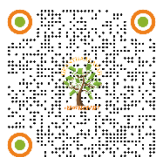


TECHNICAL ARCHIVES AND CLASSIFICATION OF DOCUMENTS: AN APPLICATION MODEL FOR GRAPHIC MATERIAL

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ABSTRACT

From the literature on the archives, it is possible to perceive different solicitations relative to an instrument, the classification, whose purpose, among others, is to simplify the recognition of the graphic material preserved within a Fund. Generally, a drawing presents distinctive peculiarities in reference to what comes depicted from it to the type of representation to which it appertains, to the purpose that it must achieve. Moreover, of course, all these aspects contribute to determining the class to which it belongs within a reorganization process related to documents produced by construction activities. Therefore, the following exposition presents the methods and theoretical instruments used to treat information extracted from technical and project drawings.

Keywords: Archives, Classification, Drawings

1. INTRODUCTION

The analysis and evaluation regarding a set of technical and project drawings – a significant part of a Fund¹ consisting of material of a different nature – become actions aimed at a better comprehension of the documental complex to which they belong. The process of extrapolation and computerisation of data² obtained from graphic material promotes major attention to those different characteristics findable in the drawings. Characteristics connected to their role within the technical

¹ Construction archive of Politecnico di Milano

² The data have been inserted into a Microsoft Access database.

and project process, to the quality of the graphic representation, and to their transformation from functional instruments to cultural heritage. [Alisio et al. \(1994\)](#)

The graphic representations from the construction sector express different qualitative and typological levels if contextualised in their content. Drawings that photograph sections of buildings and belong to the classic repertoire of the architectural project (plans, fronts, views), technical representations relating to elements in detail, to implants in general (electrical and hydraulic schemes), and to technological instrumentation of service. What has just been affirmed prefigures, during the classification, discreet attention to the peculiarities of each graphic model, namely a certain adherence in the transformation phase into computer data to those visible characteristics that each drawing expresses and communicates through the various forms in which it manifests itself. [Antuono \(1990\)](#)

The following sections will expose, with the help of examples, the system used addressed to a rational organisation of the data extracted from the graphic material to obtain a feasible identification and relative reading of what is preserved in the archive. [Carpeggiani & Patetta \(1989\)](#)

2. MODALITY OF DATA ORGANIZATION DERIVING FROM GRAPHIC MATERIAL

The organisation of the data obtained from the graphic material is exposed as follows, taking the schematisation reported in [Table 1](#) as the main reference.

Through this tool, the presentation considers an exhibition itinerary connected to the functionality of sectors (database spaces³). It means that these fields are described mainly in relation to the quality of their content and secondarily regarding the numerical consequentiality highlighted in the scheme just mentioned. The setting modalities of data are made visible with the help of tables and appendices through which to verify what was expressed in the narration dedicated to them. [Corti \(1999\)](#)

Table 1

Table 1 Fields and Relative Content		
FIELD	CAPTION	CONTENT
ID	PROGRESSIVE NUMBER	A sequential number assigned to the Record in which the data acquired from the drawing is inserted
1	CAMPUS ACRONYM	Abbreviation derived from the location/campus where the technical intervention that produced the drawing was performed.
2	TECHNICAL INTERVENTION	Brief definition of the technical operation from which the graphic material comes
3	LOCALIZATION 1	Building/Unit/Structure affected by the intervention that has produced the drawing.
4	LOCALIZATION 2	City/Campus/Area affected by the intervention that has produced the drawing.
5	FOLDER CODE	Code assigned to the folder containing the graphic material
6	DOCUMENT TYPE	Typology to which the drawing belongs
7	DOCUMENT CLASS	Class to which the graphic material belongs

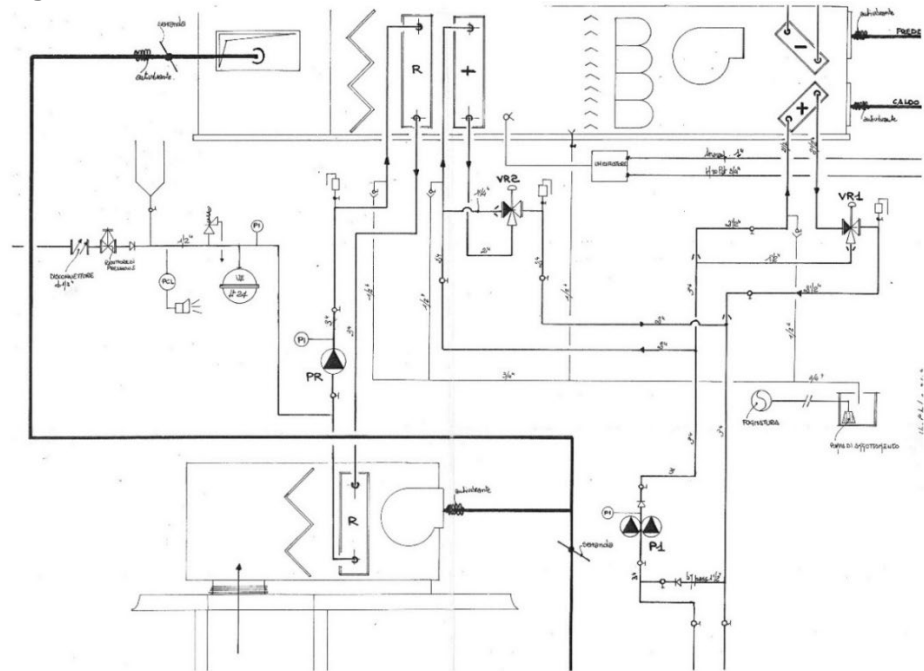
³ The terms space and field assume identical meaning. They are utilised alternately to avoid the repetition of the same word

8	IDENTIFICATION CODE	Drawing code
9	DESCRIPTION	Description referring to drawing content
10	VARIABLE DATA	Data relating to drawing
11	DATE	Production date of drawing
12	YEAR	Production year of drawing
13	DOCUMENT PRODUCTION Indication 1	First subject (Institution, Company, etc.) involved in drawing formation
14	VARIABLE DATA	Data relating to drawing
15	DOCUMENT PRODUCTION Indication 2	Second subject (Institution, Company, etc.) involved in drawing formation
16	COLLOCATION	Cabinet in which the drawing is placed
17	POSITIONING	Code relating to the position of the drawing

Following what has been affirmed above, it is proper to start with the interpretation of database spaces. The comprehension relating to localisation connected to the graphic material affects Fields 1, 3, and 4. Therefore, its geographical association inasmuch produced (the graphic material) by technical operations effectuated in structures and areas included in the university's territorial network. The information legible in the three fields is closely linked because it visualises the working context (site, area) from which the drawings are generated.

Field 1 regards the city/district dimension synthesised through an abbreviation of three letters. Fields 3 and 4 highlight the specific references of the technical intervention from which the graphic material comes. While the content in these spaces (3-4) regards the minor situation, quite variable (classroom, building), the acronym (field 1) identifying the territorial pole establishes a geographical division concerning the actions effectuated within the single urban campus; the division interest the organisation of data acquired from the retained drawings. [De Simone \(1990\)](#)

The three spaces mentioned, detectable in [Table 1](#), are exemplified through the data displayed in Masks A and B ([Appendix 1](#) and [Appendix 2](#)). Mask A refers to a planimetry performed within an operation related to the maintenance of electrical systems. In this case, the university seat involved is within the city of Como, and therefore, the abbreviation COM is legible in Field 1, representing the territorial seat in which the technical operation has been completed. Mask B proposes a scheme ([Figure 1](#)) realised within a maintenance intervention of mechanical implants. The drawing is part of the document group attributable to the intervention: *Department of Electronics. General maintenance of mechanical implants*, a department located in the district called City of Studies (Milano), abridged in Field 1 with the acronym CIS. Thus, the indications referring to the localisation – this one is divided into two territorial scale levels, the lower one in Field 3, and the upper one in 4 – display in Masks A and B, the two areas (Anzani and Bassini) affected by the interventions and inserted respectively in the university settlements of Como and Milano; these latter are visible in Field 4 as higher level indicators [Del Monaco & Re \(1986\)](#)

Figure 1**Figure 1** Mechanical Scheme

The examples just mentioned underline the meaning relating to the order of the territorial scale of what is reported in the two fields. As it is easy to imagine, it passes by drawings resulting from project proposals involving areas/buildings to realisations connected to simple maintenance regarding minor situations in classrooms and offices. In any case, graphic material referring to major or minor interventions has in common the prerogative of being connected to the physical place where the technical operation that generated it was performed. Therefore, the geographical and localisation framing of data originating from drawings makes available a more complete information. [Guillermé \(1982\)](#)

It is now plausible to proceed with the narration relating to the other sectors of the database in which to find the data concerning the graphic representations.

The text visible in Fields 2–9 is of a descriptive nature and relates to the general definition of the document grouping to which the graphic material belongs (Space 2) and the specific one relative to its content (Space 9). The following example is useful for verifying the type of information associated with the two situations now cited. [Massironi \(1989\)](#)

The drawing ([Figure 2](#)), whose data are evident in [Appendix 3](#) (Mask C), displays an implant schematically represented in the plan of a building. Space 2 reports the definition concerning the technical intervention that has produced the graphic work cited as an example, namely *School of Architecture: Heating system*. The document series with this description collects 12 pieces, including the scheme presented above. The remainder of a limited number of elements is probably due to the time passage and other reasons, because this intervention belongs to a typology that usually releases a fair amount of graphic and administrative material.

Every project action may include a very variable quantity of documents. This depends on the consistency of the intervention from which they are produced, and obviously, all the drawings resulting from the same operation will report an equal definition in Field 2. The utility of this common denominator resides in the

possibility of identifying the document situation in which the drawing, the object of attention, is inserted. Therefore, the consequent simplification relative to the single element position and its connection to other documents, conceived by the same work but placed in different folders. [Mezzanotte & Mazzotta Buratti \(1980\)](#)

Figure 2

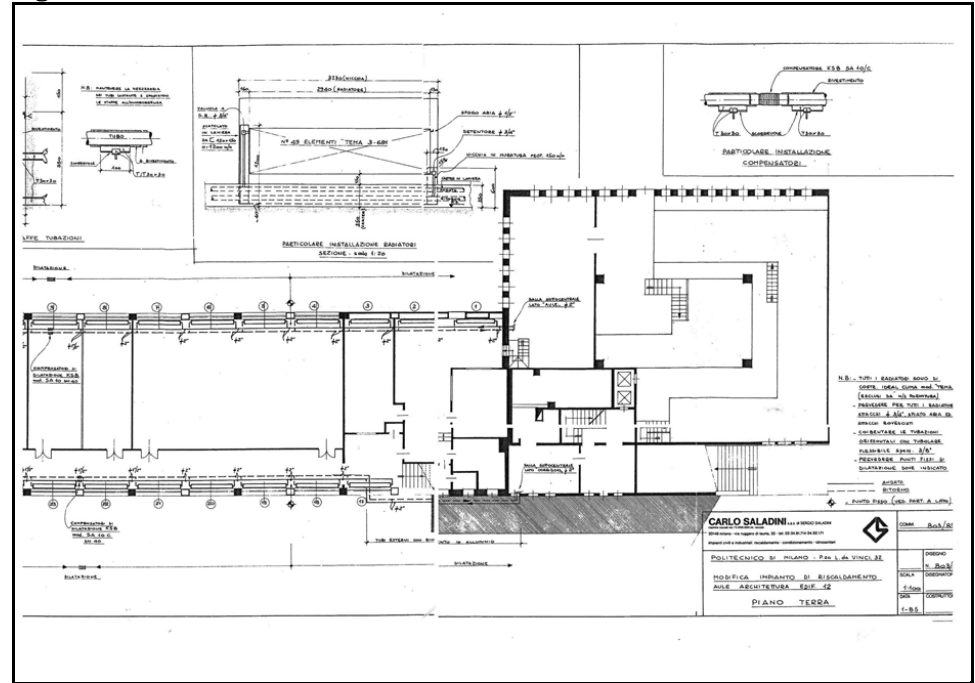


Figure 2 School of Architecture. Heating System. Plan-Details-Section (1:100)

The description relating to the content of the graphic material is inserted in Space 9. The text may differ in terms of extension, as the drawings present themselves in diverse expressive forms. The redaction modalities of a plan or planimetry assume proper characteristics as a consequence, for example, of the dimensional scale and the level of detail used. Thus, the text used – to describe these aspects and peculiarities of other type visible within the graphic part – can be synthetic or more dilated in compliance with the features of the drawing. Reviewing the content exhibited in Mask C ([Appendix 3](#)) – used before for the evidence of Field 2 – it is possible to ascertain an essential description of the drawing in Space 9 ([Figure 2](#)). In the graphic part outside the plan, details of the implant are visible as, in effect, reported in the text, while its structure inside the building plan is well represented. The presence of some technical annotations, in this case, legible above the title block, is a particular that is sometimes visible in the drawings depicting implants or technological instrumentation. [Ministry of Cultural and Environmental Heritage \(1999\)](#)

Continuing in the manifestation of the organisational modalities of data extracted from graphic material and, therefore, maintaining the schematisation proposed in [Table 1](#) as a directional instrument, it is now possible to verify the quality of the content present in Fields 5 and 16–17. The information legible in these three spaces is aimed at the physical identification of the drawings. Field 5 highlights the container through the code assigned to it; this abbreviation is obtained from the definition attributed to the material⁴ produced by the technical intervention and

⁴ It refers to the definition of documental grouping visible in Space 2

preserved in the folder. Field 16 contains the indication regarding the cabinet in which the folder resides and, finally, Field 17, in which the sequence (alphanumeric) relative to the collocation of the single element is legible.

The example presented below serves to visualise the three options cited and highlight the relational dimension existing between them and connected to the information present in the other fields. [Patetta \(2009\)](#)

The drawing, whose data are readable in [Appendix 4](#) (Mask D), has been generated by the intervention defined: *Bookshop CLUP. Emergency exits*, effectuated in 1984, of which have remained four pieces. The graphic representation exhibits the plan, the front and the section of the edifice fraction affected by the project; the minor binder in which it is inserted is part of the folder INV12 containing 13 dossiers for 136 pieces. Therefore, the code assigned to the folder in which the drawing just displayed is placed is shown in Space 5; obviously, it allows its identification inside the cabinet where it is collocated. The cabinet identification, legible in Space 16, comes about by letters/numbers affixed to its opening/closing doors. The two alphanumeric combinations – the first necessary to recognise the folder containing the graphic material and the second to identify the cabinet in which it is placed – are included in the final sequence, relating to the physical position of the drawings reported in Field 17. In this space, always referring to the data shown in Mask D, the sequence assigned to the drawing is as follows: A.INV12.DS28021984/748, where A identifies the cabinet, INV12 is the folder, DS is the abbreviated category as visible in [Table 2](#), 28021984 is the date without separators⁵, and 748 is the number assigned to the internal dossier containing the material relative to the intervention described in Space 2. [Piva & Galliani \(2005\)](#)

It is probably easy to imagine the usefulness of a classification system in the presence of a discreet concentration of graphic material produced from activities related to the construction sector.

The different characteristics detectable in terms of functional, aesthetic, dimensional scale, and type of representation suggest the formation of an instrument through which to assign classes that consider these peculiarities.

Table 2

Table 2 Categories of Graphic Material	
Graphic Material (cartography)	Code
DRAWING (DISEGNO)	DS
FRONT (PROSPETTO)	PR
PICTURE (IMMAGINE)	IM
PLAN (PIANTA)	PT
PLANIMETRY (PLANIMETRIA)	PL
SCHEME (SCHEMA)	SC
SECTION (SEZIONE)	SE
VIEW (VISTA)	VS

[Table 2](#) reports the categories attributed to the graphic material with the relative abbreviations utilised for forming the collocation code legible in Space 17 ([Table 1](#)), as seen in the example just shown. [Poggiali & Bigi \(1983\)](#)

The database fields, where the classes in which the graphic material is divided, are Fields 6 and 7 ([Table 1](#)), as perceptible in the record visualised in [Appendix 5](#)

⁵ In the absence of the identification elements of the graphic representation (drawing number), the date is utilised in numerical sequence without separators in Spaces 8 and 17, as in this case.

(Mask E). Field six is useful to differentiate the graphic material from the common documents ⁶ and the seven to classify it based on the representation type adopted (Front, Plan, etc.). The data, legible in Mask E, have been taken from the drawing of an air conditioning system (Figure 3). The graphic part resumes the scheme, and two details of the implant are described in the title block as a plan of the air conditioning system. Considering the characteristics, what is reported in the description, and the presence of different expressive styles (plan-scheme-section), the graphic illustration has been assigned to the generic class Drawing ⁷. Sometimes this type of representation is shown in the edifice plan; in this case, the implant scheme is graphically isolated from the referencing context. [Ratto & Calloni \(1965\)](#)

Figure 3

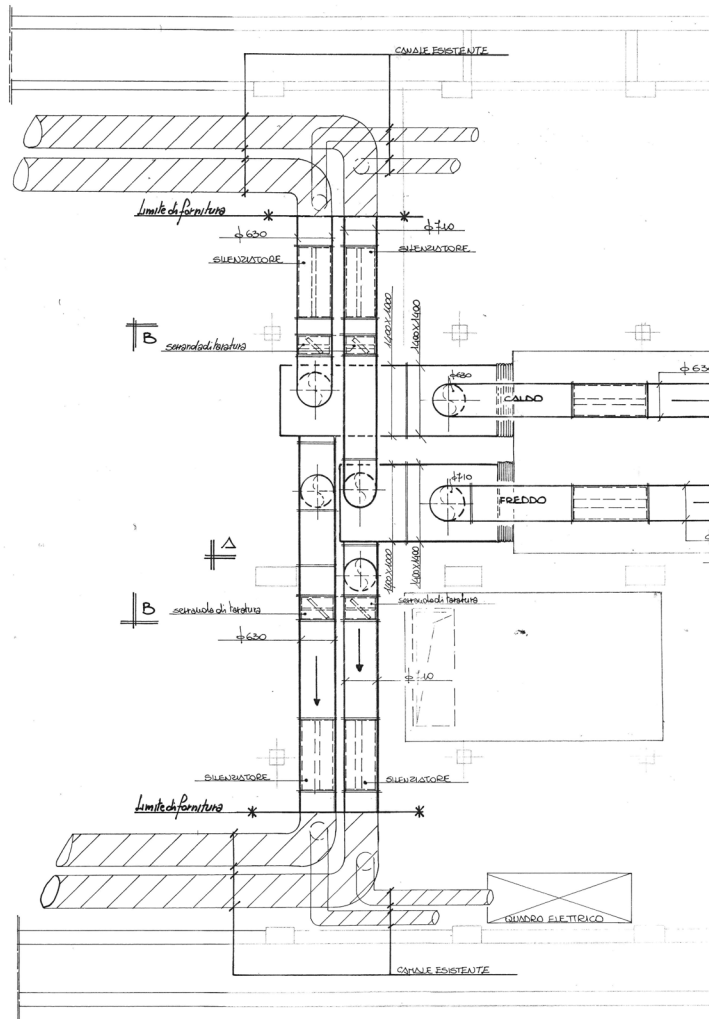


Figure 3 Detail of the Air Conditioning System

After having seen the content of Fields 6–7 regarding the division of the graphic material into classes, this exposition continues – always considering [Table 1](#) – with the interpretation of data entered in the spaces not yet examined.

⁶ The Archive in which the graphic material is preserved, also contains text documents (reports, correspondence, etc.). It has been therefore necessary to adopt a first level of classification to separate the graphic representations from textual material.

⁷ The generic class, drawing, is assigned to an elaborate in which the representation object comes displayed through different expressive types (plan, front, section).

The information legible in the lower band of the drawing – preferably on the right side in the space occupied by the title block – comes exhibited in Fields 8, 11–12, and 13–15 of the database. In the example manifested in [Appendix 6](#) (Mask F), it is possible to verify what is affirmed. The electrical scheme proposed in the visualisation belongs to the document grouping with the definition: *Diverse works relating to electrical systems and substations*. This last definition is used for material contained in five folders and, therefore, derives from a consistent intervention. The data obtained from the title block, as mentioned above, complete the spaces specified before and regard the number or alphanumeric code assigned to the drawing, the date and year of production, and the indications about the subjects involved in their execution. Returning to data visible in Mask F concerning an electric scheme, it is possible to ascertain the content of the spaces previously mentioned. Space 8 shows the identification code, in this case, present and assigned to the drawing as follows: 462/C1⁸; Date and year are legible, respectively, in fields 11 and 12 ⁹; the producer of this one, the technical department, is visible in Space 13 as the only indication reported in the title block ¹⁰.

The final part of this writing concerns the information relative to Fields 10–14, characterised by a certain variability in terms of content. This is because the data perceptible in these spaces assume – as shown in the examples presented below – a dimension useful but probably less significant compared to what was reported in other parts of the database. [Rovida \(1999\)](#)

In [Appendix 1](#), [Appendix 2](#), [Appendix 3](#), [Appendix 4](#) and [Appendix 6](#), the attributions relative to Spaces 10 and 14 are visible. The quality of the information detectable from them and labelled with the definition variable data, as observable in the already cited [Table 1](#). In effect, their prerogative is to complete, with additional details of a different nature, the information framework connected to the graphic material in the classification phase. The drawings presented in the masks, through their data and their characteristics, also become useful for a synthetic and quick analysis relating to the content of Fields 10–14. The type of data may concern the dimension scale of the graphic representations (Masks A, D, and E), the number of the internal dossier in which the drawing is inserted (Masks C–D), and a technical specification relating to an electrical system (Mask F).

The situations just highlighted conclude the exposition relating to the modalities of setting the data obtained from the drawings. The different cases presented through the text, appendices, and images are aimed at the comprehension of the conceptual system used and an aware reading of the information detected from the graphic material and translated into computer data. [Vetriani & Morabito \(1984\)](#)

3. FINAL CONSIDERATIONS

The model exposed in this paper – with the assistance of tables, appendices, and figures to support the text – in addition to the classification system, highlights, through the reading of data, the relational intertwining perceptible in the recognition of the document aggregation to which the drawings refer.

⁸ This kind of data is not always visible in graphic material. In the absence of any recognisable element, Space 8 uses present alternatives legible in the title block (date, year, letters/numbers taken from the description of the drawing).

⁹ Sometimes comes omitted the creation day of drawing with the restitution of the indications relating to month and year, or only this last one. To cope with the absence of a specific date, usually legible in the title block, the spaces related to time references are two to insert in Space 12, in similar cases, the only indication of the drawing production year.

¹⁰ Often, there are two references (not in this case) related to the production of drawing in the title block. Usually, the two entities specified are the technical office and the company that has realised what is represented (implant, equipment). Therefore, the formation of two spaces (13–15) has consented to report the options legible relative to the subjects involved.

The visibility of data – reported through masks ¹¹ presented for this purpose – contributes to increasing knowledge relative to specific technical situations and allows the retrieval of material potentially useful to support maintenance and project operations in the various areas and structures involved.

In closing, the last annotation concerns the cultural dimension acquired by the drawings with the time passage. The verification of the graphic material produced in the past for different motives becomes interesting, among which are the historical research connected to the evolution of the technical instrumentation and the aesthetic value recognisable in representations performed manually. Those just mentioned are only some of the reasons for which the preservation and enhancement of graphic material remain practicable options in the presence of a discreet concentration of pieces detectable in a technical archive.

CONFLICT OF INTERESTS

None.

ACKNOWLEDGMENTS

None.

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¹¹ The Mask is an MS Access software tool that allows the display of data entered in the database.

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APPENDIX

Appendix 1

Appendix 1 MASK A		
ID	PROGRESSIVE NUMBER	671
1	CAMPUS ACRONYM	COM
2	TECHNICAL INTERVENTION	Regional pole of Como. Realization of low voltage three-phase line and new electrical substation
3	LOCALIZATION 1	ANZANI
4	LOCALIZATION 2	COMO
5	FOLDER CODE	COM/A
6	DOCUMENT TYPE	CARTOGRAPHY
7	DOCUMENT CLASS	PLANIMETRY
8	IDENTIFICATION CODE	SI01.0/0
9	DESCRIPTION	Safety and coordination plan. Current status. General planimetry
10	VARIABLE DATA	1:2000
11	DATE	01/06/2004
12	YEAR	2004
13	DOCUMENT PRODUCTION Indication 1	Technical Department
14	VARIABLE DATA	*
15	DOCUMENT PRODUCTION Indication 2	*
16	COLLOCATION	CABINET D6
17	POSITIONING	D6.PRC/A. PLSI0100

Appendix 2

Appendix 2 MASK B		
ID	PROGRESSIVE NUMBER	8725
1	CAMPUS ACRONYM	CIS
2	TECHNICAL INTERVENTION	Department of Electronics. General maintenance of mechanical implants
3	LOCALIZATION 1	EDIFICE 18
4	LOCALIZATION 2	BASSINI
5	FOLDER CODE	DEL24
6	DOCUMENT TYPE	CARTOGRAPHY
7	DOCUMENT CLASS	SCHEME
8	IDENTIFICATION CODE	153PLT32
9	DESCRIPTION	Edifice 18-Air conditioning system. Mechanical scheme
10	VARIABLE DATA	*
11	DATE	07/06/95
12	YEAR	1995
13	DOCUMENT PRODUCTION Indication 1	SPRING civil engineering
14	VARIABLE DATA	*
15	DOCUMENT PRODUCTION Indication 2	*
16	COLLOCATION	CABINET AA
17	POSITIONING	AA. DEL24.153PLT32

Appendix 3

Appendix 3 MASK C		
ID	PROGRESSIVE NUMBER	8713
1	CAMPUS ACRONYM	CIS
2	TECHNICAL INTERVENTION	School of Architecture. Heating system
3	LOCALIZATION 1	EDIFICE 12
4	LOCALIZATION 2	BONARDI
5	FOLDER CODE	INV12
6	DOCUMENT TYPE	CARTOGRAPHY
7	DOCUMENT CLASS	PLAN
8	IDENTIFICATION CODE	803/1
9	DESCRIPTION	Classrooms Building 12 ground floor. Implant modification. Plan-details-section (1:100)
10	VARIABLE DATA	Annex to communication 803/85
11	DATE	00/03/1985
12	YEAR	1985

13	DOCUMENT PRODUCTION Indication 1	SALADINI SAS
14	VARIABLE DATA	Internal folder 753
15	DOCUMENT PRODUCTION Indication 2	*
16	COLLOCATION	CABINET A
17	POSITIONING	A. INV12.DS8031/753

Appendix 4

Appendix 4 MASK D		
ID	PROGRESSIVE NUMBER	8704
1	CAMPUS ACRONYM	CIS
2	TECHNICAL INTERVENTION	CLUP University Bookshop. Emergency exits
3	LOCALIZATION 1	EDIFICE 2
4	LOCALIZATION 2	LEONARDO
5	FOLDER CODE	INV12
6	DOCUMENT TYPE	CARTOGRAPHY
7	DOCUMENT CLASS	DRAWING
8	IDENTIFICATION CODE	28021984
9	DESCRIPTION	CLUP University Bookshop -Project. Plan/Front/Section
10	VARIABLE DATA	1:50
11	DATE	28/02/84
12	YEAR	1984
13	DOCUMENT PRODUCTION Indication 1	Technical Department
14	VARIABLE DATA	Internal folder 748
15	DOCUMENT PRODUCTION Indication 2	*
16	COLLOCATION	CABINET A
17	POSITIONING	A. INV12.DS28021984/748

Appendix 5

Appendix 5 MASK E		
ID	PROGRESSIVE NUMBER	8726
1	CAMPUS ACRONYM	CIS
2	TECHNICAL INTERVENTION	Department of Electronics. General maintenance of mechanical implants
3	LOCALIZATION 1	EDIFICE 18
4	LOCALIZATION 2	BASSINI
5	FOLDER CODE	DEL24
6	DOCUMENT TYPE	CARTOGRAPHY

7	DOCUMENT CLASS	DRAWING
8	IDENTIFICATION CODE	153PLT34
9	DESCRIPTION	E18-Air-conditioning system. Scheme input ducts
10	VARIABLE DATA	1:50
11	DATE	07/06/95
12	YEAR	1995
13	DOCUMENT PRODUCTION Indication 1	SPRING civil engineering
14	VARIABLE DATA	*
15	DOCUMENT PRODUCTION Indication 2	*
16	COLLOCATION	CABINET AA
17	POSITIONING	AA. DEL24.153PLT34

Appendix 6

Appendix 6 MASK F		
ID	PROGRESSIVE NUMBER	8010
1	CAMPUS ACRONYM	CIS
2	TECHNICAL INTERVENTION	Diverse works relating to electrical systems and substations
3	LOCALIZATION 1	ELECTRICAL SUBSTATIONS
4	LOCALIZATION 2	CITY OF STUDIES DISTRICT
5	FOLDER CODE	ELE4
6	DOCUMENT TYPE	CARTOGRAPHY
7	DOCUMENT CLASS	SCHEME
8	IDENTIFICATION CODE	462/C1
9	DESCRIPTION	Electrical substation 1. Power scheme and addresses of telecontrol
10	VARIABLE DATA	New electrical implant at medium voltage
11	DATE	00/10/1983
12	YEAR	1983
13	DOCUMENT PRODUCTION Indication 1	Technical Department
14	VARIABLE DATA	*
15	DOCUMENT PRODUCTION Indication 2	*
16	COLLOCATION	CABINET A
17	POSITIONING	A. ELE4.SC462C1