Accessing and Working in Wind Turbine Generators Procedure

WNH Q28 - Revision 3.0

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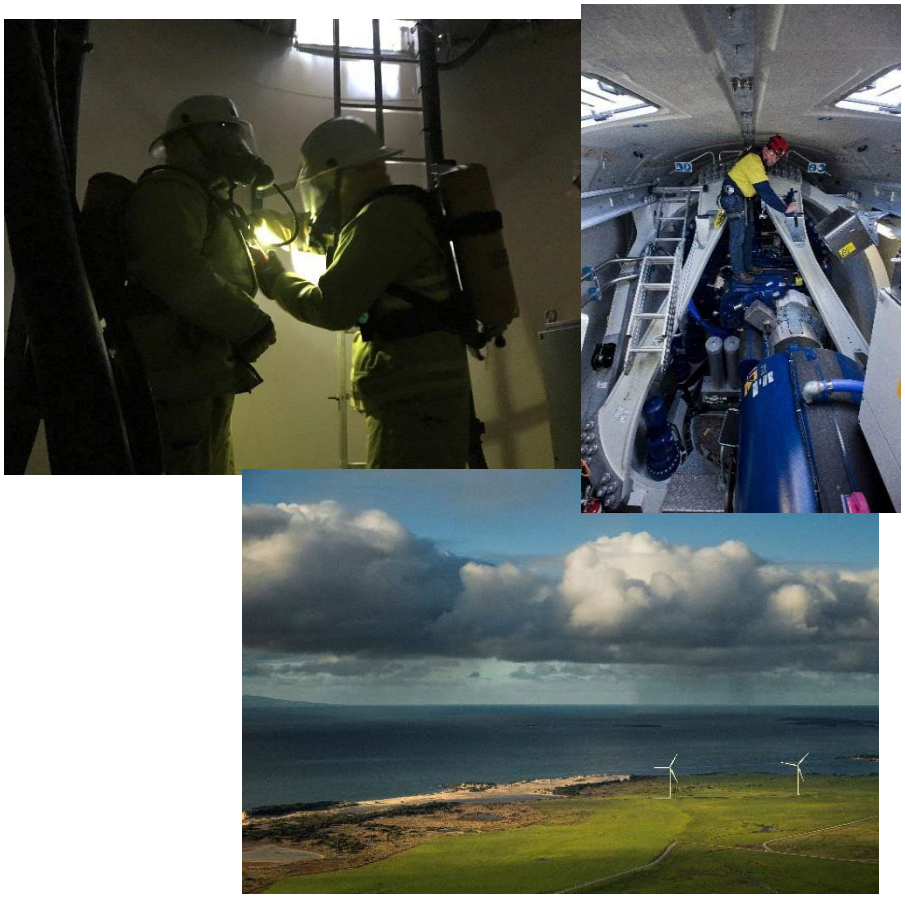


Contents

1.0 This Document

1.1 Purpose

The purpose of this procedure is to detail the requirements of Woolnorth Wind Farms (WNH) when accessing and working in wind turbine generators (WTG). The procedure is intended to maximise personal safety as far as reasonably practical when accessing or working in such environments.

1.2 Scope

This procedure applies on all WNH worksites. It shall be used for any access or work in, on or around WTG. The principals and concepts described in this procedure:

- are minimum standards and other methods, strategies or approaches can be used where they exceed these minimum standards; and
- must be understood and followed by all personnel working in or near WTG, as far as reasonably practical.

2.0 Entry requirements

WTGs are considered restricted areas. Standard site Personal Protective Equipment (PPE) requirements apply and depending on the nature of the task, Personal Climbing Equipment may be required (see section 3.2). The following entry requirements must be followed by ALL personnel:

1. You must be trained and authorised by WNH as a Restricted Area Worker, to enter, work and access anything more than the WTG entry level, **or**,
2. You must be treated as an accompanied worker and be constantly and continually accompanied by a Restricted Area Worker and you may only proceed beyond the entry level if you are competent and trained in Working Safely at heights (see section 3.1), **or**,
3. You must be treated as a visitor and be constantly and continually accompanied by a Restricted Area Worker. Visitor shall not go beyond the entry level, unless competent in workings at heights (see section 3.1), **or**,
4. Emergency services will be permitted to enter a WTG following their standard procedures and protocols. Where possible, a competent WNH restricted area worker will accompany such personnel to provide advice on hazards, guidance on the plant and provide assistance as required.

Regardless of your competency if you do not regularly access the WTGs at a WNH wind farm site you shall ensure you are fully aware of any existing or new hazards (and the risk level) prior to entry. This should be done via the WNH Site Supervisor or their delegate.

2.1 Entry level hazards

- A Ring Main Unit (RMU) is usually present at the entry level. The RMU is a purpose built enclosure containing high voltage (HV) equipment and when connected is energized to 22/33kV. The RMU shall only be operated by personnel authorized to operate the RMU (site authorized). Appropriate precautions and controls shall be considered during operation of the RMU.
- Other control equipment (including emergency stop buttons, WTG control panels and RMU trip buttons) exist at this level. These are operational controls and safety switches and normally would be operated by trained personnel.

Sulphur Hexafluoride

- The SF6 (Sulphur Hexafluoride) gauge on the RMU shall be checked immediately on entry to the WTG entry level and if the indicator gauge is in the red section (or falls during access), all personnel shall immediately exit the area, secure it (to prevent inadvertent access) and the WNH Site Supervisor notified.
- Examples of normal and abnormal SF6 gauges are shown below (Figure 1 & 2).

Figure 1. Normal operating condition (in green)
ENTRY OK

Figure 2. Abnormal condition DO NOT ENTER or EXIT IMMEDIATELY

2.2 Basement access

Access to the basement of a wind turbine is via a short vertical ladder. The area can be accessed without personal climbing equipment or using the fall arrest system, by adopting good ladder use techniques (namely 3 points of contact at all times). Portable lighting equipment may also be necessary. Accessing the area to conduct work should be risk assessed. This area is not classed as a confined space under normal operating conditions, however for all jobs conducted in this area this should be reviewed during the risk assessment process. Controls applied (such as confined space requirements i.e. monitoring) to manage risks present during entry. It should also be noted the area has a number of restrictive properties that should be considered in the risk assessment process. These include access and egress, possible low light levels and poor ventilation/ air movement/circulation.

3.0 Vertical access

3.1 Prior to vertical access of a WTG

- Under normal circumstances, at the control room, a note should be placed on the SCADA (VOB) screen to indicate the turbine personnel point of contact and the reason for disconnecting the communication link to the turbine (this can performed with the assistance of a suitably trained/qualified person)[1].
- Set the wind turbine in 'Pause' mode and disable the 'Remote communications' link in accordance with manufacturers specifications and remove the Local/Remote control key.
- A dedicated work party of two or more is required, with an established (primary and back up) communication protocol. Where a written risk assessment is completed it should include a communications protocol/control. It is acceptable for the work party to be separated provided a reliable source of communication is available for the worker based at the WTG, the period of absence from the WTG is short and the work being undertaken at the WTG is not of a complex or high risk nature.
- All individuals climbing shall hold a current (completed within the last 2 years) Statement of Attainment of a Nationally Accredited 'Working Safely at Heights' training course or equivalent[2].
- Ideally each individual will hold a current Statement of Attainment for an approved 'Wind Tower Rescue' course (or equivalent). At a minimum at least one individual of the work party shall hold a current qualification. Depending on the nature of the work being performed and experience of each member of the work party, another person should be present at the site with this qualification to assist in an emergency situation. This should be considered in the risk assessment process and documented as required.
- A pre-use check of the Fall Arrest System and Personal Climbing Equipment shall be performed.
- A pre-climb check must be conducted to ensure there are no loose items such as keys, phones, radios, pens, etc. that may fall or be dislodged during the climb. If transporting tools or equipment, all sources of power (e.g. batteries) and energy (e.g. gas canisters) shall be physically disconnected from this equipment.
- Any equipment that is to be carried by a climber is to be secured in a closed tool bucket/bag (attached to the climber's harness not carried in hand) and not exceed:
    - 5kg in combined weight from the tower base to the top lift platform; and
    - 10kg in combined weight from the top lift platform to the yaw deck/nacelle.
- Consider carrying a battery powered head torch or hand held torch (with wrist strap). If work will be conducted when the WTG has no power supply or an outage is forecast or know prior to vertical access then a battery powered head torch or is mandatory.
- Ensure the drop zone requirements are implemented (section 4.3).
- A medium risk portable first aid kit shall be available and located in the vicinity of the highest risk task when a 'permit to work' or 'special permit' (hot work, confined space) is necessary for the job, or the job risk assessment deems one may be necessary. For other work, a kit (medium risk portable) shall be located in a vehicle parked at the base of the tower being worked in. A vehicle kit may need to be relocated should the vehicle leave the turbine hardstand.

[1] In some cases it may not be practical to complete this, but it is intended that this be followed under normal circumstances.
[2] See **Definitions** for further clarification. Training records may be requested to validate qualifications. Where a person holds an 'equivalent' qualification, details of this qualification may be required. If the qualification is not deemed 'equivalent' by the Woolnorth Wind Farm Holding General Manager (or delegate) access and/or work may not be authorised.

3.2 Personal Climbing Equipment

- Personal Climbing Equipment includes:
    - helmet with strap
    - fall arrest traveller
    - fall arrest harness (fitted with suspension trauma straps is mandatory)
    - shock absorbing lanyard (twin tailed or dual lanyard) fitted with 2 climbing hooks
    - karabiners
    - Head torch recommended

3.3 Climbing (ascending/descending) the internal ladder of the WTG (inc. working on tower platforms)

- Climbing or working on internal tower platforms is not permitted:
    a. If the average wind speed is above **25 m/sec**. (descending is obviously acceptable if already in the nacelle of the WTG; see section 4.3.
    b. If weather conditions indicate lightning in the area or approaching.
- For the Avanti rail type fall arrest system (V90s) climbers shall be separated by a distance of no less than 6 metres. For the Ladsafe cable fall arrest system (V66s) only one climber is permitted to be attached to the fall arrest wire at any one time (it has a 15kN rating).
- Stand clear of the ladder base while personnel are climbing (unless there is a closed hatch above).
- Climbers carrying additional equipment (tools or personal belongings) in a suitable closed bag (backpack or lanyard), must not have anyone below them while climbing. They must be the last up and first down or there must be no other personnel in the potential drop zone.
- If heavy items have been lifted in the maintenance lift, a safe method/technique should be used to lift the items from the upper lift deck to the yaw deck. This may include a hauling device or technique. Items over 10kg should not be carried/man handled by a person climbing the vertical ladder system.
- If working on a tower platform (or resting) ensure hatches/gates are closed at all times (i.e. there is no access to a 'live' edge). When they are not, or if the work task requires them to be open, all personnel shall be connected to either an anchor point or the Fall Arrest System.
- Also ensure when working on a tower platform that any tools, materials or other equipment are secured and not able to fall. This may require using tool lanyards, bags or trays to secure loose items. During the course of any such work, a drop zone within the turbine tower should be established to prevent access within the drop zone.
- Caution is necessary when passing through the top ladder section hatch onto the yaw deck. Personnel should be aware that the yaw deck to nacelle ladder (when folded down) may present an overhead hazard or partially restrict the opening of the hatch.

4.0 Managing work

4.1 Operating the Maintenance Lift (personnel lift)

- To operate the Maintenance Lift you must have been instructed in its use by an experienced operator in its operation, emergency and safety features and how to perform a pre-use inspection.
- A pre-use inspection must be carried out prior to the first use for every job/task (i.e. only the first use for a multi-day job/ or multiple tasks conducted on the same day). The pre-start checklist shall be used to document the inspection.
- The lift shall be used for its intended purpose with due regard for its operating limits.
- Minimum PPE requirements apply when using the lift, including all Personal Climbing Equipment (a harness, with twin tailed lanyards fitted with climbing hooks shall be worn).
- The platform gates at the designated entry and exit points to the lift shall be left in the closed position unless the lift is left stationary at that platform.
- If exiting the lift at a non-designated entry or exit points (e.g. top or bottom), before opening lift gates or doors all occupants must be attached to the internal anchor point of the lift and must not disconnect until another anchor point is achieved.
- If a lift malfunction occurs during use, a manual descent will be required. Lift operators should be aware of how this is completed but if uncertain of the method seek assistance. Exit the lift as described above.

4.2 Operating the internal crane (chain hoist)

- To operate the internal crane, you must have been instructed in its use by an experienced operator in its operation, emergency and safety features and how to perform a pre-use inspection. The **WNR Competency Assessment Internal Crane (Chain Hoist)** must have been completed.
- A pre-use inspection must be carried out prior to the first use for every job/task (i.e. only the first use for a multi-day job/ or multiple tasks conducted on the same day). The pre-start checklist shall be used to document the inspection.
- The internal crane shall be used for its intended purpose with due regard to its operating limits.
- The WTG shall not be placed into operation or yawed, unless closely supervised, with the crane chain paid out and/or secured to an object out of the nacelle.
- Prior to opening the rear crane hatches:
    - Confirm there are no personnel in the drop zone.
    - Check that all loose items are secured.
    - Communicate to the PIC, or if you are the PIC with your work party, that the rear hatches are being opened and to stay well clear.
    - All personnel within 2 m of the hatch edges (live edge) shall be harnessed and connected to a suitable anchor point.
- When the hatches are open:
    - The rear crane hatches shall be open for the minimum amount of time and not left unattended/unmanned.
    - All personnel within 2 m of the hatch edges (live edge) shall be harnessed and connected to a suitable anchor point.
    - No person shall enter the drop zone when the hatches are open, unless clearly instructed to do so by the internal crane operator. The operator will not provide any instruction to enter the drop zone until the crane hook is as close as reasonably practicable to attach or detach a load.
- No work shall be performed in the nacelle unless authorised by the PIC and appropriately risk assessed. The PIC shall consider if the work is compatible with the hatch doors being open.

- **Safety Priorities and consideration** for attaching and detaching loads (and lifting):
  - Lifting bags shall be load rated, in good condition and closed at all times when being lifted or lowered. **No open top bags shall be used.**
  - Items that cannot be lifted in a closed bag will be attached to the crane hook or chain by a suitably experienced person using appropriately load rated devices /slings and attachment techniques. The object will be inspected to ensure no loose or detachable parts can be dislodged during the lifting or lowering process.
  - Packing of lifting bags should consider the future safe handling of the bags – workshop to nacelle (and visa-versa).
  - If tools or equipment are to be packed in bags for lifting, all sources of power (e.g. batteries) and energy (e.g. gas canisters) shall be physically disconnected from this equipment.
  - Personnel loading items onto the crane hook or chain shall consider the safe handling and unloading of the item (nacelle or transport vehicle).
  - Positive (reciprocal) verbal communication is required and/or agreed and clear hand signals may be used.
  - To eliminate any risk to ground crew from a crane chain break, as far as reasonably practicable, the internal crane chain will be lowered further than required so the operator can confirm the continuity of the chain (i.e. the chain is not broken).
  - No person shall remain in vehicles that are being loaded or unloaded.
  - Transport vehicles should remain in the drop zone for the shortest practicable period and the crane will not be operated when the transport vehicle is leaving or being positioned in the drop zone.
  - Load swing should be minimised during all stages of the operating, loading and unloading. Consider tag lines to stabilise and maneuver loads.
  - **To the greatest extent possible**, ground personnel will not position themselves directly under a load suspended on the crane chain or hook. **As far as reasonably practicable** methods (e.g. careful planning and positioning to achieve load offsetting, tag lines) shall be implemented to eliminate or minimise suspended load risks.

- During its operation, **particularly when the crane chain is being lowered,** the operator of the internal crane shall remain attentive to the operation of crane, paying close attention both visually and audibly to the operation and the flow of chain in and out of the crane and its chain box. Abnormalities shall be investigated immediately. **NOTE: Issues to be attentive to include chain lubrication, chain bundling causing blockages, uneven chain distribution in the collection box. If an abnormal or loud sound is detected during operation of the crane, the chain shall not be driven in a downwards direction unless the chain continuity can be confirmed.**
- **As far as reasonably practicable**, at all times when the crane is being operated no person (or vehicle) shall be in the drop zone and no vehicle shall be permitted to pass through the drop zone unless operations cease.

Internal crane operation and wind conditions

- Use of the chain hoist in windy conditions can cause a range of issues including, excessive bag and load sway, bag and load collisions with the tower, bags and loads that spiral/wind on the chain, excessive wind deflection. The operator should consider these factors prior and during all hoisting operations.
- **IMPORTANT –** if the crane chain is hitting the crane hatch frame do not continue to bring the load into or out of the nacelle. It is possible the load will be dislodged on entry/exit. Suspend crane operation and implement the below methods to avoid hitting and dragging of the crane chain.
  - Yaw the nacelle into a position where the chain no longer hits or drags on the hatch.
  - Physically center the chain as the load approaches the access hatch to avoid snagging.
  - If the above methods fail to stop the chain from dragging, a tag line (controlled from the ground) attached to the load may prevent the chain dragging on the nacelle hatch and allow the load to be stabilised. The tag line must be controlled by a person. It is critical that the ground crew (including tag line operator) stay clear of the established drop zone.

4.3 Managing the 'drop zone'

- There is a risk of objects falling during many tasks associated with WTG maintenance activities (including external based activities requiring the use of a crane or elevated work platform).
- Minimising the risk to personnel, plant and equipment is a two-fold process.
  1. As far as reasonably practicable:
     - ensuring all hatches and doors are closed when not in use
     - any necessary gaps to the external environment are covered
     - ensuring that loose items (including personal equipment) are always placed in a secure location – the hatches may be opened at various stages so keep all loose parts, tool secure from the start
     - where necessary use lanyards on tool, equipment, components
  2. Ensure the drop zone risks are managed as outlined below.
- The drop zone should be considered as a second 'line of defence' should an object fall from a WTG. The objective of establishing a drop zone is to protect all personnel, plant and equipment from being struck by a falling object that has been accidentally dislodged from work being conducted above.
- The drop zone is a dynamic zone (diagrams below (Figure 3 &4) illustrate the potential drop zone).
- The extent of the drop zone required should consider the aspects such as height of the plant/work, wind direction and strength, size, mass and shape of the falling object etc..
- The position of the drop zone on the ground changes with wind direction and the PIC and the work party should take reasonable steps to ensure the drop zone is managed accordingly.
- A nominal, minimum distance of 20m (from the WTG base) shall be maintained during all work activities carried out at height, either internally or externally (See Figure 5). It may be necessary, depending on the work activities, to extend this distance in a manner consistent with Figures 3 and 4.

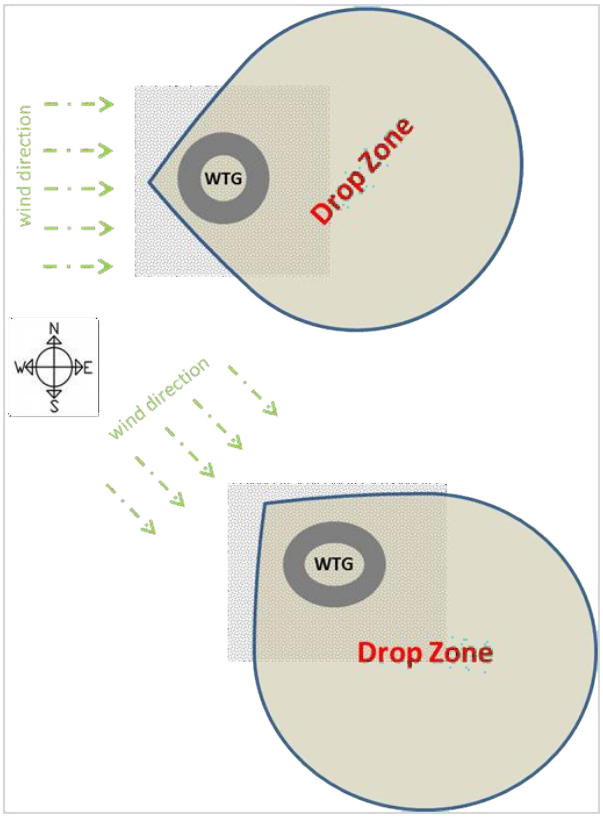


Figure 3. Demonstrates the changes to the position of the drop zone with wind direction changes. Note that the length of the zone will increase proportionally with wind speed e.g. <4m/s a zone length of 20m may be adequate but at 20m/s the zone length (and width) should be increased to a greater distance such as 60m.

Figure 4. A further example of the extent of the drop zone under high wind conditions.

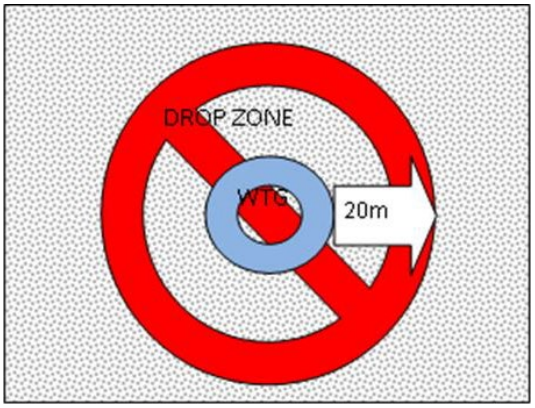


Figure 5. The nominal, minimum drop zone that must be established and maintained for all work activities undertaken at height, internal or external of the nacelle.

- When any access creates a risk of an object falling or being dislodged, to ensure that any personnel in the vicinity of the WTG can recognise the potential risk, the drop zone shall be suitably identifiable **at all times**.
- Practically, this means a drop zone must be established for any access to the roof, nose cone, hub, transformer enclosure (those with a mesh floor), under nacelle floor area, for use of the internal chain hoist (where the floor hatches are opened), and any other activities where external access is required.
- In cases where a drop zone is not initially deemed necessary (due to the nature of the work), **if the work changes**, the drop zone requirements shall be revaluated and implemented accordingly.
- At a minimum the area shall be marked with a Danger Sign (see Figure 6), so it can be seen from the principle access road and traffic direction (see example below). Ideally the signage will be accompanied by some form of complete or partial barrier. Where a vehicle, that is used to host the sign and/or form all or part of the barrier, leaves the work site while work continues another method will be required to warn and demarcate the drop zone.

Figure 6. This sign, or similar, shall be placed in a suitable location to ensure the drop zone is identifiable.

- All work SHALL cease by the work party at height when a person enters the drop zone and work SHALL NOT recommence until the drop zone has been cleared by all ground based personnel (exception to this is using the internal crane to attach and detach loads – see section 4.2).
- No personnel shall pass into an area under drop zone management unless positive communication has been achieved with either the PIC or another member of the work party delegate.
- With the exception of passing through the drop zone (e.g. a direct vehicle movement), positive communication must be made when the drop zone has been cleared by the ground based personnel. This is to ensure that the PIC can instruct the work party that the work above must cease and when it can resume.
- Unless suitably planned and risk assessed, no other work party shall be authorised (by the PIC or other site personnel) or shall undertake a separate work activity at a wind turbine that is under drop zone management.
- To ensure the drop zone is adequately managed, the following shall also be implemented as far as reasonably practicable:
    - All communication between ground personnel and personnel at height must be positive (e.g. question and answer).
    - Vehicles, plant and other equipment should be parked/stored, where reasonably practicable, as far from the WTG as possible.
    - The requirements outlined in section 2.4 (Operating the internal crane) must be followed.
    - There shall be no personnel occupying vehicles or plant parked within a drop zone regardless of whether operating, loading and unloading equipment from the internal crane.

4.4 Working in the Nacelle

- The nacelle presents a combination of unique hazards that should be considered during work and access:
  - Hot environment
  - Slippery surfaces
  - Very heavy equipment, parts and items
  - Awkward work positioning/cramped conditions
  - High voltage, high pressure, rotating parts, high energy present, arc flash
- As outlined in Section 3.3 above, access to the nacelle is not permitted if the average wind speed is greater than 25 m/sec. If during access to this area the wind speed exceeds 25 m/sec (average), all work should cease, the area made safe and personnel should retreat to the ground.
- Minimum PPE requirements apply (and Personal Climbing Equipment must be available).
- In certain circumstances some PPE may not be appropriate for the task or create an unwanted risk. In these cases the task risk assessment must provide adequate evidence demonstrating a deviation from the minimum PPE requirements is necessary.
- Close the nacelle floor hatches when not in use.
- Ensure you are familiar with the emergency exit and escape routes (see attachment 1 and 2).
- Ensure you have located and have easy access to the Emergency Descent kit (see attachment 1).
- Ensure you have suitable access to your personal climbing equipment so that you can effectively undertake an emergency evacuation.
- Ensure you have located and have easy access to the portable fire extinguishers (see attachment 1).
- Ensure you have access to a first aid kit as outlined in Section 3.1 of this procedure.
- If within 2 metres of an open crane hatch ('live edge') all personnel must wear a fall arrest harness and have at least one lanyard (or lanyard tail) attached to an anchor point (see attachment 1 – list of rated anchor points). Open hatches must not be left unattended.
- If access under the nacelle sub-floor is required, workers shall consider any potential 'fall from height' risks and where required wear a fall arrest harness and have at least one lanyard (or lanyard tail) attached to an anchor point. This shall be done at the task risk assessment phase.
- Flash Photography is not permitted in the nacelle except for testing of the 'arc flash' detectors. This may result in a loss of power to the tower and nacelle.
- Secure loose items in appropriate locations and ensure the drop zone is managed as per section 4.3.

4.5 Working in the nosecone (spinner)

- Relevant requirements outlined in Section 4.4 apply.
- Access to the nosecone/hub is prohibited if the average wind speed is above 15 m/sec for a V66 WTG and 23m/sec for a V90 WTG. Blades on either WTG type cannot be pitched above 15m/sec. If during access to this area the wind speed exceeds these designated limits (on an average basis), all work should cease, the area made safe and personnel retreat to the Nacelle.
- The rotor must be locked before entry into the nose cone is permissible. Locking and unlocking the rotor must be performed in accordance with the manufacturers and owners specifications (locked and/or tagged).
- Confined space conditions do not exist in the nosecone.
- All tools should be connected to the technician or a suitable anchor point via a tool lanyard and/or any open-air gaps below a point of work covered to prevent objects falling though these voids.

4.6 Working in the hub or blades

- Access to the hub and blades is via the nosecone and the requirements outlined above (Section 4.4 and 4.5) must be met (where applicable).
- Confined space:
    - Under normal working conditions, confined space requirements do not exist in the hub. However, a calibrated gas detector must be utilised when any work on the accumulator gas (nitrogen) system is being performed, and the area shall be evacuated if a low oxygen alarm sounds and no personnel will re-enter until the area is proven safe with a second gas detector.
    - Confined space requirement do not exist when accessing the blade bearing lubrication system in the blade root to undertake routine maintenance.
    - Confined space requirements do apply if other access inside the blade is required.
    - For all non-routine tasks, the confined space requirements should be evaluated during the risk assessment phase, noting that jobs modifying the make-up of the atmosphere (oxygen concentration, or harmful airborne contaminant) or introduce a fire or explosion hazard may change the confined space status
    - A confined space permit and other controls (including workers trained and certified to enter and work in confined spaces) is required where a confined space is recognised.

4.7 Working on the nacelle roof

- Minimum PPE requirements apply and Personal Climbing Equipment must be worn to access the roof of the nacelle noting that in certain circumstances some PPE may not be appropriate for the task or create an unwanted risk). In these cases the task risk assessment must provide adequate evidence demonstrating a deviation from the minimum PPE requirements is necessary.
- A 'climbing' helmet is preferred over standard type 2 hard hat. A chin strap is mandatory.
- When working on the roof of the nacelle, two points of attachment are required (roof rail/anchor point) at all times. When passing through the nacelle hatch to access the roof, achieving two attachment points shall be done as soon as practicable. It is permissible to have one attachment point but only when changing work positions.
- A 'restraint' system or methodology shall be applied (e.g. attached to anchor points or rail on opposite sides of nacelle, not same side).
- **Extreme** caution must be used when working on the roof and should only be carried out at wind speeds of no more than 15 m/sec. If during access to this area the wind speed exceeds 15 m/sec (average), all work should cease, the area made safe and personnel retreat to the nacelle.
- No more than 2 persons shall access the nacelle roof at any one time.
- During any work on the nacelle roof, another person shall be present in the nacelle with Personal Climbing Equipment readily available. While this person is not a 'safety observer', they must regularly monitor and communicate with the person or work party on the nacelle roof.
- Before accessing the nacelle roof, secure all loose items in appropriate locations, tools and equipment to be fitted with straps or lanyards, other loose items stored in a closed bucket or bag and ensure the drop zone is being managed as outlined in section 4.3.

  Caution note: The perimeter roof rail (PRR) on the V66 nacelle roof is NOT RATED or APPROVED to be used as a fall prevention system (FPS) or anchor point. This is based on engineering assessments, the complexities of approving the structure (as a FPS) and recent inspections that have identified concerning levels of corrosion on sections of the PRR. The PRR may be used as a lifting point when the roof is removed for relevant major component changes, but ONLY once it has been carefully inspected and assessed as suitable.

The PRR must, therefore, no longer be used as the primary FPS (in fall arrest or fall restraint) for ANY work conducted on the nacelle roof. An alternate FPS such as an anchor line or adjustable lanyard must ALWAYS be established to a suitable anchor point within the nacelle. It must be kept as short as possible and edge protection where it passes through a nacelle hatch must be considered. The PRR may be used for work positioning, but they must NEVER be used as the only FPS (anchor point). The worker must be connected to an anchor point in the nacelle. All other requirements outlined in Section 4.7 must be strictly followed. To allow the PRR to be used for work positioning and/or as a lifting point (for major component jobs), they must continue to be inspected and maintained or replaced, not left to deteriorate. If a roof rail is not deemed suitable to remain in service, it must be tagged out until it can be replaced or repaired.

4.8 Major component works

- Major component changes occur from time to time and often involve removal of the nacelle roof, parts of the floor and blades.
- Relevant requirements outlined in Section 4.4 apply.
- Activities involving removal of the nacelle roof, floor or blades should only be carried out at wind speeds less than 15 m/sec. If during access the wind speed exceeds 15 m/sec (average), all work should cease, the area made safe and personnel retreat to a safe location.
- All crane operations (lifting of major components) shall be conducted within the safe operating limits of the crane and/or at the discretion of the crane operator and be conducted in accordance with a crane lift study. The PIC should confirm with the crane operator that a crane study has been completed to cover the task being undertaken.
- For relevant major component work, a suitably experienced and qualified rigger shall form part of the work party. Where required this person shall perform all tasks associated with the rigging, lifting and shifting of the component, as well as providing necessary instruction to the crane operator.
- In cases where the nacelle roof has been removed, all personnel must be wearing Personal Climbing Equipment and have at least one lanyard (or lanyard tail) attached to an anchor point if:
    - the task being performed requires work/inspection within 2 metres (horizontally) of a ‘live edge’ and/or 0.9 metres (vertically) of a live edge.
- In cases where parts of the floor or blades have been removed all personnel within 2 metres of the ‘live edge’ must be wearing a fall arrest harness and have at least one lanyard (or lanyard tail) attached to an anchor point.
- Personnel present in the nacelle during the process of removing or reinstating a major component with a crane should, where reasonably practicable, adopt a work position that limits or mitigates potential ‘line of fire’ risks.

4.9 Rope or Elevated Work Platform or Crane access

- Rope, Elevated Work Platform (EWP) or crane access may be required, from time to time, to undertake inspections, maintenance or repair activities**.**
- Relevant requirements outlined in Section 3.0 apply.
- Where necessary, it is acceptable for a worker to undertake low risk, routine tasks alone provided a reliable source of communication is available to the worker, a communication strategy is documented in the task risk assessment and a suitable qualified worker is assigned as a buddy.
- Rope, EWP or crane access should only be carried out at wind speeds of less than 15 m/sec, noting the task risk assessment and plant limitations may dictate operations at a lower wind speed limits. If during access the wind speed exceeds 15 m/sec (average), or as specified in the risk assessment/ plant specification, all work should cease, the area made safe and personnel retreat to a safe location.
- Work should also cease if lightning is detected or identified in the vicinity of the wind farm.

- Access utilising rope access techniques shall be thoroughly risk assessed and the relevant personnel will hold appropriate qualifications and experience to perform the task.
- Only individuals holding a current competency (completed within the last 2 years) in Working Safely at Heights or equivalent (see footnote 2) shall undertake rope, EWP or crane access. The work party (including the 'buddy') shall also hold a current High Risk Workers License (or other relevant competency) relevant to the EWP being used. Other training competencies and relevant experience are required for rope access work.
- For rope, EWP or crane access secure all loose items in appropriate locations, tools and equipment to be fitted with straps or lanyards, other loose items stored in a closed bucket or bag and ensure the drop zone is being managed as outlined in section 4.3.

4.10 Other Safety Considerations

- Care shall be taken when cleaning electrical enclosures (junction boxes, terminal boxes, electrical cabinets) to ensure there is no risk of electric shock. Inspect enclosures for structural integrity, ensure closing mechanism is sound and secures correctly.
- When working in A1, A3 and A4 electrical cabinets containing a Firetrace fire suppression system care shall be taken not to touch or modify, damage, or expose to heat the Firetrace Detection Tubing (FDT). All technicians working on or near the Firetrace system must read and understand the system manual and SDS. Always ensure the Firetrace system for the cabinet being worked in in disabled if there is a risk of the Firetrace Detection Tubing (FDT) being damaged.
- If any tools, plant, or equipment are found to be faulty or damaged they shall be locked out, tagged out, labelled or otherwise identified and reported to the site supervisor and/or team leader.

5.0 Emergency Equipment, Plans, Rescue and Evacuation

With the exception of access to the base (entry level) of the WTG for visitation purposes only (e.g. to show a visitor the inside of the WTG from the base), all personnel shall be familiar with the emergency equipment available within the WTG and the location of Emergency Stops. The location of equipment and Emergency Stops is shown and described in Attachment 1. Emergency Stops are standard red push button stops as shown below (Figure 7):

Figure 7. Emergency stop button (bottom controller)

Please note that emergency stops should only be pressed in an emergency situation or on controlled situations where the work party (particularly individuals in the nacelle) has been notified of the action. Rapid stalling of the turbine occurs resulting in severe movement of the tower and nacelle.

All personnel will also be familiar with the emergency evacuation plan (Attachment 2). At least one person in the work party will also be familiar with the use of the emergency evacuation equipment to the extent they can perform and assist in an evacuation situation. This requirement is met by having at least one person in the work party competent in the use and rigging of the nacelle evacuation equipment.

5.1 Emergency Services Access

In the event emergency service personnel are required to access the WTG, site personnel shall, to the greatest extent practical and if deemed safe to do so, assist emergency services personnel. This may include providing guidance on the relevant risks, provision of site equipment and/or accompanying emergency service personnel.

6.0 Definitions

Working Safely at Heights	Means a Nationally Accredited 'Working Safely at Heights' training course (recognised within the Australian Qualifications Framework and issued under authority of the National Vocational Education and Regulator Act 2011, course id RIIOHS204A / D Work safely at heights)
Person in Charge/ PIC	Means a person assigned to ensure, as far as reasonably practicable, that the task is undertaken in a manner consistent with the risk assessment for the task, WNH procedures and process and other relevant supporting documentation (work instructions etc.).
Restricted Area Worker	Means a worker authorised by WNH to enter a restricted area. Authorisation shall be determined by satisfactory completion of WNH training.

7.0 Accountabilities

General

Officers of WNH shall ensure that, As Far As Reasonably Practicable (AFARP), hazards are identified and where they cannot be eliminated, will be controlled. This shall include documenting hazards, processes to identify hazards relevant to WNH business and tasks it undertakes and lastly communicating hazards to the workers of WNH.

Where relevant, all workers of WNH shall ensure AFARP that:

- they understand the requirements of this procedure
- ensure their activities are in compliance with this procedure
- can access this procedure
- support the implementation of this Procedure by providing feedback to peers and supervisors where improvements to task compliance or risk management can be made.

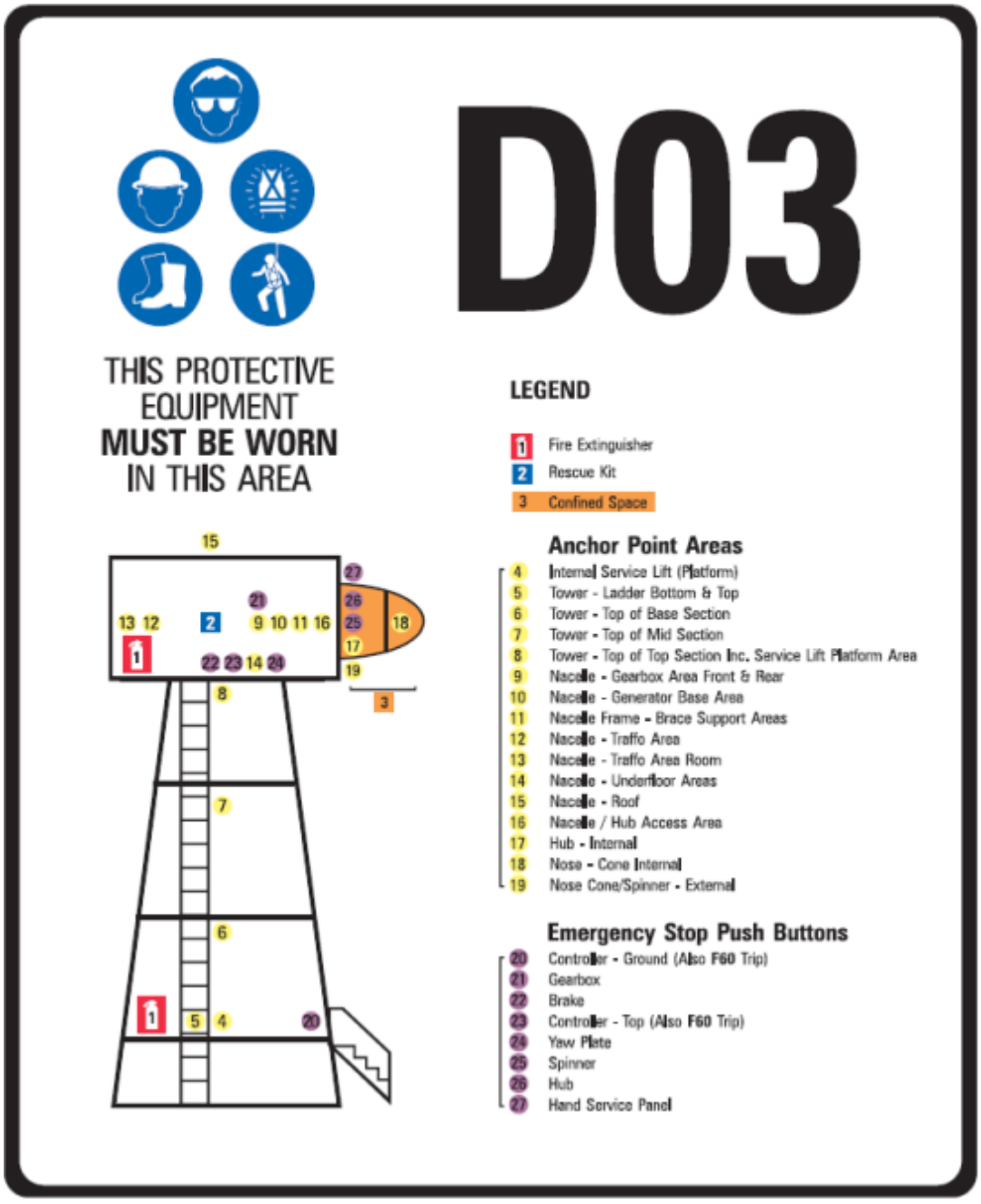
The HSE Manager for WNH is to ensure AFARP that this meets National and State legislative requirements and Standards and that this document is maintained as a part of the businesses HSE management system.

8.0 References

National Vocational Education and Regulator Act 2011

Relevant WNH HSE system documents

9.0 Attachment 1



Example plan of emergency equipment, emergency stops and anchor point locations in turbines.

Inventory of emergency equipment in all WNH owned WTGs

Fire extinguisher (dry powder)	Turbine base, nacelle
Emergency descent kit	Nacelle

10.0 Attachment 2 – Emergency Evacuation Considerations

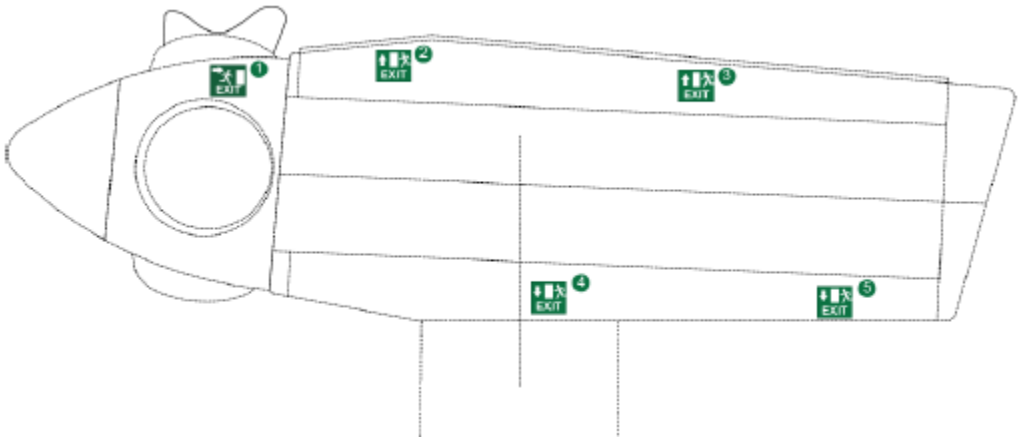
An emergency evacuation may be required under certain circumstances and conditions. These could include fire, explosion, catastrophic equipment failure, structural collapse or failure. This section covers an emergency evacuation in these circumstances, it does not include considerations for an evacuation due to a medical emergency.

Recognising an emergency

An event requiring an emergency evacuation is highly unlikely but could arise at any time during access to the turbine. Recognising and assessing the situation early is important to ensure the safety of the workers/work party.

Escape routes

Emergency exit and escape points are located as shown in the diagram below.



Escape Routes

1. Hub to nacelle
2. Front hatch in nacelle roof
3. Rear hatch in nacelle roof
4. Tower
5. Hatch in nacelle floor

The preferred exit and escape route is through the tower, using the vertical ladder system. The personnel lift shall not be used in an emergency exit/escape situation. The escape route used will depend on the nature of the situation and the location of emergency and the worker/work party.

Emergency equipment

Personal climbing equipment and the nacelle evacuation kit will be required to ensure a safe and effective evacuation under all circumstances except a tower evacuation (where personal climbing equipment should be worn). Equipment should be located to allow for easy and simple access, and this includes locating personal climbing equipment at the point of work (e.g. the nacelle). In the event the nacelle evacuation kit is required, it must be attached to a designated anchor point or another suitable structure capable of anchoring this equipment. Edge protection may be required.

Caution note: the rope contained in the emergency evacuation kit is NOT fire resistance or fire proof and therefore should be protected where there is a risk it may be subject to immediate heat or flame exposure.

Small fire extinguishers are located in the nacelle (and tower entry level) and these should be used where required to assist in an evacuation.

Emergency equipment must be available at all times and **there must be sufficient equipment** to allow the work party to evacuate within a 10 minute, 600 second time period. In the case where an emergency descent is required, 10 minutes provides for the evacuation of 6 workers as follows - 4 minutes to set up the descent device and put harnesses on, 2 minutes for each pair to descend from nacelle to ground. All emergency evacuation kits contain 'auto-descenders' and these should be capable of allowing two people to connect and descend together. However, **beware** of the limitations of the equipment and to the greatest extent practicable follow these limitations.

Priority

The priority will be to determine if the tower exit point is safe, locate personal climbing equipment and evacuate. If the tower exit is not safe, locating the nacelle evacuation kit will be required before proceeding as quickly as possible using the most favorable evacuation point (as far from the impending hazard as possible).

Emergency lighting

If the electrical supply to the turbine is lost, then emergency lighting in the hub, nacelle and tower will activate. An alternative source of lighting is a personal head-torch.

Smoke/fire in the tower

It is possible a fire could start in the tower and fill with smoke (or just fill with smoke from something smoldering). Given the tower structure, ladder and platforms are not combustible, it is possible that a fire in the tower would self-extinguish and not propagate into a large fire. However, it is possible smoke could infiltrate into and fill the nacelle space. If this occurs, the work party should:

- ⇒ Locate personal climbing equipment, the emergency descent kit and evacuate to the roof.
- ⇒ Advise other site personnel and request assistance to investigate and if possible, suppress the fire or alleviate the issue. Consider closing the tower door (entry level) to reduce venting of the tower and possible acceleration or propagation of fire.
- ⇒ Rig emergency descent kit in preparation for an emergency descent
- ⇒ Continue to evaluate the situation and evacuate should the work party believe personal safety is in imminent danger or if advised by an investigating party (e.g. that a fire in the tower cannot be controlled

Contacting Emergency Services

Emergency services are unlikely to be of any assistance if the evacuation is time sensitive. However, if time permits (and weather) it is possible that the work party could be extracted from the roof of the nacelle by helicopter (arrival to site estimated at 90 minutes ++).

11.0 Emergency Evacuation Plan for Nacelle

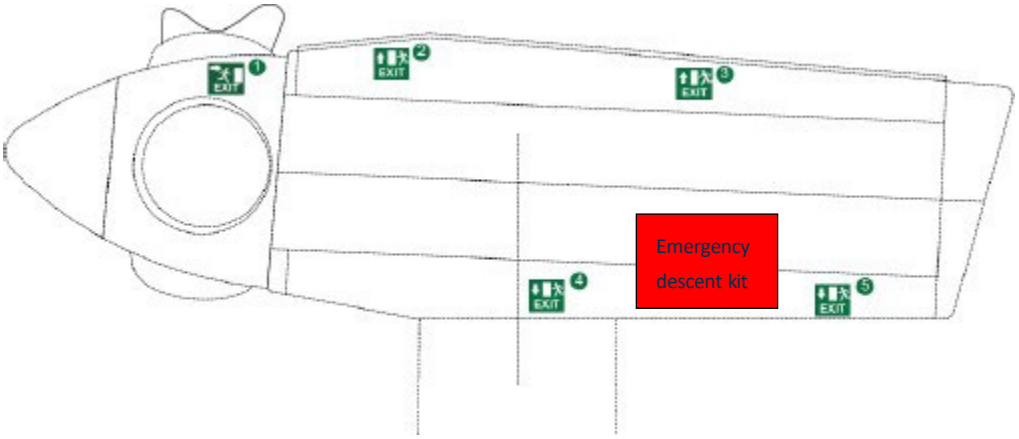
1. Emergency situation recognised by work party
2. Work party assemble to safe location in nacelle
3. If practicable communicate emergency situation over radio system
4. Determine if the tower can be used as the evacuation route
5. IF YES

    ⇒ Proceed quickly, using personal climbing equipment is possible. DO NOT use personnel lift

6. IF NO

    ⇒ Locate personal climbing equipment

    ⇒ Locate the emergency descent kit and move quickly to the preferred exit point as shown below



⇒ Rig emergency descent equipment, cross check with work party to confirm correct

⇒ If possible 2 person to descend together, or one at a time

⇒ Repeat once first 2 (or 1) person/s have reached the ground

⇒ Once on ground move to safe area, well clear of the turbine >200m

⇒ Assist other where safe to do so