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PUMA5, ELENA and COSMO5
for EPC Contractors



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1. PUMA5

PUMA5 is a software for the management of piping bulk materials. This application is designed for piping departments in EPC, chemical, petrochemical, pharmaceutical, thermal plant power generation and similar companies.

This application solves the problems related to the development of the following activities:

- Process data (fluid list, line list)
- Piping classes
- Piping material take-off
- Material requisitions
- Welding list
- Weight calculation
- Insulation and painting calculation
- Mechanical tests

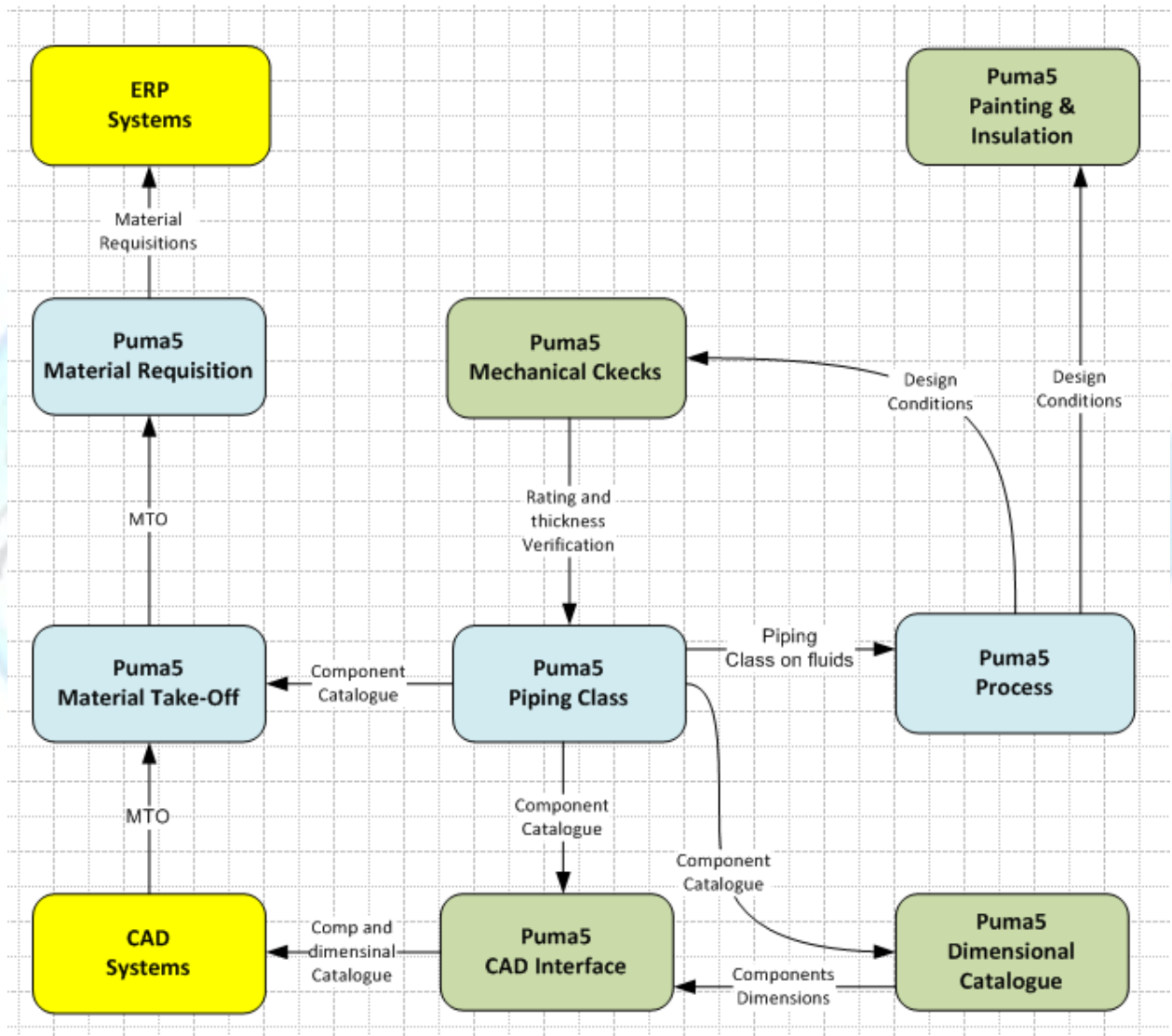
PUMA5 is provided with starting databases which include:

- Piping components
- Materials
- Engineering practice and standards
- Tables with allowable stresses from ANSI B31.3
- Weights
- Stud, bolt and nut dimensions list
- Painting and insulation surface list
- Configurations for exporting piping classes to various 3D CAD systems

These databases usually cover 90%-95% of the needs of a piping department. In fact, only minor modifications are requested to new clients in order to start loading piping specifications. This directly translates in reduced start-up time, which is now measured in weeks and not in months.

PUMA5 is not designed for the management of purchasing, expediting, logistics and all other activities which are downstream from piping department. However, we do have an application for the management of warehouses on construction sites (COSMO5).

PUMA5 is organized in modules, most of which can be purchased separately. For relations between modules, see the diagram here below and following you will find the module's descriptions.



1.1 PIPING CLASSES

Piping Classes: They define the characteristics of the components related to piping specifications. Editing is very quick since it is carried out using the Data Dictionaries. From the Piping classes, the application automatically creates the list of the project piping components (component catalog) that will be later used to carry out the Material Take-Off.

Branches Tables: They define components for line intersections between header and branch in a specific project. A branch table can be linked to one or more piping classes: automatically the application will provide the necessary components from the piping classes connected to the branches tables.

Assemblies: They define the typical assemblies in the piping design regarding vents, drains, instrument connections, steam traps. The piping assemblies together with the piping classes define the typical assemblies in the project. The piping assemblies are used in MTO allowing users to count only assemblies; the application will automatically provide the necessary piping components.

Components catalogues: The components catalogue is automatically produced from piping classes. This capability is unique to PUMA5. No one of our competitors has similar functions. Each component included in the piping classes can produce a number of components which is related to the selected size range. Each piping component is automatically associated with two different codes: one used only in the database (Total Code), the other used only in the Project (Mark). The Total Code is neither printed nor visualized: it is only used by the application to select the piping components inside the database. The Mark is the code printed and visualized by the application whenever a specific piping component is recalled in the project. Marks are project-dependent. Different projects for the same component can have different marks.

Companies that already have their own coding for piping components can insert them directly in one of five dedicated fields (custom code) or can apply the logic of codification through Composer, if the code is structured (see Composer in par. 1.7).

Issues: PUMA5 allows a sophisticated management of the project document official issues. The application is designed to work with two databases: one to work with (Working), the second to proceed with issues (Issues). The Working database contains all the data updated to the latest revision. The Issues database contains the same data updated to the latest official issue. Thanks to the documents produced by PUMA5, variations between working documents and documents automatically issued by means of a revision number are underlined in every line of the document where the revision has been applied.

1.2 MATERIAL TAKE OFF

Material Take Off: The Material Take off can be performed per line or per isometric drawing. The input is easy and quick through a friendly interface that allows to select components directly from the piping classes; also, it is possible to import the material lists directly from CAD systems through import/export interfaces.

M.T.O. Checks: PUMA5 automatically records changes in piping classes and it can upgrade MTO to the last available component catalog while work is in progress. In this way the consistency between Material Take-Off and Piping classes is always guaranteed.

Surplus Tables: The user can create and apply his own surplus tables according to his project requirements. These tables will automatically increase the quantities of the calculated materials in order to balance the construction and assembly scraps.

Bill of Materials List: From the Bill of Materials List the user can automatically obtain the documents for: site assembly weights (prefabrication material), welding quantities, construction, component traceability and historical data for planning and management control. All these documents are essential for a correct management of the piping materials. The user can set filters and printing form.

Shop/Field Fabrication: According to his own project requirements the user can define his own divisions between prefabrication and assembly materials and obtain the relative documents for a site and workshop check.

Subprojects and purchase locations: PUMA5 can manage subprojects with different purchase locations.

Automatic assignments: Rules for automatic assignments of attributes can be easily implemented in PUMA5, for example the distribution of materials between shop/field.

1.3 MATERIAL REQUISITIONS

Materials Requisitions: Material Requisitions can be automatically obtained from the Bill of Materials List by optimized aggregations of components that allow to address suppliers in a specific and selective way. The quantities of the accounted materials can be increased or decreased according to the user's requirements before the purchase order.

Materials Requisitions Issues: The generation of material requisitions can be performed in one or more phases (by means of subsequent input) and, when necessary, after material purchase orders; the previous calculations can be deleted in order to proceed with a new general calculation ("by comparison"). The new obtained quantities can be automatically "compared" with the ordered materials and therefore purchase orders for the balances (missing materials) can be automatically issued.

1.4 PROCESS

Fluids List: This project document describes the process fluids in their phases, indicating the maximum conditions of pressure, temperature and the main characteristics of the lines (basic material, rating and flange coupling).

Lines List: This project document describes the conditions of pressure and temperature, the main characteristics of the lines (basic material, rating and flange coupling). Design conditions in the project piping classes are checked on the basis of this document.

Fluids List and Lines List Checks: The application checks the design conditions present in the fluids list and the piping classes, and between the lines list and the piping classes. The check of the design conditions is performed by the application between the fluids list and piping classes, and between the lines list and piping classes.

1.5 PAINTING AND INSULATION

Painting and Insulation is one the most cost effective modules of PUMA5 because it mostly uses data from other modules. The user needs to insert only the painting/insulation specifications and the application calculates the surfaces for painting and insulation materials, using temperature form line list and quantities from MTO. The module produces various reports subdivided by painting cycles and materials. Documentation for contracts with subcontractors is also produced. Besides painting/insulation, the module also calculates quantities of components necessary for steam tracing.

1.6 MECHANICAL CHECKS

The Mechanical Checks module calculates pipe thickness using data from piping classes or line list. The module also checks the vacuum condition, piping classes and lines rating curves; it calculates and sizes reinforcing pads and it performs hydraulic and pneumatic tests. It supports ANSI B 31.1, 31.3, 31.4, 31.8 and ASME VIII.

1.7 IMPORT AND EXPORT

This module handles the import-export of data from other applications. Through this application it is possible to exchange data between PUMA5 and any other application – not necessarily database. The data exchange is performed using the most common formats. This module imports/exports data regarding Material Take-Off, Piping Classes, Line list, Bill of Material List.

To make PUMA5 more flexible, particular attention has been paid to solve problems related to the transfer of PUMA5 data from other computers. This makes the work easier for companies using engineering subcontractors for the Material Take-Off. The data exchange can take place in a quick and easy way: appropriate functions for the import/export of the Piping classes and of the Take-Off data have been arranged. If the company owns PUMA5 and uses external companies for the Material Take-Off, PUMA5 can be installed in the computers of those companies, the project piping classes can be transferred there and then the Material Take-Off can be collected in their main computer.

This module also contains “Composer”, which can be used for the generation of custom description and custom codification. User can create its own descriptions combining various components attributes, for example long descriptions for purchasing and short descriptions for isometrics. These descriptions can be also automatically translated from one language to other using dictionaries.

Clients can apply their wholly structured codification of piping components with Composer. In this case, also the database organization must be adjusted accordingly (see paragraph below).

Codification

As mentioned previously, PUMA5 automatically generates two codes for each component in the Component catalogue. The “Total code” is used for the management of all components inside the application. This code is very long (more than 70 bytes) so “mark” is shown on reports and forms, because it is simply one sequentially incremented number. These “marks” are generated independently for each project so they are different from project to project. An identical component can have different “marks” in two different projects and vice versa. This method works very well for EPC because after the delivery of a plant, the project is closed and archived. The opposite method is having a universal codification, where

the component code does not change from project to project. Until recently there was not much request for universal codification, but as EPC started to use ERP systems (SAP, Baan, J.D. Edwards etc.) the need for it has increased (otherwise, after a few projects, the ERP system would explode due to the enormous number of components; and also statistics, price lists maintenance etc. are needed).

There are three methods to implement Universal codification in PUMA5:

a) A completely structured code; it is generally a 14-18 characters long code in which each position has a defined code representing the specific characteristics of the components. This is the classical way, but it has two main disadvantages:

1. all combinations of the components and their attributes shall be foreseen;
2. a long time is required to implement it.

Customer shall develop the codification, then the organization of components in PUMA5 database is adjusted accordingly and it gets implemented in Composer.

b) Mixed system, the combination of a structured code and a sequentially generated number. In this case one part of the code is structured, based on main attributes like component code, diameters, type of material etc. and the second part is a sequentially generated number. These are custom-made modules, extra to PUMA5 at a relatively low cost. This solution is not as elegant as method a), but implementation times are practically zero and no investment is required in codification development. It is used by most of our Customers needing universal codification.

c) For Customers already having codification and associated descriptions loaded in ERP, PUMA5 exports descriptions (with quantities) matching ERP descriptions. The advantage is that there is no overhead in PUMA5 and management is simplified; however, there are discrepancies in codes between various documents, i.e. orders and isometrics have different codes, such custom modules have been created for Customers like Saipem and Technip.

Based on our experience, solution b) is the simplest way to go because of the easy setup, the low cost (additional modules customized according to Customer's needs generally have a low cost, sometimes being free) and the low additional overhead in PUMA5.

1.8 CAD INTERFACES

PUMA5 is the only product offering multiple interfaces to CAD systems: PDS, Autoplant, PDMS, Unigraphics, Esapro are directly supported. Piping classes for E-plant can also be produced when using suitably defined databases. Under the term "interface" is understood the capability to produce piping specifications in CAD's native format. Capability and complexity of those interfaces vary and very much depend on capabilities of the receiving CAD system: for example interface to PDS is more capable than the interface to Autoplant because PDS has more sophisticated piping specifications.

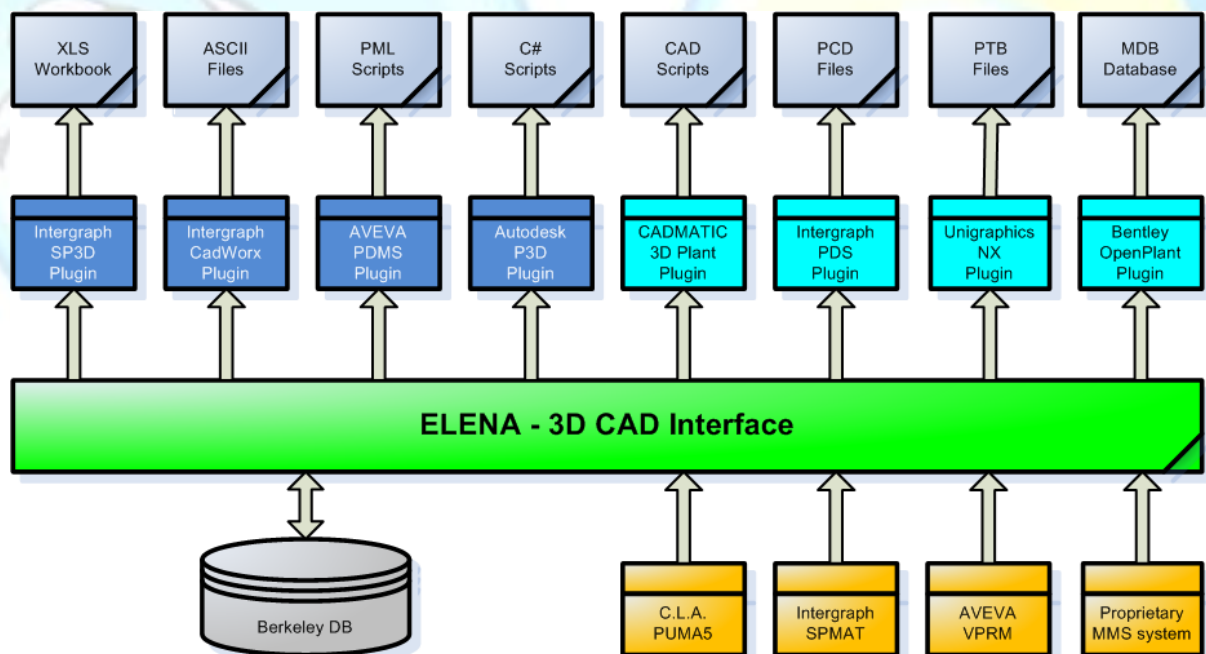
At the time of this writing (2012) we support, by means of an external module called ELENA (described in the next paragraph), also the interface with Cadmatic, SmartPlant 3D, PDMS, Cadworx and AutoCAD Plant 3D, other interfaces are currently under review for a possible implementation, we intend to port to ELENA also the 3D CAD directly supported by PUMA5.

2. ELENA

ELENA is a software system which allows the integration of heterogeneous 3D CAD systems with heterogeneous material management systems.

It is a platform based on plugins: each plugin contains the specific requirements for each CAD and for each material management software.

ELENA has been designed to work with any material management system. For example, all the supported plugins must be configured by means of a series of Excel workbooks that contain the mappings between the material management system (for example our PUMA5) and the relevant CAD definitions, here below a simple schema which represents the plugin based system.



The structure and layout of the various outputs to be produced by means of templates are properly formatted for the production of the specific CAD needs. During its operation the program reads the configuration workbooks, receives as input a series of neutral files in CSV format (from the material management system), and always outputs a series of Excel workbooks in XML format, the catalog and the piping classes will be then loaded into the CAD system by means of their own loader.

In the event that the material management system, to which the ELENA plugin is wished to be connected, does not manage the dimensional data of the piping components, ELENA is also capable of manage a dimensional catalog. ELENA envisages that every project may have its own configuration files or it is referred to general configuration files. It is also possible to parametrically define the relevant attributes to configure the mappings between the material management system and a supported 3D model, and the relevant attributes that determine the search keys in the dimensional catalog.

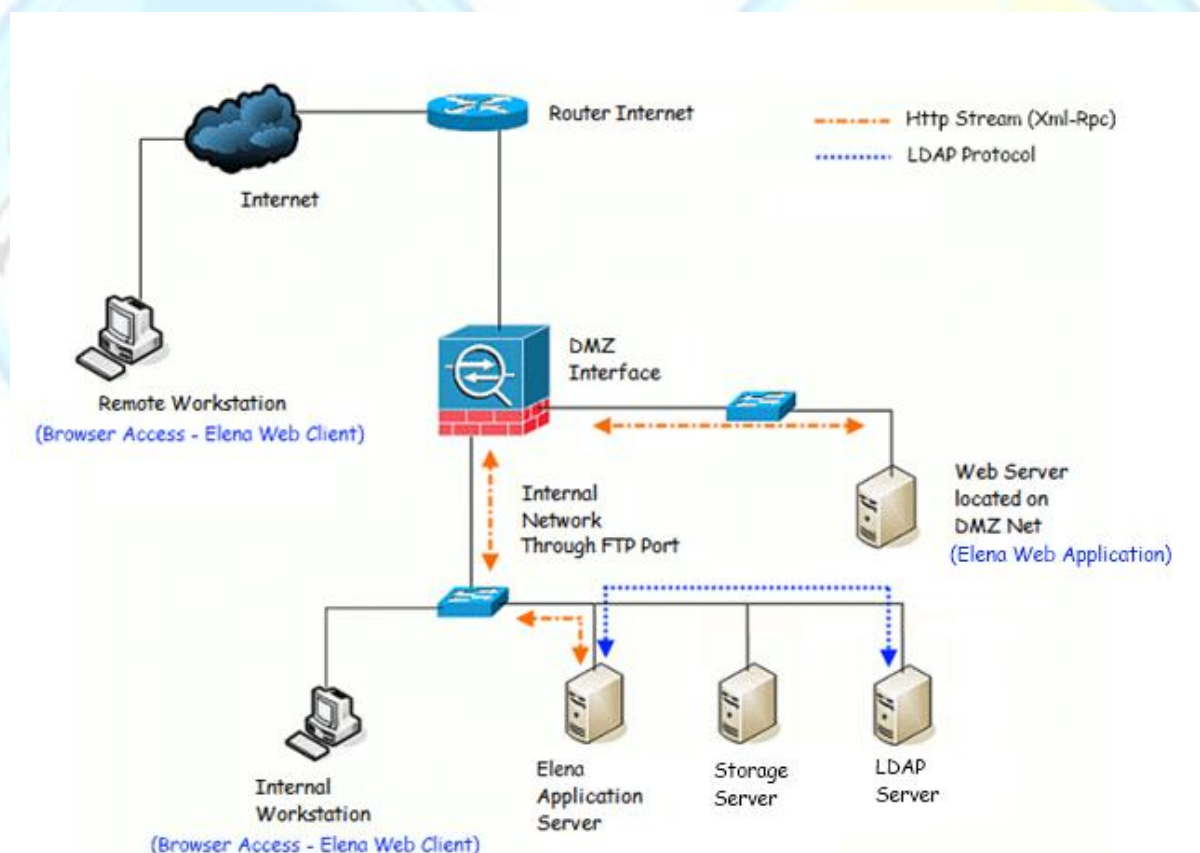
After the first loading of the output files, the CAD system usually requires subsequent loadings to be loaded by difference. At each new generation, the interface takes care of managing the new records, the modified records and the records to be deleted, generating the output files for each of the cases required by the loading program.

ELENA has been built with the following strong open source technologies: business logics developed with the Python language, Berkeley DB is the database used. The latter is an embedded database alternative to relational databases which is extremely robust, high performing and scalable; furthermore, it does not need any "server side" service and needs no administration services.

The database is organized by project and against every new issue, the information is memorized in a separate Berkeley DB. This approach allows the facilitation of user management and, in the event that it is wished to eliminate an issue, it is sufficient to cancel the related Berkeley DB file.

The interface can run with the Windows 2000, Windows XP Professional, Windows Vista, Windows 7 and all operating systems that support Python 2.5 and later.

ELENA can be used as a local installation for simple configurations, e.g. installed on a desktop or for Companies that have multiple offices located in different cities or even different Continents, ELENA can be installed in a client/server configuration where the configuration and dimensional files are located in the server side (master) and the clients will communicate through the XML-RPC protocol and get the results from the server.



3. COSMO5

COSMO5 is the software for managing the yard warehouse and the activities of prefabrication and assembly. Information regarding the components features and their location on the lines are extracted from PUMA5 through the import functions.

These data, together with information coming from the Purchasing dept. (i.e. request of offer, P.O., packing slip) and with data regarding the available material in stock, allow to analyse piping lines feasibility.

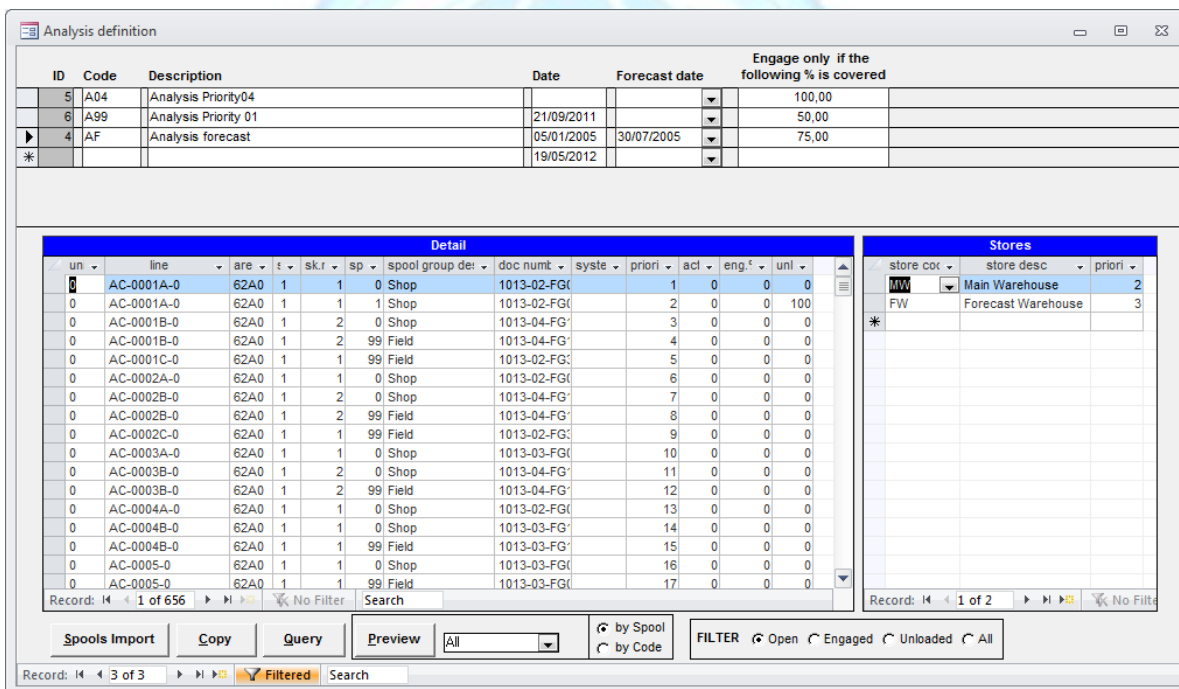
Note:

- This application can work also independently from PUMA5; in this case, requested data can be inserted manually or they can be imported from an .xls/txt file duly structured.

3.1 SIMULATION OF LINE FEASIBILITY

The application checks the warehouse situation and, according to the material available in stock for the analysed lines, it indicates the feasibility percentage listing, if it's the case, those components that are missing and that are needed to complete the lines. User can also select lines to be analysed assigning them a building priority. Lines can be selected according to criteria defined previously (such as plant, fluid, etc.). The application allows also the execution of feasibility studies with theoretical material supply, according to the current material available and to material purchasing orders that are being fulfilled. Once lines to be prefabricated or mounted are selected, the application automatically unloads the relevant materials from the warehouse and prints the withdrawing slips for the warehouseman.

By using the load/unload functions the warehouse situation is always kept updated and the requested material situation can be printed only when needed.



The screenshot displays the COSMO5 software interface. At the top, the 'Analysis definition' window is open, showing a table with columns: ID, Code, Description, Date, Forecast date, and Engage only if the following % is covered. The table contains three rows of analysis data.

Below the analysis definition window, the main data table is visible. It has columns: un, line, are, t, sk, f, sp, spool group det, doc num, syst, priori, act, eng, t, unl. The table lists various components and their associated data.

On the right side, there is a 'Stores' window showing a table with columns: store coc, store desc, and priori. It lists 'Main Warehouse' and 'Forecast Warehouse'.

At the bottom, there are buttons for 'Spools Import', 'Copy', 'Query', 'Preview', and a 'FILTER' section with options for 'Open', 'Engaged', 'Unloaded', and 'All'.

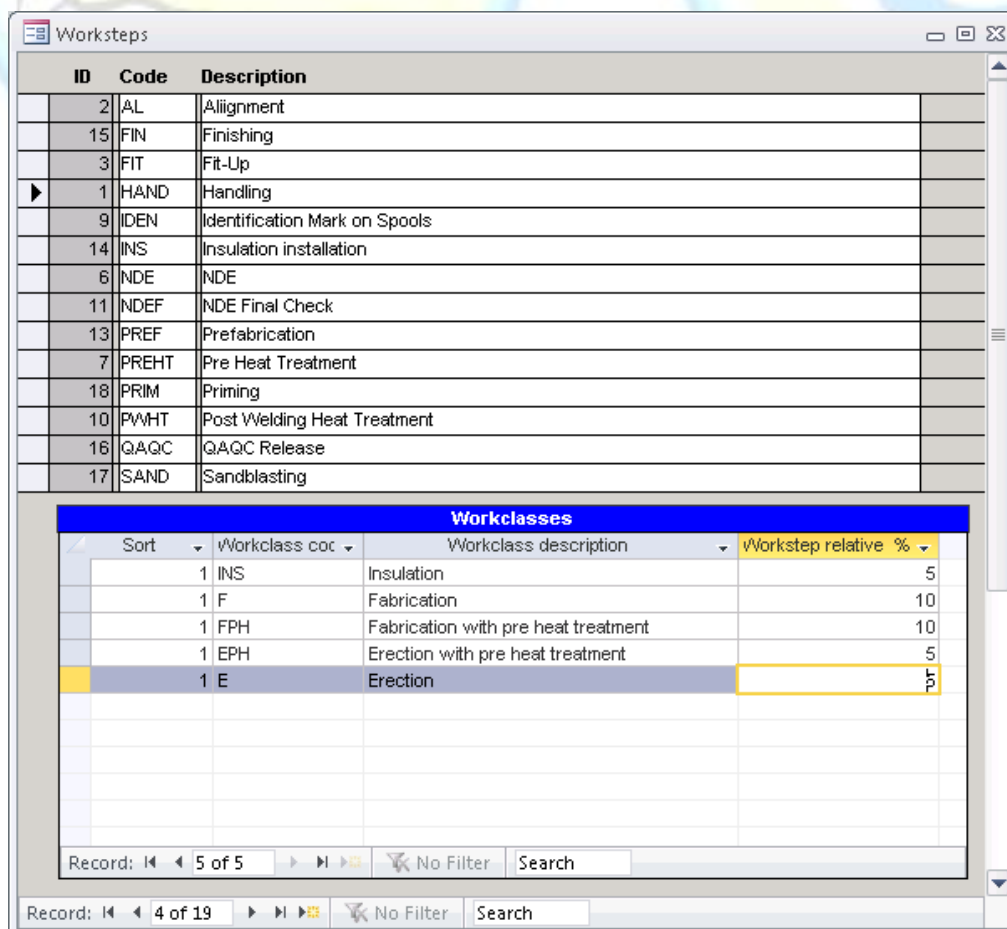
3.2 DOCUMENT MANAGEMENT

COSMO5 can manage the documents regarding the lifecycle of the piping materials, making it possible to check the purchasing situation; this ensures the traceability and status check of the purchasing order for each component during its whole lifecycle (quantity in Take-Off, requested quantity and ordered quantity, foreseen quantity to be delivered, delivered quantity, etc.).

3.3 “PROGRESS” MODULE

“Progress” is an additional module of COSMO5 for the progress monitoring of the prefabrication, construction and installation activities.

The first configuration to be made is “Worksteps”, showing the minimum detail of the activities that will be performed during the different stages of the construction; an example is shown in the following screenshot:



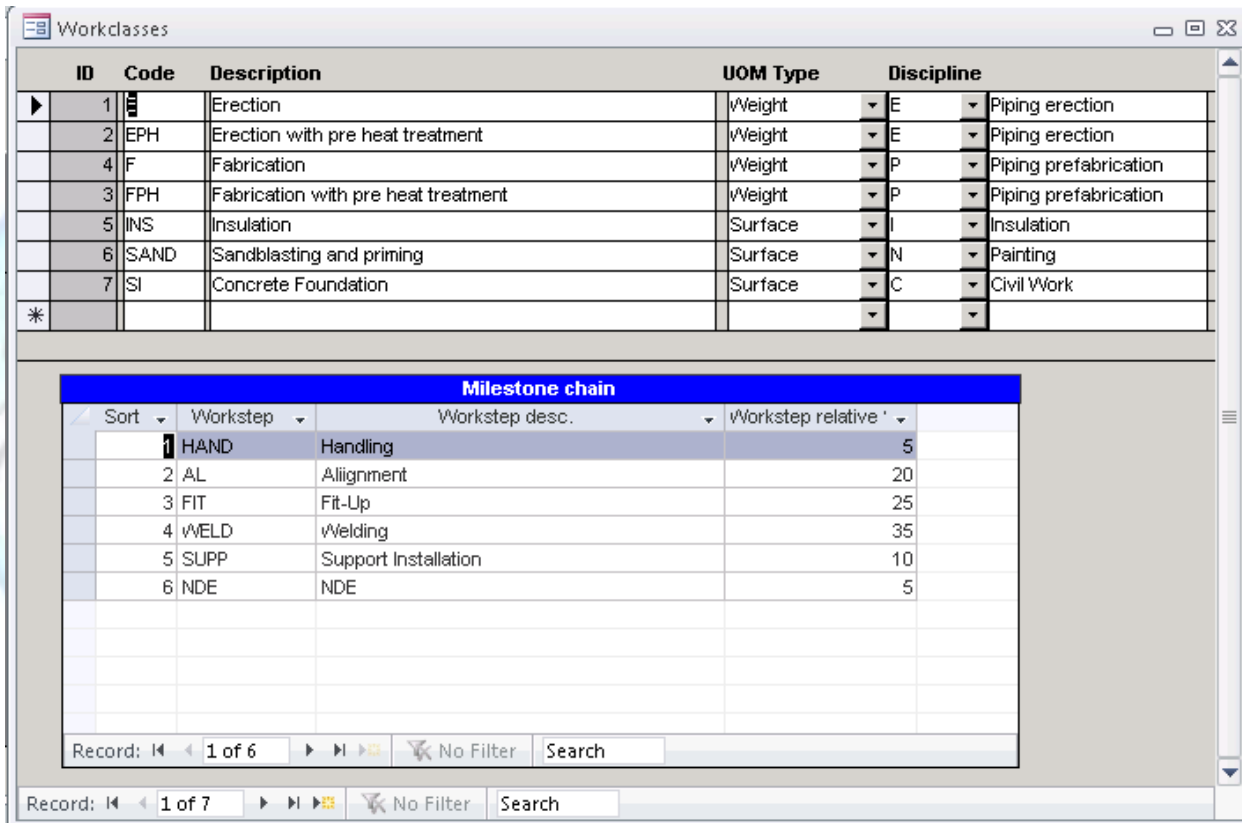
ID	Code	Description
2	AL	Alignment
15	FIN	Finishing
3	FIT	Fit-Up
1	HAND	Handling
9	IDEN	Identification Mark on Spools
14	INS	Insulation installation
6	NDE	NDE
11	NDEF	NDE Final Check
13	PREF	Prefabrication
7	PREHT	Pre Heat Treatment
18	PRIM	Priming
10	PWHT	Post Welding Heat Treatment
16	QAQC	QAQC Release
17	SAND	Sandblasting

Workclasses			
Sort	Workclass coc	Workclass description	Workstep relative %
	1 INS	Insulation	5
	1 F	Fabrication	10
	1 FPH	Fabrication with pre heat treatment	10
	1 EPH	Erection with pre heat treatment	5
	1 E	Erection	5

Record: 14 of 5 of 5 No Filter Search

Record: 4 of 19 No Filter Search

The Activities can be used in more than a Workstep (or activities collection); the Workclasses must be configured in the following menu:



ID	Code	Description	UOM Type	Discipline	
1		Erection	vWeight	E	Piping erection
2	EPH	Erection with pre heat treatment	vWeight	E	Piping erection
4	F	Fabrication	vWeight	P	Piping prefabrication
3	FPH	Fabrication with pre heat treatment	vWeight	P	Piping prefabrication
5	INS	Insulation	Surface	I	Insulation
6	SAND	Sandblasting and priming	Surface	N	Painting
7	SI	Concrete Foundation	Surface	C	Civil Work
*					

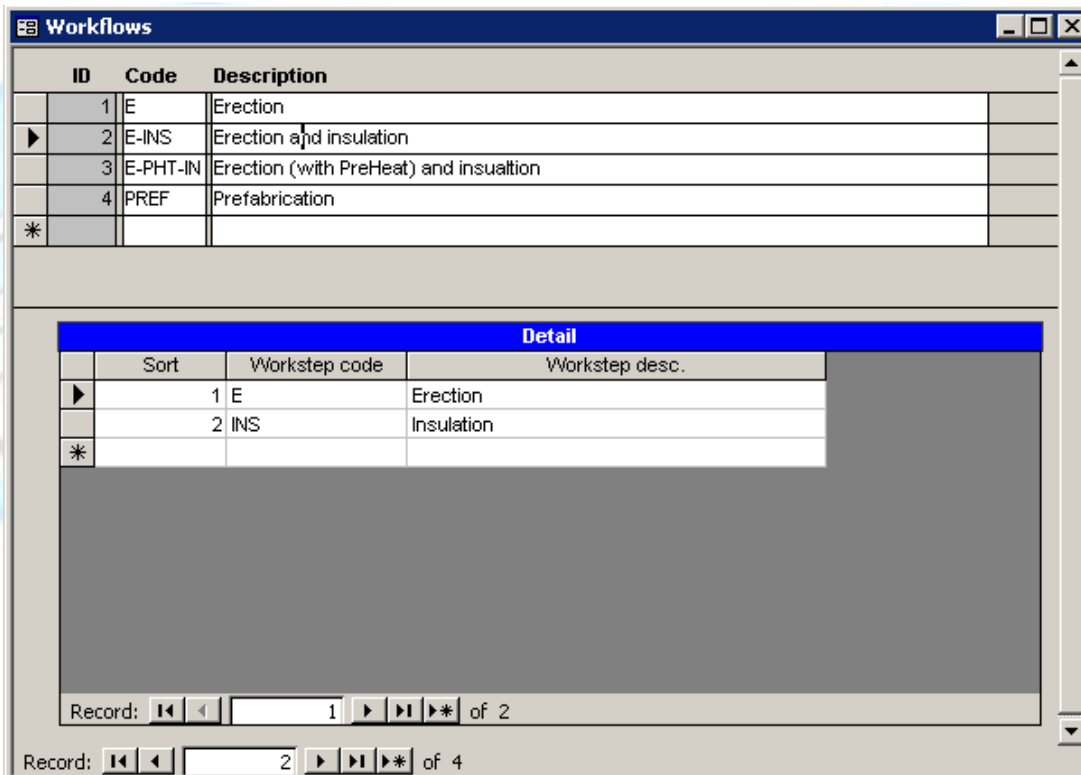
Milestone chain			
Sort	Workstep	Workstep desc.	vWorkstep relative
1	HAND	Handling	5
2	AL	Alignment	20
3	FIT	Fit-Up	25
4	vWELD	welding	35
5	SUPP	Support Installation	10
6	NDE	NDE	5

Record: 1 of 6 No Filter Search

Record: 1 of 7 No Filter Search

During the configuration of Workclasses, besides listing how these activities are made, the relative weight of each activity must be given; the total of the activities shall add up to 100%.

In turn Workstep will be collected in the workflow, representing the complete cycle in which the materials are involved; the following example is an erection and insulation workflow, composed by 2 worksteps.



The screenshot shows a software window titled "Workflows". It contains a table with the following data:

ID	Code	Description
1	E	Erection
2	E-INS	Erection and insulation
3	E-PHT-IN	Erection (with PreHeat) and insulation
4	PREF	Prefabrication
*		

Below this table is a "Detail" section with a table showing the breakdown of a workflow:

Sort	Workstep code	Workstep desc.
1	E	Erection
2	INS	Insulation
*		

At the bottom of the window, there are two record navigation controls:

Record: 1 of 2

Record: 2 of 4

The materials (in this case the spools) will be associated with the workflow and their progress will be monitored until the end of the construction; the following form shows the assignment of the spools to the Workflow, after all the settings are completed, the progress of individual activities will be monitored in the period established by each client; the period is usually weekly but the application has no limits, a complete reporting via a convenient report generator completes the application.

Progress management

Workstep: E Erection Last revision: 2 2 22 08/09/2010

Unit	Line	Area	Sheet	Sketch rev.	Spool	Spool doc. num.	Size	BUDGET HOURS	
								Previous	Actual
1000	N-1031-0	10C	1	2	22/09/2008	0	2	0	0
1000	N-1032-0	10D	1	2	28/10/2008	0	3/4	0	0
1000	N-1032-0	10D	1	2	28/10/2008	0	1+1/2	0	0
1000	N-1033-0	10D	1	2	28/10/2008	0	3/4	0	0
1000	N-1033-0	10D	1	2	28/10/2008	0	1+1/2	0	0
1000	N-1034-0	10D	1	2	28/10/2008	0	3/4	0	0
1000	N-1035-0	10D	1	2	28/10/2008	0	3/4	0	0
1000	N-1036-0	10B	1	2	30/09/2008	0	3/4	0	0
1000	N-1036-0	10B	1	2	30/09/2008	0	M90	0	0
1000	N-1037-0	10B	1	2	30/09/2008	0	3/4	0	0
1000	N-1037-0	10B	1	2	30/09/2008	0	1	0	0
1000	N-1038-0	10B	1	3	30/09/2008	0	3/4	0	0
1000	N-1039-0	10B	1	2	30/09/2008	0	3/4	0	0

Activities progress

Sort	Weight %	Activity	Activity desc.	Completion date	Previous progr. %	Progress %
1	5	HAND	Handling		0	0
2	20	AL	Alignment		0	0
3	25	FIT	Fit-Up		0	0
4	35	WELD	Welding		0	0
5	10	SUPP	Support Installation		0	0
6	5	NDE	NDE		0	0

Record: 1 of 6

Filters New revision Check differences & Update Close revision

Record: 2101 of 8160

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