

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



---

**Framework for energy market communications –  
Part 451-8: HVDC Scheduling process, contextual and assembly models for  
European style market**

**Cadre pour les communications pour le marché de l'énergie –  
Partie 451-8: Processus de programmation de liaisons HVDC, modèles  
contextuels et modèles d'assemblage pour le marché de style européen**



**THIS PUBLICATION IS COPYRIGHT PROTECTED**  
**Copyright © 2022 IEC, Geneva, Switzerland**

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Secretariat  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

#### **About the IEC**

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

#### **About IEC publications**

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

#### **IEC publications search - [webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)**

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

#### **IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)**

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

#### **IEC Customer Service Centre - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)**

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: [sales@iec.ch](mailto:sales@iec.ch).

#### **IEC Products & Services Portal - [products.iec.ch](http://products.iec.ch)**

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

#### **Electropedia - [www.electropedia.org](http://www.electropedia.org)**

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

---

#### **A propos de l'IEC**

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

#### **A propos des publications IEC**

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

#### **Recherche de publications IEC -**

#### **[webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)**

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

#### **IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)**

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

#### **Service Clients - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)**

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: [sales@iec.ch](mailto:sales@iec.ch).

#### **IEC Products & Services Portal - [products.iec.ch](http://products.iec.ch)**

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

#### **Electropedia - [www.electropedia.org](http://www.electropedia.org)**

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 300 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 19 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.



IEC 62325-451-8

Edition 1.0 2022-03

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



---

**Framework for energy market communications –  
Part 451-8: HVDC Scheduling process, contextual and assembly models for  
European style market**

**Cadre pour les communications pour le marché de l'énergie –  
Partie 451-8: Processus de programmation de liaisons HVDC, modèles  
contextuels et modèles d'assemblage pour le marché de style européen**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

---

ICS 33.200

ISBN 978-2-8322-1081-4

**Warning! Make sure that you obtained this publication from an authorized distributor.  
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

## CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	9
2 Normative references .....	9
3 Terms and definitions .....	10
4 Document contextual model and message assembly model basic concepts .....	11
4.1 Overview.....	11
4.2 European style market package structure (ESMP) .....	12
4.3 From the European style market profile to the document contextual model .....	14
4.4 From the document contextual model to the message assembly model.....	14
4.5 From the assembly model to the XML schema .....	14
5 The HVDC Link scheduling business process .....	14
5.1 General.....	14
5.2 Roles .....	15
5.2.1 The Scheduling Area Responsible role .....	15
5.2.2 Sub-roles.....	15
5.3 HVDC Link scheduling business process .....	15
5.4 Use Cases .....	16
5.4.1 General Overview .....	16
5.4.2 HVDC Link constraints.....	16
5.4.3 HVDC Link configuration.....	16
5.4.4 HVDC Link schedule.....	17
5.5 Sequence Diagram .....	17
5.6 Electronic documents used .....	18
5.6.1 HVDC Link Document .....	18
5.6.2 Capacity Document .....	18
5.7 Generic business rules for documents .....	19
5.7.1 General .....	19
5.7.2 Document instance implementation .....	19
5.8 Rules governing the HVDCLink_MarketDocument.....	20
5.8.1 Retransmission of historical information.....	20
5.8.2 Rules governing the TimeSeries class .....	20
6 Contextual and assembly models.....	20
6.1 HVDCLink document contextual model .....	20
6.1.1 Overview of the model .....	20
6.1.2 IsBasedOn relationships from the European style market profile.....	21
6.1.3 Detailed HVDCLink document contextual model .....	21
6.2 HVDCLink document assembly model.....	29
6.2.1 Overview of the model .....	29
6.2.2 IsBasedOn relationships from the European style market profile.....	30
6.2.3 Detailed HVDCLink document assembly model.....	31
6.2.4 Primitives .....	35
6.2.5 Datatypes .....	35
6.2.6 Enumerations .....	43
7 XML Schema .....	43
7.1 XML schema URN namespace rules .....	43

7.2	Code list URN namespace rules.....	44
7.3	URI rules for model documentation .....	44
7.3.1	Datatype.....	44
7.3.2	Class.....	44
7.3.3	Attribute.....	45
7.3.4	Association end role name.....	45
7.4	HVDCLink_MarketDocument schema.....	45
7.4.1	Schema structure .....	45
7.4.2	Schema description .....	48
	Bibliography.....	53
	Figure 1 – IEC 62325-450 modelling framework.....	12
	Figure 2 – Overview of European style market profile dependency.....	13
	Figure 3 – Steps of the HVDC Link scheduling business process .....	15
	Figure 4 – HVDCLink Scheduling Process Overview .....	16
	Figure 5 – Generic sequence diagram of the information flows .....	18
	Figure 6 – HVDCLink document contextual model.....	20
	Figure 7 – HVDCLink document assembly model .....	30
	Figure 8 – HVDCLink_MarketDocument XML schema structure (1/2) .....	46
	Figure 9 – HVDCLink_MarketDocument XML schema structure (2/2) .....	47
	Table 1 – Dependency table outline for the HVDC Link scheduling process .....	19
	Table 2 – IsBasedOn dependency.....	21
	Table 3 – Attributes of HVDCLink document contextual model::HVDCLink_MarketDocument .....	22
	Table 4 – Association ends of HVDCLink document contextual model::HVDCLink_MarketDocument with other classes.....	22
	Table 5 – Attributes of HVDCLink document contextual model::DateAndOrTime .....	23
	Table 6 – Attributes of HVDCLink document contextual model::Domain .....	23
	Table 7 – Attributes of HVDCLink document contextual model::Exchange_Quantity .....	23
	Table 8 – Attributes of HVDCLink document contextual model::HVDCMode_AttributeInstanceComponent .....	24
	Table 9 – Attributes of HVDCLink document contextual model::MarketParticipant.....	24
	Table 10 – Association ends of HVDCLink document contextual model::MarketParticipant with other classes .....	24
	Table 11 – Attributes of HVDCLink document contextual model::MarketRole .....	24
	Table 12 – Attributes of HVDCLink document contextual model::Measure_Unit.....	25
	Table 13 – Attributes of HVDCLink document contextual model::Point .....	25
	Table 14 – Association ends of HVDCLink document contextual model:: Point with other classes .....	25
	Table 15 – Attributes of HVDCLink document contextual model::Process.....	26
	Table 16 – Attributes of HVDCLink document contextual model::Quantity .....	26
	Table 17 – Attributes of HVDCLink document contextual model::Reason .....	26
	Table 18 – Attributes of HVDCLink document contextual model::RegisteredResource.....	26
	Table 19 – Attributes of HVDCLink document contextual model::Series_Period .....	27

Table 20 – Association ends of HVDCLink document contextual model:: Series_Period with other classes .....	27
Table 21 – Attributes of HVDCLink document contextual model::Time_Period.....	27
Table 22 – Attributes of HVDCLink document contextual model::TimeSeries.....	28
Table 23 – Association ends of HVDCLink document contextual model:: TimeSeries with other classes .....	28
Table 24 – IsBasedOn dependency.....	30
Table 25 – Attributes of HVDCLink document assembly model::HVDCLink_MarketDocument .....	31
Table 26 – Association ends of HVDCLink document assembly model::HVDCLink_MarketDocument with other classes.....	32
Table 27 – Attributes of HVDCLink document assembly model::Point.....	32
Table 28 – Attributes of HVDCLink document assembly model::Reason.....	32
Table 29 – Attributes of HVDCLink document assembly model::Series_Period.....	33
Table 30 – Association ends of HVDCLink document assembly model:: Series_Period with other classes .....	33
Table 31 – Attributes of HVDCLink document assembly model::TimeSeries .....	33
Table 32 – Association ends of HVDCLink document assembly model:: TimeSeries with other classes .....	34
Table 33 – Attributes of ESMPDataTypes::Action_Status.....	35
Table 34 – Attributes of ESMPDataTypes::ESMP_DateTimeInterval .....	36
Table 35 – Attributes of ESMPDataTypes::AreaID_String.....	36
Table 36 – Restrictions of attributes for ESMPDataTypes::AreaID_String .....	36
Table 37 – Attributes of ESMPDataTypes::BusinessKind_String .....	36
Table 38 – Attributes of ESMPDataTypes::CurveType_String .....	37
Table 39 – Attributes of ESMPDataTypes::EnergyProductKind_String .....	37
Table 40 – Attributes of ESMPDataTypes::ESMP_DateTime.....	37
Table 41 – Restrictions of attributes for ESMPDataTypes::ESMP_DateTime.....	37
Table 42 – Attributes of ESMPDataTypes::ESMPVersion_String.....	38
Table 43 – Restrictions of attributes for ESMPDataTypes::ESMPVersion_String.....	38
Table 44 – Attributes of ESMPDataTypes::HVDCMode_String .....	38
Table 45 – Attributes of ESMPDataTypes::ID_String.....	38
Table 46 – Restrictions of attributes for ESMPDataTypes::ID_String.....	39
Table 47 – Attributes of ESMPDataTypes::MarketRoleKind_String.....	39
Table 48 – Attributes of ESMPDataTypes::MeasurementUnitKind_String .....	39
Table 49 – Attributes of ESMPDataTypes::MessageKind_String .....	39
Table 50 – Attributes of ESMPDataTypes::ObjectAggregationKind_String.....	40
Table 51 – Attributes of ESMPDataTypes::PartyID_String.....	40
Table 52 – Restrictions of attributes for ESMPDataTypes::PartyID_String.....	40
Table 53 – Attributes of ESMPDataTypes::Position_Integer .....	40
Table 54 – Restrictions of attributes for ESMPDataTypes::Position_Integer .....	41
Table 55 – Attributes of ESMPDataTypes::ProcessKind_String .....	41
Table 56 – Attributes of ESMPDataTypes::ReasonCode_String .....	41
Table 57 – Attributes of ESMPDataTypes::ReasonText_String.....	41
Table 58 – Restrictions of attributes for ESMPDataTypes::ReasonText_String.....	41

Table 59 – Attributes of ESMPDataTypes::ResourceID\_String .....42  
Table 60 – Restrictions of attributes for ESMPDataTypes::ResourceID\_String .....42  
Table 61 – Attributes of ESMPDataTypes::Status\_String .....42  
Table 62 – Attributes of ESMPDataTypes::YMDHM\_DateTime.....42  
Table 63 – Restrictions of attributes for ESMPDataTypes::YMDHM\_DateTime.....43

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FRAMEWORK FOR ENERGY MARKET COMMUNICATIONS –****Part 451-8: HVDC Scheduling process, contextual and assembly models for European style market**

## FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 62325-451-8 has been prepared by IEC technical committee 57: Power systems management and associated information exchange. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
57/2452/FDIS	57/2468/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This IEC standard includes Code Components i.e. components that are intended to be directly processed by a computer.

Such content is any text found between the markers <CODE BEGINS> and <CODE ENDS>, or otherwise is clearly labelled in this standard as a Code Component. The code component of this document is the XML schema file defined in Clause 7.

The purchase of this IEC standard carries a copyright license for the purchaser to sell software containing Code Components from this standard to end users either directly or via distributors, subject to IEC software licensing conditions, which can be found at: <http://www.iec.ch/CCv1>.

A list of all parts in the IEC 62325 series, published under the general title *Framework for energy market communications*, can be found on the IEC website.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/standardsdev/publications](http://www.iec.ch/standardsdev/publications).

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under [webstore.iec.ch](http://webstore.iec.ch) in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

**IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.**

## INTRODUCTION

This document is one part of the IEC 62325 series for deregulated energy market data exchanges based on the European style market profile. This part of IEC 62325 defines the document contextual models, the message assembly models as well as the XML schemas to be used for the HVDC Link Scheduling process.

The principal objective of the IEC 62325 series is to produce standards which facilitate the integration of market application software developed independently by different vendors into a market management system, between market management systems and market participant systems. This is accomplished by defining message exchanges to allow these applications or systems access to public data and exchange information independent of how such information is represented internally.

The common information model (CIM), i.e. IEC 62325-301, IEC 61970-301 and IEC 61968-11, specifies the basis for the semantics for message exchange.

This European style market profile is based on different parts of the CIM IEC standards and specifies the content of the messages exchanged.

This document provides, for the European style market profile, the necessary information to be exchanged between Scheduling Area Responsibilities (this role is mostly performed by Transmission System Operators) about their HVDC Links. This part of IEC 62325 was originally based upon the work of the European Network of Transmission System Operators (ENTSO-E) CIM Expert Group (formerly Working Group EDI).

## **FRAMEWORK FOR ENERGY MARKET COMMUNICATIONS –**

### **Part 451-8: HVDC Scheduling process, contextual and assembly models for European style market**

#### **1 Scope**

This part of IEC 62325 specifies a UML package for the HVDC Link scheduling business process and its associated document contextual models, assembly models and XML schemas for use within the European style electricity markets.

This part of IEC 62325 is based on the European style market contextual model (IEC 62325-351). The business process covered by this part of IEC 62325 is described in Subclause 5.3.

The relevant aggregate core components (ACCs) defined in IEC 62325-351 have been contextualised into aggregated business information entities (ABIEs) to satisfy the requirements of the European style market HVDC Link scheduling business process.

#### **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.

IEC TS 61970-2, *Energy management system application program interface (EMS-API) – Part 2: Glossary*

IEC 62325-351:2016, *Framework for energy market communications – Part 351: CIM European market model exchange profile*

IEC 62325-450:2013, *Framework for energy market communications – Part 450: Profile and context modelling rules*

IEC 62325-451-1, *Framework for energy market communications – Part 451-1: Acknowledgement business process and contextual model for CIM European market*

IEC 62325-451-3, *Framework for energy market communications – Part 451-3: Transmission capacity allocation business process (explicit or implicit auction) and contextual models for European market*

IEC 62361-100, *Power systems management and associated information exchange – Interoperability in the long term – Part 100: CIM profiles to XML schema mapping*