

System for piping global management

White Paper
June 2006

WHITE PAGE

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Summary

Puma5 is a data-centric software application for the management of piping materials. It is specifically designed for companies working in industrial plant layouts, such as: refineries, petrochemical plants, power stations, iron and steel works, water treatment works, naval installations, pharmaceutical plants, food installations, etc...

Besides having the normal functions which are standard in material management systems, Puma5 essentially represents a working methodology, since it is an effective tool for carrying out and optimising design and management activities throughout the whole project life-cycle; from the creation of piping classes to materials accounting and related MTOs, to procurement and construction.

Based on the requirements of major international EPC companies, its features allow piping design and management activities to be performed in a fully integrated environment and through easy-to-use modules, yielding high quality results. Puma5's main functions are:

- Elaboration and management of piping classes
- Definition and optimisation of Fluid Lists and line lists
- Materials accounting and issue of MTOs
- Requisitions and support to procurement activities
- Calculation of welding quantities
- Calculation of construction and erection weights
- Calculation of surfaces and materials for painting and insulation
- Automated mechanical verification of pipe thicknesses and intersections
- Integration with the 3D CAD systems used worldwide
- Integration with the major ERP systems

The system runs in Microsoft Windows and is fully integrated with MS Office, thus permitting immediate import/export to and from Word and Excel. It is available in both Client-Server and Web-enabled versions, which allow the centralised project database to be simultaneously accessed by Clients, Contractors and Sub-Contractors, Partners, Construction sites, etc...

A successful history started 1990 and continuing

March 1990: In order to satisfy increasing market demands, a feasibility study was carried out and an integrated software system was developed for the management of piping materials in the Home Office and on the Construction Site.

The required features were defined by engineering and construction companies, which at that time were starting to ask for modular and flexible management systems, working on Personal Computers. In January 1991 the first Puma version was released, and it was one of the first

pipng material management systems available on the market.

The increased availability and performance of personal computers led to the continuous evolution and more widespread use of the system. In the meantime, users were becoming more active; thus contributing, with their requirements, to the implementation of new modules and functions.

February 1994: The first Puma interface module was implemented with the AutoPLANT (Bentley) CAD system, which provided direct exchange between the material management system and the 3D modelling environment. Together with the progressive growth of Puma, new requirements were emerging, such as: increased quality control, integration among 2D-3D CAD systems and client working procedures, design activities carried out in different locations by several sub-contractors and/or partners, and joint ventures with construction companies.

March 1996: To meet the above requirements, the Puma5 project started as a joint venture with Technipetrol S.p.A. (at present Technip Italy S.p.A.) and was completed in April 1998. The new Puma5 has also been integrated with the AutoPLANT CAD system, in a joint venture with AEM S.p.A., giving rise to a global system for piping design and management.

The great flexibility of Puma5 allowed its integration with other CAD systems: during 2000 with PDS (Intergraph) and in 2001 with PDMS (AVEVA).

June 2002: After far-reaching market analysis, GE Power System Oil & Gas (Nuovo Pignone) selected Puma5 as the most convenient system to organise and manage the piping component database to support UG (Unigraphics) CAD, for designing Turbogas and Compressor Systems.

June 2004: Agip, a division of ENI, selected Puma5 as their standard software for the development of piping specifications and the coding of piping bulk materials. The first implementation was performed for AGIP KCO for the Kashagan Field Development project.

June 2006: A new interface was created for PDMS (AVEVA).

Today Puma5 is used widely in more than a hundred engineering companies and has an excellent track record of successfully executed projects. In the last sixteen years Puma5 has been used on more than a thousand projects, ranging from simple skids up to mega projects consisting of ten thousand lines and twenty-five thousand tons of piping materials.

Why management of piping materials is such a challenge?

The complexity of piping material management and its related difficulties are due to the large number of different components which have to be defined and managed for each project.

For example, a typical GOSP project can have between 30 and 40 piping specifications. These specifications will define 10,000-15,000 different components which, when distributed over various specifications, will create a component catalogue with more than 30,000 records.

When the above is added to the necessity of tracking the changes in components which normally occur during the life of a project, the huge challenge which the management of piping materials represents is clear.

Additional difficulties come from the fact that most of components defined for one project cannot be recycled in another. This is due not only to different underlying processes for different projects, but also because different end clients often have different additional requirements.

All these difficulties, and the need for great flexibility and adaptability to meet different project requirements, make classical systems for warehouse management and their derivatives unsuitable for such tasks and, in any case, less efficient than industry-specific solutions like Puma5.

In today's global environment everybody needs to reduce total project costs, compress schedules and reduce risks.

Puma5 allows all that by:

- Reducing labour costs in engineering, procurement, and construction
- Reducing material surpluses and shortages
- Integrating engineering with the corporate enterprise resource planning (ERP) worlds
- Reducing the overall general and administrative (G&A) costs
- Reducing the IT costs
- Reducing risk (especially in lump sum turn-key projects)
- Improving overall efficiency and increasing accountability
- Ensuring competitiveness
- Reducing the time to market
- Achieving economies of scale potentials across multiple projects

As material management is closely connected with capital expenditures, any improvements in the material management process directly contribute to the bottom line.

To meet this goal, it is essential that data quality is always maintained at a high level and that all modifications which

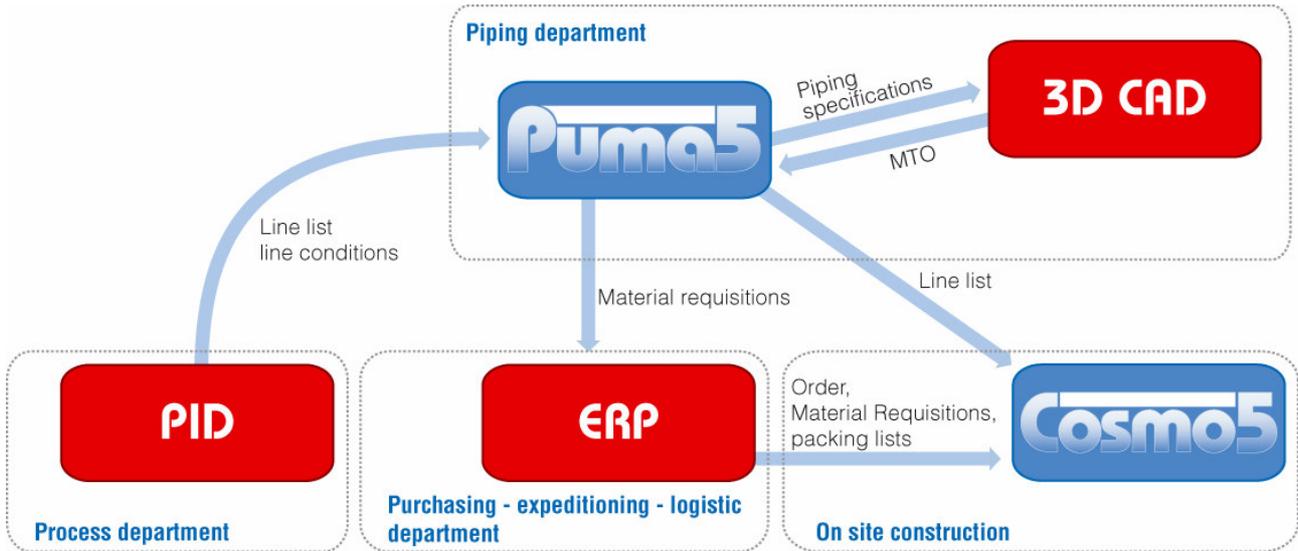
involve material management are immediately identified and solved.

Data-centric solutions like Puma5 will eliminate the confusion which results when many paper documents regarding the same data are in too many hands, and in too many different versions.

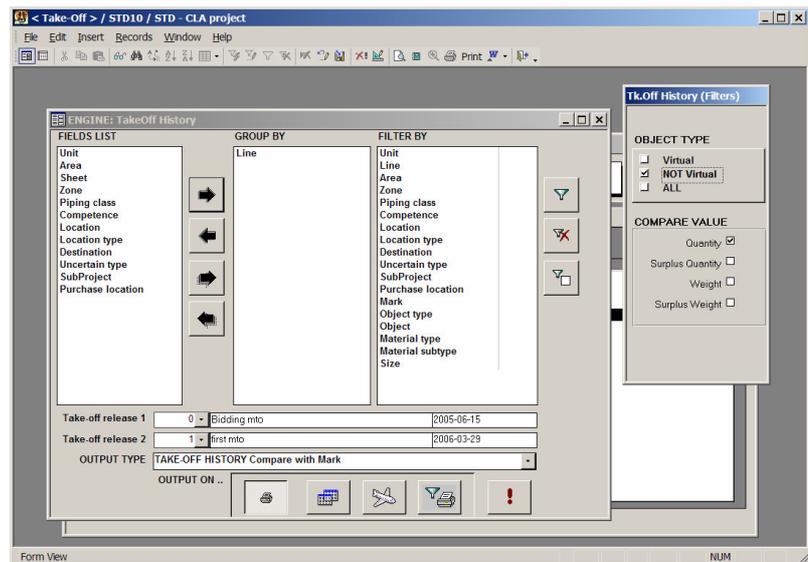
Positioning in typical EPC

Puma5 can be integrated into EPC workflows in different ways.

The diagram below represents the optimum integration of Puma5 into a typical EPC workflow. However, due to its modular approach and great flexibility, each company can define which type of integration it wants to implement. Puma5 does not require a radical approach which affects the entire organisation. Puma5 does not have to be implemented all at once; it can be implemented in small steps thus allowing the end user to assimilate its functionalities better.

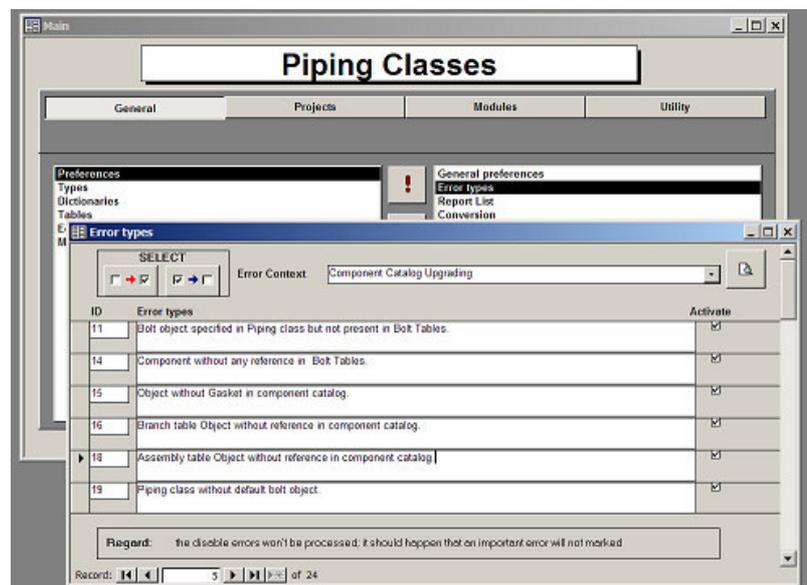


As Puma5 allows multiple versions of the MTO to be maintained for the purposes of making comparisons, it can be used right from the proposal phase. In this way the EPC can control which assumptions made during the bidding were accurate and feedback improvements.



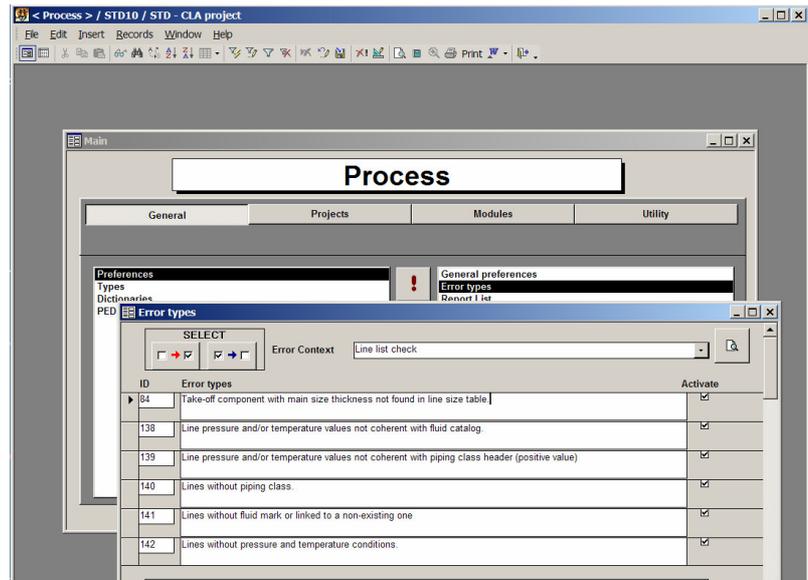
One of Puma5 strengths is that it can perform various consistency checks to ensure that all data are coherent and do not violate any of the design standards. Because

data flow from different sources is time-consuming to manage and represents a potential source of error, ensuring that the data remain consistent across the project is crucial. The engineer is immediately notified if an inconsistency is found. This is much better than discovering an error weeks later, which may require reworking and extra costs. In addition, the design rules streamline the entire data checking process. For example, the system displays or flags inconsistent data, and information that needs to be updated. Rather than the designer having to spend hours checking each individual item, the incorrect or missing data can be identified through one simple command, and can then be quickly updated, resulting in substantial time savings and ensuring an accurate design.



Example of checks during component catalogue upgrade

Puma5 helps ensure that the piping data accurately reflect the as-built plant design at all times and data accuracy can be maintained through the engineering rules. This means that accurate infrastructure data pertaining to current plant operations can always be provided when requested, and changes to the existing plant design can be checked and verified. A very effective handover tool for the owner can be provided by supplying Puma5. Puma5 promotes and simplifies commissioning and plant data handover to operations. Puma5 makes engineering data available throughout the organization, eliminating the need for managing and distributing paper documents, saving on time and associated costs.



Example of consistency check between the line list, the fluid list and the piping specifications.

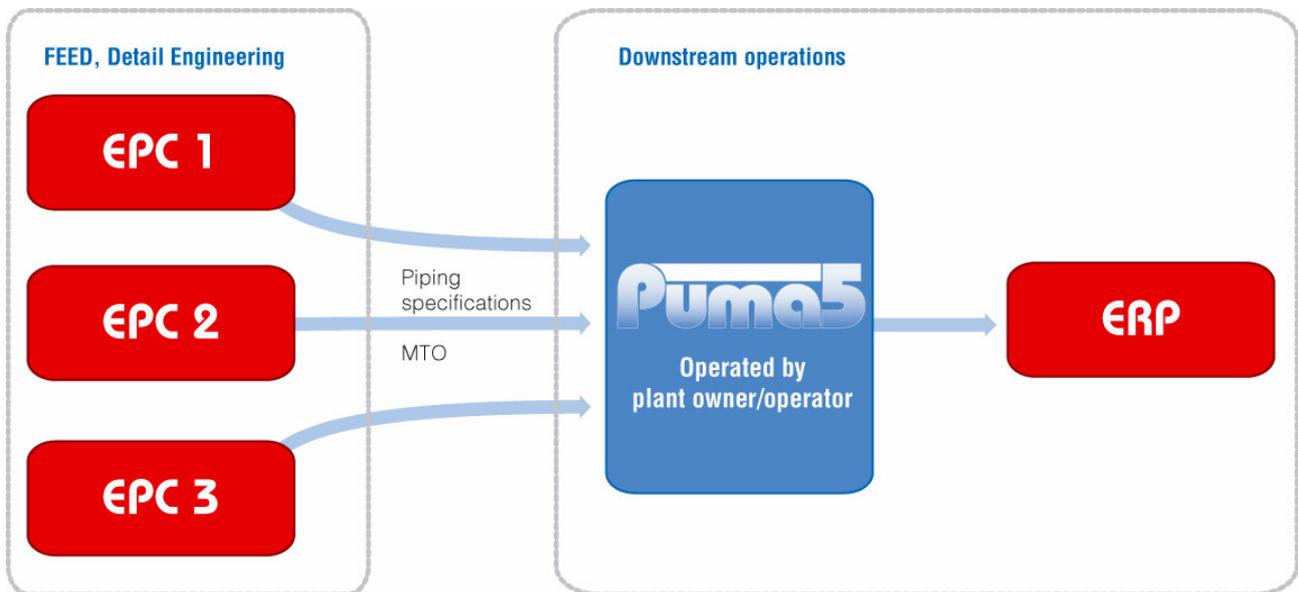
Puma5 for plant owner/operator

Puma5 allows the plant owner/operator to implement proprietary material coding, thus providing consistent data throughout the life cycle of the plant.

Data entered in any engineering phase are directly usable in downstream operations, maintenance and refurbishment processes.

As Puma5 can be used via web or independently by external companies, it is an excellent repository for all the piping specifications and materials of all plants. Reducing the variety of specifications and standardizing components facilitates downstream operations.

In this way the plant owner/operator can optimise the management of materials for maintenance and refurbishment.



As Puma5 is a data-centric solution, it will eliminate the confusion that can result when too many copies of the same data are in too many hands. Puma5 helps ensure that the data accurately reflect the as-built plant at all times by means of the updating and modification features, and the data accuracy can be maintained using engineering rules. Precise piping data pertaining to current plant operations can be provided when requested, and changes to the existing plant design can be checked and verified.

Puma5 within IT department

Large companies which have invested heavily in various enterprise resource planning (ERP) systems (e.g. SAP, Oracle applications, or JD Edwards) will find Puma5 the perfect choice, as it will naturally integrate into their ERP. This is due to the fact that there is no functionality overlap between ERP and Puma5. This avoids confusion, the risk of duplicating data, and preserves investments in the existing ERP.

Thanks to its flexibility, Puma5 can be integrated with ERP on various levels; it does not require radical changes which overturn standard company practices.

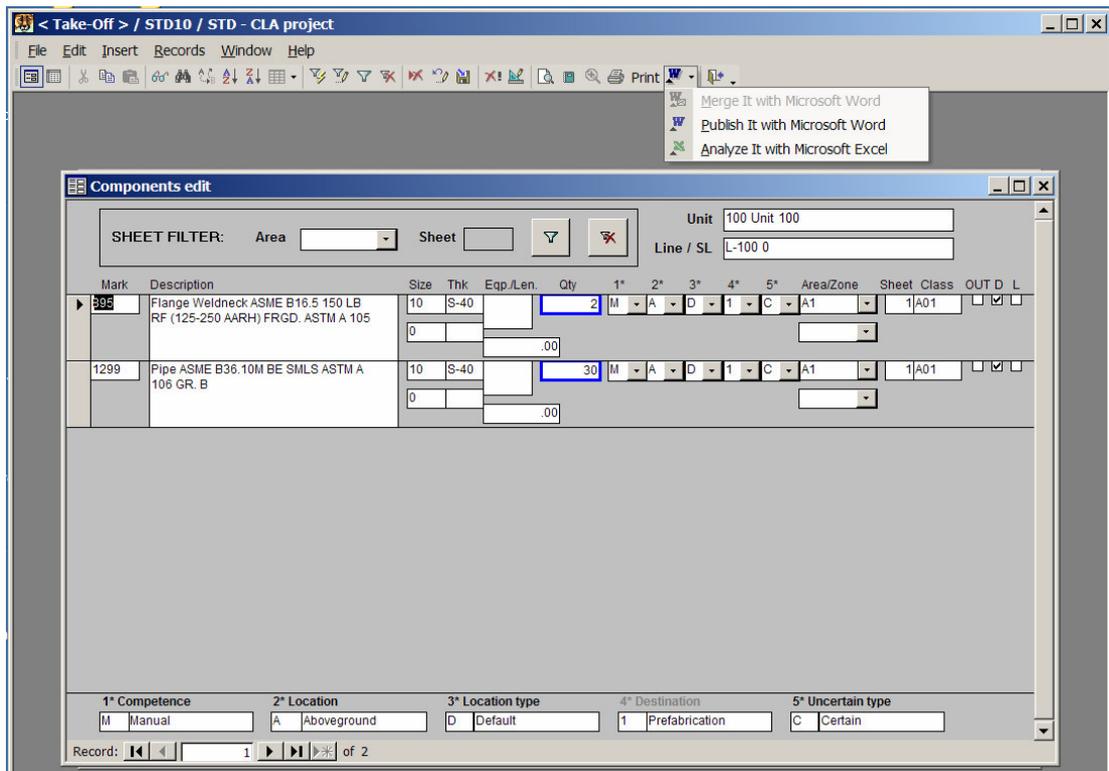
For large installations, it is significant that Puma5 can run well on Microsoft Terminal Server or Citrix Metaframe, thus eliminating the costs and time necessary for maintaining software on each individual PC.

Small and medium sized companies, for which ERP is too complex and costly a solution, still have an excellent tool in Puma5 for solving problems in piping material management.

Puma5 for end user

Puma5 has a standard Windows user interface which is common today on business PCs. It has standard Windows controls and forms so the end user will find it familiar in a short time. This reduces the learning curve and boosts production. As the interface is consistent throughout all the modules, users do not get lost when they change modules. This reduces the number of keystrokes and mouse-clicks and avoids a “trial and error” approach to solutions.

Puma5 not only has a standard Windows interface but is also highly integrated with MS Office, so producing reports in Excel or Word is just a mouse-click away. However Puma5 provides more than 300 ready-to-use reports, a number which is unmatched in the sector.



Exporting directly to Excel

Modules

Puma5 consists of logically connected modules which cover all areas of piping material management, and much more. As most modules are purchased separately, each company can tailor Puma5 according to its needs.

Piping Classes

Management of piping specifications with the automatic creation of the component catalogue

Process

Definition and management of the line list and fluid list, consistency check and alignment with the piping classes, calculations of the PED category for the line list and service list

Take-off

Quantification of materials and management of the MTO in order to obtain the quantities for procurement and construction, both from manual input and/or directly from 3D CAD systems

Mechanical Checks

Calculation of pipe thicknesses in accordance with the ANSI design codes, calculation of the hydraulic or pneumatic minimum test pressure and definition of the test circuits, calculation of the reinforcing pads, and verification of the vacuum

Material Requisitions

Generation of material requisitions, from MTOs and/or simulated accounting, grouped and organised by product class, project or sub-project, and purchase location

Painting & Insulation

Calculation of surfaces and quantities for painting and insulation based on the Line List data and the component quantities contained in the MTOs

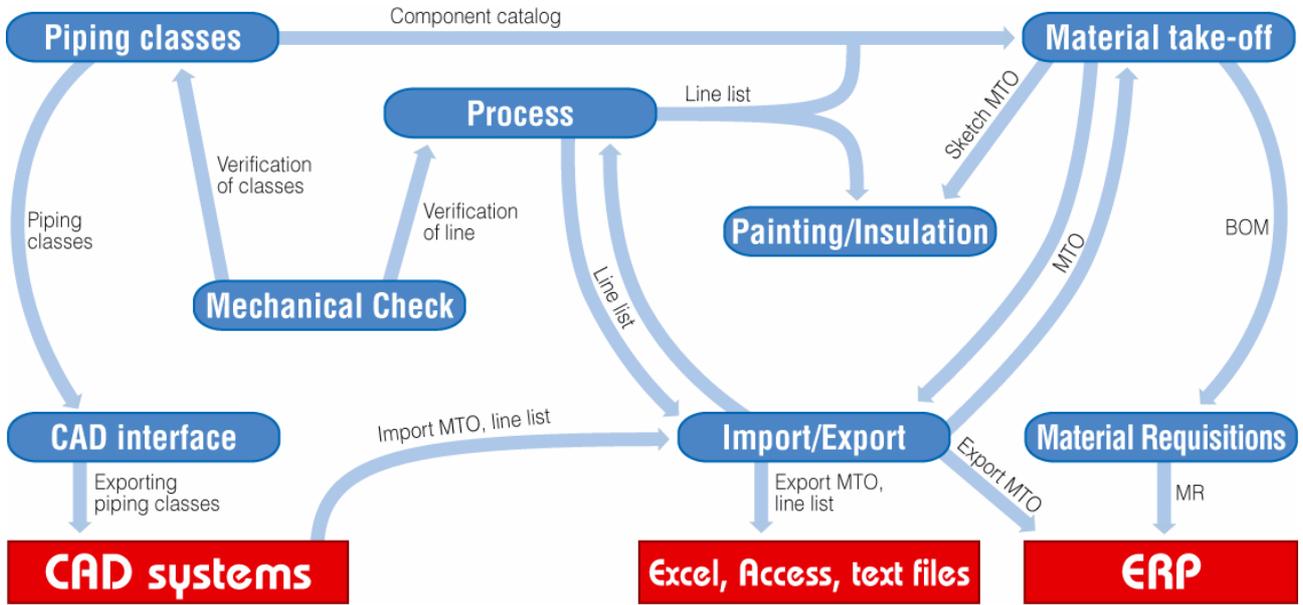
Import / Export

Data import/export from/to different groups of datasets, exporting in the most common formats, interface with other applications

Integration with CAD modules

Interface and integration with the most commonly used 3D CAD systems, allowing the quick and easy generation of the component database and the piping classes

Puma5 flow diagram

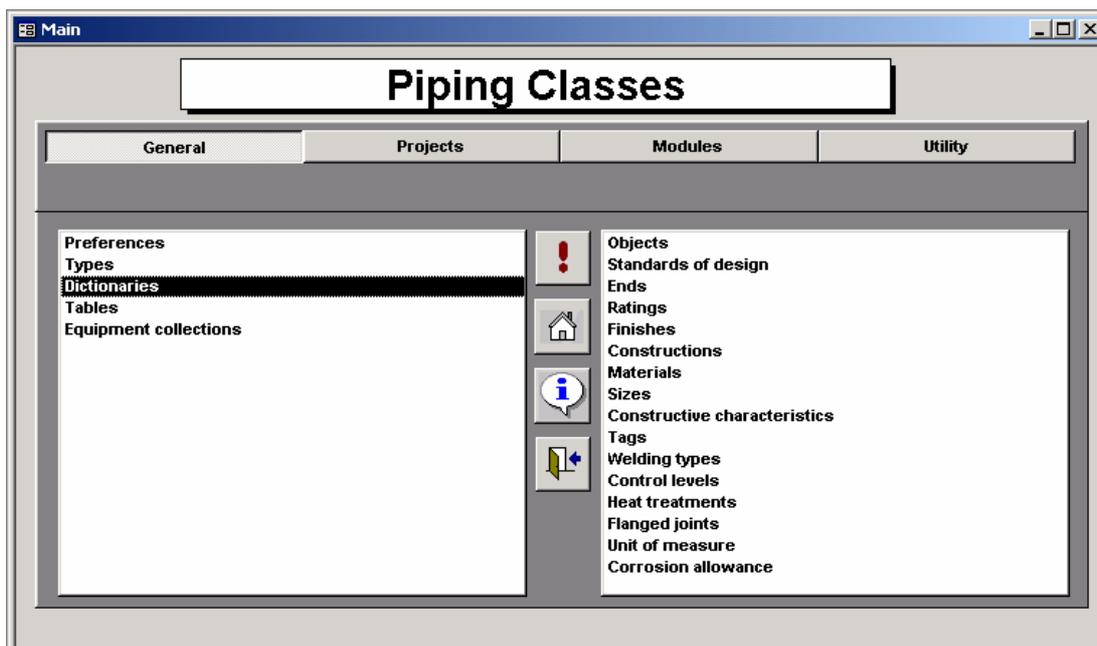


Piping Classes

This is the main module in PUMA5 which is used for the creation and management of the piping classes. It includes dictionaries for the definition of components, materials, design standards, weight tables, and stud and bolts dimensions. This module manages all aspects of the piping classes, including branch tables, assemblies, revision management and official reports. It consists of several applications, described below.

Data Dictionaries

These contain the basic information for the definition of piping components, e.g. materials, standards of design, and piping objects.

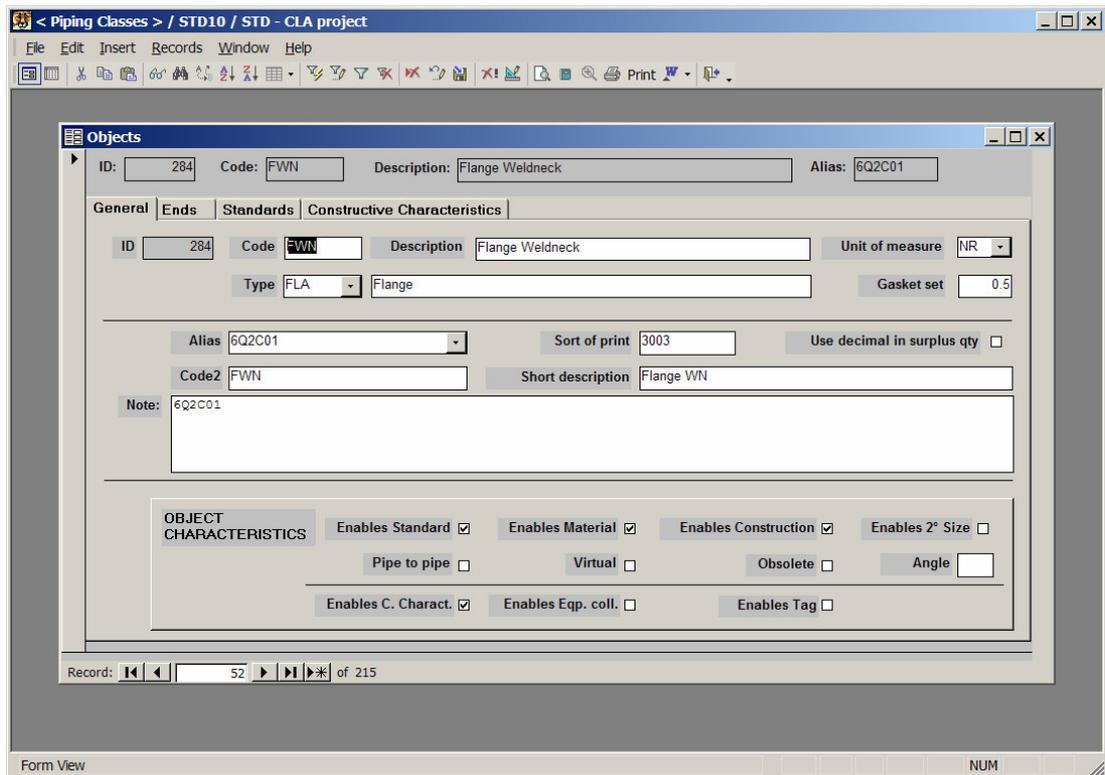


Differently from other systems, in Puma5 the dictionaries do not contain all possible components with all combinations of materials, standards, ends etc. but the components are defined as a set of rules for generating a component catalogue.

The typical component dictionary in Puma5 contains about 200 components which will be used to generate thousands of components in the component catalogue according to the project piping specifications.

This greatly reduces start-up times compared to other systems, where it is first necessary to create the component catalogue with perhaps 100,000 components before starting to insert the piping specifications.

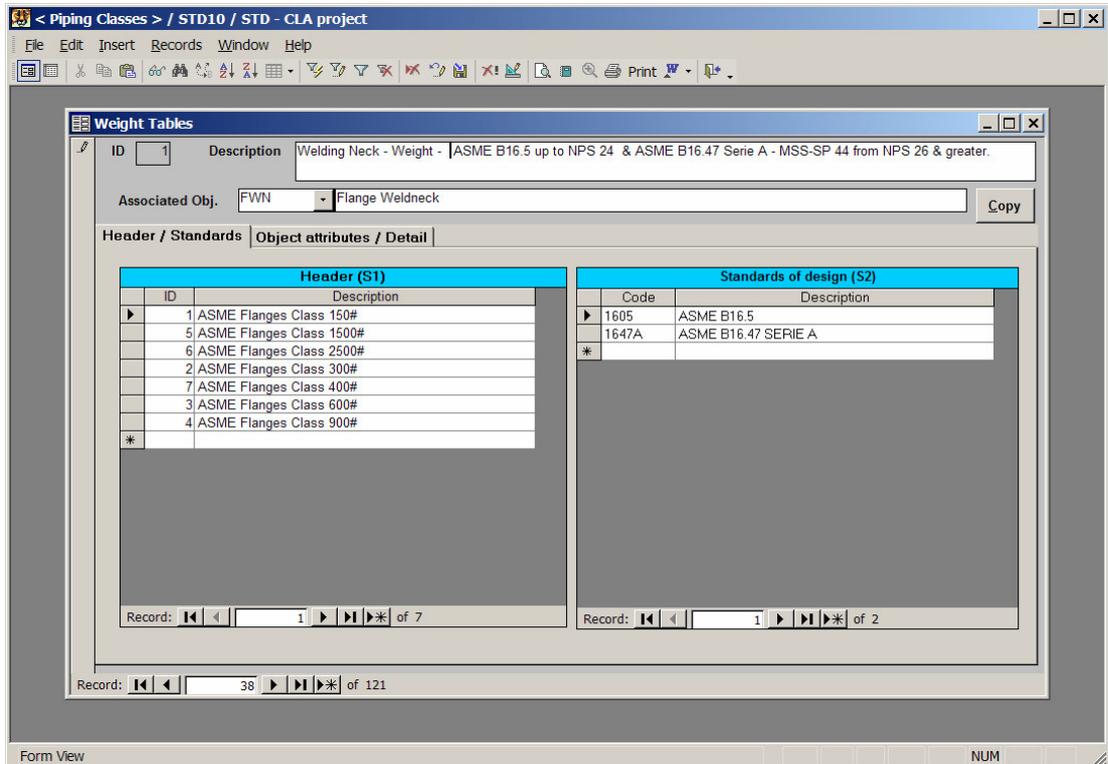
Puma5 allows new components to be defined as the need arises; Puma5 is also very flexible and allows the user to define components as he wishes. There are no built-in rules which limit the user's ability.



Puma5 components are also independent from units of measure; the same project can have a mixture of components in NS and DN.

Tables

Tables are used to define thicknesses, component weights and bolt lengths.



Example of weight table

Once again, there are relatively few weight tables because Puma5 has a unique feature to transmit weight to dimensionally-identical components which can have different descriptions. Puma5 also automatically adjusts the component weight for different materials using different specific densities.

Bolt tables contain all the standard lengths of bolts for flanged joints. Bolts are automatically associated with each component which has flanged connections so there is no need to count bolts in the MTO.

< Piping Classes > / STD10 / STD - CLA project

File Edit Insert Records Window Help

Bolt tables

Length unit of measure: mm Weight unit of measure: kg

ID: 9 Description: Stud Bolts for Flanges ASME B16.5 up to NPS 24 & ASME B16.47 Serie A for NPS =>26

Bolt weight calculation: STUD BOLT WITH TWO NUTS [Weight calc.] [Upgrade]

| Object attributes (S1) | | | | | Detail (S1.S1) | | | | |
|------------------------|------|--------|---------------------|---------------|----------------|-----------|-----|--------|--------|
| ID | Code | Rating | Flanged joint | Finish type | Size | Bolt size | Set | Length | Weight |
| 76 | 0150 | 150 LB | Wafer check LP | Ring Joint | 2 | 5/8 | 4 | 160.00 | 0.32 |
| 1 | 0150 | 150 LB | Standard | Raised & Flat | 2 1/2 | 5/8 | 4 | 170.00 | 0.33 |
| 94 | 0150 | 150 LB | Wafer check SP | Ring Joint | 3 | 5/8 | 4 | 180.00 | 0.35 |
| 93 | 0150 | 150 LB | Wafer check SP | Raised & Flat | 4 | 5/8 | 8 | 180.00 | 0.35 |
| 77 | 0150 | 150 LB | Lug butterfly valve | Raised & Flat | 6 | 3/4 | 8 | 215.00 | 0.60 |
| 75 | 0150 | 150 LB | Wafer check LP | Raised & Flat | 8 | 3/4 | 8 | 250.00 | 0.67 |
| 64 | 0150 | 150 LB | Blind/Spacer | Ring Joint | 10 | 7/8 | 12 | 280.00 | 1.03 |
| 33 | 0150 | 150 LB | Pump/Psv | Raised & Flat | 12 | 7/8 | 12 | 320.00 | 1.14 |
| 78 | 0150 | 150 LB | Lug butterfly valve | Ring Joint | 14 | 1 | 12 | 330.00 | 1.58 |

Record: 1 of 84

| Bolts and Standards of design (S2) | | | |
|------------------------------------|--------------------|-------|--------------------------------|
| Code | Object Description | Code | Standard of design description |
| STB2 | Stud bolt w/2nuts | 1605 | ASME B16.5 |
| STB2 | Stud bolt w/2nuts | 1605M | Manuf. s STD/flg ASME B16.5 |
| STB2 | Stud bolt w/2nuts | 1605T | Manuf. s STD/flg ASME B16.5 |
| STB2 | Stud bolt w/2nuts | 1609 | ASME B16.9 |
| STB2 | Stud bolt w/2nuts | 1634 | ASME B16.34 |
| STB2 | Stud bolt w/2nuts | 1647A | ASME B16.47 SERIE A |

Record: 1 of 21

Form View NUM

Puma5 also simplifies the quantification of bolts for wafer components because it automatically adds longer bolts and removes shorter bolts when they are necessary for wafer components.

< Piping Classes > / STD10 / STD - CLA project

File Edit Insert Records Window Help

Objects

ID: 292 Code: BSPA Description: Spectacle blind Alias: 6Q2C10

General Ends Standards Constructive Characteristics

| Ends (S1) | | | | | | | |
|-----------|-------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------|-------------|---------------|
| End | Description | En. Finish | En. Rat | En. Thk | Rating type | Description | Obj-End Code2 |
| WAF | WAFER | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | ANSI | ANSI | |
| * | | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | | | |

Record: 1 of 1

| Welding types (S1.S1) | | | |
|-----------------------|-------------|--------|--------|
| Code | Description | S1 qty | S2 qty |
| | | | |

Record: 1 of 1

| Flanged joints (S1.S2) | | | |
|------------------------|------|------|--|
| Description | Sets | Sign | |
| Blind/Spacer | 1. | + | |
| Standard | 1. | - | |
| * | | | |

Record: 1 of 2

Record: 3 of 215

Form View NUM

The thickness table allows users to select the units in which thicknesses are to be displayed; inches, millimetres, schedule or a combination of units.

The screenshot shows the 'Thickness tables' window in the Piping Management System. The window title is '< Piping Classes > / STD10 / STD - CLA project'. The main window has a menu bar (File, Edit, Insert, Records, Window, Help) and a toolbar. The 'Thickness tables' window is open, showing a table with the following data:

| ID | Description |
|----|------------------------|
| 1 | STEEL PIPE ASME B36.10 |

Below the table, there are two sub-tables: 'Detail (S1)' and 'Material SubTypes (S2)'. The 'Detail (S1)' table has columns: Size, Thk, Thk (mm), Thk (Inc.), Sch. (mm), Sch. (Inc.), Sch., and Code2. The 'Material SubTypes (S2)' table has columns: Code and Description.

The 'Detail (S1)' table data (partial):

| Size | Thk | Thk (mm) | Thk (Inc.) | Sch. (mm) | Sch. (Inc.) | Sch. | Code2 |
|------|---------|----------|------------|-----------|-------------|------|-------|
| 1/8 | 1.24000 | 1.240 | 0.049 | S-10 | S-10 | | |
| 1/8 | 1.45000 | 1.450 | 0.057 | S-30 | S-30 | | |
| 1/8 | 1.73000 | 1.730 | 0.068 | S-40 | S-40 | | |
| 1/8 | 1.73001 | 1.730 | 0.068 | S-STD | S-STD | | |
| 1/8 | 2.41000 | 2.410 | 0.095 | S-80 | S-80 | | |
| 1/8 | 2.41001 | 2.410 | 0.095 | S-XS | S-XS | | |
| 1/4 | 1.65000 | 1.650 | 0.065 | S-10 | S-10 | | |
| 1/4 | 1.85000 | 1.850 | 0.073 | S-30 | S-30 | | |
| 1/4 | 2.24000 | 2.240 | 0.088 | S-40 | S-40 | | |
| 1/4 | 2.24001 | 2.240 | 0.088 | S-STD | S-STD | | |
| 1/4 | 3.02000 | 3.020 | 0.119 | S-80 | S-80 | | |
| 1/4 | 3.02001 | 3.020 | 0.119 | S-XS | S-XS | | |
| 3/8 | 1.65000 | 1.650 | 0.065 | S-10 | S-10 | | |
| 3/8 | 1.85000 | 1.850 | 0.073 | S-30 | S-30 | | |
| 3/8 | 2.31000 | 2.310 | 0.091 | S-40 | S-40 | | |
| 3/8 | 2.31001 | 2.310 | 0.091 | S-STD | S-STD | | |
| 3/8 | 3.20000 | 3.200 | 0.126 | S-80 | S-80 | | |

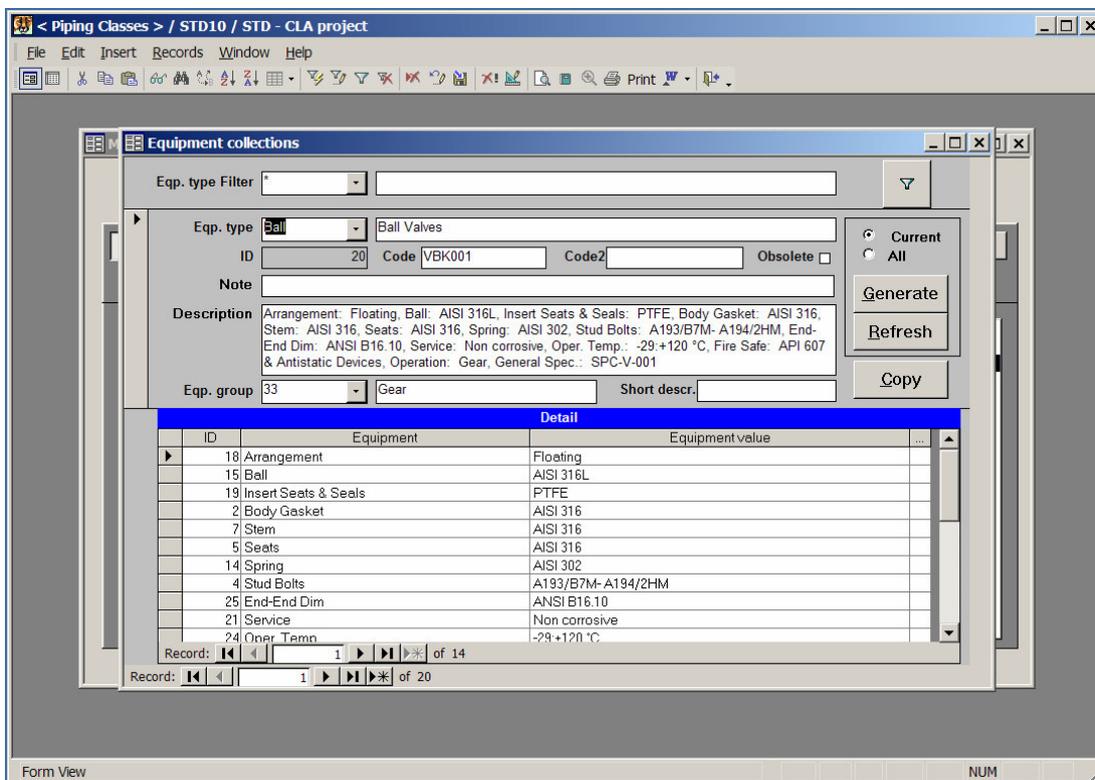
The 'Material SubTypes (S2)' table data (partial):

| Code | Description |
|------|---------------------------|
| 11 | CARBON STEEL |
| 110 | 2.25 CHROME |
| 113 | 5 CHROME |
| 114 | 9 CHROME |
| 11a | CEMENT LINED CARBON STEEL |
| 11b | CARBON STEEL & GALVANIZED |
| 11c | PP LINED CARBON STEEL |
| 11d | TEFLON LINED CARBON STEEL |
| 11e | KILLED CARBON STEEL |
| 11f | ALUMINIUM COATED |
| 13 | LOW TEMP. CARBON STEEL |
| 14 | LOW TEMP. CARBON STEEL |
| 15 | CARBON-MOLY |

At the bottom of the window, there are record navigation controls. The 'Detail (S1)' table shows 'Record: 1 of 725' and the 'Material SubTypes (S2)' table shows 'Record: 2 of 6'. The status bar at the bottom indicates 'Form View' and 'NUM'.

Equipment collections

Puma5 allows the user to define composite components, e.g. valves, filters, and steam traps, and fill in the data as in a normal datasheet.



Puma5 has special functions to ensure that data are consistent; i.e. that there are no duplicate datasheets or missing values in the datasheet.

Piping Classes

These are used to create piping specifications in Puma5; defining the piping components is easy and they are quickly filled in using the Data Dictionaries. The user has a vast number of possibilities for optimising components.

The image shows two overlapping software windows. The top window, titled "Piping classes", contains the following fields:

- ID: 63, Code: 01A, Service: PROCESS
- Client reference: EX SPC. T 1016
- Base material: 11 CARBON STEEL, Document number: GA-E-60005
- Rating: 0150 150 LB, Finish: RF3 RF 125 AARH
- Heat treatment: (empty)
- Branch: AA14
- Temperature: (empty), Pressure: (empty)
- Mod: (empty), Edition: (empty)
- Chgd: (empty), Revision: (empty)
- Buttons: Thickness, Standards of Design
- Record: 14 of 1

The bottom window, titled "Components", is for defining a component for piping class 01A. It includes:

- Piping class: 01A, ID: 4, Position: 01
- Object: V/GAT GATE VALVE, Alias: 07
- Standard of design: A602 API 602
- End: SF SW-F
- Rating: 0800 800#
- Finish: (empty)
- Construction: FOR FORGED
- Material: CF ASTM A 105
- Constr. characterist.: 150 VS 215 C 30
- Equipment type: (empty)
- Equipment: (empty)
- Tag: GA-E-60698, Tag type: (empty)
- Alternative thk: (empty)
- From: 1/2, To: 1+1/2, From R: (empty), To R: (empty)
- Imposed Gasket: (empty), Note: (empty)
- Default Branch: (empty)
- Buttons: Alternative bolts, Alternative gaskets, Size Exclude, Equipment collections
- Record: 7 of 116

Form for the definition of the piping class header and components

Branch Tables

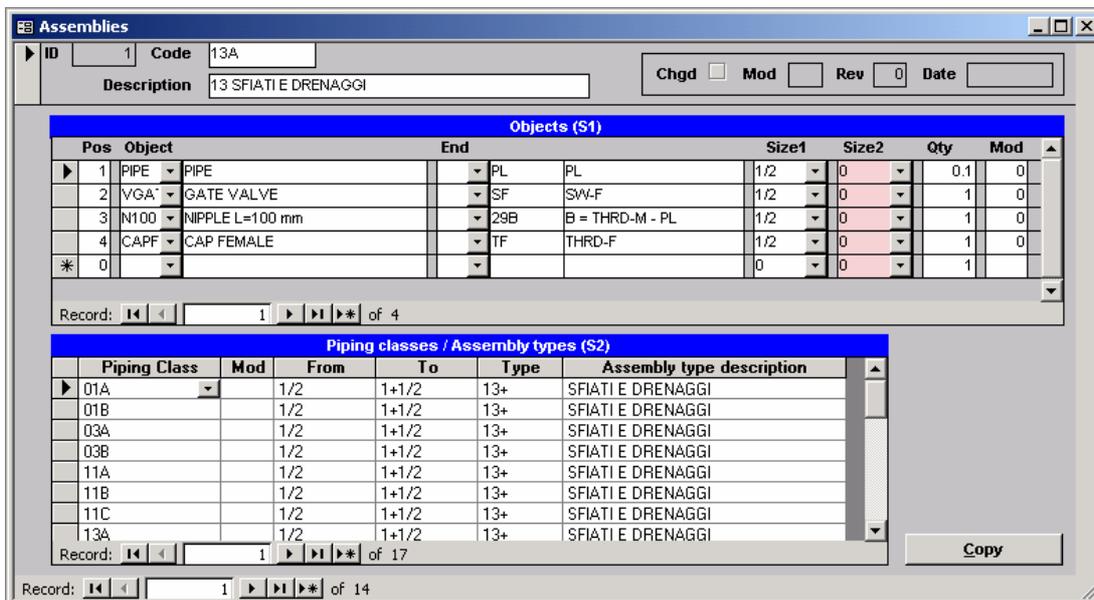
Puma5 has full support for branch tables which are used in the MTO and can be exported to CAD systems. A branch table can be linked to one or more piping classes; this automatically defines the intersection objects foreseen in the linked piping class, avoiding mistakes in the automatic importation of the take-off.

During the generation of the component catalogue Puma5 performs cross checks between the branch tables and the piping specifications to ensure that all the components needed for the branch tables are also correctly defined in the piping specifications.

Assemblies

Together with the related piping classes the assembly defines the typical components of a standard arrangement; normally these are vents, drains, instrument connections, and steam traps.

In Puma5 the assemblies are easily standardized and this allows for the automatic quantification of the assembly piping components in the MTO. Using this feature, the time to insert the MTO in Puma5 is reduced by at least 10%.



Form for assembly definition

During the generation of the component catalogue Puma5 performs cross checks between the assemblies and the piping specifications to ensure that all the components needed for the assemblies are also correctly defined in the piping specifications.

Components catalogues

A unique feature of Puma5 is the automatic generation of the component catalogue. Using rules defined in the data dictionary and the characteristics of components from the piping classes, Puma5 generates unique components. Each component automatically has its description, weight, rating, surface and project generated code (Mark) associated to it. Besides its own coding, Puma5 allows the implementation of up to five custom codes; for example the EPC can produce MTOs with their own coding and with the plant owner coding.

| Mark | Description | Size1 | Size2 | Thk1 | Thk2 | T Len. | Eqp. | Weight | Lock | Custom Code | Ext. Surf. | Int. Surf. |
|------|---------------------------------------------------------------------------------------------------|-------|-------|------|------|--------|------|--------|------|-------------|------------|------------|
| 2786 | BUTTERFLY VALVE API 609 WAFER 150 LB RF 250 AARH CAST ASTM A 216 GR. WCB VF 911 SP 1CC GA-E-60698 | In | mm | | | | | 38.00 | | | 0.00 | 0.00 |
| 2787 | BUTTERFLY VALVE API 609 WAFER 150 LB RF 250 AARH CAST ASTM A 216 GR. WCB VF 911 SP 1CC GA-E-60698 | In | mm | | | | | 72.00 | | | 0.00 | 0.00 |
| 2788 | BUTTERFLY VALVE API 609 WAFER 150 LB RF 250 AARH CAST ASTM A 216 GR. WCB VF 911 SP 1CC GA-E-60698 | In | mm | | | | | 100.00 | | | 0.00 | 0.00 |
| 2789 | BUTTERFLY VALVE API 609 WAFER 150 LB RF 250 AARH CAST ASTM A 216 GR. WCB VF 911 SP 1CC GA-E-60698 | In | mm | | | | | 155.00 | | | 0.00 | 0.00 |
| 2790 | BUTTERFLY VALVE API 609 WAFER 150 LB RF 250 AARH CAST ASTM A 216 GR. WCB VF 911 SP 1CC GA-E-60698 | In | mm | | | | | 220.00 | | | 0.00 | 0.00 |
| 2791 | BUTTERFLY VALVE API 609 WAFER 150 LB RF 250 AARH CAST ASTM A 216 GR. WCB VF 911 SP 1CD GA-E-60698 | In | mm | | | | | 3.50 | | | 0.00 | 0.00 |

Generation of component catalogue

During the generation of the component catalogue Puma5 performs numerous checks to ensure that the generated components are consistent with piping specifications and that the piping specifications themselves are correctly defined; e.g. the piping specifications must have adequate gaskets for flanged components, the materials of the components must be compatible with those of the piping specifications, the components defined in the branch table must be present in the piping specifications etc.

Process

This module allows the management of the process data in the Fluid list and Line List, thus permitting constant control over the revisions and the automatic adjustment of the data and the documents created in the different engineering phases (Piping Classes, Material Take-Off).

The module also makes calculations of the equipment category according to the Pressure Equipment Directive 97/23/CE (PED).

Fluid List

The conveyed fluids are defined by indicating the maximum pressure and temperature conditions, the main characteristics of the components, e.g. basic material, rating and flange facing, heat treatment and valve type. The application creates links between the Fluid List, the Piping Classes and the Line List, in order to ensure alignment and simulate the consequences of modifications to the Project Line List and the Take-Off.

The screenshot shows the 'Fluid list' window with the following fields:

- ID: 1, Code: 1, Fluid: CHL (Chloride)
- Material SubType: CS (CARBON STEEL)
- Rating: 150
- Finish: RF (125 Ra - 250 Ra)
- Special service: (empty)
- Competence: P (PIPING)
- Location: A (ABOVEGROUND)
- Note: (empty text area)
- Patentee Specification: A1A1
- Max. Size: 2
- Max. Design Temperature: 120.0
- Max. Design Pressure: 370.00
- Corrosion allowance: 1,5
- Heat treatment indicator:

Buttons: Chgd Mod. Revision: 1, 30/Jul/98

| Fluid list Valve link | | | | |
|-----------------------|------|--------------------|-----------|---------|
| | Code | Object description | From Size | To Size |
| | 03 | BALL VALVE | 1/8 | 2 |
| | 01 | GATE VALVE | 1/8 | 2 |
| | * | | 1/8 | 2 |

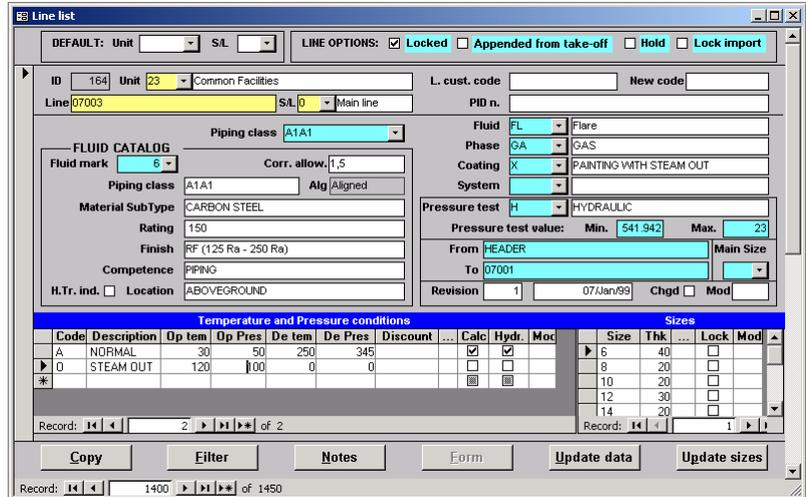
Record: 2 of 2

Record: 1 of 95

Form for the definition of the fluid list

Line List

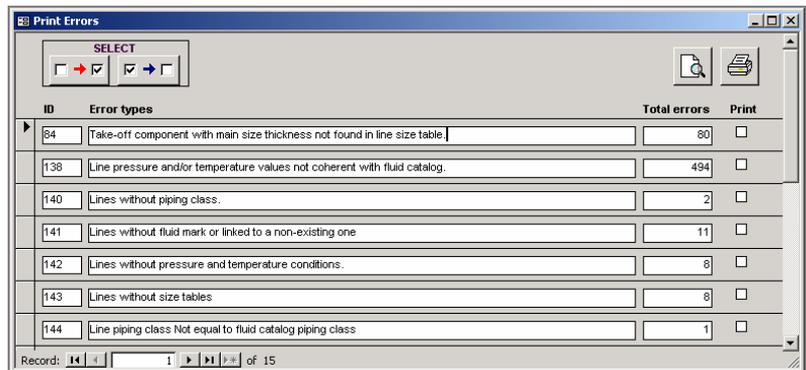
Puma5 allows links to be created among the Line List, the Fluid List and the Piping Classes in order to ensure alignment and simulate the consequences of modifications to the Project Line List and the Take-Off.



Form for the definition of the line list

Line List Checking

By creating links among the Line List, the Fluid List and the Piping Classes, Puma5 checks the data integrity and consistency between the Piping Classes, the Project Line List and the Take-Off. This ensures that the correct Piping Classes are used on the appropriate fluids.



Warning list

Take-off

This module permits the materials accounting to be performed so as to obtain the MTOs for procurement and construction. The Take-Off may be performed by line or by isometric drawing. Input is easy and fast and can be manually performed by means of a user-friendly interface that allows components to be selected directly from the Piping Classes, or they can be imported automatically from CAD systems through import/export interfaces.

Form for the material accounting

MTO checks

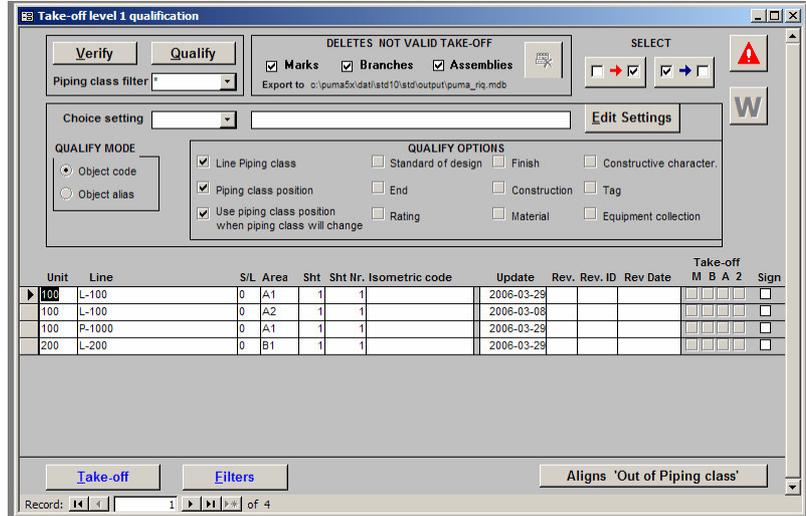
The variations in material quantities due to Piping Classes revisions are automatically recorded and upgraded, even while the work is in progress, thus always guaranteeing consistency in the Material Take-offs, the Piping Classes and the Material Requisitions.

Surplus Tables

The user has the possibility of creating and applying his own surplus tables, which will automatically increase the quantities of the calculated materials, in order to balance the construction and erection scrap.

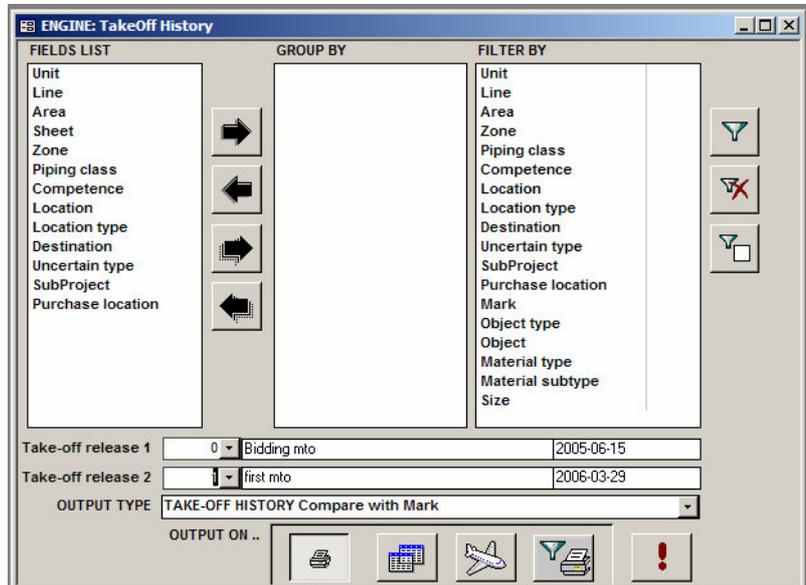
MTO upgrade

Puma5 has a unique feature which allows users to upgrade the existing MTO according to the last Piping Classes. This function allows significant time saving and ensures that the MTO reflects changes to the Piping classes.



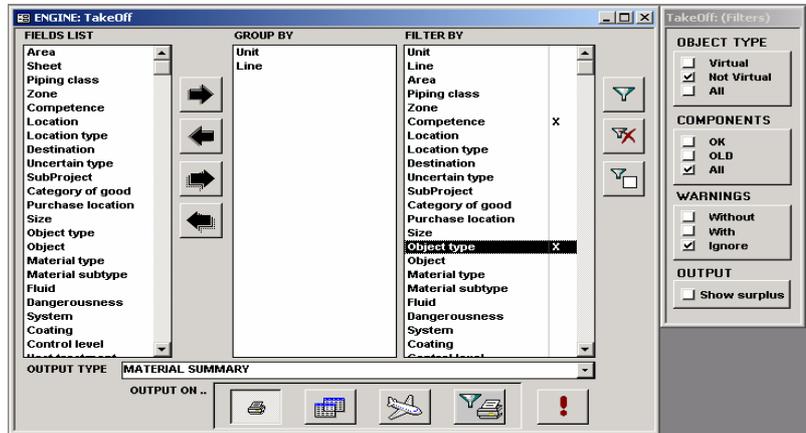
MTO history

MTO history allows users to save various revisions of MTOs and make comparisons between them. This feature allows the early detection of problems in material management and simplifies changes tracking.



Bill of Materials List

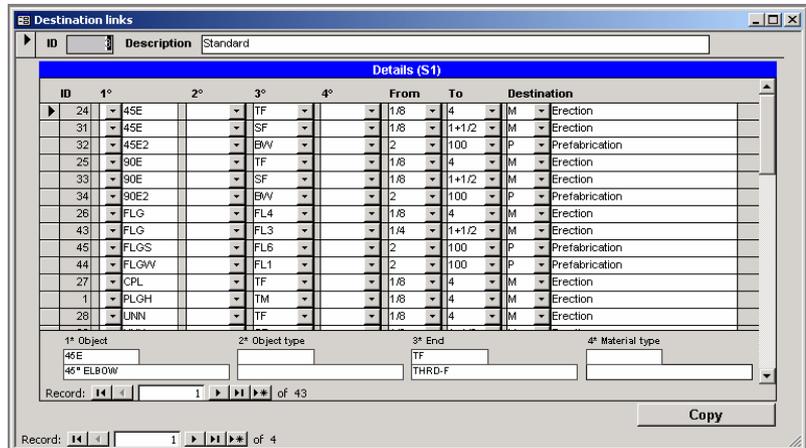
From the Bill of Materials List, the user can directly obtain the lists normally needed for planning and management control, as well as for prefabrication and erection, construction, and component traceability. The user can set his own filters and printing forms.



Form to filter and print Take-Off

Shop fabrication

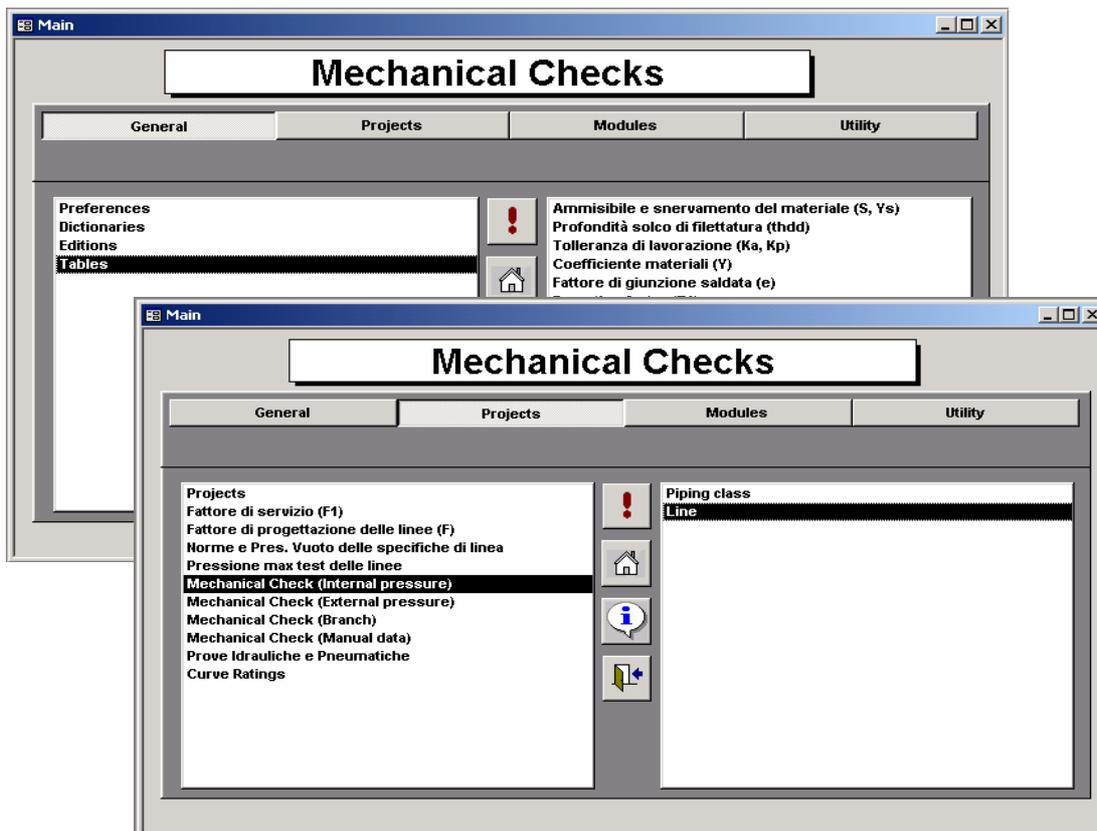
According to the project requirements, the user can define the divisions between prefabrication and erection and the MTO will be automatically subdivided.



Definition of prefabrication

Mechanical Checks

This module performs the mechanical checks on the piping components according to the standard piping design codes, which are: ASME B31.1, B31.3, B31.4, B31.8, and ASME VIII. The pressure rating curves and their automatic association to the piping classes are also checked, together with the calculation of the minimum test pressure (hydraulic or pneumatic) and the definition of the test circuits.



Menu to access the mechanical checks

Checks for internal/external pressure

The check for internal and external pressure (vacuum) can be performed both on the Piping Classes and on the Line List.

Checks for intersections

The necessity of reinforcing pads in “pipe-to-pipe” intersections may be checked at the piping class maximum conditions, or at the effective design conditions indicated in the Line list and, if necessary, Puma5 calculates the dimensions.

Manual calculations

Puma5 also includes a manual calculator for mechanical checks, thus allowing the user to make verifications even when the piping classes or the line list are not loaded in Puma5.

The screenshot shows the 'Manual calculations' interface in Puma5. It is divided into several sections:

- External pressure option:** Includes checkboxes for 'Reinforced Ring', 'Decrease L/D', and 'Increase thickness'.
- Operations:** Includes checkboxes for 'External pressure Check' and 'Branches Check', and a 'Use DPads' checkbox.
- Report type:** A dropdown menu showing 'Pressione Interna / Esterna' and 'Intersezioni'.
- INTERNAL PRESSURE:**
 - Standard of design: 3103 (ASME B31.3)
 - Construction: SML (SMLS)
 - Material: A2P (ASTM A 335 GR. P22)
 - End: BE
 - Design Service Factor (F): 0.4
 - From size: 2, To size: 24
 - Pressure (BAR): 25, Temp. (°C): 340
 - Discount %: 1, Corrosion allow. ("): 0.1
- EXTERNAL PRESSURE:**
 - Vacuum Std: 8000 (ASME VIII)
 - Vacuum pressure: 0.1
- BRANCH CHECK:**
 - Object: RWEL (Reinforcing weld)
 - Angle: 90
 - Branches Thickness: (button)
- Sizes Table:**

| S1 | S2 | Con | Construction | Mat | Material | End | End |
|----|----|-----|--------------|-----|--------------------|-----|-----|
| 20 | 16 | SML | SMLS | A2P | ASTM A 335 GR. P22 | BE | BE |
| * | | SML | | | | BE | |

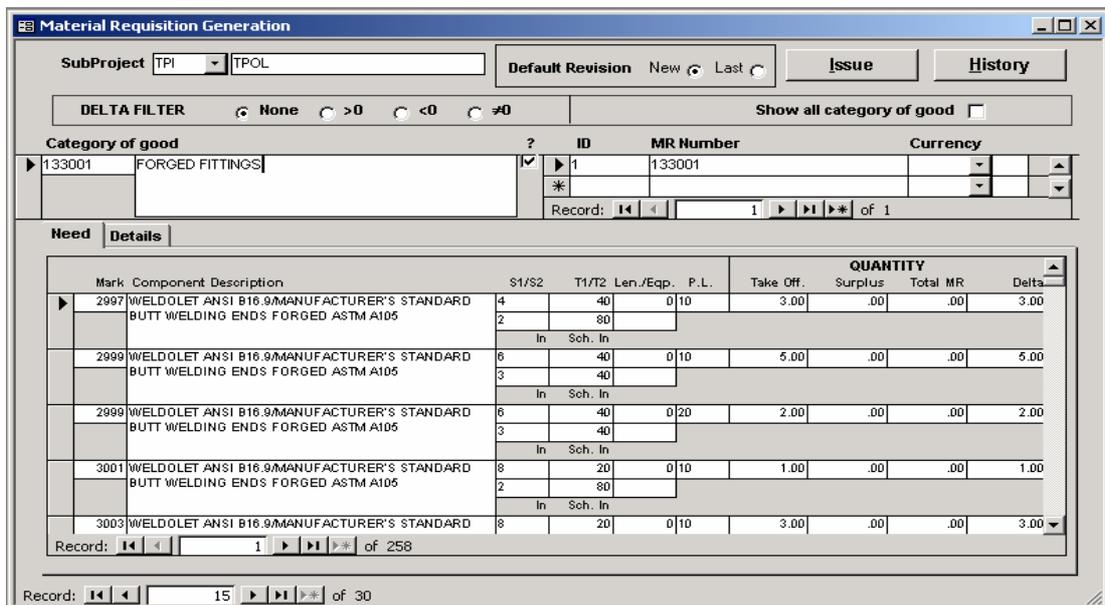
Record: 1 of 1

Material Requisitions

Puma5 automatically generates Material Requisitions from the MTO; they can be grouped by project, sub-project and destination. The material components are organised according to aggregations (product classes) that match the selected market suppliers. Before the issue of requisitions, the MTO quantities may be manually and/or automatically rounded off if necessary, so to have commercially available quantities (e.g. pipes in 6 or 12 metre lengths). It is also possible to issue material requisitions for materials not yet included in the Take-Off. Puma5 allows the user to choose the method used to manage deltas; making revisions of existing requisitions, issuing new requisitions, or a mixture of both. The user can also generate multiple material requisitions for the same components, if the material acquisition is protracted over time. Material requisitions can be exported to ERP systems, such as SAP, Oracle etc.

Requisition generation and issue

The Material Take-Offs are usually performed in several phases, at the end of which the requisitions are issued or updated. The application automatically monitors the difference between current and previous requirements by comparing the quantities already issued for purchase with the updated quantities from the Take-Off.

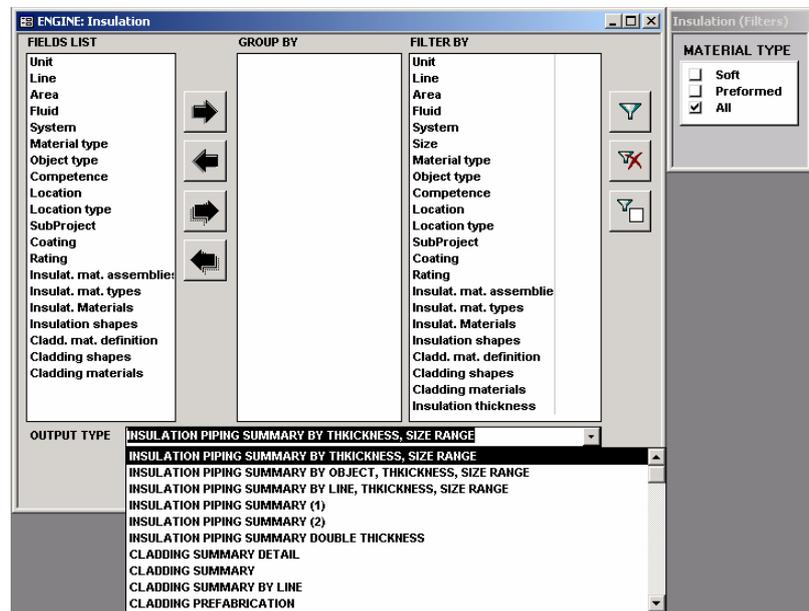
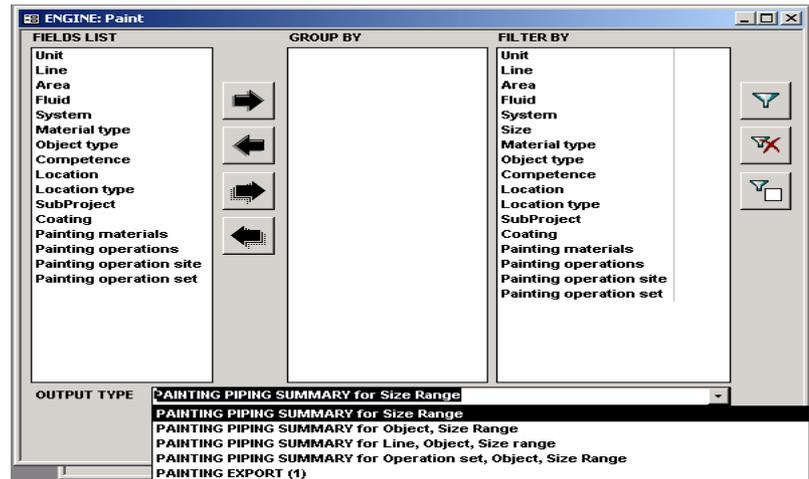


Painting & Insulation

This module performs the calculation of surfaces and the material quantities necessary for painting and insulation. The calculation is based on the Project Line list data (i.e. temperatures and coating types) and the Material Take-Off data (i.e. material quantities and types).

The module has a complete set of dictionaries for: painting materials, insulation materials, piping component surfaces, and the most commonly-used standard coatings.

An easy-to-use interface allows reports to be selected according to the user's requirements.



Import / Export

In order to make Puma5 more flexible to use, particular attention has been paid to the exchange of data among the different working groups.

External companies: to facilitate the transfer of data to/from external companies in the case of subcontracted work, special functions have been implemented to import/export data to and from the Piping Classes, the Take-Off and the Line List.

This is obtained by installing Puma5 in the computers of the external companies; afterwards the piping classes are transferred there for the accounting activities. Once finished, the Material Take-Offs can be collected in the main computer to obtain the project MTO.

DRIE: this tool handles the operations of importing/exporting data from other applications. Its chief attribute is its option of being configured directly by the end user, including the definition of the record layout of files to be imported or exported.

The main purpose of this module is to allow the easy transfer of data from/to Puma5 without creating specific interfaces, saving time and maintenance operations.

Integration with CAD modules

These are interface and integration modules with the most commonly used 3D CAD systems, which permit the quick and easy generation of the component database and the piping classes.

The modules available at present are:

- Dimensional catalogue, for AutoPLANT (Bentley), Esapro and Unigraphics
- PDS-Link, for PDS (Intergraph)
- PDMS-Link, for PDMS (AVEVA)

Dimensional Catalogue

Size Catalogue: customisation of size attributes, automatic codification of components from the Puma5 component catalogue, and revision management.

Piping class generation: generation of the component database and piping classes for the AutoPLANT Piping 3D and Isometrics modules.

| Piping class | Sign |
|--------------|--------------------------|
| A1A1 | <input type="checkbox"/> |
| A1A1N | <input type="checkbox"/> |
| A1A1N1 | <input type="checkbox"/> |
| A1A1T | <input type="checkbox"/> |
| A1A1U | <input type="checkbox"/> |
| A1A2N | <input type="checkbox"/> |
| A1A2N1 | <input type="checkbox"/> |
| A2A1 | <input type="checkbox"/> |
| A2A1. | <input type="checkbox"/> |
| A2A1N | <input type="checkbox"/> |
| A2A1T | <input type="checkbox"/> |

Form for the generation of the piping classes

PDS-Link

Piping Class generation: PDS-Link allows the piping classes and supporting tables for PDS to be automatically generated: Material Class Data, Commodity Specs Data, Branch Insertion Tables, Nominal Piping Diameters, Gaskets Separation tables, implied components, Option codes, Bolt tables, Component description library, Size dependant material data, and Weight tables.

Form for the generation of the piping classes

PUMA5 Training and start-up

Thanks to its ease of use, the Puma5 start-up time is measured in weeks. Puma5 is delivered with a starting database which includes:

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

This database usually covers 90%-95% of the requirements of the piping department. In practice, the new user will make some minor modifications (if necessary), and start loading the piping specifications.

Typical training schedule is given bellow:

PIPING CLASSES MODULE (PUMA5 BASE) 2 DAYS

- General Dictionaries;
- Bolt/weight/thickness tables;
- Equipment collections;
- Definition of the Piping classes;
- Definition of the Branch tables;
- Definition of the Assemblies;
- Generation and maintenance of the Component Catalogue;
- Generation and maintenance of the Branch Catalogue;
- Generation and maintenance of the Assemblies Catalogue;
- Revision management.

MTO MODULE (PUMA5 BASE) 2 DAYS

- General Dictionaries;
- Welding tables;
- Categories of goods;
- Project structure;
- Project tables;
- Automatic assignments;
- MTO Input;
- MTO Generation;
- MTO and Welding reports;
- Mark Tracing;
- Prequalification of MTO;
- BOM reports;
- MTO Isometrics;
- Revision management.

MODULE PROCESS (PUMA5 BASE)

1 DAY

- General Dictionaries;
- Project Dictionaries;
- Fluid List;
- Generation of the fluid list catalogue;
- Line list, association with the fluid list;
- Reports;
- Revision management.

MODULE IMPORT/EXPORT (PUMA5 BASE) + DRIE

1 DAY

- Custom code;
- Custom descriptions and translations;
- Import/export of the lines list, the MTO and the component catalogue;
- Definition of the forms for Import/Export in DRIE;
- Definition of the Context for Import/Export in DRIE.

MODULE MATERIAL REQUISITIONS (PUMA5 BASE)

1 DAY

- Generation of the Material Requisitions;
- Manual rounding off;
- Reports and output;
- Revision management.

PAINTING AND INSULATION MODULE

2 DAYS

- General Dictionaries;
- Project Dictionaries;
- Definition of the painting cycles;
- Definition of the insulation;
- Definition of the Tracing;
- Project structure;
- Reports for painting;
- Reports for insulation;
- Revision management.

MODULE MECHANICAL CHECKS

2 DAY S

- General Dictionaries
- Material Tables;
- Verification of the External pressure;
- Verification of the Internal pressure;
- Verification of the Intersections;
- Hydraulic and Pneumatic Tests;
- Design conditions check.

DIMENSIONAL CATALOG MODULE

1 DAY

- Definitions of the catalogue structure;
- Map of assignments;
- Export of the piping specs to AutoPLANT, Esapro and Unigraphics.

PDS-LINK MODULE

1 DAY

- General Dictionaries
- Setup of the dictionary maps;
- Project tables;
- Implied components;
- Export of the piping classes;
- Export of the project specifications tables.

MODULE PDMS-LINK

1 DAY

- General Dictionaries
- Setup of the dictionary maps;
- Setup of the templates;
- Project setup;
- Export of the piping classes.

The total number of training days depends on the modules purchased.

The typical complete training course lasts 12 days; Puma5 base 7 days; Painting/Insulation 2 days; Mechanical Checks 2 days; and 1 day for one module for CAD interfaces. The start-up time is very short because it is sufficient to have undergone training in the Piping Classes module to be able to start creating specifications in Puma5.

Considering that it takes between 4 and 8 hours to load one specification, a typical project with 30 specifications can be started in less than 5 weeks. Then, as the project progresses, the training is extended to other modules on an as-needed basis. This genuine on-the-job training not only reduces time and costs, but also increases the quality of training because the users immediately start applying their new knowledge.

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