
**Information technology database
languages — SQL —**

**Part 15:
Multi-dimensional arrays (SQL/MDA)**

Langages de base de données IT — SQL —

Partie 15: Tableaux multi-dimensionnels (SQL/MDA)
iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO/IEC 9075-15:2019

<https://standards.iteh.ai/catalog/standards/sist/feb3715c-d769-45c7-aba8-30fc4dde1b4f/iso-iec-9075-15-2019>



iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO/IEC 9075-15:2019](https://standards.iteh.ai/catalog/standards/sist/feb3715c-d769-45c7-aba8-30fc4dde1b4f/iso-iec-9075-15-2019)

<https://standards.iteh.ai/catalog/standards/sist/feb3715c-d769-45c7-aba8-30fc4dde1b4f/iso-iec-9075-15-2019>



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2019

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents	Page
Foreword.....	ix
Introduction.....	x
1 Scope.....	1
2 Normative references.....	3
3 Terms and definitions.....	5
3.1 Definitions.....	5
3.1.1 Definitions provided in this document.....	5
4 Concepts.....	7
4.1 SQL data types.....	7
4.1.1 SQL data types.....	7
4.1.1.1 Collection types.....	7
4.2 SQL-schema objects.....	7
4.2.1 User-defined types.....	7
4.2.1.1 Distinct types.....	7
5 The parts of ISO/IEC 9075.....	9
5.1 Overview.....	9
5.2 ISO/IEC 9075-15: MultiDimensional Arrays (SQL/MDA).....	9
6 Concepts.....	11
6.1 Data types.....	11
6.1.1 General introduction to data types.....	11
6.1.2 Data type terminology.....	11
6.2 Numbers.....	11
6.2.1 Operations involving numbers.....	12
6.3 User-defined types.....	12
6.3.1 Distinct types.....	12
6.4 Collection types.....	12
6.4.1 Introduction to collection types.....	12
6.4.2 MD-arrays.....	13
6.4.3 Collection comparison and assignment.....	14
6.4.4 Operations involving MD-arrays.....	14
6.4.4.1 Operators that operate on MD-array values and return MD-array values.....	14
6.4.4.2 Operators that operate on MD-array values and return tables.....	16
6.4.4.3 Operators that operate on MD-array values and return numbers.....	16
6.4.4.4 Operators that operate on MD-array values and return character strings.....	16
6.4.4.5 Operators that operate on MD-array values and return numbers or Boolean values.....	17
6.4.4.6 Operators that operate on MD-array values and return character or binary strings.....	17
6.4.4.7 Operators that construct new MD-array values.....	17
6.4.4.8 Operators that operate on MD-array values and return MD-array elements.....	18

6.4.5	MD-axis variables.....	18
7	Lexical elements.....	19
7.1	<token> and <separator>.....	19
7.2	Names and identifiers.....	20
8	Scalar expressions.....	21
8.1	<data type>.....	21
8.2	<value expression primary>.....	24
8.3	<md-array subset>.....	26
8.4	<identifier chain>.....	29
8.5	<md-array aggregation expression>.....	30
8.6	<case expression>.....	33
8.7	<cast specification>.....	35
8.8	<numeric value function>.....	38
8.9	<string value function>.....	41
8.10	<md-array encode function>.....	43
8.11	<value expression>.....	45
8.12	<md-array value expression>.....	46
8.13	<md-array value function>.....	52
8.14	<md-array value constructor>.....	60
8.15	<md-array element reference>.....	66
9	Query expressions.....	69
9.1	<table reference>.....	69
9.2	<query specification>.....	73
10	Predicates.....	75
10.1	<distinct predicate>.....	75
11	Additional common rules.....	77
11.1	Retrieval assignment.....	77
11.2	Store assignment.....	79
11.3	Passing a value from a host language to the SQL-server.....	80
11.4	Passing a value from the SQL-server to a host language.....	81
11.5	Result of data type combinations.....	82
11.6	Type precedence list determination.....	83
11.7	Type name determination.....	84
11.8	Determination of identical values.....	85
11.9	Equality operations.....	86
11.10	Grouping operations.....	87
11.11	Multiset element grouping operations.....	88
11.12	Ordering operations.....	89
11.13	Data type identity.....	90
11.14	Indexed name.....	91
11.15	MD-array subset.....	92
11.16	Canonicalize MD-array element reference.....	96
11.17	Execution of MD-array-returning functions.....	98
12	Additional common elements.....	101
12.1	<routine invocation>.....	101

iTech STANDARD PREVIEW
(standards.itech.ai)

<https://standards.itech.ai/catalog/standards/sist/fb3715c-d769-45c7-aba8-30fc4dde1b4f/iso-iec-9075-15-2019>

12.2	<md-extent alternative>.....	103
12.3	<md-array md-axis>.....	105
13	Schema definition and manipulation.....	107
13.1	<column definition>.....	107
13.2	<view definition>.....	108
13.3	<user-defined type definition>.....	109
13.4	<SQL-invoked routine>.....	110
14	SQL-client modules.....	111
14.1	<externally-invoked procedure>.....	111
14.2	Data type correspondences.....	113
15	Data manipulation.....	115
15.1	<set clause list>.....	115
16	Dynamic SQL.....	119
16.1	Description of SQL descriptor areas.....	119
16.2	<get descriptor statement>.....	121
16.3	<describe statement>.....	122
17	Embedded SQL.....	123
17.1	<embedded SQL Ada program>.....	123
17.2	<embedded SQL C program>.....	125
17.3	<embedded SQL COBOL program>.....	126
17.4	<embedded SQL Fortran program>.....	127
17.5	<embedded SQL MUMPS program>.....	128
17.6	<embedded SQL PL/I program>.....	129
18	Call-Level Interface specifications.....	131
18.1	SQL/CLI data type correspondences.....	131
19	Information Schema.....	133
19.1	ELEMENT_TYPES view.....	133
19.2	MD_EXTENTS view.....	134
20	Definition Schema.....	135
20.1	DATA_TYPE_DESCRIPTOR base table.....	135
20.2	ELEMENT_TYPES base table.....	136
20.3	MD_EXTENTS base table.....	137
20.4	SQL_CONFORMANCE base table.....	139
21	Status codes.....	141
21.1	SQLSTATE.....	141
22	Conformance.....	143
22.1	Claims of conformance to SQL/MDA.....	143
22.2	Implied feature relationships of SQL/MDA.....	143
Annex A	(informative) SQL Conformance Summary.....	145
Annex B	(informative) Implementation-defined elements.....	151
Annex C	(informative) Implementation-dependent elements.....	153
Annex D	(informative) Incompatibilities with ISO/IEC 9075:2011.....	155
Annex E	(informative) SQL feature taxonomy.....	157

Index..... 159

**iTeh STANDARD PREVIEW
(standards.iteh.ai)**

[ISO/IEC 9075-15:2019](https://standards.iteh.ai/catalog/standards/sist/feb3715c-d769-45c7-aba8-30fc4dde1b4f/iso-iec-9075-15-2019)

<https://standards.iteh.ai/catalog/standards/sist/feb3715c-d769-45c7-aba8-30fc4dde1b4f/iso-iec-9075-15-2019>

Tables

Table	Page
1 Table aggregation operators.	17
2 Data type correspondences for Ada.	113
3 Data type correspondences for C.	113
4 Data type correspondences for COBOL.	113
5 Data type correspondences for Fortran.	113
6 Data type correspondences for M.	114
7 Data type correspondences for Pascal.	114
8 Data type correspondences for PL/I.	114
9 Data types of <key word>s used in SQL item descriptor areas.	119
10 Codes used for SQL data types in Dynamic SQL.	120
11 SQL/CLI data type correspondences for Ada.	131
12 SQL/CLI data type correspondences for C.	131
13 SQL/CLI data type correspondences for COBOL.	132
14 SQL/CLI data type correspondences for Fortran.	132
15 SQL/CLI data type correspondences for M.	132
16 SQL/CLI data type correspondences for Pascal.	132
17 SQL/CLI data type correspondences for PL/I.	132
18 SQLSTATE class and subclass values.	141
19 Implied feature relationships of SQL/MDA.	143
20 Feature taxonomy for optional features.	157

[ISO/IEC 9075-15:2019](https://standards.iteh.ai/catalog/standards/sist/feb3715c-d769-45c7-aba8-30fc4dde1b4f/iso-iec-9075-15-2019)

<https://standards.iteh.ai/catalog/standards/sist/feb3715c-d769-45c7-aba8-30fc4dde1b4f/iso-iec-9075-15-2019>

(Blank page)

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO/IEC 9075-15:2019

<https://standards.iteh.ai/catalog/standards/sist/feb3715c-d769-45c7-aba8-30fc4dde1b4f/iso-iec-9075-15-2019>

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

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 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents), or the IEC list of patent declarations received (see <http://patents.iec.ch>).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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/IEC JTC 1, *Information technology*, Subcommittee SC 32, *Data management and interchange*.

This is the first edition of this document.

A list of all parts in the ISO/IEC 9075 series can be found on the ISO website.

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.

NOTE 1 — The individual parts of multi-part standards are not necessarily published together. New editions of one or more parts may be published without publication of new editions of other parts.

Introduction

This document was developed in response to industry demand for the ability to store and manipulate data in the form of multidimensional arrays within databases managed using database language SQL.

The organization of this document is as follows:

- 1) **Clause 1, “Scope”**, specifies the scope of this document.
- 2) **Clause 2, “Normative references”**, identifies additional standards that, through reference in this document, constitute provisions of this document.
- 3) **Clause 3, “Terms and definitions”**, defines the notations and conventions used in this document.
- 4) **Clause 4, “Concepts”**, describes the concepts used in ISO/IEC 9075.
- 5) **Clause 5, “The parts of ISO/IEC 9075”**, augments Clause 5, “The parts of ISO/IEC 9075”, of ISO9075-1, by summarizing the content of this document, in terms of the concepts described in Clause 4, “Concepts”, of ISO9075-1.
- 6) **Clause 6, “Concepts”**, presents concepts used in the definition of multidimensional arrays.
- 7) **Clause 7, “Lexical elements”**, defines a number of lexical elements used in the definition of multidimensional arrays.
- 8) **Clause 8, “Scalar expressions”**, defines a number of scalar expressions used in the definition of multidimensional arrays.
- 9) **Clause 9, “Query expressions”**, defines the elements of the language that produce rows and tables of data as used in multidimensional arrays.
- 10) **Clause 10, “Predicates”**, defines the predicates used in the definition of multidimensional arrays.
- 11) **Clause 11, “Additional common rules”**, specifies the rules for assignments that retrieve multidimensional array data from or store multidimensional array data into SQL-data, and formation rules for set operations.
- 12) **Clause 12, “Additional common elements”**, defines additional common elements used in the definition of multidimensional arrays.
- 13) **Clause 13, “Schema definition and manipulation”**, defines facilities for creating and managing a schema.
- 14) **Clause 14, “SQL-client modules”**, defines SQL-client modules and externally-invoked procedures in the context of multidimensional arrays.
- 15) **Clause 15, “Data manipulation”**, defines the data manipulation statements.
- 16) **Clause 16, “Dynamic SQL”**, defines the facilities for executing SQL-statements dynamically in the context of multidimensional arrays.
- 17) **Clause 17, “Embedded SQL”**, defines the host language embeddings in the context of multidimensional arrays.
- 18) **Clause 18, “Call-Level Interface specifications”**, defines facilities for using SQL through a Call-Level Interface.
- 19) **Clause 19, “Information Schema”**, defines the Information and Definition Schema objects associated with multidimensional arrays.
- 20) **Clause 20, “Definition Schema”**, defines base tables on which the viewed tables containing schema information depend.

- 21) **Clause 21, “Status codes”**, defines SQLSTATE values related to multidimensional arrays.
- 22) **Clause 22, “Conformance”**, defines the criteria for conformance to this document.
- 23) **Annex A, “SQL Conformance Summary”**, is an informative Annex. It summarizes the conformance requirements of the SQL language.
- 24) **Annex B, “Implementation-defined elements”**, is an informative Annex. It lists those features for which the body of this document states that the syntax, the meaning, the returned results, the effect on SQL-data and/or schemas, or any other behavior is partly or wholly implementation-defined.
- 25) **Annex C, “Implementation-dependent elements”**, is an informative Annex. It lists those features for which the body of this document states that the syntax, the meaning, the returned results, the effect on SQL-data and/or schemas, or any other behavior is partly or wholly implementation-dependent.
- 26) **Annex D, “Incompatibilities with ISO/IEC 9075:2011”**, is an informative Annex. It lists incompatibilities with the previous version of this document.
- 27) **Annex E, “SQL feature taxonomy”**, is an informative Annex. It identifies features of the SQL language specified in this document by an identifier and a short descriptive name. This taxonomy is used to specify conformance.

In the text of this document, Clauses and Annexes begin new odd-numbered pages, and in **Clause 7, “Lexical elements”**, through **Clause 22, “Conformance”**, Subclauses begin new pages. Any resulting blank space is not significant.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[ISO/IEC 9075-15:2019](https://standards.iteh.ai/catalog/standards/sist/feb3715c-d769-45c7-aba8-30fc4dde1b4f/iso-iec-9075-15-2019)

<https://standards.iteh.ai/catalog/standards/sist/feb3715c-d769-45c7-aba8-30fc4dde1b4f/iso-iec-9075-15-2019>

(Blank page)

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO/IEC 9075-15:2019

<https://standards.iteh.ai/catalog/standards/sist/feb3715c-d769-45c7-aba8-30fc4dde1b4f/iso-iec-9075-15-2019>

Information technology database languages — SQL —

Part 15:

Multi-dimensional arrays (SQL/MDA)**1 Scope**

This document defines ways in which Database Language SQL can be used in conjunction with multidimensional arrays.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO/IEC 9075-15:2019](https://standards.iteh.ai/catalog/standards/sist/feb3715c-d769-45c7-aba8-30fc4dde1b4f/iso-iec-9075-15-2019)

<https://standards.iteh.ai/catalog/standards/sist/feb3715c-d769-45c7-aba8-30fc4dde1b4f/iso-iec-9075-15-2019>

(Blank page)

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO/IEC 9075-15:2019

<https://standards.iteh.ai/catalog/standards/sist/feb3715c-d769-45c7-aba8-30fc4dde1b4f/iso-iec-9075-15-2019>

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/IEC 9075-1:2016, *Information technology — Database languages — SQL — Part 1: Framework (SQL/Framework)*.

ISO/IEC 9075-2:2016, *Information technology — Database languages — SQL — Part 2: Foundation (SQL/Foundation)*.

ISO/IEC 9075-3:2016, *Information technology — Database languages — SQL — Part 3: Call-Level Interface (SQL/CLI)*.

ISO/IEC 9075-11:2016, *Information technology — Database languages — SQL — Part 11: Information and Definition Schemas (SQL/Schemata)*.

Multipurpose Internet Mail Extensions (MIME), Part Two: Media Types
<http://tools.ietf.org/html/rfc2046>

The JavaScript Object Notation (JSON) Data Interchange Format
<http://tools.ietf.org/html/rfc7159>

ITeH STANDARD PREVIEW
(standards.iteh.ai)
<https://standards.iteh.ai/catalog/standards/sist/feb3715c-d769-45c7-aba8-30fc4dde1b4f/iso-iec-9075-15-2019>