DRÄXLMAIER

SPECIFICATIONS MANUAL

As-built Documentation

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1 General Part of the As-built Documentation

1.1 Preliminary Remarks

Preliminary Remarks Technical Documentation:

The Supplier has to compile technical as-built documentation based on the latest version of the execution plans, the compiled and released shop floor planning, the latest architect works plans and the work performance, if necessary with additional information, for the entire scope of work as described in these specifications and discuss them with the Buyer if necessary.

The technical documentation is a collection of the revision and as-built documentation to be compiled and submitted by the Supplier. From these documents, the user will clearly and unmistakably recognize the set-up, function and operation of all the systems.

Note:
In order to ensure trouble-free compilation of the documentation, coordination talks (so-called CAD preliminary talks) and coordination talks across the subsection have to be planned. Before submission, a test has to be made in which the quality of the CAD drawings is assessed.

Two copies of the documentation are to be submitted in paper and 2 copies on data carriers (CD or DVD) by the time of acceptance. The documentation is to be compiled completely (with all the documents and plans) both in paper and on data carriers.
The as-built documentation in paper form may be dispensed with if so agreed to or instructed by the Project Manager.

If specifications are not complied with the requirements, the documents will be returned for revision and will be noted as an error in the punch list. Final hand over is only possible with fulfilled requirements.

1.2 Basic Principles of as-built Documentation

1.2.1 General Principles:

The as-built documentation has to be given as a completed package to the owner.

The as-built documentation is to be marked as such and has to contain the final condition of the provided deliveries and services. As-built drawings have to show all correctly dimensioned changes that occur in course of the execution. All the documents required for the technical documentation (description of the unit, calculations, spec sheets, service notes, etc.) are to be indicated in the as-built documentation.

Compilation of as-built documentation is required for all the parts of the scope of work.

In case of renovation or expansion of existing buildings, as-built documentation has to be done partly, extent is described in the scope of work.

Documents and drawings are all in English and in the national language.

- Project number and project title has to be indicated in fully correspondence and in as-built documentation.
- Back up of all Data has to be done on a standard data carrier and named according to the specified structure.
  - ► (SEE ADDENDUM: "INDEX_DATA CARRIER") (FOLDER STRUCTURE)
- Data Carriers are to be labeled as specified.
  - ► (SEE ADDENDUM: "LABELING_DATA CARRIER.DOCX")

- Specified table of contents is mandatory both in paper form and for data carriers.
  - ► (SEE ADDENDUM: "TABLE OF CONTENTS.DOCX")
  - ► (SEE ADDENDUM: "INDEX_DATA CAREIR") (FOLDER STRUCTURE)

- Before data is exchanged, make sure that there is no malware on the medium. All media have to be examined for malware immediately before submission. A professional virus protection has to be used. In the case of damage, the cause may be obliged to compensate for damages.

- All documents (planning documents, operating instructions, instruction reports, inspection certificates, etc.) have to be sorted for submission for technical approval according to the table of contents.

- Text contributions, charts, data sheets or other data are to be submitted without password protection in the usual file formats of the current MS Office package and also as pdf files.

- Scanned data sheets, photographs or other details are to be submitted in the usual file formats of the current standard software packages and also as pdf files.

- As-built documentation and the sectional and detail drawings are to be attached as the latest versions of current implemented drawing in the appropriate scale.

- Original documents (inspection certificates, measurements, permissions, etc.) are implemented in the "owner version" copies are used in the other versions.

- For as-built folders black color is preferred. The labeling of the folders has to be done according to the template.

  ► (SEE ADDENDUM: "LABELING_BINDER LABELS.XLSM")

- Other documents that may be listed in the specifications are to be included in the documentation.

- A transfer confirmation has to be compiled for the as-built documentation which confirms the correctness of the entire documentation. Hand over certificate for the delivery of the as-built documentation has to be signed by both parties and has to be attached to the "owner version" as a signed original copy. In the other copies, copies of the documents have to be attached as the appropriate places.

  ► (SEE ADDENDUM: "DELIVERY CONFIRMATION AS-BUILT DOCUMENTATION.DOCX")

1.2.2 Drawing Standards (CAD Standard)

General information
The requirements and specifications in this section form the basis for the compilation and processing of digital drawings for the as-built data acquisition. The CAD standard defined for this should ensure a data structure as a basis that is as uniform as possible that may result from possibly different CAD systems, program versions and individual working methods.

As a matter of course all drawings, graphics and illustrations have to be according the local codes and standards.

Template files are provided for each discipline. These drawing-related basic settings like the layer structure, symbol legends, etc. are already included.
Drawings submitted by DRÄXLMAIER GROUP are to be continued. If new drawings have to be compiled, they are to created/compiled based on the template drawing.

- ► (SEE ADDENDUM: "TEMPLATE DRAWING_CIVIL ENGINEERING.DWT")
- ► (SEE ADDENDUM: "TEMPLATE DRAWING_ELECTRICAL ENGINEERING.DWT")
- ► (SEE ADDENDUM: "TEMPLATE DRAWING_MECHANICAL ENGINEERING.DWT")

As-built data and schematic diagrams have to be shown in a way that the delivered, assembled units are shown in the final condition after the completion of the assembly.
Only complete as-built drawings with the correct file names, color and layout templates and the right file location will be accepted. If this is not the case, the entire package will be returned for revision to the corresponding company.

One to two trial plans for each discipline can be sent in advance for review to DRÄXLMAIER GROUP.
Do not draw on the "0" layer in CAD drawing.

Format / System:
All drawings have to be shown in the CAD form (e.g. floor plans, detail drawings, lightning protection drawings, outdoor facility plants, schematic diagrams, etc.).
The currently applied system is AutoCAD Architecture 2013.
For Mechanical Engineering, AutoCAD extension pit-CAD 2013 is also used.
Circuit diagrams for electrical engineering have to be compiled with EPLAN P8 2.2.

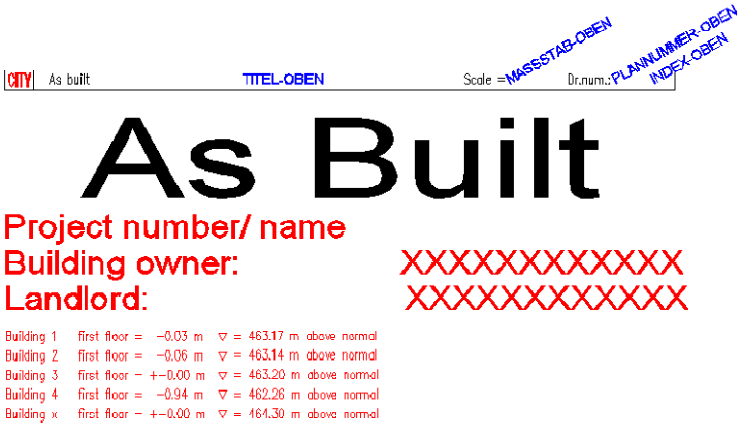
The drawing exchange format is AutoCAD-DWG in the AutoCAD 2010 version or later.

In order to ensure smooth transfer of the CAD data, the data formats for the transfer of drawing are specified to ensure data compatibility.
The original copies or certified Autodesk DWG format are specified as a mandatory transfer format for CAD data.
EPLAN files have to be transferred as a backed up project. ZW1 file format.

Model area/paper area:
Every layout drawing, projection, schematic drawing or sectional drawing in a CAD drawing, represents a separate layout or a separate file. The content has to be shown in the file name/layout name. Only one type of drawing may appear in a DWG file. Schematic diagrams can therefore not be included in layout drawings. Paper area: (layout area) This is where plot layout module is compiled. Moreover, the elements specific to the layout such as header, sheet frame and if necessary the approval stamp are entered.
Model area: all the discipline-related geometrical and alphanumerical information of a drawing is compiled in the model area only.
Change marking, legends, inscriptions, drawing elements and symbols of the drawing have to be compiled in the model area and shown in the layout.

Headers and drawingning frames
Headers and frames have to be used in accordance with the applicable documents.

The template drawings have an automatic layout. After marking the drawing frame, a context menu arrow appears that can be used to select the paper size and automatically the size of the header labeling. If a size other than the DIN formats has to be used, the sheet can be changed with the help of the blue arrow to the required format by selecting "Benutzerdefiniert". The drawing frame may not be copied as otherwise the automatic labeling would not work. The only exception is copying the whole layout. (Right-hand click on Layout-> "shift or copy…")



Headers are referenced separately in each layout with the relative path type (Xref) in order to retain the basic data.

Headers are used to uniquely identify a drawing and usually contain the following information:

- Drawing contents such as building/ structure, subsection, floor details
- Scale
- Sheet size
- Created by
- Date of the drawing level
- Real estate, incl. country and place
- Building owner and Landlord
- File name
- Project number
- Project description
- heights
- Company logo of the Supplier
- Photo/view of the building

The header is labeled once in its basic data and saved in a separate file. The basic data here is the country and place in the upper left or in the middle (abbreviated form DE and GSH) as well as the country, place and real estate. In addition, the owner, the Landlord (if different), the project number and description and the heights have to be entered. *(shown in red in the picture)*

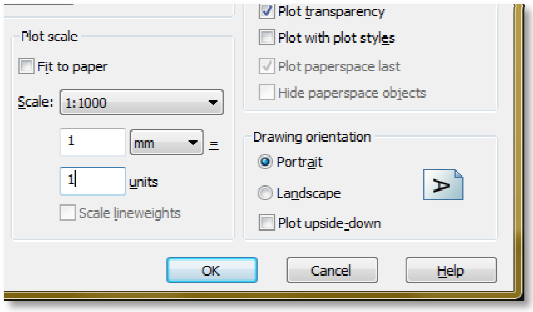
You can edit the attributes shown in geen in the picture (header labeling) for each layout with a double-click
The attributes shown in blue are adapted automatically (the drawing has to be REFRESHED at this point).

► (SEE ADDENDUM: "G_XXX_HEADER AS-BUILT DOCUMENTATION_A4.DWG")
► (SEE ADDENDUM: "G_XXX_HEADER AS-BUILT DOCUMENTATION_SMALL.DWG")

Formats/sizes:
DIN formats should be used as possible for frame sheet formats. If different formats are used, indicate the sheet format in the title block.
The drawing documents have to be compiled according to norm. The paper height may not be more than 900 mm. The drawing frames of the template files have to be used and the actual dimensions changed.

► (SEE ADDENDUM: "TEMPLATE DRAWING_CIVIL ENGINEERING.DWT")
► (SEE ADDENDUM: "TEMPLATE DRAWING_ELECTRICAL ENGINEERING.DWT")
► (SEE ADDENDUM: "TEMPLATE DRAWING_MECHANICAL ENGINEERING.DWT")

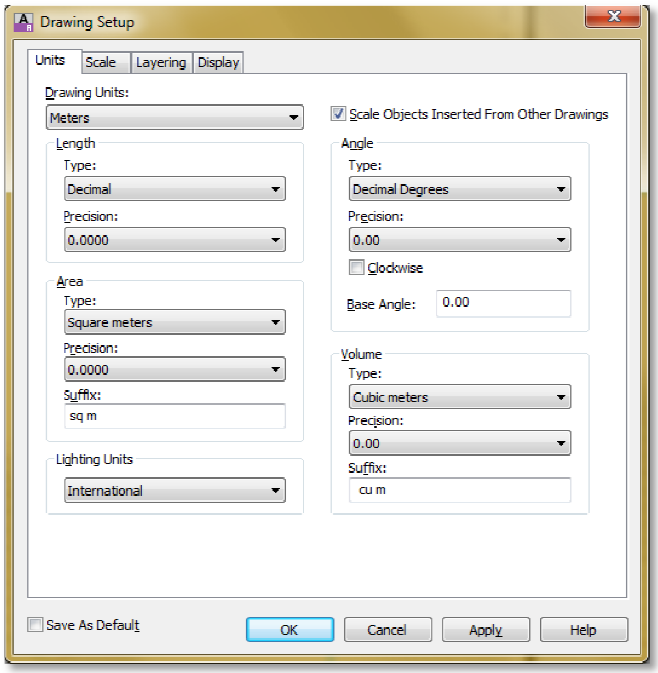
Scale:
The drawings have to be drawn in the 1:1 scale (i.e. drawing units in the program correspond to 1.00 measurement units). Other conventional scales can be used to compile detail drawing within the drawings.
Plot scale: 1:1



Units:
The following are to be used as drawing units in the model area:

- Department Structural/civil engineering: meters [m]
- Department Engineering (supply technology): millimeters [mm]
- Department Technology (electrical engineering): meters [m]

Exception: Drawings in the USA are made in feet/inches.



Layer structure:
In general, it is mandatory to go ahead with the given specified layer structure.
All the drawing elements have to be compiled with the specified layer structure.
Color allocation of drawing elements and drawing symbols is "from layer".

► (SEE ADDENDUM: "TEMPLATE DRAWING_CIVIL ENGINEERING.DWT")
► (SEE ADDENDUM: "TEMPLATE DRAWING_ELECTRICAL ENGINEERING.DWT")
► (SEE ADDENDUM: "TEMPLATE DRAWING_MECHANICAL ENGINEERING.DWT")

Amendments to individual layers have to be admitted by project management/ project leader. Any missing layers have to be re-compiled in accordance with existing layer structure with the following characteristics:

- Place the first symbol as a capital letter for the discipline, e.g. “A” for Architecture
- Separate single words or letter with an underline (A_DOORS_TEXT)
- Material or type name in German or English without numbers (A_**DOORS**_TEXT)
- Additional descriptions in German or English without numbers (A_DOORS_**TEXT**)

The following applies to mechanical engineering:
The layer name for the discipline mechanical engineering is divided up into two levels, each separated by an underline.
The first level is for the structure of the contents, the second level contains the "layer name". If required for further differentiation, other flexible levels can be added, connected with t minus sign or an underline.

1st level: Type of presentation and discipline
Floor plan:
2H → heating, drawn two-dimensionally
2L → ventilation, drawn two-dimensionally
2S → plumbing, drawn two-dimensionally
2T → across the disciplines, drawn two-dimensionally

Schema:
HZ → heating
LU → ventilation
SA → plumbing

2nd level: Layer name in abbreviated form
e.g. SWGR → wastewater underground pipe

The full name of a layer, here for "wastewater underground pipe" (German: “Schmutzwasser Grundleitung” as an example is therefore: 2S_SWGR

The layers from the template drawing have to be used.
Attention: Because of using PIT-CAD for FM the layers has to be named in German in all drawings.

If other layers required not available in the template, they can be analogously created along specified structure.

All the layers with the associated filters are already created in the template files. In the final drawings not used layers should be deleted.

Symbols or Blocks have to be used out of the template drawings. If new symbols or blocks are required, the blocks should generally be created on the "0" layer. The drawings may not contain any unused blocks for the transfer. Before the data transfer, the drawings therefore always have to be cleared of "unused" blocks.
In addition to the transferred DRÄXLMAIER GROUP symbols, the symbols effective in each country are allowed. Symbols specific to a country have to be noted clearly in the legend.

Legends:
For each drawing a legend has to be compiled, containing only the symbols that are used.
If any symbols that are not provided by DRÄXLMAIER GROUP are used, all the symbols and drawing elements have to be included in a separate DWG called Legends.

► (SEE ADDENDUM: "FILE NAME AND DRAWING NUMBER.DOCX")

Shading:
The shading used in drawings has to be shown as shading or as a coherent object/block. Thus, shading cannot be shown as individual lines. The used shading has to be compiled on separate layers. Exceptions to this is shading that is integrated in blocks, parts or objects out of the application.

Dimensioning:
Dimensioning is done according to the effective DIN norm, unless other agreements were made. Dimensions have to be made as associative dimensions. Dimensions may not be manipulated by dimension text transference. An exception is the indicated height of door and window sizes for 2D layout drawings. Only the AEC dimensions or pure AutoCAD dimensions ("contorted dimension") are allowed. Dimensioning out of external systems is only allowed if it is recognized at least as a "rotated dimension" in the AutoCAD.

Materials: The used materials/types have to be labeled.

External references:
References always have to be given with the relative path.
External as drawings or pixel pictures have to be provided when transferring the drawings if this data contains supplementary information on the master data or is of significance for the exchange of information. Delivered CAD data and reference drawings have to refer to the same data stock in order to avoid double information. When allocating references, the special insertion layer out of the CAD layer structure has to be set and/or used as the effective layer.

The file names and/or paths may not be changed so that the necessary external references can always be allocated currently.

Coordinate System, Insertion Points and Alignment:
Before starting the drawing, a drawing basis point (reference 0,0,0) is to be specified and documented specific to the project. In preliminary/shop floor drawings all the drawing elements are drawn by DRÄXLMAIER GROUP in the correct position to the point 0,0,0 (x, y, z of the world coordinate system =WKS).
This point is to be used as a binding basic point.
In order to facilitate drawing for rotated basic layouts, user-defined coordinate systems = BKS may be created with other basic points. If drawings are sent, care must be taken to ensure that the WKS is set and/or that the used BKS = WKS.
If copies of site relevant drawings are used take care that they refer to the WKS 0,0,0
All drawing geometries have to be set up with the precise position, length and angle by using identical coordinate systems.
The basic point for layout drawings has to be the same for the entire transfer of the as-built data.

Live loads: Assumed live loads have to be inserted in the drawings for the internal and external areas together with all the charts and legends.

Labeling and Display:
The drawings have to show and label all the rooms, fire resistance classes, parts and regulated/controlled unit parts as well as the associated electrical, measurement and control units in their joint function.

All the labeling or multi-functional objects have to be compiled in "Arial" font. Texts have to be compiled as MText on the appropriate layers in a font that is adapted to the scale. Care must be taken to ensure that the texts, dimensions and other labels do not overlap. (ACAD shortcut: Mtext -> multi-line text that can be formatted).

Plots and PDF's:
All plots have to be compiled with the provided plot style charts (*.ctb).

Which plotter configurations for which drawings:

Drawing type:	**Plot style chart:**
All in the pdf format	Fine color.ctb
Site drawings	Fine color.ctb
measurement	Fine color.ctb
Layout drawings	Fine color.ctb
Sections	Fine color.ctb
Views	Fine color.ctb
Outside facilities	Fine color.ctb
Visualization	Fine color.ctb
Installations/operational layouts	Fine color.ctb
Installation drawings Mechanical Engineering	none
Diagrams Mechanical Engineering	none
Overall electrical engineering:	Elektro color.ctb

The appropriate plotter configuration file "DWG To PDF.pc3" has to be used to compile and/or plot pdf's.

Note on Mechanical Engineering:
Processing is done here without the plot style chart. The appropriate colors, line types and thicknesses are already included in each of the layer characteristics and are put down that way on paper.

► (SEE ADDENDUM: "ELECTRO COLOR.CTB")
► (SEE ADDENDUM: "FINE COLOR.CTB")
► (SEE ADDENDUM: "DWG TO PDF.PC3")

1.2.3 Folder labeling/FOLDER STRUCTURE

- The data carriers have to be labeled in accordance with the template. Data carriers are to be filed in each first folder of the documentation.
  ► (SEE ADDENDUM: "LABELING_DATA CARRIER.DOCX")
- The specified folders and directory have to be adhered to.
  ► (SEE ADDENDUM: "INDEX_DATA CARRIER") (FOLDER STRUCTURE)
- Folders have to be labeled according to the template.
  ► (SEE ADDENDUM: "LABELING_BINDER LABELS.XLSM")
- Folders are to be given a cover sheet that provides information on the construction project.
  ► (SEE ADDENDUM: "CONTENTS_FOLDER COVER SHEET.DOCX")
- The table of contents is to be filed in the folder in a transparent film. Each folder has to contain a directory with the contents of all the folders. The contents of each folder have to be marked (*marked grey).* The folder should be consecutively numbered.

  ► (SEE ADDENDUM: "TABLE OF CONTENTS.DOCX")
- The various chapters/titles have to be separated by tabs (DIN A4) and labeled according to the addendums. The sub-chapters/titles have to be separated by dividing bands.

  ► (SEE ADDENDUM: "TABLE OF CONTENTS_REGISTER.DOCX")
  ► (SEE ADDENDUM: "TABLE OF CONTENTS_SEPARATING PAGES.DOCX")
- The original copies of the product data sheets have to be filed in the "main copy" and as colored copies in the other copies.
- Drawings and documents have to be compiled in English and in the national language. If it is a project in a German-speaking area, the German version will suffice.

1.3 File Names and Drawing Numbers

File names: The name of drawing files and other documents that are produced in a digital data collection has to be structured. The structured file names have the task of clearly identifying each file in the data exchange process and preparing it for clear data filing. The name has to be given in accordance with the appropriate template.

Drawing numbers: Drawings have to be given an explicit drawing number and retained even in the drawing list in order to enable the data package to be checked faster to ensure it is complete.

► (SEE ADDENDUM: "FILE NAME AND DRAWING NUMBERS.DOCX")

1.4 Numbering

1.4.1 Room numbers:

The appropriate template has to be used for the issue of explicit room numbers.

► (SEE ADDENDUM: "AA-DTA-07-04-0013-NUMBERING OF BUILDINGS, FLOORS AND ROOMS ")

1.4.2 Door Numbers, Window Numbers:

Door numbers contain the room number, in the direction of which the door panel swings open, supplemented by the letter" T" and a serial number referring to this room. In the next room, the door numbering re-commences with "T01". If a door opens to the outside, this door is to be designated with the room number of the outgoing room.

- Door and window numbers are comprised of the room number and the element number.
- For doors, the element number is described with a **"T",** for windows, it is described with an **"F"**.
- Doors always belong to the room in which they can be opened. Doors that open outwards (to the outside) have to be allocated to the room in which they are located.
- The first number combination consists of the room number to which the appropriate element belongs (**01-0-10** F01)
- A blank space has to be left between the room number and the corresponding window number.
- The rear part describes the element number (01-0-10 **F01**) and it always has to be behind the letter with two digits and be consecutive in a clockwise direction.

Example of door numbers:

1-0-01 T01	⇨	(Building 1, ground floor, Room 01 + Door number 01)
5.1-2-15 T03	⇨	(Building 5.1, 2. First floor, Room 15 + Door number 03)
21-U2-70 T15	⇨	(Building 21, 2. basement, Room 70 + Door number 15)

Examples Window numbers:

1-0-01 F02	⇨	(Building 1, ground floor, Room 01 + Window number 02)
5.1-2-15 F08	⇨	(Building 5.1, 2. first floor, Room 15 + Window number 08)
21-U2-70 F05	⇨	(Building 21, 2. basement, Room 70 + Window number 05)

1.4.3 Equipment numbers (HLS/HVAC):

Each machine, each unit or each relevant part has to be marked with an equipment number. The number in the as-built documents should show the brand, the model, the performance data etc.

The purpose of the equipment name is to clearly identify the equipment parts. The equipment number is there to make purchase of spare parts and exchange easier. The equipment name should be shown on the equipment and in the as-built documentation (drawings, directory, calculations, characteristic lines, etc.). Basically, equipment is named via the room number and the discipline. A code designation of the unit parts should also facilitate the allocation.

The numbering should be made according to
► (SEE ADDENDUM: "UNIT_NUMBERS-GENERATOR.XLSM ").

1.4.4 Distributor numbers (electrical engineering)

The designation of the electric distributors is made according to the following scheme:
Type of distributor – power supply type – locality – consecutive numbering (2 digits)

Type of distributor:

MSB	= Main Switch Board	
BSPD	= Building Service Power Distribution	
PSDP	= Power Sub Distribution Panel	
BSPP	= Building Service Power Panel	(480/277V)
BSRP	= Building Service Receptacle Panel	(208/120V)
PPSD	= Production Power Sub Distribution	
PDP	= Production Distribution Panel	(480/277V)
PRP	= Production Receptacle Panel	(208/120V)
UPP	= UPS Power Panel	
EPDP	= EPS Power Distribution Panel	

Power supply:

UPS	= Uninterruptible Power Supply
PV	= Photovoltaic System
CHP	= Combined Heat and Power unit
EPS	= Emergency Power Supply

The general power supply/normal network is not included in the naming. If the drawing or power supply types mentioned here are not adequate, additional types have to be agreed on with the professional drawingner for electrical systems.

Locality:

40-01	=	Building 40 – 1. First floor
27-00	=	Building 27 – Ground floor
39-U1	=	Building 39 – 1. Basement

Examples:
Distributor name at the site:

GHV-40-01-19	(main building distribution – normal network – bldg. 40 – FIRST FLOOR1 – Number 19)
UVM-DN-27-00-05	(machine sub-distribution – diesel-powered network – bldg. 27 – ground floor – Number 5)
HV-SV-39-00-01	(main distribution – security supply – bldg. 39 – ground floor – Number 1)

1.4.4.1 File name

The file name of the distributor drawings consists of the abbreviations of the addendum. However, the order here is changed.
Type_site_Building_distributor number out of 1.4.4 (distributor type – power supply – locality – consecutive no.)
Example:
E_VIB_21_ UVM-DN-27-00-05

► (SEE ADDENDUM: "FILE NAMES AND DRAWING NUMBERS.DOCX")

1.5 File structure

The folder structure must be adhered to, as it is a centralized filing system.
The contents of the index of the digital version have to be completed in accordance with the as-built folders of the paper version. Only the sub-folders for each of the disciplines are inserted. The contents of the as-built folders should be reflected 1:1 in the file structure.

► (SEE ADDENDUM: "INDEX_DATA CARRIER") (FOLDER STRUCTURE)

The construction project and/or the site is designated in the file path with the country, the place and the real estate. A separate folder has to be created for the documentation and as-built drawings of the cross-site and/or cross-building constructions. This folder contains all the layout drawings of the site. A new folder is created for the documents specific to the building. These folders contain all the documents that can be allocated directly to the buildings. The folder structure is to be used according to the pattern

► (SEE ADDENDUM: "INDEX_DATA CARRIER") (FOLDER STRUCTURE)

1.6 Table of Contents

For better orientation, the contents for each discipline should be set up uniformly. For this purpose, the following table of contents applies, the sub-items of which may turn out differently (see Title 2, Technical Part of the As-built Documentation).
The basic structure looks as follows:

1. Building / Unit Specification

2. As-built drawings
   - 2.1. Drawing list
   - 2.2. Layout drawing
   - 2.3. Measurement
   - 2.4. Floor drawings
   - 2.5. Sections
   - 2.6. Views
   - 2.7. Schematic diagrams
   - 2.8. Distribution drawings
   - 2.9. Installation drawings
   - 2.10. Lightning protection
   - 2.11. Outdoor facilities
   - 2.12. Visualization
   - 2.13. Facilities/Operational layouts
   - 2.14. …

3. Meeting Minutes, Reports, Verifications
   - 3.1. Certification by the Supplier
   - 3.2. Hand Over Protokoll
   - 3.3. Surveys, expert opinions, inspection by experts
   - 3.4. Test and Measurement Reports
   - 3.5. Verifications
   - 3.6. ….

4. Maintenance instructions, Inspection Notes
   - 4.1. Maintenance instructions accord.to VDMA
   - 4.2. Maintenance instructions of the manufacturer
   - 4.3. Testing instructions
   - 4.4. …

5. Manufacturer and/or Supplier Register

6. Technical Documents / Product Descriptions / Operating Instructions

7. Building Approvals/ Test Certificates
   - 7.1. Building Permits
   - 7.2. Test Certificates
   - 7.3. …

8. Calculations
   - 8.1. …
   - 8.2. ….

9. Structural design
   - 9.1. Title page
   - 9.2. Revision directory
   - 9.3. Table of contents
   - 9.4. Preliminary remarks
   - 9.5. Load assumptions
   - 9.6. Calculations and verifications in the individual positions
   - 9.7. Connection structural design or connection load tables
   - 9.8. Overview drawings, position drawings
   - 9.9. Formwork drawings, design drawings and reinforcement drawings
   - 9.10. Final page with signature
   - 9.11. …

► (SEE ADDENDUM: "TABLE OF CONTENTS.DOCX")

1.7 Quality Assurance

All documents of the construction documentation will be assumed to have been checked by Supplier according to the specifications of the general conditions of Buyer and transferred to enable the quality assurance of the as-built documentation to be made on this basis.

This particularly applies to:

1. The Completeness Check
Documentation has to be checked that all changes occurred during construction phase are implemented.

2. Review of the contents for correctness and conformity with the project volumes that have been put into effect.
Supplier has to ensure that the illustrated data conforms to the actually built local conditions.

3. Form and Structural Test

The Supplier is required to review the as-built documentation according to the specifications (data types, file names, layer structure, data format and additional identification through drawing number).
After the handover to DRÄXLMAIER GROUP a final check is required by DRÄXLMAIER GROUP Project leader.

► (SEE ADDENDUM: "LF-DTA-02-01-0002-PROJECT COMPLETION.DOCX")

1.8 Real estate, Copyright and Data Protection

The Buyer is entitled to exclusive use of the documents made by the Supplier, particularly also their changes, copies or transfer of use to third parties. The afore-mentioned rights of use also apply for the building(s)/unit(s) constructed according to the documents. The Buyer listens to the Supplier before any significant changes to a piece of work protected by copyright.

The Supplier has to take care that all persons involved in the project complies with the required legal regulations on data protection and that the information attained from the Buyer is not disclosed to any third parties or otherwise exploited. An obligation according to data protection law by this person to maintain data confidentiality (NDA's) has to be enforced before the initial beginning of the work and shown to the Buyer upon request.

2 Technical Part of the As-built Documentation

2.1 Building and Unit Specification

Documents have to be compiled for the individual discipline and divided up separately.
The unit description should contain the following information:
Set-up, function, design data and/or design principles, safety-related installations, local allocation of the buildings, indication of the warranty-related data, general description of the scope of installation.

2.1.1 Civil Engineering:

No further particulars

2.1.2 Electrical engineering:

No further particulars

2.1.3 Mechanical Engineering:

The supply-related disciplines include:

- Heating
- Plumbing
- Ventilation
- Air-conditioning
- Sprinkler systems
- Fire main
- Pneumatics
- Cooling
- Industrial process measurement and control

Separate as-built documentation is to be compiled for each discipline.

The individual units with all the technical data (temperatures, pressure, etc.) and the set values have to be described in the unit description.
The individual parts of the control system are to be described with their tasks and functions in the unit and functional description for the industrial process and measurement control.

2.2 As-built drawings

As-built drawings have to be compiled and plotted in color according to the appropriate CAD standards (see item 1.2.2). The drawings have to be filed with adequate reinforcements of the perforation or filed in a separate box file.

If the order is for reconstruction, the effective as-built drawings have to be requested from DRÄXLMAIER GROUP.

Drawing list:
All drawings have to be entered in a drawing list in accordance with the template. It is also to be filed as a printout.

► (SEE ADDENDUM: "DRAWING LIST_AS-BUILT DRAWINGS.XLSX")

2.2.1 Civil Engineering:

Construction drawings:
All construction-related drawings, such as floor drawings, views, section, drainage and detail drawing have to be filed here.
Site drawings:
Site drawings of all divisions with their underground pipes, such as water supply, drainage, gas, electrical systems, district/local heating, telecommunications and all the divisions necessary for supply and disposal are filed here. Importance is attached to extreme precision in these drawings in order to be able to calculate the exact position of the individual pipes for later reconstruction work.

Measuring:
Site drawings, such as digital field maps, site measuring drawings for the properties, official site drawings, land registry drawings and all the necessary drawings that belong to the base and field maps are to be filed here.

Outdoor areas:
Drawings with information such as traffic and its routes, hubs, video surveillance, barriers, quiet zones, bicycle parking, waste disposal etc. are filed here.

Visualizations/ Renderings:
All visualizations and renderings are filed here.

2.2.2 Electrical Engineering:

Installation drawings, outdoor area and site drawings:
This is where the location of all the electrical parts in the floor drawing is specified. The meaning of the applied symbols has to be clearly legible in the legends. Installation heights and electric circuit numbers have to be clearly allocated. Electric circuit numbers have to match the circuit diagrams and be suited to local conditions.

► (SEE ADDENDUM: "DRAWING CONTENTS_ELECTRICAL AS-BUILT DRAWINGS.DOCX")

Circuit diagrams (distribution drawings):
Drawings have to be submitted as pdf and in the "EPLAN" formats.
The "EPLAN" and "PDF" subfolders are to be compiled in the parent folder "circuit diagrams", files are to be archived accordingly.
EPLAN exchange format, see item "1.2.2 Format and System". In exceptional cases, the as-built documentation of the electrical distributor can be made in the DWG format, if so agreed to by the planner.

All the parameters of the used electrical parts have to be given clearly in the circuit diagram.

The circuit diagrams have to be drawn in detached representation, multipolar illustration.

Schematic diagrams:
Schematic diagrams of the various wiring systems as an overview (e.g. IT diagram; riser diagram, fire alarm diagram, burglar alarm diagrams, antenna diagrams,…)

Lightning protections:
This folder contains all drawings that are connected with lightning protection such as concrete footing ground drawings, drawings with numbered terminal lugs, etc.

Interval Drawing Transfer:
If there are two or more assignments by a Supplier at one site during minor measures, as-built documentation should be divided up according to the measures (order numbers). Various measures submitted in one as-built drawing should be an exception and has to be discussed with and agreed to by the responsible professional drawingner (Buyer).

Disassembly:
If sockets, lamps, fuses, distributors etc. are disassembled, they have to be recorded in a separate drawing and submitted to the Buyer with the as-built documentation.

2.2.3 Mechanical Engineering:

- Each drawing is to be given a legend of the pipelines (colors) and of the fittings/systems!
- The Buyer uses an AutoCAD attachment to show the Mechanical Engineering. The layers, colors and symbols of this attachment have to be used. (PIT CAD)
- The equipment names have to be entered in the drawings to clearly show which device was installed.
- The drawings have to be given an exact drawing number.
- The drawings have to contain the pipe axes, and indicate the heights and slopes.
- Dimensions and pressure stages of pipelines and canals have to be indicated.
- The materials that are used have to be indicated.
- Flow rates (m/s), volume flows (m³/h, kg/h,…) have to be indicated.
- Drawings have to show draining and ventilation
- Building and operator limits borders have to be indicated
- Unit numbers have to be indicated.
- Temperatures have to be entered
- Floor drawings are to be highlighted in grey as external references and included in the submission.
- When the MSR circuit diagrams and wiring diagrams are compiled, the indications out of the discipline electrical systems (see item 2.2.2) have to be observed.

2.3 Meeting Minutes, Reports and Verifications

Certification by the Supplier that the delivered, installed units adhere to the relevant specifications, the norms and regulations and the official specifications and are free of defects, signed for testing by the responsible person.

The legally prescribed or officially required (e.g. fire department) reports, verifications, protocols, inspections reports, special inspections and experts tests are to be attached to the appropriate documents.

Measurement protocols: The measurement results have to be summarized, target/actual comparison. Individual protocols should include details on the measuring point, the date of the measurement, target and actual values and any other necessary factors.

Certificates of compliance for fire protection-related parts have to be compiled and submitted.

For new installed unites/ buildings a briefing is required made by Contractor. Participants are named by project leading (DRÄXLMAIER GROUP). The contractor is committed to create an attendance protocol. This has to be provided with the as-built documentation.

2.3.1 Construction Engineering:

Protocols, reports and verifications have to be filed here for the following divisions:

- Structural design check
- Thermal construction physics
- Sound insulation and room acoustics
- Soil mechanics, Geotechnics
- Measuring
- Light and daylight technology
- Fire protection certificate
- Safety and health protection
- Environmental protection and existing waste deposits
- Other reports

2.3.2 Electrical Engineering:

Units have to be tested after completion of the building phase in accordance with the effective regulations and specifications of each country (Germany: VDE specifications, DIN norm, ASR, etc.).
Narrow separation sheets have to be used as separators for each discipline and each individual part such as e.g. unit, transformer, distribution, etc.

Verification is also required that the different lamp is of equal quality.
The same applies to safety lighting.

2.3.3 Mechanical Engineering:

- Hand over protocol
- Reports, expert opinion, inspections by experts (this also includes e.g. reports for fire protection – related execution of technical approvals, inspection of fire dampers, etc.)
- Authorities
  (Documents that are submitted to the authorities, so that the equipment receives an operating license)
- Testing and measurement reports
  (air volume measurement reports, performance measurements, adjustment protocols, functional tests etc.)
- Pressure and density protocols
  (Protocols on the rinsing and bursting the pipeline for an adequate duration of time)
- Verifications
- Certificate of compliance of adherence in carrying out fire-protection-related activities, verification of the equivalence of building materials)
- Instruction and setup protocols
  (Instruction of the operator's personnel –with signatures by the instructed personnel and setup reports with all setting values etc.)

2.4 Maintenance Instructions, Inspection Notes

The general descriptions of the maintenance and testing work and/or responsibility in the utilization phase with details on the maintenance and testing intervals, as well as any possible downtimes for each unit (parts, components, etc.) are filed here.

2.4.1 Construction Engineering:

Maintenance and testing instructions of structural installations that has to be adhered to in each country due to applicable law or comparable regulations or policies.

2.4.2 Electrical Engineering:

Maintenance and testing instructions/activities of electro technical systems that has to be adhered to in each country due to applicable law or comparable regulations or policies.

2.4.3 Mechanical Engineering:

Maintenance activities and maintenance intervals have to be compiled according to the template of the (Germany:"VDMA") for the individual devices and unit parts. Work and units not required/used have to be removed from the template.

The Supplier compiles an appropriate list that shows how many fittings, pumps, ventilation units, etc. have to be maintained. The offer shows which tasks have to be carried out by the company and which by a specialized company. The Supplier will submit a maintenance offer to the Buyer that shows the scope of the maintenance work.

2.5 Manufacturer and/or Supplier Register

The producer and/or supplier register contains a list in alphabetical order of all relevant devices/parts, indicating the model and the manufacturer (incl. the address and telephone number). If possible, the model description should also directly indicate the power ratings.

The quality certification of all the installed materials and parts giving the following details:

- Material /product name and description
- Manufacturer (Name, address, telephone, e-mail)
- Supplier (Name, address, telephone, e-mail)

2.5.1 Civil Engineering:

No further particulars

2.5.2 Electronic Engineering:

No further particulars

2.5.3 Mechanical Engineering:

No further particulars

2.6 Technical Documents/ Product Descriptions/ Operating Instructions

The technical documents include product descriptions, data sheets, operating and maintenance instructions, inspection books, spare parts lists and section and detail drawings of all the function-related and maintenance-related parts and system sections. The documents are to be filed in alphabetical order according to the producer register (see item 2.5). The various producers have to be divided by narrow separation sheets or by colored sheets.

All the execution documents like the approved assembly and workshop drawings (manufacturer).

2.6.1 Construction Engineering:

Lifts, cranes, automatically operated doors and gates, levellers, chimneys, fire-protection-related construction systems, etc.

2.6.2 Electrical Engineering:

Measurement devices, lamps, light controls, circuit breakers, installation devices, UPS systems, emergency generating systems, harmonic filter, transformers, medium voltage systems, inside and outside lighting protection, fire alarm system, burglar alarm system, access control bus systems, building control systems and alarm systems, wiring in the functional integrity, firewall, video surveillance system etc.

2.6.3 Mechanical Engineering:

The data sheets and the producer documents have to be clearly allocated (device number).
Error message lists, setting values of control units and valves have to be filed here.

2.7 Building Approvals/ Test Certificates

A building approval and/or test certificate have to be provided for each construction element requiring approval. The documents have to be filed in alphabetical order according to the producer register (see item 2.5). The various manufacturers have to be divided by narrow separation sheets by with colored sheet.

2.7.1 Construction Engineering:
No further particulars

2.7.2 Electrical Engineering:
No further particulars

2.7.3 Mechanical Engineering:
Appropriate building approvals by the (Germany:"DIBT") or by other approved testing institutes have to be submitted for all the safety and fire-protection-related parts (e.g. fire protection flaps, etc.). In addition, all the test certificates and certification (certificate of compliance with the order) for the above-mentioned parts have to be submitted.

2.8 Calculations

Calculations, verifications, suitability tests etc., that documented the installed final condition of the service.

2.8.1 Construction Engineering:
No further particulars

2.8.2 Electrical Engineering:
If lamps other than those tendered are installed, mathematical verification has to be made that the mean illumination equals the tendered lighting.
It must also be proven that the other luminaire is equivalent in quality.
The same applies for the emergency lighting.
If cable cross sections are different to planning, they must be proven to be sufficient.
(Germany: DIN VDE 0298).
It is similar to all procedural calculations and design criteria.

2.8.3 Mechanical Engineering:
Calculations/characteristics:
All the procedural calculations and design criteria that had to be made for the design of the system (e.g. pipe network analysis, radiator layouts, calculation of required heating, cooling load, etc.) are to be submitted. The characteristics of pumps and ventilators must be submitted with their operating points. The appropriate device number has to be entered in the individual calculations and characteristics. Calculations of heating load, cooling load, pipe network analyses, radiator layouts, etc. also have to be submitted.

2.9 Structural design

The structural stability and serviceability of a building are verified in the calculation of the statics.

- Title sheet
- Revision directory
- Table of contents
- Preliminary remarks
- Load assumptions *(the details on the load assumptions such as e.g. dead loads, snow loads, wind load, traffic loads, etc. have to be explicitly listed. The concept of snow and wind loads on the building envelope should be sketched. Special features like possible snow accumulation, impact load, ice load etc. have to be documented, also load from fillings, machines, system parts, cranes, etc. Assumptions for construction and assembly conditions have to be explained).*
- Calculations and verifications of the individual positions with load assumptions, loads, stress resultants and dimensions
- Connection statics or connection load table
- Overview drawings, Position drawings
- Formwork drawings, design and reinforcement drawings
- Final sheet with signature

3 Addendums

- AA-DTA-07-04-0013-NUMBERING BUILDINGS FLOORS AND ROOMS
- LF-DTA-02-01-0002-PROJECT COMPLETION.DOCX
- LABELING_BINDER LABELS.XLSM
- LABELING_DATA CARRIERS.DOCX
- FILE NAMES AND DRAWING NUMBERS.DOCX
- G_XXX_HEADER AS-BUILT DOCUMENTATION_A4.DWG
- G_XXX_HEADER AS-BUILT DOCU_SMALL.DWG
- UNIT NUMBERS-GENERATOR.XLSM
- CONTENTS_FOLDER COVER SHEET.DOCX
- TABLE OF CONTENTS.DOCX
- TABLE OF CONTENTS_REGISTER.DOCX
- TABLE OF CONTENTS_SEPARATING PAGES.DOCX
- DRAWING LIST - AS-BUILT DRAWINGS .XLSX
- DRAWING CONTENTS_ELECTRICAL AS-BUILT DRAWINGS.DOCX
- DELIVERY CONFIRMATION AS-BUILT DOCUMENTATION.DOCX
- INDEX_DATA CARRIER (FOLDER STRUCTURE)
- TEMPLATE DRAWING_CIVIL ENGINEERING.DWT
- TEMPLATE DRAWING_ELECTRICAL ENGINEERING.DWT
- TEMPLATE DRAWING_MECHANICAL ENGINEERING.DWT
- ELECTRO COLOR.CTB
- FINE COLOR.CTB
- DWG TO PDF.PC3

4 Abbreviations/Terms

AN	supplier
AG	buyer
DVD	data carrier
HLS/HVAC	Heating Ventilation Air-conditioning
MS	Microsoft
ZE	drawing units
2D	two-dimensional
AEC	Architecture, Engineering, Construction
WKS	World Coordinate System
BKS	user defined coordinate system
VDMA	Verband Deutscher Maschinen- und Anlagenbau e.V.
MSR	Process Measuring and Control Technology
TÜV	Technischer Überwachungsverein
VdS	Verband der Sachversicherer
VDE	Verband der Elektrotechnik, Elektronik und Informationstechnik
DIBT	Deutsches Institut für Bautechnik

5 Miscellaneous / References

-none-

	Date	Department	Name	Signature
Compiled	09.03.2017	DIT	Maximilian Steckenbiller	
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