```
--- ODA-5.4.1.md        2023-11-20 18:53:23.909377915 +0100
+++ ODA-5.4.2-libredwg.md       2023-11-20 18:53:23.913377883 +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 AutoCADÂ® and a trademark of Autod
esk, 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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 # 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 rea
d at the bit level. Various parts of the drawing use data in compressed forms, which ar
e explained below. Here are the abbreviations used in this document for the various com
pressed forms:
+Much of the data in the DWG file format versions 13/14/2000/2004/2007/2010/2013/2018 m
ust 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 v
arious 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 i
mage 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 Portoguese)
+|   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 an
-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 sixt
h 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
ll 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.

@@ -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 re
ferred 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:
@@ -5624,20 +5689,23 @@

 ### 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 +5732,23 @@

 ### 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 +5820,23 @@

 ### 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 +5859,14 @@

 ### 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 +5929,23 @@

 ### 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 +5982,14 @@
  |                          | 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 +6040,23 @@

 ### 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 +6083,14 @@

 ### 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 +6157,23 @@

 ### 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 +6196,14 @@

 ### 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 +6297,23 @@

 ### 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 +6336,14 @@

 ### 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 +6401,14 @@

 ### 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 +6442,14 @@

 ### 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 +6573,14 @@

 ### 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 +6612,14 @@

 ### 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 +6662,14 @@

 ### 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 +6700,11 @@
 ```

 ### 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 +6901,24 @@
 ```

 ### 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 +6941,15 @@
 ```

 ### 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 +7004,15 @@
 |          |  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 +7049,15 @@
 ```

 ### 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 +7126,15 @@
 NOTE: OBJECTS LISTED AFTER THIS POINT DO NOT HAVE FIXED TYPES. THEIR TYPES ARE DETERMI
NED BY FINDING THE CLASS ENTRY WHOSE POSITION IN THE CLASS LIST + 500 EQUALS THE TYPE O
F 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.
@@ -7397,12 +7528,15 @@
 ### 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 +7651,15 @@

 ### 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 +7704,15 @@

 ### 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 +7743,15 @@
 ```

 ### 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 +7801,14 @@

 ### 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 +8187,15 @@
 | | 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 +8230,15 @@

 ### 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 +8285,15 @@
 | | 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 +8346,15 @@

 ### 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 +8413,15 @@
 ```

 ### 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 +9302,15 @@
 |       |       |     | 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 +9370,42 @@
 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 vali
-d 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      | maxrl, 0xffffffff.
       |
+| UInt64          | 8      | maxrl hi, 0x00000000.
       |

 # 22 Data section: AcDb:Template

 This section is optional in releases 13-15. The section is mandatory in the releases 1
8 and newer. The template section only contains the MEASUREMENT system variable.

@@ -9716,23 +9892,10 @@
 }
 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 +10045,11 @@
      RL : 0
      RL : 0
      RL : 0
      RL : 0

-R2018+
+R2018+:

      RS : 0
      RS : 0
      RS : 0
```