Progress Report 2
PP-2308 Dry Dock Block Indicator System

28 Aug 2023
Rev A

Prepared for:

National Shipbuilding Research Program

Prepared by:

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Contents

Contents

1. Executive Summary

This is a Research and Development Panel Project accepted by the National Shipbuilding Research Program (NSRP). Panel Projects are project opportunities that are important to the shipbuilding and ship repair industry chosen by the NSRP Executive Control Board.

This document summarizes the activities since the start of the project to date. This document is a preliminary / rough draft of the final report, with portions or sections written as the engineering related to those section is performed. The intent is to continue to add, revise, and expand this report until the final report is completed. Changes in this document are marked with a line on the lefthand side of the page.

As of the date on this report, the main system components have been identified, purchased, and delivered. Currently, programming and bench testing of the system is being performed and expected to be completed within one month (finished by mid-September). Once completed, the system will be field tested during a dry docking, which may occur before the next progress report.

2. Introduction

Divers are often used when drydocking after vessel touchdown but before the main lifting sequence to confirm that all of the blocks are properly contacted. If the diver inspection indicates that the blocks are not properly contacted by the vessel being lifted, the dry dock operator has the chance to submerge and re-align the vessel or abandon the drydocking prior to lifting a vessel and possibility damaging the vessel or the dry dock.

Two challenges that occur when using divers in drydocking is reliability and visibility. Unfortunately, a large percentage of dry dock accidents are a result of issues with divers. Miscommunication, lack of knowledge, or confusion of the divers can give a dock master bad information when lifting a vessel. Furthermore, even a well-informed experienced diver can have issues when diving in locations with poor visibility. In some locations, visibility can be as low as six inches. This makes the reliability of divers worse and exposes diving personnel to risk of injury or loss of life. The proposed system could be a less expensive package for obtaining reliable information and reducing diver time.

An additional benefit of this system is to get real time data of the touch down and landing of vessel. With use of hauling blocks, this system gives the ability to see when the hauling blocks are contacting the lifted vessel. Due to safety concerns, divers are unable to be in the water near blocks while they are being hauled, and divers are only used after hauling to confirm contact between the lifted vessel and the hauling block.

This paper describes the use and increased safety during dry docking when using a block contact indicator system as described herein. This paper also briefly discusses the design, components, and installation of the system.

If successful, the project will lead to the widespread use of a dry dock block contract indicator system throughout the industry, providing dock masters with more feedback during docking and greatly increasing safety for the vessel being dry docked and the dry docks themselves.

3. Progress Report

Since award, DM Consulting has accomplished the following tasks / activities since the project award:

Accomplished to Date:

- Wrote project execution plan
- Further researched and refined the functional requirements of the system
- Advanced the design of the system
- Verified and ordered the major components
- Prepared project timesheet and invoice templates for the project
- Prepared this progress report
- Finished detailing the system including cables and ancillary items
- Procured and taken delivery of cables and ancillary items
- Started programming and bench testing

Planned Activities for Next Month

- Finish programming and bench testing
- Finish detailing the physical mount of the sensors
- Update this document

Major and Noteworthy Changes to Project

- None for this revision

The remainder of this document represents the current revision of the final deliverable that will be issued at the end of this panel project.

4. System Functionality & Design

The system will consist of three main components.

System Functionality

The goal of the system is to place sensors at specific or targeted dry dock blocks so that a dock master can have real-time verification that the vessel being lifted is in contact with the dry dock blocks. The system will be able to detect a vessel as it approaches the blocks within a few inches as well as detect the moment of touchdown and even post-contact crushing of the soft cap.

The information provided by the system is intended to allow the dock master to pause, investigate, and take corrective action if / when the blocks are not loaded as anticipated.

Contact detectors will be mounted to the specified blocks (varies per naval architect for each docking) prior to submerging the dock. Once the vessel is within the detectable range, the sensors will contact the vessel will start to actuate the sensors. A micro controller located in the dry dock control room and connected to the sensors by cables will process the sensor information and then make the information available to the dock master on a display. The dock master will then interpret the information to determine what, if any, corrective actions are needed.

Contact Detectors

The first component will be a set of linear transmitters (or detectors) that are mounted on blocks. These transmitters will be waterproof to at least the maximum depth of the 100 ft. They will be designed to detect when a vessel contacts the block, but also allow for overtravel / compression of the block without

damaging the vessel, the blocks, or the switches. The exact location of the transmitters will be strategically located to provide full block contact indication. The minimum envisioned transmitter locations would be the first and last keel block and at least one side block per side of the vessel. The system will be designed to have additional transmitters for more complex dockings. Finally, the transmitter will be designed so that it returns a low signal even when not activated so that the indicator board can have an “off scale zero” indication as well.

Figure 1: Linear Position Sensor

Instrument Cables

The second component will be the wires / cables connecting the switch to the indicator board. The wires will also be designed for submergence of the dry dock. The system will be run on low voltage power (50V or less) so that divers may still operate in the vicinity of the blocks without restriction. Additionally, the cables, while they will be suitable for installation in ‘rough service’ environments, still need to be suitably protected. Selection of the cable materials and construction together with installation techniques combined with steps to protect the cables will be utilized to enable the use of less expensive non-armored cables.

Micro Controller & Operator Interface Terminal

The third component will be the micro controller with attached Operator Interface Terminal indicator board. This device will receive signals from the dry dock block contact transmitters. Using these signals, it will process and then display the signals into the dry dock control room.

Figure 2: Microcontroller

5. Installation

Hold for development.

6. Procurement Information

The system components ordered so far as listed below.

Dry Dock Block Indicator System Cost Tracking				
Line No.	**Description**	**Unit Cost**	**Qty**	**Cost**
1	Sensors (Linear transmitt	$ 1,425	4	$ 5,700
2	Micro 800 PLC	$ 362	1	$ 362
3	HMI	$ 2,666	1	$ 2,666
4	Power Supply	$ 72	1	$ 72
5	Programming Cable	$ 52	1	$ 52
6	HMI to PLC Cable	$ 52	1	$ 52
7	Analog Input Card	$ 221	1	$ 221
8	Misc Cables & Connectors	$ 557	1	$ 557
	Total Cost			**$ 9,682**

7. Risk Management

Technical difficulties during testing and analysis

Budget overruns due to unexpected costs

8. Dockings

Hold for development.

9. Interpretations of Indicators

Hold for development.

10. Recommended Future Changes

Hold for development.

11. Distribution

DM Consulting is dedicated to supporting distribution. Below are the previous and on-going efforts of distribution.

Previous Distribution:

March 28-30, 2023	NSRP All Panels Meeting
April 1, 2023	Dry Dock Quarterly Newsletter
April 24-28, 2023	Dry Dock Training - Asia/Australia/Oceania - Live Online
May 8-11, 2023	Dry Dock Training - Pascagoula, MS, USA
June 6-9, 2023	Dry Dock Training - London, United Kingdom
June 13-16, 2023	Dry Dock Training - London, United Kingdom
July 1, 2023	Dry Dock Quarterly Newsletter

Active Distribution:

Home Page Updates	www.DryDockTraining.com
Project Page	www.DryDockTraining.com/Block-Contact-Indicator.html

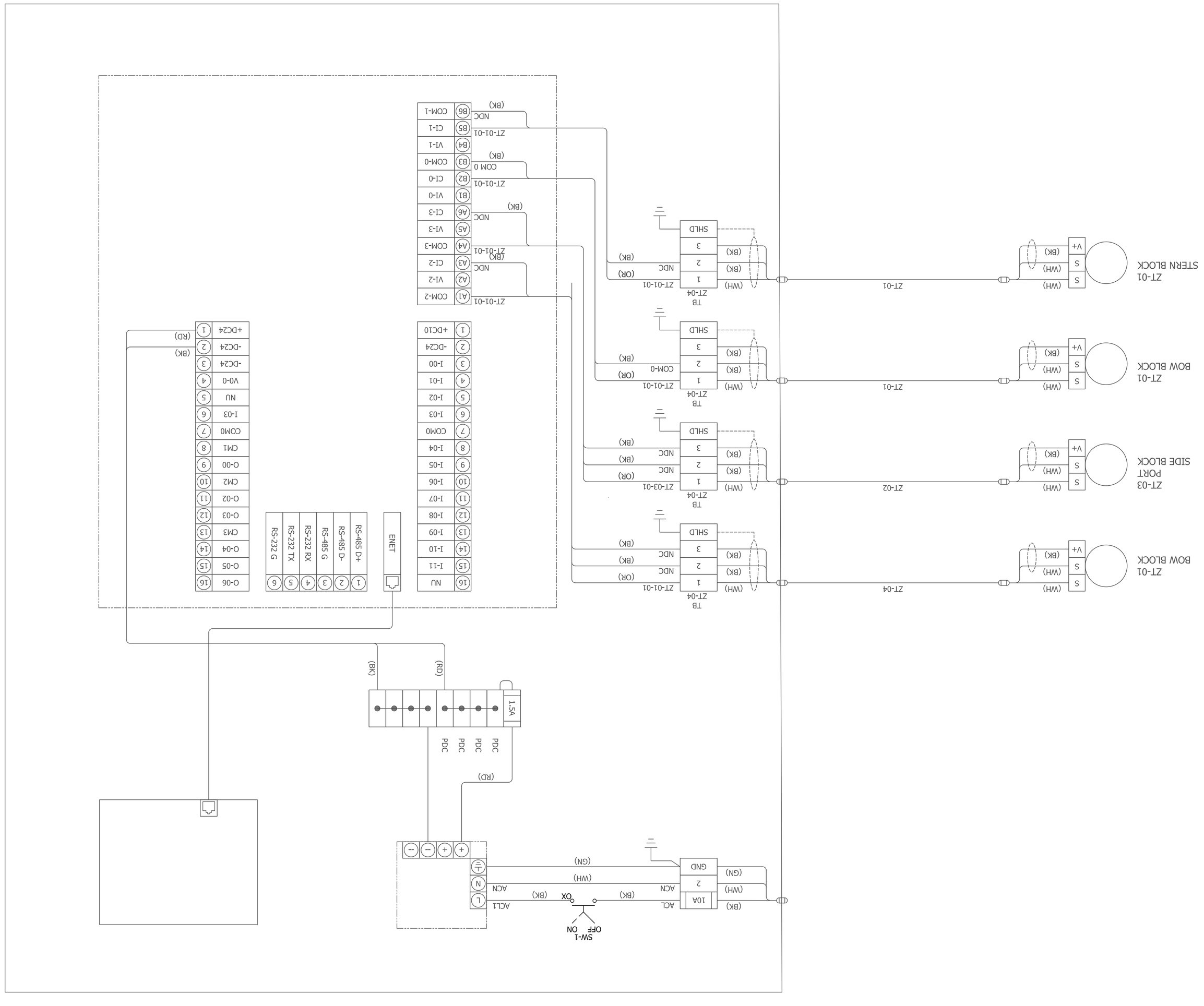
Future Distribution:

October 1, 2023	Dry Dock Quarterly Newsletter
October 23-26, 2023	Dry Dock Training - North America/South America - Live Online
December 5-8, 2023	Dry Dock Training - Virginia Beach, VA, USA
January 1, 2024	Dry Dock Quarterly Newsletter
February 5-9, 2024	Dry Dock Training - San Diego, CA, USA
March 5-8, 2024	Dry Dock Training - London, UK - Live Online
April 1, 2024	Dry Dock Quarterly Newsletter

Appendix A. Block Diagram

The following items are contained within this appendix:

1. Control Panel Wiring Diagram: Preliminary
2. Control Panel Layout: Preliminary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RS-232 G
+DC24
-DC24
VO-0
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CM0
CM1
CM2
CM3
1.5A
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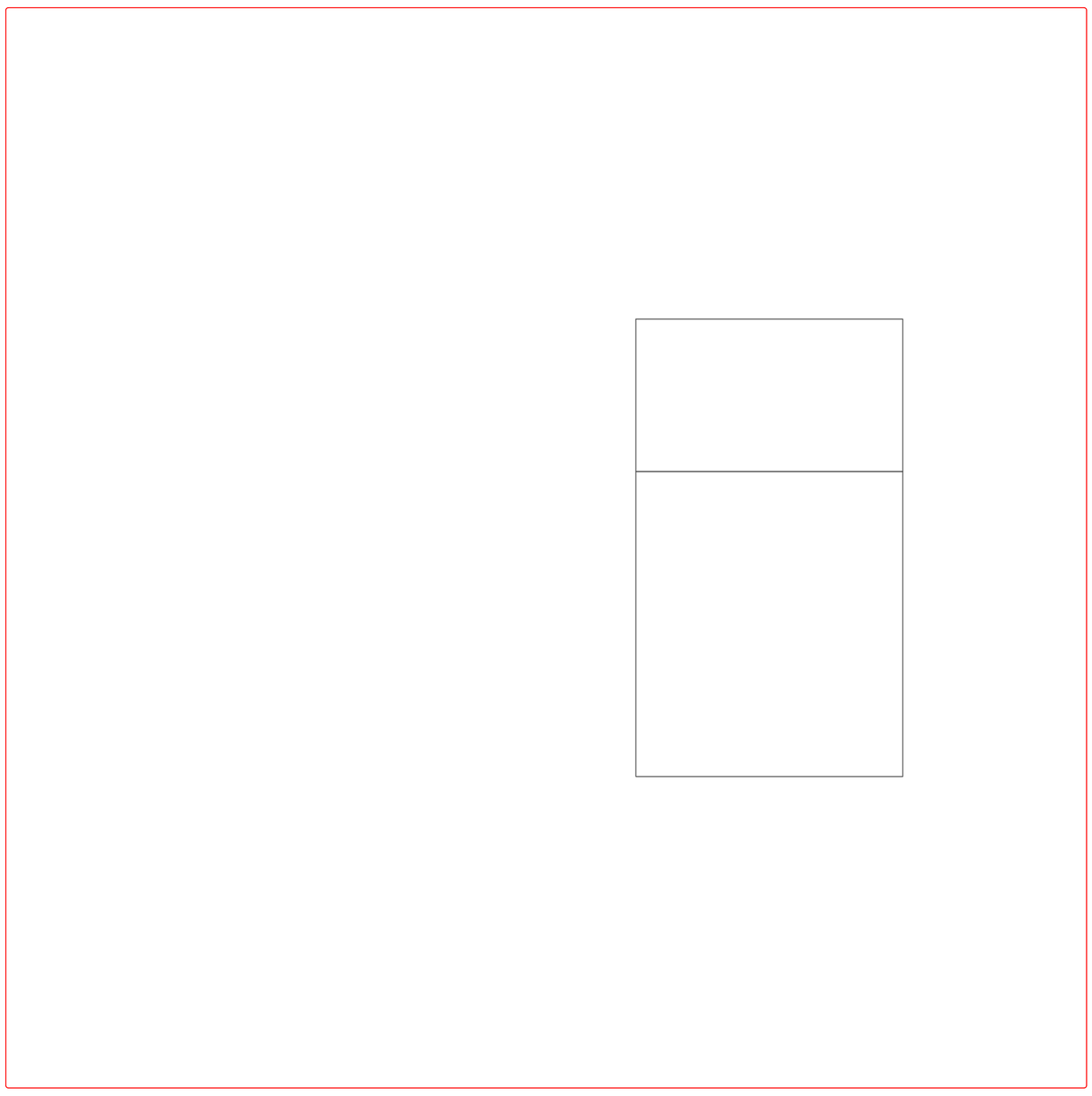

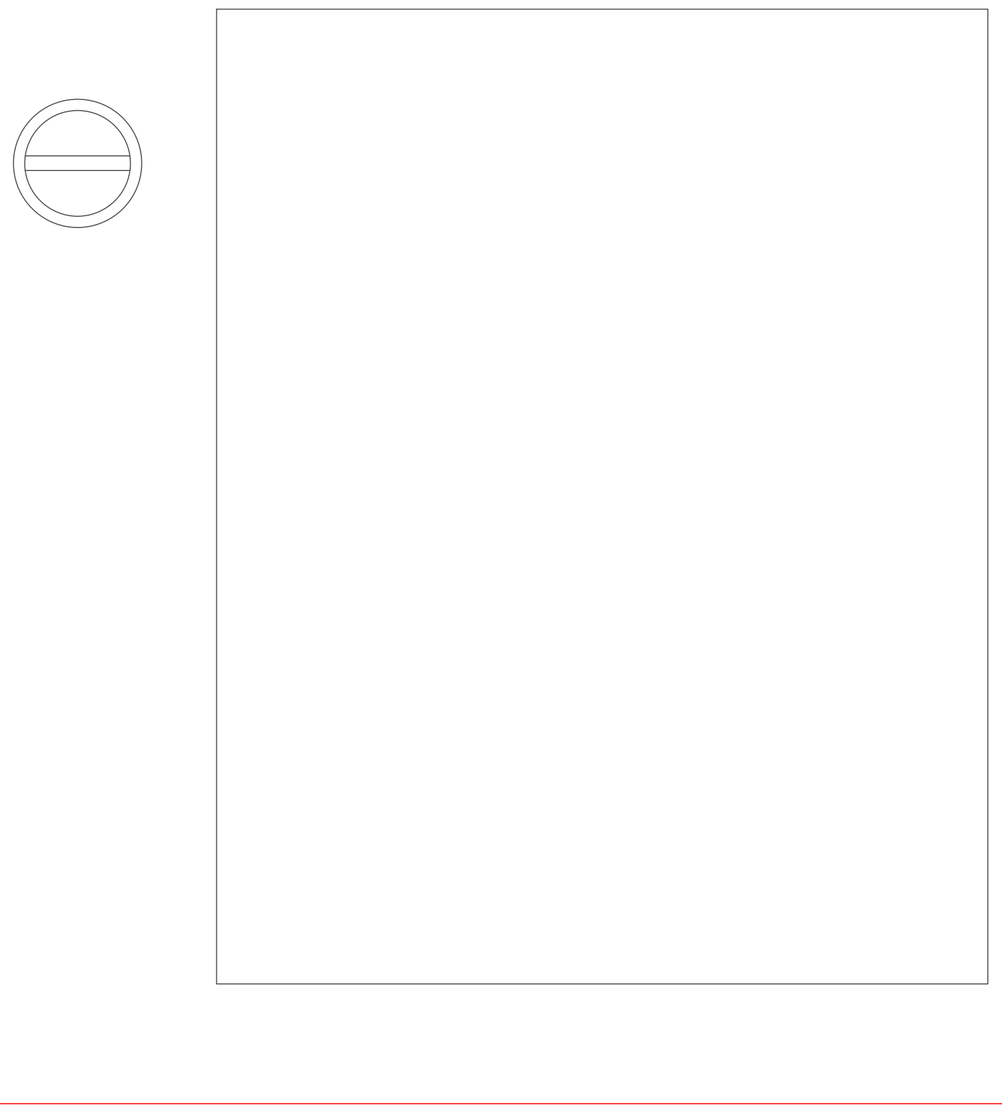

CAD FILE: STS-20-XX-XXX Hybrid Tug Template rev A.3dm