A
Database Limits

This appendix lists the limits of values associated with database functions and objects. Limits exist on several levels in the database. There is usually a hard-coded limit in the database that cannot be exceeded. This value may be further restricted for any given operating system. Database limits are divided into four categories:

- Datatype Limits
- Physical Database Limits
- Logical Database Limits
- Process and Runtime Limits

> **See Also:**
>
> Your operating system-specific Oracle documentation

A.1 Datatype Limits

This table documents the limits for datatypes, and includes comments about the datatypes.

Datatypes	Limit	Comments
BFILE	Maximum size: 2^{64} bytes (18.44 exabytes) or OS file size limit, whichever is the lower value Maximum size of a file name: 255 characters Maximum size of a directory name: 128 bytes Maximum number of open BFILEs: see Comments	The maximum number of BFILEs is limited by the value of the SESSION_MAX_OPEN_FILES initialization parameter, which is itself limited by the maximum number of open files the operating system will allow.
BLOB	Maximum size: (4 GB - 1) * DB_BLOCK_SIZE initialization parameter (8 TB to 128 TB)	The number of LOB columns per table is limited only by the maximum number of columns per table (that is, 1000 if MAX_COLUMNS = STANDARD and 4096 if MAX_COLUMNS = EXTENDED[1]). **See Also:** "MAX_COLUMNS" initialization parameter for additional details
CHAR	Maximum size: 2000 bytes	None
CLOB	Maximum size: (4 GB - 1) * DB_BLOCK_SIZE initialization parameter (8 TB to 128 TB)	The number of LOB columns per table is limited only by the maximum number of columns per table (that is, 1000 if MAX_COLUMNS = STANDARD and 4096 if MAX_COLUMNS = EXTENDED[1]). **See Also:** "MAX_COLUMNS" initialization parameter for additional details
JSON	Maximum size: 32 MB	None

Datatypes	Limit	Comments
Literals (characters or numbers in SQL or PL/SQL)	Maximum size: 4000 characters	None
LONG[2]	Maximum size: 2 GB - 1	Only one LONG column is allowed per table.
NCHAR	Maximum size: 2000 bytes	None
NCLOB	Maximum size: (4 GB - 1) * DB_BLOCK_SIZE initialization parameter (8 TB to 128 TB)	The number of LOB columns per table is limited only by the maximum number of columns per table (that is, 1000 if MAX_COLUMNS = STANDARD and 4096 if MAX_COLUMNS = EXTENDED[1]). **See Also:** "MAX_COLUMNS" initialization parameter for additional details
NUMBER	999...(38 9's) x10^{125} maximum value -999...(38 9's) x10^{125} minimum value	Can be represented to full 38-digit precision (the mantissa) Can be represented to full 38-digit precision (the mantissa)
NVARCHAR2	Maximum size: 4000 bytes, or 32767 bytes if the MAX_STRING_SIZE initialization parameter is set to EXTENDED **See Also:** "MAX_STRING_SIZE" initialization parameter for additional details	None
Precision	38 significant digits	None
RAW	Maximum size: 2000 bytes, or 32767 bytes if the MAX_STRING_SIZE initialization parameter is set to EXTENDED **See Also:** "MAX_STRING_SIZE" initialization parameter for additional details	None
VARCHAR2	Maximum size: 4000 bytes, or 32767 bytes if the MAX_STRING_SIZE initialization parameter is set to EXTENDED **See Also:** "MAX_STRING_SIZE" initialization parameter for additional details	None

1 The absolute maximum number of columns in a table is 1000 or 4096, depending on the value of the MAX_COLUMNS initialization parameter. However, when you create an object table (or a relational table with columns of object, nested table, varray, or REF type), Oracle maps the columns of the user-defined types to relational columns, creating in effect hidden columns that count toward the maximum column limit. For details on how Oracle calculates the total number of columns in such a table, refer to *Oracle Database Administrator's Guide*.

2 All forms of LONG data types (LONG, LONG RAW, LONG VARCHAR, LONG VARRAW) were deprecated in Oracle8*i* Release 8.1.6. For succeeding releases, the LONG data type was provided for backward compatibility with existing applications. In new applications developed with later releases, Oracle strongly recommends that you use the CLOB or NCLOB data type for storing large amounts of character data.

See Also:

- *Oracle Database SQL Language Reference* for more information about datatypes
- *Oracle Database SQL Language Reference* for more information on naming database objects

A.2 Physical Database Limits

This table describes limit types and limit values for physical database items.

Item	Type of Limit	Limit Value
Controlfiles	Number of control files	1 minimum; 2 or more (on separate devices) strongly recommended
Controlfiles	Size of a control file	Maximum of 201031680 logical blocks
Database Block Size	Minimum	2048 bytes; must be a multiple of operating system physical block size
Database Block Size	Maximum	Operating system dependent; never more than 32 KB
Database Blocks	Minimum in initial extent of a segment	2 blocks
Database Blocks	Maximum per datafile	Platform dependent; typically 2^{22} - 1 blocks
Database extents	Maximum per dictionary managed tablespace	4 GB * physical block size (with K/M modifier); 4 GB (without K/M modifier)
Database extents	Maximum per locally managed (uniform) tablespace	256 KB * physical block size
Database file size	Maximum	Operating system dependent. Limited by maximum operating system file size. See the **Bigfile Tablespaces** and **Smallfile (traditional) Tablespaces** rows for more information about the maximum database file size in these types of tablespaces.
Database files	Maximum per tablespace	Operating system dependent; usually 1023
Database files	Maximum per database	65533 May be less on some operating systems Limited also by size of database blocks and by the DB_FILES initialization parameter for a particular instance
External Tables file	Maximum size	Dependent on the operating system An external table can be composed of multiple files.
MAXEXTENTS	Default value	Derived from tablespace default storage or DB_BLOCK_SIZE initialization parameter
MAXEXTENTS	Maximum	Not defined
Redo Log File Size	Minimum size	4 MB
Redo Log File Size	Maximum Size	Operating system limit; typically 2 TB

Item	Type of Limit	Limit Value
Redo Log Files	Maximum number of logfiles	Limited by value of `MAXLOGFILES` parameter in the `CREATE DATABASE` statement Control file can be resized to allow more entries; ultimately an operating system limit
Redo Log Files	Maximum number of logfiles per group	Not defined
Tablespaces	Maximum number per database	`64 K` Number of tablespaces cannot exceed the number of database files because each tablespace must include at least one file
Bigfile Tablespaces	Number of blocks	A bigfile tablespace contains only one datafile or tempfile, which can contain up to approximately 4 billion (2^{32}) blocks. The maximum size of the single datafile or tempfile is 128 terabytes (TB) for a tablespace with 32 K blocks and 32 TB for a tablespace with 8 K blocks.
Smallfile (traditional) Tablespaces	Number of blocks	A smallfile tablespace is a traditional Oracle tablespace, which can contain 1023 datafiles or tempfiles, each of which can contain up to approximately 4 million (2^{22}) blocks.

A.3 Logical Database Limits

This table describes limit types and limit values for logical database items.

Item	Type of Limit	Limit Value
Columns	Maximum per table	If `MAX_COLUMNS` = `STANDARD`: 1000 If `MAX_COLUMNS` = `EXTENDED`: 4096 (available starting with Oracle Database 23ai) **See Also:** "MAX_COLUMNS" initialization parameter for additional details
Columns	Maximum per index (or clustered index)	32
Columns	Maximum per bitmapped index	30
Constraints	Maximum per column	Not defined Oracle does not define a limit on the number of constraints per column. However, constraints are subject to the limit on the maximum number of constraints in the database. See the entry for "Constraints - Maximum per database" in this table.

Item	Type of Limit	Limit Value
Constraints	Maximum per database	4,294,967,293 Constraints are numbered internally from 1 to 4,294,967,294. The internal number is incremented each time a constraint is created. One number is always consumed by a special internal user called `_NEXT_CONSTRAINT`, which represents the next available number for a new constraint. Starting with Oracle Database 23ai, the database reuses constraint numbers. Therefore, the maximum number of constraints that can exist in the database at any given time is 4,294,967,293. You can view constraint numbers by querying the `CON#` column of the `SYS.CON$` table.
Dictionary-managed database objects	Maximum per database	4,254,950,911 - overhead • The value of 4,254,950,911 is derived as follows: The data type used for object identifiers can store a maximum value of 4,294,967,294. However, approximately 40 million of these values are reserved at the high end for other purposes, which results in a maximum object identifier value of 4,254,950,911. • Overhead includes the following: – Multiple object identifiers for one database object Database objects consume one object identifier at the time of creation. This identifier is displayed in both the `OBJECT_ID` and `DATA_OBJECT_ID` columns of the ALL_OBJECTS view. Over the lifetime of an object, the value of `OBJECT_ID` remains unchanged, but the value of `DATA_OBJECT_ID` changes when the object is altered, for example, with a DDL statement or a table truncation. Therefore, one object can consume more than one object identifier over its lifetime. – Object identifiers for lightweight jobs Lightweight jobs consume object identifiers, even though they are not permanent objects. Therefore, if many lightweight jobs are running in the database, the number of objects that can be created in the database is dependent upon the remaining pool of identifiers.
Indexes	Maximum per table	Not defined Oracle does not define a limit on the number of indexes per table. However, indexes are subject to the limit on the maximum number of dictionary-managed database objects allowed per database. See the entry for "Dictionary-managed database objects" in this table.
Indexes	Total size of indexed column(s)	Approximately 75% of the database block size minus some overhead

Item	Type of Limit	Limit Value
Partitions	Maximum length of linear partitioning key	4 KB - overhead
Partitions	Maximum number of columns in partition key	16 columns
Partitions	Maximum number of partitions allowed per table or index	1024K - 1
Rows	Maximum number per table	Not defined
Stored Packages	Maximum size	Approximately `6,000,000` lines of code. **See Also:** *Oracle Database PL/SQL Language Reference* for details
Subpartitions	Maximum number of subpartitions in a composite partitioned table	1024K - 1
Subqueries	Maximum levels of subqueries in a SQL statement	`255` subqueries in the `WHERE` clause A limit is not defined for subqueries in the `FROM` clause of the top-level query.
System Change Numbers (SCNs)	Maximum	$2^{63} - 2^{48}$ = 9,223,090,561,878,065,152 SCNs
Tables	Maximum per clustered table	32 tables
Tables	Maximum per database	Not defined Oracle does not define a limit on the number of tables per database. However, tables are subject to the limit on the maximum number of dictionary-managed database objects allowed per database. See the entry for "Dictionary-managed database objects" in this table.
Temporary Tablespaces	Maximum used per session	16
Users and Roles	Maximum	2,147,483,638 Users and roles are numbered internally from 0 to 2,147,483,638. The internal number is incremented each time a user or role is created, and numbers are never recycled. One number is always consumed by a special internal user called `_NEXT_USER`, which represents the next available number for a new user or role. Therefore, the maximum number of users and roles that can be created during the lifetime of a database is 2,147,483,638. You can view user and role numbers by querying the `USER#` column of the `SYS.USER$` table.

> **Note:**
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> The limit on how long a SQL statement can be depends on many factors, including database configuration, disk space, and memory

> **Note:**
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> When an object instance exists in memory, there is no fixed limit on the number of attributes in the object. But the maximum total amount of memory consumed by an object instance is 4 GB. When an object instance is inserted into a table, the attributes are exploded into separate columns in the table, and these columns count toward the limit on the maximum number of columns per table.

A.4 Process and Runtime Limits

This table describes limit types and limit values for process and runtime items.

Item	Type of Limit	Limit Value
Advanced Queuing Processes	Maximum per instance	10
Backup Sessions	Maximum per instance	Limited by the PROCESSES and SESSIONS initialization parameters, for instance
Dispatchers	Maximum per instance	Limited by the PROCESSES and SESSIONS initialization parameters, for instance
Global Cache Service Processes	Maximum per instance	10
Instances per database	Maximum number of cluster database instances per database	Operating system-dependent
I/O Worker Processes	Maximum per background process (DBWR, LGWR, and so on)	15
I/O Worker Processes	Maximum per Backup session	15
Job Queue Processes	Maximum per instance	1000
Locks	Row-level	Not defined
Parallel Execution Workers	Maximum per instance	Limited by the PROCESSES and SESSIONS initialization parameters, for instance
Services	Maximum per instance	8200
Sessions	Maximum per instance	2^{18} - 1, which is 262143; limited by the PROCESSES and SESSIONS initialization parameters.
SGA size	Maximum value	Operating system-dependent; typically 2 to 4 GB for 32-bit operating systems, and > 4 GB for 64-bit operating systems
Shared Servers	Maximum per instance	Limited by the PROCESSES and SESSIONS initialization parameters, for instance