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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

Datatype Limits

Datatypes	Limit	Comments
BFILE	Maximum size: 4 GB	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.
	Maximum size of a file name: 255 characters	
	Maximum size of a directory name: 30 characters	
	Maximum number of open BFILEs: see Comments	
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[1]).
CHAR	Maximum size: 2000 bytes	None
CHAR VARYING	Maximum size: 4000 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[1]).
Literals (characters or numbers in SQL or PL/SQL)	Maximum size: 4000 characters	None
LONG	Maximum size: 2 GB - 1	Only one LONG column is allowed per table.
NCHAR	Maximum size: 2000 bytes	None

Datatypes	Limit	Comments
NCHAR VARYING	Maximum size: 4000 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[1]).
NUMBER	999...(38 9's) $\times 10^{125}$ maximum value	Can be represented to full 38-digit precision (the mantissa)
	-999...(38 9's) $\times 10^{125}$ minimum value	Can be represented to full 38-digit precision (the mantissa)
Precision	38 significant digits	None
RAW	Maximum size: 2000 bytes	None
VARCHAR	Maximum size: 4000 bytes	None
VARCHAR2	Maximum size: 4000 bytes	None

[1] The absolute maximum number of columns in a table is 1000. 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 1000-column limit. For details on how Oracle calculates the total number of columns in such a table, refer to *Oracle Database Administrator's Guide*.

> **See Also:** *Oracle Database SQL Language Reference* for information on the rules and limitations governing the use of datatypes and naming database objects

Physical Database Limits

Item	Type of Limit	Limit Value
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
Controlfiles	Number of control files	1 minimum; 2 or more (on separate devices) strongly recommended
Controlfiles	Size of a control file	Dependent on operating system and database creation options; maximum of 25,000 x (database block size)
Database files	Maximum per tablespace	Operating system dependent; usually 1022
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
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	2 GB * physical block size (with K/M modifier); 2 GB (without K/M modifier)

Item	Type of Limit	Limit Value
Database file size	Maximum	Operating system dependent. Limited by maximum operating system file size; typically 2^{22} or 4 MB blocks
MAXEXTENTS	Default value	Derived from tablespace default storage or DB_BLOCK_SIZE initialization parameter
MAXEXTENTS	Maximum	Unlimited
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	Unlimited
Redo Log File Size	Minimum size	4 MB
Redo Log File Size	Maximum Size	Operating system limit; typically 2 GB
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 1022 datafiles or tempfiles, each of which can contain up to approximately 4 million (2^{22}) blocks.
External Tables file	Maximum size	Dependent on the operating system.
		An external table can be composed of multiple files.

Logical Database Limits

Item	Type of Limit	Limit Value
GROUP BY clause	Maximum length	The GROUP BY expression and all of the nondistinct aggregate functions (for example, SUM, AVG) must fit within a single database block.
Indexes	Maximum per table	Unlimited
Indexes	Total size of indexed column	75% of the database block size minus some overhead
Columns	Per table	1000 columns maximum
Columns	Per index (or clustered index)	32 columns maximum
Columns	Per bitmapped index	30 columns maximum
Constraints	Maximum per column	Unlimited
Subqueries	Maximum levels of subqueries in a SQL statement	Unlimited in the FROM clause of the top-level query
		255 subqueries in the WHERE clause

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	Unlimited
Stored Packages	Maximum size	PL/SQL and Developer/2000 may have limits on the size of stored procedures they can call. The limits typically range from 2000 to 3000 lines of code. **See Also:** Your PL/SQL or Developer/2000 documentation for details
Trigger Cascade Limit	Maximum value	Operating system-dependent, typically 32
Users and Roles	Maximum	2,147,483,638
Tables	Maximum per clustered table	32 tables
Tables	Maximum per database	Unlimited

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

> **Note:** 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 the Oracle 1000-column limit applies.

Process and Runtime Limits

Item	Type of Limit	Limit Value
Instances per database	Maximum number of cluster database instances per database	Operating system-dependent
Locks	Row-level	Unlimited
Locks	Distributed Lock Manager	Operating system dependent
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
Advanced Queuing Processes	Maximum per instance	10
Job Queue Processes	Maximum per instance	1000
I/O Slave Processes	Maximum per background process (DBWR, LGWR, etc.)	15
I/O Slave Processes	Maximum per Backup session	15

Item	Type of Limit	Limit Value
Sessions	Maximum per instance	2^{31}; limited by the `PROCESSES` and `SESSIONS` initialization parameters
Global Cache Service Processes	Maximum per instance	`10`
Shared Servers	Maximum per instance	Unlimited within constraints set by the `PROCESSES` and `SESSIONS` initialization parameters, for instance
Dispatchers	Maximum per instance	Unlimited within constraints set by `PROCESSES` and `SESSIONS` initialization parameters, for instance
Parallel Execution Slaves	Maximum per instance	Unlimited within constraints set by `PROCESSES` and `SESSIONS` initialization parameters, for instance
Backup Sessions	Maximum per instance	Unlimited within constraints set by `PROCESSES` and `SESSIONS` initialization parameters, for instance
Services	Maximum per instance	115