# ISO/IEC 9075-1:2023-06 (E)

## Information technology - Database languages SQL - Part 1: Framework (SQL/Framework)

## Contents

Page


Foreword . . . x

Introduction . . . xii

**1 Scope . . . 1**

**2 Normative references . . . 2**

**3 Terms and definitions . . . 3**

3.1 Definitions taken from ISO/IEC 10646:2020 . . . 3

3.2 Definitions provided in this document . . . 3

**4 Concepts . . . 6**

4.1 What is SQL? . . . 6

4.2 Use of terms . . . 6

4.3 Caveat . . . 7

4.4 SQL-environments and their components . . . 7

4.4.1 SQL-environments . . . 7

4.4.2 SQL-agents . . . 7

4.4.3 SQL-implementations . . . 7

4.4.3.1 Introduction to SQL-implementations . . . 7

4.4.3.2 SQL-clients . . . 7

4.4.3.3 SQL-servers . . . 8

4.4.4 SQL-client modules . . . 8

4.4.5 User identifiers . . . 8

4.4.6 Roles . . . 8

4.4.7 User mapping concepts . . . 8

4.4.8 Routine mapping concepts . . . 8

4.4.9 Catalogs and schemas . . . 9

4.4.9.1 Catalogs . . . 9

4.4.9.2 SQL-schemas . . . 9

4.4.9.3 Information Schema . . . 9

4.4.9.4 Definition Schema . . . 9

4.4.10 Foreign servers and descriptors . . . 9

4.4.11 Foreign-data wrappers and descriptors . . . 9

4.4.12 SQL-data . . . 10

4.5 Tables . . . 10

4.6 SQL data types . . . 11

4.6.1 General data type information . . . 11

4.6.2 Null value . . . 11

4.6.3 Predefined types . . . 11

4.6.3.1 Numeric types . . . 11

4.6.3.2 Character string types . . . 12

4.6.3.3 Binary string types. . . . 12
4.6.3.4 Boolean type. . . . 12
4.6.3.5 Datetime types. . . . 12
4.6.3.6 Interval types. . . . 12
4.6.3.7 XML type. . . . 12
4.6.3.8 JSON type. . . . 13
4.6.4 Constructed atomic types: reference types. . . . 13
4.6.5 Constructed composite types. . . . 13
4.6.5.1 Collection types. . . . 13
4.6.5.2 Row types. . . . 13
4.7 Sites and operations on sites. . . . 13
4.7.1 Sites. . . . 13
4.7.2 Assignment. . . . 13
4.7.3 Nullability. . . . 14
4.8 SQL-schema objects. . . . 14
4.8.1 General SQL-schema object information. . . . 14
4.8.2 Descriptors relating to character sets. . . . 14
4.8.2.1 Character sets. . . . 14
4.8.2.2 Collations. . . . 15
4.8.2.3 Transliterations. . . . 15
4.8.3 Domains and their components. . . . 15
4.8.3.1 Domains. . . . 15
4.8.3.2 Domain constraints. . . . 15
4.8.4 User-defined types. . . . 15
4.8.4.1 Introduction to user-defined types. . . . 15
4.8.4.2 Distinct types. . . . 15
4.8.4.3 Structured types. . . . 16
4.8.5 Base tables and their components. . . . 16
4.8.5.1 Base tables. . . . 16
4.8.5.2 Columns. . . . 16
4.8.5.3 Periods. . . . 16
4.8.5.4 Table constraints. . . . 16
4.8.5.5 Triggers. . . . 17
4.8.6 View definitions. . . . 17
4.8.7 Assertions. . . . 17
4.8.8 SQL-server modules (defined in ISO/IEC 9075-4). . . . 17
4.8.9 Schema routines. . . . 17
4.8.10 Sequence generators. . . . 17
4.8.11 Privileges. . . . 17
4.9 Integrity constraints and constraint checking. . . . 18
4.9.1 Constraint checking. . . . 18
4.9.2 Determinism and constraints. . . . 18
4.9.3 Consistency when deleting and updating multiple rows. . . . 19
4.10 Communication between an SQL-agent and an SQL-server. . . . 19
4.10.1 Host languages. . . . 19
4.10.2 Source language character set. . . . 20
4.10.3 Parameter passing and data type correspondences. . . . 20

4.10.3.1 General parameter passing and data type correspondence information. . . . 20
4.10.3.2 Data type correspondences. . . . 20
4.10.3.3 Locators. . . . 21
4.10.3.4 Status parameters. . . . 21
4.10.3.5 Indicator parameters. . . . 21
4.10.4 Descriptor areas. . . . 21
4.10.5 Diagnostic information. . . . 21
4.10.6 SQL-transactions. . . . 21
4.11 Modules. . . . 22
4.12 Routines. . . . 22
4.12.1 General routine information. . . . 22
4.12.2 Type preserving functions. . . . 23
4.13 SQL-statements. . . . 23
4.13.1 Classes of SQL-statements. . . . 23
4.13.2 SQL-statements classified by function. . . . 24
**5 Parts of the ISO/IEC 9075 series. . . . 25**
5.1 Overview. . . . 25
5.2 ISO/IEC 9075-1: Framework (SQL/Framework). . . . 25
5.3 ISO/IEC 9075-2 Foundation (SQL/Foundation). . . . 26
5.3.1 Introduction to ISO/IEC 9075-2 Foundation (SQL/Foundation). . . . 26
5.3.2 Bindings methods. . . . 26
5.3.2.1 Introduction to bindings methods. . . . 26
5.3.2.2 Embedded SQL. . . . 26
5.3.2.3 Dynamic SQL. . . . 26
5.3.2.4 Direct invocation of SQL. . . . 26
5.3.3 SQL-statements specified in ISO/IEC 9075-2. . . . 26
5.4 ISO/IEC 9075-3: Call-Level Interface (SQL/CLI). . . . 27
5.5 ISO/IEC 9075-4: Persistent Stored Modules (SQL/PSM). . . . 28
5.5.1 Introduction to SQL/PSM. . . . 28
5.5.2 SQL-statements specified in ISO/IEC 9075-4. . . . 28
5.6 ISO/IEC 9075-9: Management of External Data (SQL/MED). . . . 28
5.7 ISO/IEC 9075-10: Object Language Bindings (SQL/OLB). . . . 28
5.8 ISO/IEC 9075-11: Information and Definition Schemas (SQL/Schemata). . . . 28
5.9 ISO/IEC 9075-13: SQL Routines and Types Using the Java™ Programming Language (SQL/JRT). . . . 29
5.10 ISO/IEC 9075-14: XML-Related Specifications (SQL/XML). . . . 29
5.11 ISO/IEC 9075-15: Multidimensional Arrays (SQL/MDA). . . . 29
5.12 ISO/IEC 9075-16: Property Graph Queries (SQL/PGQ). . . . 29
**6 Notation and conventions used in other parts of the ISO/IEC 9075 series. . . . 31**
6.1 Notation taken from ISO/IEC 10646:2020. . . . 31
6.2 Notation provided in the ISO/IEC 9075 series. . . . 31
6.3 Conventions. . . . 32
6.3.1 Specification of syntactic elements. . . . 32
6.3.2 Specification of the Information and Definition Schemata. . . . 33
6.3.3 Use of terms. . . . 33
6.3.3.1 Syntactic containment. . . . 33
6.3.3.2 Terms denoting rule requirements. . . . 34
6.3.3.3 Rule evaluation order. . . . 35

6.3.3.4 Conditional rules. . . . 36
6.3.3.5 Syntactic substitution. . . . 36
6.3.3.6 Other terms. . . . 37
6.3.3.7 Exceptions. . . . 37
6.3.4 Descriptors. . . . 38
6.3.5 Application of technical corrigenda. . . . 39
6.3.6 Relationships of parts within the ISO/IEC 9075 series. . . . 39
6.3.6.1 Introduction to relationships among parts. . . . 39
6.3.6.2 Clauses 1, 2, and 3. . . . 40
6.3.6.3 New and modified Clauses and Subclauses. . . . 40
6.3.6.4 New and modified Tables, Figures, Examples, and Equations. . . . 41
6.3.6.5 Functions. . . . 41
6.3.6.6 New and modified Format Items. . . . 41
6.3.6.7 New and modified paragraphs and rules. . . . 42
6.3.6.8 Modified Subclause Signatures. . . . 44
6.3.6.9 New and modified Annexes. . . . 44
6.3.6.10 Order of merging an incremental part. . . . 45
6.3.7 Subclauses used as subroutines. . . . 45
6.3.8 Document typography. . . . 46
6.3.9 Index typography. . . . 46
6.3.10 Feature ID and Feature Name. . . . 46
6.3.11 Implementation-defined and implementation-dependent. . . . 47
6.4 Digital artifacts. . . . 48
6.4.1 Introduction to digital artifacts. . . . 48
6.4.2 Language syntax. . . . 48
6.4.3 Condition codes. . . . 48
6.4.4 Feature codes. . . . 49
6.4.5 Implementation-defined items. . . . 50
6.4.6 Implementation-dependent items. . . . 50
6.4.7 Header files. . . . 51
6.4.8 Ada interface. . . . 51
6.4.9 Schema definition. . . . 51
6.4.10 XML Schemata. . . . 52
**7 Annexes to the parts of the ISO/IEC 9075 series. . . . 53**
7.1 Annexes are informative. . . . 53
7.2 SQL conformance summary. . . . 53
7.3 Implementation-defined elements. . . . 53
7.4 Implementation-dependent elements. . . . 53
7.5 Deprecated features. . . . 53
7.6 Incompatibilities with previous versions. . . . 53
7.7 SQL feature taxonomy. . . . 53
7.8 Defect Reports. . . . 53
**8 Status codes. . . . 54**
8.1 SQLSTATE. . . . 54
**9 Conformance. . . . 55**
9.1 Kinds of conformance claims. . . . 55

9.2 Minimum conformance. . . . . 55
9.3 Conformance to parts. . . . . 55
9.4 Conformance to features. . . . . 55
9.5 Extensions and options. . . . . 56
9.6 SQL flagger. . . . . 56
9.7 Claims of conformance. . . . . 57
9.7.1 How conformance is claimed. . . . . 57
9.7.2 Requirements for SQL applications. . . . . 58
9.7.3 Requirements for SQL-implementations. . . . . 58
**Annex A** (informative) **SQL conformance summary. . . . . 59**
**Annex B** (informative) **Implementation-defined elements. . . . . 60**
**Annex C** (informative) **Implementation-dependent elements. . . . . 63**
**Annex D** (informative) **SQL optional feature taxonomy. . . . . 65**
**Annex E** (informative) **Deprecated features. . . . . 66**
**Annex F** (informative) **Incompatibilities with ISO/IEC 9075:2016. . . . . 67**
**Annex G** (informative) **Defect Reports not addressed in this edition of this document. . . . . 68**
**Annex H** (informative) **Maintenance and interpretation of SQL. . . . . 69**
**Annex I** (informative) **Support for the use of inter-document links in the ISO/IEC 9075 series. . 70**
**Bibliography. . . . . 71**
**Index. . . . . 72**