International Standard

ISO 16425

Ships and marine technology — Specifications for the installation of ship communication networks for shipboard equipment and systems

Navires et technologie maritime — Spécifications pour l'installation de réseaux de communication des navires pour les équipements et systèmes embarqués

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 6, *Navigation and ship operations*.

This second edition cancels and replaces the first edition (ISO 16425:2013), which has been technically revised.

The main changes compared are as follows:

— the title of this document has been changed from “guidelines” to “specification”;

— all Clauses have been revised in line with the shipboard network design procedure;

— designs for Wi-Fi networks, networks equipped with a shipboard data server that conform to ISO 19847 and ISO 19848, and requirements for cybersecurity for shipboard networks have been added;

— in Clause 5, the scope of this document has been included in the network system architecture;

— in Clause 6, information necessary for network design has been provided;

— in Clause 7, the requirements for the operation plan design of the shipboard network have been added;

— in Clause 8, information on shipboard network devices has been added;

— in Clause 9, the network design methods for the physical design of cable and connector for shipboard network equipment and for the logical design of network separation and communication between networks with cyber security have been updated;

— in Clause 10, the equipment, grounding and termination of cables and network equipment have been clarified;

— in Clause 11, network testing and inspection objectives, conditions, methods and criteria have been added;

— in Clause 12, information necessary for network operation has been provided;

— in Clause 13, cyber security requirements for networks have been added;

— in Annex A examples of input/output information required for network design have been added;

— in Annex B, examples of monitoring and managing the shipboard network and the nodes connected to the network have been added;

— in Annex C, an example of secure-network implementation compliant with this document has been added.

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 gives specifications relating to communication network-system architecture, data requirements, administration, operation, commissioning, inspection and testing for shipboard equipment and systems.

This document also takes into account differences between shipboard communication networks and networks that are used outside of ships, and stipulates requirements and specifications relating to matters unique to shipboard use.

Until the publication of this document, there has been a lack of comprehensive specifications for connecting devices that are provided by many different manufacturers to a network via a generic means. This gap has impeded the wider use of shipboard networks.

This document aims to improve the convenience for all involved parties, including manufacturers, engineering firms, shipbuilders, and shipping companies.

Ships and marine technology — Specifications for the installation of ship communication networks for shipboard equipment and systems

1 Scope

This document provides installation specifications for ship communication networks, so as to improve communication between shipboard equipment and within shipboard systems that are independent from navigational equipment networks and engine-control networks. This document can also be applied to operational technology (OT) networks that use software and hardware to control and monitor devices and infrastructure such as navigational equipment networks and machinery control networks in ship.

The ship communication networks covered in this document are intended for information sharing and are not directly related to safety of navigation.

This document utilizes existing standards relating to protocols, and provides new specifications for aspects such as communication network-system architecture, administration, operation and installation.

The new specifications in this document include: redundancy, if necessary, for a shipboard communication network system; a network administration that does not require experts; physical as well as logical security; and network installation.

This document uses the standard communication network Internet protocol.

This document applies to shipboard wired networks for IP communication, using Fast Ethernet and Gigabit Ethernet as specified in IEEE 802.3 and to shipboard wireless networks for IP communication, using the unlicensed 2,4 GHz and 5 GHz bands as specified in IEEE 802.11.

NOTE Other wireless technologies based on non-IP communication such as IEEE 802.15.1, IEEE 802.15.4 or wireless communication methods using 920 MHz band are not covered in this document.

2 Normative references

The following 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 24060:2021, *Ships and marine technology — Ship software logging system for operational technology*

ISO/IEC 11801-1, *Information technology — Generic cabling for customer premises — Part 1: General requirements*

ISO/IEC 14763-3, *Information technology — Implementation and operation of customer premises cabling — Part 3: Testing of optical fibre cabling*

ISO/IEC 20000 (all parts), *Information technology — Service management*

IEC 60092-504:2016, *Electrical installations in ships— Part 504: Automation, control and instrumentation*

IEC 60945, *Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results*

IEC 61162-450, *Maritime navigation and radio communication equipment and systems — Digital interfaces — Part 450: Multiple talkers and multiple listeners — Ethernet interconnection*

IEC 61162-460:2018/AMD1:2020, *Maritime navigation and radio communication equipment and systems — Digital interfaces — Part 460: Multiple talkers and multiple listeners — Ethernet interconnection — Safety and security*

IEEE 802.3, *Ethernet (Formerly: Carrier Sense Multiple Access with Collision Detection)*

IEEE 802.11, *Ethernet (Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications)*

ANSI/TIA-568.0:2020, *Generic Telecommunications Cabling for Customer Premises*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

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

3.1
16425-Network
controlled network consisting of devices that meet the requirements of the *16425-Network node* (3.4)

3.2
16425-Network device
hubs (3.21), layer 2 switches, layer 3 switches, routers and other devices that connect and relay between networks

3.3
16425-Network equipment
shipboard equipment for processing, sending and receiving data

3.4
16425-Network node
16425-Network equipment (3.3) and *16425-Network device* (3.2)

3.5
AES
advanced encryption standard
symmetric key cryptosystem

3.6
application level gateway
network infrastructure device that connects 16425-Networks with other networks and which satisfies the safety and security requirements as specified in this document

3.7
business local area network
business LAN
network that crewmembers use for ship operation duties

3.8
broadcast domain
domain on a computer network where broadcasted frames (broadcasts) are received

3.9
collision domain
domain in a computer network where simultaneous transmission cause collisions or congestion

3.10
controlled network
network that has been designed to operate such that authorities are satisfied by documented evidence that the network does not pose any security risks to any connected network nodes

Note 1 to entry: For example, any network compliant to IEC 61162-450 or this document that is approved by classification society, flag state or recognized organization (RO) is considered as a controlled network.

3.11
Crew local area network
Crew LAN
network that crewmembers use for personal matters or in their spare time

3.12
extender connector
non-powered connections, including telecommunication outlets

3.13
data base system
systems equipped on the internet working or shore to manage data efficiently

3.14
DIAMETER
authentication, authorisation, and accounting protocol for computer networks

3.15
DMZ
demilitarized zone
physical or logical sub-network that contains and exposes an organization's external-facing services to a larger and un-trusted network, usually the Internet

3.16
firewall
system installed at network nodes to ensure security by controlling unwanted traffic among different network segments and to and from the internet and other external sources

3.17
gateway
communication device that connects computer networks to networks with differing protocols

3.18
hub
concentrator that is centrally located in a network comprising a star physical topology

3.19
ICMP
internet control message protocol
communication rules that are used for such purposes as notifications of errors in the processing of datagrams, and notifications of information relating to communication

3.20
IP
internet protocol
network layer communications protocol in the Internet protocol suite for relaying datagrams across network boundaries

3.21
IT network
information network not related to onboard control system

3.22
layer 2 switch
hub (3.18) that can direct traffic on an *open systems interconnection reference model* (3.28) layer 2 (data link layer)

3.23
layer 3 switch
hub (3.18) that can direct traffic on an *open systems interconnection reference model* (3.28) layer 3 (network layer)

3.24
log rotation
automated process used in system administration in which log files are compressed, moved (archived), renamed or deleted once they are too old or too big

3.25
MAC address
media access control address
identifier used to identify network interfaces

3.26
MD5
message digest algorithm 5
hash function producing a 128-bit hash value

3.27
MIB
management information base
type of database for managing devices in a network

3.28
OSI reference model
open systems interconnection reference model
model that divides the communication functions for computers into layers

Note 1 to entry: See ISO/IEC 7498 for further details.

3.29
operation technology network
OT network
exclusive network of control and operational technology for optimal operation of products, equipment, and systems on board

3.30
proxy
component acting as an intermediary between two equipment on the network

3.31
port trunk
method of raising transmission speed by governing two or more physical cables

3.32
RADIUS
remote authentication dial-in user service
networking protocol that provides centralized authentication, authorization, and accounting management for users who connect and use a network service

3.33
REDS
removable external data source
user removable non-network data source, including, but not limited to, compact discs, memory sticks and devices compliant with IEEE 802.15.1

3.34
SNMP
simple network management protocol
communication rules that define methods for communicating information in order to monitor and control network devices within a network

3.35
shore network
non-shipboard networks, including internet working

3.36
SSID
service set identifier
name which identifies an access point in a wireless network

3.37
SHA
secure hash algorithm
cryptographic hash function

3.38
STP
spanning tree protocol
method of control in a loop topology network for preventing data from entering endless loops

3.39
SYN flood attacks
attack that abuses transmission control protocol (TCP) connections and overloads the system to prevent it from operating

3.40
TAG VLAN
tag virtual local area network
function that adds an ID called a VLAN tag to Ethernet frames to identify the *VLAN* (3.44) to which the frames forwarded across the switch belong

3.41
trouble report
statement reporting the nature of a malfunction to the system integrator, shipowner, or management company, in the event of a malfunction within shipboard equipment or networks

3.42
uncontrolled network
data network that is not compliant with IEC 61162-450, IEC 61162-460, this document, or a controlled network

3.43
UTM
unified threat management
collective control over several different security systems, such as firewall and website filtering, by consolidating them into a single hardware

3.44
VLAN
virtual local area network
method for configuring a local area network virtually, regardless of the physical network configuration

4 Abbreviated terms

AMS	alarm monitoring system
ASCII	American Standard Code for Information Interchange
BR	bridge
BWMS	ballast water management system
C/R	control room
CCR	cargo control room
CD	compact disc
CSMA/CD	carrier sense multiple access/collision detection
DVD	digital versatile disc
ECR	engine control room
E/R	engine room
FBB	fleet broad band
FTP	File Transfer Protocol
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol over Secure Socket Layer
ICMP	Internet Control Message Protocol
IGMP	Internet Group Management Protocol
IoT	Internet of Things
IP	internet protocol
IT	information technology
LAN	local area network
MAC	Media Access Control
MD5	message digest algorithm 5
MIB	management information base
MSTP	Multiple Spanning Tree Protocol
NTP	Network Time Protocol
OID	Object Identifier