

Find the Hand™ in Wind Turbine Nacelle & Hub Manufacturing

Typical Hand-Exposure Applications in Nacelle, Hub
& Heavy Component Assembly

How to read this document. This document presents typical hand-exposure applications that may arise during wind turbine nacelle and hub manufacturing and heavy component assembly. It is intended as a discussion framework to help HSE, production, maintenance and lifting teams compare these common exposure points against their own operations.

The examples are illustrative and should not be treated as findings relating to any specific plant or process. **PSC's interest is in understanding where the hand enters a process, what mechanical function it is performing, why it needs to be there, and whether that function can be performed from a safer standoff distance.**

We are asking, not asserting.

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Scope

**Nacelle, hub & heavy component
assembly**

Document type

**Industry Discussion Framework —
Not a Site Assessment**

Our Starting Point

PSC's Find the Hand™ methodology begins not with tools or products, but with a single discipline: understand where the worker's hand enters the process and why. The four steps below shape every application review.

LOCATE Where is the hand at the moment of potential exposure?	UNDERSTAND What mechanical function is the hand performing?	QUESTION Why must the hand be there — is it a technical requirement or an established habit?	EXPLORE Can that function be performed from a safer standoff distance?
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The applications below reflect operations commonly found in nacelle and hub manufacturing environments where crane-assisted handling, precision component alignment and large-format bolted assembly are involved. Each is presented as a discussion question, not a finding.

Typical Applications — Nacelle & Drivetrain Assembly

Main Shaft / Drivetrain Positioning Where large shafts or drivetrain components are crane-assisted into bearing housings or mating assemblies	<i>During the final approach of the component to its receiving housing:</i> Does a worker need to guide, steady or correct the position of the component by hand during the last phase of the crane movement? A potential exposure point can arise where the hand enters the zone between a suspended component and its receiving bore or housing during final alignment.
Gearbox Mating & Alignment Where a gearbox is crane-positioned and brought to a mating interface — press-fit, shrink disc or flanged coupling	<i>During axial and rotational alignment prior to engagement:</i> How is fine correction of the component's position currently achieved? Where manual adjustment is required at the mating face, what is the worker's hand position? Close-tolerance coupling arrangements can require precise co-axial alignment, a stage at which hand exposure may arise if manual guidance is used.
Generator Positioning Where a generator is crane-positioned and set down onto a structural frame or coupling arrangement	<i>During the transition from crane control to final seating:</i> At what point is fine positioning of the generator transferred from the crane to personnel? Where manual correction is made, is the hand close to the mating face or coupling zone?
Yaw Bearing / Large Ring-Bearing Installation Where a large ring bearing is crane-positioned onto or into a structural carrier or housing	<i>During the crane approach of the bearing to its mating surface:</i> Where bolt-circle alignment is required during final positioning, does this require a person to be at the bearing face? What is the current method of controlling swing or rotation of the suspended ring? Large suspended ring components can be subject to pendulation and rotation during crane travel. The final alignment phase may present an exposure point where direct hand contact is used.

Typical Applications — Cover Installation & Crane Operations

Nacelle Cover / Panel Positioning

Where large cover sections or panels are crane-lifted and positioned onto the nacelle structure

During the final approach and landing of a suspended cover section:

How is the panel controlled during the final phase of the crane movement? Where personnel are guiding the panel, is the hand in contact with the panel edge, frame lip or the zone between panel and structure?

Composite or fabricated panels can be unpredictable under crane load, particularly where wind or air resistance affects movement. An exposure point may arise if manual contact is used to correct final position.

Heavy Component Placement — Electrical or Ancillary

Where substantial components such as electrical cabinets or transformers are crane- or forklift-positioned onto mounting arrangements

During the set-down phase of a heavy component onto its mounting points:

Where manual guidance is used to align the component to its mounting pattern, is the hand in contact with the component while it remains under crane or mechanical load?

Suspended-Load Control & Tagline Practice

Crane travel of major components throughout the assembly environment

During crane travel of suspended components between stations:

What is the current method of controlling load swing and rotation — rope taglines, push-pull tools, or a combination? Where rope taglines are in use, what is the grip technique?

The transition from rope taglines to rigid or semi-rigid push-pull tools is one of the most consistent hand-exposure improvements available in crane-intensive manufacturing. Understanding the current baseline is the starting point.

Typical Applications — Hub Assembly

Pitch Bearing / Large Ring-Bearing Placement

Where large ring bearings are crane-positioned into hub or structural bores requiring close-tolerance bolt-circle alignment

During the crane approach of a bearing ring to its receiving bore:

Where bolt-circle or rotational alignment is required during the final positioning phase, does this require a person to be at the bore face? What is the current method of guiding the bearing into position?

This application may present an exposure point where the hand is used to guide a suspended ring component into a close-tolerance bore — a zone where the hand can be between the component and its receiving structure.

Hub Turning & Indexing

Where a hub assembly is rotated on a turning fixture between sequential assembly operations

During hub rotation or indexing between assembly stages:

Where manual input is used to initiate or arrest hub rotation, what is the method — and does it require direct hand contact with the hub casting or turning structure? How is any locking or indexing pin managed relative to the weight of the assembly?

A potential exposure point can arise during pin insertion and withdrawal, or where the hub is turned manually and the hand is used to control momentum.

Component Installation Within Confined Hub Structures

Where components such as pitch drives, control systems or energy storage units are lowered into enclosed hub structures through access ports

Where components are lowered through restricted access into an enclosed hub structure:

Is personnel entry to the hub interior required at any stage while components are being positioned from above? What controls are in place to manage the risk of working in a confined structure during a lifting or lowering operation?

Typical Applications — Final Assembly & Logistics

Major Component Docking

Where a large sub-assembly — such as a completed hub — is crane-positioned to mate with a nacelle, shaft or structural interface

During the final crane approach to a mating flange or structural interface:

Where personnel are involved in guiding or aligning the component during the final phase, what is their position and what is the hand doing? Where bolt-circle alignment is required, how is this achieved while the component remains under crane load?

This application concentrates a large suspended mass, a precise alignment requirement, and personnel in close proximity — a combination that warrants specific discussion.

Initial Bolt or Pin Engagement

Where initial fasteners are engaged while a component is still supported by crane or mechanical lifting equipment

At the point of initial fastener engagement — before crane load is transferred to the joint:

Where manual assistance is required to start a bolt or locate a pin, is the hand in the joint zone at this stage? What is the current method for managing the load transition from crane support to structural fasteners?

Initial fastener engagement while a component remains crane-supported is a stage at which the hand may be between mating surfaces. Understanding whether this applies, and how it is currently managed, is part of the discussion.

Loading Completed Assemblies for Transport

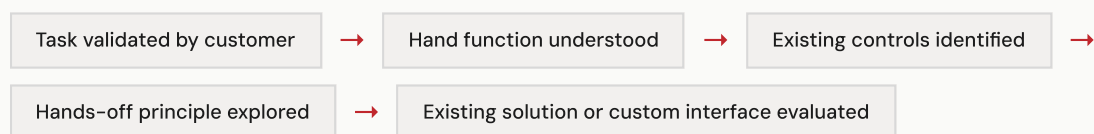
Where completed nacelle or hub assemblies are crane-positioned onto transport trailers or despatch cradles

During the crane approach and set-down of a completed assembly onto its transport arrangement:

How is the assembly guided to its transport saddles or cradles? Where personnel are involved in the final positioning phase, is there hand contact with the assembly while it remains under crane load?

What Happens After This Discussion

These questions are the beginning, not the conclusion. Where a customer's HSE or operations team identifies an application in which the hand is performing a mechanical function close to a potential hazard, PSC follows a structured review before considering any solution.



On custom tool-to-load interfaces. Some assembly applications have component geometries, flange patterns, bearing bores, lifting arrangements, restricted access conditions or alignment requirements that mean an off-the-shelf hands-off tool may not be appropriate. In these situations, PSC can investigate a purpose-designed tool-to-load interface — developed around the specific mechanical function the worker's hand is currently performing. Development of any custom interface begins only after the actual task and hand function have been understood from the customer's own photographs, footage or direct discussion.

Three Possible Outcomes

OUTCOME 1 Existing hands-off solution may apply An existing PSC solution — most likely within the RiggerSafe® platform — may be able to perform the required mechanical function from a safer standoff distance. The customer evaluates it against the actual operation in their environment.	OUTCOME 2 Custom tool-to-load interface required The application is validated, but the specific geometry, access arrangement or interface requirement means a purpose-designed tool-to-load interface is more appropriate. PSC and the customer jointly scope the requirement.	OUTCOME 3 Existing control already effective The customer already has an engineered control that adequately removes the hand from the exposure zone. No additional solution is required. This outcome is as valid as the other two — Find the Hand™ is an assessment methodology, not a route to selling products.
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About PSC Hand Safety

Find the Hand™ Methodology PSC's approach to industrial hand safety is built around a single discipline: locate the hand before recommending any solution. We begin with observation — understanding exactly what the hand is doing, why it is there, and whether that function can be re-engineered away from the hazard zone. No product is considered before the task is understood.	RiggerSafe® Platform Purpose-designed tools that allow workers to guide, push, pull or steer suspended or moving loads while maintaining separation between the worker's hand and the load. Available in multiple lengths and head configurations for different load-control applications, including crane-travel control, final positioning and component alignment tasks.	Custom Tool-to-Load Interfaces Where the RiggerSafe® platform cannot adequately perform the required mechanical function — because the task involves a specialised engagement, component geometry, bore, flange or alignment point — PSC can investigate a purpose-designed interface. The brief for any custom tool begins with one question: what is the hand currently doing, and what must a tool do to replace that function?
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Suggested next step. Compare these typical applications against your own operations and identify any tasks where the hand is currently being used to guide, align, steady, position, hold, push, pull or control a component. Photographs or short video of those specific tasks can then be reviewed by PSC to understand the actual geometry, movement, working distance and existing controls. Only after this review would PSC consider whether an existing hands-off tool may be appropriate, whether a different working method should be considered, or whether a custom tool-to-load interface warrants investigation. A short discussion can also be arranged with the relevant HSE, production, maintenance or lifting personnel.

This document presents typical industry applications for discussion purposes. It does not constitute an assessment of any specific manufacturing facility, process or safety practice. Actual recommendations should be based on review of the customer's specific task, operating conditions and existing controls. · Project Sales Corp — Hand Safety India (HSI) · www.handsafetyfirst.com