

APROPO

Short Schema of Production Costs Planning



AproSoft GmbH

CONTENT

1	Introduction	3
2	Technology and Product Price Schema of APROPO.....	4
3	Financial Concept	6
3.1	Technology	6
3.2	Product dependent Financials	7
3.3	Calculation of Process Costs	8
3.4	Product Cost Structure	11
4	Core Data	12
4.1	Machines or workstations	12
4.1.1	Structure of Workplaces/Machines	12
4.1.2	Financial Data of the Machines.....	13
4.2	Articles and Products	15
4.2.1	Products.....	15
4.2.2	Warehouse Articles	17
4.3	Processes.....	20
4.3.1	General Process Information.....	20
4.4	Product-Dependent Process Information: Product-Process Configuration.....	22
4.4.1	Bill of Materials, Tools and Inspection Devices, Supplies and Energy	22
4.4.2	Planned Production Times	24

1 Introduction

The product price calculation of ARPOPO assumes the knowledge of

- technology of the product (i.e. chain of manufacturing processes)
- process times and setup times
- operator hourly costs for each processes
- number operators required
- Setup times and number of operators for setup activities
- Machine costs incl. amortization hourly for each process

Furthermore

- Material quantities and prices used in manufacturing (incl. energy, supply, tools)
- Overhead costs
- Planned profit
- Sales, distribution and transport costs

Scalability of the products

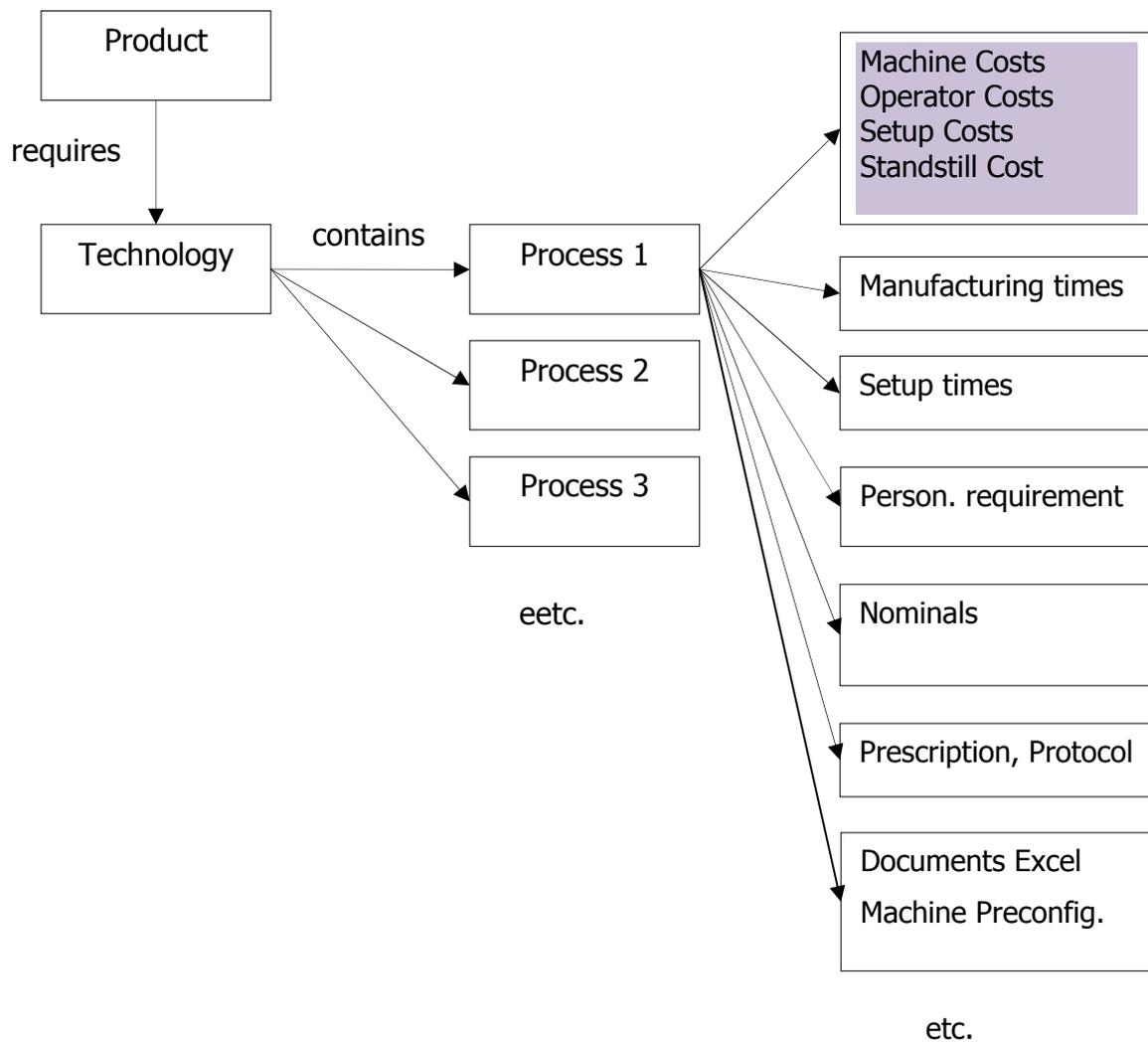
- Material demand, process parameters and process times can be expressed as variables (nominals)
- Prices can be expressed by names (tariffs)
- Configuration of product classes - only the differing products features are to be configured

Independence of technologies and processes mean:

- Technologies can be used and configured for different product classes
- Processes can be used for different technologies

2 Technology and Product Price Schema of APROPO

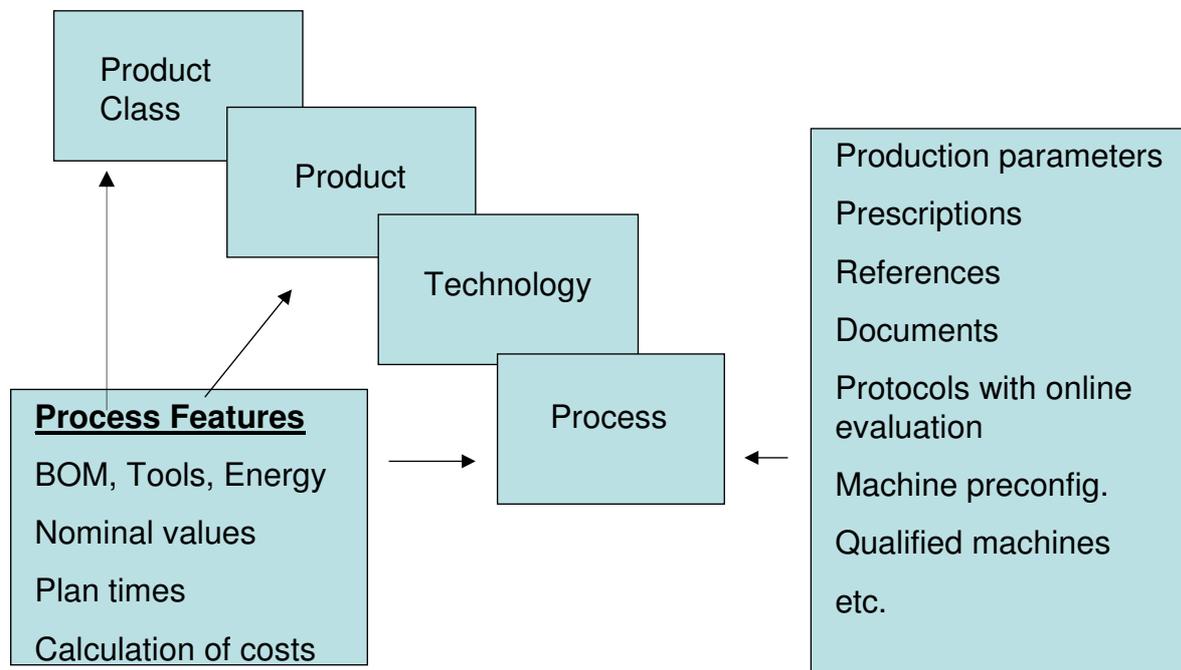
A technology – sometimes called work plan or routing - is assigned to each product. The technology contains several manufacturing processes required for production. The technology can be configured independently of the product. The master data level is as follows:



The process is the main important category for production: it contains all production information from BOM till machine preconfiguration files.

The **technology** (i.e. the processes) can be configured product-dependent:

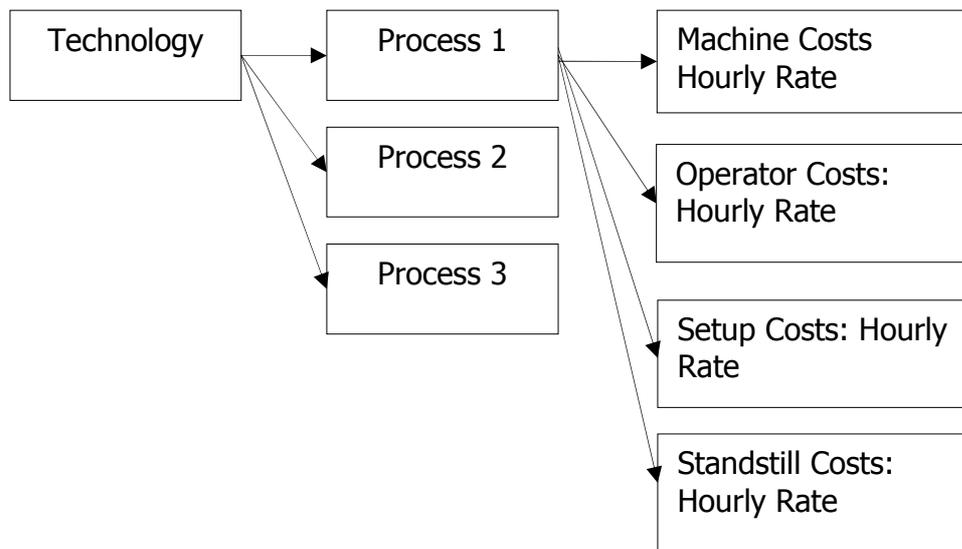
1. Material demand (BOM), operation and setup times and personnel requirements are assigned simultaneously to products (or product classes) and processes (for more information see p. 22)
2. Several products with the same technology and similar production features build a common **product class**. The configuration should be concentrated on the product class: The products themselves only get these features which differ from the features of the product class.
3. Material demand quantities, production times, personnel requirements , QC-criteria, process parameters and internal process calculation elements can be hold in variables called nominals. The products of the same product class usually differ only by some nominal values.



3 Financial Concept

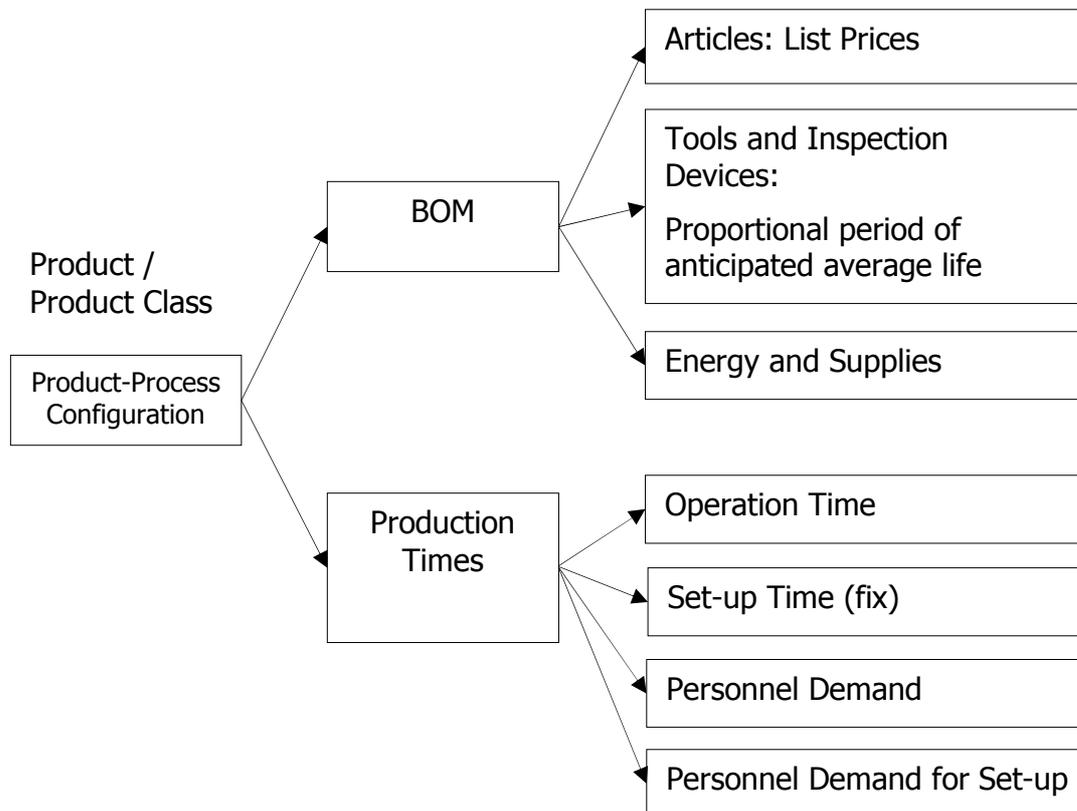
3.1 Technology

The hourly rates for each process are assigned to the 'process carriers': the machines or workplaces. All these cost factors can be overwritten in dependency of the product/ product class.



3.2 Product dependent Financials

First, for one product the personnel, machine and material costs of the processes are calculated:



3.3 Calculation of Process Costs

Production Costs for Each Process

All calculated personnel, machine and material costs are divided into variable (in proportion to the product quantity) and fix values.

Name	Value (Processing)	Value (Setup)	Dev	Quantity	Qty (Setup)	Unit	Price / Unit		SetupPrice/Un
Wärme Pers.	12,00	0,00	EUR	0,4	0,0	Z.Std	30,00	EUR	30,00
Wärme Masch.	0,00	0,00	EUR	0,4	0,0	Z.Std	0,00	EUR	20,00
NITINOL-001	0,42	52,18	EUR	0,04	0,00	L.2m	10,44	EUR	
MA 090004-001/001	0,00	0,00	EUR	0,00	0,00	L.m	0,00	EUR	
Rundfeile-01	0,00	0,00	EUR	0,00	1,00	Z.Std	10,00	EUR	
Process	Sum	Sum	Pers.	Pers.	Machine	Machine	Material	Material	
	Without Setup	Setup Only		Setup		Setup	Var	Fix	
Wärmebehandlung	12,42	52,18	12,00	0,00	0,00	0,00	0,42	52,18	

Sum of the VAR Costs for the Process: 0,42

Sum of the FIX Costs for the Process: 52,18

Form 1: Production Costs for a Particular Process

The **variable costs of materials** result from the materials defined in the BOM (→ Article/ Finances) multiplied by the quantity declared to the product class or product. Additionally, there are the hourly rates of the used tools/inspection devices in relation to the processing time.

The **fixed costs of materials** are determined by the fixed quantities of the BOM. Possible material overheads caused by operating supplies are only considered if they have been defined as auxiliary supplies.

The **direct production costs** refer to the non-material related use of resources. These are the machine and personnel costs that result from the hourly rates for the machine and personnel¹ of the target machine (→ Machine group/ Finances) related to the

¹ The determining factor for the hourly rates is the relevant tariff group of the selected process validity or machine group.

Please note that the write-off of a machine is involved in the hourly rate.

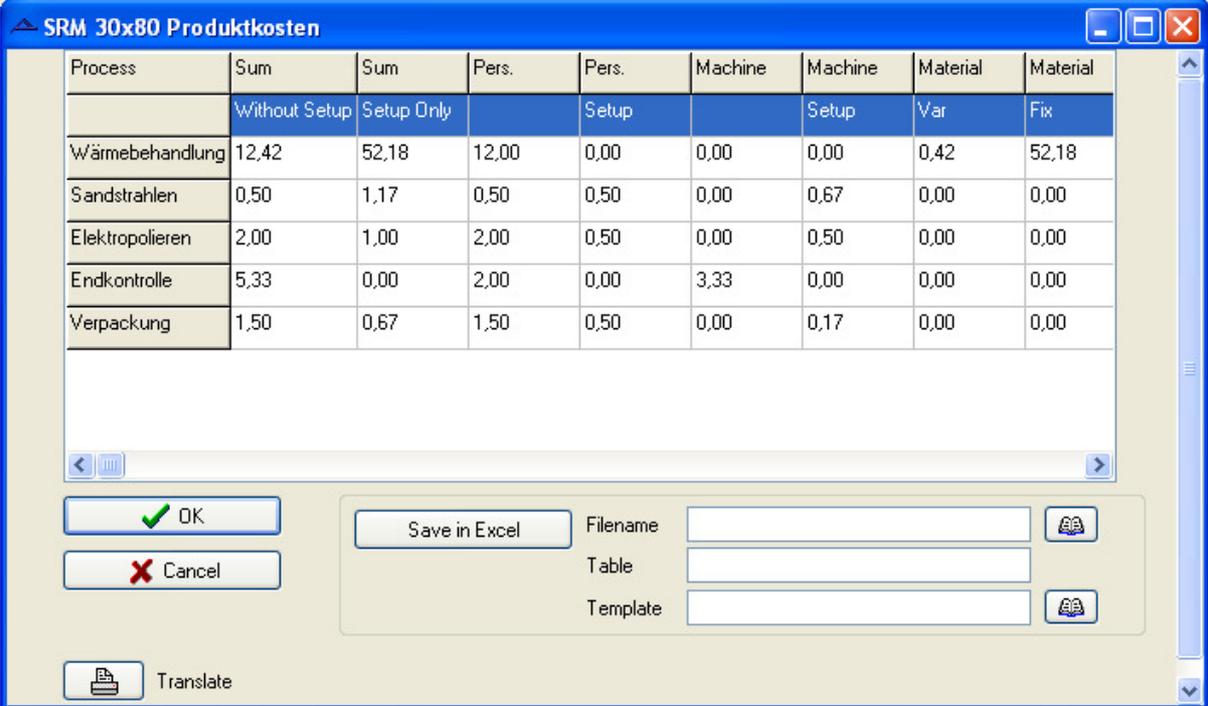
processing and set-up time. They include the cost per unit (variable) and the fixed cost, which are normally setup costs or preproduction costs.

	Displayed by APROPO	Calculated from:
Material costs	<i>Cell title in figure above</i>	
Cost per unit	<i>Value (Processing)</i> in an Article row	Quantity indicated at BOM (<i>Quantity</i>) and price of article (<i>Price / Unit</i>)
Cost per order event / lot: Supplies	<i>Value (Setup)</i> in an Article row (Supply!) (you must have defined them at the BOM!)	quantity indicated at BOM (<i>Qty(Setup)</i>) and price of article
Direct Production cost		
Cost rates / production time	<i>Value (Processing)</i> in Pers or Machine row	Hourly rates of machine + personnel (<i>Price/Unit</i>) and Processing time (<i>Quantity</i>)
Setup costs	<i>Value (Setup)</i> in Pers or Machine row	Setup rates (<i>SetupPrice/Unit</i>) and setup time (<i>Qty (Setup)</i>)

The calculation of the production costs refers to the **hourly rates of the machine groups only**, but not to a possibly deviating rate of a single machine. If, however, an hourly rate of a machine differs from the one for its group, you can get the actual costs using the post calculation of a production lot in Quality Assurance.

Total Production Costs

Having determined all process plan costs a summary list is provided:



The screenshot shows a software window titled "SRM 30x80 Produktkosten". It contains a table with the following data:

Process	Sum	Sum	Pers.	Pers.	Machine	Machine	Material	Material
	Without Setup	Setup Only		Setup		Setup	Var	Fix
Wärmebehandlung	12,42	52,18	12,00	0,00	0,00	0,00	0,42	52,18
Sandstrahlen	0,50	1,17	0,50	0,50	0,00	0,67	0,00	0,00
Elektropolieren	2,00	1,00	2,00	0,50	0,00	0,50	0,00	0,00
Endkontrolle	5,33	0,00	2,00	0,00	3,33	0,00	0,00	0,00
Verpackung	1,50	0,67	1,50	0,50	0,00	0,17	0,00	0,00

Below the table, there are several controls: an "OK" button with a green checkmark, a "Cancel" button with a red X, a "Save in Excel" button, and a "Translate" button with a printer icon. To the right of the "Save in Excel" button, there are three input fields labeled "Filename", "Table", and "Template", each with a small icon to its right.

Form 2: Calculating Total Production Costs for a Product

3.4 Product Cost Structure

The product net price can be determined directly from process manufacturing costs by adding overhead company costs, sales costs and planned gains:

The screenshot displays the SAP 'Form 3: Applying Production Costs to Product Cost Structure' interface. The window title is 'Article No.:SRM 30x80 Name:'. The main area is divided into several sections:

- Transaktionen (Transactions):** A table with columns for 'Transaktionen' and 'Debit account'. Rows include:

Costs		Lagerkosten
Warehouse		Stacking
Change Inventor		Stacking
Verkauf		Debitor
Dispatch		Stacking
		Credit account
- Externe Preise (External Prices):** Fields for 'List Price', 'Net Price' (32,7 / L.mm), 'Shipping', 'Vers.Vol', 'Net' (32,70), '+ VAT 19' (6,21), 'Total' (38,91), and 'Devis' (38,91). Includes buttons for 'Detail zeigen', 'Kurs', and 'Preis akt.'.
- Kostenstruktur (Cost Structure):** Fields for 'Manufacturing' (217,50), 'Setup' (55,02), 'Gen. Comp. Cos' (54,5), 'Profit', 'Distribution', and 'Sonstige'. Includes a 'Sum' field (327,02) and a 'Gilt für Menge' field (10). A checkbox for 'Proportional' is checked.
- Kosten / EH (Costs / EH):** Fields for 'Fert.Kosten' (21,75), 'Co-worker' (18), 'Machines' (3,33), 'Materials' (0,42), and 'Sonstige'. Includes a 'Sum' field and a 'Herstellkost.' field (27,25).

A callout box points to the 'Gen. Comp. Cos' field with the text: "Fix costs are planned / divided for a typical product amount".

Form 3: Applying Production Costs to Product Cost Structure

4 Core Data

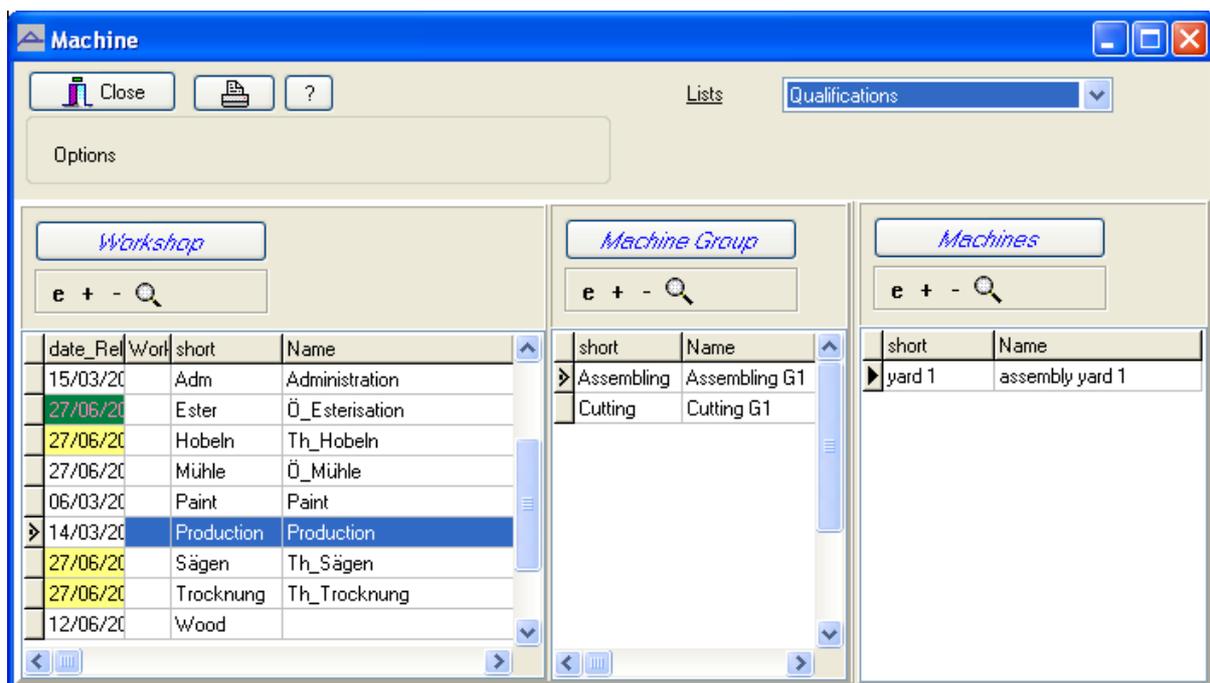
Short overview of the administration of data relevant for the production cost planning

4.1 Machines or workstations

4.1.1 Structure of Workplaces/Machines

By default the workplaces or machines are organized hierarchically into workshops and groups.

So, in the first instance, **ProcFlow** is intended for **job-shop production**. If, however, you have **flow production**, just pool all your resources and machines into a single workshop to remove the hierarchy. The workshop is then the assembly belt. By chain linking you can arrange the processes or machines according to the production flow.



The screenshot shows a software window titled "Machine" with a menu bar containing "Close", a printer icon, and a help icon. Below the menu bar is a "Lists" section with a dropdown menu set to "Qualifications". The main area is divided into three panes: "Workshop", "Machine Group", and "Machines". Each pane has a search bar with "e + -" and a magnifying glass icon. The "Workshop" pane contains a table with columns "date_Rel", "Work", "short", and "Name". The "Machine Group" pane contains a table with columns "short" and "Name". The "Machines" pane contains a table with columns "short" and "Name".

date_Rel	Work	short	Name
15/03/20	Adm	Administration	
27/06/20	Ester	Ö_Esterisation	
27/06/20	Hobeln	Th_Hobeln	
27/06/20	Mühle	Ö_Mühle	
06/03/20	Paint	Paint	
14/03/20	Production	Production	
27/06/20	Sägen	Th_Sägen	
27/06/20	Trocknung	Th_Trocknung	
12/06/20	Wood		

short	Name
Assembling	Assembling G1
Cutting	Cutting G1

short	Name
yard 1	assembly yard 1

List 1: List of Machines

The workshops or departments in **APROPO** serve as highest classification level not only for the machines but also for the personnel. Even more production-related data is subordinated to the workshops.

The groups represent an intermediate level that helps you organize your data in a hierarchical structure. In contrast to the workshops which pool machines and staff the machine groups are different from the co-worker groups, there is no relation between them!

4.1.2 Financial Data of the Machines

The screenshot shows a software window titled "M_Workshop:Assembling" with a "Finances" tab selected. The form contains the following fields and controls:

- Short Name: Assembling
- Name: Assembling G1
- Created: Micha, 19/02/2007
- Changed: Birgit, 27/06/2007
- Release: (empty)
- Locked:
- Archive:
- Qualification: (+) (-) Assembling

At the bottom, there are buttons for OK, Cancel, Conf., OK exit, Exit, and a help icon (?).

Form 4: New Machine Group

apart from names and operating licence the machine groups usually contain the relevant financial information:

- **Hourly rates of the machines** or pre-defined tariff for them
- **Hourly rates of the personnel** operating these machines or pre-defined tariff
These are the default costs for operating the machine. They actually can differ depending on the product!
- Hourly rate for the setup time of the relevant machines
- rate in standstill times
- cost centers to all of the rates

The screenshot shows a software window titled "M_Workshop:Assembling" with a "Finances" tab. It contains four sections for configuring rates and costs:

- Machine-hour rate:** Price/hour: 600, W.Hour: (dropdown), SEK, Category: (dropdown), Cost Center: production-M.
- Pers.Hour Costs:** Price/hour: 50, W.Hour: (dropdown), EUR, Category: DieselWorker, Cost Center: production-P.
- Setup:** Price/hour: 50, W.Hour: (dropdown), EUR, Category: (dropdown), Cost Center: production-P.
- Stand still:** Price/hour: 25, W.Hour: (dropdown), EUR, Category: (dropdown), Cost Center: production-M.

At the bottom, there are buttons for OK, Cancel, Conf., OK/Exit, Exit, and a help icon.

Form 5: Machine Group / *Finances* tab

We strongly recommend setting up the groups so that they contain machines of similar type disposing of the same hourly rates:

On the *Finances* tab of a machine group, enter the hourly rates for the machine and operating personnel which are valid for all subordinate machines.

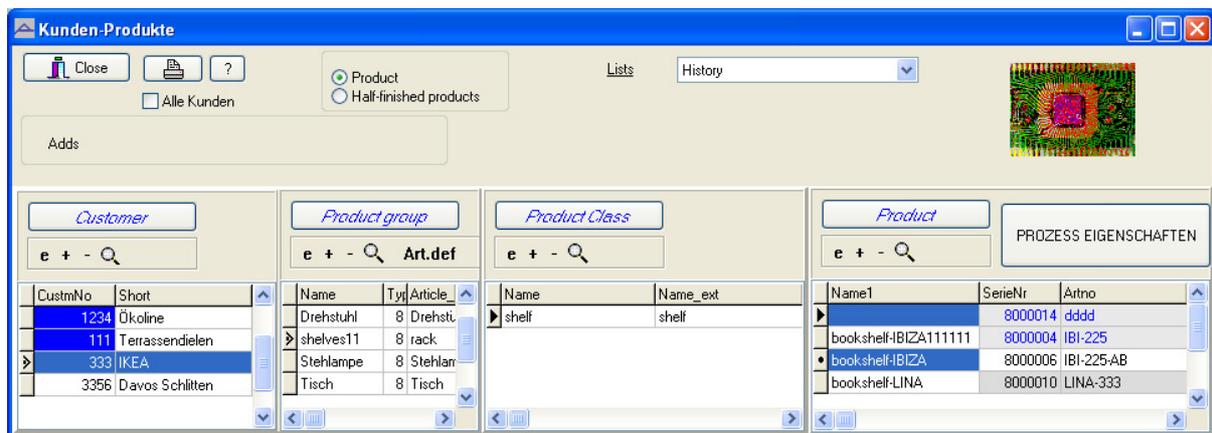
Calculation of the production costs refers to the **hourly rates of the machine groups only**, and not to a possibly deviating rate of a single machine (see Manual III, Production Costs). If, however, the hourly rate of a machine differs to the one for its group, you can determine the actual costs by post-calculating a production order in Quality Assurance (see Manual III, Post Calculation and Booking).

4.2 Articles and Products

4.2.1 Products

The customer products are subordinate to the product class, and to the product group, and finally also to the customers (or else to stock production).

The product class may contain a technology that is applied to all related products.



List 2: List of Customer Products

A product is defined by a unique serial number and/or article number and by a manufacturing technology assigned to it.

General data like names, validity, manufacturer, unit and the technology are requested on the **Article tab**. Fill in any data valid for all subordinate articles / products.

Als make sure to fill in default storage location (see p. **Fehler! Textmarke nicht definiert.**) and stock attributes on the **Attributes tab** and the financial information on the the **Finances tab**.

Apart of the regular article fields the customer product form provides some more specific fields:

The screenshot shows the SAP Customer Product Form for 'Kinderdrehstuhl TRIXI'. The form is titled '333 \ Kinder-Drehstuhl \ 8000016 Kinderdrehstuhl Trixi'. It has tabs for 'Article', 'Artikel Param.', 'Financials', 'Attributes', and 'Pack'. The main form area contains the following fields:

- SerialNo.: 8 000 016
- ArtNo (int): TRIXI-232
- Name1: Kinderdrehstuhl Trixi
- Name2: (empty)
- Class: Kinder-Drehstuhl
- Valid to: (empty) hrs
- Manufacturer: (empty)
- ArtNo. (ext): (empty) R. (empty)
- Name (ext): (empty)
- Unit: pc. 1pc
- Technology: Kinder-Drehstuhl herstellenRev.
- Lot Size: 50

At the bottom of the form is a button labeled 'PROCESS FEATURES'. Below the form are control buttons: OK, Cancel, Conf., OK, Exit, Cancel, Exit, and a help icon (?).

Callout boxes provide additional information:

- The technology required for production is selected from the list of technologies
- The lot size indicates the default quantity produced in one charge (lot).
- Direct access to process features like BOM and so on

Form 6: Customer Product 'Kinderdrehstuhl TRIXI '

The default lot size is of particular importance for advance production planning (for more information see Manual III).

Under the register *Attributes* can be entered if each production order or each part receives a unique charge number (single item tracking). The charge number is then displayed in the notation *lot number: sequential number for produced item*.

For more information about the data on all of the tabs see chapter 'Warehouse Articles', p. 17.

Qualified Products help you to protect a product and its technology including processes: They are blocked for editing. So, qualification of an element in **APROPO** means blocking of both the element and all of the subordinate elements.

4.2.2 Warehouse Articles

The warehouse provides the following types of articles²:

- Raw materials
- Products
- Tools / inspection devices
- Energy / supplies / co-products
- Semi-finished products
- Shipment / package

Raw materials can also refer to assemblies and components in the sense of purchase articles which are used in the bills of material.

Products are meant to be finished goods on stock, and customer products ready for shipment. The *semi-finished products* are used for internal partial production of assemblies which can be pre-fabricated for stock.

 Note that you cannot add or delete products to/from the warehouse. They belong to the customers and are managed there (Customer products).

Let's have a look at the main article features of stock articles and products.

² Of course you may rename these categories according to your specific structure.

4.2.2.1 Article Details

Article:HolzTR-gr

Article Stock Artikel Param. Financials Delivery Attributes

SerialNo. 1 111 131 R.

ArtNo (int) HolzTR-gr

Name1 Holzstiz Trixi grün

Name2

Charge

Valid to [] hrs

Manufacturer []

ArtNo (ext) Holz TR-gr ST00M-12 R.

Name (ext)

Unit pc.Tpc Min Quantity

Transport Gabelstaple GS1 Max Quantity

Deliverer Holzmann

Min. Time of Delive [] Workdays

Create Birgit 26.11.2007 14:1

Changed []

Released []

[] Locked

[] Archiv

Name (EN) []

Name (FR) []

OK Cancel Conf. ?

OK, Exit Cancel, Mainmen ?

Memos, Inspection Dates and Certificates

Foreign Language Names

Form 7: Warehouse article

General data such as names, validity, manufacturer, unit and the technology is requested on the first tab *Article*, as far as it is not yet stored at article definition.

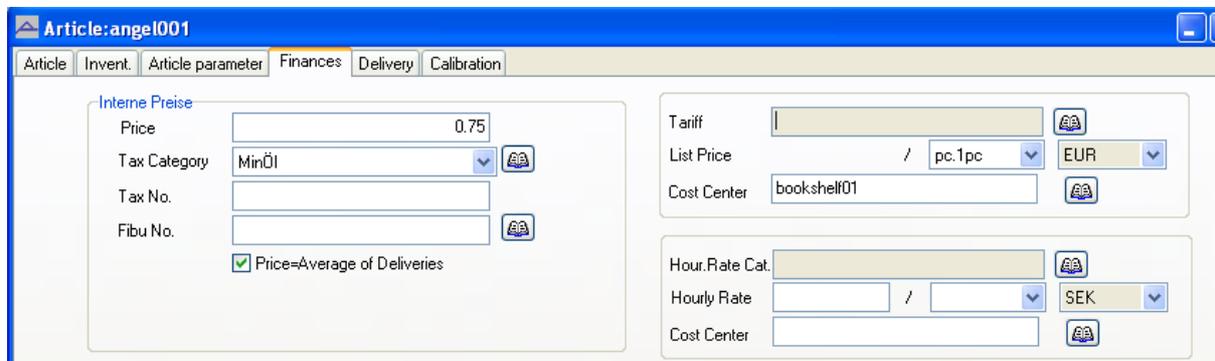
The fields *Valid to* and *Operating hours* refer to the lifetime of an article. With it, you can manage a kind of load utilization or degree of usage.

For all warehouse articles, you can manage **memos**, **quality inspection dates** and **certificates**. To access them use the icons in the upper right-hand corner of the form.

Storage Location, Attributes and Inventory of articles are not mentioned in this document.

4.2.2.2 Prices

You can find all the price data on the *Finances* tab. You should indicate your data as correct as possible since the purchase price of an article is the basis for the calculation of the material costs and the production costs.



The screenshot shows the SAP interface for Article: angel001, specifically the *Finances* tab. The interface is divided into several sections:

- Article parameter:** Contains fields for Price (0.75), Tax Category (Min01), Tax No., and Fibu No. There is a checkbox for "Price=Average of Deliveries" which is checked.
- Finances:** Contains fields for Tariff, List Price (with unit pc.1pc and currency EUR), and Cost Center (bookshelf01).
- Hourly Rate:** Contains fields for Hourly Rate (with unit SEK) and Cost Center.

Form 8: Warehouse Article / *Finances* tab

On the ***Finances*** tab you calculate the catalog price and assign the cost center. For more information about pricing see Manual VIII.

4.3 Processes

The processes and their folders that combine multiple processes belonging together are subordinate to the workshops.

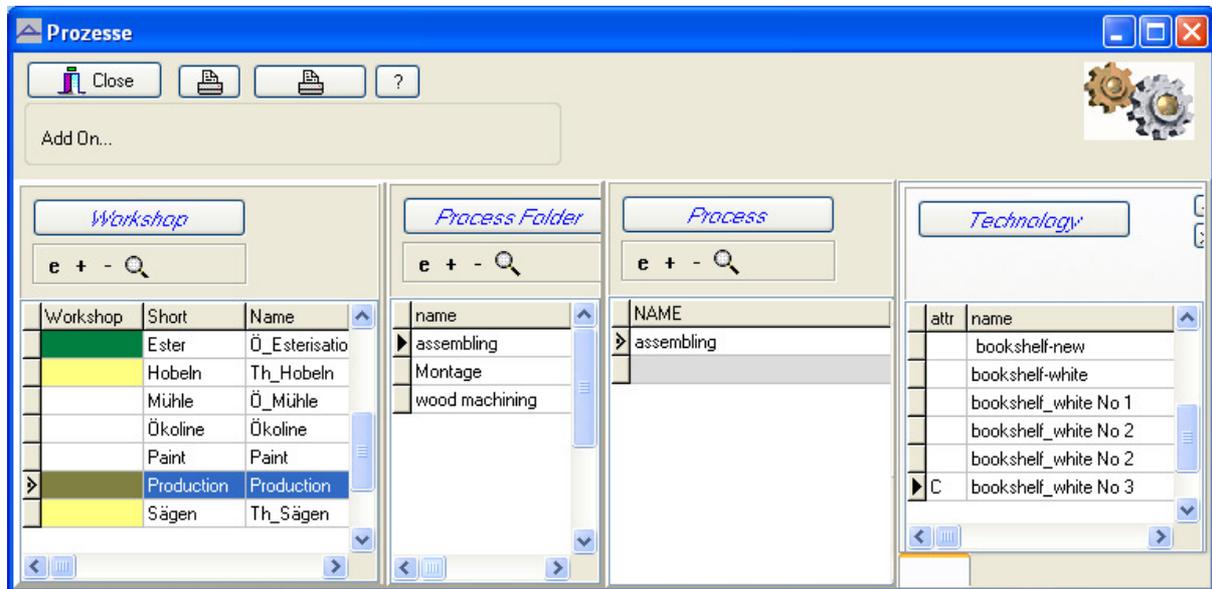


Figure 1: List of Processes

4.3.1 General Process Information

Each process determines one or more **workplaces** or **machines** as resources:

The process is only valid within a machine group or a machine. The target machine is selected from this range called **process validity**. As an alternative, you can select one or several special machines from other areas called **qualified machines**. This might be a borrowed machine.

As long as the field *target machine* is not filled out, **ProcFlow** itself will choose the optimal machine from the process validity or from the qualified machines.

Machine qualification determines the qualified staff

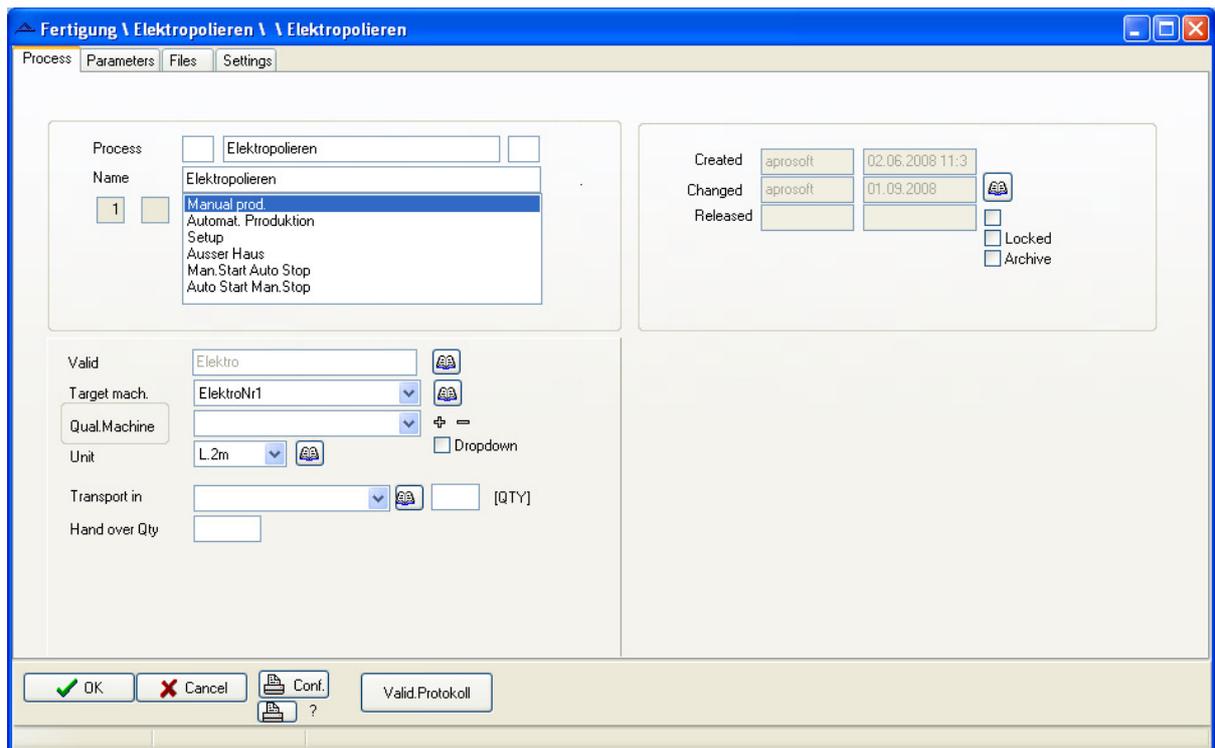


Figure 2: Process Template

Below, you select the machine(s) as explained above. If you don't select a target machine then all valid machines receive the production request: the first free machine can start the production or parallel manufacturing is possible.

The setup and operating costs depend on these machines.

4.4 Product-Dependent Process Information: Product-Configuration

All products belonging to the common product class are displayed in the upper left-hand corner.

All product configuration details (like BOM, nominals, operation times, process costs) belong to the product class (or product, below) and to one of the processes of the technology (right hand).

If possible, you can enter the features according to the product class or below the product. They always refer to a particular process highlighted in the list on the right-hand side.

4.4.1 Bill of Materials, Tools and Inspection Devices, Supplies and Energy

The screenshot displays the SAP SRM 30x80 Stent01 interface. The main window is titled "(SRM 30x80) Stent01". It features a top navigation bar with tabs for "Primäre Stückliste", "Tools, Insp.Dev.", "Energy, Supplies, Coproducts", "Nominals", "Plantimes", "Production costs", "Global nom.", and "Docs". The "Production costs" tab is active. The interface is divided into several sections:

- Product List:** A table with columns "ArtNr", "Produkt", "RevNr", and "unit". The first row shows "SRM 30x80" with unit "L.mm".
- Technology Selection:** A table with columns "Attr", "Technologie", and "Rev.". The first row shows "Stent01".
- Product Class:** A section titled "SRM Rohr 30" with a "Preview" button and a "Lot" button. It contains input fields for "Production time in min." (24), "Set-up time in min.", "Personal factor" (0.5..1..2), and "Personenfaktor Rüst." (1).
- Processes of the technology:** A table with columns "Pos.", "Name", and "Rev.Nr.". The first row shows "1 1 Wärmebehandlung".
- Product:** A section titled "SRM 30x80" with a "Preview" button and a "Lot" button. It contains input fields for "Production time in min.", "Set-up time in min.", "Personal factor", and "Personenfaktor Rüst.".

Annotations with callout boxes point to various elements: "Relevant product" points to the product list; "Technology for producing this products" points to the technology selection table; "Product class" points to the "SRM Rohr 30" section; "Processes of the technology" points to the processes table; and "Product" points to the "SRM 30x80" section.

Form 9: Process Features for 'Venezia-weiß-12' / BOM tab

Each single process can have a list of materials attached: **BOMs, tools/inspection devices** and **energy/auxiliary supplies**.

Process Mat. demand

Pos: 2 Alternative: 1

ArtNo.: Leuchtmittel-01

SerialNo.:

Charge:

Name: Illuminant 04451

Quantity: 1 in pc.1pc

Plan Qty: 1 * Quantity

Co-Product: Negative signed quantities!
Costs causing co-products:
please set negative the article price!

Parametrized Quantity: * Quantity

OK Cancel ? Translate

A BOM item can have more than one alternative

The planned quantities consist of variable data (depending on the production quantity)

Alternatively, the planned quantity can be taken from the nominal value table (*Parameters* tab).

Form 10: Record of the BOM

Each material is defined as a single record (BOM item) with its quantity. The material price results of the article list price and the indicated quantity.

To get an overview of the complete BOM with all items and across all processes, use the print function (**single-level bill of material**).

Defining tools and inspection devices is done by applying the same instructions as for BOMs with some specialiti

For tools are the number of tools is to enter. The wear lifespan can be configured time or (product) quantity dependent.

4.4.2 Planned Production Times

You can manage exact lead times for the product and the product class. The planned times which are currently valid, result from the three-stage hierarchy:

1. Product
2. Product class
3. Process

If there is special data for the **product**, it has top priority. Otherwise the data of the **product class** applies.

The planned times of the **process** (*Settings-tab*) apply only if there is neither data for the product nor for the product class.

The function *Overview* shows the data currently valid.

The screenshot shows the 'Planned Times' tab in a software interface. The window title is 'stehlampe blau (stehlampe blau) Stehlampe'. The interface includes a top bar with 'OK', 'Cancel', 'Print', and 'Release' buttons. Below this is a table with columns 'SerieNr', 'ArtNr', 'Produkt', and 'RevNr'. The table contains two rows: '8000018 halstehbil-01 Hallogen Stehlampe Bill' and '8000019 stehlampe blau stehlampe blau'. To the right of this table is a 'Technologie' table with columns 'Attr', 'Technologie', and 'Rev.', containing one row: 'Stehlampe'. Below the main table is a navigation bar with tabs: 'BOM', 'Tools/Inspec.Devices', 'Energy/Supplies/Co-Products', 'Parameters', 'Planned Times', and 'Production Costs'. The 'Planned Times' tab is active. It features a 'Preview' button and a 'Hallogen' process name. Below this are input fields for 'Production Time (min)' (value 12), 'Setup Time (min)' (value 0), 'Personnel Demand' (value 1), and 'Personenakt.Füst.' (value 1). There is an 'Import' button next to the 'Production Time' field. Below this is another 'Preview' button and a 'stehlampe blau' process name. Below this are empty input fields for 'Production Time (min)', 'Setup Time (min)', 'Personnel Demand', and 'Pers.Demand Setup'. There is an 'Import' button next to the 'Production Time' field. At the bottom center is an 'Overview' button. On the right side, there is a 'Processes' table with columns 'Pos.', 'Name', 'Rev.', 'N.Pos.', and 'F_exp'. The table contains one row: '1 1 Stehlampe Bill Montieren'. Two callout boxes are present: one pointing to the 'Hallogen' process with the text 'Planned times for the product class ('rack')' and another pointing to the 'stehlampe blau' process with the text 'Planned times for the product only'.

Form 11: Planned Times in the Process Features

You must indicate the planned times for each highlighted process. They are referred to in minutes.

The processing time always refers to one unit (te), the set-up time is a fixed date not depending on the production quantity (tr).