

ISO/IEC 9075-9:2016-12 (E)

Information technology - Database languages - SQL - Part 9: Management of External Data (SQL/MED)

Contents	Page
Foreword.....	xiii
Introduction.....	xiv
1 Scope.....	1
2 Normative references.....	3
2.1 ISO and IEC standards.....	3
2.2 Other international standards.....	3
3 Definitions, notations, and conventions.....	5
3.1 Definitions.....	5
3.1.1 Definitions taken from XML.....	5
3.1.2 Definitions provided in Part 9.....	5
4 Concepts.....	7
4.1 Data types.....	7
4.1.1 Naming of predefined types.....	7
4.1.2 Data type terminology.....	7
4.2 Foreign servers.....	7
4.3 Foreign-data wrappers.....	8
4.4 User mappings.....	9
4.5 Routine mappings.....	9
4.6 Generic options.....	10
4.7 Capabilities and options information.....	10
4.8 Datalinks.....	11
4.8.1 Operations involving datalinks.....	15
4.8.1.1 Operators that operate on datalinks.....	15
4.8.1.2 Other operators involving datalinks.....	15
4.9 Columns, fields, and attributes.....	16
4.10 Tables.....	16
4.10.1 Introduction to tables.....	16
4.10.2 Base tables.....	16
4.10.2.1 Foreign tables.....	17
4.10.3 Unique identification of tables.....	17
4.10.4 Table descriptors.....	17
4.10.5 Syntactic analysis of derived tables and cursors.....	17
4.11 Functional dependencies.....	17
4.11.1 Overview of functional dependency rules and notations.....	18
4.11.2 Known functional dependencies in a foreign table.....	18

4.12	SQL-schemas.	18
4.13	SQL-statements.	18
4.13.1	SQL-statements classified by function.	18
4.13.1.1	SQL-schema statements.	18
4.13.1.2	SQL-session statements.	19
4.14	Basic security model.	19
4.14.1	Privileges.	19
4.15	SQL-transactions.	20
4.15.1	Properties of SQL-transactions.	20
4.16	SQL-sessions.	20
4.16.1	SQL-session properties.	20
4.17	Foreign-data wrapper interface.	21
4.17.1	Handles.	21
4.17.2	Foreign server sessions.	23
4.17.3	Foreign-data wrapper interface routines.	23
4.17.3.1	Handle routines.	23
4.17.3.2	Initialization routines.	27
4.17.3.3	Access routines.	28
4.17.3.4	Termination routines.	29
4.17.3.5	Decomposition and pass-through modes.	29
4.17.3.6	Sequence of actions during the execution of foreign server requests.	29
4.17.4	Return codes.	41
4.17.5	Foreign-data wrapper diagnostics areas.	42
4.17.6	Null pointers.	44
4.17.7	Foreign-data wrapper descriptor areas.	44
4.18	Introduction to SQL/CLI.	47
5	Lexical elements.	49
5.1	<token> and <separator>.	49
5.2	Names and identifiers.	51
6	Scalar expressions.	53
6.1	<data type>.	53
6.2	<cast specification>.	56
6.3	<value expression>.	58
6.4	<string value function>.	59
6.5	<datalink value expression>.	63
6.6	<datalink value function>.	64
7	Query expressions.	67
7.1	<table reference>.	67
8	URLs.	77
8.1	URL format.	77
9	Additional common rules.	81
9.1	Retrieval assignment.	81

9.2	Store assignment.	82
9.3	Result of data type combinations.	83
9.4	Type precedence list determination.	84
9.5	Determination of identical values.	85
9.6	Equality operations.	86
9.7	Grouping operations.	87
9.8	Multiset element grouping operations.	88
9.9	Ordering operations.	89
10	Additional common elements.	91
10.1	<generic options>.	91
10.2	<alter generic options>.	93
11	Schema definition and manipulation.	95
11.1	<schema definition>.	95
11.2	<drop schema statement>.	96
11.3	<table definition>.	97
11.4	<unique constraint definition>.	98
11.5	<check constraint definition>.	99
11.6	<alter column data type clause>.	100
11.7	<drop column definition>.	101
11.8	<domain definition>.	102
11.9	<assertion definition>.	103
11.10	<user-defined type definition>.	104
11.11	<SQL-invoked routine>.	105
11.12	<drop routine statement>.	106
11.13	<user-defined cast definition>.	107
11.14	<user-defined ordering definition>.	108
11.15	<foreign table definition>.	109
11.16	<alter foreign table statement>.	112
11.17	<add basic column definition>.	114
11.18	<alter basic column definition>.	116
11.19	<drop basic column definition>.	117
11.20	<drop foreign table statement>.	119
12	Catalog manipulation.	121
12.1	<foreign server definition>.	121
12.2	<alter foreign server statement>.	123
12.3	<drop foreign server statement>.	124
12.4	<foreign-data wrapper definition>.	126
12.5	<alter foreign-data wrapper statement>.	128
12.6	<drop foreign-data wrapper statement>.	129
12.7	<import foreign schema statement>.	130
12.8	<routine mapping definition>.	132
12.9	<alter routine mapping statement>.	134
12.10	<drop routine mapping statement>.	135

13	Access control.....	137
13.1	<privileges>.....	137
13.2	<revoke statement>.....	138
13.3	<user mapping definition>.....	139
13.4	<alter user mapping statement>.....	141
13.5	<drop user mapping statement>.....	142
14	SQL-client modules.....	143
14.1	<SQL-client module definition>.....	143
14.2	<externally-invoked procedure>.....	145
14.3	<SQL procedure statement>.....	148
14.4	Data type correspondences.....	150
15	Additional data manipulation rules.....	153
15.1	Effect of deleting rows from base tables.....	153
15.2	Effect of inserting tables into base tables.....	155
15.3	Effect of replacing rows in base tables.....	157
16	Session management.....	159
16.1	<set passthrough statement>.....	159
17	Dynamic SQL.....	161
17.1	Description of SQL descriptor areas.....	161
17.2	<prepare statement>.....	163
17.3	<deallocate prepared statement>.....	165
17.4	<describe statement>.....	166
17.5	<input using clause>.....	168
17.6	<output using clause>.....	172
17.7	<execute statement>.....	176
17.8	<dynamic declare cursor>.....	177
17.9	<allocate extended dynamic cursor statement>.....	178
17.10	<allocate received cursor statement>.....	179
17.11	<dynamic open statement>.....	180
17.12	<dynamic fetch statement>.....	181
17.13	<dynamic close statement>.....	182
18	Embedded SQL.....	183
18.1	<embedded SQL Ada program>.....	183
18.2	<embedded SQL C program>.....	185
18.3	<embedded SQL COBOL program>.....	186
18.4	<embedded SQL Fortran program>.....	187
18.5	<embedded SQL MUMPS program>.....	188
18.6	<embedded SQL Pascal program>.....	189
18.7	<embedded SQL PL/I program>.....	190
19	Call-Level Interface specifications.....	191
19.1	<CLI routine>.....	191
19.2	Implicit DESCRIBE USING clause.....	192

19.3	Description of CLI item descriptor areas.	192
19.4	Other tables associated with CLI.	193
19.5	SQL/CLI data type correspondences.	196
20	SQL/CLI routines.	199
20.1	BuildDataLink.	199
20.2	GetDataLinkAttr.	201
20.3	GetInfo.	203
21	SQL/MED common specifications.	205
21.1	Description of foreign-data wrapper item descriptor areas.	205
21.2	Implicit foreign-data wrapper cursor.	209
21.3	Implicit DESCRIBE INPUT USING clause.	211
21.4	Implicit DESCRIBE OUTPUT USING clause.	214
21.5	Implicit EXECUTE USING and OPEN USING clauses.	217
21.6	Implicit FETCH USING clause.	220
21.7	Character string retrieval.	224
21.8	Binary string retrieval.	225
21.9	Tables used with SQL/MED.	226
22	Foreign-data wrapper interface routines.	239
22.1	<foreign-data wrapper interface routine>.	239
22.2	<foreign-data wrapper interface routine> invocation.	244
22.3	Foreign-data wrapper interface wrapper routines.	246
22.3.1	AdvanceInitRequest.	246
22.3.2	AllocQueryContext.	248
22.3.3	AllocWrapperEnv.	249
22.3.4	Close.	251
22.3.5	ConnectServer.	252
22.3.6	FreeExecutionHandle.	254
22.3.7	FreeFSConnection.	256
22.3.8	FreeQueryContext.	257
22.3.9	FreeReplyHandle.	258
22.3.10	FreeWrapperEnv.	259
22.3.11	GetNextReply.	260
22.3.12	GetNumReplyBoolVE.	261
22.3.13	GetNumReplyOrderBy.	262
22.3.14	GetNumReplySelectElems.	263
22.3.15	GetNumReplyTableRefs.	264
22.3.16	GetOpts.	265
22.3.17	GetReplyBoolVE.	267
22.3.18	GetReplyCardinality.	268
22.3.19	GetReplyDistinct.	269
22.3.20	GetReplyExecCost.	270
22.3.21	GetReplyFirstCost.	271
22.3.22	GetReplyOrderElem.	272

22.3.23	GetReplyReExecCost.	273
22.3.24	GetReplySelectElem.	274
22.3.25	GetReplyTableRef.	275
22.3.26	GetSPDHandle.	276
22.3.27	GetSRDHandle.	277
22.3.28	GetStatistics.	278
22.3.29	GetWPDHandle.	280
22.3.30	GetWRDHandle.	281
22.3.31	InitRequest.	282
22.3.32	Iterate.	286
22.3.33	Open.	288
22.3.34	ReOpen.	292
22.3.35	TransmitRequest.	293
22.4	Foreign-data wrapper interface SQL-server routines.	296
22.4.1	AllocDescriptor.	296
22.4.2	FreeDescriptor.	297
22.4.3	GetAuthorizationId.	298
22.4.4	GetBoolVE.	299
22.4.5	GetDescriptor.	300
22.4.6	GetDistinct.	302
22.4.7	GetNumBoolVE.	303
22.4.8	GetNumChildren.	304
22.4.9	GetNumOrderByElems.	305
22.4.10	GetNumRoutMapOpts.	306
22.4.11	GetNumSelectElems.	307
22.4.12	GetNumServerOpts.	308
22.4.13	GetNumTableColOpts.	309
22.4.14	GetNumTableOpts.	311
22.4.15	GetNumTableRefElems.	312
22.4.16	GetNumUserOpts.	313
22.4.17	GetNumWrapperOpts.	314
22.4.18	GetOrderByElem.	315
22.4.19	GetRoutMapOpt.	316
22.4.20	GetRoutMapOptName.	318
22.4.21	GetRoutineMapping.	320
22.4.22	GetSelectElem.	321
22.4.23	GetSelectElemType.	322
22.4.24	GetServerName.	323
22.4.25	GetServerOpt.	324
22.4.26	GetServerOptByName.	326
22.4.27	GetServerType.	328
22.4.28	GetServerVersion.	329
22.4.29	GetSQLString.	330
22.4.30	GetTableColOpt.	331

22.4.31	GetTableColOptByName.	333
22.4.32	GetTableOpt.	335
22.4.33	GetTableOptByName.	337
22.4.34	GetTableRefElem.	339
22.4.35	GetTableRefElemType.	340
22.4.36	GetTableRefTableName.	341
22.4.37	GetTableServerName.	342
22.4.38	GetTRDHandle.	343
22.4.39	GetUserOpt.	344
22.4.40	GetUserOptByName.	346
22.4.41	GetValExprColName.	348
22.4.42	GetValueExpDesc.	349
22.4.43	GetValueExpKind.	350
22.4.44	GetValueExpName.	351
22.4.45	GetValueExpTable.	352
22.4.46	GetVEChild.	353
22.4.47	GetWrapperLibraryName.	354
22.4.48	GetWrapperName.	355
22.4.49	GetWrapperOpt.	356
22.4.50	GetWrapperOptByName.	358
22.4.51	SetDescriptor.	360
22.5	Foreign-data wrapper interface general routines.	365
22.5.1	GetDiagnostics.	365
23	Diagnostics management.	369
23.1	<get diagnostics statement>.	369
24	Information Schema.	371
24.1	ATTRIBUTES view.	371
24.2	COLUMN_OPTIONS view.	372
24.3	COLUMNS view.	373
24.4	FOREIGN_DATA_WRAPPER_OPTIONS view.	374
24.5	FOREIGN_DATA_WRAPPERS view.	375
24.6	FOREIGN_SERVER_OPTIONS view.	376
24.7	FOREIGN_SERVERS view.	377
24.8	FOREIGN_TABLE_OPTIONS view.	378
24.9	FOREIGN_TABLES view.	379
24.10	ROUTINE_MAPPING_OPTIONS view.	380
24.11	ROUTINE_MAPPINGS view.	381
24.12	USER_MAPPING_OPTIONS view.	382
24.13	USER_MAPPINGS view.	383
24.14	Short name views.	384
25	Definition Schema.	389
25.1	COLUMN_OPTIONS base table.	389
25.2	DATA_TYPE_DESCRIPTOR base table.	390

25.3	FOREIGN_DATA_WRAPPER_OPTIONS base table.	394
25.4	FOREIGN_DATA_WRAPPERS base table.	395
25.5	FOREIGN_SERVER_OPTIONS base table.	396
25.6	FOREIGN_SERVERS base table.	397
25.7	FOREIGN_TABLE_OPTIONS base table.	398
25.8	FOREIGN_TABLES base table.	399
25.9	ROUTINE_MAPPING_OPTIONS base table.	400
25.10	ROUTINE_MAPPINGS base table.	401
25.11	SQL_CONFORMANCE base table.	401
25.12	SQL_SIZING base table.	403
25.13	TABLES base table.	404
25.14	USAGE_PRIVILEGES base table.	405
25.15	USER_MAPPING_OPTIONS base table.	406
25.16	USER_MAPPINGS base table.	407
26	Status codes.	409
26.1	SQLSTATE.	409
27	Conformance.	413
27.1	Claims of conformance to SQL/MED.	413
27.2	Additional conformance requirements for SQL/MED.	413
Annex A	(informative) SQL Conformance Summary.	417
Annex B	(informative) Implementation-defined elements.	437
Annex C	(informative) Implementation-dependent elements.	445
Annex D	(informative) Deprecated features.	449
Annex E	(informative) Incompatibilities with ISO/IEC 9075:2008.	451
Annex F	(informative) SQL feature taxonomy.	453
Annex G	(informative) Defect reports not addressed in this edition of this part of ISO/IEC 9075.	455
Annex H	(informative) Typical header files.	457
H.1	C Header File SQLCLI.H.	457
H.2	COBOL Library Item SQLCLI.	457
Annex I	(informative) SQL/MED model.	459
Index.		463

Tables

Table		Page
1	Valid datalink file control options.	14
2	Sequence of actions during the execution of foreign server requests.	30
3	Fields used in foreign-data wrapper diagnostics areas.	43
4	Fields in foreign-data wrapper descriptor areas.	45
5	Data type correspondences for Ada.	150
6	Data type correspondences for C.	150
7	Data type correspondences for COBOL.	151
8	Data type correspondences for Fortran.	151
9	Data type correspondences for M.	151
10	Data type correspondences for Pascal.	152
11	Data type correspondences for PL/I.	152
12	Codes used for SQL data types in Dynamic SQL.	161
13	Abbreviated SQL/CLI generic names.	191
14	Codes used for implementation data types in SQL/CLI.	193
15	Codes used for application data types in SQL/CLI.	193
16	Codes used to identify SQL/CLI routines.	193
17	Codes and data types for implementation information.	194
18	Codes used for datalink attributes.	194
19	Data types of attributes.	194
20	SQL/CLI data type correspondences for Ada.	196
21	SQL/CLI data type correspondences for C.	196
22	SQL/CLI data type correspondences for COBOL.	196
23	SQL/CLI data type correspondences for Fortran.	197
24	SQL/CLI data type correspondences for M.	197
25	SQL/CLI data type correspondences for Pascal.	197
26	SQL/CLI data type correspondences for PL/I.	198
27	Codes used for <table reference> types.	226
28	Codes used for <value expression> kinds.	226
29	Codes used for foreign-data wrapper diagnostic fields.	226
30	Codes used for foreign-data wrapper descriptor fields.	227
31	Codes used for foreign-data wrapper handle types.	229
32	Ability to retrieve foreign-data wrapper descriptor fields.	230
33	Ability to set foreign-data wrapper descriptor fields.	232
34	Foreign-data wrapper descriptor field default values.	234
35	Codes used for the format of the character string transmitted by GetString().	236
36	SQL-statement codes.	369
37	SQLSTATE class and subclass codes.	409
38	Implied feature relationships of SQL/MED.	415
39	Feature taxonomy for optional features.	453
40	Legend for SQL/MED interfaces.	459
41	Legend for SQL/MED information flow.	461

Figures

Figure		Page
1	SQL/MED interfaces.	459
2	SQL/MED information flow.	460