Application of rope access methods in the construction, inspection, repair and maintenance of wind turbines

Introduction

IRATA International's rope access system is a safe method of working at height, where ropes and associated equipment are used to gain access to and egress from the work place, and to be supported at it.
IRATA was established in 1988. IRATA members have been involved in carrying out rope access work in the wind energy industry since its inception. This includes assistance during the construction phase, installation of equipment in the tower, non-destructive testing on internal and external surfaces, blade inspections and repair.
The wind energy industry has developed structures that vary in design but are generally similar in configuration and, as such, represent a unique yet repeatable work site for rope access methods. This document gives guidance on how to achieve a safe system of rope access and rescue in and on such structures.
This document is intended for use by IRATA International members, IRATA International rope access technicians, national and regional enforcement agencies, safety officers, and those who commission rope access work, e.g. wind turbine generator manufacturers, site owners, site operators, maintenance engineers.

1 Scope

1.1 This document gives guidance on work in and on wind turbines (see **Figure 1**) located both onshore and offshore. It should be read in conjunction with the latest edition of the IRATA International code of practice (ICOP), should not be used in isolation and is not intended to be exhaustive. For further advice, readers should refer to relevant specialist publications.
This annex should be read in conjunction with other parts of this code of practice, should not be used in isolation and is not intended to be exhaustive.

1.2 The following elements are included in this guidance document:

a) internal access fall arrest and rope access;

b) external access rope access/work positioning/restraint;

c) rescue, i.e. the recovery of an injured or incapacitated person to a safe place;

d) evacuation, i.e. the exiting of a wind turbine in an emergency to a safe place.

1.3 The following elements are not covered by this guidance document:

a) transfer to a wind turbine (by land, air or sea);

b) trade skills;

c) single-rope emergency personal evacuation systems.

2 Planning and management

2.1 Planning and management for a safe system of rope access are addressed in **ICOP Part 2, 2.2**, which should be referred to when planning and managing rope access activities involving wind turbines.

2.2 A risk assessment complying with local legislation and taking into account client and site owner requirements should be carried out. See **ICOP Part 2, 2.2.4**. An example of a site-specific checklist for the use of rope access systems in and on wind turbines is given in **Table 1**.

2.3 When planning and managing rope access work in and on wind turbines, careful attention should be paid as to how access, egress and rescue or evacuation from exposed areas, e.g. the transition piece, or restricted space, e.g. the hub, using rope access equipment and methods would be carried out. The following points should be taken into account:

a) The nature of rope access work is such that it is likely to be in an exposed position, especially when it is on the outside of the structure. Access to an injured rope access technician on the inside of the wind turbine could be difficult due to restricted space.

b) Onshore wind turbines are often in remote locations with poor mobile phone coverage and with access via unsurfaced tracks. Consequently, it might not be possible to rely on emergency services for assistance.

c) Offshore access and transfer by boat could add time delays for emergency services, e.g. caused by the state of the sea and tidal conditions.

d) Working over water may require the use of immersion suits and life jackets, which may compromise the use of other personal protective equipment.

e) The safe area could be restricted in size and might not provide sufficient space for the emergency services personnel.

2.4 Potential hazards to be addressed when planning and managing rope access work in and on wind turbines include:

a) environmental conditions, e.g. weather, heat, lightning, wind, ice, fog, wind chill, sun burn and glare, wind burn, low or poor visibility;

b) mechanical isolation, e.g. the yaw platform;

c) entrapment and entanglement of personnel, equipment and rigging;

d) fragile surfaces, e.g. external areas of the nacelle and hub may present fragile or unstable surfaces;

e) biohazards, e.g. bird droppings, may be more significant when working in the splash zone, e.g. the transition piece;

f) potential slips and trips, e.g. caused by oil, ice, algae, wet, on surfaces such as platforms and ladders;

g) restricted space, which may present particular hazards, depending on location;

h) electrical hazards and isolation, e.g. high voltage enclosures.

i) fire hazards, e.g. identification of likely points of ignition, location of fire suppression equipment, evacuation equipment, procedures and routes.

2.5 Other points to be taken into account when planning and managing rope access work in turbines include:

a) special attention should be paid to the suitability of intended work locations for rope access activities, bearing in mind that these may not have been considered by the client/site owner;

b) there should be an understanding of the client's isolation procedures and permits to work, including de-energising and emergency stop controls;

b) manual handling and ergonomics issues should be addressed, e.g. by the provision of an additional independent lifting/lowering system for heavy equipment;

c) rope access technicians working offshore should be kept clear of the water, wherever possible. (Appropriate protective equipment may be needed for certain operations, e.g. immersion suits, life jackets/buoyancy aids.);

d) there should be appropriate welfare provision for rope access technicians. This applies to both onshore and offshore working,

3 Competence and training

Guidance on competence and training is provided in **ICOP Part 2, 2.4 and 2.5**. In addition, the need for competence in the following should be taken into account, as applicable:

a) non-IRATA International access methods and associated rescue, e.g. guided type fall arresters, climb assist, powered climbers, lifts;
b) client and site-specific requirements, including existing site evacuation/rescue equipment and procedures.

4 Work team selection, size and supervision

4.1 Guidance on the selection of rope access technicians is provided in **ICOP Part 2, 2.3** and on work teams in **ICOP Part 2, 2.11.6**. The team size and composition should be appropriate for the type and duration of the work and associated rescue provision. There

should be a minimum of two rope access technicians per team, who should be capable of carrying out their own rescue.

4.2 Supervision is covered in detail in **ICOP Part 2, 2.6**. There should be a Level 3 rope access safety supervisor positioned at each discrete work site. The supervisor is responsible for providing a safe system of work. The supervisor is also responsible for planning an appropriate rescue system and being in direct control of rescue operations. This includes ensuring that the correct evacuation and rescue equipment is readily available.

5 Communication

Guidance on communication is provided in **ICOP Part 2, 2.11.10**. In addition:

a) there should be a communication system established which caters for immediate on-site communication and appropriate longer-distance communication;

b) there should be direct and uninterrupted communication between the supervisor and the work team. It is preferable for the supervisor to have direct sight of the work team;

c) account should be taken of the potential for no reception, poor reception or loss of reception for mobile phones, in which case the use of other types of communication, e.g. radio, should be considered;

d) the possibility of interference with the communication system by electrical equipment and by noise, e.g. caused by machinery, wind, should be taken into account.

6 Selection and use of equipment

6.1 Guidance on the selection and use of equipment is provided in **ICOP Part 2, 2.7**. It may be decided to use other equipment to assist the rope access operation, e.g. guided type fall arresters, retractable fall arresters, positioning suckers, powered climb-assist equipment. Attention is drawn for the need to:

a) assess the appropriateness of the equipment selected for the given task, i.e. carry out a risk assessment on its suitability;

b) train the rope access technicians in the correct use of the equipment;

c) be aware of any limitations in the equipment's use;

d) know how to inspect equipment and when to retire it.

6.2 Harnesses may need to be equipped with fall arrest points and/or work positioning side-attachment points. On-site fall arrest systems should be checked to ensure compatibility.

6.3 Compatibility with other personal protective equipment (PPE), e.g. immersion suits, buoyancy aids, lifejackets, should be established.

7 Anchors and rigging

Guidance on anchors and rigging is provided in **ICOP Part 2, 2.7.9** and **2.11.3**, and **ICOP Part 3, Annex F**. In addition:

a) IRATA International Level 3 supervisors should be competent to select, assess and use unquestionably reliable structural anchor points in and on wind turbines;

b) it should not be assumed that the presence of installed anchors means they are suitable for rope access, e.g. anchors installed in fibreglass housings;

c) the suitability of designated anchor points should be confirmed prior to rope access use (see **ICOP Part 2, 2.11.2.6**), as should those used for lifting equipment.

d) where appropriate, it is recommended that anchor lines are 'rigged for rescue', e.g. they utilise releasable anchors with additional rope to allow for remote lowering to a safe place;

e) where appropriate, it is recommended to rig for evacuation, e.g. provide additional escape anchor lines;

f) edges should be adequately protected from contact with the anchor lines, e.g. by rigging to avoid them or by edge protectors such as rollers or plates;

g) anchor lines should be adequately protected from contact with any sharp, abrasive or hot surfaces, e.g. by rigging to avoid them or by the use of appropriate anchor line protectors.

8 Care and maintenance of equipment

Guidance on care and maintenance of equipment is provided in **ICOP Part 2, 2.10**. In addition, account should be taken of:

a) the need to check for and avoid abrasion to equipment made from textiles, e.g. the rear of the harness when ascending or descending the ladder in the tower;

b) the possibility of contamination of equipment, e.g. by chemicals;

c) the possibility of corrosion of equipment by salt water;

d) the need to clean and store equipment properly;

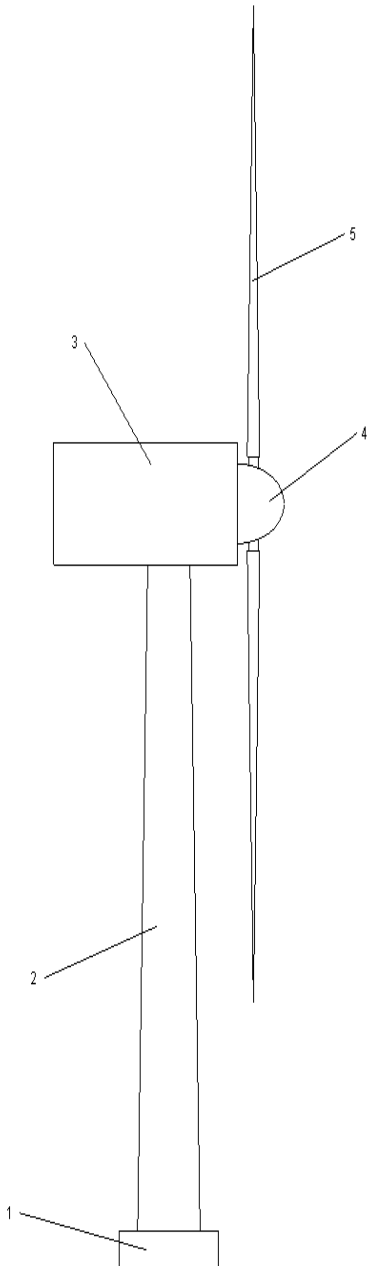
e) that offshore equipment should be transported in waterproof bags suitable for marine transfer;

f) that before use as anchor lines, ropes are conditioned to wet to ensure that any shrinkage is kept to a minimum.

9 Emergency procedures: rescue and evacuation

9.1 The team at each wind turbine should have the ability to carry out the rescue and evacuation of its rope access technicians.

9.2 Guidance on emergency procedures is provided in **ICOP Part 2, 2.11.12**. Also see **ICOP Part 2, 2.11.6**. Emergency procedures on wind turbines should also take into account:



Key

1	Foundation (onshore) Transition piece (offshore)
2	Tower
3	Nacelle
4	Hub
5	Blade

Figure 1 – Example of a typical wind turbine

a) that each area of the wind turbine is likely to have its own rescue requirements. Examples are:

(i) the inside of the tower, where there may be a need for rescue from the ladder, lift or climb-assist system;

(ii) external surfaces, such as the blades or surface of the nacelle;

(iii) inside the hub, which may be a restricted space;

b) that the route of evacuation may not always be the most obvious, e.g. returning to the nacelle from the blades could be preferable to lowering to the ground or sea;

c) that IRATA International personnel may be called upon to carry out the rescue or evacuation of other personnel as a pre-contract provision of rescue cover.

9.3 The competency of personnel to carry out rescues and evacuations should be established and the responsibilities for those operations should be clearly identified and communicated prior to work commencing. The rescue plan should include the nomination of a specific location for handover of a casualty to the emergency services. The location should be uniquely identified in a way understood by the emergency services and all other interested parties.

9.4 For both offshore and onshore working, plans should be made to ensure the casualty can be taken from their position at height to a suitable place for the continuation of their rescue or evacuation. Offshore, this could be, for example, either the base of the tower and then onwards to a vessel or directly to a helicopter. Onshore, this could be by road or air ambulance, assuming the necessary access to the wind turbine exists. Plans should be in place to ensure that during the rescue or evacuation, casualties are kept warm and dry.

9.5 Co-operation and co-ordination with all participants in the rescue or evacuation, e.g. the crew of boats, helicopters, emergency services, is essential for an efficient rescue or evacuation. Typical information required to assist in achieving a successful rescue or evacuation includes:

a) local emergency services contact requirements, e.g. phone number, radio channel;

b) local information required by emergency services, e.g. postcode, grid reference, latitude and longitude.

9.6 Rescue and evacuation may be carried out using normal work equipment via normal rigging, as appropriate.

9.7 The use of a rigid stretcher may not be possible in a wind turbine and consideration should be given to the use of other types of stretcher, e.g. a confined space stretcher.

9.8 The time taken to carry out a rescue from a wind turbine is likely to be affected by factors such as the precise location of the incident, difficulty in extracting the casualty from the structure and prevailing weather conditions, and consequently could become lengthy. Advanced first aid and casualty management skills therefore may be required following an incident, e.g. when working offshore, there could be a need to have CPR skills available for suspected drowning and hypothermia casualties.

Table 1 – Example of a site-specific checklist for the use of IRATA International rope access in and on wind turbines (non-exhaustive)

	Company details	
	Name	
	IRATA International membership number	
	Wind farm details	
	Name	
	Location and description	
	Onshore or offshore	
	Wind turbine number/identification	
	Location reference e.g. Ordinance Survey grid reference; post code/zip code; latitude and longitude	
	Turbine type	
	Nacelle height	
	Blade length	
	Site access	
	Tower access fall protection details e.g. model of guided type fall arrest system	
	Site owner details	
	Name	

	Contact				
	Wind farm operator details				
	Name				
	Contact person				
	Site specific requirements e.g. vehicle access, other competencies, client restrictions				
	Site induction carried out				
	Job work type details				
	Work description and location of work				
	Start date				
	Duration				
	Site-specific risk assessment carried out				
	Method statement completed				
	Permits to work completed and issued				
	Communication plan in place and understood				
	Work team details				
	Name	IRATA International level	Other work at height competencies	Trade skills	Fitness to work
	e.g. A. N. Other	e.g. Level 3	e.g. regional or turbine	e.g. electrician	e.g. medical certificate

			operator's certificate		supplied
	Equipment details				
	Rope access equipment available and inspected				
	Tower climbing system e.g. guided type fall arrest system, available and inspected				
	Designated anchor points for rope access, fall arrest, rescue and lifting				
	Clothing is appropriate to the environmental conditions				
	Appropriate first aid kit available				
	Radio available and tested (and charged)				
	Tools checklist completed				
	Specific hazards				
	Weather appropriate for tasks to be carried out				
	WT secured (service mode)				
	Tower climbing system inspected				
	WNF deactivated				
	High voltage equipment de-energised				

	Rotor braked/locked	
	Emergency OFF switch activated	
	Anchor points secure	
	Exclusion zone established (if applicable)	
	Rope access rescue action plan details	
	Rescue plan in place	
	Rescue plan understood	
	Rescue communication plan in place	
	Rescue equipment/rigging in place & inspected	
	Specific rescue and first aid equipment is on site e.g. stretcher, neck collar	
	Safe place for casualty identified e.g. leeward side of base of tower	
	Evacuation action plan details	
	Evacuation plan in place	
	Evacuation plan understood	
	Equipment available and inspected	