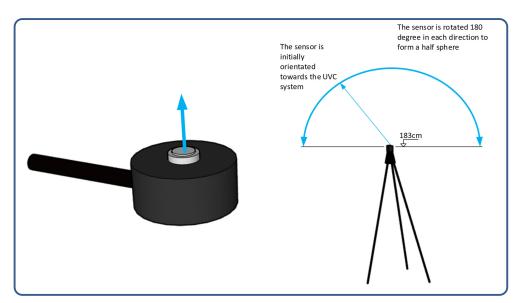


Setting the height of the sensor head to a standard 6 ft. (183 cm) or acceptable height for the tasks that are performed in the room.



Measurement of irradiation in grid points.

Sensor Orientation





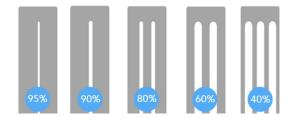
Examples of different sensor directions when measuring to locate hotspots.

Mechanical Damping of UV-C System

The system must be damped if irradiation intensities that exceed permitted values in APPENDIX A – LIMIT VALUES FOR ARTIFICIAL OPTICAL IRRADIATION are registered during the assessment. Mechanical damping is done by replacing the glass that covers the integrated UV-C light sources with dampers that block some of the irradiation.

Use the supplied damper plates to dampen the system. 5 different damper plates are included, which block from 40% up to 95% of the irradiation (the quartz glass alone blocks 20% of the irradiation).

The mechanical damping removes a given percentage of the irradiation, and it is therefore possible to estimate which damper plate to use, based on the initial irradiation.



NOTE: After calibration/damping of the system, a full assessment of the system must be performed to verify compliance with limit values, after damping has been performed.

Example: A measurement has been taken in a room and maximum irradiation has been measured at 0.41 μ W/ cm2 4 hours exposure time. The system's owner does not wish to put time limits on the use of the system, so damping is necessary.

To comply with IEC/EN 62471 requirements, maximum constant irradiation must not exceed 0.21 μ W/cm2 when working up to or over 8 hours.

To achieve the desired reduction in irradiation, the damper can be estimated as:

$$1 - \left(\frac{0.21\frac{\mu W}{cm^2}}{0.41\frac{\mu W}{cm^2}}\right) * 80\% = 59\% \rightarrow 60\% \ damper$$

NOTE: This calculation only indicates a damping estimate. A subsequent on-site inspection assessment must be performed to ensure compliance with permitted limit values.

Installation of the Damper Plates is Illustrated Below.

1. Loosen the end section and replace the currently installed damper with the required UV-C irradiation damper.



2. Attach the end section to the blade and screw the parts back together.



3. Blade with UV-C irradiation damper inserted.



Documentation and Requirements

After activation, assessment and possible damping/ calibration of the system, an assessment report must be prepared and made available to all involved parties.

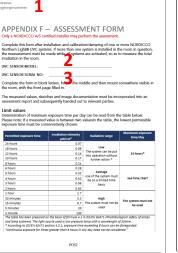
The report must at least contain the following information:

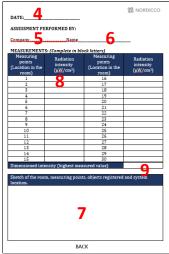
- **Inspection Report** A safety inspection must be performed if the certified installer has not been responsible for the fan's suspension and connection to ensure that the fan is installed correctly as set out in Part 1 of the installation procedure.
- Visual Inspection Note any highly reflective objects and other objects that might affect irradiation intensity. For control measurements, compare with the previous visual inspection.
- Irradiation Measurements Measurements of UV-C irradiation in the room; refer to the assessment form.
- Notes and More Attach any notes and observations.

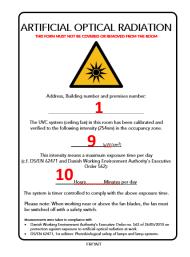
The assessment form in its entirety can be found in APPENDIX C – ASSESSMENT FORM.

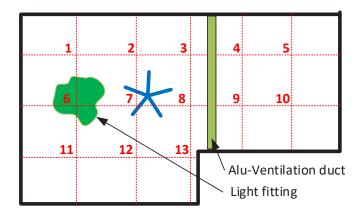
Complete the form with the relevant information listed below:

- 1. Specify Address, Building Number and Room Number.
- 2. Specify the Sensor Model, for example Safester from Sglux.
- 3. Specify the Sensor Serial Number S/N.
- 4. Specify the Date the measurement was performed.
- 5. Specify the name of the company that performed the assessment.
- 6. State the name of the certified employee who performed the assessment.
- 7. Draw a sketch of the room to indicate where the measurements were performed. Note objects etc.
- 8. Specify the maximum irradiation intensity for each of the specified measuring points in 7).
- 9. Specify the highest measured intensity.
- 10. Using the limit value table, specify the specified maximum exposure time.
- 11. Produce photographic documentation of the front and back of the form for archiving and documentation purposes if the form in the room should be misplaced.
- 12. Place both pages of the form somewhere visible in the measured room.









User Safety Instructions



ARTIFICIAL OPTICAL IRRADIATION

THIS SYSTEM PERIODICALLY EMITS ULTRAVIOLET IRRADIATION AT A WAVELENGTH OF 254NM, WHICH CAN BE HARMFUL TO HUMANS IN EXCESSIVE DOSES. THE SYSTEM IS CALIBRATED TO COMPLY WITH CURRENT LEGISLATION.

IF YOU UNEXPECTEDLY NOTICE REDNESS OF THE SKIN OR EYE IRRITATION, SWITCH OFF THE UV-C LIGHT IMMEDIATELY BY PRESSING THE LIGHT BUTTON ON THE CONTROL PANEL AND CONTACT THE INSTALLER OR MANUFACTURER.

THE BUILT-IN UV-C SYSTEM IS INTEGRATED IN THE UPPER SIDE OF THE BLADES AND ONLY CASTS LIGHT IN AN UPWARD DIRECTION. **NEVER LOOK DIRECTLY INTO THE LIGHT SOURCES.** THE FAN MUST THEREFORE ALWAYS BE SWITCHED OFF WITH A SAFETY SWITCH BEFORE WORKING NEAR OR ABOVE THE FAN.



USE OF THE UV-C SYSTEM OVER TIME CAN RESULT IN DISCOLORATION AND DECOMPOSITION OF NON-UV-RESISTANT MATERIALS.

IMPORTANT: THE LIGHT SOURCES USED IN THE SYSTEM CONTAIN SMALL AMOUNTS OF MERCURY. IN THE EVENT OF DAMAGE TO A LIGHT SOURCE, IT IS UNLIKELY THAT EXPOSURE WILL AFFECT YOUR HEALTH AS LONG AS THE DAMAGED LIGHT SOURCE IS HANDLED AND DISPOSED OF SAFELY. IF A LIGHT SOURCE BREAKS, THE FAN MUST BE SWITCHED OFF IMMEDIATELY, THE ROOM MUST BE VENTILATED FOR A MINIMUM OF 30 MINUTES, AND THE BROKEN PARTS MUST BE REMOVED (WEARING GLOVES). PUT THE PARTS IN A CLOSED PLASTIC BAG AND DEPOSIT AT YOUR LOCAL RECYCLING STATION. DO NOT USE A VACUUM CLEANER.

Appendices

APPENDIX A – LIMIT VALUES FOR ARTIFICIAL OPTICAL IRRADIATION

When calibrating the system, the limit values specified in IEC/EN 62471 Photobiological safety of lamps and lamp systems must be observed. Table 2 states the maximum permitted limit values for the Northern Light System, calculated on the basis of IEC/EN 62471.

Permissible exposure time below for a 254nm low pressure lamp is calculated in accordance with IEC/ EN 62471. A detailed calculation can be found in APPENDIX AA – CALCULATION EXAMPLE

Table 2: Limit Values for Artificial Optical Irradiation at 254 nm

Permissible Irradiation exposure time μ W/cm ²		Radiated area	Maximum exposure time/day	
24 hours	0.07	Low		
18 hours	0.09	The system		
12 hours	0.14	can be put into operation	24 hours*	
10 hours	0.17	without further		
8 hours	0.21	action*		
6 hours	0.28	Medium		
5 hours	0.33	The system		
4 hours	0.42	must be time-limited	See time chart	
3 hours	0.56	or dampened		
2 hours	0.83	further		
1 hour	1.7			
30 minutes	3.3	High	The system	
15 minutes	6.7	The system must not be	must not be	
5 minutes	20	used	used	
1 minute	100			

The table has been prepared on the basis of formula 4.1 in IEC/EN 62471 (Photobiological safety of lamps and lamp systems). The light source used is low pressure lamp with a wavelength of 254nm. * According to IEC/EN 62471 section 4.3.1, exposure time

exceeding 8 hours can be disregarded:

"Continuous exposure for times greater than 8 hours in any day need not be considered."

APPENDIX AA – IRRADIATION CALCULATION EXAMPLE

NORMS AND STANDARDS

The calculation has been prepared on the basis of the following norms, standards and directives:

 IEC/EN 62471 (2008-09-29) - Photobiological safety of lamps and lamp systems

Product data

General Information		
Cap-Base	2G11 [2G11]	
Main Application	Disinfection	
Useful Life (Nom)	9000 h	
System Description	High Output	
Light Technical		
Color Code	TUV	

Color Designation	- [Not Specified]
Depreciation at Useful Lifetime	20 %
Operating and Electrical	
Power (Nom)	67 W
Lamp Current (Nom)	0.800 A
Order product name	TUV PL-L 60W/4P HO 1CT/25
EAN/UPC - Product	8711500710345
Order code	927909004007

1

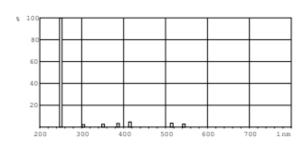
25

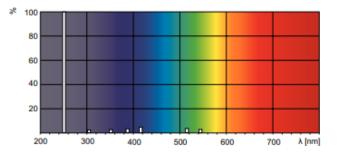
Voltage (Nom)	84 V	
Mechanical and Housing		
Cap-Base Information	4 Pins	
Bulb Shape	2xT16	
Approval and Application		
Mercury (Hg) Content (Nom)	4.4 mg	
UV		
UV-C Radiation at 100 hr	19.0 W	
Product Data		
Full product code	871150071034540	
Material Nr. (12NC)	927909004007	
Net Weight (Piece)	104.000 g	

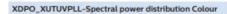
Photometric data

Numerator - Quantity Per Pack

Numerator - Packs per outer box







Reference

ASSUMPTIONS USED IN CALCULATIONS

The system uses 5 TUV PL-L 60W/4P HO 1CT/25 low pressure lamps mounted as up-lights in the blades. Light source data can be found in the following:

FORMULAE

The calculation is performed in accordance with the instructions in IEC/EN 62471 and is based on formula (4.1).

$$E_{s} \cdot t = \sum_{200}^{400} \sum_{t} E_{\lambda}(\lambda, t) \cdot S_{UV}(\lambda) \cdot \Delta t \cdot \Delta \lambda \leq 30 \qquad J \cdot m^{-2}$$

The above formula takes into account multiple simultaneous wavelengths, as well as different exposure intensities over time.

If the maximum irradiation over time and the spectrum of light sources for 254nm low-pressure lamps are conservatively calculated, the formula can be rewritten as:

$$E_s \cdot t = t \cdot E_{\lambda} \cdot S_{UV}(\lambda) \le 30 \qquad \qquad J \cdot m^{-2}$$

The spectral weighting $S_{UV}(\lambda)$ is specified in table 4.1

Wavelength ¹	UV hazard function	Wavelength	UV hazard function				
λ, nm	$S_{UV}(\lambda)$	<i>λ</i> , nm	S _{UV} (λ)				
200	0,030	313*	0,006				
205 0,051		315	0,003				
210	0,075	316	0,0024				
215	0,095	317	0,0020				
220	0,120	318	0,0016				
225	0,150	319	0,0012				
230	0,190	320	0,0010				
235	0,240	322	0,00067				
240	0,300	323	0,00054				
245	0,360	325	0,00050				
250	0,430	328	0,00044				
254*	0,500	330	0,00041				
255	0,520	333*	0,00037				
260	0,650	335	0,00034				
265	0,810	340	0,00028				
270	1,000	345	0,00024				
275	0,960	350	0,00020				
280*	0,880	355	0,00016				
285	0.770	360	0.00013				
290	0.640	365*	0.00011				
295	0,540	370	0,000093				
297*	0,460	375	0,000077				
300	0,300	380	0,000064				
303*	0,120	385	0,000053				
305	0,060	390	0,000044				
308	0,026	395	0,000036				
310	0,015	400	0,000030				
¹ Wavelengths chosen are representative: other values should be obtained by logarithmic interpolation at intermediate wavelengths.							
* Emission lines of a mercury discharge spectrum.							

Table 4.1 Spectral weighting function for assessing ultraviolet hazards for skin and eye.

If this is introduced, the formula can be rewritten to:

$$\begin{split} E_S \cdot t &= t \cdot E_\lambda \cdot 0.5 \leq 30 \qquad J \cdot m^{-2} \\ E_S \cdot t &= t \cdot E_\lambda \leq 60 \qquad J \cdot m^{-2} \end{split}$$

Formula 4.2 from IEC/EN 62471 can thus also be rewritten as:

$$t_{max} = \frac{60}{E_s}$$

S

where ${\rm t}_{max}$ is maximum exposure time and ${\rm E}_{\rm S}$ is irradiation intensity

CALCULATION EXAMPLE

Based on the described formula 4.2, maximum exposure time can now be calculated at different irradiation intensities.

The following is an example where the measured irradiation in the room is measured to ${\rm E}_{\rm S}$

 $E_{\rm S}=0.150~\mu W\cdot cm^{-2}$ Measured intensity at a 254 nm low pressure lamp

Based on the measured irradiation intensity, maximum exposure time can now be calculated as.

$$t_{max} = \frac{60 J \cdot m^{-2}}{0.150 \ \mu W \cdot cm^{-2}} = 11.11 \ hours$$

APPENDIX B - REFLECTIVITY FACTORS

Reflectivity factors for common materials

Table 3 and Table 4 specify reflectivity values for common materials. The values in some cases cover both UV-B and UV-C wavelengths and must therefore be considered to be indicative.

Material	Reflection (%)
Untreated aluminum surface	40-60
Surface-treated aluminum	60-89
Aluminum (mirror covering)	75-85
Aluminum paint	55-75
Stainless steel	25-30
Tin sheet	25-30
Magnesium oxide	75-88
Calcium carbonate	70-80
Putty	55-60
White oil-based paint	5-10
White water-based paint	10-35
Zinc oxide paint	4-5

 Table 3: Common Material Reflection Values

Source: Illuminating Engineering Society of North America (IESNA) (2000) Nonvisual Effects of Radiant Energy-Effects on Microorganisms-Germicidal (Bactericidal) Ultraviolet Irradiance. In Lightning Handbook (Edited by M. S. Rea)

Table 4: Additional Common Material ReflectionValues

Material (selected)	Reflection (%) (both UVB and UV-C)
Silicone	62-73
Galvanized pipe - smooth	57
Galvanized pipe - corrugated	53
White putty	46
Chrome	39
Nickel	37-38
Steel	37
Zinc	37
Wallpaper (white)	25-35
Stainless steel	28
Copper	25-31
Concrete	<19
Wallpaper (other color)	18
Linen	17
Carbon fiber	16
Cement	11
Oil-based paint	8
Glass	4

Source: Kowalski, W. (2009) Ultraviolet material reflectivities (UV-B/ UV-C range). In Ultraviolet Germicidal Irradiation: UVGI for Air and Surface Disinfection, Springer, New York

Reflectivity factors for common ceiling panels

Table 5 and Table 6 indicate reflection values for common ceiling panels. The reflection values should be considered indicative. The reflection values have been prepared on the basis of the 254nm low-pressure lamp.

Table 5: Reflection Values for Ceiling Panels

ID	INCL SPECULAR	EXCL SPECULAR	ID	INCL SPECULAR	EXCL SPECULAR	ID	INCL SPECULAR	EXCL SPECULAR
А	0.035± 0.001	0.034	Ν	0.096 ± 0.003	0.041	Ζ	0.260±0.048	0.288
В	0.043±0.002	0.041	0	0.106±0.006	0.047	AA	0.260 ± 0.035	0.243
С	0.048±0.001	0.047	Р	0.107±0.024	0.05	BB	0.273±0.007	0.274
D	0.051±0.001	0.05	Q	0.122±0.007	0.047	CC	0.275±0.016	0.28
E	0.052±0.002	0.047	R	0.151±0.008	0.054	DD	0.276±0.013	0.283
F	0.055±0.006	0.054	S	0.152±0.009	0.059	EE	0.276±0.026	0.29
G	0.060±0.002	0.059	Т	0.165±0.021	0.062	FF	0.282±0.029	0.306
Н	0.064±0.004	0.062	U	0.237±0.011	0.065	GG	0.334±0.024	0.333
Ι	0.070±0.001	0.065	V	0.240±0.033	0.071	ΗΗ	0.353±0.031	0.363
J	0.071±0.005	0.071	W	0.240±0.063	0.069	II	0.362±0.028	0.364
К	0.071±0.001	0.069	Х	0.244±0.023	0.071	JJ	0.423±0.103	0.41
L	0.074±0.001	0.071	Y	0.245±0.070	0.067	KK	0.459±0.015	0.438
М	0.076±0.003	0.067						

Refer to Table 6 for panel categories.

Source: Reed NG, Wengraitis S, "Ultraviolet Spectral Reflectance of Ceiling Tiles, and Implications for the Safe Use of Upper-Room Ultraviolet Germicidal Irradiation". Photochemistry & Photobiology 2012, 88: 1480-1488

Table 6: Ceiling Panel Categories

Supplier	Product name	Product number	Materials	Obvious surface properties	ID
Armstrong	Armatuff	860	Wet-formed high-density mineral fiber	Latex paint	R
Armstrong	Ceramagurad	605	Ceramic and mineral fiber composite	Scrubbable plastic finish	KK
Armstrong	Cirrus	574	Wet-formed mineral fiber	Latex paint	HH
Armstrong	Cirrus (camel)	589	Wet-formed mineral fiber	Latex paint	S
Armstrong	Cirrus (platinum	589	Wet-formed mineral fiber	Latex paint	Х
Armstrong	Clean Room Mylar	1721	Wet-formed mineral fiber	Soil-resistant polyester film	G
Armstrong	Clean Room VL	870	Wet-formed mineral fiber	Vinyl-faced membrane	К
Armstrong	Cortega	769	Wet-formed mineral fiber	Latex paint	V
Armstrong	Crossgate	2625	Wet-formed mineral fiber	Latex paint	AA
Armstrong	Dune	1772	Wet-formed mineral fiber	Latex paint	U
Armstrong	Endura	639	Wet-formed high-density mineral fiber	Vinyl latex paint	GG
Armstrong	Fine Fissured School Zone	1714	Wet-formed mineral fiber	Latex paint	FF
Armstrong	Fine Fissured (camel)	1729	Wet-formed mineral fiber	Latex paint	Т
Armstrong	Fine Fissured (haze)	1729	Wet-formed mineral fiber	Latex paint	DD
Armstrong	Fine Fissured (techblack)	1729	Wet-formed mineral fiber	Latex paint	D
Armstrong	Fine Fissured (white)	1729	Wet-formed mineral fiber	Latex paint	Z
Armstrong	Fine Fissured Open Plan	1754	Wet-formed mineral fiber	Latex paint	Ш
Armstrong	Georgian	17	Wet-formed mineral fiber	Latex paint	CC
Armstrong	Graphis	1753	Wet-formed mineral fiber	Latex paint	J
Armstrong	Latitudes	8005	Wet-formed mineral fiber	Latex paint	W
Armstrong	Ledges	8011	Wet-formed mineral fiber	Latex paint	Р
Armstrong	Mesa	680	Wet-formed mineral fiber	Latex paint	E
Armstrong	Optima	3151	Fiberglass with acoustically transparent membrane	Acoustically transparent membrane and latex paint	в
Armstrong	Painted Nubby	3101	Fiberglass	Latex paint	EE
Armstrong	Pebble	2989	Fiberglass	Latex paint	N
Armstrong	Random Fissured	2910	Fiberglass	Scrubbable vinyl film facing	F
Armstrong	Sansera	573	Embossed wet-formed mineral fiber	Latex paint	Y
Armstrong	Shasta	2906	Fiberglass	Scrubbable vinyl film facing	Н
Armstrong	Stratus	531	Wet-formed mineral fiber	Latex paint	JJ
Armstrong	VL	871	Wet-formed mineral fiber	Vinyl-faced membrane	L
Certain-Teed	Ecophon Gedina E	-	Fiberglass	Sound-resistant coating	BB
Certain-Teed	Fine Fissured High NRC	454	Wet-felted mineral fiber	Latex paint	М
Certain-Teed	Symphony F	134,2,4	Fiberglass	Laminate	С
Certain-Teed	Theatre Black F	1910.2	Fiberglass	Laminate	A
Certain-Teed	Vinyl Rock	1140,2-CRF-1	Gypsum	Scrubbable vinyl film facing	1
USG	Astro Climaplus	-	Mineral fiber	-	Q
USG	Brio Climaplus	-	Mineral fiber	-	Q

Refer to Table 5 for reflection values.

Please note: All panels are white unless otherwise indicated in parentheses next to the model or in the model name itself. ID is used to identify specific panels in diagrams, tables, and text.

APPENDIX C - ASSESSMENT FORM

Only a qualified installer who is familiar with commissioning UV-C light sources may perform the assessment.

Complete this form after installation and calibration/damping of one or more Northern Light[®] UV-C systems. If more than one system is installed in the room in question, the measurement must be made while all systems are activated, so as to measure the total irradiation in the room.

Complete the form in block letters, then mount somewhere visible in the room.

The measured values, sketches and image documentation must be incorporated into an assessment report and subsequently handed out to relevant parties.

Limit values

Determination of maximum exposure time per day can be read from the table below: Please note: If a measured value is between two values in the table, the lowest permissible exposure time must be conservatively chosen.

Permitted exposure time	Irradiation intensity µw/cm ²	Radiation range	Maximum exposure time/day
24 hours	0.07		
18 hours	0.09	Low	
12 hours	0.14	The system can be put into operation without	24 hours*
10 hours	0.17	further action *	
8 hours	0.21		
6 hours	0.28		
5 hours	0.33	Average	
4 hours	0.42	Use of the system must be on a limited time	See time chart
3 hours	0.56	be on a limited time basis	
2 hours	0.83		
1 hour	1.7		
30 minutes	3.3	High	- 1
15 minutes	6.7	The system must not be	The system must not be used
5 minutes	20	used	שב משבע
1 minute	100		

The table has been prepared on the basis of formula 4.1 in IEC/EN 62471 (Photobiological safety of lamps and lamp systems). The light source used is low pressure lamp with a wavelength of 254nm. * According to IEC/EN 62471 section 4.3.1, exposure time exceeding 8 hours can be disregarded:

"Continuous exposure for times greater than 8 hours in any day need not be considered."

ARTIFICIAL OPTICAL RADIATION

THIS FORM MUST NOT BE COVERED OR REMOVED FROM THE ROOM



Address, Building Number and Premises Number:

The UV-C system (ceiling fan) in this room has been calibrated and verified to the following intensity (254nm) in the occupancy zone.

(μW/cm²)

This intensity means a maximum exposure time per day of (according to IEC/EN 62471):

Hours Minutes per day

The system is timer controlled to comply with the above exposure time.

Please note: When working near or above the fan blades, the fan must be switched off with a safety switch.

Measurements were taken in compliance with IEC/EN 62471, 1st edition: Photobiological safety of lamps and lamp systems

UV-C	SENSOR	MODEL:
------	--------	--------

UV-C SENSOR SERIAL NO:

DATE:_____

ASSESSMENT PERFORMED BY:

Company_____Name_____

MEASUREMENTS: (Complete in block letters)

Measuring points (Location in the room)	Radiation intensity (µW/cm²)	Measuring points (Location in the room)	Radiation intensity (μW/cm²)
1		16	
2		17	
3		18	
4		19	
5		20	
6		21	
7		22	
8		23	
9		24	
10		25	
11		26	
12		27	
13		28	
14		29	
15		30	
Dimensioned inte	ensity (highest meas	sured value)	

Sketch of the room, measuring points, objects registered and system location.

Maintenance Log

	Time		Time	
 Date	Time	AM/PM	Time	
	Time		Time	

Maintenance Log

Date	Time	AM/PM	Date	Time	AM/PM
Notes:			Notes:		
Notes:	Time		Notes:	Time	
	Time			Time	
	Time			Time	
 Date	Time	AM/PM	 Date	Time	AM/PM
	Time			Time	

Maintenance Log

	Time		Time	
 Date	Time	AM/PM	Time	
	Time		Time	

Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Product warranties can be found online at Greenheck.com, either on the specific product page or in the literature section of the website at Greenheck.com/Resources/Library/Literature.



Phone: 715.359.6171 • Fax: 715.355.2399 • Parts: 800.355.5354 • E-mail: gfcinfo@greenheck.com • Website: www.greenheck.com