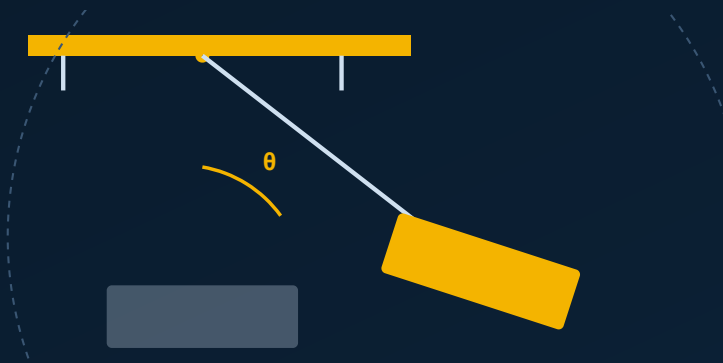


Magnetic Push-Pull Tools for Suspended Steel Loads

The Engineering Handbook for Hands-Free Guidance, Positioning, and Load Control

The physics of suspended load behaviour, the engineering of magnetic guidance, and a complete reference for selecting and applying push-pull tools in industrial lifting work.



DOCUMENT TYPE

Engineering Handbook

AUDIENCE

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SUBJECT

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PSC Hand Safety

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HOW TO USE THIS HANDBOOK

Chapters 1–2 establish the physics of suspended load behaviour — the engineering foundation for everything that follows. Chapters 3–6 explain why steel loads create unique positioning hazards and how magnetic guidance tools address them. Chapters 7–9 form the core engineering reference on head design: the two guiding philosophies, and the engineering problem each is built to solve, before introducing PSC's implementation of each. Chapters 10–13 cover magnetic force and selection logic for head, strength, length, and configuration. Chapters 14–17 apply this knowledge through case studies, best practice, frequently asked questions, and conclusion.

01 Introduction

Many steel loads can be lifted without difficulty. The challenge begins when the load must be controlled.

Lifting a steel component is, in most cases, the straightforward part of the operation. A crane, hoist, or lifting beam applies a calculated force, a rigging arrangement distributes that force across appropriate attachment points, and the load leaves the ground. The engineering behind the lift itself is well understood and governed by established lifting standards.

What is far less standardised — and far less discussed — is what happens once the load is in the air. A suspended steel load rarely behaves like a fixed object. It swings gently on the hook. It rotates as rigging settles. It drifts sideways in response to crane travel, wind, or the natural sway of the lifting line. It resists final alignment, sliding past where it needs to sit, or stopping just short of a mating surface. None of this is a malfunction. It is the physical behaviour of a heavy, rigid, unsupported mass hanging from a suspension system.

The operational response to this behaviour has, for decades, been largely unchanged: a worker moves toward the load and uses their hands to guide it — steadying a swinging plate, rotating a beam into alignment, nudging a motor housing the final few centimetres onto its mounting studs, reaching between the load and an adjacent structure to correct an angle.

This is the point in the lifting sequence where hand exposure is highest — not during the lift itself, but during the positioning phase that follows it. The crane has done its job. The hazard now belongs to the worker standing closest to the steel.

“ **The final positioning phase often creates the highest exposure, because this is precisely when workers move closer to the load to guide, steady, rotate, align, or reposition it.** ”

This guide examines why guidance and positioning create hand exposure, how that exposure can be engineered out through magnetic guidance tools, and how to select and apply the correct tool for a given task. It is not a product catalogue. It is a technical reference for engineers, riggers, lifting supervisors, maintenance personnel, fabricators, offshore crews, and HSE professionals responsible for the safety of people working around suspended ferrous loads.

Who This Guide Is For

- **Riggers and lifting crews** responsible for final positioning of suspended loads.
- **Lifting supervisors and crane operators** coordinating multi-person lifts.
- **Maintenance and installation teams** handling motors, gearboxes, and machine components.
- **Steel fabricators and structural erectors** aligning beams, plates, and assemblies.
- **Shipyard and offshore personnel** positioning modules and steel components in constrained environments.
- **HSE professionals and procurement teams** evaluating engineering controls for hand and finger injury prevention.

02 The Physics of Guiding a Suspended Steel Load

Before a tool can be selected, the problem itself must be understood.

Most discussions of load positioning begin with the equipment: which tool, which length, which head. This handbook begins differently, because the equipment only makes sense once the underlying physics is understood. A suspended steel load is not a passive object waiting to be moved into place. It is a physical system with its own momentum, its own centre of gravity, and its own tendency to rotate, drift, and swing — independent of anything the crane operator does correctly.

This chapter sets out the mechanics behind that behaviour: pendulum motion, centre of gravity, rotational inertia, and the everyday phenomenon of load drift. It also addresses a question that is rarely asked directly — why, given the well-known risks, do experienced workers still reach in with their hands? Understanding the physics of the load is the first step. Understanding the instinct of the worker is the second. Both are necessary before the rest of this handbook's engineering content can be properly applied.

9.1 The Load as a Pendulum

A load suspended from a single hook point is, mechanically, a pendulum. This is not a loose analogy — it is the precise physical description. The suspension line acts as the pendulum's arm, the hook acts as its pivot, and the load itself acts as the pendulum's bob. Like any pendulum, it has a natural tendency to swing whenever a lateral force is introduced, and very little in a typical lift removes that lateral force entirely.

Lateral force enters the system in several ordinary ways: the crane travels horizontally while the load is airborne, wind acts on the load's surface area, or tension in the lifting line is released unevenly as the load comes off a supporting surface. None of these requires an error or a fault. They are simply the normal mechanical inputs of a working lift, and each one imparts swing.

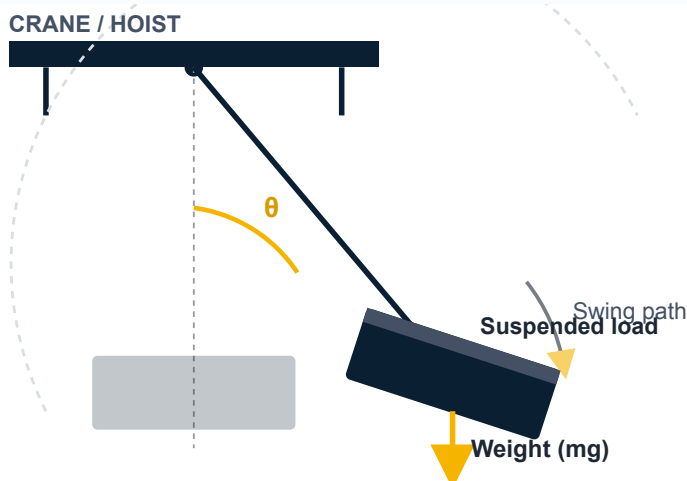


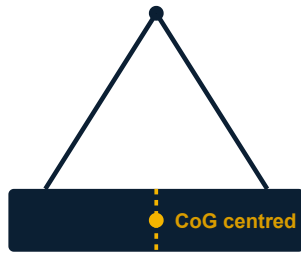
Fig. 2.1 — A load suspended from a single point behaves as a pendulum. Lateral force produces swing angle θ , and the load continues to oscillate until that energy is removed.

Once swing begins, it does not stop on its own quickly. A pendulum loses energy only gradually, through air resistance and friction at the pivot — both very small for a heavy steel load on a steel hook. In practical terms, this means a load that begins swinging during a lift will often still be swinging, even if only gently, by the time it needs to be positioned precisely. This residual motion is the first physical reason positioning is harder than lifting.

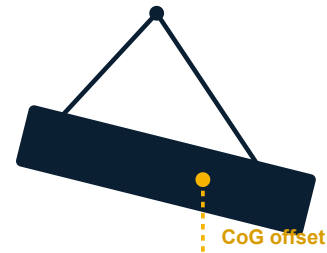
9.2 Centre of Gravity and Why Loads Settle at an Angle

Every rigid object has a centre of gravity — the single point at which its entire weight can be considered to act. When a load is suspended, it naturally orients itself so that its centre of gravity sits directly beneath the point of suspension. For a load lifted from a single, perfectly centred hook point, this is straightforward: the load hangs level, because its centre of gravity already sits beneath the hook.

Real-world rigging is rarely this tidy. Multi-point slings, asymmetric components, and fabricated assemblies with uneven mass distribution all introduce a mismatch between where the rigging attaches and where the centre of gravity actually sits. The load is still obeying the same physical rule — settling so its centre of gravity hangs beneath the effective suspension point — but because the rigging geometry does not match the mass distribution, the result is a load that hangs at an angle rather than level.

BALANCED LIFT

Load hangs level. No correction required.

UNEVEN SLING LENGTH

Load settles at an angle and requires manual correction before final placement.

Fig. 2.2 — A balanced lift hangs level because centre of gravity sits beneath the suspension point. Uneven sling length or asymmetric mass shifts that point, producing an angled load that must be corrected.

This is why so many positioning tasks begin with a load that is already slightly tilted, slightly twisted, or sitting at an unexpected angle the moment it clears the ground. It is not a rigging error in most cases — it is the geometry of an imperfectly centred lift expressing itself exactly as physics predicts. The practical consequence is the same regardless of cause: the load will need angular correction before it can be set down cleanly onto a rack, a mounting surface, or an adjacent structure.

ENGINEERING NOTE

Centre of gravity rarely aligns perfectly with rigging geometry, especially for irregular fabrications, multi-component assemblies, and asymmetric machine parts. Expecting a level, drift-free load by default is expecting more of routine rigging than physics generally allows.

9.3 Rotational Inertia and Why Loads Keep Turning

A separate but related behaviour is rotation around the load's own vertical axis — the load slowly turning in place as it hangs. This is governed by rotational inertia: once a mass begins rotating, it continues rotating until something applies a force to stop it. For a suspended steel load, very little exists to provide that stopping force.

Steel offers very little air resistance relative to its mass, and a hook-and-sling suspension provides very little rotational friction at the pivot. Once rotation is introduced — by wind, by residual torque left over from how the load was lifted off the ground, or by incidental contact with an adjacent surface during descent — that rotation tends to continue largely unchecked. Nothing in the system is designed to damp it out quickly.

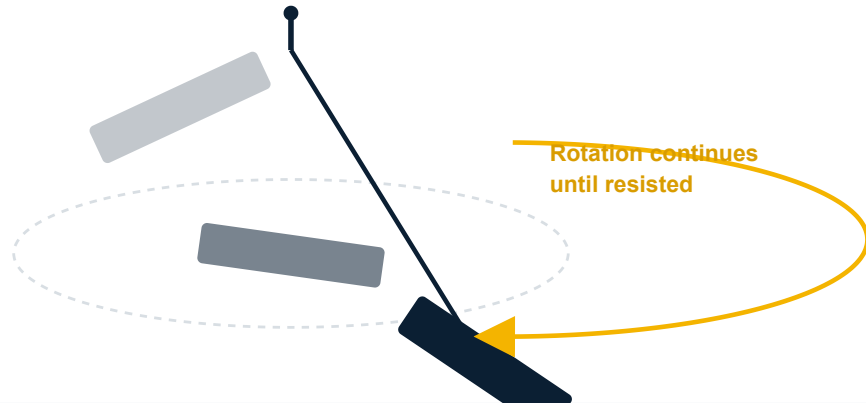


Fig. 2.3 — Once rotation begins, low air resistance and minimal pivot friction mean a suspended steel load continues turning until something — usually a worker's hands — applies a stopping force.

This is the second physical reason positioning is difficult: not only does a load drift sideways from pendulum swing, it can simultaneously rotate around its own suspension axis, changing its orientation independently of its position. An operator attempting to land a rotating beam onto a fixed mounting point is contending with two separate kinds of motion at once.

9.4 Why Suspended Loads Drift

"Drift" is the everyday term riggers use for the combined effect of these behaviours — swing, settling angle, and rotation acting together so that a load's position and orientation continue to change slightly even when the crane itself is holding still. Drift is not a sign that something has gone wrong. It is the expected behaviour of a rigid mass connected to a fixed point through a flexible suspension system, subject to the small, constant lateral disturbances of any real work environment.

The practical implication is direct: a load essentially never arrives at its final position purely through the lifting action. By the time it reaches the vicinity of its intended location, it typically needs some combination of lateral correction, rotational correction, and fine alignment — correction that something or someone has to apply.

SUMMARY SO FAR

Pendulum motion explains lateral swing. Centre-of-gravity offset explains settling angle. Rotational inertia explains turning. Together, these three mechanics explain why "drift" is the rule for suspended steel loads, not the exception.

9.5 Why Workers Instinctively Reach In

If suspended loads drift, swing, and rotate as a matter of routine physics, a reasonable question follows: why do experienced workers, who understand these risks as well as anyone, still reach in with their hands to correct it? The answer is not carelessness. It is a predictable consequence of how the human hand compares to every other tool available on a typical site.

The hand is, in almost every practical sense, the best positioning tool a worker has immediate access to. It provides instant feedback through touch — the operator feels resistance, slippage, and surface condition in real time. It offers infinitely variable grip and angle, adjusting instantly to whatever shape or orientation the load presents. It requires no setup, no attachment step, and no separate piece of equipment to fetch, inspect, or carry. When a load drifts a few centimetres off target and needs an immediate, small correction, the hand is faster to deploy than almost anything else — and workers under time pressure consistently default to the fastest available method.

This is the core of the problem this handbook addresses. The hand is not a poor tool. It is, in many respects, an excellent one — which is exactly why it continues to be used for tasks that place it inside pinch, crush, swing, and line-of-fire zones. Telling a worker to simply stop using their hands does not remove the underlying advantage that makes the hand the instinctive choice. It only removes the tool without replacing its function.

PSC DOCTRINE

An instinct cannot be removed by instruction alone. It can only be replaced by a tool that offers comparable speed, feedback, and control — without placing the operator's hand inside the hazard.

9.6 The Engineering Requirement This Creates

This reframes the design problem for any guidance tool intended to replace hand contact. It is not enough for a tool to be merely safer than a hand; if it is also slower, clumsier, or harder to control, operators will quietly revert to hand contact whenever supervision is light or time pressure is high. A genuinely effective guidance tool has to compete with the hand on its own terms: fast to engage, responsive to small adjustments, and intuitive enough that the operator does not need to think about the mechanism while concentrating on the load.

This is the engineering brief that shapes every chapter that follows. A magnetic push-pull tool is not simply a barrier placed between a worker and a hazard. It is an attempt to reproduce the speed and control advantages of the hand — quick attachment, immediate directional feedback, fine control over force and angle — while relocating the actual point of contact away from the operator's body. The chapters ahead examine how that objective is engineered into the magnetic interface, the articulating head, and the selection logic for matching a tool to a task.

ENGINEERING NOTE

The engineering principles discussed in this handbook are intended to assist in the selection and application of magnetic push-pull guidance tools during suspended load positioning. Actual performance depends on numerous variables including load geometry, steel composition, surface condition, coatings, magnet size, attachment area, operator technique, environmental conditions, and lifting configuration.

The crane, hoist, and approved rigging remain solely responsible for supporting the suspended load at all times. The magnetic push-pull tool is intended only as a guidance interface and must not be used as a lifting attachment or load-bearing device.

This principle underlies every chapter that follows. Where this handbook discusses the physics of suspended loads, the engineering of magnetic guidance, or the selection of a specific PSC tool, it does so within the boundary stated above: the tool guides; it does not support, suspend, or lift.

03 Why Steel Loads Are Different

Not all suspended loads present the same handling characteristics. A steel load behaves differently from a palletised load, a fabric sling bag, or a containerised unit, largely because of three combined properties: mass concentrated in a rigid form, a high centre of gravity relative to a single or limited suspension point, and surface geometry that frequently offers few safe handholds.

These properties apply across a wide range of steel items routinely lifted on industrial sites:

- **Steel plates** — flat, often slippery, with edges that present shear and impact hazards during rotation.
- **H-beams and I-beams** — long, asymmetric, and prone to pendulum swing along their length.
- **Structural assemblies** — multi-component frames where several mating faces must align simultaneously.
- **Motors and machine components** — compact, dense, requiring precise final positioning onto studs, rails, or mounting plates.
- **Lifting beams and spreader bars** — rigging hardware that itself must be positioned before the primary load is attached.
- **Steel fabrications** — irregular shapes with shifting centres of gravity as sub-components are added or removed.

Why Steel Loads Rotate, Drift, and Swing

A load suspended from a single hook point behaves as a pendulum. Any lateral force — crane travel, wind, an uneven release of tension — will cause it to swing. A load suspended from two or more points is rarely perfectly balanced; minor differences in sling length or load distribution cause it to settle at an angle rather than level, and that angle frequently needs correction before the load can be set down or mated to another surface.

Rotation is a related but distinct behaviour. Even a well-rigged load can rotate slowly around its vertical suspension axis simply because nothing is resisting that rotation. Wind, residual torque from how the load was lifted, or contact with an adjacent surface during descent can all initiate rotation. Because steel has so little surface friction with air, once rotation begins it tends to continue until something — usually a person's hands — stops it.

This is the underlying engineering reality that drives the rest of this guide: **steel loads require correction**. They do not arrive at their final position purely through the lifting action. Someone, or something, must apply a final, controlled, directional force to bring the load into alignment.

DOCTRINE

A lift is rarely complete the moment the load leaves the ground. It is complete only when the load reaches its intended position, orientation, and seating. The positioning phase is a distinct phase of work, with its own hazard profile, and it deserves its own engineering controls.

04 The Traditional Approach

Without a dedicated guidance interface, the only tool available to most operators for final positioning is the hand. The traditional approach to correcting a swinging, drifting, or misaligned steel load typically involves one or more of the following:

- **Direct hand contact** with the suspended load to steady or stop movement.
- **Grabbing edges** of plates, beams, or fabrications to apply rotational correction.
- **Pushing plates or panels** by hand to walk them into final alignment.
- **Touching suspended loads** during descent to guide them onto a base, rack, or mounting surface.
- **Reaching between the load and adjacent structure** to correct an angle or clear an obstruction.

Each of these actions places a hand inside, or very close to, the zone where the load is capable of moving. This is the operational definition of hand exposure: the hand is near enough to a moving or potentially moving object that an unplanned or uncontrolled movement could result in contact injury.

Where the Exposure Occurs

EXPOSURE PATTERNS DURING MANUAL LOAD POSITIONING

EXPOSURE TYPE	DESCRIPTION	TYPICAL TASK CONTEXT
Pinch points	Hand caught between the load and a fixed or secondary moving surface.	Guiding a plate toward a rack or frame
Crush points	Hand or fingers trapped under load weight as it settles or seats.	Final placement onto a base or mounting surface
Swing paths	Hand positioned within the arc of a pendulum-style load movement.	Steadying a beam suspended from a single point
Line-of-fire zones	Body positioned in the direct path the load would travel if released, dropped, or if rigging failed.	Reaching between load and structure during alignment

It is worth being precise about what causes these exposures. It is not carelessness on the part of the worker. In the absence of an alternative tool, hand contact is often the only practical way to apply the small, directional correction a load requires. The hazard is not behavioural — it is a consequence of the task being performed with the wrong tool, or with no tool at all.

WHY THIS MATTERS

Hand and finger injuries during load positioning are rarely the result of a major rigging failure. They typically occur during routine, low-speed movements — the kind of small correction that happens repeatedly during a normal shift. This is what makes the positioning phase a persistent source of exposure rather than a rare event.

The engineering question this raises is direct: if direct hand contact is the source of the exposure, can the same directional control be applied without the hand being in contact with the load at all? This is the problem that magnetic push-pull tools are designed to solve.

05 How Magnetic Push-Pull Tools Work

A magnetic push-pull tool is, in its simplest description, an extension handle with a magnetic head at one end. The operator holds the handle at a distance from the load, brings the magnetic head into contact with a ferrous surface, and uses the handle to apply push or pull force through the magnetic attachment point rather than through a hand gripping the load directly.

PHOTOGRAPH PLACEHOLDER — FIG. 5.1

Product photograph: PSC Load-It MagHead engaging structural steel, showing the swivel joint, magnetic base, and rigging hook.

The Core Components

- **Magnetic head** — a high-strength permanent magnet, rated up to 550 lb of pull force on PSC's 75 mm head in its standard fixed-length configuration, that attaches to any clean, flat ferrous surface.
- **Extension handle** — a rigid fixed-length shaft, or a telescopic fibreglass pole on the extendable model, that sets the operator's standoff distance from the load.
- **Articulating joint** — either a 180° swivel or a 90° fixed pivot connecting the handle to the magnetic head, examined in detail in Chapters 7–9.

One-Hand Operation

Because the tool transmits force through a rigid handle rather than requiring a full hand grip on the load itself, it can typically be operated with one hand. This leaves the operator's other hand free for balance, for a tagline, or for communication signals, and it means the operator's body remains upright and at a natural standoff distance rather than leaning into the load's working envelope.

Safe-Distance Guidance in Practice

Consider a steel plate being lowered toward a vertical storage rack. Without a guidance tool, an operator would typically position a hand on the leading edge of the plate to control its final approach, placing fingers directly in the gap between the plate and the rack — a textbook pinch point. With a magnetic push-pull tool, the operator instead attaches the magnetic head to the face of the plate, several feet from the rack, and uses the handle to apply a controlled push or pull. The plate is guided into position; the operator's hand never enters the gap.

The same principle applies whether the task involves steadying a rotating beam, walking a panel into alignment, or making a final correction to a component's position before it is lowered onto a mounting surface. In every case, the function being performed is the same as a hand would perform — a push, a pull, a steadying force, a small rotational nudge — but the contact point has moved from the worker's hand to the end of an extension tool.

PSC DOCTRINE

The tool does not change what needs to be done to the load. It changes where the operator's body is standing while it is done.

What the Tool Does Not Do

A magnetic push-pull tool is a guidance and positioning interface. It is not a lifting device, and it is not a substitute for proper rigging, taglines, or crane control. The crane or hoist continues to support the full weight of the load at all times. The magnetic tool's role is limited to providing directional control during the final stages of positioning — a distinction examined in full in Chapters 9 and 10.

06 Common Applications

Magnetic push-pull tools are used across a wide range of industrial environments where ferrous loads must be lifted, positioned, or aligned. The specific task varies by industry, but the underlying exposure pattern — a hand required near a moving steel surface — remains consistent.

STEEL MILLS

Coil, Plate, and Billet Handling

Task: Guiding plates and coils during transfer between processing stations, storage racks, and loading bays.

Exposure: Pinch points between plate edges and rack structures; crush points during final seating.

Application: Mid-length fixed tools (3–4 ft) for routine transfer guidance; 90° Flex Heads where approach geometry is repetitive.

STEEL SERVICE CENTRES

Cut-to-Length and Slit Coil Positioning

Task: Aligning processed sheet and plate stock onto pallets, racks, or outbound transport.

Exposure: Hand contact during repeated, high-frequency positioning cycles.

Application: Shorter tools (1–2 ft) suited to close-quarters, high-repetition handling.

FABRICATION YARDS

Structural Assembly Alignment

Task: Positioning beams, columns, and fabricated sub-assemblies for welding, bolting, or fit-up.

Exposure: Crush and line-of-fire exposure while aligning mating faces under suspension.

Application: 90° Flex Heads for predictable structural profiles; longer tools (4–6 ft) for working around adjacent steelwork.

FOUNDRIES

Casting and Component Positioning

Task: Guiding heavy ferrous castings during cooling, transfer, and final placement.

Exposure: Heat-adjacent hand exposure combined with standard pinch and crush hazards.

Application: Extended-length tools that increase standoff distance from both the load and residual process heat.

SHIPYARDS

Hull Section and Module Guidance

Task: Aligning large steel hull sections, brackets, and fittings during block construction.

Exposure: Confined access between sections; operator frequently changes position as the section is walked into place.

Application: 180° Swivel Heads for continuous engagement as operator position shifts around large sections.

OFFSHORE PLATFORMS

Module and Skid Positioning

Task: Final positioning of equipment skids, structural modules, and piping supports in constrained deck space.

Exposure: Limited working space increases the likelihood of hand exposure during close-quarters correction.

Application: Fixed-length tools matched precisely to available standoff distance; corrosion-aware inspection routine given marine environment.

OIL AND GAS FACILITIES

Equipment Skid and Pipe Support Alignment

Task: Positioning skid-mounted equipment and structural pipe supports during installation and turnaround work.

Exposure: Repeated fine alignment near flanges and mounting points.

Application: Mid-length tools (3–4 ft) with 90° heads for repetitive, predictable approach angles.

CONSTRUCTION PROJECTS

Structural Steel Erection

Task: Final alignment of beams and columns prior to bolt-up at height or ground level.

Exposure: Crush and pinch exposure during fit-up; line-of-fire exposure near suspended members at height.

Application: Extendable fiberglass telescopic tools (4–8 ft) allow ground crew to assist alignment without entering the suspended load's envelope.

HEAVY EQUIPMENT ASSEMBLY**Component and Sub-Assembly Installation**

Task: Positioning engine blocks, counterweights, and structural components during assembly.

Exposure: Crush exposure during final seating onto mounting points.

Application: Shorter, fixed tools for precise, repeatable final-inch positioning.

WIND TURBINE MANUFACTURING**Tower Section and Gearbox Positioning**

Task: Aligning tower flange sections and internal drivetrain components during assembly.

Exposure: Confined internal access combined with large component mass.

Application: 180° Swivel Heads suited to confined, awkward-angle access points.

COMMON THREAD

Across every industry above, the underlying task is the same: a worker needs to apply a small, controlled, directional force to a steel load that is not yet in its final position. The environment changes. The exposure pattern does not.

07 Two Engineering Philosophies for Magnetic Load Guidance

At first glance, magnetic push-pull tools often appear very similar. They consist of a handle, an articulated head, and a magnetic interface used to guide suspended steel loads from a safe standoff distance. The engineering differences lie not in the magnet alone, but in the way the operator interacts with the load throughout the positioning task.

PSC offers two distinct magnetic head configurations. They are not intended to represent a basic product and a premium product. Instead, they reflect two different engineering philosophies for solving different suspended load guidance challenges.

7.1 Why Different Guidance Philosophies Exist

No single articulation range suits every positioning task, because positioning tasks themselves are not uniform. Some require the operator to track a load that is changing orientation continuously, approaching it from a shifting sequence of angles as the task unfolds. Others involve a single, repeatable approach to a load that arrives in essentially the same orientation cycle after cycle. A guidance tool engineered for the first scenario is not automatically the right tool for the second — and treating articulation as a single, linear scale from "less" to "more" obscures that distinction rather than clarifying it.

This is the underlying reason PSC engineers two head configurations rather than one with a single compromise range of motion. Each is matched to a different combination of operator movement, load trajectory, and task geometry, not ranked against the other on a single specification.

7.2 Why Articulation Is Not Simply "More Is Better"

It is tempting to assume that a wider range of articulation is always the superior engineering choice — that a head capable of more movement can only outperform one capable of less. This assumption does not hold up under closer examination of how positioning tasks actually behave.

Unconstrained articulation has a cost as well as a benefit. A tool with a very wide working angle gives the operator little mechanical feedback about where the boundary of safe, controlled engagement actually lies; every angle feels equally available, whether or not it is appropriate to the task. For tasks with a consistent, repeatable approach — the kind found throughout structural fabrication and production environments — that absence of a defined boundary does not add capability. It removes a useful constraint that would otherwise reinforce a safe, repeatable working pattern.

The correct engineering question is therefore not "how much articulation is available," but "how much articulation does this specific task require, and what does the operator gain or lose by having more or less of it." Framed this way, a deliberately bounded working envelope is not a limitation to be tolerated — it is, for the right task, the more precisely engineered solution.

ENGINEERING PRINCIPLE

Articulation should be matched to the task's operator-movement and trajectory requirements, not maximised as a specification in its own right. More articulation is the right answer for some tasks and the wrong answer for others.

7.3 The Variables That Actually Drive Selection

Choosing between the two philosophies is a matter of reading the task correctly before reading a specification sheet. Four variables, considered together, predict which philosophy fits a given application far more reliably than treating one head as a general upgrade over the other:

- **Operator movement** — does the operator's position relative to the load change during the task, or does the operator work from one consistent position throughout?
- **Load trajectory** — does the load's orientation change continuously as it is lifted, rotated, and positioned, or does it arrive and remain in a broadly consistent orientation?
- **Task geometry** — is the approach angle and mating surface the same from one cycle to the next, or does it vary with the specific component, assembly, or access point?
- **Working environment** — does the task take place in open, unconstrained space, or in a confined access point where the practical range of motion is limited regardless of what the tool permits?

Chapters 8 and 9 examine each philosophy in turn, beginning in each case with the engineering problem it addresses, before introducing the PSC head configuration engineered to solve it.

PSC DOCTRINE

Neither philosophy is universally superior. Each has been engineered to solve a different operational problem. Selecting the correct head depends on understanding the task — not on choosing the product with the greatest articulation.

08 Maintaining Continuous Magnetic Engagement™

Suspended loads rarely move in a single plane.

As a crane raises, lowers, rotates, and positions a suspended steel load, the load's orientation continuously changes. Chapter 2 established the underlying physics: pendulum swing, centre-of-gravity offset, and rotational inertia all act on the load at once, and rarely settle into a single, stable plane of motion for the duration of a positioning task. The load drifts. It rotates. It oscillates. Its orientation at the start of a task is frequently not its orientation a few seconds later.

8.1 The Engineering Problem: Operator Movement Exceeds Load Movement

It is easy to assume that the load is the primary source of motion in a positioning task, and that the operator simply reacts to it. In practice, the relationship is often reversed. A suspended load, once initial drift has settled, tends to move slowly and within a limited arc. The operator, by contrast, frequently needs to move substantially — stepping around the load to reach a better angle, repositioning to apply force from a different direction, or walking alongside the load as it is guided across a distance, all while the load's own orientation continues to shift independently underneath the tool.

A tool with a fixed, narrow engagement angle treats every one of these operator movements, and every one of these changes in load orientation, as an interruption — a moment where the tool must be lifted away, the operator repositioned, and the tool reattached. Over the course of a single positioning task, this can mean several detachment-reattachment cycles, each one a small pause in control and a small increase in total task time.

8.2 The Engineering Principle: Accommodating a Changing Load Trajectory

The engineering response to this problem is not simply to make the tool "more flexible" in a general sense. It is to give the tool enough independent freedom of movement that it can continue tracking a moving target — both the operator's changing body position and the load's changing orientation — without breaking contact between them.

This requires two separate freedoms, because the operator's movement and the load's movement are two separate sources of change, not one. The handle needs freedom to follow the operator's hand wherever it needs to be. The magnetic face needs freedom to follow the steel surface's changing orientation, independent of where the handle is pointing. A tool that only solved one of these would still force a disengagement whenever the other source of change exceeded its range.

ENGINEERING PRINCIPLE

Maintaining engagement against a continuously changing load trajectory requires articulation that accommodates the operator's movement and the load's own changing orientation simultaneously, not just a wider angle in one fixed plane.

8.3 PSC's Engineering Solution: The 180° Swivel Head

PSC's implementation of this principle is the 180° Swivel Head, which combines two mechanically independent movements working together, rather than a single flexible joint. The first is 180° articulation between the handle and the head — the handle can swing through a wide arc relative to the magnetic head without that head losing contact with the steel surface. The second is 360° rotation of the magnetic face itself around its own mounting axis, independent of the handle's angle.

This combination is significant enough to warrant its own name within PSC's engineering doctrine: **Continuous Magnetic Engagement™**.

8.4 Two Independent Movements

Because the handle articulation and the magnetic face rotation are mechanically independent, the operator can change body position, walking direction, push or pull direction, and wrist angle simultaneously — all while the magnetic face remains flush against the steel surface. The handle adapts to wherever the operator's hand needs to be; the magnetic face adapts to whatever angle keeps it seated against the load, including a load whose own orientation is changing at the same time. Neither movement constrains the other.

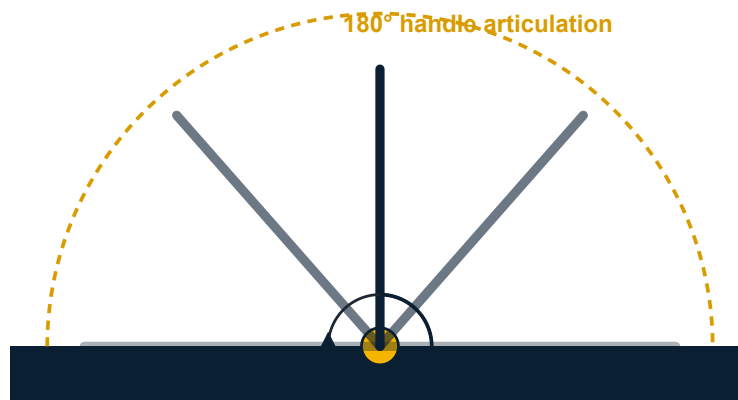


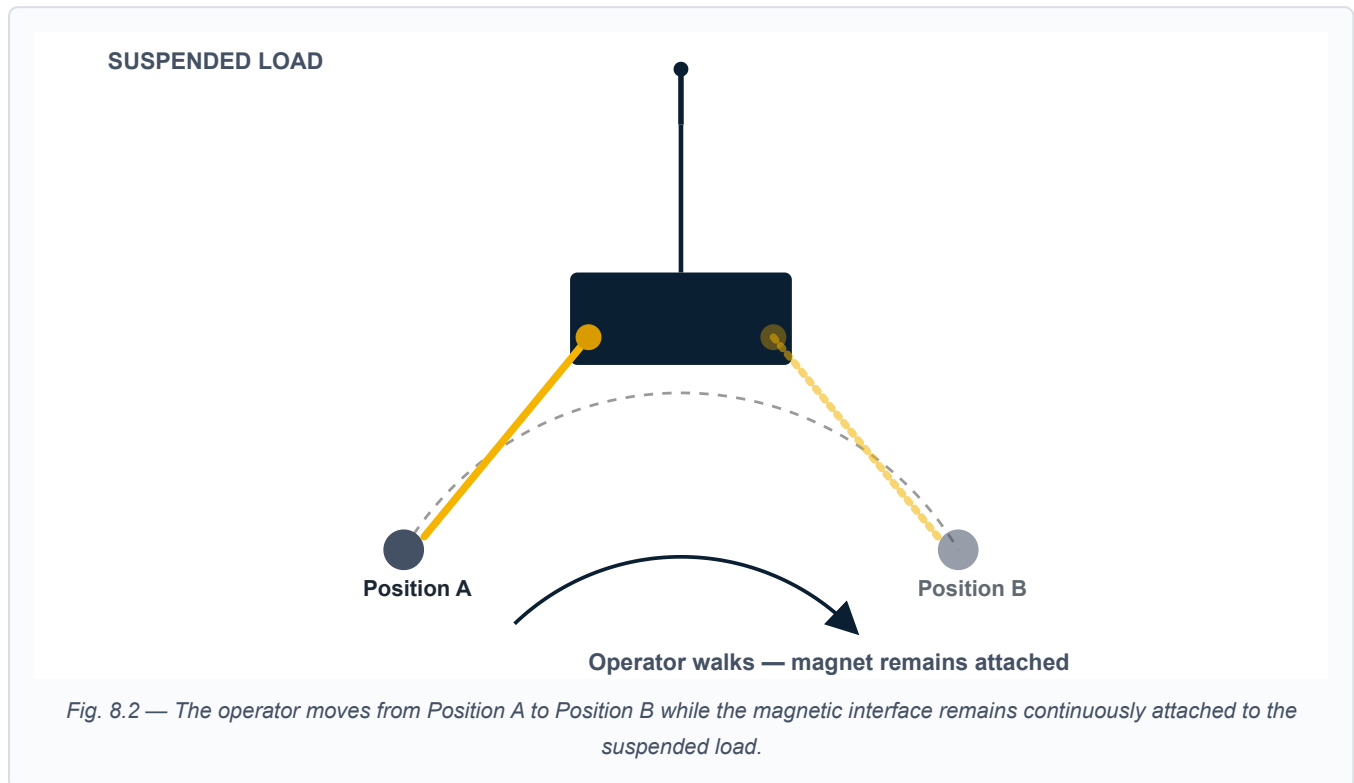
Fig. 8.1 — Two independent movements combine: 180° handle articulation and 360° magnetic face rotation, allowing body position and push/pull angle to change without breaking contact.

PSC DOCTRINE

The operator moves. The magnet stays attached. The load remains under control.

8.5 Walking Around the Load

The clearest illustration of Continuous Magnetic Engagement is an operator physically walking from one position to another while remaining attached to the load throughout. As the suspended load rotates, drifts, or simply requires a different approach angle, the operator can follow it — adjusting handle angle and magnetic face orientation as they go — rather than stopping to disengage, reposition, and reattach.



8.6 Engineering Benefits

Continuous Magnetic Engagement produces a consistent set of practical benefits, all of which follow directly from the same underlying mechanical principle:

- **Continuous attachment** — the magnetic interface is not broken simply because the operator's body position, or the load's orientation, changes.
- **Continuous control** — directional force can be applied without a gap in engagement while repositioning.
- **Reduced interruption** — the task is not punctuated by repeated stop-detach-reposition-reattach cycles.
- **Smoother positioning** — continuous force application, rather than a series of disconnected corrections, tends to produce a steadier final approach.
- **Improved ergonomics** — the operator can move naturally and let the tool's articulation absorb the change, rather than adopting awkward body positions to keep a narrow engagement angle satisfied.

Taken together, these benefits are why PSC treats Continuous Magnetic Engagement as one of its core engineering doctrines, applied to tasks where the load's trajectory and the operator's own movement both depart from a single, predictable plane.

09 Operating Within a Controlled Working Envelope

Not every positioning task involves a load whose orientation is changing continuously, or an operator whose position must shift throughout the task. Many tasks, in fact, involve the opposite: predictable geometry, a repetitive approach, and an operator who works from one consistent position cycle after cycle.

9.1 The Engineering Problem: When Unrestricted Articulation Adds Nothing

Structural members such as H-beams and I-beams present consistent, known geometry — the approach angle for guiding a beam flange is essentially the same lift after lift. Production environments, where the same component is handled repeatedly, present the same characteristic. Confined workspaces often constrain the practical range of motion regardless of what a tool's joint permits. In each of these cases, a tool engineered for unrestricted articulation does not add capability the task can use; it adds a degree of freedom that goes unexercised, with no defined boundary to reinforce a safe, repeatable working pattern.

The engineering question this raises is the inverse of the one addressed in Chapter 8: not "how can the tool track a constantly changing trajectory," but "how can the tool reinforce a consistent, repeatable one."

9.2 The Engineering Principle: A Defined Envelope Provides Predictability

A constrained working envelope sounds, on first hearing, like a limitation to be tolerated. For tasks with predictable geometry, it is the opposite — a defined, predictable range of motion is precisely what the work requires. Several task characteristics make this true:

- **Repetitive production work** — where the same positioning motion is performed many times a day, a tool that engages and disengages predictably within a known angle range is faster to use correctly than one with an unconstrained range that must be judged afresh each time.
- **Structural sections** — consistent, known geometry matches a bounded working envelope rather than needing open-ended flexibility.
- **Predictable approach** — tasks where the operator always works from the same side or direction benefit from a tool that reinforces that consistency rather than permitting, and therefore requiring judgement about, a wider range of angles.
- **Confined work** — in tight access conditions, a bounded working envelope can be easier to operate within reliably than a wide range of articulation that has little room to be exercised safely in any case.

ENGINEERING PRINCIPLE

Where task geometry is consistent and repeatable, a defined operating envelope produces predictable and repeatable guidance characteristics. The constraint is the engineering value, not a compromise accepted in exchange for something else.

9.3 PSC's Engineering Solution: The 90° Flex Head

PSC's implementation of this principle is the 90° Flex Head. The magnetic face still rotates through a full 360°, exactly as it does on the 180° Swivel Head, allowing it to seat flush against the steel surface regardless of minor surface irregularities. What is constrained is the handle's articulation relative to that face, defining an operating range of approximately 90° rather than the 180° Swivel Head's full range.

Within this operating range, the operator maintains effective magnetic engagement while applying push and pull guidance forces. During normal use, the handle is typically maintained approximately perpendicular to the steel surface. As the handle approaches the limit of its intended articulation, the operator simply repositions the magnetic head before continuing guidance, rather than working the joint toward an undefined limit.

To intentionally disengage the tool, the operator changes the handle angle, allowing the magnetic interface to be peeled from the surface in accordance with normal operating practice. This is a deliberate part of how the head is intended to be used, not a malfunction of the mechanism.

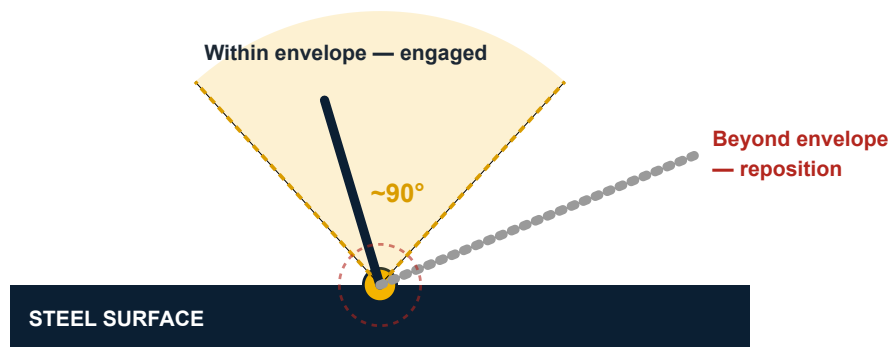


Fig. 9.1 — Within the working envelope, the magnetic interface remains engaged for controlled guidance. Beyond approximately 90°, normal operating practice is for the operator to reposition the head.

9.4 Suited Applications

The 90° Flex Head is well matched to:

- **Predictable geometry** — tasks where the load's approach orientation is essentially the same from one cycle to the next.
- **Repetitive approach** — high-frequency positioning cycles where a known, bounded working angle supports faster, more consistent use.
- **Structural members** — beams, columns, and other sections with consistent profile and approach geometry.
- **Production environments** — settings where the same component is handled repeatedly under similar conditions.
- **Confined workspaces** — access points where the practical range of motion is limited by the environment itself.

9.5 Two Philosophies, Not Two Tiers

The clearest way to state the relationship between the two heads is this: the 180° Swivel Head maximises freedom of movement for tasks where operator position and load trajectory both change. The 90° Flex Head maximises consistency for tasks where they do not. Neither is superior in an absolute sense, because they are not competing on the same criterion. Choosing between them is a matter of matching the engineering philosophy to the task, not selecting a "better" or "lesser" product tier.

ENGINEERING SUMMARY

The 90° Flex Head's working envelope is a deliberate constraint that produces predictable, repeatable engagement — an asset in production environments, structural sections, and controlled-access work, not a reduced version of the 180° Swivel Head's capability.

10 Understanding Magnetic Force

Strong enough to guide. Easy enough to reposition.

Few specifications are as widely misunderstood as a magnet's published force rating. A figure like 550 lb sounds like a simple, absolute measure of holding strength — and many buyers reasonably assume it describes how hard the tool resists being pulled away from steel in any direction, under any condition. This chapter explains why that assumption is incorrect, what the rating actually measures, and why the gap between laboratory rating and real-world guidance force is not a flaw to be minimised but a deliberate part of the engineering.

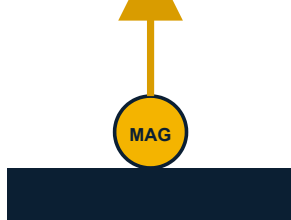
10.1 Three Distinct Concepts

Clarity here depends on separating three concepts that are routinely treated as one:

- **Perpendicular Pull Force** — the force required to pull the magnetic head directly away from a flat steel surface, measured under controlled laboratory conditions. This is the number printed on a specification sheet.
- **Lateral Shear Force** — the resistance the magnetic interface offers to force applied sideways, across the face of the magnet, rather than straight away from it.
- **Guidance Force** — the practical, usable force available to an operator during real guidance work, which is overwhelmingly a function of lateral shear, not perpendicular pull.

PERPENDICULAR PULL FORCE

Force pulls straight away from the surface



Laboratory rating (e.g. 75 mm head, 550 lb).
Measured on clean, flat, thick steel.

LATERAL SHEAR FORCE

Force applied sideways, across the magnetic face



This is what guidance actually uses.
Resistance depends on friction and surface condition.

Fig. 9.1 — Perpendicular pull force (left) is measured straight away from the surface under laboratory conditions. Lateral shear force (right) is what guidance work actually uses.

10.2 Laboratory Testing vs Field Conditions

A published pull force rating — 550 lb for PSC's 75 mm fixed-length head, 275 lb for the 60 mm fibreglass telescopic pole head — is measured under conditions designed to produce a clean, comparable, repeatable number: a thick, flat, clean steel plate, with force applied perpendicular to the magnetic face. This is the correct and standard way to rate a permanent magnet, and it is the figure used internationally to compare one magnet against another.

It is not, however, a description of how the tool behaves in the field. In practice, the operator is rarely pulling the magnetic head straight away from the surface. They are pushing, pulling, and nudging the load sideways — applying lateral shear force across the magnetic interface while it remains seated against the steel. Several field conditions affect how much of that lateral force the interface can resist before sliding or releasing:

- **Friction** between the magnetic face and the steel surface, which varies with surface texture and cleanliness.
- **Coatings** — paint or other surface treatments introduce a small air gap between the magnet and the base steel, reducing magnetic coupling.
- **Rust**, which reduces both the frictional grip and the magnetic coupling at the contact surface.
- **Mill scale**, a common as-rolled steel surface condition that behaves similarly to light surface contamination.
- **Contact area** — how fully and flatly the magnetic face seats against the surface, which can be reduced by curvature, debris, or surface irregularity.
- **Air gap** — any separation between the magnetic face and the steel, however small, disproportionately reduces magnetic holding force.

Each of these factors can reduce the force actually available at the magnetic interface well below the laboratory pull rating, and they do so in combination, on real surfaces, in real industrial environments — not as edge cases, but as the normal operating condition.

PSC'S POSITION ON PUBLISHED PERCENTAGES

PSC intentionally does not publish a fixed percentage relating laboratory pull force to field guidance force, because real-world performance varies meaningfully with surface condition, and a single number would imply a precision the physics does not support. The operating principle is that only a fraction of the laboratory rating is typically available as lateral guidance resistance — verify attachment quality on the actual surface in question rather than relying on the printed rating.

IMPORTANT

A larger magnetic holding force does not necessarily mean a larger guidance force is required. The published holding force describes the magnetic interface. During normal operation, the crane supports the suspended load, while the operator applies only the guidance force needed to control its movement.

10.3 Understanding Magnetic Holding Force, Guidance Force and Disengagement Force

Sections 10.1 and 10.2 distinguished perpendicular pull force from lateral shear force as two different ways of measuring resistance at the magnetic interface. It is equally important to separate three different engineering *conditions* the tool experiences at different stages of a single positioning task. Treating these three conditions as one figure — the published rating — is the most common source of confusion about how a magnetic push-pull tool actually behaves in use.

1. Published Magnetic Holding Force

PSC offers two magnetic head sizes:

- **60 mm magnetic head** — 275 lb holding force
- **75 mm magnetic head** — 550 lb holding force

These published ratings describe the magnetic head's attraction or holding capability when fully seated on a suitable ferrous surface under specified test conditions. They should not be confused with the forces encountered during suspended-load guidance. The published holding force is intended to describe the magnetic interface itself, not the force required from the operator during normal use.

2. Guidance Force

During suspended-load positioning, the magnetic head is not supporting the suspended load. The crane supports the load. The rigging transfers the load. The magnetic interface transfers only the operator's guidance force.

The operator uses the tool to:

- steady the load
- reduce swing
- guide rotation
- align components
- make controlled positioning adjustments

The forces required for these activities are generally much smaller than the published magnetic holding force, because the tool is not lifting or supporting the suspended load.

3. Disengagement Force

Once positioning is complete, the operator intentionally removes the magnetic interface from the steel surface. This is achieved by changing the handle angle and progressively peeling the magnetic interface away from the steel, rather than attempting to pull the entire magnetic face directly away from the surface. As a result, the force required for intentional disengagement is significantly lower than the published magnetic holding force.

The exact disengagement force depends upon many factors, including:

- magnetic head size
- surface condition
- coatings
- rust
- contact area
- steel thickness
- geometry
- operator technique
- handle length

Accordingly, published magnetic holding force should not be interpreted as the force required for normal guidance operations or intentional tool removal.

ENGINEERING PRINCIPLE

A magnetic push-pull guidance tool experiences different force conditions during different stages of use. Published Holding Force describes the magnet's attraction capability. Guidance Force describes the operator's steering input while the crane supports the load. Disengagement Force describes the operator's intentional removal of the magnetic interface after positioning has been completed. Understanding the distinction between these three force conditions is essential for selecting and applying magnetic guidance tools correctly.

10.4 Why Guidance Magnets Should Not Behave Like Lifting Magnets

It is worth asking directly why PSC does not simply engineer the highest possible holding force into every magnetic head. The answer lies in what the tool is for. A lifting magnet is designed to support and suspend the full weight of a load, and for that application, maximum sustained holding force is the entire point — the magnet must not let go.

A guidance tool has the opposite requirement. If the magnetic interface resisted its full perpendicular pull rating during every lateral guidance movement, the operator would be fighting the magnet on every repositioning — struggling to detach and reattach the tool as the task demanded, rather than working with it. Repositioning would become slow, physically tiring, and impractical for the kind of frequent, small adjustments that load guidance actually requires.

“ **Strong enough to guide. Easy enough to reposition. Not maximum holding force — maximum operator usability.**

10.5 Practical Operator Usability as an Engineering Design Goal

This reframes what "correct" magnetic force means for a guidance tool. The objective is not the highest number on a specification sheet. It is a force calibrated to the tool's intended use: strong enough to maintain positive directional control while guiding a load, and weak enough — relative to the operator's own strength and the leverage of the tool — that intentional disengagement and repositioning remain quick and unforced.

This is why PSC's product range uses two different ratings rather than a single maximum figure across all configurations, and it is the subject of the next chapter: selecting the head, the length, and the magnetic strength as a matched system, rather than maximising any single specification in isolation.

11 Selecting the Correct Head

Chapters 7–9 established the engineering philosophy behind each head design: the 180° Swivel Head maximises freedom of movement through Continuous Magnetic Engagement; the 90° Flex Head maximises consistency through a controlled working envelope. This chapter turns that philosophy into a practical selection process.

11.1 The Question That Matters

Rather than comparing specifications side by side, the more useful starting question is operational: **does the operator's position relative to the load change during the task?** This single question does more to predict which head will perform well than any other factor, because it speaks directly to whether Continuous Magnetic Engagement's core benefit — tolerating operator movement without reattachment — will actually be exercised.

- If the operator walks around the load, follows it across a distance, or needs to approach from multiple angles during a single positioning sequence — the 180° Swivel Head's freedom of movement is being used continuously, and the case for it is strong.
- If the operator works from one consistent position, with a single, repeatable approach angle — the 90° Flex Head's working envelope is well matched to the task, and the 180° Swivel Head's additional articulation goes largely unused.

11.2 A Second Question: Geometric Predictability

Where the first question does not give a clear answer — tasks with some, but not extensive, operator movement — a second question helps: is the approach geometry consistent and repeatable from one cycle to the next? Structural sections such as H-beams and I-beams, and production environments where the same component is handled repeatedly, tend to answer yes, favouring the 90° Flex Head even when some operator movement is involved.

11.3 Head Selection Decision Logic

The two questions above combine into a single decision path:

Head Selection — Decision Logic

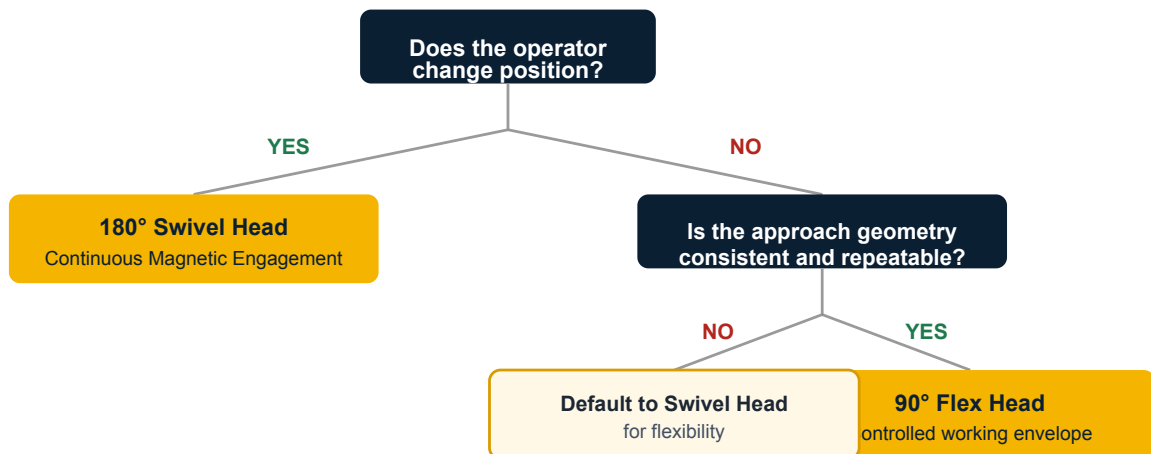


Fig. 10.1 — Head selection decision logic. Operator movement is the primary branch; geometric predictability resolves the remaining cases.

READING THIS TREE

The 180° head maximises freedom of movement. The 90° head maximises consistency. Neither is universally superior — the correct choice depends on whether the operator's body position is expected to change during the positioning task, and, secondarily, on whether the approach geometry repeats predictably.

11.4 Mixed Fleets

Many operations do not need to settle on a single head type for every tool in the fleet. A site running both structural erection work (favouring the 90° Flex Head) and module or vessel positioning (favouring the 180° Swivel Head) is well served by stocking both configurations and matching the head to the task at hand, rather than standardising on one to the exclusion of the other.

12 Selecting Magnetic Strength

PSC's range uses two magnetic head ratings: 550 lb on the 75 mm head used on fixed-length tools, and 275 lb on the 60 mm head used on the MAG-FG-008 fibreglass telescopic pole. It is tempting to read these numbers as a simple hierarchy — 550 lb as the "strong" option and 275 lb as the "weaker" one — and to default to the higher figure whenever possible. Chapter 10 explained why a higher rating is not automatically the better choice for guidance work. This chapter applies that principle directly to PSC's product range.

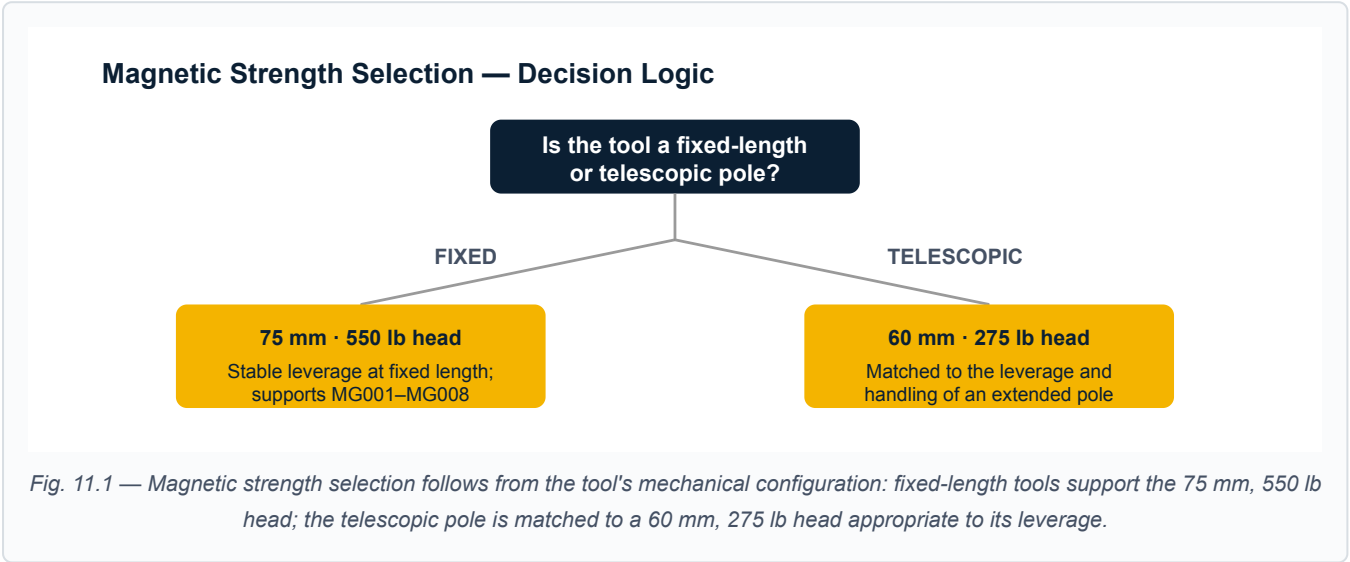
12.1 What Actually Drives the Selection

The correct magnetic strength for a given tool is determined by the mechanical system the magnet is part of, not by an abstract preference for maximum holding force. The relevant factors are:

- **Tool length** — a longer lever arm between the operator's hand and the magnetic interface changes how much force is required to intentionally disengage the head.
- **Leverage** — the same lateral force applied at the end of a longer handle produces a different effective force at the magnetic interface than the identical force applied through a shorter one.
- **Intended application** — fixed-length tools are used in a relatively consistent handling posture; a telescopic pole is used across a range of extensions, each with different handling characteristics.
- **Operator control** — the magnetic rating must remain within the range a typical operator can manage comfortably at the leverage the tool presents.
- **Ease of disengagement** — the rating must allow the operator to release and reposition the tool without excessive effort, at whatever leverage applies.
- **Ergonomic handling** — sustained use across a shift should not require fighting the tool's own magnetic interface.

12.2 Why the Telescopic Pole Uses a Lower Rating

The MAG-FG-008's 60 mm, 275 lb head is not a cost-reduced or lesser component. It is the rating deliberately matched to the leverage present when the pole is extended toward its full 8 ft reach. A 75 mm, 550 lb head at that same extension would present significantly more resistance to intentional disengagement than an operator could comfortably manage — working against the operator rather than for them, exactly the failure mode described in Chapter 10.



12.3 The Selection Principle

This is not a "stronger is better" decision. A higher-rated head on a longer lever arm increases the force required to intentionally disengage and reposition the tool, working against the operator rather than for them. The 60 mm head's 275 lb rating on the telescopic pole is deliberately matched to the leverage present at extension, preserving controlled, practical engagement and disengagement throughout its working range.

PSC DOCTRINE

Select the magnetic interface appropriate to the tool and its leverage — not simply the strongest rating available. The objective is a matched system, not a maximised specification.

13 Selecting Length and Configuration

Tool length is the single most important selection variable in a magnetic push-pull tool programme. Length determines standoff distance — how far the operator's hand remains from the load — and it directly affects how much leverage, reach, and manoeuvrability the operator has for a given task.

There is no universally correct length. A tool that is too short reduces the safety margin it is meant to provide. A tool that is too long becomes difficult to control precisely, increases handling weight at the working end, and can make fine positioning more difficult rather than easier. The objective is to match length to the specific task, access conditions, and required precision.

13.1 Length Selection Matrix

PSC LOAD-IT MAGHEAD — LENGTH SELECTION REFERENCE (PART 1 OF 2)

MODEL	LENGTH	TYPICAL TASK	STANDOFF	ADVANTAGES	LIMITATIONS
MG001	1 ft	Close-quarters guidance; high-repetition tasks	Minimal	Maximum control and precision; lightest in hand	Limited standoff; not suited to swing-prone loads
MG002	2 ft	Bench and floor-level component positioning	Short	Good balance of control and reach	Reduced clearance from larger suspended loads
MG003	3 ft	General plate and beam guidance	Moderate	Versatile across most routine tasks	May require closer approach for very large loads

Continued on the following page: lengths suited to extended-reach and variable-distance tasks, including the fibreglass telescopic model.

PSC LOAD-IT MAGHEAD — LENGTH SELECTION REFERENCE (PART 2 OF 2)

MODEL	LENGTH	TYPICAL TASK	STANDOFF	ADVANTAGES	LIMITATIONS
MG004	4 ft	Structural alignment; fabrication yard tasks	Moderate–extended	Increased standoff for larger steel sections	Slightly reduced fine-control sensitivity
MG006	6 ft	Crane-assisted positioning; larger assemblies	Extended	Significant standoff from swing and pinch zones	Greater handling weight at extended reach
MG008	8 ft	Large module or beam positioning; offshore lifts	Maximum (fixed)	Maximum standoff for high-mass, high-swing loads	Reduced manoeuvrability in confined spaces
MAG-FG-008	4–8 ft, fibreglass telescopic	Variable-distance tasks; mixed-environment crews	Adjustable	One pole covers a range of standoff requirements; fibreglass keeps weight manageable at full extension	Extension/locking collars require inspection before use

13.2 How to Use This Table

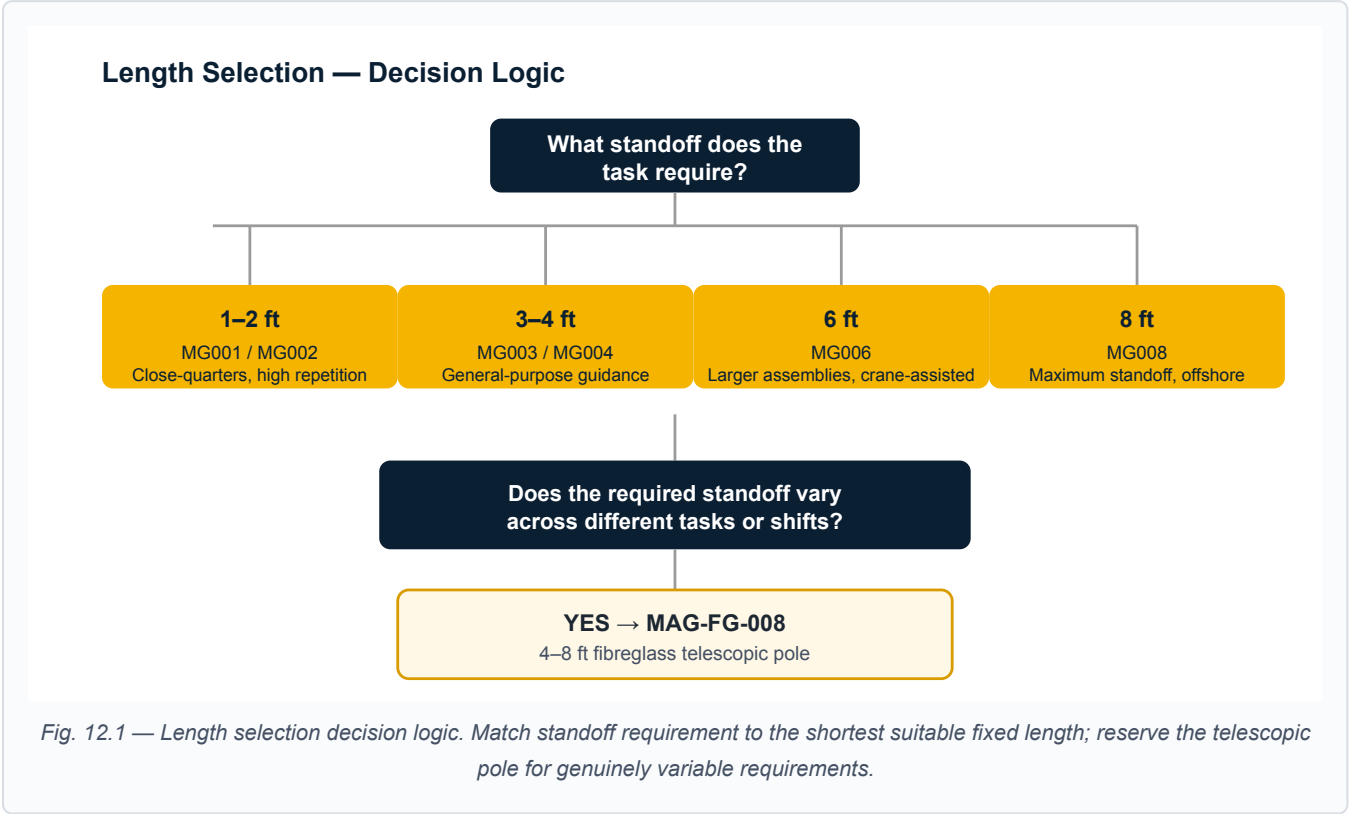
Start from the task, not the tool. Identify the typical standoff distance the work requires, and select the shortest length that comfortably achieves that distance. A longer tool than necessary does not add safety margin once adequate standoff has been achieved; it primarily adds weight and reduces precision.

PRACTICAL GUIDANCE

Plants running mixed operations commonly standardise on a mid-length fixed tool (3–4 ft) for daily use, supplemented by an 8 ft fixed unit or the MAG-FG-008 fibreglass telescopic pole reserved for larger or higher-swing tasks.

13.3 Length Selection Decision Logic

The selection matrix translates into a straightforward decision path, starting from the standoff distance the task requires:



SELECTION PRINCIPLE

Choose the shortest fixed length that comfortably achieves the required standoff. Reserve the telescopic pole for crews whose standoff requirement genuinely varies across tasks or shifts, rather than as a default first purchase.

13.4 Tool Weight and Handling Considerations

As length increases, so does the leverage required to hold the tool steady at full extension, even though the tool's absolute weight increase is modest. Operators working at the upper end of the length range (6–8 ft), or extending the MAG-FG-008 fibreglass pole to its full reach, should be trained to brace the handle against the body or a fixed point where practical, rather than holding it purely at arm's length, to maintain control and reduce fatigue over a shift.

13.5 Why Fibreglass for the Telescopic Pole

The MAG-FG-008 uses a fibreglass telescopic pole rather than a metal shaft. Fibreglass keeps the pole's own weight low relative to its length — an important property for a tool that may be extended to a full 8 ft reach — while remaining rigid enough to transmit controlled push and pull force without excessive flex. Fibreglass is also electrically non-conductive, which is a relevant secondary consideration in some industrial environments where a metal extension pole would be undesirable near live electrical equipment.

13.6 Fixed Length vs Telescopic Pole

Beyond raw length, the second major design choice is between a fixed-length tool and the telescopic fibreglass pole. Each addresses a different operational need, and the choice has practical consequences for control, weight, and flexibility.

Advantages of Fixed-Length Tools

- **Structural rigidity.** A fixed shaft has no moving extension joints, which means no flex and no mechanical play under load.
- **Predictable handling.** The operator always knows the exact reach and balance point of the tool, supporting muscle memory for repetitive tasks.
- **Lower weight for a given length.** Without a telescopic locking mechanism, a fixed tool is generally lighter than an extendable tool of the same maximum length.
- **Fewer inspection points.** No extension mechanism means a simpler pre-use inspection routine.

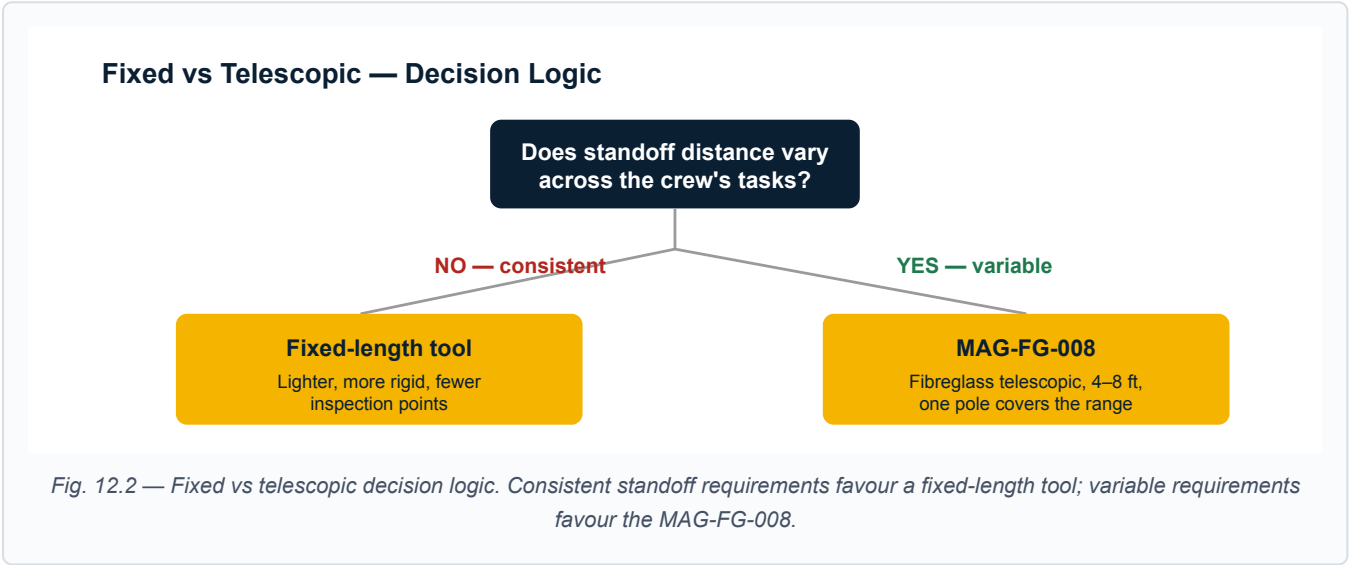
Advantages of the Fibreglass Telescopic Pole

- **Single-tool flexibility.** One pole covers a range of standoff distances, reducing the number of tools a crew needs to carry between tasks.
- **Adaptability to changing site conditions.** Useful where access distance varies from lift to lift — common on construction sites and in maintenance environments with varied equipment layouts.
- **Reduced tool inventory.** Smaller crews or multi-site teams can standardise on a single extendable pole rather than carrying several fixed lengths.
- **Manageable weight at extension.** The fibreglass pole construction keeps handling weight reasonable even when extended toward its full 8 ft reach.

The MAG-FG-008: 4–8 ft Fibreglass Telescopic Pole

The MAG-FG-008 extends the PSC Load-It MagHead range into telescopic territory, providing an adjustable working length from 4 to 8 ft from a single fibreglass pole. This is particularly useful for crews who move between tasks with different standoff requirements over the course of a shift — positioning a smaller component at 4 ft of reach in the morning, then handling a larger module requiring 8 ft of standoff in the afternoon, without needing to switch tools.

The pole itself is built from fibreglass rather than metal, which keeps the tool's handling weight manageable at full extension and avoids the added weight a comparable metal telescopic shaft would carry at that length. The extendable design uses a 60 mm, 275 lb-rated magnetic head, rather than the 75 mm, 550 lb head used on PSC's standard fixed-length tools, exactly as discussed in Chapter 12.



13.7 When a Plant Should Own Both

Operations with a narrow, well-defined range of tasks — a fabrication line with a consistent product size, for example — are typically well served by a small set of fixed-length tools matched to their specific standoff requirements. Operations with more variable work, such as maintenance teams servicing multiple equipment types, construction sites with changing lift geometries, or multi-discipline crews, often benefit from owning both: fixed-length tools for routine, repeatable tasks, and the fibreglass telescopic pole held in reserve for non-standard situations.

FIXED VS TELESCOPIC — SELECTION SUMMARY

CONSIDERATION	FIXED-LENGTH TOOL	MAG-FG-008 FIBREGLASS TELESCOPIC POLE
Magnetic head rating	75 mm head, up to 550 lb	60 mm head, 275 lb
Pole construction	Rigid fixed shaft	Telescopic fibreglass pole
Best for	Repeatable, well-defined standoff tasks	Variable standoff, mixed-task environments
Inspection requirement	Standard pre-use check	Standard check plus extension/locking collar check

14 Industry Case Studies

The following application examples illustrate how the principles in this guide apply to specific, realistic tasks. They are intended as representative scenarios rather than documented client case histories.

APPLICATION 01

Guiding a Steel Plate into Storage Rack

Context: A cut steel plate is being lowered by overhead crane into a vertical slot storage rack, with a tendency to drift slightly as it descends — requiring fine lateral correction precisely in the zone where a hand would otherwise be placed between the plate and the rack structure.

Tool selection: MG002 or MG003 (2–3 ft), 90° Flex Head, given the consistent, repeatable approach angle of plates entering the same rack position.

APPLICATION 02

Positioning a Lifting Beam

Context: Before a primary lift, a spreader or lifting beam must itself be positioned and aligned with rigging attachment points — often requiring small rotational adjustments while suspended.

Tool selection: MG003 or MG004 (3–4 ft), 180° Swivel Head, allowing the operator to walk around the beam as its orientation changes during alignment.

APPLICATION 03

Controlling Motor Installation

Context: A motor is being lowered onto mounting studs. The final centimetres of placement require precise control to avoid pinching fingers between the motor housing and the mounting frame.

Tool selection: MG001 or MG002 (1–2 ft) for maximum precision at close range, 90° Flex Head given the single, predictable approach direction.

APPLICATION 04

Guiding a Structural Assembly

Context: A fabricated steel frame is suspended for fit-up against an existing structure, requiring alignment of multiple mating faces while the assembly hangs in position.

Tool selection: MG004 or MG006 (4–6 ft), 180° Swivel Head, to accommodate operator movement around the multi-point assembly.

APPLICATION 05

Offshore Module Positioning

Context: An equipment module is being landed onto deck-mounted supports in constrained space, with limited room for crew to manoeuvre around the suspended load.

Tool selection: MG006 (6 ft) for extended standoff in confined deck space, with corrosion-aware inspection of the magnetic face given the marine environment.

APPLICATION 06

Wind Turbine Gearbox Assembly

Context: Internal drivetrain components must be positioned within the confined interior of a nacelle or tower section, with awkward access angles around adjacent components.

Tool selection: MG003 (3 ft), 180° Swivel Head, suited to the variable, awkward-angle access typical of confined internal assembly work.

15 Best Practice

A magnetic push-pull tool delivers its intended safety benefit only when it is selected correctly and used consistently as part of a planned approach to load positioning. The following practices apply across all applications described in this guide.

Verify Magnetic Attachment Before Applying Force

Before committing full guidance force, apply a light test pull to confirm the magnetic head is properly seated against the steel surface. This is particularly important on coated, painted, rusted, or mill-scaled surfaces.

Match Tool Length to the Task

Refer to the selection matrix in Chapter 13 and choose the shortest tool that comfortably achieves the required standoff distance for the specific task. Avoid defaulting to the longest available tool out of habit.

Maintain Exclusion Zones

Even when using a guidance tool, operators and bystanders should maintain awareness of the load's potential swing radius and maintain appropriate exclusion zones around the suspended load, consistent with standard lifting safety practice.

Keep Outside the Swing Path

The standoff distance provided by the tool is only effective if the operator's body position is also outside the load's swing path. A long tool used while standing directly in the swing arc does not fully address the hazard.

Use With Taglines Where Appropriate

Magnetic push-pull tools complement, rather than replace, taglines and other established rigging controls. Many tasks benefit from a combination: a tagline providing general directional control, with the magnetic tool providing fine, final-stage positioning.

Inspect Before Use

Check the magnetic face for damage, debris, or contamination; check the handle and any articulating joints for wear or play; and, for the fiberglass telescopic pole, check the extension and locking collar for secure engagement before each use.

QUICK REFERENCE

Verify attachment · Match length to task · Maintain exclusion zones · Stay outside the swing path · Use with taglines where appropriate · Inspect before use.

16 Frequently Asked Questions

Q. Can a magnetic push-pull tool lift a load?

No. The tool is a guidance and positioning interface, not a lifting device. The crane or hoist supports the full weight of the load at all times.

Q. Can it replace a tagline?

No. A tagline provides general directional control of a suspended load from a distance. The magnetic tool is generally used for finer, final-stage positioning and complements taglines rather than replacing them.

Q. Can it work on painted steel?

Yes, but attachment quality will be reduced compared with clean, bare steel, because the paint layer creates a gap between the magnet and the base metal. Always verify attachment with a light test pull before applying full force.

Q. Can it work on curved surfaces?

Yes, particularly with the 180° Swivel Head, which allows the magnetic face to rotate and align with curved or irregular surface geometry.

Q. Which length should I choose?

Match the tool length to the standoff distance the task requires. Refer to the selection matrix in Chapter 13; choose the shortest tool that comfortably achieves adequate distance from the load's pinch, crush, or swing zone.

Q. Should I choose the 180° Swivel Head or the 90° Flex Head?

Choose the 180° Swivel Head when your body position relative to the load is expected to change during the task. Choose the 90° Flex Head when the approach angle is consistent and repeatable, such as with structural beam work.

Q. Does 550 lb mean I need 550 lb of force to remove the tool?

No, not during normal guidance use. The published pull force represents ideal perpendicular pull conditions on a clean, flat steel surface. During practical guidance work, the operator applies lateral force, and the tool is designed to allow intentional disengagement when repositioning is required.

Q. Why does a suspended load drift even when the crane isn't moving?

Because the load behaves as a pendulum and is subject to centre-of-gravity offset and rotational inertia, as explained in Chapter 2. Small lateral disturbances introduced during the lift continue to express themselves as swing, settling angle, and rotation even once the crane itself is stationary.

Q. If hand contact is risky, why do experienced workers still do it?

Because the hand offers immediate feedback, infinitely variable grip, and no setup time — advantages no other tool fully replicates, as discussed in Chapter 2. An effective guidance tool has to compete with those advantages, not simply prohibit hand contact.

Q. What is "Continuous Magnetic Engagement"?

It is PSC's term for the 180° Swivel Head's defining capability: maintaining magnetic attachment to the load while the operator changes body position, walking direction, or push/pull angle. See Chapter 8 for the full engineering explanation.

Q. Is a higher magnetic force rating always better?

No. Magnetic strength must be matched to the tool's leverage and intended use, not maximised in isolation. See Chapter 12 for the full reasoning behind PSC's 75 mm, 550 lb and 60 mm, 275 lb head ratings.

Q. How do I decide between the 180° Swivel Head and 90° Flex Head without guessing?

Use the decision logic in Chapter 11: the primary question is whether the operator's position relative to the load changes during the task. If yes, the 180° Swivel Head is favoured. If no, and the approach geometry is consistent, the 90° Flex Head is favoured.

Q. Why is magnetic force quoted in pounds, and why does it vary by model?

Pull force in pounds is the standard international method for comparing the holding strength of permanent magnets. PSC's fixed-length tools use a 75 mm, 550 lb-rated head, while the 4–8 ft fibreglass telescopic MAG-FG-008 uses a 60 mm, 275 lb-rated head, reflecting the different leverage and handling characteristics of a telescopic pole.

Q. Why does the tool detach if I push it beyond a certain angle on the 90° Flex Head?

This is a deliberate design feature, not a defect. The working envelope of the 90° Flex Head is engineered to maintain predictable, controlled engagement within a defined range of motion; moving beyond that range is designed to release the magnetic interface rather than risk an uncontrolled force application.

Q. Can it replace certified lifting magnets?

No. Certified lifting magnets are engineered and rated specifically to support and suspend load weight. A magnetic push-pull tool is engineered for guidance and positioning, and is never intended to support or suspend a load.

Q. Will surface rust significantly affect performance?

Yes. Rust reduces both magnetic coupling and frictional contact at the surface, lowering the lateral force the tool can resist before sliding. Inspect the contact surface and adjust technique and expectations accordingly.

Q. Does the tool require maintenance?

Routine maintenance is minimal: keep the magnetic face clean and free of debris, check the handle and joints for wear, and for the fibreglass telescopic model, periodically check the extension and locking collar for secure engagement.

Q. Can one operator use the tool while another manages a tagline?

Yes. Because the tool is typically operated with one hand, it integrates well into a coordinated team approach where one operator manages fine positioning with the magnetic tool while another manages a tagline or signals the crane.

Q. Is training required before using the tool?

Basic familiarisation is recommended — understanding the difference between pull force and shear resistance, correct attachment verification, and the tool's intended scope of use.

17 Conclusion

The positioning phase of a lift is not an afterthought to the lifting operation. It is, in practical terms, where most of the hand and finger exposure in load handling actually occurs — not while the load is rising or being transported, but in the final moments when it must be guided, steadied, rotated, aligned, or seated into place.

Magnetic push-pull tools address this phase directly, by giving the operator a way to apply the same controlled push, pull, and steadying force a hand would otherwise apply — without the hand itself entering the pinch, crush, swing, or line-of-fire zone around the load.

“ **The purpose of a magnetic push-pull tool is not to move the load. It is to move the worker away from the load.** ”

It is worth being precise about where the real benefit of this tool category lies. It is tempting to describe these tools primarily in terms of the control they offer — the ability to nudge, rotate, or steady a steel load with precision. That control is real, but it is not the primary safety benefit.

The greatest benefit is often not control. It is distance.

Selecting the correct tool length, the appropriate head configuration, and understanding the realistic force characteristics of the magnetic interface are all part of applying this principle correctly. A tool matched poorly to its task can fail to deliver adequate standoff; a tool understood and applied correctly removes the hand from the hazard entirely, while still allowing the precise positioning work that steel handling requires.

This is the underlying logic that connects every section of this guide, from the engineering behind head geometry to the selection tables for tool length: identify where the hand would otherwise need to go, and engineer a way for the work to be done without it going there.

ENGINEERING NOTE

The engineering principles discussed in this handbook are intended to assist in the selection and application of magnetic push-pull guidance tools during suspended load positioning. Actual performance depends on numerous variables including load geometry, steel composition, surface condition, coatings, magnet size, attachment area, operator technique, environmental conditions, and lifting configuration.

The crane, hoist, and approved rigging remain solely responsible for supporting the suspended load at all times. The magnetic push-pull tool is intended only as a guidance interface and must not be used as a lifting attachment or load-bearing device.

Before deploying any magnetic push-pull tool on site, confirm current product specifications, magnetic ratings, and inspection requirements directly with PSC, and ensure tool selection has been matched to the specific task, surface condition, and lifting configuration described throughout this handbook.

About This Handbook

This engineering handbook was developed to give lifting engineers, riggers, lifting supervisors, maintenance teams, steel fabricators, offshore personnel, HSE professionals, and procurement teams a complete technical reference for understanding suspended load behaviour and applying magnetic push-pull guidance tools as an engineering control for hand exposure during steel load positioning.

Hand Safety First studies the exposure.
PSC Hand Safety engineers the control.

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This document is an engineering reference handbook and does not constitute a substitute for site-specific risk assessment, manufacturer operating instructions, or applicable lifting and rigging standards. Tool selection should be confirmed against current product specifications prior to procurement.