

**Continuous Improvement**  
**Retrofitting Cable Reel Drums with IGUS**  
**Chain Flex System for GTSU-01**



**Prepared by:**

**Sunardi**

**Electrical Manager**

**PT Cirebon Power Services**  
**PLTU #1 Cirebon**

## **PREFACE**

This technical paper is presented to address persistent operational challenges within the coal handling system of Cirebon Power Unit #1. It outlines a comprehensive analysis and proposes a strategic upgrade to a critical component: the power supply system for mobile equipment.

The reliable operation of a coal-fired power plant is intrinsically linked to the uninterrupted flow of fuel. The coal handling system, therefore, forms the backbone of plant availability. A recurring point of failure in this system has been the Cable Reel Drum (CRD), which provides power to essential mobile equipment like the Ship Unloader and Stacker Reclaimer. Historical data indicates that chronic CRD failures—including cable slack, over-tension, and short circuits—have directly caused significant operational downtime and, in severe instances, forced plant de-rating.

This document provides a detailed justification for retrofitting the existing CRD systems with the IGUS Chain Flex solution. The proposal is based on a thorough evaluation of historical performance data, a comparative technical and economic analysis, and the demonstrated success of a pilot installation on the Tripper Cars. The recommended solution promises enhanced reliability, reduced maintenance, and greater operational efficiency.

The author wishes to acknowledge the valuable contributions and support of the Cirebon Power Unit #1 maintenance team. Special thanks are also extended to the Plant Management, Directors, and Owners for their endorsement of this initiative. We trust this study will serve as a useful reference for improving operational reliability, not only at our facility but across the industry.

Cirebon, October 2025

## **ABSTRAK**

Cable Reel Drums (CRDs) are a traditional method for supplying power and control to mobile equipment like Ship Unloaders (GTSUs) and Stacker Reclaimers. However, in the harsh environment of a coal handling system, CRDs are prone to frequent failures, leading to operational downtime, high maintenance costs, and safety risks. This paper presents a case study on the retrofit of CRDs with an IGUS Energy Chain System (Chain Flex) at a power plant. We analyze the historical failure data of the existing CRDs, demonstrating chronic issues such as cable twisting, slack, and short circuits. A comparative analysis between the conventional CRD system and the proposed IGUS system is conducted, evaluating factors such as mechanical complexity, maintenance requirements, and cost. The successful implementation of the IGUS system on Tripper Cars, which resulted in zero reported issues since 2020, serves as a pilot validation. The study concludes that retrofitting with an IGUS Chain Flex system is a technically superior and economically viable solution, offering enhanced reliability, reduced maintenance, and a lower total cost of ownership for mobile equipment in industrial settings.

## TABLE OF CONTENTS

PREFACE.....	2
ABSTRAK.....	3
TABLE OF CONTENTS .....	4
LIST OF ABBREVIATION.....	5
CHAPTER I: INTRODUCTION.....	6
CHAPTER II: PROBLEM ANALYSIS .....	7
A. Historical Failures of Cable Reel Drums .....	7
B. Chronic Failures.....	8
C. Critical Incidents.....	8
CHAPTER III: PROPOSE SOLUTION .....	10
A. Retrofitting into IGUS Chain Flex System .....	10
B. Pilot Project Validation .....	10
C. Technical Comparison .....	10
D. Economic Analysis .....	11
E. The advantages using IGUS chain flex system are; .....	11
.....	12
CHAPTER IV: IMPLEMENTATION PLAN .....	13
A. An implementation plan is proposed to manage risk and capital expenditure: .....	13
B. Timeline Schedule Retrofitting for GTSU-01:.....	13
C. Project Budget for GTSU-01 (MOH 2024): .....	13
CHAPTER V: CONCLUSION & RECOMMENDATION .....	14
A. Conclusion.....	14
B. Recommendation.....	14
CHAPTER VI: REFERENCE .....	15

## LIST OF ABBREVIATION

**CRD** : Cable Reel Drum

**GTSU** : Grab Type Ship-Unloader

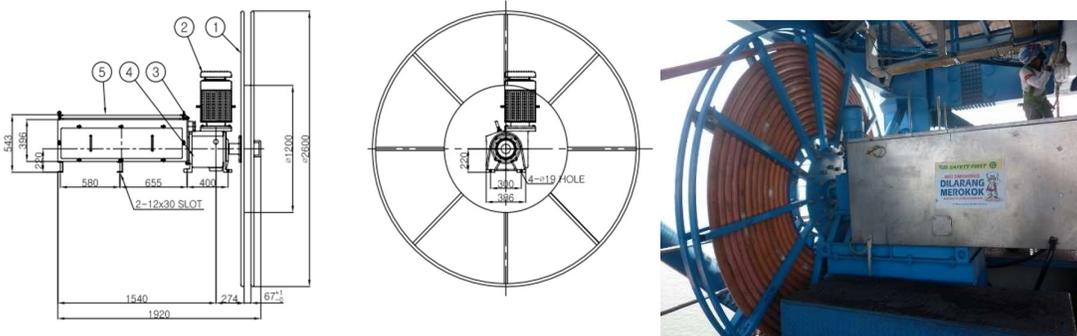
**CPS** : Cirebon Power Services

## CHAPTER I: INTRODUCTION

Mobile equipment in bulk material handling, such as Ship Unloaders (GTSUs) and Stacker Reclaimers, require a reliable system for transmitting electrical power and control signals. The conventional solution has been the Cable Reel Drum (CRD), a motorized system that winds and unwinds cables. While functional, CRDs are complex mechanical assemblies comprising motors, gearboxes, slip rings, and braking systems. This complexity, combined with exposure to harsh industrial environments, makes them a frequent point of failure.

This paper documents a persistent operational challenge with CRDs at a coal-fired power plant and proposes a systematic retrofit to an IGUS Energy Chain System (Chain Flex). The primary objectives of this study are:

1. To quantify the historical failure rates and associated costs of the existing CRD systems.
2. To present a technical and economic comparison between the CRD and IGUS Chain Flex systems.
3. To propose a phased implementation plan based on a successful pilot project and provide a detailed budget and timeline for the first unit.



### Components;

1. Drum
2. Motor
3. Cable Gland
4. Reducer Box
5. Slip Ring Box

1. Cable: 2.5sq\*50c + 4sq\*16c + 6sq\*4c – R  
Size Ø56.5 Weight: 4.7 Kg/m
2. Winding Length: 60m (120m of center supply)
3. Winding Speed: 15m/min (Max)
4. Power source: 380 VAC 50Hz 3 Phase
5. Winding Torque :29Kg-m

Figure 1, Overview of CRD System

## CHAPTER II: PROBLEM ANALYSIS

### A. Historical Failures of Cable Reel Drums

An analysis of historical work orders reveals a pattern of chronic and critical failures associated with the CRDs.

#### ❖ Ship unloader (GTSU)

No	Work Order No.	Problem
1	WK130507.0059	GTSU02: Check and Rectify CRD Fault When Travel to Centre Point
2	WK140823.0004	Rectify Cable CRD Fault When Pass the Middle Point
3	WK150818.0005	GTSU02: Rectify CRD Cable Due To Loose And Limit Switch Not active
4	WK170408.0018	GTSU 01: Rectify CRD Due Fault Active When Position On Middle
5	WK190512.0011	GTSU02: Rectify CRD due to can't roll-up
6	WK190926.0008	Please Check CRD Fault On Middle Position at GTSU 02
7	WK130720.0004	GTSU01: Rectify CRD Over Temperature
8	WK180514.0315	GTSU 02: Need Rectify CRD Often Fault When Gantry Increasing Speed
9	WK200415.0013	GTSU 02: Please Install Cover for Power Motor CRD due to loose
10	WK210419.6599 2	GTSU 02: CRD Often Slack
11	WK211221.1835 1	GTSU 01: CB Motor CRD broken
12	WK221212.3407 8	GTSU 02: CRD Often Fault Active

### ❖ Stacker Reclaimer

	Work Order No.	Problem
	WK151111.0007	ST/RE Need check and rectify CRD cable reel due to Trip Out
	WK190518.0002	STARE: Please check and rectify Cable CRD fault
	WK200307.0001	SR : Please check and rectify due to CRD often fault active
	WK201003.0007	SR : Need check and repair due to hose reel rotation not sync with CRD, and often fault
	WK220705.256895	SR: CRD Cable out of position reeling drum and fault active

### B. Chronic Failures

Over a ten-year period, the GTSUs experienced numerous faults, including:

- Frequent tripping due to slack cables, loose connections, and limit switch malfunctions.
- Mechanical failures such as motor breakdowns and an overheated system.
- Inability to roll up the cable, causing operational stoppages.

### C. Critical Incidents

Beyond chronic issues, two major failures highlight the system's risk:

- **October 2017:** A short circuit in the Stacker Reclaimer's CRD cable caused 11kV voltage to interfere with control circuits, destroying PLC cards. This resulted in a complete halt of coal delivery and subsequent plant de-rating.
- **July 2022:** A CRD cable on a Stacker Reclaimer became slack, derailed from the drum, and broke, causing significant damage and downtime.

These incidents underscore that CRD failures are not merely maintenance nuisances but pose a substantial risk to **plant availability and safety**.

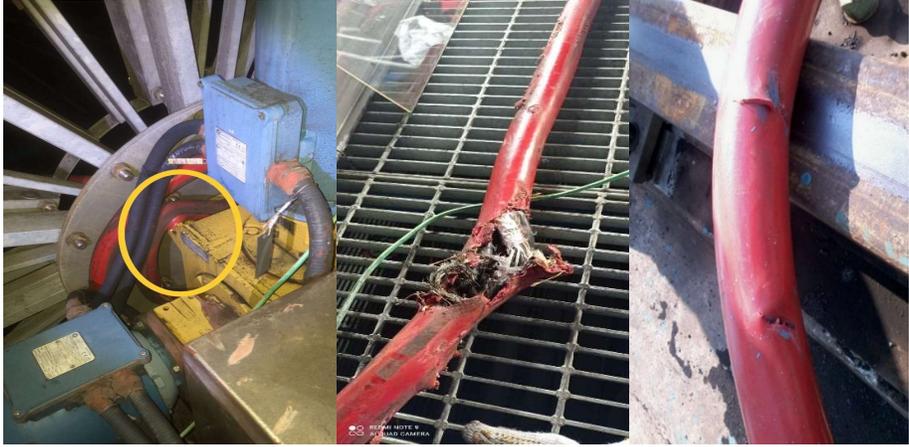


Figure 2, Problem of CRD

## CHAPTER III: PROPOSE SOLUTION

### A. Retrofitting into IGUS Chain Flex System

The proposed countermeasure is the complete retrofit of the CRD system with an IGUS Chain Flex system. This system uses a flexible, guided e-chain to carry and protect cables during linear movement, eliminating the need for a rotating drum.

### B. Pilot Project Validation

The solution was first implemented on **Tripper Cars BC-08A (2020)** and **BC-08B (2022)**. Since their installation, these systems have operated without any reported failures, demonstrating "less maintenance, and trouble-free" performance. This successful pilot provides empirical validation for the proposed retrofit on larger equipment.

### C. Technical Comparison

A systematic comparison highlights the advantages of the IGUS system:

Component/Requirement	IGUS® Chain	Conventional CRD	Advantage of IGUS
Motor	No required	Required	Simplicity, No Power Needed
Gearbox	No required	Required	Less Maintenance
Slip Ring Contact	No required	Required	Eliminates a Common Failure Point
Braking system	No Required	Required	Increased Simplicity & Reliability
Control system	No required	Required	Reduced Complexity
IGUS e-Chain	Required	No required	No need electrical power, follow the Machine

#### D. Economic Analysis

A detailed cost comparison for retrofitting a single GTSU unit reveals significant economic benefits.

No	Component	IGUS® Chain Estimated Price	CRD (GTSU), Estimated Price	Spare Part Preparation
1	Motor & Drive	0	30,000	Yes
2	Gearbox	0	40,000	Yes
3	Slip Ring Contact	0	25,000	Yes
4	Braking system	0	15,000	Yes
5	Control Switch	0	20,000	Yes
6	Cable (power, control, FO)	29,453	50,000	Yes
7	IGUS e-Chain	35,326	0	No
8	IGUS Stainless steel Guide	30,833	0	No
<b>Total (USD)</b>		<b>95,612</b>	<b>180,000</b>	

The IGUS solution is approximately **47% cheaper** in initial material costs alone. Furthermore, it eliminates the need for stocking expensive spare parts for motors, gearboxes, and slip rings.

#### E. The advantages using IGUS chain flex system are;

- Chain flex system provide a continues and flexible link for the cables, allowing for smooth and controlled movement.
- They are generally more durable and requires less maintenance than cable reels
- Better suited for application with frequent and rapid movement.
- Longer lifespan, less consumable part, and easy maintenance

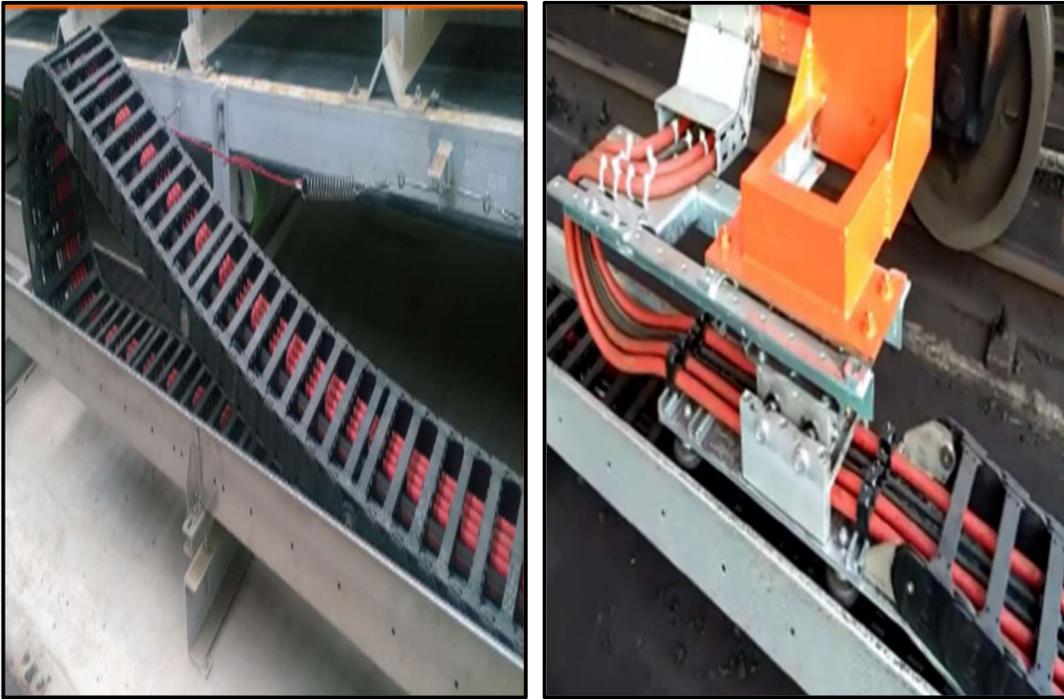


Figure 3, Propose of IGUS Chain Flex

## CHAPTER IV: IMPLEMENTATION PLAN

**A. An implementation plan is proposed to manage risk and capital expenditure:**

- **Phase 1:** GTSU-01 retrofit during the 2024 Major Overhaul (MOH).
- **Phase 2:** GTSU-02 retrofit during the 2026 MOH.
- **Phase 3:** Stacker Reclaimer retrofit during the 2028 MOH.

The schedule for GTSU-01 involves a 6-month timeline from Internal Resolution/Procurement Request approval through to project installation, targeting completion within the 2024 overhaul window.

**B. Timeline Schedule Retrofitting for GTSU-01:**

Process	2024					
	January	February	March	April	May	June
IR & PR Approval						
Issuing PO						
Materials Delivery						
Project Installation						

**C. Project Budget for GTSU-01 (MOH 2024):**

- Materials (IGUS e-Chain, Cable, Guide): \$95,612
- Installation Cost: \$26,280
- **Total Project Cost: \$121,892**
- This is within the allocated CAPEX budget of \$150,000.

## **CHAPTER V: CONCLUSION & RECOMMENDATION**

### **A. Conclusion**

The evidence from historical failure data, a successful pilot project, and a clear technical and economic analysis strongly supports the proposed retrofit. The Cable Reel Drum system has proven to be an unreliable component, leading to high maintenance costs and significant operational risk. The IGUS Chain Flex system offers a more robust, simpler, and less expensive alternative.

### **B. Recommendation**

It is recommended that management approve the next retrofit of CRD as outlined. The success of this project will pave the way for standardizing this technology across all mobile equipment in the coal handling system, leading to improved overall reliability, reduced maintenance workload, and enhanced plant availability.

## CHAPTER VI: REFERENCE

1. Internal Work Order Data, PT. Cirebon Power Services (2013-2022).
2. Internal Resolution: CPS-MNT-ELC-SD-X-17-01.
3. IGUS GmbH. (2023). *Energy Chain Systems® & Cables Catalog*.