

```
--- ODA-5.4.1.md          2023-11-20 18:53:23.909377915 +0100
+++ ODA-5.4.2-libredwg.md 2023-11-20 22:34:08.826990795 +0100
```

```
@@ -1,8 +1,8 @@
```

```
-# Open Design Specification for .dwg files
```

```
+# Open Design Specification for .dwg files, fixed by LibreDWG
```

```
-## Version 5.4.1
```

```
+## Version 5.4.2
```

```
## Open Design Alliance
```

```
## <http://www.opendesign.com>
```

```
@@ -20,11 +20,11 @@
```

```
Printed in USA.
```

* DWG is the native and proprietary file format for AutoCAD® and a trademark of Autodesk, Inc. The Open Design Alliance is not associated with Autodesk.

```
-# Open Design Specification for .DWG files
```

```
+# Open Design Specification for .DWG files (fixed)
```

```
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@@ -72,12 +72,10 @@
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```
@@ -94,11 +92,11 @@
```

```
# 2 BIT CODES AND DATA DEFINITIONS
```

NOTE: Unless otherwise stated, all data in this manual is in little-endian order, with the least significant byte first.

-Much of the data in the DWG file format versions 13/14/2000/2004/2007/2010 must be read at the bit level. Various parts of the drawing use data in compressed forms, which are explained below. Here are the abbreviations used in this document for the various compressed forms:

+Much of the data in the DWG file format versions 13/14/2000/2004/2007/2010/2013/2018 must be read at the bit level. Various parts of the drawing use data in compressed forms, which are explained below. Here are the abbreviations used in this document for the various compressed forms:

```
----
```

B : bit (1 or 0)

BB : special 2 bit code (entmode in entities, for instance)

```
@@ -623,12 +621,12 @@
```

```

)
    PADDING (R13C3 AND LATER, 200 bytes, minutes the template section above if present)
    IMAGE DATA (PRE-R13C3)
    OBJECT DATA
        All entities, table entries, dictionary entries, etc. go in this section.
    OBJECT MAP
-   OBJECT FREE SPACE (optional)
    TEMPLATE (R14-R15, optional)
+   OBJECT FREE SPACE (optional)
    SECOND HEADER
    IMAGE DATA (R13C3 AND LATER)

```

```
## 3.2 FILE HEADER
```

```
@@ -636,13 +634,29 @@
```

The first 6 bytes are:

	Bytes (ascii encoded)	Version
	:-----	:-----
+ MC0.0		MicroCAD R1.1
+ AC1.2		R1.2
+ AC1.3		R1.3
+ AC1.40		R1.4
+ AC1.50		R2.0
+ AC2.10		R2.10
+ AC2.21		R2.21
+ AC2.22		R2.22
+ AC1001		R2.4
+ AC1002		R2.5
+ AC1003		R2.6
+ AC1004		R9
+ AC1006		R10
+ AC1009		R11
	AC1012	R13
+ AC1013		R13C3
	AC1014	R14
	AC1015	R2000
+ AC1016		R2000i
	AC1018	R2004
	AC1021	R2007
	AC1024	R2010
	AC1027	R2013
	AC1032	R2018

```
@@ -653,20 +667,68 @@
```

At 0x0D is a seeker (4 byte long absolute address) for the beginning sentinel of the image data.

```
### 3.2.3 OBJECT FREE SPACE
```

```
-**TODO.**
```

```
+See chapter 21.
```

```
### 3.2.4 TEMPLATE
```

This section is optional, see chapter 22.

```
### 3.2.5 DWGCODEPAGE:
```

Bytes at 0x13 and 0x14 are a raw short indicating the value of the code page for this drawing file.

Codepage	Name
0	UTF8 (Unused)
1	US_ASCII
2	ISO-8859-1
3	ISO-8859-2
4	ISO-8859-3
5	ISO-8859-4
6	ISO-8859-5
7	ISO-8859-6
8	ISO-8859-7
9	ISO-8859-8
10	ISO-8859-9
11	CP437 (DOS English)
12	CP850 (DOS Latin-1)
13	CP852 (DOS Central European)
14	CP855 (DOS Cyrillic)
15	CP857 (DOS Turkish)
16	CP860 (DOS Portuguese)
17	CP861 (DOS Icelandic)
18	CP863 (DOS Hebrew)
19	CP864 (DOS Arabic IBM)
20	CP865 (DOS Nordic)
21	CP869 (DOS Greek)
22	CP932 (DOS Japanese, shiftjis)
23	MACINTOSH
24	BIG5
25	CP949 (Korean, Wansung + Johab)
26	JOHAB
27	CP866 (Russian)
28	ANSI-1250 (Windows Central + Eastern European)
29	ANSI-1251 (Windows Cyrillic)
30	ANSI-1252 (Windows Western European)
31	GB2312 (Windows EUC-CN Chinese)
32	ANSI-1253 (Windows Greek)
33	ANSI-1254 (Windows Turkish)
34	ANSI-1255 (Windows Hebrew)
35	ANSI-1256 (Windows Arabic)
36	ANSI-1257 (Windows Baltic)
37	ANSI-874 (Windows Thai)
38	ANSI-932 (Windows Japanese, extended shiftjis, windows-31j)
39	ANSI-936 (Windows Simplified Chinese)
40	ANSI-949 (Windows Korean Wansung)
41	ANSI-950 (Windows Trad Chinese)
42	ANSI-1361 (Windows Korean Wansung)
43	UTF16 (Default since R2007)
44	ANSI-1258 (Windows Vietnamese)

3.2.6 SECTION-LOCATOR RECORDS:

At 0x15 is a long that tells how many sets of recno/seeker/length records follow. Each record has the following format:

```
Record number (raw byte) | Seeker (raw long) | Size (raw long)
@@ -676,16 +738,13 @@
```

- 0 : Header variables (covers beginning and ending sentinels).
- 1 : Class section.
- 2 : Object map.
- 3 : (C3 and later.) A special table (no sentinels). See unknown section (R13 C3 and
- d later). The presence of the 4th record (3) indicates that the C3 file format
-

```

-      applies. Just look at the long at 21; if it's 4 or greater, it's the C3-and-la
ter
-      format.
-      4 : In R13-R15, points to a location where there may be data stored. Currently we
-      have seen only the MEASUREMENT variable stored here. See chapter 22.
+      3 : (C3 and later.) OBJECT FREE SPACE (without sentinels),
+      followed by the SECOND HEADER (with sentinels).
+      4 : In R13-R15, TEMPLATE with the MEASUREMENT variable. See chapter 22.
      This section is optional.

```

Remarks: We have seen files with up to 6 sets in this section; the meaning of the sixth one is unknown. The Open Design Toolkit emits files with the first 5 sets only.

RS : CRC for BOF to this point. Use 0 for the initial value, and depending on the
@@ -2774,11 +2833,11 @@

11 PADDING (R13C3 AND LATER)

0x200 bytes of padding. Can be ignored. When writing, the Open Design Toolkit writes a
11 0s.

-Occasionally AutoCAD will use the first 4 bytes of this area to store the value of the
â\200\234measurementâ\200\235 variable. This padding was evidently required to allow p
re-R13C3 versions of AutoCAD to read files produced by R13C3 and later.

+Occasionally AutoCAD will use the first 4 bytes of this area to store the value of the
â\200\234measurementâ\200\235 variable., i.e the TEMPLATE section. This padding was ev
idently required to allow pre-R13C3 versions of AutoCAD to read files produced by R13C3
and later.

12 Data section: â\200\234â\200\235

The empty data section was introduced in R18. This section contains no data.

@@ -3060,11 +3119,11 @@

Version	Field type	DXF group	Description
	MS		Size in bytes of object, not including the CRC
R2010+	MC		Size in bits of the handle stream (unsigned, 0x40 is not i nterpreted as sign). This includes the padding bits at the end of the handle stream (th e padding bits make sure the object stream ends on a byte boundary).

- Common

+ Common

	OT		Object type
R2000-R2007	RL		Size of object data in bits (number of bits before the han dles), or the â\200\234endbitâ\200\235 of the pre-handles section.

Common:

	H	5	Objectâ\200\231s handle
--	---	---	-------------------------

@@ -3097,11 +3156,11 @@

Drawing entities, which are of course objects, have the same format as objects, with s
ome additional standard items:

MS : Size of object, not including the CRC

R2010+:

MC : Size in bits of the handle stream (unsigned, 0x40 is not interpreted as si
gn).

- Common:

+ Common:

OT : Object type

R2000+ Only:

RL : Size of object data in bits

Common:

H : Objectâ\200\231s handle

@@ -3297,11 +3356,14 @@

20.4.1 Common Entity Data

The following data appears at the beginning of each entity in the file, and will be referred to as Common Entity Data in the subsequent entity descriptions.

```

-      Length      MS  -- Entity length (not counting itself or CRC).
-      Type        BS  0  1 (internal DWG type code).
+      R2010+:
+      Handle Stream Size MC  -- not counted in the Length
+      Common:
+      Type        OT  0  internal DWG type code. BS or OT since R2010.
      R2000+ Only:
        Obj size      RL      size of object in bits, not including
                           end handles
      Common:
        Handle        H      5  code 0, length followed by the handle bytes.

```

@@ -5162,21 +5224,24 @@

20.4.44 DICTIONARY (42)

Basically a list of pairs of string/objhandle that constitute the dictionary entries.

```

...
-      Length      MS  -- Entity length (not counting itself or CRC).
-      Type        S   0  42 (internal DWG type code).
+      Length      MS  -- Object length (not counting itself or CRC).
+R2010+:
+      Handle Stream Size MC  -- not counted in the Length
+Common:
+      Type        OT  0  42 (internal DWG type code).
      R2000+:
        Obj size      RL      size of object in bits, not including end handles
      Common:
        Handle        H      5  Length (char) followed by the handle bytes.
        EED           X     -3  See EED section.
      R13-R14 Only:
        Obj size      RL      size of object in bits, not including end handles
      Common:
-      Numreactors   S      number of reactors in this object
+      Numreactors   BL      number of reactors in this object
      R2004+:
        XDic Missing Flag B      If 1, no XDictionary handle is stored for this
                                   object, otherwise XDictionary handle is stored as in
                                   R2000 and earlier.
      Common:
@@ -5256,46 +5321,46 @@
      R2000+:
        Linespacing Style BS  73
        Linespacing Factor BD  44
        Unknown bit      B
      R2004+:
-      Background flags BL  90  0 = no background, 1 = background fill, 2 =
+      Background fill flag BL  90  0 = no background, 1 = background fill, 2 =
                                   background fill with drawing fill color, 0x10 = text
                                   frame (R2018+)

-IF background flags has bit 0x01 set, or in case of R2018 bit 0x10:
-      Background scale factor
+IF Background fill flag has bit 0x01 set, or in case of R2018 bit 0x10:
+      Background fill scale factor
                                   BL  45  default = 1.5
-      Background color CMC  63

```

```

-   Background transparency
+   Background fill color CMC 63
+   Background fill transparency
                                BL 441
-END IF background flags 0x01/0x10
+END IF Background fill flags 0x01/0x10
R2018+
    Is NOT annotative          B
    IF MTEXT is not annotative
        Version                 BS          Default 0
        Default flag            B          Default true
    BEGIN REDUNDANT FIELDS (see above for descriptions)
        Registered application H          Hard pointer
-   Attachment point           BL
-   X-axis dir                  3BD 10
-   Insertion point            3BD 11
+   Ignore Attachment          BL
+   X-axis dir                  3BD 11
+   Insertion point            3BD 10
        Rect width              BD 40
        Rect height             BD 41
-   Extents width              BD 42
        Extents height          BD 43
+   Extents width              BD 42
    END REDUNDANT FIELDS
        Column type             BS 71 0 = No columns, 1 = static columns, 2 = dynamic
                                columns
    IF Has Columns data (column type is not 0)
        Column height count     BL 72
-   Column width               BD 44
+   Column width               BD 44
        Gutter                  BD 45
        Auto height?            B 73
        Flow reversed?          B 74
    IF not auto height and column type is dynamic columns
-REPEAT Column heights
+REPEAT Column height count
    Column height              BD 46
END REPEAT END
    IF (has column heights)
    END IF (has columns data)
    END IF (not annotative)
@@ -5324,25 +5389,25 @@
### 20.4.47 LEADER (45)

'''
    Common Entity Data
    Unknown bit                B -- Always seems to be 0.
-   Annot type                 BS -- Annotation type (NOT bit-coded):
+   Annot type                 BS 73 Annotation type (NOT bit-coded):
                                Value 0 : MTEXT
                                Value 1 : TOLERANCE
                                Value 2 : INSERT
                                Value 3 : None
-   path type                  BS --
+   path type                  BS 72
        numpts                  BL -- number of points
        point                   3BD 10 As many as counter above specifies.
        Origin                   3BD -- The leader plane origin (by default itâ\200\231s the
first
                                point).
        Extrusion                3BD 210
        x direction              3BD 211

```

```

offsettoblockinspt 3BD 212 Used when the BLOCK option is used. Seems to be an
                           unused feature.

-R14+:
+R14-R2007:
    Endptproj          3BD  -- A non-planar leader gives a point that projects the
                           endpoint back to the annotation. It's the offset
                           from the endpoint of the leader to the annotation,
                           taking into account the extrusion direction.

    R13-R14 Only:
@@ -5355,27 +5420,28 @@
        Box width      BD  41  taller, probably by some DIMvar amount.)
                           MTEXT extents width. (A text box is slightly wider,
                           probably by some DIMvar amount.)
        Hooklineonxdir  B      hook line is on x direction if 1
        Arrowheadon     B      arrowhead on indicator

-R13-R14 Only:
    Arrowheadtype      BS      arrowhead type
+R13-R14 Only:
    Dimasz              BD      DIMASZ at the time of creation, multiplied by
                           DIMSCALE

    Unknown             B
    Unknown             B
    Unknown             BS
    Byblockcolor        BS
    Unknown             B
    Unknown             B
R2000+:
-   Unknown            BS
    Unknown            B
    Unknown            B
Common:
    Common Entity Handle Data
-   H 340 Associated annotation activated in R14. (hard pointer
)
+R13+:
+   H 340 Associated annotation activated in R14. (soft owner
+Common:
    H 2 DIMSTYLE (hard pointer)
    X --
    CRC
    ...

**_20.4.47.1 Example:_**
@@ -5624,20 +5690,23 @@

### 20.4.51 BLOCK CONTROL (48)

...
    Length             MS  -- Object length (not counting itself or CRC).
-   Type               BS 0&2 48 (internal DWG type code).
+R2010+:
+   Handle Stream Size MC  -- not counted in the Length
+Common:
+   Type               OT  0  48 (internal DWG type code).
R2000+:
    Obj size           RL      size of object in bits, not including end handles
Common:
    Handle             H  5  Owner handle (soft pointer) of root object (0).
    EED                X -3  See EED section.
R13-R14 Only:
    Obj size           RL      size of object in bits, not including end handles
Common:
-   Numreactors        L      Number of persistent reactors attached to this obj
+   Numreactors        BL     Number of persistent reactors attached to this obj

```

R2004+:
 XDic Missing Flag B If 1, no XDictionary handle is stored for this object, otherwise XDictionary handle is stored as in R2000 and earlier.

Common:

@@ -5664,20 +5733,23 @@

20.4.52 BLOCK HEADER (49)

```

Length      MS -- Object length (not counting itself or CRC).  
 -    **Type**      **BS 0&2 49 (internal DWG type code).**

+R2010+:

+    **Handle Stream Size**    **MC -- not counted in the Length**

+Common:

+    **Type**      **OT 0 49 (internal DWG type code).**

R2000+:

Obj size      RL      size of object in bits, not including end handles

Common:

Handle      H 5 Owner handle (soft pointer) of root object (0).

EED      X -3 See EED section.

R13-R14 Only:

Obj size      RL      size of object in bits, not including end handles

Common:

-    **Numreactors**      **L Number of persistent reactors attached to this obj**

+    **Numreactors**      **BL Number of persistent reactors attached to this obj**

R2004+:

XDic Missing Flag      B      If 1, no XDictionary handle is stored for this object, otherwise XDictionary handle is stored as in R2000 and earlier.

Common:

@@ -5749,20 +5821,23 @@

### 20.4.53 LAYER CONTROL (50) (UNDOCUMENTED)

```

Length MS -- Object length (not counting itself or CRC).
 - **Type** **BS 0&2 50 (internal DWG type code).**

+R2010+:

+ **Handle Stream Size** **MC -- not counted in the Length**

+Common:

+ **Type** **OT 0 50 (internal DWG type code).**

R2000+:

Obj size RL size of object in bits, not including end handles

Common:

Handle H 5 Owner handle (soft pointer) of root object (0).

EED X -3 See EED section.

R13-R14 Only:

Obj size RL size of object in bits, not including end handles

Common:

- **Numreactors** **L Number of persistent reactors attached to this obj**

+ **Numreactors** **BL Number of persistent reactors attached to this obj**

R2004+:

XDic Missing Flag B If 1, no XDictionary handle is stored for this object, otherwise XDictionary handle is stored as in R2000 and earlier.

Common:

@@ -5785,11 +5860,14 @@

20.4.54 LAYER (51)

```

Length      MS -- Object length (not counting itself or CRC).



```

- Type BS 0&2 51 (internal DWG type code).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 51 (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 code 0, length followed by the handle bytes.
 EED X -3 See EED section.
@@ -5852,20 +5930,23 @@

20.4.55 SHAPEFILE CONTROL (52) (UNDOCUMENTED)

'''
 Length MS -- Object length (not counting itself or CRC).
- Type BS 0&2 52 (internal DWG type code).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 52 (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 Owner handle (soft pointer) of root object (0).
 EED X -3 See EED section.
R13-R14 Only:
 Obj size RL size of object in bits, not including end handles
Common:
- Numreactors L Number of persistent reactors attached to this obj
+ Numreactors BL Number of persistent reactors attached to this obj
R2004+:
 XDic Missing Flag B If 1, no XDictionary handle is stored for this
 object, otherwise XDictionary handle is stored as in
 R2000 and earlier.

Common:
@@ -5902,11 +5983,14 @@
| | Character set (bitmask) = 0x0000ff00
| 1002 (Bracket) | â\200\230}â\200\231 (optional) |

'''
 Length MS -- Object length (not counting itself or CRC).
- Type BS 0&2 53 (internal DWG type code).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 53 (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 code 0, length followed by the handle bytes.
 EED X -3 See EED section.
@@ -5957,20 +6041,23 @@

```

```
20.4.57 LINETYPE CONTROL (56) (UNDOCUMENTED)
```

```

'''
 Length MS -- Object length (not counting itself or CRC).
- Type BS 0&2 56 (internal DWG type code).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 56 (internal DWG type code).

```

```

R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 Owner handle (soft pointer) of root object (0).
 EED X -3 See EED section.
R13-R14 Only:
 Obj size RL size of object in bits, not including end handles
Common:
- Numreactors L Number of persistent reactors attached to this obj
+ Numreactors BL Number of persistent reactors attached to this obj
R2004+:
 XDic Missing Flag B If 1, no XDictionary handle is stored for this
 object, otherwise XDictionary handle is stored as in
 R2000 and earlier.

Common:
@@ -5997,11 +6084,14 @@

20.4.58 LTYPE (57)

...
 Length MS -- Object length (not counting itself or CRC).
- Type BS 0&2 57 (internal DWG type code).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 57 (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 code 0, length followed by the handle bytes.
 EED X -3 See EED section.
@@ -6068,20 +6158,23 @@

20.4.59 VIEW CONTROL (60) (UNDOCUMENTED)

...
 Length MS -- Object length (not counting itself or CRC).
- Type BS 0&2 60 (internal DWG type code).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 60 (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 Owner handle (soft pointer) of root object (0).
 EED X -3 See EED section.
R13-R14 Only:
 Obj size RL size of object in bits, not including end handles
Common:
- Numreactors L Number of persistent reactors attached to this obj
+ Numreactors BL Number of persistent reactors attached to this obj
R2004+:
 XDic Missing Flag B If 1, no XDictionary handle is stored for this
 object, otherwise XDictionary handle is stored as in
 R2000 and earlier.

Common:
@@ -6104,11 +6197,14 @@

20.4.60 VIEW (61)

...
 Length MS -- Object length (not counting itself or CRC).

```

```

- Type BS 0&2 61 (internal DWG type code).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 61 (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 code 0, length followed by the handle bytes.
 EED X -3 See EED section.
@@ -6202,20 +6298,23 @@

20.4.61 UCS CONTROL (62) (UNDOCUMENTED)

'''
 Length MS -- Object length (not counting itself or CRC).
- Type BS 0&2 62 (internal DWG type code).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 62 (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 Owner handle (soft pointer) of root object (0).
 EED X -3 See EED section.
R13-R14 Only:
 Obj size RL size of object in bits, not including end handles
Common:
- Numreactors L Number of persistent reactors attached to this obj
+ Numreactors BL Number of persistent reactors attached to this obj
R2004+:
 XDic Missing Flag B If 1, no XDictionary handle is stored for this
 object, otherwise XDictionary handle is stored as in
 R2000 and earlier.

```

Common:  
@@ -6238,11 +6337,14 @@

### 20.4.62 UCS (63)

```

'''
 Length MS -- Object length (not counting itself or CRC).
- Type BS 0&2 63 (internal DWG type code).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 63 (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 code 0, length followed by the handle bytes.
 EED X -3 See EED section.
@@ -6300,11 +6402,14 @@

```

### 20.4.63 TABLE (VPORT) (64) (UNDOCUMENTED)

```

'''
 Length MS -- Object length (not counting itself or CRC).
- Type BS 0&2 64 (internal DWG type code).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 64 (internal DWG type code).

```

```

R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 code 0, length followed by the handle bytes.
 EED X -3 See EED section.
@@ -6338,11 +6443,14 @@

20.4.64 VPORT (65)

...
 Length MS -- Object length (not counting itself or CRC).
- Type BS 0&2 65 (internal DWG type code).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 65 (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 Length (char) followed by the handle bytes.
 EED X -3 See EED section.
@@ -6466,11 +6574,14 @@

20.4.65 TABLE (APPID) (66) (UNDOCUMENTED)

...
 Length MS -- Object length (not counting itself or CRC).
- Type BS 0&2 66 (internal DWG type code).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 66 (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 Owner handle (soft pointer) of root object (0).
 EED X -3 See EED section.
@@ -6502,11 +6613,14 @@

20.4.66 APPID (67)

...
 Length MS -- Object length (not counting itself or CRC).
- Type BS 0&2 67 (internal DWG type code).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 67 (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 Length (char) followed by the handle bytes.
 EED X -3 See EED section.
@@ -6549,11 +6663,14 @@

20.4.67 DIMSTYLE CONTROL (68) (UNDOCUMENTED)

...
 Length MS -- Object length (not counting itself or CRC).
- Type BS 0&2 68 (internal DWG type code).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:

```

```

+ Type OT 0 68 (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 Owner handle (soft pointer) of root object (0).
 EED X -3 See EED section.
@@ -6584,11 +6701,11 @@
'''

20.4.68 DIMSTYLE (69)

'''
- Length MS -- Entity length (not counting itself or CRC).
+ Length MS -- Object length (not counting itself or CRC).
 Type BS 0 69 (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 Length (char) followed by the handle bytes.
@@ -6785,21 +6902,24 @@
'''

20.4.69 VIEWPORT ENTITY CONTROL (70) (UNDOCUMENTED)

'''
- Length MS -- Entity length (not counting itself or CRC).
- Type BS 0&2 70 (internal DWG type code).
+ Length MS -- Object length (not counting itself or CRC).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 70 (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 Owner handle (soft pointer) of root object (0).
 EED X -3 See EED section.
R13-R14 Only:
 Obj size RL size of object in bits, not including end handles
Common:
- Numreactors B L Number of persistent reactors attached to this obj
+ Numreactors BL Number of persistent reactors attached to this obj
R2004+:
 XDic Missing Flag B If 1, no XDictionary handle is stored for this
 object, otherwise XDictionary handle is stored as in
 R2000 and earlier.

Common:
@@ -6822,12 +6942,15 @@
'''

20.4.70 VIEWPORT ENTITY HEADER (71)

'''
- Length MS -- Entity length (not counting itself or CRC).
- Type BS 0&2 71 (internal DWG type code).
+ Length MS -- Object length (not counting itself or CRC).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 71 (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:

```

```

 Handle H 5 Length (char) followed by the handle bytes.
 EED X -3 See EED section.
@@ -6882,12 +7005,15 @@
| | H | 340 | Handle to scale (AcDbScale) object (hard pointer). See par
agraph 20.4.92. |

```

```

20.4.72 GROUP (72): Group of ACAD entities

```

```

'''
- Length MS -- Entity length (not counting itself or CRC).
- Type BS 0 72 (internal DWG type code).
+ Length MS -- Object length (not counting itself or CRC).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 72 (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 Length (char) followed by the handle bytes.
 EED X -3 See EED section.

```

```

@@ -6924,12 +7050,15 @@
'''

```

```

20.4.73 MLINestyle (73):

```

```

'''
- Length MS -- Entity length (not counting itself or CRC).
- Type BS 0 73 (internal DWG type code).
+ Length MS -- Object length (not counting itself or CRC).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 73 (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 Length (char) followed by the handle bytes.
 EED X -3 See EED section.

```

```

@@ -6998,12 +7127,15 @@

```

NOTE: OBJECTS LISTED AFTER THIS POINT DO NOT HAVE FIXED TYPES. THEIR TYPES ARE DETERMINED BY FINDING THE CLASS ENTRY WHOSE POSITION IN THE CLASS LIST + 500 EQUALS THE TYPE OF THIS OBJECT

```

20.4.74 DICTIONARYVAR (varies)

```

```

'''
- Length MS -- Entity length (not counting itself or CRC).
- Type BS 0 72 (internal DWG type code).
+ Length MS -- Object length (not counting itself or CRC).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 72 (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 Length (char) followed by the handle bytes.
 EED X -3 See EED section.

```

```

@@ -7264,11 +7396,11 @@

```

```

| | BL | 96 | Other error = 64
| | TV | 300 | Evaluation error code
| | | | Evaluation error message

```

|      |       |                                                     |
|------|-------|-----------------------------------------------------|
| ...  | ...   | The field value, see paragraph 20.4.99.             |
| TV   | 301,9 | Value string (DXF: written in 255 character chunks) |
| - TV | 98    | Value string length                                 |
| + BL | 98    | Value string length                                 |
| BL   | 93    | Number of child fields                              |
|      |       | Begin repeat child fields                           |
| TV   | 6     | Child field key                                     |
| ...  | ...   | The field value, see paragraph 20.4.99.             |
|      |       | End repeat child fields                             |

@@ -7397,12 +7529,15 @@

### 20.4.79 IDBUFFER (varies)

(holds list of references to an xref)

...

|                      |    |                                                   |
|----------------------|----|---------------------------------------------------|
| - Length             | MS | -- Entity length (not counting itself or CRC).    |
| - Type               | S  | 0 (internal DWG type code).                       |
| + Length             | MS | -- Object length (not counting itself or CRC).    |
| +R2010+:             |    |                                                   |
| + Handle Stream Size | MC | -- not counted in the Length                      |
| +Common:             |    |                                                   |
| + Type               | OT | 0 (internal DWG type code).                       |
| R2000+:              |    |                                                   |
| Obj size             | RL | size of object in bits, not including end handles |
| Common:              |    |                                                   |
| Handle               | H  | 5 Length (char) followed by the handle bytes.     |
| EED                  | X  | -3 See EED section.                               |

@@ -7517,12 +7652,15 @@

### 20.4.81 IMAGEDEF (varies)

...

(used in conjunction with IMAGE entities)

|                      |    |                                                   |
|----------------------|----|---------------------------------------------------|
| - Length             | MS | -- Entity length (not counting itself or CRC).    |
| - Type               | S  | 0 (internal DWG type code).                       |
| + Length             | MS | -- Object length (not counting itself or CRC).    |
| +R2010+:             |    |                                                   |
| + Handle Stream Size | MC | -- not counted in the Length                      |
| +Common:             |    |                                                   |
| + Type               | OT | 0 (internal DWG type code).                       |
| R2000+:              |    |                                                   |
| Obj size             | RL | size of object in bits, not including end handles |
| Common:              |    |                                                   |
| Handle               | H  | 5 Length (char) followed by the handle bytes.     |
| EED                  | X  | -3 See EED section.                               |

@@ -7567,12 +7705,15 @@

### 20.4.82 IMAGEDEFREACTOR (varies)

...

(used in conjunction with IMAGE entities)

|                      |    |                                                   |
|----------------------|----|---------------------------------------------------|
| - Length             | MS | -- Entity length (not counting itself or CRC).    |
| - Type               | S  | 0 (internal DWG type code).                       |
| + Length             | MS | -- Object length (not counting itself or CRC).    |
| +R2010+:             |    |                                                   |
| + Handle Stream Size | MC | -- not counted in the Length                      |
| +Common:             |    |                                                   |
| + Type               | OT | 0 (internal DWG type code).                       |
| R2000+:              |    |                                                   |
| Obj size             | RL | size of object in bits, not including end handles |
| Common:              |    |                                                   |
| Handle               | H  | 5 Length (char) followed by the handle bytes.     |
| EED                  | X  | -3 See EED section.                               |

@@ -7603,12 +7744,15 @@  
 \ \ \

### 20.4.83 LAYER\_INDEX

\ \ \

```
- Length MS -- Entity length (not counting itself or CRC).
- Type BS 0 (internal DWG type code).
+ Length MS -- Object length (not counting itself or CRC).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 Length (char) followed by the handle bytes.
 EED X -3 See EED section.
```

@@ -7658,11 +7802,14 @@

### 20.4.84 LAYOUT (varies)

\ \ \

```
Length MS -- Entity length (not counting itself or CRC).
- Type BS 0 (internal DWG type code).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 Length (char) followed by the handle bytes.
 EED X -3 See EED section.
```

@@ -8041,12 +8188,15 @@

```
| B | 290 | Default flag (default value is false).
```

### 20.4.90 PROXY (varies):

\ \ \

```
- Length MS -- Entity length (not counting itself or CRC).
- Type BS 0 typecode (internal DWG type code).
+ Length MS -- Object length (not counting itself or CRC).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 typecode (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 Length (char) followed by the handle bytes.
 EED X -3 See EED section.
```

@@ -8081,12 +8231,15 @@

### 20.4.91 RASTERVARIABLES (varies)

\ \ \

(used in conjunction with IMAGE entities)

```
- Length MS -- Entity length (not counting itself or CRC).
- Type BS 0 typecode (internal DWG type code).
+ Length MS -- Object length (not counting itself or CRC).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
```



+Common:

```
+ Type OT 0 typecode (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 Length (char) followed by the handle bytes.
 EED X -3 See EED section.
```

@@ -8133,12 +8286,15 @@

```
| | B | 290 | Has unit scale |
```

### 20.4.93 SORTENTSTABLE (varies)

```

```
-   Length        MS  --   Entity length (not counting itself or CRC).
-   Type          BS    0   typecode (internal DWG type code).
+   Length        MS  --   Object length (not counting itself or CRC).
+R2010+:
+   Handle Stream Size MC  --   not counted in the Length
+Common:
+   Type          OT    0   typecode (internal DWG type code).
R2000+:
  Obj size        RL          size of object in bits, not including end handles
Common:
  Handle          H     5   Length (char) followed by the handle bytes.
  EED             X    -3   See EED section.
```

@@ -8191,12 +8347,15 @@

20.4.94 SPATIAL_FILTER (varies)

```

(used to clip external references)

```
- Length MS -- Entity length (not counting itself or CRC).
- Type BS 0 typecode (internal DWG type code).
+ Length MS -- Object length (not counting itself or CRC).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 typecode (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 Length (char) followed by the handle bytes.
 EED X -3 See EED section.
```

@@ -8255,12 +8414,15 @@

```

20.4.95 SPATIAL_INDEX (varies):

```

```
- Length MS -- Entity length (not counting itself or CRC).
- Type BS 0 typecode (internal DWG type code).
+ Length MS -- Object length (not counting itself or CRC).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 typecode (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 Length (char) followed by the handle bytes.
 EED X -3 See EED section.
```

@@ -9141,12 +9303,15 @@

```
| | | | End repeat rows |
```

```
20.4.104 XRECORD (varies):
```

```

'''
- Length MS -- Entity length (not counting itself or CRC).
- Type BS 0 typecode (internal DWG type code).
+ Length MS -- Object length (not counting itself or CRC).
+R2010+:
+ Handle Stream Size MC -- not counted in the Length
+Common:
+ Type OT 0 typecode (internal DWG type code).
R2000+:
 Obj size RL size of object in bits, not including end handles
Common:
 Handle H 5 Length (char) followed by the handle bytes.
 EED X -3 See EED section.
@@ -9206,30 +9371,42 @@
00B28 45 76 crc
'''

```

```
21 Data section AcDb:ObjFreeSpace
```

-The meaning of this section is not completely known. The ODA knows how to write a valid section, but

-the meaning is not known of every field.

+From R13c3 to R15 this section is the third section, which is immediately followed by the SECOND FILE HEADER (R13-R15). See chapter 26.

-## 21.1 Until R18

+## 21.1 Until R2007

| Type            | Length | Description                                                       |
|-----------------|--------|-------------------------------------------------------------------|
| Int32           | 4      | 0                                                                 |
| UInt32          | 4      | Approximate number of objects in the drawing (number of handles). |
| Julian datetime | 8      | If version > R14 then system variable TDUPDATE otherwise TDUUPD   |

ATE.

|        |   |                                                     |
|--------|---|-----------------------------------------------------|
| UInt32 | 4 | Offset of the objects section in the stream.        |
| UInt8  | 1 | Number of 64-bit values that follow (ODA writes 4). |
| UInt32 | 4 | ODA writes 0x00000032.                              |
| UInt32 | 4 | ODA writes 0x00000000.                              |
| UInt32 | 4 | ODA writes 0x00000064.                              |
| UInt32 | 4 | ODA writes 0x00000000.                              |
| UInt32 | 4 | ODA writes 0x00000200.                              |
| UInt32 | 4 | ODA writes 0x00000000.                              |
| UInt32 | 4 | ODA writes 0xffffffff.                              |
| UInt32 | 4 | ODA writes 0x00000000.                              |
| UInt8  | 1 | Number of 64-bit values that follow (Always 4).     |
| UInt64 | 8 | max32, 0x00000032.                                  |
| UInt64 | 8 | max64, 0x00000064.                                  |
| UInt64 | 8 | maxtbl, 0x00000200.                                 |
| UInt64 | 8 | maxrl, 0xffffffff.                                  |

+## 21.2 Since R2010

| Type  | Length | Description |
|-------|--------|-------------|
| ----- |        |             |

```

-----|
+| Int64 | 8 | 0
+| UInt64 | 8 | Approximate number of objects in the drawing (number of ha
ndles).|
+| Julian datetime| 8 | If version > R14 then system variable TDUPDATE otherwise T
DUUPDATE.|
+| UInt8 | 1 | Number of 64-bit (resp. 128-bit) values that follow (Alway
s 4).|
+| UInt64 | 8 | max32, 0x00000032.
+| UInt64 | 8 | max32 hi, 0x00000000.
+| UInt64 | 8 | max64, 0x00000064.
+| UInt64 | 8 | max64 hi, 0x00000000.
+| UInt64 | 8 | maxtbl, 0x00000200.
+| UInt64 | 8 | maxtbl hi, 0x00000000.
+| UInt64 | 8 | maxr1, 0xffffffff.
+| UInt64 | 8 | maxr1 hi, 0x00000000.

```

# 22 Data section: AcDb:Template

This section is optional in releases 13-15. The section is mandatory in the releases 18 and newer. The template section only contains the MEASUREMENT system variable.

```

@@ -9716,23 +9893,10 @@
 }
 handleToDataRecord {
 }
 ...

```

## -# 25 UNKNOWN SECTION

- This section is largely unknown. The total size of this section is 53. We simply patch in "known to be valid" data. We first write a 0L, then the number of entries in the ob jmap +3, as a long. Then 45 bytes of "known to be valid data". Then we poke in the star t address for objects at offset 16.

- The 45 bytes of known to be valid data are:

```

- 0xA7,0x62,0x25,0x00,0xF6,0xAF,0x25,0x02,
- 0x3B,0x04,0x00,0x00,0x04,0x32,0x00,0x00,
- 0x00,0x00,0x00,0x00,0x00,0x64,0x00,0x00,
- 0x00,0x00,0x00,0x00,0x00,0x00,0x02,0x00,
- 0x00,0x00,0x00,0x00,0x00,0xFF,0xFF,0xFF,
- 0xFF,0x00,0x00,0x00,0x00

```

# 26 SECOND FILE HEADER (R13-R15)

## 26.1 Beginning sentinel

```

 {0xD4,0x7B,0x21,0xCE,0x28,0x93,0x9F,0xBF,0x53,0x24,0x40,0x09,0x12,0x3C,0xAA,0x01 }
;
@@ -9882,11 +10046,11 @@
 RL : 0
 RL : 0
 RL : 0

```

RL : 0

~~R2018+~~

+R2018+:

RS : 0

RS : 0

RS : 0