

WIND TURBINE MAINTENANCE SOLUTION



ALLEYOOOP

WIND SERVICE



CONTENTS

Who is ALLEYOOOP

Safety System

Cleaning

Coation / Welding

Rotor Blade Inspection / Repair

Additional Repair

Certification

Other Service

WHO IS ALLEYOOP



ALLEYOOP is the premier provider of rope access maintenance, inspection and performance enhancement services that require specialized access approaches.

Our roots are in the wind turbine operations and maintenance market where we refined our business practices and developed a reputation for uncompromising safety and high quality results.

In the last ten years, our rapid-response ALLEYOOP technicians have completed several projects for every major manufacturer and the majority of wind farm owners. By partnering with these clients, applying safe, cost-effective, and environmentally appropriate solutions, we reduce turbine downtime, increase production-based availability and ultimately the life-span of our client's turbines.

Nice job summarizing the effort put forth and the findings. I appreciated the professionalism and the responsiveness of the team. I believe they were key to the success of the project. Thanks to all.



ALLEYOOP

Safety System

ALLEYOOP's safety and health management system is a global system that continuously complements and improves a set of processes of planning, implementation, inspection, and action based on the CEO's safety policies to ensure the best autonomous safety and health system is implemented.



ALLEYOOP

Ethics

ALLEYOOP is committed to ethical responsibility to create a trusted and just company.



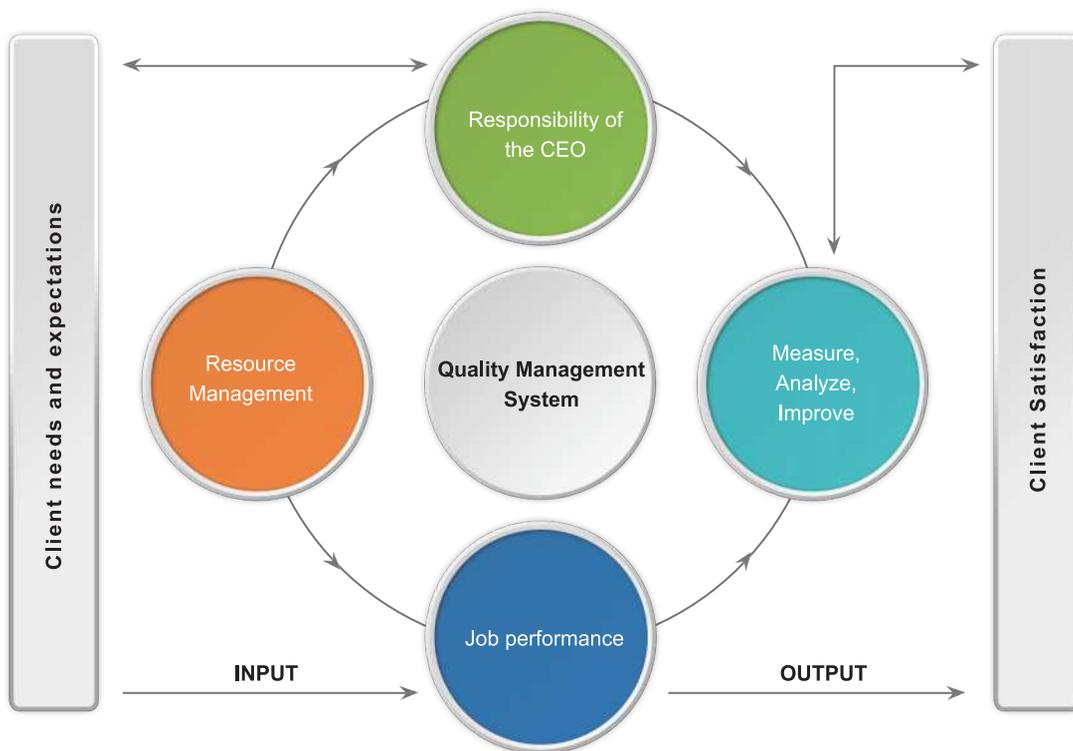
ALLEYOOP

Quality

We build, implement and improve quality management systems that meet global standards and customer requirements to realize customer satisfaction.

1. Optimal service is provided based on understanding and technical skills to customers.
2. We guarantee the highest quality improvement through continuous improvement and innovation.
3. We pursue sustainable management through win-win cooperation with business partners.

All executives and employees of Aliluv practice quality management policies to create the best client satisfaction and management performance and maximize corporate value.



SAFETY FIRST





What Can We Do ?!

Cleaning

It is commonly accepted that the build-up of dirt, grime and other subjects on the surface of a Rotor Blade can negatively affect the WTG output. Not only this, Blade Inspections can also be hampered as surface debris can often mask the initial stages of erosion or a defect.

Our Blade Cleaning Service can not only aesthetically restore your WTG's but also ensure they operate in optimum condition. Cleaning your Blades can also reveal any defects or damage which has previously being unnoticed.

Using our very own exclusive cleaning systems, the days of needing endless water resources on site is now a thing of the past. In fact, our cleaning system hardly uses any water at all compared to traditional cleaning methods. We don't believe there is a more environmentally

Coating / Welding

Dealing with Corrosion:

Corrosion is a serious detriment to the structural integrity of any wind turbine.

ALLEYOOOP offers an integrated approach of corrosion removal and new coating application for a cost-effective means of preserving your investment. With the capability to provide all materials and consumables, ALLEYOOOP technicians combine significant coating experience with the use of specialized tooling to get the job done.

Our exceptional quality of work can be verified by our provided reports that detail every step of the repair.

Surface Preparation:

ALLEYOOOP technicians utilizes a variety of reliable and cost-effective techniques for achieving a clean, profiled and corrosion-free surface profile. This process maximizes adhesion of the coating regardless of repair size.

Application of New Coatings:

Wind turbine coatings technology is frequently changing and ALLEYOOOP technicians keep abreast of innovations as they become commercially available. As a result, Rope Partner has the capability and expertise to apply coatings of any composition. Our preferred materials offer excellent performance and resistance to environmental conditions and have been proven over decades of use in the field.

No matter the size and scope of your coating requirements, ALLEYOOOP technicians can offer our clients an unmatched level of service and finish quality.



Rotor Blade Inspection / Repair

Performance Composites provides reliable wind turbine blade repair, inspection and consulting services. We are blade and composite experts with a dedicated group of experienced engineers and technicians focused on quality. We are advocates for turbine owners and operators and we will help you develop cost effective solutions to maintain your blades for a 20+ year life.

Using our advanced and competent blade technicians we can perform a range of complex and non-complex repairs to wind turbine blades. From simple fill and paint for minor gel coat damages to far more advanced blade repair services and inspections. (category 1 ~ category 5)



We repair it according to the manufacturer's instructions. Therefore, better quality can be achieved. We have various repair experiences and submit a repair report to the client when the repair is complete. Complex forms of repair seek smart ways through discussions with clients about repair methods.

Our blade technicians are DNV-GL, GWO certified and IRATA trained. We insist on the highest safety standards, because there is no margin for error when working at height. Rope access is faster and more cost-effective than working with platforms or similar forms of access. It keeps operations and maintenance costs under control, while providing successful outcomes.

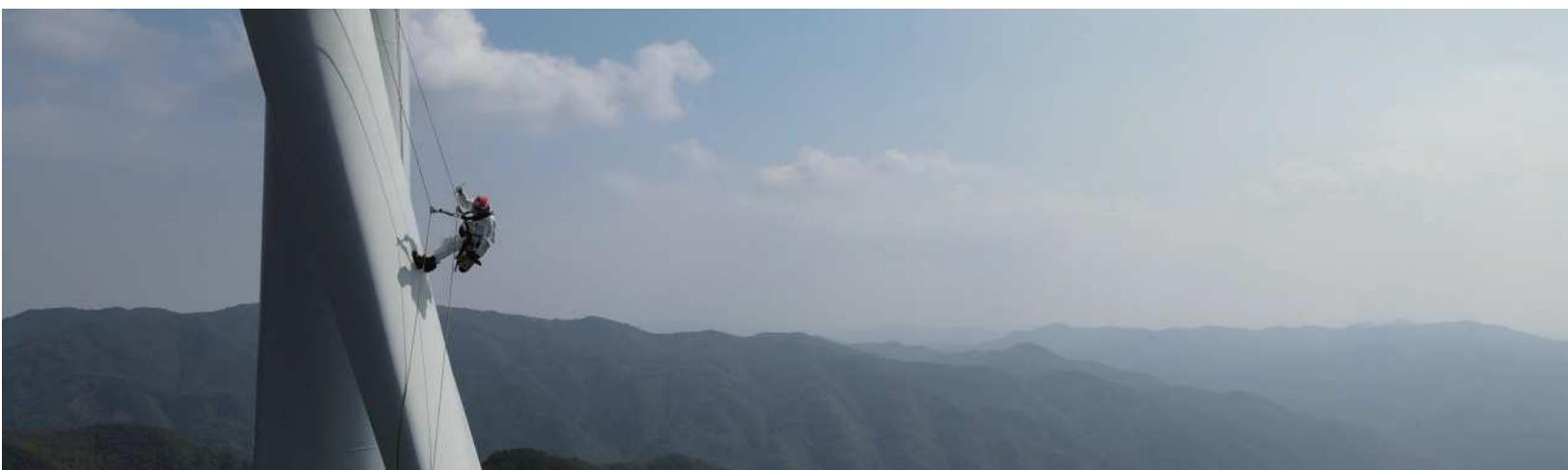
Prevention is better than cure. This undoubtedly applies to wind farm maintenance. Wind turbines have an average lifespan of 15 years, but the lifespan of surface coatings may be much less. This means your return on investment depends on repairing any damage before it becomes a major problem. Or a catastrophic failure, particularly following the end of the warranty period.

Effective wind turbine maintenance relies on regular annual inspections. Our highly trained team of blade technicians provides quick and effective work. Using rope access techniques, they'll identify damage that could affect your wind farm's performance. This includes leading edge erosion, bladeline failure and installation errors. Not to mention damage caused by the weather, such as rain, hail, ice and lightning.

ALLEYOOP also has extensive experience in industrial access, coatings and composite services. This means that you can rely on us for effective repairs, every time. From fill-and-paint jobs to dealing with gel coat damage and core material replacement. From retrofitting power curve upgrades in soft shell, to leading edge tape and cutting-edge coatings. In other words, from simple through to advanced wind turbine maintenance services.

ALLEYOOP offers wind energy maintenance services for on-shore and off-shore installations. We can work on an agreed schedule or ad-hoc basis. And we're happy to pre-visit on-shore sites, if you prefer.

Offshore wind farm maintenance is a tough business. Based on many years of experience, we understand the harsh conditions and exacting standards. Our focus is firmly on minimising downtime and maximising annual energy production. And we can offer the expertise needed to troubleshoot unexpected drops in performance. This protects the lifetime output of the plant and your investment.



LPS(Lightning Protection System) TEST

Lightning strike? Preventive maintenance is the best for your blades

There are over 1,700 electrical storms active throughout the world at any time producing over 100 flashes per second. This equates to some 7 to 8 million strikes per day, which means your wind farm is at risk. Preventing direct and near-strike damage to wind turbines is critical to decreasing downtime and extending reliable turbine performance.

Testing method

The resistance of the conductor section from ground or nacelle to tip is measured with a low-Ohm measuring instrument.

Either 2-wire or 4-wire measuring principle is applied

Testing instruments

Special instruments designed for performing low Ohm measuring tests are used

Measuring range: 1Ohm, 20hm, 200hm, 2000hm

Test current: 0.1A, 0.2A, 1A, 2A

MEGGER – BT51

Schleich Handheld

BEHA UNITEST TELASRIS



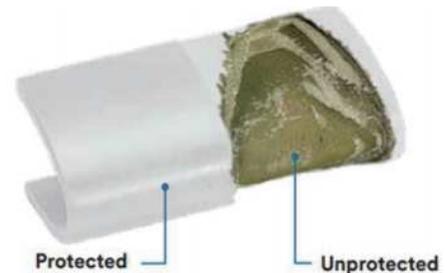
Extending equipment life with Our leading edge protection (LEP) solutions

Why do you need it?

Rotating up to 250 mph, wind blades are faced with erosion caused by rain, hail, salt spray, and other debris. As a result, many blades can suffer pitting, gouging, and delamination that can affect aerodynamic efficiency and even impact the integrity of the entire blade. Poor blade performance can also reduce annual energy production, and repair downtime is costly.

LEP tape

LEP tape offers an array of products to both repairs and helps prevent damage caused by minor impacts and erosion. This advanced solution is designed to enhance reliability, improve performance and extend the life of your valuable equipment.



LEP coating

High-quality and easy-to-apply Leading Edge Protection (LEP) coating has never been more important to keep up with demand. Wind turbine blades are getting larger with increased tip speeds. The renewable wind industry can rely on us to maintain blade performance and efficiency.

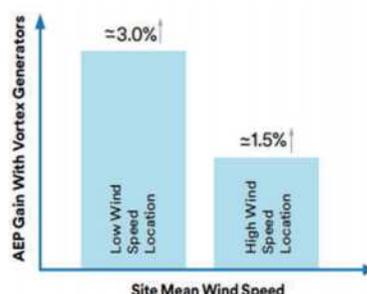
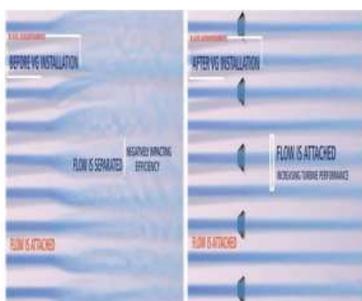
Optimize power product with Vortex Generators

We provide the latest development in wind turbine blade technology to increase your fleet's profitability.

Vortex generators

Vortex Generators (VGs) improve the performance of the blades by reducing flow separation. This leads to more torque turning the rotor and thus more energy produced. Even modern wind turbine blades suffer from poor aerodynamic performance in the root region. The reasons are blade production and operational limitations. The use of Vortex Generators gives you a fast, economical way to address aerodynamic blade issues caused by limited twist and chord length at the blade root.

- Increased annual energy production, typically of 2 to 3%, has been confirmed in different case studies
- Stabilized aerodynamics help balance load effects of unsteady wind conditions
- Reduced noise due to fewer stall
- Payback time of approximately 1 to 2 years including installation, materials, and downtime



Certification

We have accumulated experience and know-how, and all of our technicians have related certifications.

Related rotor blade inspection/repair

Level A : “Rotor Blade - Inspection & Repair Perspectives”.

Level B : Rotor Blade Repair – Basic – Training topics: Basics of chemical processes, polyester & epoxy resin, physical characteristics, composite materials, adhesion & adhesives technology, safety rules, health protection, chamfering, laminating, and documentation.

Level C : Rotor Blade Repair – Advanced : Advanced repair techniques, repair at leading edge & trailing edge, bonding techniques, leading edge protection, common failures and repair on lightning protection systems, vacuum technique, tip mechanism– training other topics on demand on demand.

Level D : Structural repairs - Repair and replacement of spar-web, repair of girder/ web-cap, training on real blade section

Level E : Repair of carbon fiber components , Mechanics of Adhesion – theoretical facts compiled for application of practice on rotor blade repair

Level F : Production of blade section through vacuum infusion process. Simulation of leading and trailing edge bonding failures, simulating lightning strike damage and practical repair of the lightning strike damage. Working with carbon fibers



- * ROTOR BLADE INSPECTION - LEVEL A,B,C,D
- * ROTOR BLADE REPAIR TECHNIQUES - LEVEL A,B,C,D
- * ROTOR BLADE REPAIR WORK
- ADVANCED REPAIR TECHNIQUES - LEVEL A,B,C,D,E,F

- * GWO BLADE REPAIR
- * GWO FIRST AID
- * GWO FIRE AWARENESS
- * GWO MANUAL HANDLING
- * GWO WORKING AT HEIGHT

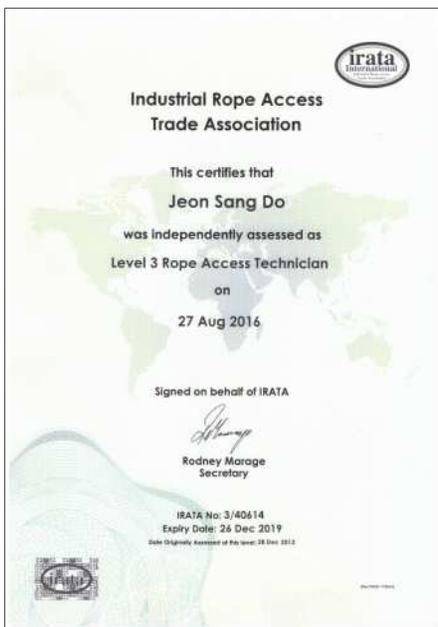


Related Rope Access & Rescue

Level 1 : This is a rope access technician who is able to perform a specified range of rope access tasks under the supervision of a Level 3 rope access safety supervisor.

Level 2 : This is an experienced rope access technician who has Level 1 skills plus more complex rigging, rescue and rope access skills, under the supervision of a Level 3 rope access safety supervisor.

Level 3 : This is a rope access technician who is able to demonstrate the skills and knowledge required of Levels 1 and 2; is conversant with relevant work techniques and legislation; has an extensive knowledge of advanced rigging and rescue techniques; holds an appropriate and current first aid certificate and has knowledge of the IRATA International training, assessment and certification scheme. Subject to a Level 3 having the necessary supervisory skills, he/she can become a rope access safety supervisor with responsibility for rope access safety in work projects



- * IRATA LEVEL3 / TRAINER
- * PETZL PPE INSPECTOR
- * RESCUE 3 INTERNATIONAL TECHNICAL ROPE RESCUE
- * ROPES THAT RESCUE TEAM SKILL RESCUE



Other Service

We provide long-established working at height techniques and rescue training. We have an irata training center currently in operation and provide essential training at the client's level.

Rescue training consists of basic emergency escape training and advanced Rescue. It also provides solutions for emergency escape from Nacelle. We have a clear solution of what needs to be inside the nacelle for emergency escape and what techniques are needed.

Working at Height Training

Knowledge and technical training required for working at height

Theory

- Definition of working at height and related laws
- FPE
- PPE
- Rescue equipment
- Experience simulation of working at height through VR

Practice

- Wearing PPE
- Technical description of rescue equipment
- Rescue methods for incidents that occur during a working at height operation
- Risk assessment and planning

Self Rescue Training

How to evacuate in case of an emergency

- Description of equipment used and how to wear it
- How to Knot
- Inspection method for equipment
- Escape method for 1 or 2 persons
- How to install a self-rescue system
- Self-rescue escape
- Set the lanyard

We can provide a business trip service.



Advanced Rescue Training

Theory

- Understanding the regulations applicable to the rope rescue
- Hazards and risks associated with rope rescue
- PPE, Rescue equipment management

Practice

- Knot method used in rescue techniques
- Access and Egress with working at height skills and rope access techniques
- Rescue system configuration and stretcher rescue
- Pick-off rescue
- Rescue using pulley system
- Lowering the casualties.
- Slope or horizontal rescue

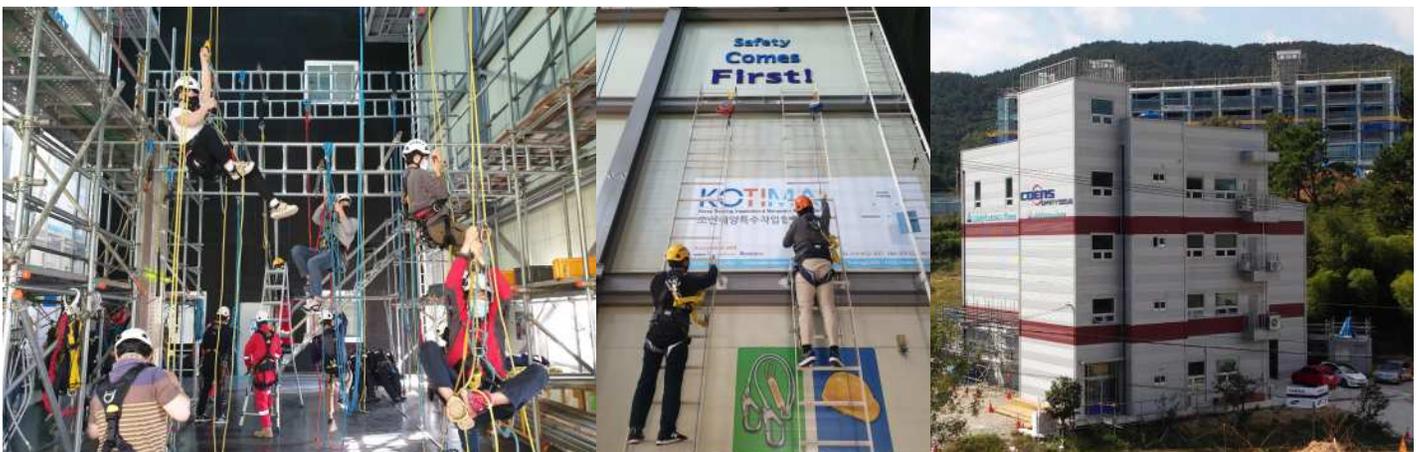
IRATA Training



IRATA is an organization with a proven safe working method for all work at height. We are a proud member of IRATA and have been an IRATA certified training center for over 10 years. In our training center in Geo-je we offer training for IRATA level 1, 2 and 3. Partly due to the atmosphere within the organization and the quality of our trainers, the success rate is well above 95%.

5 days duration for all level certification followed by a day of Assessment by an approved independent Assessor by IRATA. Equipment will be provided throughout the course and assessment.

Under the IRATA certification scheme, all rope access work must be supervised by an IRATA Level 3 supervisor, qualified in First Aid.





ALLEYOOP

IF YOU IGNORE SAFETY, IT MEANS YOU ARE NOT ALLEYOOP

대표전화 070-4045-8382

FAX 070-4045-8382

휴대전화 010-2001-4340

이메일 admin@alleyoop.co.kr

대표자 전상도

사업자등록번호 119-21-31914

경상남도 거제시 사등면 두동로 54-8 나라빌딩 201호

WWW.ALLEYOOP.CO.KR