
**Information technology — Database
languages — SQL —**

**Part 9:
Management of External Data (SQL/MED)**

*Technologies de l'information — Langages de base de données — SQL —
Partie 9: Gestion des données externes (SQL/MED)*

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO/IEC 9075 may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

International Standard ISO/IEC 9075-9 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 32, *Data management and interchange*.

ISO/IEC 9075 consists of the following parts, under the general title *Information technology — Database languages — SQL*:

- *Part 1: Framework (SQL/Framework)*
- *Part 2: Foundation (SQL/Foundation)*
- *Part 3: Call-Level Interface (SQL/CLI)*
- *Part 4: Persistent Stored Modules (SQL/PSM)*
- *Part 5: Host Language Bindings (SQL/Bindings)*
- *Part 9: Management of External Data (SQL/MED)*
- *Part 10: Object Language Bindings (SQL/OLB)*

Annexes A, B, C, D, E, F, G and H of this part of ISO/IEC 9075 are for information only.

Introduction

The organization of this part of ISO/IEC 9075 is as follows:

- 1) Clause 1, “Scope”, specifies the scope of this part of ISO/IEC 9075.
- 2) Clause 2, “Normative references”, identifies additional standards that, through reference in this part of ISO/IEC 9075, constitute provisions of this part of ISO/IEC 9075.
- 3) Clause 3, “Definitions, notations, and conventions”, defines the notations and conventions used in this part of ISO/IEC 9075.
- 4) Clause 4, “Concepts”, presents concepts related to this part of ISO/IEC 9075.
- 5) Clause 5, “Lexical elements”, defines the lexical elements of the language specified in this part of ISO/IEC 9075.
- 6) Clause 6, “Scalar expressions”, defines the elements of the language that produce scalar values.
- 7) Clause 7, “Query expressions”, defines the elements of the language that produce rows and tables of data.
- 8) Clause 8, “Predicates”, defines the predicates of the language.
- 9) Clause 9, “URLs”, specifies the format of URLs used in this part of ISO/IEC 9075.
- 10) Clause 10, “Data assignment rules and routine determination”, specifies the rules for assignments that retrieves data from or store data into SQL-data, and formation rules for set operations.
- 11) Clause 11, “Additional common elements”, defines additional common elements used in the definition of foreign tables, foreign servers, and foreign-data wrappers.
- 12) Clause 12, “Schema definition and manipulation”, defines facilities related to foreign tables and datalink type support for creating and managing a schema.
- 13) Clause 13, “Catalog manipulation”, defines facilities for creating, altering, and dropping foreign servers and foreign-data wrappers.
- 14) Clause 14, “Access control”, defines facilities for controlling access to SQL-data.
- 15) Clause 15, “SQL-client modules”, defines SQL-client modules and externally-invoked procedures.
- 16) Clause 16, “Data manipulation”, defines the data manipulation statements.
- 17) Clause 17, “Session management”, defines the SQL-session management statements.
- 18) Clause 18, “Dynamic SQL”, defines the dynamic SQL statements.
- 19) Clause 19, “Embedded SQL”, defines the embedded SQL statements.

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- 20) Clause 20, “Call-Level Interface specifications”, defines facilities for using SQL through a Call-Level Interface.
- 21) Clause 21, “SQL/CLI routines”, defines each of the routines that comprise the Call-Level Interface.
- 22) Clause 22, “SQL/MED common specifications”, specifies common facilities used by SQL/MED.
- 23) Clause 23, “Foreign-data wrapper interface routines”, specifies the interaction between an SQL-server and a foreign-data wrapper.
- 24) Clause 24, “Diagnostics management”, defines the diagnostics management facilities.
- 25) Clause 25, “Information Schema”, defines viewed tables that contain schema information.
- 26) Clause 26, “Definition Schema”, defines base tables on which the viewed tables containing schema information depend.
- 27) Clause 27, “Status codes”, defines values that identify the status of the execution of SQL-statements and the mechanisms by which those values are returned.
- 28) Clause 28, “Conformance”, specifies the way in which conformance to this part of ISO/IEC 9075 may be claimed.
- 29) Annex A, “SQL Conformance Summary”, is an informative Annex. It summarizes the conformance requirements of the SQL language.
- 30) Annex B, “Implementation-defined elements”, is an informative Annex. It lists those features for which this part of ISO/IEC 9075 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.
- 31) Annex C, “Implementation-dependent elements”, is an informative Annex. It lists those features for which this part of ISO/IEC 9075 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.
- 32) Annex D, “Deprecated features”, is an informative Annex. It lists features that the responsible Technical Committee intend will not appear in a future revised version of this part of ISO/IEC 9075.
- 33) Annex E, “Incompatibilities with ISO/IEC 9075:1992”, is an informative Annex. It lists incompatibilities with the previous version of ISO/IEC 9075.
- 34) Annex F, “Typical header files”, is an informative Annex. It provides examples of typical definition files for application programs using the SQL Call-Level Interface.
- 35) Annex G, “SQL feature and package taxonomy”, is an informative Annex. It identifies features and packages of the SQL language specified in this part of ISO/IEC 9075 by an identifier and a short descriptive name. This taxonomy is used to specify conformance to the packages specified in this part of ISO/IEC 9075. The feature taxonomy may be used to develop other profiles involving the SQL language.

- 36) Annex H, “SQL/MED model”, is an informative Annex. It uses annotated diagrams to illustrate the more important concepts of the model of SQL/MED, including the relationships between the SQL-server, foreign-data wrappers, and foreign servers.

In the text of this part of ISO/IEC 9075, Clauses begin a new odd-numbered page, and in Clause 5, “Lexical elements”, through Clause 28, “Conformance”, Subclauses begin a new page. Any resulting blank space is not significant.

Information technology — Database languages — SQL —

Part 9: Management of External Data (SQL/MED)

1 Scope

This part of ISO/IEC 9075 defines extensions to Database Language SQL to support management of external data through the use of foreign-data wrappers and datalink types.

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2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 9075. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO/IEC 9075 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

2.1 ISO/IEC JTC 1 standards

- ISO/IEC 1539-1:1997, *Information technology — Programming languages — Fortran — Part 1: Base language*.
- ISO 1989:1985, *Programming languages — COBOL*.
(Endorsement of ANSI X3.23-1985).
- ISO 6160:1979, *Programming languages — PL/I*.
(Endorsement of ANSI X3.53-1976).
- ISO/IEC 7185:1990, *Information technology — Programming languages — Pascal*.
- ISO/IEC 8652:1995, *Information technology — Programming languages — Ada*.
- ISO/IEC 9075-1:1999, *Information technology — Database languages — SQL — Part 1: Framework (SQL/Framework)*.
- ISO/IEC 9075-2:1999, *Information technology — Database languages — SQL — Part 2: Foundation (SQL/Foundation)*.
- ISO/IEC 9075-3:1999, *Information technology — Database languages — SQL — Part 3: Call-Level Interface (SQL/CLI)*.
- ISO/IEC 9075-4:1999, *Information technology — Database languages — SQL — Part 4: Persistent Stored Modules (SQL/PSM)*.
- ISO/IEC 9075-5:1999, *Information technology — Database languages — SQL — Part 5: Host Language Bindings (SQL/Bindings)*.

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2.1 ISO/IEC JTC 1 standards

- ISO/IEC 9899:1990, *Programming languages — C*.
- ISO/IEC 10206:1991, *Information technology — Programming languages — Extended Pascal*.
- ISO/IEC 11756:1992, *Information technology — Programming languages — M*.

2.2 Publicly-available specifications

- RFC 1738: *Uniform Resource Locators (URL)*, T. Berners-Lee, L. Masinter, M. McCahill, December, 1994.
- RFC 1808, *Relative Uniform Resource Locators*, R. Fielding, June, 1995.
- RFC 2368, *The mailto URL scheme*, R. Hoffman, L. Masinter, J. Zawinski, July, 1998.
- <http://www.w2.org/TR/1998/REC-xml-19980210>, *Extensible Markup Language (XML) 1.0*, Tim Bray, Jean Paoli, and C. M. Sperberg-McQueen (editors), corrected by <http://www.w3.org/XML/xml-19980210-errata>

3 Definitions, notations, and conventions

3.1 Definitions

3.1.1 Definitions provided in Part 9

Insert this paragraph For the purposes of this part of ISO/IEC 9075, the definitions given in ISO/IEC 9075-1, ISO/IEC 9075-2, ISO/IEC 9075-3, ISO/IEC 9075-4, and ISO/IEC 9075-5 and the following definitions apply.

- a) **access token:** An encrypted value returned under certain conditions by an SQL-server in combination with the File Reference of a datalink value.
- b) **datalink:** A value, of data type DATALINK, referencing some file that is not part of the SQL-environment. The file is assumed to be managed by some external file manager.
- c) **datalinker:** An implementation-dependent component for controlling access and referential integrity to external files.
- d) **external data:** Data that is not managed by an SQL-server involved in an SQL-session, but that is nevertheless accessible to that SQL-session.
- e) **foreign-data wrapper:** A named collection of routines, invocable by the SQL-server, supporting the programming interface specified for such routines in this part of ISO/IEC 9075.
- f) **foreign server:** A named server, external to the SQL-environment, but known to the SQL-server, that manages external data.
- g) **foreign table:** A named table whose rows are supplied when needed by some foreign server. The mechanism by which these rows are supplied is provided by a foreign-data wrapper. The data constituting a foreign table is not part of the SQL-environment.
- h) **integrity option:** Specifies the level of integrity of the link between a datalink and the file that it references.
- i) **link control:** A property of a column of data type DATALINK, specifying the extent to which the links between datalinks in that column and the files they reference are to be monitored (in various specific manners).
- j) **read permission option:** A link control option specifying how permission to read external files referenced by certain datalinks is determined.
- k) **recovery option:** A link control option specifying whether or not point in time recovery is required for the files referenced by certain datalinks.
- l) **SQL/MED-implementation:** An SQL-implementation that processes SQL-statements that are possibly extended by the language defined in this part of ISO/IEC 9075. A *conforming SQL/MED-implementation* is an SQL/MED-implementation that satisfied the requirements for SQL/MED-implementations as defined in Clause 28, "Conformance".

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3.1 Definitions

- m) **unlink option**: A link control option specifying the action to be taken when certain sites occupied by datalinks are updated or deleted.
- n) **user mapping**: An implementation-defined mapping of an authorization identifier to an equivalent concept maintained by a foreign server.
- o) **write permission option**: A link control option specifying how permission to write files referenced by certain datalinks is determined.

3.1.2 Definitions taken from XML

This part of ISO/IEC 9075 makes use of the following terms defined in the W3C Recommendation for XML:

- a) **Valid XML document**
- b) **XML document**
- c) **XML document type declaration** (also known as “DTD”)

3.2 Notations

Insert this paragraph The syntax notation used in this part of ISO/IEC 9075 is an extended version of BNF (“Backus Normal Form” or “Backus Naur Form”). This version of BNF is fully described in Subclause 6.1, “Notation”, of ISO/IEC 9075-1.

3.3 Conventions

Insert this paragraph Except as otherwise specified in this part of ISO/IEC 9075, the conventions used in this part of ISO/IEC 9075 are identical to those described in ISO/IEC 9075-1 and ISO/IEC 9075-2.

3.3.1 Relationships to other parts of ISO/IEC 9075

3.3.1.1 Clause, Subclause, and Table relationships

Table 1—Clause, Subclause, and Table relationships

Clause, Subclause, or Table in this part of ISO/IEC 9075	Corresponding Clause, Subclause, or Table from another part	Part containing correspondence
Clause 1, “Scope”	Clause 1, “Scope”	ISO/IEC 9075-2
Clause 2, “Normative references”	Clause 2, “Normative references”	ISO/IEC 9075-2
Subclause 2.1, “ISO/IEC JTC 1 standards”	Clause 2, “Normative references”	ISO/IEC 9075-2

Table 1—Clause, Subclause, and Table relationships (Cont.)

Clause, Subclause, or Table in this part of ISO/IEC 9075	Corresponding Clause, Subclause, or Table from another part	Part containing correspondence
Subclause 2.2, "Publicly-available specifications"	<i>none</i>	<i>none</i>
Clause 3, "Definitions, notations, and conventions"	Clause 3, "Definitions, notations, and conventions"	ISO/IEC 9075-2
Subclause 3.1, "Definitions"	Subclause 3.1, "Definitions"	ISO/IEC 9075-2
Subclause 3.1.1, "Definitions provided in Part 9"	<i>none</i>	<i>none</i>
Subclause 3.1.2, "Definitions taken from XML"	<i>none</i>	<i>none</i>
Subclause 3.2, "Notations"	Subclause 6.1, "Notation"	ISO/IEC 9075-1
Subclause 3.3, "Conventions"	Subclause 3.3, "Conventions"	ISO/IEC 9075-1
Subclause 3.3.1, "Relationships to other parts of ISO/IEC 9075"	<i>none</i>	<i>none</i>
Subclause 3.3.1.1, "Clause, Subclause, and Table relationships"	<i>none</i>	<i>none</i>
Subclause 3.4, "Object identifier for Database Language SQL"	Subclause 6.3, "Object identifier for Database Language SQL"	ISO/IEC 9075-1
Clause 4, "Concepts"	Clause 4, "Concepts"	ISO/IEC 9075-2
Subclause 4.1, "SQL-environments and their components"	Subclause 4.2, "SQL-environments and their components"	ISO/IEC 9075-1
Subclause 4.1.1, "SQL-environments"	Subclause 4.2.1, "SQL-environments"	ISO/IEC 9075-1
Subclause 4.1.2, "User mapping concepts"	<i>none</i>	<i>none</i>
Subclause 4.1.3, "Catalogs and schemas"	Subclause 4.2.6, "Catalogs and schemas"	ISO/IEC 9075-1
Subclause 4.1.3.1, "Catalogs"	Subclause 4.2.6.1, "Catalogs"	ISO/IEC 9075-1
Subclause 4.1.4, "Foreign servers and descriptors"	<i>none</i>	<i>none</i>
Subclause 4.1.5, "Foreign-data wrappers and descriptors"	<i>none</i>	<i>none</i>
Subclause 4.2, "Data types"	Subclause 4.1, "Data types"	ISO/IEC 9075-2
Subclause 4.3, "Foreign servers"	<i>none</i>	<i>none</i>
Subclause 4.4, "Foreign-data wrappers"	<i>none</i>	<i>none</i>
Subclause 4.5, "User mappings"	<i>none</i>	<i>none</i>
Subclause 4.6, "Generic options"	<i>none</i>	<i>none</i>

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Table 1—Clause, Subclause, and Table relationships (Cont.)

Clause, Subclause, or Table in this part of ISO/IEC 9075	Corresponding Clause, Subclause, or Table from another part	Part containing correspondence
Subclause 4.7, “Capabilities and options information”	<i>none</i>	<i>none</i>
Subclause 4.8, “Datalinks”	<i>none</i>	<i>none</i>
Subclause 4.8.1, “Operations involving datalinks”	<i>none</i>	<i>none</i>
Subclause 4.8.1.1, “Operators that operate on datalinks”	<i>none</i>	<i>none</i>
Subclause 4.8.1.2, “Other operators involving datalinks”	<i>none</i>	<i>none</i>
Subclause 4.9, “Type conversion and mixing of data types”	Subclause 4.12, “Type conversions and mixing of data types”	ISO/IEC 9075-2
Subclause 4.10, “Columns, fields, and attributes”	Subclause 4.15, “Columns, fields, and attributes”	ISO/IEC 9075-2
Subclause 4.11, “Tables”	Subclause 4.16, “Tables”	ISO/IEC 9075-2
Subclause 4.11.1, “Types of tables”	Subclause 4.16.1, “Types of tables”	ISO/IEC 9075-2
Subclause 4.12, “Functional dependencies”	Subclause 4.18, “Functional dependencies”	ISO/IEC 9075-2
Subclause 4.12.1, “Known functional dependencies in a foreign table”	<i>none</i>	<i>none</i>
Subclause 4.13, “SQL-schemas”	Subclause 4.20, “SQL-schemas”	ISO/IEC 9075-2
Subclause 4.14, “SQL-statements”	4.30, “SQL-statements”	ISO/IEC 9075-2
Subclause 4.14.1, “SQL-statements classified by function”	Subclause 4.30.2, “SQL-statements classified by function”	ISO/IEC 9075-2
Subclause 4.15, “SQL-sessions”	Subclause 4.34, “SQL-sessions”	ISO/IEC 9075-3
Subclause 4.16, “Privileges”	Subclause 4.31.2, “Privileges”	ISO/IEC 9075-2
Subclause 4.17, “SQL-transactions”	Subclause 4.32, “SQL-transactions”	ISO/IEC 9075-2
Subclause 4.18, “Foreign-data wrapper interface”	<i>none</i>	<i>none</i>
Subclause 4.18.1, “Handles”	<i>none</i>	<i>none</i>
Subclause 4.18.2, “Foreign server sessions”	<i>none</i>	<i>none</i>
Subclause 4.18.3, “Foreign-data wrapper interface routines”	<i>none</i>	<i>none</i>
Subclause 4.18.3.1, “Handle routines”	<i>none</i>	<i>none</i>
Subclause 4.18.3.2, “Initialization routines”	<i>none</i>	<i>none</i>

Table 1—Clause, Subclause, and Table relationships (Cont.)

Clause, Subclause, or Table in this part of ISO/IEC 9075	Corresponding Clause, Subclause, or Table from another part	Part containing correspondence
Subclause 4.18.3.3, "Access routines"	<i>none</i>	<i>none</i>
Subclause 4.18.3.4, "Termination routines"	<i>none</i>	<i>none</i>
Subclause 4.18.3.5, "Decomposition and pass-through modes"	<i>none</i>	<i>none</i>
Subclause 4.18.3.6, "Sequence of actions during the execution of requests involving foreign tables and foreign servers"	<i>none</i>	<i>none</i>
Subclause 4.18.4, "Return codes"	<i>none</i>	<i>none</i>
Subclause 4.18.5, "Foreign-data wrapper diagnostics areas"	<i>none</i>	<i>none</i>
Subclause 4.18.6, "Null pointers"	<i>none</i>	<i>none</i>
Subclause 4.18.7, "Foreign-data wrapper descriptor areas"	<i>none</i>	<i>none</i>
Subclause 4.19, "Introduction to SQL/CLI"	Subclause 4.1, "Introduction to SQL/CLI"	ISO/IEC 9075-3
Clause 5, "Lexical elements"	Clause 4, "Lexical elements"	ISO/IEC 9075-2
Subclause 5.1, "<token> and <separator>"	Subclause 5.2, "<token> and <separator>"	ISO/IEC 9075-2
Subclause 5.2, "Names and identifiers"	Subclause 5.4, "Names and identifiers"	ISO/IEC 9075-2
Clause 6, "Scalar expressions"	Clause 6, "Scalar expressions"	ISO/IEC 9075-2
Subclause 6.1, "<data type>"	Subclause 6.1, "<data type>"	ISO/IEC 9075-2
Subclause 6.2, "<column reference>"	Subclause 6.6, "<column reference>"	ISO/IEC 9075-2
Subclause 6.3, "<set function specification>"	Subclause 6.16, "<set function specification>"	ISO/IEC 9075-2
Subclause 6.4, "<string value function>"	Subclause 6.18, "<string value function>"	ISO/IEC 9075-2
Subclause 6.5, "<datalink value function>"	<i>none</i>	<i>none</i>
Subclause 6.6, "<cast specification>"	Subclause 6.22, "<cast specification>"	ISO/IEC 9075-2
Subclause 6.7, "<value expression>"	Subclause 6.23, "<value expression>"	ISO/IEC 9075-2
Subclause 6.8, "<datalink value expression>"	<i>none</i>	<i>none</i>

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Table 1—Clause, Subclause, and Table relationships (Cont.)

Clause, Subclause, or Table in this part of ISO/IEC 9075	Corresponding Clause, Subclause, or Table from another part	Part containing correspondence
Clause 7, "Query expressions"	Clause 7, "Query expressions"	ISO/IEC 9075-2
Subclause 7.1, "<table reference>"	Subclause 7.6, "<table reference>"	ISO/IEC 9075-2
Subclause 7.2, "<joined table>"	Subclause 7.7, "<joined table>"	ISO/IEC 9075-2
Subclause 7.3, "<group by clause>"	Subclause 7.8, "<group by clause>"	ISO/IEC 9075-2
Subclause 7.4, "<query specification>"	Subclause 7.11, "<query specification>"	ISO/IEC 9075-2
Subclause 7.5, "<query expression>"	Subclause 7.12, "<query expression>"	ISO/IEC 9075-2
Clause 8, "Predicates"	Clause 8, "Predicates"	ISO/IEC 9075-2
Subclause 8.1, "<unique predicate>"	Subclause 8.18, "<unique predicate>"	ISO/IEC 9075-2
Clause 9, "URLs"	<i>none</i>	<i>none</i>
Subclause 9.1, "URL format"	<i>none</i>	<i>none</i>
Clause 10, "Data assignment rules and routine determination"	Clause 9, "Data assignment rules and routine determination"	ISO/IEC 9075-2
Subclause 10.1, "Retrieval assignment"	Subclause 9.1, "Retrieval assignment"	ISO/IEC 9075-2
Subclause 10.2, "Store assignment"	Subclause 9.2, "Store assignment"	ISO/IEC 9075-2
Subclause 10.3, "Data types of results of aggregations"	Subclause 9.3, "Data types of results of aggregations"	ISO/IEC 9075-2
Subclause 10.4, "Type precedence list determination"	Subclause 9.5, "Type precedence list determination"	ISO/IEC 9075-2
Subclause 10.5, "Determination of identical values"	Subclause 9.0, "Determination of identical values"	ISO/IEC 9075-2/Cor.1
Clause 11, "Additional common elements"	Clause 10, "Additional common elements"	ISO/IEC 9075-2
Subclause 11.1, "<privileges>"	Subclause 10.5, "<privileges>"	ISO/IEC 9075-2
Subclause 11.2, "<generic options>"	<i>none</i>	<i>none</i>
Subclause 11.3, "<alter generic options>"	<i>none</i>	<i>none</i>
Clause 12, "Schema definition and manipulation"	Clause 11, "Schema definition and manipulation"	ISO/IEC 9075-2
Subclause 12.1, "<schema definition>"	Subclause 11.1, "<schema definition>"	ISO/IEC 9075-2
Subclause 12.2, "<drop schema statement>"	Subclause 11.2, "<drop schema statement>"	ISO/IEC 9075-2

Table 1—Clause, Subclause, and Table relationships (Cont.)

Clause, Subclause, or Table in this part of ISO/IEC 9075	Corresponding Clause, Subclause, or Table from another part	Part containing correspondence
Subclause 12.3, "<table definition>"	Subclause 11.3, "<table definition>"	ISO/IEC 9075-2
Subclause 12.4, "<column definition>"	Subclause 11.4, "<column definition>"	ISO/IEC 9075-2
Subclause 12.5, "<unique constraint definition>"	Subclause 11.7, "<unique constraint definition>"	ISO/IEC 9075-2
Subclause 12.6, "<drop column definition>"	Subclause 11.17, "<drop column definition>"	ISO/IEC 9075-2
Subclause 12.7, "<domain definition>"	Subclause 11.23, "<domain definition>"	ISO/IEC 9075-2
Subclause 12.8, "<SQL-invoked routine>"	Subclause 11.49, "<SQL-invoked routine>"	ISO/IEC 9075-2
Subclause 12.9, "<user-defined type definition>"	Subclause 11.40, "<user-defined type definition>"	ISO/IEC 9075-2
Subclause 12.10, "<user-defined cast definition>"	Subclause 11.52, "<user-defined cast definition>"	ISO/IEC 9075-2
Subclause 12.11, "<user-defined ordering definition>"	Subclause 11.54, "<user-defined ordering definition>"	ISO/IEC 9075-2
Subclause 12.12, "<foreign table definition>"	<i>none</i>	<i>none</i>
Subclause 12.13, "<alter foreign table statement>"	<i>none</i>	<i>none</i>
Subclause 12.14, "<add basic column definition>"	<i>none</i>	<i>none</i>
Subclause 12.15, "<alter basic column definition>"	<i>none</i>	<i>none</i>
Subclause 12.16, "<drop basic column definition>"	<i>none</i>	<i>none</i>
Subclause 12.17, "<drop foreign table statement>"	<i>none</i>	<i>none</i>
Clause 13, "Catalog manipulation"	<i>none</i>	<i>none</i>
Subclause 13.1, "<foreign server definition>"	<i>none</i>	<i>none</i>
Subclause 13.2, "<alter foreign server statement>"	<i>none</i>	<i>none</i>
Subclause 13.3, "<drop foreign server statement>"	<i>none</i>	<i>none</i>
Subclause 13.4, "<foreign-data wrapper definition>"	<i>none</i>	<i>none</i>

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Table 1—Clause, Subclause, and Table relationships (Cont.)

Clause, Subclause, or Table in this part of ISO/IEC 9075	Corresponding Clause, Subclause, or Table from another part	Part containing correspondence
Subclause 13.5, "<alter foreign-data wrapper statement>"	<i>none</i>	<i>none</i>
Subclause 13.6, "<drop foreign-data wrapper statement>"	<i>none</i>	<i>none</i>
Subclause 13.7, "<import foreign schema statement>"	<i>none</i>	<i>none</i>
Clause 14, "Access control"	Clause 12, "Access control"	ISO/IEC 9075-2
Subclause 14.1, "<revoke statement>"	Subclause 12.1, "<revoke statement>"	ISO/IEC 9075-2
Subclause 14.2, "<user mapping definition>"	<i>none</i>	<i>none</i>
Subclause 14.3, "<alter user mapping statement>"	<i>none</i>	<i>none</i>
Subclause 14.4, "<drop user mapping statement>"	<i>none</i>	<i>none</i>
Clause 15, "SQL-client modules"	Clause 13, "SQL-client modules"	ISO/IEC 9075-2
Subclause 15.1, "<SQL-client module definition>"	Subclause 13.1, "<SQL-client module definition>"	ISO/IEC 9075-2
Subclause 15.2, "<externally-invoked procedure>"	Subclause 13.3, "<externally-invoked procedure>"	ISO/IEC 9075-2
Subclause 15.3, "Calls to an <externally-invoked procedure>"	Subclause 13.4, "Calls to an <externally-invoked procedure>"	ISO/IEC 9075-2
Subclause 15.4, "<SQL procedure statement>"	Subclause 13.5, "<SQL procedure statement>"	ISO/IEC 9075-2
Subclause 15.5, "Data type correspondences"	Subclause 13.6, "Data type correspondences"	ISO/IEC 9075-2
Clause 16, "Data manipulation"	Clause 14, "Data manipulation"	ISO/IEC 9075-2
Subclause 16.1, "<declare cursor>"	Subclause 14.1, "<declare cursor>"	ISO/IEC 9075-2
Subclause 16.2, "Effect of deleting rows from base tables"	Subclause 14.14, "Effect of deleting rows from base tables"	ISO/IEC 9075-2
Subclause 16.3, "Effect of inserting tables into base tables"	Subclause 14.17, "Effect of inserting tables into base tables"	ISO/IEC 9075-2
Subclause 16.4, "Effect of replacing rows in base tables"	Subclause 14.20, "Effect of replacing rows in base tables"	ISO/IEC 9075-2
Clause 17, "Session management"	Clause 18, "Session management"	ISO/IEC 9075-2
Subclause 17.1, "<set passthrough statement>"	<i>none</i>	<i>none</i>
Clause 18, "Dynamic SQL"	Clause 15, "Dynamic SQL"	ISO/IEC 9075-5

Table 1—Clause, Subclause, and Table relationships (Cont.)

Clause, Subclause, or Table in this part of ISO/IEC 9075	Corresponding Clause, Subclause, or Table from another part	Part containing correspondence
Subclause 18.1, "Description of SQL descriptor areas"	Subclause 15.1, "Description of SQL descriptor areas"	ISO/IEC 9075-5
Subclause 18.2, "<prepare statement>"	Subclause 15.6, "<prepare statement>"	ISO/IEC 9075-2
Subclause 18.3, "<deallocate prepared statement>"	Subclause 15.7, "<deallocate prepared statement>"	ISO/IEC 9075-2
Subclause 18.4, "<describe statement>"	Subclause 15.8, "<describe statement>"	ISO/IEC 9075-5
Subclause 18.5, "<input using clause>"	Subclause 15.9, "<input using clause>"	ISO/IEC 9075-5
Subclause 18.6, "<output using clause>"	Subclause 15.10, "<output using clause>"	ISO/IEC 9075-5
Subclause 18.7, "<execute statement>"	Subclause 15.11, "<execute statement>"	ISO/IEC 9075-5
Subclause 18.8, "<dynamic declare cursor>"	Subclause 15.13, "<dynamic declare cursor>"	ISO/IEC 9075-5
Subclause 18.9, "<allocate cursor statement>"	Subclause 15.14, "<allocate cursor statement>"	ISO/IEC 9075-5
Subclause 18.10, "<dynamic open statement>"	Subclause 15.15, "<dynamic open statement>"	ISO/IEC 9075-5
Subclause 18.11, "<dynamic fetch statement>"	Subclause 15.16, "<dynamic fetch statement>"	ISO/IEC 9075-5
Subclause 18.12, "<dynamic close statement>"	Subclause 15.18, "<dynamic close statement>"	ISO/IEC 9075-5
Clause 19, "Embedded SQL"	Clause 16, "Embedded SQL"	ISO/IEC 9075-5
Subclause 19.1, "<embedded SQL Ada program>"	Subclause 16.3, "<embedded SQL Ada program>"	ISO/IEC 9075-5
Subclause 19.2, "<embedded SQL C program>"	Subclause 16.4, "<embedded SQL C program>"	ISO/IEC 9075-5
Subclause 19.3, "<embedded SQL COBOL program>"	Subclause 16.5, "<embedded SQL COBOL program>"	ISO/IEC 9075-5
Subclause 19.4, "<embedded SQL Fortran program>"	Subclause 16.6, "<embedded SQL Fortran program>"	ISO/IEC 9075-5
Subclause 19.5, "<embedded SQL MUMPS program>"	Subclause 16.7, "<embedded SQL MUMPS program>"	ISO/IEC 9075-5
Subclause 19.6, "<embedded SQL Pascal program>"	Subclause 16.8, "<embedded SQL Pascal program>"	ISO/IEC 9075-5
Subclause 19.7, "<embedded SQL PL/I program>"	Subclause 16.9, "<embedded SQL PL/I program>"	ISO/IEC 9075-5

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Table 1—Clause, Subclause, and Table relationships (Cont.)

Clause, Subclause, or Table in this part of ISO/IEC 9075	Corresponding Clause, Subclause, or Table from another part	Part containing correspondence
Clause 20, "Call-Level Interface specifications"	Clause 5, "Call-Level Interface specifications"	ISO/IEC 9075-3
Subclause 20.1, "<CLI routine>"	Subclause 5.1, "<CLI routine>"	ISO/IEC 9075-3
Subclause 20.2, "Implicit DESCRIBE USING clause"	Subclause 5.5, "Implicit DESCRIBE USING clause"	ISO/IEC 9075-3
Subclause 20.2.1, "CLI-specific status codes"	Subclause 5.12, "CLI-specific status codes"	ISO/IEC 9075-3
Subclause 20.2.2, "Description of CLI item descriptor areas"	Subclause 5.13, "Description of CLI item descriptor areas"	ISO/IEC 9075-3
Subclause 20.2.3, "Other tables associated with CLI"	Subclause 5.14, "Other tables associated with CLI"	ISO/IEC 9075-3
Subclause 20.3, "SQL/CLI data type correspondences"	Subclause 5.15, "SQL/CLI data type correspondences"	ISO/IEC 9075-3
Clause 21, "SQL/CLI routines"	Clause 6, "SQL/CLI routines"	ISO/IEC 9075-3
Subclause 21.1, "BuildDataLink"	<i>none</i>	<i>none</i>
Subclause 21.2, "GetDataLinkAttr"	<i>none</i>	<i>none</i>
Subclause 21.3, "GetInfo"	Subclause 6.38, "GetInfo"	ISO/IEC 9075-3
Clause 22, "SQL/MED common specifications"	<i>none</i>	<i>none</i>
Subclause 22.1, "Description of foreign-data wrapper item descriptor areas"	<i>none</i>	<i>none</i>
Subclause 22.2, "Implicit cursor"	<i>none</i>	<i>none</i>
Subclause 22.3, "Implicit DESCRIBE INPUT USING clause"	<i>none</i>	<i>none</i>
Subclause 22.4, "Implicit DESCRIBE OUTPUT USING clause"	<i>none</i>	<i>none</i>
Subclause 22.5, "Implicit EXECUTE USING and OPEN USING clauses"	<i>none</i>	<i>none</i>
Subclause 22.6, "Implicit FETCH USING clause"	<i>none</i>	<i>none</i>
Subclause 22.7, "Character string retrieval"	<i>none</i>	<i>none</i>
Subclause 22.8, "Binary large object string retrieval"	<i>none</i>	<i>none</i>
Subclause 22.9, "Tables used with SQL/MED"	<i>none</i>	<i>none</i>

Table 1—Clause, Subclause, and Table relationships (Cont.)

Clause, Subclause, or Table in this part of ISO/IEC 9075	Corresponding Clause, Subclause, or Table from another part	Part containing correspondence
Clause 23, “Foreign-data wrapper interface routines”	<i>none</i>	<i>none</i>
Subclause 23.1, “<foreign-data wrapper interface routine>”	<i>none</i>	<i>none</i>
Subclause 23.2, “<foreign-data wrapper interface routine> invocation”	<i>none</i>	<i>none</i>
Subclause 23.3, “Foreign-data wrapper interface wrapper routines”	<i>none</i>	<i>none</i>
Subclause 23.3.1, “AllocWrapperEnv”	<i>none</i>	<i>none</i>
Subclause 23.3.2, “Close”	<i>none</i>	<i>none</i>
Subclause 23.3.3, “ConnectServer”	<i>none</i>	<i>none</i>
Subclause 23.3.4, “FreeExecutionHandle”	<i>none</i>	<i>none</i>
Subclause 23.3.5, “FreeFSConnection”	<i>none</i>	<i>none</i>
Subclause 23.3.6, “FreeReplyHandle”	<i>none</i>	<i>none</i>
Subclause 23.3.7, “FreeWrapperEnv”	<i>none</i>	<i>none</i>
Subclause 23.3.8, “GetNumReplySelectElems”	<i>none</i>	<i>none</i>
Subclause 23.3.9, “GetNumReplyTableRefs”	<i>none</i>	<i>none</i>
Subclause 23.3.10, “GetOpts”	<i>none</i>	<i>none</i>
Subclause 23.3.11, “GetReplySelectElem”	<i>none</i>	<i>none</i>
Subclause 23.3.12, “GetReplyTableRef”	<i>none</i>	<i>none</i>
Subclause 23.3.13, “GetSPDHandle”	<i>none</i>	<i>none</i>
Subclause 23.3.14, “GetSRDHandle”	<i>none</i>	<i>none</i>
Subclause 23.3.15, “GetStatistics”	<i>none</i>	<i>none</i>
Subclause 23.3.16, “GetWPDHandle”	<i>none</i>	<i>none</i>
Subclause 23.3.17, “GetWRDHandle”	<i>none</i>	<i>none</i>
Subclause 23.3.18, “InitRequest”	<i>none</i>	<i>none</i>

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Table 1—Clause, Subclause, and Table relationships (Cont.)

Clause, Subclause, or Table in this part of ISO/IEC 9075	Corresponding Clause, Subclause, or Table from another part	Part containing correspondence
Subclause 23.3.19, “Iterate”	<i>none</i>	<i>none</i>
Subclause 23.3.20, “Open”	<i>none</i>	<i>none</i>
Subclause 23.3.21, “ReOpen”	<i>none</i>	<i>none</i>
Subclause 23.3.22, “TransmitRequest”	<i>none</i>	<i>none</i>
Subclause 23.4, “Foreign-data wrapper interface SQL-server routines”	<i>none</i>	<i>none</i>
Subclause 23.4.1, “AllocDescriptor”	<i>none</i>	<i>none</i>
Subclause 23.4.2, “FreeDescriptor”	<i>none</i>	<i>none</i>
Subclause 23.4.3, “GetAuthorizationId”	<i>none</i>	<i>none</i>
Subclause 23.4.4, “GetDescriptor”	<i>none</i>	<i>none</i>
Subclause 23.4.5, “GetNumSelectElems”	<i>none</i>	<i>none</i>
Subclause 23.4.6, “GetNumServerOpts”	<i>none</i>	<i>none</i>
Subclause 23.4.7, “GetNumTableColOpts”	<i>none</i>	<i>none</i>
Subclause 23.4.8, “GetNumTableOpts”	<i>none</i>	<i>none</i>
Subclause 23.4.9, “GetNumTableRefElems”	<i>none</i>	<i>none</i>
Subclause 23.4.10, “GetNumUserOpts”	<i>none</i>	<i>none</i>
Subclause 23.4.11, “GetNumWrapperOpts”	<i>none</i>	<i>none</i>
Subclause 23.4.12, “GetSelectElem”	<i>none</i>	<i>none</i>
Subclause 23.4.13, “GetSelectElemType”	<i>none</i>	<i>none</i>
Subclause 23.4.14, “GetServerName”	<i>none</i>	<i>none</i>
Subclause 23.4.15, “GetServerOpt”	<i>none</i>	<i>none</i>
Subclause 23.4.16, “GetServerOptByName”	<i>none</i>	<i>none</i>
Subclause 23.4.17, “GetServerType”	<i>none</i>	<i>none</i>
Subclause 23.4.18, “GetServerVersion”	<i>none</i>	<i>none</i>

Table 1—Clause, Subclause, and Table relationships (Cont.)

Clause, Subclause, or Table in this part of ISO/IEC 9075	Corresponding Clause, Subclause, or Table from another part	Part containing correspondence
Subclause 23.4.19, "GetSQLString"	<i>none</i>	<i>none</i>
Subclause 23.4.20, "GetTable-ColOpt"	<i>none</i>	<i>none</i>
Subclause 23.4.21, "GetTable-ColOptByName"	<i>none</i>	<i>none</i>
Subclause 23.4.22, "GetTableOpt"	<i>none</i>	<i>none</i>
Subclause 23.4.23, "GetTableOptByName"	<i>none</i>	<i>none</i>
Subclause 23.4.24, "GetTableRef-Elem"	<i>none</i>	<i>none</i>
Subclause 23.4.25, "GetTableRef-ElemType"	<i>none</i>	<i>none</i>
Subclause 23.4.26, "GetTableRef-TableName"	<i>none</i>	<i>none</i>
Subclause 23.4.27, "GetTableServer-Name"	<i>none</i>	<i>none</i>
Subclause 23.4.28, "GetTRDHandle"	<i>none</i>	<i>none</i>
Subclause 23.4.29, "GetUserOpt"	<i>none</i>	<i>none</i>
Subclause 23.4.30, "GetUserOptByName"	<i>none</i>	<i>none</i>
Subclause 23.4.31, "GetValExprCol-Name"	<i>none</i>	<i>none</i>
Subclause 23.4.32, "GetWrapperLibraryName"	<i>none</i>	<i>none</i>
Subclause 23.4.33, "GetWrapper-Name"	<i>none</i>	<i>none</i>
Subclause 23.4.34, "GetWrapper-Opt"	<i>none</i>	<i>none</i>
Subclause 23.4.35, "GetWrapperOpt-ByName"	<i>none</i>	<i>none</i>
Subclause 23.4.36, "SetDescriptor"	<i>none</i>	<i>none</i>
Subclause 23.5, "Foreign-data wrapper interface general routines"	<i>none</i>	<i>none</i>
Subclause 23.5.1, "GetDiagnostics"	<i>none</i>	<i>none</i>
Clause 24, "Diagnostics management"	Clause 19, "Diagnostics management"	ISO/IEC 9075-2
Subclause 24.1, "<get diagnostics statement>"	Subclause 19.1, "<get diagnostics statement>"	ISO/IEC 9075-2

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3.3 Conventions

Table 1—Clause, Subclause, and Table relationships (Cont.)

Clause, Subclause, or Table in this part of ISO/IEC 9075	Corresponding Clause, Subclause, or Table from another part	Part containing correspondence
Clause 25, "Information Schema"	Clause 20, "Information Schema"	ISO/IEC 9075-2
Subclause 25.1, "ATTRIBUTES view"	Subclause 20.11, "ATTRIBUTES view"	ISO/IEC 9075-2
Subclause 25.2, "COLUMN_OPTIONS view"	<i>none</i>	<i>none</i>
Subclause 25.3, "COLUMNS view"	Subclause 20.18, "COLUMNS view"	ISO/IEC 9075-2
Subclause 25.4, "FOREIGN_DATA_WRAPPER_OPTIONS view"	<i>none</i>	<i>none</i>
Subclause 25.5, "FOREIGN_DATA_WRAPPERS view"	<i>none</i>	<i>none</i>
Subclause 25.6, "FOREIGN_SERVER_OPTIONS view"	<i>none</i>	<i>none</i>
Subclause 25.7, "FOREIGN_SERVERS view"	<i>none</i>	<i>none</i>
Subclause 25.8, "FOREIGN_TABLE_OPTIONS view"	<i>none</i>	<i>none</i>
Subclause 25.9, "FOREIGN_TABLES view"	<i>none</i>	<i>none</i>
Subclause 25.10, "USER_MAP_OPTIONS view"	<i>none</i>	<i>none</i>
Subclause 25.11, "USER_MAPPINGS view"	<i>none</i>	<i>none</i>
Subclause 25.12, "Short name views"	Subclause 20.69, "Short name views"	ISO/IEC 9075-2
Clause 26, "Definition Schema"	Clause 21, "Definition Schema"	ISO/IEC 9075-2
Subclause 26.1, "COLUMN_OPTIONS base table"	<i>none</i>	<i>none</i>
Subclause 26.2, "DATA_TYPE_DESCRIPTOR base table"	Subclause 21.15, "DATA_TYPE_DESCRIPTOR base table"	ISO/IEC 9075-2
Subclause 26.3, "FOREIGN_DATA_WRAPPER_OPTIONS base table"	<i>none</i>	<i>none</i>
Subclause 26.4, "FOREIGN_DATA_WRAPPERS base table"	<i>none</i>	<i>none</i>
Subclause 26.5, "FOREIGN_SERVER_OPTIONS base table"	<i>none</i>	<i>none</i>
Subclause 26.6, "FOREIGN_SERVERS base table"	<i>none</i>	<i>none</i>
Subclause 26.7, "FOREIGN_TABLE_OPTIONS base table"	<i>none</i>	<i>none</i>

Table 1—Clause, Subclause, and Table relationships (Cont.)

Clause, Subclause, or Table in this part of ISO/IEC 9075	Corresponding Clause, Subclause, or Table from another part	Part containing correspondence
Subclause 26.8, "FOREIGN_TABLES base table"	<i>none</i>	<i>none</i>
Subclause 26.9, "SQL_SIZING base table"	Subclause 7.2, "SQL_SIZING base table"	ISO/IEC 9075-3
Subclause 26.10, "TABLES base table"	Subclause 21.43, "TABLES base table"	ISO/IEC 9075-2
Subclause 26.11, "USAGE_PRIVILEGES base table"	Subclause 21.50, "USAGE_PRIVILEGES base table"	ISO/IEC 9075-2
Subclause 26.12, "USER_MAPPING_OPTIONS base table"	<i>none</i>	<i>none</i>
Subclause 26.13, "USER_MAPPINGS base table"	<i>none</i>	<i>none</i>
Clause 27, "Status codes"	Clause 22, "Status codes"	ISO/IEC 9075-2
Subclause 27.1, "SQLSTATE"	Subclause 22.1, "SQLSTATE"	ISO/IEC 9075-2
Clause 28, "Conformance"	Clause 8, "Conformance"	ISO/IEC 9075-1
Subclause 28.1, "SQL-server conformance to SQL/MED"	<i>none</i>	<i>none</i>
Subclause 28.2, "Foreign-data-wrapper conformance to SQL/MED"	<i>none</i>	<i>none</i>
Subclause 28.3, "Claims of conformance by SQL-servers"	<i>none</i>	<i>none</i>
Subclause 28.4, "Claims of conformance by foreign-data wrappers"	<i>none</i>	<i>none</i>
Subclause 28.5, "Extensions and options"	<i>none</i>	<i>none</i>
Annex A, "SQL Conformance Summary"	Annex A, "SQL Conformance Summary"	ISO/IEC 9075-2
Annex B, "Implementation-defined elements"	Annex B, "Implementation-defined elements"	ISO/IEC 9075-2
Annex C, "Implementation-dependent elements"	Annex C, "Implementation-dependent elements"	ISO/IEC 9075-2
Annex D, "Deprecated features"	Annex D, "Deprecated features"	ISO/IEC 9075-2
Annex E, "Incompatibilities with ISO/IEC 9075:1992"	Annex E, "Incompatibilities with ISO/IEC 9075:1999"	ISO/IEC 9075-2
Annex F, "Typical header files"	Annex A, "Typical header files"	ISO/IEC 9075-3
Subclause F.1, "C Header File SQLCLI.H"	Subclause A.1, "C header file SQL-CLI.H"	ISO/IEC 9075-3

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Table 1—Clause, Subclause, and Table relationships (Cont.)

Clause, Subclause, or Table in this part of ISO/IEC 9075	Corresponding Clause, Subclause, or Table from another part	Part containing correspondence
Subclause F.2, "COBOL Library Item SQLCLI"	Subclause A.2, "COBOL library item SQLCLI"	ISO/IEC 9075-3
Annex G, "SQL feature and package taxonomy"	Annex F, "SQL feature and package taxonomy"	ISO/IEC 9075-2
Annex H, "SQL/MED model"	<i>none</i>	<i>none</i>
Figure 1, "SQL/MED interfaces"	<i>none</i>	<i>none</i>
Figure 2, "SQL/MED information flow"	<i>none</i>	<i>none</i>
Table 1, "Clause, Subclause, and Table relationships"	<i>none</i>	<i>none</i>
Table 2, "Valid datalink file control options"	<i>none</i>	<i>none</i>
Table 3, "Sequence of actions during foreign server request executions"	<i>none</i>	<i>none</i>
Table 4, "Fields used in foreign-data wrapper diagnostics areas"	<i>none</i>	<i>none</i>
Table 5, "Fields in foreign-data wrapper descriptor areas"	<i>none</i>	<i>none</i>
Table 6, "Data type correspondences for Ada"	Table 18, "Data type correspondences for Ada"	ISO/IEC 9075-2
Table 7, "Data type correspondences for C"	Table 19, "Data type correspondences for C"	ISO/IEC 9075-2
Table 8, "Data type correspondences for COBOL"	Table 20, "Data type correspondences for COBOL"	ISO/IEC 9075-2
Table 9, "Data type correspondences for Fortran"	Table 21, "Data type correspondences for Fortran"	ISO/IEC 9075-2
Table 10, "Data type correspondences for MUMPS"	Table 22, "Data type correspondences for MUMPS"	ISO/IEC 9075-2
Table 11, "Data type correspondences for Pascal"	Table 23, "Data type correspondences for Pascal"	ISO/IEC 9075-2
Table 12, "Data type correspondences for PL/I"	Table 24, "Data type correspondences for PL/I"	ISO/IEC 9075-2
Table 13, "Codes used for SQL data types in Dynamic SQL"	Table 4, "Codes used for SQL data types in Dynamic SQL"	ISO/IEC 9075-5
Table 14, "Abbreviated SQL/CLI generic names"	Table 4, "Abbreviated SQL/CLI generic names"	ISO/IEC 9075-3
Table 15, "SQLSTATE class and subclass values for SQL/CLI-specific conditions"	Table 5, "SQLSTATE class and subclass values for SQL/CLI-specific conditions"	ISO/IEC 9075-3

Table 1—Clause, Subclause, and Table relationships (Cont.)

Clause, Subclause, or Table in this part of ISO/IEC 9075	Corresponding Clause, Subclause, or Table from another part	Part containing correspondence
Table 16, "Codes used for implementation data types in SQL/CLI"	Table 7, "Codes for implementation data types in SQL/CLI"	ISO/IEC 9075-3
Table 17, "Codes used for application data types in SQL/CLI"	Table 8, "Codes for application data types in SQL/CLI"	ISO/IEC 9075-3
Table 18, "Codes used to identify SQL/CLI routines"	Table 27, "Codes used to identify SQL/CLI routines"	ISO/IEC 9075-3
Table 19, "Codes and data types for implementation information"	Table 28, "Codes and data types for implementation information"	ISO/IEC 9075-3
Table 20, "Codes used for datalink attributes"	<i>none</i>	<i>none</i>
Table 21, "Data types of attributes"	Table 19, "Data types of attributes"	ISO/IEC 9075-3
Table 22, "SQL/CLI data type correspondences for Ada"	Table 44, "SQL/CLI data type correspondences for Ada"	ISO/IEC 9075-3
Table 23, "SQL/CLI data type correspondences for C"	Table 45, "SQL/CLI data type correspondences for C"	ISO/IEC 9075-3
Table 24, "SQL/CLI data type correspondences for COBOL"	Table 46, "SQL/CLI data type correspondences for COBOL"	ISO/IEC 9075-3
Table 25, "SQL/CLI data type correspondences for Fortran"	Table 47, "SQL/CLI data type correspondences for Fortran"	ISO/IEC 9075-3
Table 26, "SQL/CLI data type correspondences for MUMPS"	Table 48, "SQL/CLI data type correspondences for MUMPS"	ISO/IEC 9075-3
Table 27, "SQL/CLI data type correspondences for Pascal"	Table 49, "SQL/CLI data type correspondences for Pascal"	ISO/IEC 9075-3
Table 28, "SQL/CLI data type correspondences for PL/I"	Table 50, "SQL/CLI data type correspondences for PL/I"	ISO/IEC 9075-3
Table 29, "Codes used for <table reference> types"	<i>none</i>	<i>none</i>
Table 30, "Codes used for <value expression> types"	<i>none</i>	<i>none</i>
Table 31, "Codes used for foreign-data wrapper diagnostic fields"	<i>none</i>	<i>none</i>
Table 32, "Codes used for foreign-data wrapper descriptor fields"	<i>none</i>	<i>none</i>
Table 33, "Codes used for foreign-data wrapper handle types"	<i>none</i>	<i>none</i>
Table 34, "Ability to retrieve foreign-data wrapper descriptor fields"	<i>none</i>	<i>none</i>
Table 35, "Ability to set foreign-data wrapper descriptor fields"	<i>none</i>	<i>none</i>

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Table 1—Clause, Subclause, and Table relationships (Cont.)

Clause, Subclause, or Table in this part of ISO/IEC 9075	Corresponding Clause, Subclause, or Table from another part	Part containing correspondence
Table 36, "Foreign-data wrapper descriptor field default values"	<i>none</i>	<i>none</i>
Table 37, "Codes used for the format of the character string transmitted by GetSQLString()"	<i>none</i>	<i>none</i>
Table 38, "SQL-statement codes"	Table 26, "SQL-statement codes"	ISO/IEC 9075-2
Table 39, "SQLSTATE class and subclass values"	Table 27, "SQLState class and subclass values"	ISO/IEC 9075-2
Table 40, "Implied feature relationships"	Table 30, "Implied feature relationships"	ISO/IEC 9075-2
Table 41, "SQL/MED feature taxonomy for features outside Core SQL"	<i>none</i>	<i>none</i>
Table 42, "Legend for SQL/MED interfaces"	<i>none</i>	<i>none</i>
Table 43, "Legend for SQL/MED information flow"	<i>none</i>	<i>none</i>

3.4 Object identifier for Database Language SQL

The object identifier for Database Language SQL is defined in Subclause 6.3, "Object identifier for Database Language SQL", in ISO/IEC 9075-1 with the following additions:

Format

```

<Part 9 yes> ::=
    <Part 9 conformance> <Part 9 datalink> <Part 9 wrapper>

<Part 9 conformance> ::= 9 | sqlmed2000 <left paren> 9 <right paren>

<Part 9 datalink> ::=
    <Part 9 datalink no>
    | <Part 9 datalink yes>
      <Part 9 datalink CLI> <Part 9 datalink language>

<Part 9 datalink CLI> ::=
    <Part 9 datalink CLI yes>
    | <Part 9 datalink CLI no>

<Part 9 datalink CLI yes> ::=
    1 | datalinkCLIyes <left paren> 1 <right paren>

<Part 9 datalink CLI no> ::=
    0 | datalinkCLIno <left paren> 0 <right paren>

<Part 9 datalink language> ::=
    <Part 9 datalink language yes>

```

3.4 Object identifier for Database Language SQL

```

| <Part 9 datalink language no>

<Part 9 datalink language yes> ::=
  1 | datalinklanguageyes <left paren> 1 <right paren>

<Part 9 datalink language no> ::=
  0 | datalinklanguageno <left paren> 0 <right paren>

<Part 9 datalink yes> ::=
  1 | datalinkyes <left paren> 1 <right paren>

<Part 9 datalink no> ::=
  0 | datalinkno <left paren> 0 <right paren>

<Part 9 wrapper> ::=
  <Part 9 wrapper no>
  | <Part 9 wrapper SQLserver yes>
    <Part 9 server schemaimport> <Part 9 server getstring>
  | <Part 9 wrapper FDW yes>
    <Part 9 FDW transmit> <Part 9 FDW SQLaware> <Part 9 FDW options>

<Part 9 wrapper SQLserver yes> ::=
  1 | sqlserveryes <left paren> 1 <right paren>

<Part 9 server schemaimport> ::=
  <Part 9 server schemaimport yes>
  | <Part 9 server schemaimport no>

<Part 9 server schemaimport yes> ::=
  1 | sqlserverschemaimportyes <left paren> 1 <right paren>

<Part 9 server schemaimport no> ::=
  0 | sqlserverschemaimportno <left paren> 0 <right paren>

<Part 9 server getstring> ::=
  <Part 9 server getstring yes>
  | <Part 9 server getstring no>

<Part 9 server getstring yes> ::=
  1 | sqlservergetstringyes <left paren> 1 <right paren>

<Part 9 server getstring no> ::=
  0 | sqlservergetstringno <left paren> 0 <right paren>

<Part 9 wrapper FDW yes> ::=
  2 | fdwyes <left paren> 2 <right paren>

<Part 9 FDW transmit> ::=
  <Part 9 FDW transmit yes>
  | <Part 9 FDW transmit no>

<Part 9 FDW transmit yes> ::=
  1 | sqlfdwtransmityes <left paren> 1 <right paren>

<Part 9 FDW transmit no> ::=
  0 | sqlfdwtransmitno <left paren> 0 <right paren>

<Part 9 FDW sqlaware> ::=
  <Part 9 FDW sqlaware yes>
  | <Part 9 FDW sqlaware no>

```

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3.4 Object identifier for Database Language SQL

<Part 9 FDW sqlaware yes> ::=
1 | sqlfdwsqlawareyes <left paren> 1 <right paren>

<Part 9 FDW sqlaware no> ::=
0 | sqlfdwsqlawareno <left paren> 0 <right paren>

<Part 9 FDW options> ::=
<Part 9 FDW options yes>
| <Part 9 FDW options no>

<Part 9 FDW options yes> ::=
1 | sqlfdwoptionsyes <left paren> 1 <right paren>

<Part 9 FDW options no> ::=
0 | sqlfdwoptionsno <left paren> 0 <right paren>

<Part 9 wrapper no> ::=
0 | wrapperno <left paren> 0 <right paren>

Syntax Rules

- 1) Specification of <Part 9 yes> implies that conformance to ISO/IEC 9075-9 is claimed.
- 2) Specification of <Part 9 datalink yes> implies that conformance to Feature M001, “Datalinks”, is claimed.
- 3) Specification of <Part 9 datalink no> implies that conformance to Feature M001, “Datalinks”, is not claimed.
- 4) Specification of <Part 9 wrapper SQLserver yes> implies that conformance to Feature M004, “Foreign data support”, is claimed by an SQL-server.
- 5) Specification of <Part 9 server schemaimport yes> implies that conformance to Feature M005, “Foreign schema support”, is claimed by an SQL-server.
- 6) Specification of <Part 9 server schemaimport no> implies that conformance to Feature M005, “Foreign schema support”, is not claimed by an SQL-server.
- 7) Specification of <Part 9 server getstring yes> implies that conformance to Feature M006, “Get-SQLString routine”, is claimed by an SQL-server.
- 8) Specification of <Part 9 server getstring no> implies that conformance to Feature M006, “Get-SQLString routine”, is not claimed by an SQL-server.
- 9) Specification of <Part 9 wrapper FDW yes> implies that conformance to Feature M004, “Foreign data support”, is claimed by a foreign-data wrapper.
- 10) Specification of <Part 9 FDW transmit yes> implies that conformance to Feature M007, “TransmitRequest”, is claimed by an SQL-server.
- 11) Specification of <Part 9 FDW transmit no> implies that conformance to Feature M007, “TransmitRequest”, is not claimed by an SQL-server.
- 12) Specification of <Part 9 FDW sqlaware yes> implies that conformance to Feature M008, “SQL-awareness”, is claimed by an SQL-server.

3.4 Object identifier for Database Language SQL

- 13) Specification of <Part 9 FDW sqlaware no> implies that conformance to Feature M008, “SQL-awareness”, is not claimed by an SQL-server.
- 14) Specification of <Part 9 FDW options yes> implies that conformance to Feature M009, “GetOpts and GetStatistics routines”, is claimed by an SQL-server.
- 15) Specification of <Part 9 FDW options no> implies that conformance to Feature M009, “GetOpts and GetStatistics routines”, is not claimed by an SQL-server.
- 16) Specification of <Part 9 wrapper no> implies that conformance to Feature M004, “Foreign data support”, is not claimed.

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4 Concepts

4.1 SQL-environments and their components

4.1.1 SQL-environments

Replace the first paragraph An SQL-environment comprises:

- One SQL-agent.
- One SQL-implementation.
- Zero or more SQL-client modules, containing externally-invoked procedures available to the SQL-agent.
- Zero or more authorization identifiers.
- Zero or more user mappings.
- Zero or more catalogs, each of which contains one or more SQL-schemas, zero or more foreign server descriptors, and zero or more foreign-data wrapper descriptors.
- The sites, principally base tables, that contain SQL-data, as described by the contents of the schemas. This data may be thought of as “the database”, but the term is not used in ISO/IEC 9075, because it has different meanings in the general context.

4.1.2 User mapping concepts

A *user mapping* pairs an authorization identifier with a foreign server descriptor.

4.1.3 Catalogs and schemas

4.1.3.1 Catalogs

Replace first paragraph A *catalog* is a named collection of SQL-schemas, foreign server descriptors, and foreign-data wrapper descriptors in an SQL-environment. The mechanisms for creating and destroying catalogs are implementation-defined.

4.1.4 Foreign servers and descriptors

A *foreign server* is a processor that is not part of the SQL-implementation. A foreign server is described by a foreign server descriptors. A foreign server manages data that is not part of the SQL-environment. An SQL-server and an SQL-client can use a foreign server descriptor, which is a catalog element, to communicate with a foreign server. The data managed by a foreign server can be accessed by an SQL-server or an SQL-client through foreign tables, which are SQL-schema elements.

4.1.5 Foreign-data wrappers and descriptors

A *foreign-data wrapper* provides the mechanism by which an SQL-server can access the data that is managed by a foreign server. A foreign-data wrapper is described by a foreign-data wrapper descriptor.

4.2 Data types

Insert after 7th paragraph SQL defines a predefined data type named by the following <key word>: DATALINK.

Insert after 8th paragraph For reference purposes, the data type DATALINK is referred to as a (or the) *datalink type*.

Insert this paragraph A type *T* is DATALINK-ordered if *T* is *D*-ordered, where *D* is the set of datalink types.

4.3 Foreign servers

A *foreign server* is a named server, external to the SQL-environment but known to the SQL-server, that manages external data. Such external data is manifested as SQL-data by use of a mechanism called a *foreign-data wrapper* (see Subclause 4.4, “Foreign-data wrappers”).

A *foreign server descriptor* is a catalog element, identified by a *foreign server name* and created by invoking a <foreign server definition>. A foreign server descriptor consists of:

- A foreign server name, identifying the foreign server locally to the SQL-server.
- The <authorization identifier> of the owner of the resulting foreign server descriptor.
- The name of the foreign-data wrapper.
- A generic options descriptor.
- Optionally, the foreign server type.
- Optionally, the foreign server version.

The possible values of server type and server version, and their meanings, are implementation-defined.

The <authorization identifier> associated with a foreign server identifies the role of managing the capabilities and resources at that foreign server; however, that role is implementation-defined.

A foreign server descriptor is said to be *owned by* or to have been *created by* the current authorization identifier for the SQL-session when the <foreign server definition> was invoked.

A foreign server descriptor can be modified by an <alter foreign server statement> and destroyed by a <drop foreign server statement>.

A foreign server can be an *SQL-aware foreign server* or a *non-SQL-aware foreign server*. An SQL-aware foreign server is a foreign server that has the ability to process a subset of statements conforming to ISO/IEC 9075, particularly the statements comprising Feature E051, in a standard-conforming manner. A non-SQL-aware foreign server is a foreign server that has no ability to process SQL language. If the foreign-data wrapper associated with a non-SQL-aware foreign server

provides some (limited or conforming) ability to process SQL language, then the effect is that the foreign server can be treated as though it is an SQL-aware foreign server.

NOTE 1 – Some SQL-aware foreign servers may be, in fact, SQL-servers. However, because they are not in the same SQL-environment as the SQL-server responding to an SQL-client, they are managed only through foreign-data wrappers and are treated as foreign servers. Such foreign servers may concurrently respond to SQL-clients of their own; this does not change the relationships specified in this part of ISO/IEC 9075.

Some foreign servers, especially SQL-aware foreign servers, admit the concept of a schema and the concept of a table that are similar to SQL-schemas and to base tables, respectively. Such servers may (and SQL-aware foreign servers do) maintain schema information about those entities, such as the Information Schema and Definition Schema specified in ISO/IEC 9075-2.

If a foreign server maintains schema information about entities analogous to SQL-schemas and base tables, then execution of an <import foreign schema statement> retrieves information about the tables (either all or only some, as specified in the <import foreign schema statement>) associated with the named SQL-schema analog and performs one or more effective <foreign table definition> statement executions.

If a foreign server does not maintain such information or does not admit the concept of a schema, then foreign tables managed by that server must be specified by means of explicit <foreign table definition>s.

This International Standard does not specify the manner in which the SQL-server and the foreign-data wrapper interact to cause information about foreign tables to be retrieved by execution of an <import foreign schema statement>. In particular, no foreign-data wrapper interface routines are specified to support such interaction. Such interaction is implementation-dependent.

4.4 Foreign-data wrappers

A foreign-data wrapper is the mechanism by which the SQL-server accesses external data managed by foreign servers. Every foreign server is accessed through exactly one foreign-data wrapper, but one foreign-data wrapper can be used to access several different foreign servers. A foreign-data wrapper is made up of foreign-data wrapper interface routines, a set of routines written in a standard programming language. Foreign-data wrapper interface routines are used to access every foreign server whose descriptor includes the name of that foreign-data wrapper. It is possible for a foreign-data wrapper to exist that is not used to access any foreign server.

A *foreign-data wrapper descriptor* is a catalog element, identified by a *foreign-data wrapper name* and created by invoking a <foreign-data wrapper definition>. A <foreign-data wrapper definition> specifies the foreign-data wrapper name, a library name that identifies a library containing the foreign-data wrapper interface routines, and the name of the language in which the foreign-data wrapper interface routines are written.

A *foreign-data wrapper descriptor* consists of:

- A foreign-data wrapper name.
- The authorization identifier of the owner of the foreign-data wrapper descriptor.
- Name of the language in which the foreign-data wrapper interface routines are written.
- A generic options descriptor.
- A library name.

A foreign-data wrapper descriptor can be modified by an `<alter foreign-data wrapper statement>` and destroyed by a `<drop foreign-data wrapper statement>`.

4.5 User mappings

A user mapping is an SQL-environment element, pairing an authorization identifier *U* or the special identifier PUBLIC, denoting all `<authorization identifier>`s in the SQL-environment, with a foreign server *FS*. It defines how to map *U* to an equivalent concept known to *FS* when a foreign table whose source is *FS* is to be accessed during an SQL-session with current authorization identifier *U*. The mapping is specified by generic options defined by the foreign-data wrapper.

A user mapping is defined by invoking an `<user mapping definition>`. Invocation of an `<user mapping definition>` results in the creation of a user mapping descriptor in a catalog. A user mapping descriptor consists of:

- An authorization identifier.
- A foreign server name, identifying a foreign server descriptor.
- A generic options descriptor.

A user mapping descriptor can be modified by an `<alter user mapping statement>` and destroyed by a `<drop user mapping statement>`.

4.6 Generic options

Several of the objects used in connection with external data support the specification of *generic options*. These objects are foreign-data wrappers, foreign servers, foreign tables, columns of foreign tables, and user mappings. A generic option is an option name paired with an optional option value. Both the option name and the permissible ranges of option values of a generic option are defined by the foreign-data wrappers. A set of generic options is described by a generic options descriptor. A generic options descriptor is included in the descriptor of the object to which it pertains. The generic options are stored in the SQL-server for the foreign-data wrapper to retrieve when the foreign-data wrapper needs this information.

Generic options may be specified in either `<foreign-data wrapper definition>`, `<foreign server definition>`, `<foreign table definition>`, `<user mapping definition>`, `<alter foreign-data wrapper statement>`, `<alter foreign server statement>`, `<alter foreign table statement>`, or `<alter user mapping statement>`.

Generic options are specific to the object for which they are defined. For example, the generic options for a foreign table are most likely different from the generic options for a foreign server, in both option names and option values. Furthermore, generic options are highly dependent on the foreign-data wrapper that is used to access the external data. For example, the generic options for a foreign server that uses a foreign-data wrapper *A* might be totally different from the generic options specified for another foreign server that uses a foreign-data wrapper *B*. Even the fact that the option names of two generic options for two different foreign-data wrappers might be the same does not necessarily mean that the semantics and therefore the permissible range of option values are the same.

Since an SQL-server cannot anticipate the different kinds of foreign-data wrappers with which it is likely to deal, no generic option can ever be determined by the SQL-server or by this part of ISO/IEC 9075. Only a foreign-data wrapper can specify generic options for that foreign-data wrapper, or for a foreign server, a foreign table, a column of a foreign table or a user mapping for which it is used.

A *generic options descriptor* is either an empty list or a list consisting of one or more option names, each option name being paired with at most one option value.

4.7 Capabilities and options information

The SQL-server needs information from the foreign-data wrapper about the capabilities of the foreign-data wrapper itself, about the foreign server accessed through the foreign-data wrapper, and about certain schema elements (foreign tables and their columns, user mappings) managed by the foreign server. The SQL-server also needs information about options supported by the foreign-data wrapper, the foreign server, and certain schema elements. The SQL-server invokes the `GetOpts( )` routine to request the capabilities and other information from a foreign-data wrapper.

The specific capabilities and other information of a foreign-data wrapper, a foreign server, or any schema element managed by a foreign server that are reported to the SQL-server in response to an invocation of `GetOpts( )` are partly specified in this part of ISO/IEC 9075 and partly implementation-defined. In general, each capability or other piece of information that is reported corresponds to a generic option associated with the object being queried by the invocation.

The capabilities and other information is returned in a buffer whose contents may comprise an XML document or that may be returned in a format defined by the foreign-data wrapper. If the contents comprise an XML document, then it shall be a valid XML document, the format of which is specified by a Document Type Declaration (DTD) that is either internal to the XML document or external (requiring that it be available to the SQL-server in an implementation-defined manner).

NOTE 2 – This edition of this part of ISO/IEC 9075 specifies the use of a DTD. Future editions may specify the use of an XML Schema, either as an alternative to a DTD or instead of a DTD.

4.8 Datalinks

A datalink is a value of the DATALINK data type. A datalink references some file that is not part of the SQL-environment. The file is assumed to be managed by some external file manager. A datalink is conceptually represented by:

- File Reference: A character string forming a reference to an external file.
- SQL-Mediated Access Indication: A boolean value, where *True*, in data link *DL* indicates that the referenced file, being linked to the SQL-environment, is accessible only by use of the specially provided operations (see below) on *DL*.

The File Reference of a datalink is accessible by invoking built-in scalar functions defined in this part of ISO/IEC 9075. The character set of the File Reference, referred to as the *datalink character set* is implementation-defined.

The purpose of datalinks is to provide a mechanism to synchronize the integrity control, recovery, and access control of the files and the SQL-data associated with them. This part of ISO/IEC 9075 standardizes the way that an SQL-server is made aware of datalink values and how applications retrieve information about the files identified by datalink values. The mechanisms that enable integrity control, recovery, and access control for the files represented by the datalink values are implementation-dependent. These mechanisms are collectively called the *datalinker*.

A file is *linked* to the SQL-environment whenever execution of an SQL-data change statement causes a value *DL1* that references that file to appear in some datalink column whose descriptor includes the link control FILE LINK CONTROL. If the read permission option included in the column descriptor is DB, then access to the referenced file is said to be *SQL-mediated*. This is

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indicated by setting the SQL-Mediated Access Indication of *DL1* to *True* , and *DL1* is said to be an *SQL-mediated datalink*. If the read permission option included in the column descriptor is not DB, then the Linked Indication of *DL1* is set to *False* .

Execution of an SQL-data change statement that causes a value *DL2* to appear in a datalink column defined with the link control NO LINK CONTROL does not cause any file to be linked to the SQL-environment.

A linked file cannot be renamed or deleted by any agency outside of the SQL-environment. A datalink value always references just one file. A file is *unlinked* from the SQL-environment whenever execution of an SQL-data change statement causes a datalink that references that file to be removed from some datalink column whose descriptor includes the link control FILE LINK CONTROL. The actions that occur when a datalink is removed from a column depend on the link control options that are specified in the column descriptor of that column. The file might be deleted, or the datalinker might return control of the file to the external data manager.

With the function provided by datalinks and the datalinker, it is possible to specify that access to the files should be mediated by the SQL-server rather than by the external data manager. When access to the files is mediated by an SQL-server, any request to access a file must operate on an SQL-mediated datalink to obtain a character string with which to reference the file, using one of the built-in functions provided for that purpose. This character string is constructed by combining the File Reference of a datalink value with an encrypted value called an *access token*. The generation of the access token and the method of combining it with the File Reference is implementation-dependent. When the application uses the returned character string value to access a file, the datalinker checks to see if the access token is *valid*. If it is valid, then the application is allowed to access the file pointed to by the File Reference. Every attempt by an application to access, without a valid access token, a file referenced by an SQL-mediated datalink is unsuccessful. The time at which a valid access token ceases to be valid is implementation-defined.

A datalink data type is described by a *datalink data type descriptor*. A datalink data type descriptor consists of the name DATALINK and the set of *link control options*:

- The link control (NO LINK CONTROL or FILE LINK CONTROL).
- The integrity control option (ALL, SELECTIVE, or NONE).
- The read permission option (FS or DB).
- The write permission option (FS or BLOCKED).
- The recovery option (NO or YES).
- The unlink option (RESTORE, DELETE, or NONE).

The meanings of the various link control options are:

- NO LINK CONTROL: Although every File Reference must conform to the Format and Syntax Rules of Subclause 9.1, “URL format”, it is permitted for there to be no file referenced by that File Reference. This option implies that the integrity control option is NONE, the read permission option is FS, the write permission option is FS, the recovery option is NO and the unlink option is NONE, and no explicit syntax to specify these options is permitted.
- FILE LINK CONTROL: Every File Reference must reference an existing file. Further file control depends on the link control options.