



Jingtao Energy Power Catwalk Technical White Paper

1. Executive Summary

Jingtao Energy presents the Next-Generation Intelligent Power Catwalk System, a revolutionary solution designed to address the high labor intensity, significant safety risks, and low efficiency inherent in traditional drill pipe handling operations. By integrating our proprietary "Dual Inner-Expansion & Outer-Clamping Fixation Technology" with a "Fully Electric Intelligent Drive Architecture," this system completely eliminates the need for traditional manual hooking and pulling.

Built upon over a decade of R&D expertise and multiple national patents, the Jingtao Energy Power Catwalk has been successfully deployed in numerous ultra-deep well projects for CNPC and Sinopec. Notably, it supported Team 90008 in setting the Asian land record for the deepest well (8,882 meters). The system achieves fully automatic, high-precision, and zero-accident transfer of drill pipes, casings, and drill collars between the ground rack and the drill floor, propelling oilfield drilling operations into a new era of "unmanned, intelligent, and green" practices.

2. Industry Background & Challenges

2.1 Bottlenecks of Traditional Operations

In conventional oil drilling, the transfer of drill strings (drill pipes, casings, etc.) between the wellhead and the ground rack has long relied on a semi-mechanized "manual + pneumatic winch" model:

- High Risk: Workers must perform hooking, unhooking, and pushing operations in close proximity to heavy moving loads,



leading to frequent incidents of struck-by injuries and crushing accidents.

- **High Labor Intensity:** With single joints weighing several tons, manual assistance is physically demanding and severely affected by adverse weather conditions.
- **Low Efficiency:** The process is cumbersome, requiring 3-5 personnel to coordinate. Long cycle times for each operation constrain overall drilling efficiency.
- **High Pipe Damage Rate:** Rough dragging and collision often damage pipe threads (connections), shortening pipe life and increasing maintenance costs.

2.2 The Urgent Need for Intelligent Transformation

As exploration moves deeper into ultra-deep wells and shale gas formations, drilling conditions have become increasingly complex. The industry demands higher levels of equipment safety, reliability, and automation. Building an "intrinsically safe" drilling site and achieving full automation in pipe handling has become a critical step for improving quality and efficiency in oil and gas exploration.

3. Product Overview

The Jingtao Energy Power Catwalk is a comprehensive conveying system integrating mechanical transmission, hydraulic control, electrical automation, and intelligent sensing. The system primarily consists of a catwalk base, adjustable ramp, pipe conveying unit, intelligent transport cart, and a PLC central control system.

Its core function is the automatic gripping, lifting, conveying, positioning, and reverse removal of drill strings from the ground rack to the drill floor. Through modular design and adaptive control algorithms, the Jingtao Energy Power Catwalk accommodates various pipe specifications (diameter, length, weight) and adapts to diverse operational scenarios, including land rigs.

4. Core Technology Principles



4.1 Proprietary "Dual Inner-Expansion & Outer-Clamping" Anti-Drop Fixation

Addressing the industry-wide challenge of pipes slipping off support plates during downward conveyance, Jingtao Energy employs a patent-level dual fixation mechanism:

Inner Expansion Fixation:

- The transport cart features an intelligent expansion component. An electric cylinder drives an expansion shaft into the drill pipe's inner bore.
- A mechanical spreading structure (expansion rods) applies radial pressure against the pipe's inner wall, creating a secure "internal lock."
- Thread Protection Design: A built-in telescopic airbag inflates automatically before expansion, wrapping and isolating the internal threads to prevent metal-to-metal contact and damage.

Outer Clamping & Limiting:

- Equipped with a V-groove frame and pneumatic/hydraulic clamping blocks to hold the pipe externally.
- Through-Hole Physical Limiting: The pipe end is precisely guided into a through-hole on the push plate, forming a rigid stop that completely eliminates the risk of slippage during descent.

4.2 Intelligent Adaptive Support System

- Pneumatic Sensing Support: The V-groove frame integrates high-sensitivity support airbags and pressure gauges.
- Real-Time Dynamic Adjustment: The system monitors pipe weight changes in real-time. If a pipe is detected lifting off or shifting, the system automatically inflates the support airbag to raise the support plate, ensuring the pipe remains horizontally stable throughout the process and preventing bending deformation.



4.3 Fully Electric Drive & Precision Control

- **Multi-Motor Synergy:** Independent servo motors drive the walking wheels, chain transport cart, shielding plates, and clamping mechanisms. Replacing traditional hydraulic drives improves response speed by 40% and achieves millimeter-level control precision.
- **Stepless Speed Regulation:** The system automatically adjusts running speed based on pipe weight and slope, enabling soft starts and stops to minimize mechanical shock.

5. System Architecture & Functional Modules

Module Name	Key Components	Function Description
Base Support Unit	Catwalk Base, Hinged Ramp	Provides stable support. The ramp angle is adjustable (typically 55°) and can be folded for compact transport when not in use.
Core Conveying Unit	V-Groove Frame, Transport Cart	Carries the drill string. Uses chain transmission for reciprocating motion along the ramp; integrates the inner-expansion/outer-clamping mechanism.
Auto Loading/Unloading Unit	Flipper Mechanism, Pusher	Automatically flips pipes from the rack into the V-groove or pushes them back, minimizing manual intervention.
Safety Protection Unit	Stop Bar, Shielding Plate	Prevents pipes from rolling sideways; the shielding plate



Module Name	Key Components	Function Description
		closes the limiting hole during non-operation to prevent debris entry.
Intelligent Control Unit	PLC Cabinet, Wireless Remote	Integrates logic interlocks, fault self-diagnosis, and status monitoring. Supports Fully Automatic, Semi-Automatic, and Manual modes.

6. Key Advantages & Specifications

6.1 Core Advantages

- **Intrinsic Safety:** Completely eliminates manual hooking, keeping personnel away from danger zones and achieving "human-machine separation."
- **High Efficiency:** Reduces the single-joint conveyance cycle to under 45 seconds, improving efficiency by over 50% compared to traditional methods.
- **Pipe Life Extension:** Unique thread protection and flexible support technologies reduce thread damage rates by 95%.
- **Wide Adaptability:** Compatible with drill pipes, casings, and drill collars ranging from $\Phi 60\text{mm}$ to $\Phi 508\text{mm}$.
- **Energy Saving & Eco-Friendly:** Fully electric drive saves 30% energy compared to hydraulic systems and eliminates the risk of hydraulic oil leaks.

6.2 Typical Technical Specifications

Note: Specific parameters can be customized based on rig models.

- **Max Conveying Load:** ≤ 80 Tons (single joint)
- **Applicable Pipe Length:** 6m - 13.5m



- Ramp Adjustment Angle: 30° - 60° (Adaptive to drill floor height)
- Operating Speed: 0 - 0.5 m/s (Stepless adjustment)
- Control Mode: PLC Auto / Wireless Remote / Driller Console Linkage
- Protection Rating: IP65 (Suitable for sand, rain, snow, and high-temperature environments)
- Mean Time Between Failures (MTBF): $\geq 5,000$ Hours

7. Applications & Case Studies

7.1 Primary Application Scenarios

- Deep & Ultra-Deep Well Drilling: Handles high-load, high-frequency operational demands.
- Shale Gas Horizontal Wells: Meets the fast-paced requirements of large-scale factory-style operations.
- Harsh Environment Operations: Suitable for extreme cold, high heat, and high-altitude conditions.
- Well Workovers & Retrofits: Replaces old, simple catwalks to enhance safety.

7.2 Benchmark Case: Western Drilling Ultra-Deep Well Projects

Jingtao Energy Power Catwalks have deeply served CNPC Western Drilling Company, equipping over 20 top-tier drilling teams.

- Asia's Deepest Well (8,882m): Supporting Team 90008, which set the Asian land record, the Jingtao Energy large-scale automated catwalk operated stably throughout the project. It withstood the rigorous tests of ultra-deep well high-intensity operations with zero equipment failures, earning high praise from the crew.
- Key Team Coverage: Deployed in nearly 10 ultra-deep well projects including Teams 80026 and 80005, significantly reducing worker labor intensity and improving overall drilling efficiency.

8. Frequently Asked Questions (FAQ)



Q1: Is the Jingtao Energy Power Catwalk compatible with rigs from different manufacturers?

A: Yes. Our system features a modular design and an adjustable ramp structure with customizable interfaces. It seamlessly adapts to major domestic and international land rigs and some offshore platforms without requiring major modifications to the existing rig structure.

Q2: Is the installation and mobilization of the system complex?

A: No. Designed for rapid deployment, the base and ramp utilize a hinged plus slide-groove storage design, allowing them to be folded compactly for transport. On-site assembly mainly involves bolted connections, typically completed within 24 hours, greatly reducing mobilization time.

Q3: How does the system handle special dimensions or irregular pipes (e.g., large-diameter casings)?

A: The system boasts powerful adaptability. By changing V-groove liners of different specifications and adjusting the expansion component parameters, it covers a wide range from $\Phi 60\text{mm}$ small-diameter drill pipes to $\Phi 508\text{mm}$ large-diameter casings. For special non-standard pipes, we provide exclusive custom tooling services.

Q4: How are after-sales service and technical support provided?

A: Jingtao Energy adheres to a "Direct Factory Service" model. We do not use intermediate agents; our headquarters' professional technical team connects directly with clients. We provide 24/7 remote technical support, regular inspection and maintenance, operator training, and emergency on-site repair services to ensure efficient operation throughout the equipment's lifecycle.

Q5: What specific safety interlock mechanisms are included in the system?

A: The system contains multiple safety logics: overload protection, anti-derailment detection, emergency stop interlocks, personnel intrusion light curtain alarms, and action sequence interlocks (e.g.,



lifting is impossible unless clamped). Any anomaly triggers an immediate shutdown and alarm to ensure absolute safety.

9. Contact Us

Start a New Chapter in Drilling Automation with Jingtao Energy. If you wish to obtain a detailed technical proposal, receive customized selection advice, or schedule a live demonstration, please contact the Jingtao Energy Headquarter Expert Team directly. We are committed to being more than just an equipment vendor; we aim to be your technical partner for the entire lifecycle.

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