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Ships and marine technology — Cutter suction dredger supervisory and control systems

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Foreword

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This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document describes the supervisory and control system for a number of components, functions and systems that can, but do not have to, be installed on board of a cutter dredger. It does not prescribe that all described components, functions and systems need to be installed.

Ships and marine technology — Cutter suction dredger supervisory and control systems

1 Scope

This document specifies the components and structure, general requirements, and subsystem functional requirements, of cutter suction dredger supervisory and control systems.

It is applicable only to the installed components, functions or systems. It covers the design, manufacture and modifications.

2 Normative references

The following referenced documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 8384, *Ships and marine technology — Dredgers — Vocabulary*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO 8384 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1.1
cutter suction dredger supervisory and control system
CSD-SCS
system used for supervising and controlling the dredging operations performed by a cutter suction dredger

3.1.2
depth of cutter
distance from the water surface to the lower edge of the cutter head

3.2 Abbreviated terms

CCS   Cutter control system

CSD   Cutter suction dredger

CSD-SCS   Cutter suction dredger supervisory and control system

DPM	Dredging profile monitor
HMI	Human machine interface
SCADA	Supervisory control and data acquisition

4 Components and structure

4.1 Components

The CSD is usually equipped with a CSD-SCS used for monitoring and controlling the dredging operations performed by the CSD.

The CSD-SCS is an integrated system which consists of an integrated SCADA system comprising a CCS and a DPM.

The SCADA system is used to monitor and control the main dredging installation, cutter drive system, dredge pump system, dredging valves, swing winches, ladder winch, anchor and anchor boom winches (if any) and the spud and spud carriage system.

The DPM is both used to measure the position and heading of the dredger, and the position and depth of the cutter, and to provide for visualization in the plan view with a numeric window and side views.

4.2 Structure

The SCADA and DPM should either be independent or linked by a network to create an integrated dredging control system.

5 General requirements

5.1 Operating position and control mode

5.1.1 Operating position

The CSD-SCS should have local and remote operating positions.

5.1.2 Control modes

The CSD-SCS should have the following control modes:

a) manual: manual operation by handle/button/knob and in graphical user interface;

b) emergency: direct operation through hardwire, only for dredging equipment that affects the safety of the ship.

5.2 External communication

The system should have the following communication devices interfacing with the standard industrial devices protocols:

a) a heading sensor, such as a gyro compass;

b) a tide measurement device, such as a tide receiver;

c) a depth measurement device, such as an echo sounder.

5.3 Diagnostic

A CSD-SCS should provide the following diagnostic information:

a) equipment failure;

b) interlocking between equipment;

c) interlocking between operation position;

d) communication failure;

e) sensor failure.

5.4 Visualization of the system information

The monitoring and control stations on the dredging desk are provided for the visualization of the system process.

All relevant measurement and computation data values are displayed in a series of real time process display pages in graphical or numeric form.

The mimic pages should be provided on the system stations to be freely selected by the user. These views comprise the following:

a) main dredging overview;

b) preset page;

c) DPM view;

d) CCS view;

e) cutter and cutter drive system;

f) dredge pumps with relevant data and dredge pipelines with valves;

g) swing winches;

h) ladder winches;

i) spud and spud carriage systems;

j) production relevant data;

k) diagnostic pages.

5.5 HMI graphics

5.5.1 Alarm level

In HMI graphics, the CSD-SCS alarm level can be set in two colours.

EXAMPLE   Red is the highest level alarm, meaning danger; yellow is the secondary level alarm, meaning warning or abnormal condition.

This principle can be applied to all graphical symbols, function-keys, and digital data.

5.5.2 Conventions on graphic colours

The HMI graphic colours can be specified as follows.

a) For HMI graphics, cold tone colours are recommended, and for non-operating graphical interfaces, warm tone colours can be adopted.

b) The colour matching of the HMI graphics should make the flow chart simple and clear with harmonious and consistent colours. It is advisable that the number of colours adopted not be excessive.

c) Colour adoption of the HMI graphics can be in accordance with the specifications in Table 1.

Table 1 — Convention on graphical adoptions

Colour	General meaning	Meaning of colour in combination with graphical symbol	Meaning of colour in combination with digital data
Red	Danger	Highest level alarm	Highest level alarm
Yellow	Warning	Abnormal condition, secondary alarm	Abnormal condition, secondary alarm
Grey	Static state	Stop, shut down, disconnection	None
Cyan	Special meaning	Remote control, etc.	None
Blue	Secondary importance	Backup equipment	Tag number
White	Safe, program in activation status	None	Measured value or status value, dynamic data
Green	Safe, program in activation status	Normal operation, working, open, shut down, graphic value	None

5.5.3 Brightness of the HMI

The brightness of the HMI graphics should match that of the environment. For screen in bridge, the HMI can have a "night" display mode, and brightness of the screen should be lowered enough not to affect the sailors lookout in the night.

5.6 Alarm

The system should give the alarm in case dredging equipment fails or running parameters are oversetting values.

5.7 Calibration of system

The system should have the following calibration functions for the position and headings of the dredger, the depth of the cutter, and other sensors parameters:

a) the calibration parameter settings;

b) the calibration and adjustment of the measurement instruments and sensors.

6 Functional requirements

6.1 Preset/setup

The following preset points should be included.

a) Dimensions settings: special geometrical parameters of the dredger used for the calculations of monitoring and control values can be entered by authorized personnel only.

b) System settings: control parameters to adjust the behaviour and characteristic of system components can be entered.

c) Process settings: all settings that the dredge operator may change for typical operation.

6.2 Spuds and spud carrier system

The system should have the following functions for the working spud with carrier and auxiliary spud:

a) move each spud up or down;

b) activate free fall for each spud;

c) spud carrier fully in;

d) spud carrier fully out;

e) spud carrier one step in;

f) spud carrier one step out;

g) spud carrier in;

h) spud carrier out;

i) display the relevant measured values for spuds and the spud carrier system on the SCADA monitors in graphical or numeric form.

6.3 Cutter system

The system should have the following functions for cutter systems:

a) cutter drive start;

b) cutter drive stop;

c) cutter emergency stop;

d) cutter speed control;

e) cutter manual local control for (safe) cutter change;

f) display the relevant measured values for the cutter system on the SCADA monitors in graphical or numeric form.

6.4 Submersible dredge pump system

The system should have the following functions for the submersible dredge pump system:

a) to start all subsystems of the submersible dredge pump;

b) to stop all subsystems of the submersible dredge pump;

c) submersible dredge pump start;

d) submersible dredge pump stop;

e) submersible dredge pump emergency stop;

f) submersible dredge pump speed control;

g) display the relevant measured values for the submersible dredge pump system on the SCADA monitors in graphical or numeric form.

6.5 Inboard dredge pumps

The system should have the following functions for inboard dredge pumps:

a) inboard dredge pump start;

b) inboard dredge pump stop;

c) inboard dredge pump emergency stop;

d) inboard dredge pump speed control;

e) display the relevant measured values for inboard dredge pumps on the SCADA monitors in graphical or numeric form.

6.6 Dredge valves

The system should have the following functions for dredge valves:

a) the valves should manually be controlled by individual or interlocked close/open operation;

b) the respective open or close output for indication of actual valve position should be displayed on the SCADA monitors in a mimic graphical form.

6.7 Ladder winches

The system should have the following functions for ladder winches:

a) ladder winch selection: single mode, combined mode (if applicable);

b) ladder winch start;

c) ladder winch stop;

d) ladder winch emergency stop;

e) hoisting and lowering the ladder with the set speed;

f) display all the relevant measurement and computation data values for ladder winches on the SCADA monitors in graphical or numeric form.

6.8 Swing winches

The system should have the following functions for swing winches:

a) swing winch selection: single mode, combined mode (if applicable);

b) swing winch start;

c) swing winch stop;

d) swing winch emergency stop;

e) hauling and veering the swing winch with the set speed;

f) display all the relevant measurement and computation data values for swing winches on the SCADA monitors in graphical or numeric form.

6.9 Anchor hoisting winches and guy winches

The system should have the following functions for anchor hoisting winches and guy winches:

a) operation control of anchor hoisting winches and guy winches;

b) stop control of the anchor hoisting winches and guy winches;

c) speed control of the anchor hoisting winches and guy winches with set speed;

d) display all the relevant measurement and computation data values for anchor and guy winches on the SCADA monitors in graphical or numeric form.

6.10 Dredging profile monitor (DPM)

The DPM should have the following functions:

a) depth of cutter measurement;

b) position of cutter measurement;

c) swings speed measurement;

d) display all important data information such as the depth and position of the cutter, width of cutting, swing speed and the dredger's draught together with the dredged profile of the dredging area on the SCADA monitors in graphical or numeric form.

6.11 Measurement sensor and meter

6.11.1 The SCADA system should be equipped with the following measurement sensors and meters:

a) spud carrier position;

b) mixture flow meter;

c) mixture density meter;

d) vacuum and pressure measurements sensor for the dredging pumps;

e) production meter.

6.11.2 The relevant measurement and computation data values of the sensor should be displayed on the SCADA monitors in trending graphical or numeric form.

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