PC pump
Applications

PC Pump application

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1. Biogas
2. Mining
3. Liquid Explosive
4. Brewery
5. Water Treatment
6. Pulp and Paper

Biogas

Biogas

Growth of bioenergy – some facts

- In 2050 more than 10% of the worldwide primary energy demand can be covered by bio-energies
  (german climate research institute)

Example Germany

- ✓ In 2010 approx. 7% of the total energy consumption was covered by bio-energies (growth of 16% vs. 2008). Until 2020 the share should grow to 12%
- ✓ Number of installed biogas plants 2013: more than 7000
  total installed electric power: approx. 3.000 MW

Biogas

Basically there are three types of biogas plants

Agriculture biogas plant – utilize the waste, mainly manure, from one or number of farms + energy crop

Food waste plant – utilize food waste from industrial food production plants and household waste

Joint biogas plant – combination of energy crop, agriculture waste and food waste

Sliding floor co-ferment

- Corn silage
- Grass silage
- Early cereals
- Root vegetables
- Potatoes
- Onions
- Maize silage

Substrate

- simultaneous mixing of liquid manure and co-ferment possible

Digester

Post-fermentation

Final storage

BTTP

Barn

- Liquid cow manure
- Liquid pig manure
- Liquid calf manure
- Liquid chicken manure
- Dung

:

- Slurry tank
- T-Pump for mixing
- Fermenter

Slurry tank

Preparation of liquid manure and co-ferments

Maceration / homogenisation with macerator and pump

Example of biogas application

Example: Generation of Bioenergy

- Waste from beer production (Spent grain)
- Pumping of Spent grain from silo to belt press (typical 18-20% ds)
- Belt press dewaters 40+% DS
- Final product from belt press for combustion (waste to energy)

Mining Industry and application

The Definition of Mining

Mining is the process of extracting valuable/precious materials from the ground. The first form of extraction are ores.

Ores are rocks that contain these valuable/precious materials.

Valuable/Precious Materials
- metals (gold, silver, nickel, copper, etc.)
- coal & oil shale (energy)
- gemstone (diamond, ruby, opal, etc.)
- limestone (building materials, fillers in toothpaste, etc.)
- dimension stone (construction aggregate, etc.)

Mining Industry and application

Natural Resources in the Region

Indonesia - nickel, bauxite, copper, coal, gold, silver

Korea (South) - coal, lead

Laos - gold, gemstones

Malaysia - tin, copper, iron ore

Myanmar - lead, coal, marble, limestone, precious stones

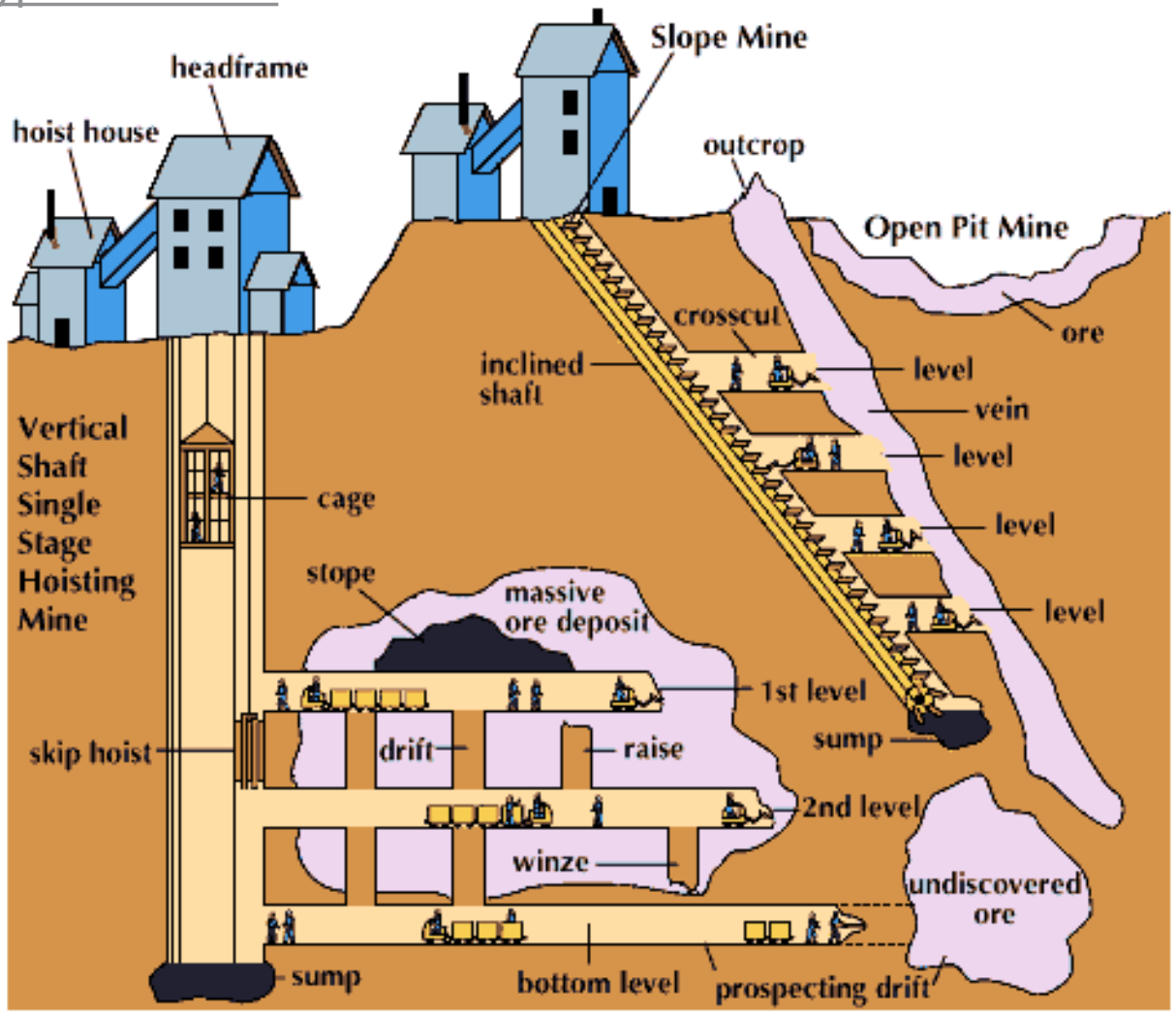
Philippines - nickel, silver, gold, copper

Taiwan - small deposits of coal, limestone, marble

Thailand - tin, lead

Vietnam - coal, manganese, rare earth elements

Typical Types of Mines



Mining application

Mine Dewatering

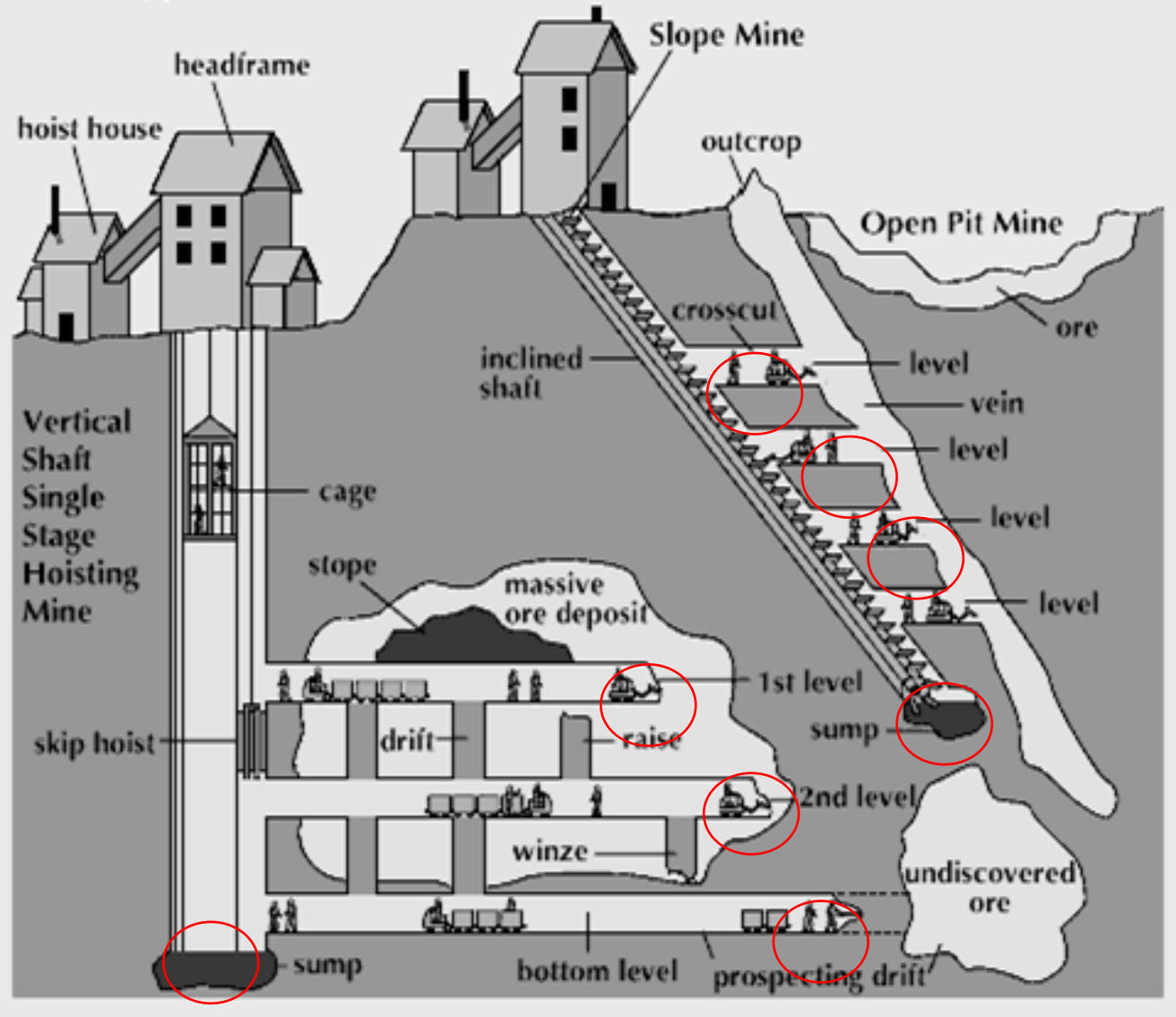
Water in the mines:

1. Brought in to remove overburden (waste) or rock debris, ‘washing’ crushed ores, etc.
2. Underground water (natural).

Mine dewatering is carried out for several reasons including:

- Dewatering of the ore and/or waste rock actively;
- Maintenance of dry pit floor and/or underground workings for operations;
- Prevention of sudden flooding and/or mud rushes;
- Release of pore pressures in open pit slopes and/or underground workings to prevent failure of pit benches or u/g workings.

Mining application



Water Sumps / Holding Tank

Medium:
Mine Acidic Water
pH 3 – 5
solid content (3-5%)
ambient temperature

Dewatering Range:
~ 20 - 500 m^3/hour

Mining application

Philsaga gold mine (Philippines)

Mine Dewatering Pump
Medium: **Mine Acidic Water**
Solid Content: **5%**
Capacity: **49.96 m^3/hr**
Pressure: **25 bars**
Speed: 240 rpm
Drive Power: 51 kW
Depth: 240 m

Liquid Explosives

Pumping ammonium nitrate:

Progressive cavity pumps are commonly used to pump explosives on mobile bulk handling equipment. They are also preferred for many applications in fixed explosive materials manufacturing plants.

There are four types of water-based explosives:

1. Slurries with solids (primarily fuel, but there may be crystals of oxidizer as well) in a thickened aqueous solution of oxidizers.

2. Watergels that are formed by linking the molecules of the thickener in a slurry together by chemical bonds. A well-formed gel cannot normally be pumped, but partially formed gels can be pumped.

3. Emulsion explosives are an emulsion in which a super-saturated aqueous solution of oxidizer is dispersed in an oil or oil-wax liquid. They are commonly blended with ANFO (ammonium nitrate and fuel oil) or ammonium nitrate to form a booster-sensitive mix.

4. Blends are mixtures of ANFO or ammonium nitrate with a water-based explosive (either an emulsion or emulsion matrix or a water gel)

Liquid Explosives

Applications in an explosive plant:

A typical explosive plant uses the emulsion manufacturing process. There are two basic units: the emulsion matrix process and the blend process. In the blend process, glass microspheres or other solid additives are introduced. There are three applications in these processes where the progressive cavity pump is used as a standard:

1. The emulsion process meters oxidizer solution and fuel oil emulsifier solution into a pre-mix vessel with an agitator. The mixture is then pumped by a progressive cavity pump through a motionless mixer assembly to a storage vessel or to the blend process.

2. The blend process meters glass microspheres into a blender and is mixed with un-sensitized emulsion product. The sensitized product is then pumped with a progressive cavity pump to a storage vessel.

3. The explosive is pumped to a specially designed tank truck for transportation to the site where it will be used.

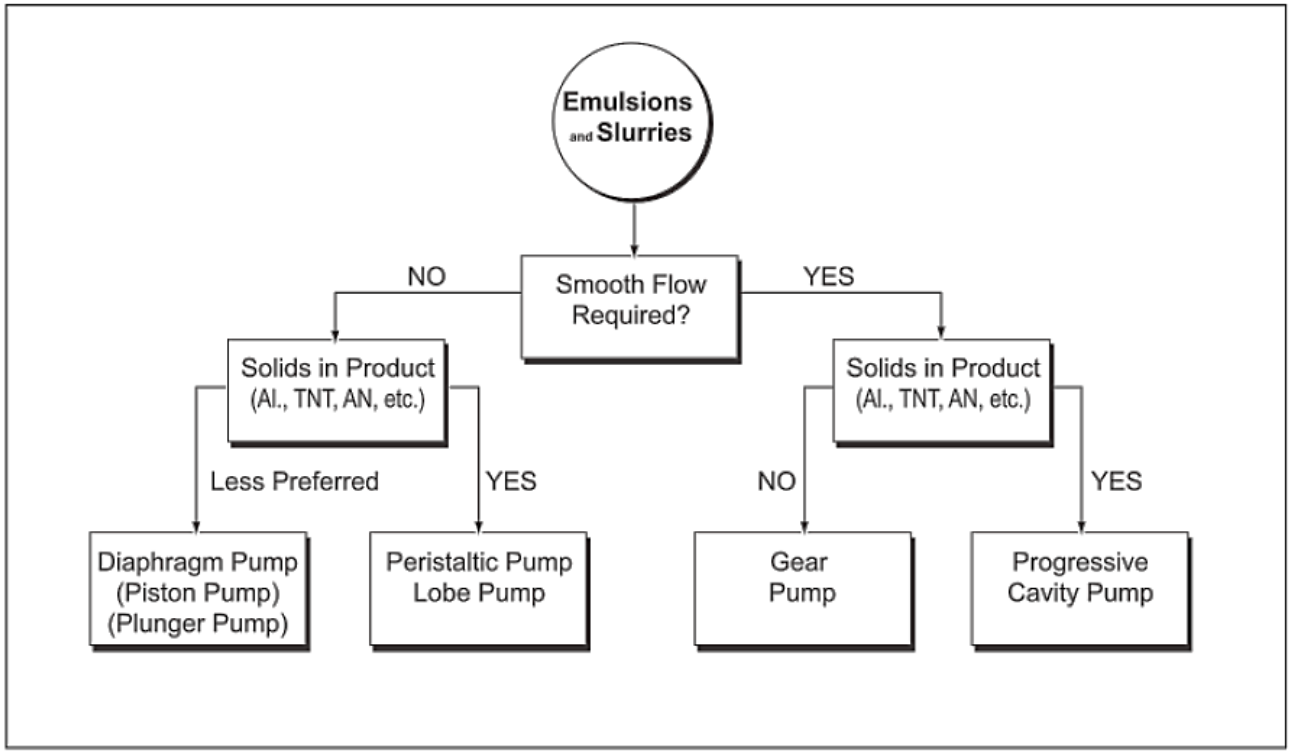
Note 1: The above applications generally use progressive cavity pumps, but other pump types of positive displacement pump are occasionally used.

Note 2: There are also similar applications on mobile bulk pumping equipment. These trucks transport transfers materials in bulk form for mixing and / or loading directly into blast holes.

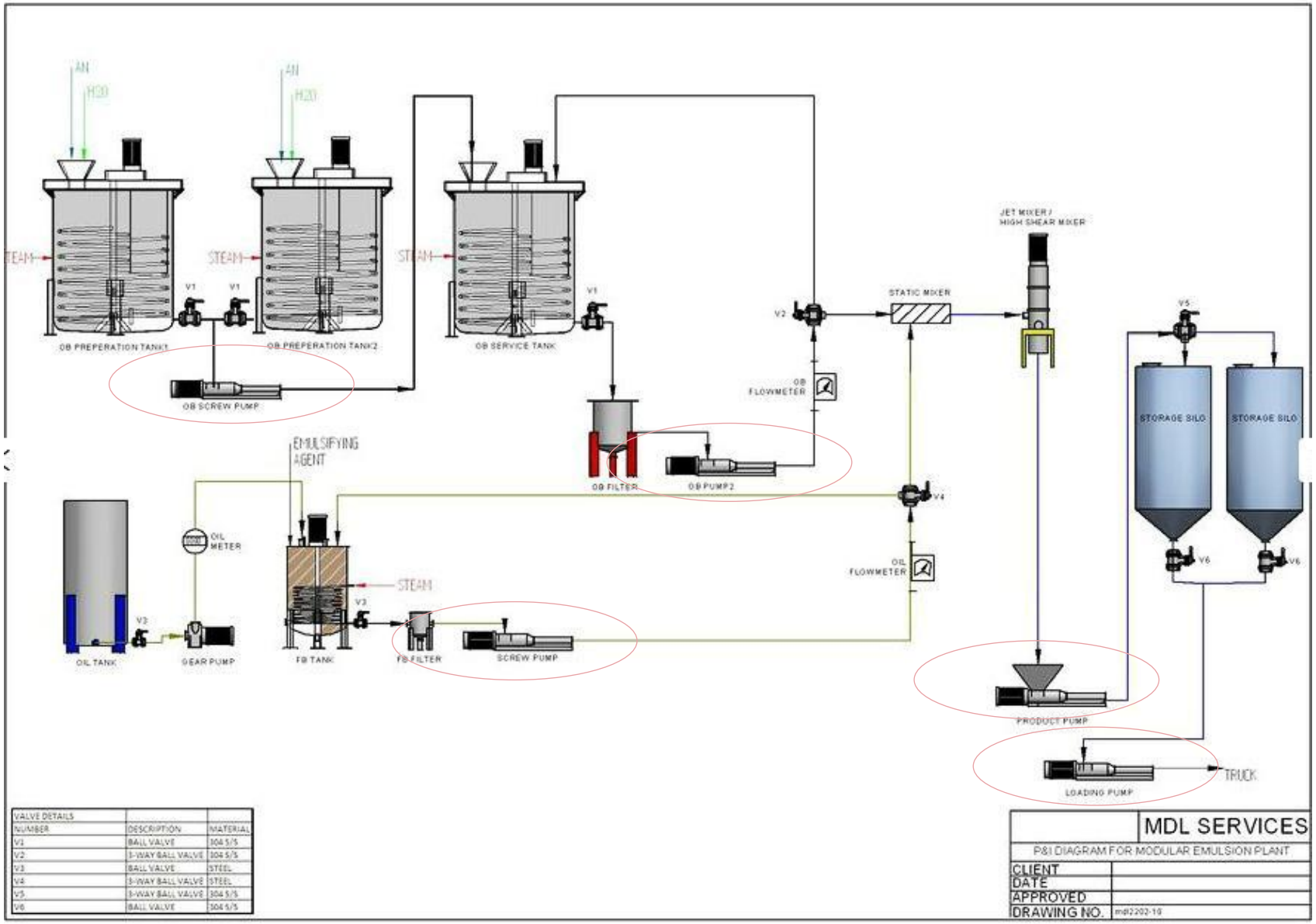
Liquid Explosives

One major company has developed a decision tree for pump selection. It is reproduced here, with their permission. with one minor modification: peristaltic pumps are grouped with lobe pumps (for solids in the product in a non-smooth flow situation) whereas, in the original, it appeared under the “less preferred” category only along with diaphragm pumps for solids in a non-smooth flow. In referring to the tree, one must realize that it is permissible to use smooth-flow pumps even when smooth flow is not required. An obvious example is the widespread use of progressive cavity pumps

Figure 2
Decision Tree for Selecting Pumps



Bulk emulsion explosives production facility- process



Bulk emulsion explosives production facility

Dissolving tank

Emulsion tank

Emulsion silo

Mobile Processing Units (MPU) / Mobile Manufacturing Unit (MMU)

Definition:

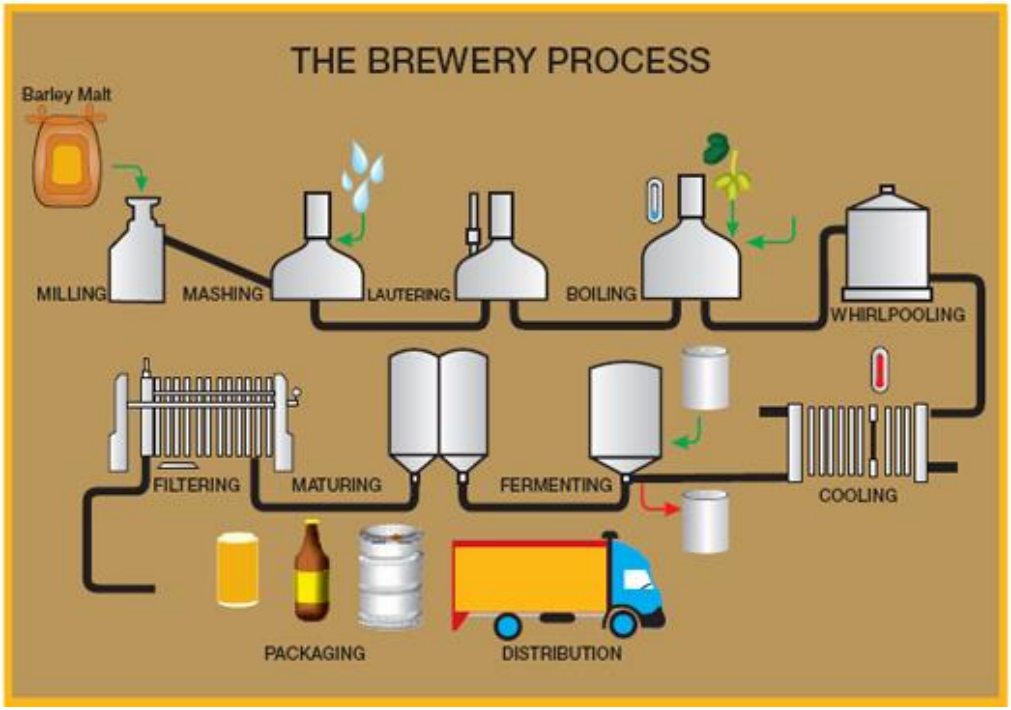
For the purposes of this code a Mobile Processing Unit (MPU) is defined as follows:

1. a vehicle mounted plant which can carry its own ingredients, can manufacture or blend a Class 1 explosive and which contains it own delivery system for the explosive or

2. a vehicle mounted bulk explosives container which contains its own delivery system for the explosive.

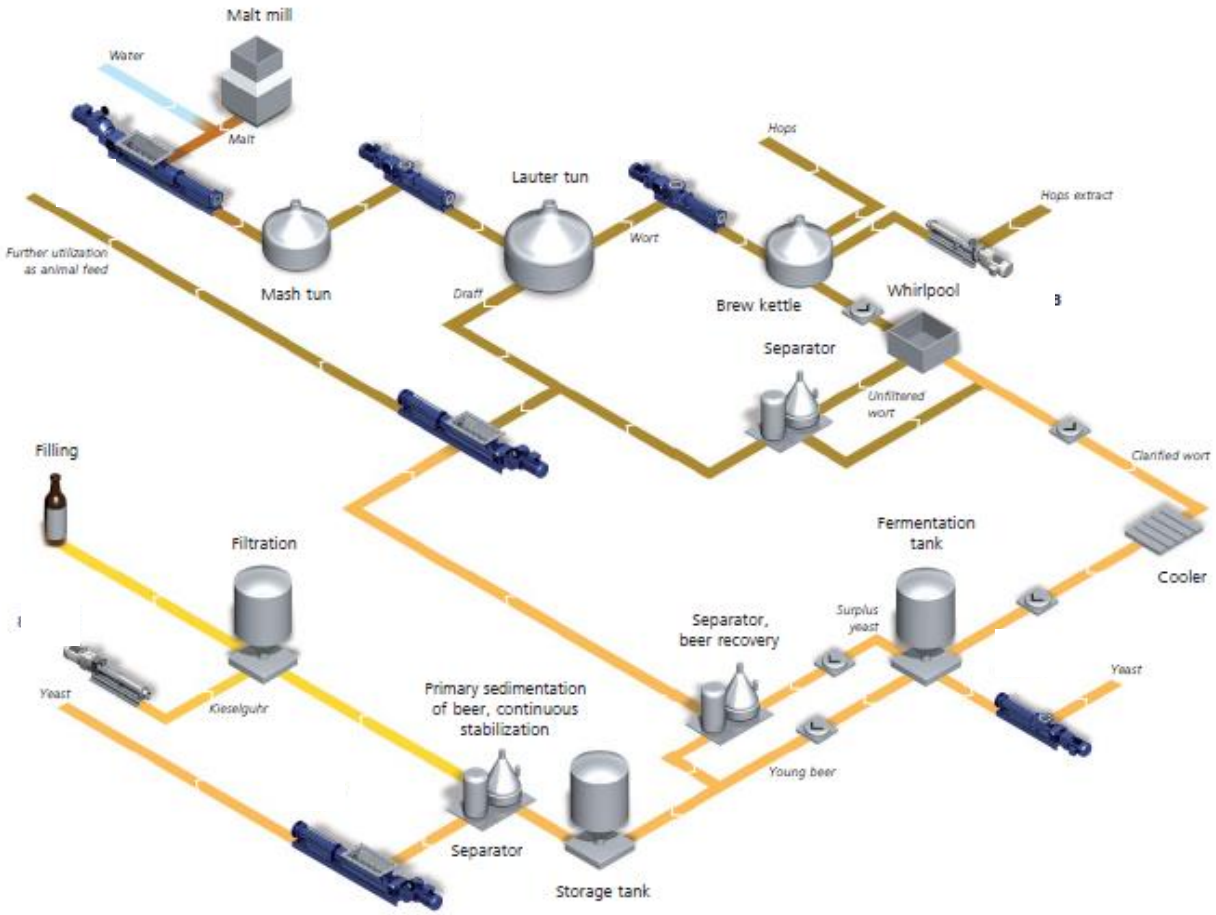
Liquid Explosives

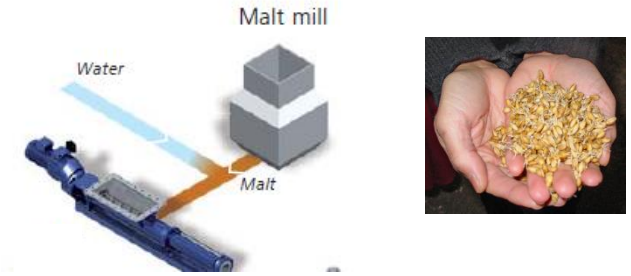
Brewery

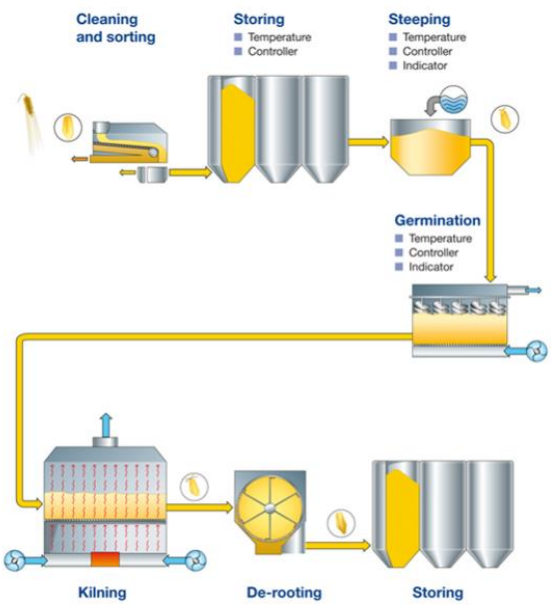


- Malting
- Milling
- Mashing
- Lautering
- Boiling
- Wirlpooling
- Cooling
- Fermenting
- Maturation
- Filtering
- Filling / Packaging

Flow chart based on beer production







Source: Wikipedia

- Typical malting is the process where grain is prepared for brewing and is broken down into three steps in order to help to release the starches in the grain:
  - steeping: the grain is added to a vat with water and allowed to soak for approximately 40 hours
  - Germination: the grain is spread out on the floor of the germination room for around 5 days
  - Kilning: the grain goes through very high temperature drying in a kiln. The temperature is increased gradually so as not to disturb or damage the enzymes in the grain.

When complete, the grain is now called malt

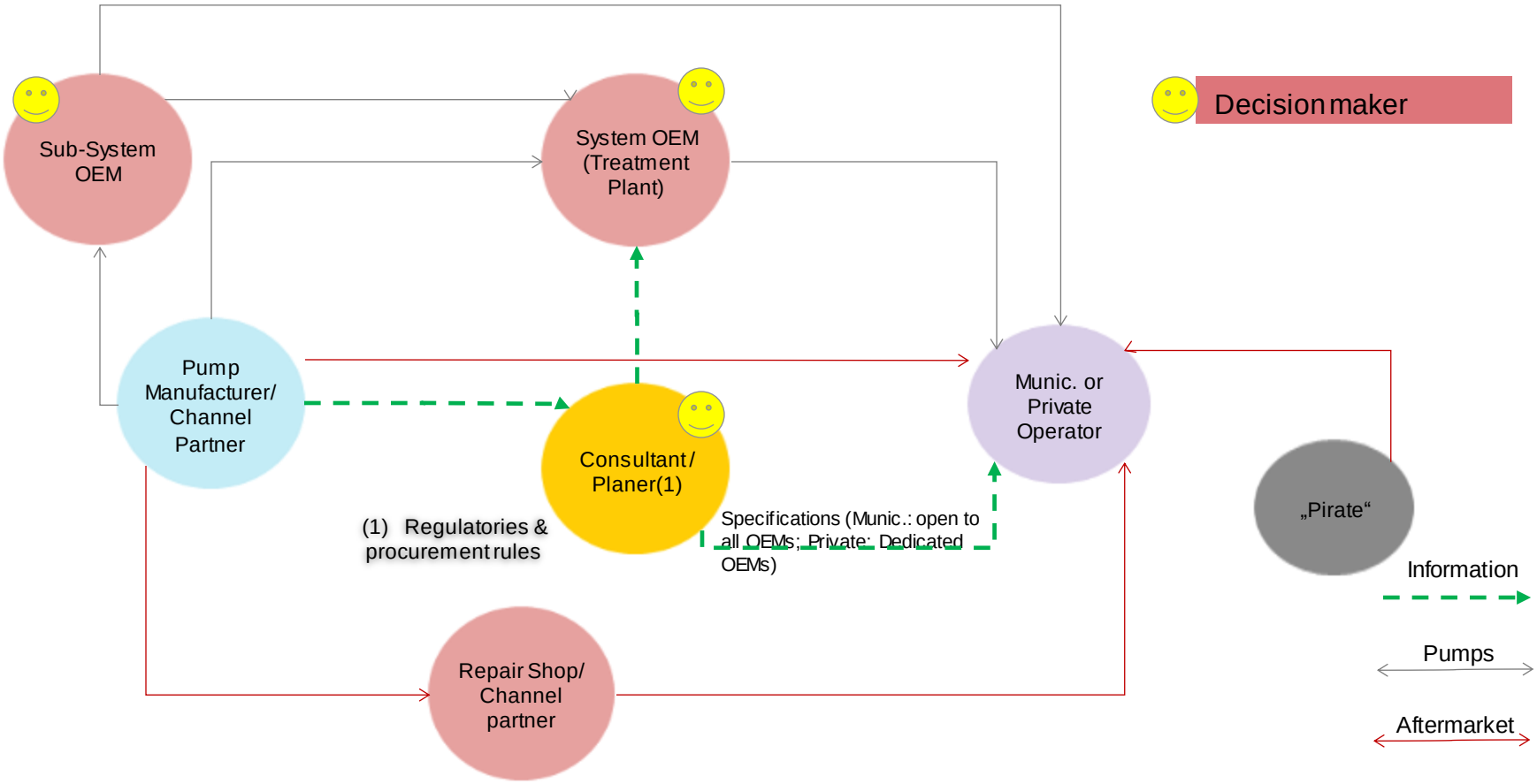
Sewage – WHERE to sell

- The waste water market can be split into two sub market
  - Waste water transport
    - Key products are CP with open impellers that we don´t manufacture, so this portion of the market cannot be served. Only in some cases we can offer PCPs if flow can be handled.
  - Waste water treatment
    - In this sub market we can offer various products
- Further more it is divided into municipal and industrial waste water treatment that have different value and business systems

Global sewage market is about 1,7 Billion $ with an estimated 50/50 split between transport and treatment

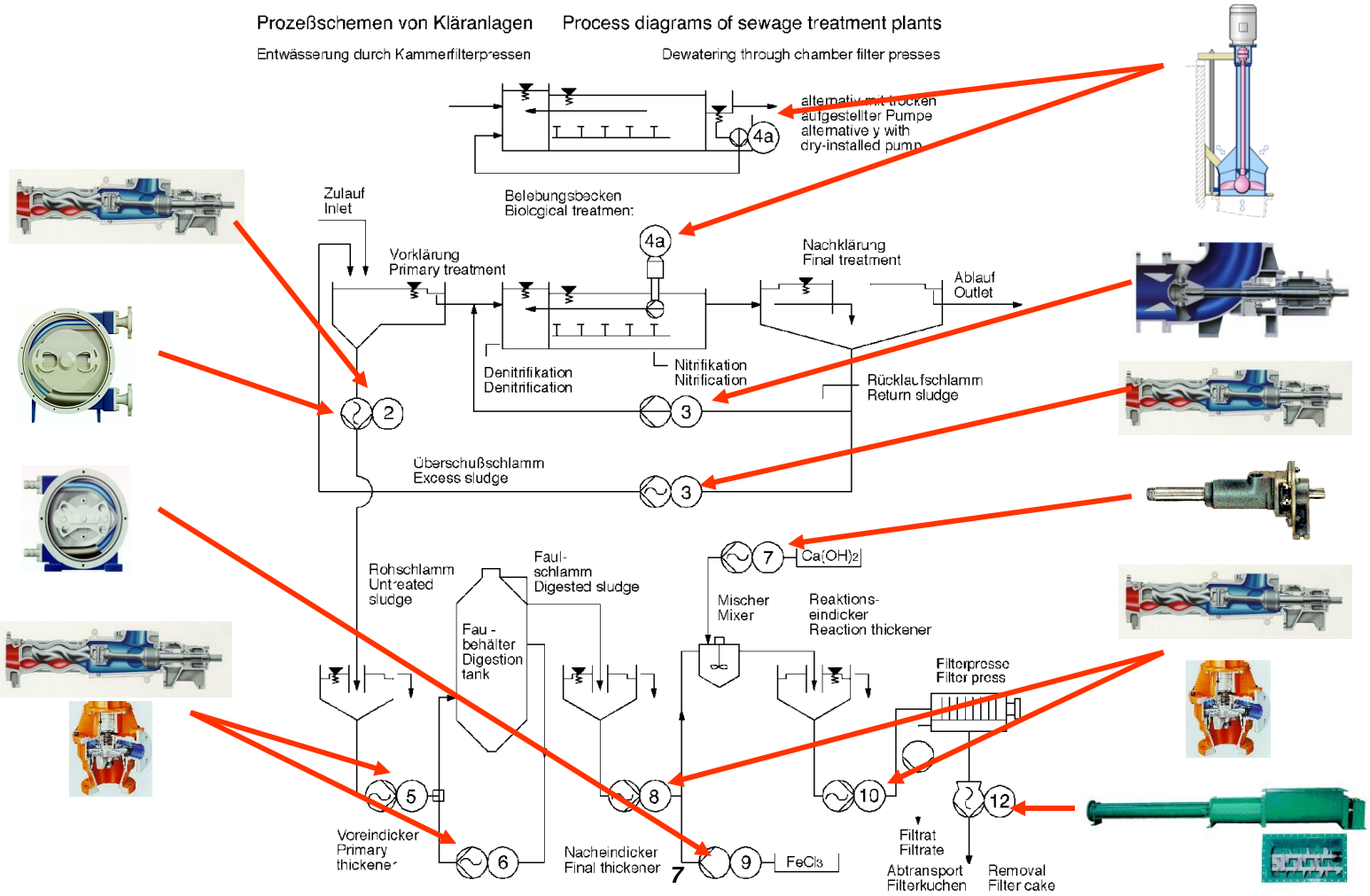
Sewage – WHERE to sell

Municipal WW value system - Example



Complex business with a lot of players. It is important to understand where the key decision maker is located.

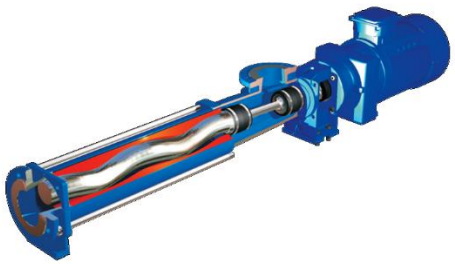
Sewage – WHERE to sell



We can offer various products in different process steps during WW treatment.

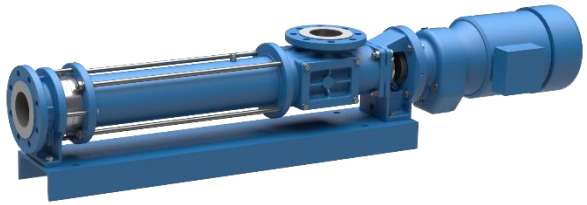
Sewage – WHAT to sell – PC pumps

- PCP Pump Range
  - All-Optiflow



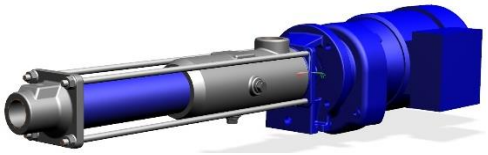
Flow Rate	up to 228 m3/hr / 862 U.S.G.P.M.
Differential Pressure	up to 6 bar / 87 psi
Max. Operating Temp.	up to 100° C / 212° F (135° C / 275° F)
Max. Viscosity	up to 300.000 mPa s
Max. Solid Content	up to 60 %

  - All-Optifix



Flow Rate	up to 96 m3/hr / 423 U.S.G.P.M.
Differential Pressure	up to 10 bar / 145 psi
Max. Operating Temp.	up to 100° C / 212° F
Max. Viscosity	up to 190.000 mPa s
Max. Solid Content	up to 10 %

  - AEB-DE



Flow Rate	up to 2 m3/hr / 9 U.S.G.P.M.
Differential Pressure	up to 24 bar / 348 psi
Max. Operating Temp.	up to 100° C / 212° F
Max. Viscosity	up to 28.000 mPa s
Max. Solid Content	up to 60 %

Sewage – WHAT to sell – PC pumps

- PCP Pump Range
  - AEB-E/N

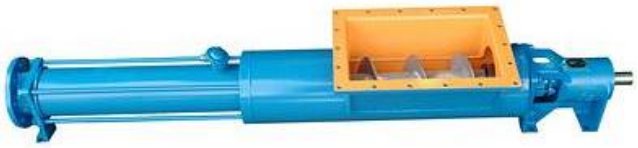
Flow Rate	up to 175 m3/hr / 770 U.S.G.P.M.
Differential Pressure	up to 12 bar / 175 psi
Max. Operating Temp.	up to 100° C / 212° F
Max. Viscosity	up to 300.000 mPa s
Max. Solid Content	up to 60 %

  - AE-E/N

Flow Rate	up to 540 m3/hr / 2.480 U.S.G.P.M.
Differential Pressure	up to 48 bar / 700 psi
Max. Operating Temp.	up to 150° C / 330° F
Max. Viscosity	up to 300.000 mPa s
Max. Solid Content	up to 60 %

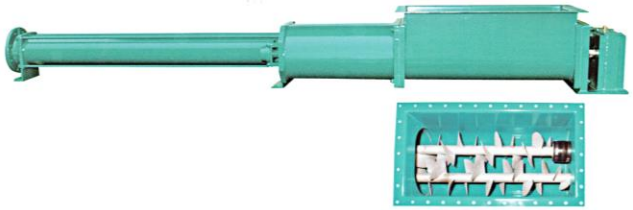
Sewage – WHAT to sell – PC pumps

- PCP Pump Range
  - AEB-ZE/ AE-ZD



Flow Rate	up to 100 m3/hr / 450 U.S.G.P.M.
Differential Pressure	up to 36 bar / 522 psi
Max. Operating Temp.	up to 150°C / 330°F
Max. Viscosity	up to 1.000.000 mPa s
Max. Solid Content (DS)	up to 38 %

  - AE-RG



Flow Rate	up to 30 m3/hr / 130 U.S.G.P.M.
Differential Pressure	up to 20 bar / 290 psi
Max. Operating Temp.	up to 150°C / 330°F
Max. Viscosity	up to 1.000.000 mPa s
Max. Solid Content (DS)	up to 45 %

Sewage – WHAT to sell – PC pumps

- PCP – Features in General
  - Reversible sense of rotation
  - Self priming
  - Low NPSHr
  - Low Pulsation
  - Flow regulation only by speed
  - Able to handle various fluids
    - Fluids with changing viscosities & system pressures
    - Fluids with solid content
  - Gentle handling, no emulsification or turbulences

Sewage – WHAT to sell – PC pumps

- Applications fields:
  - High or changing viscosities
  - Abrasive fluids or fluids with solids
  - Smooth & gentle fluid handling

- Applications
  - Fresh, Digested, Activated and Thickened Sludge
  - Feeding Dewatering Machines like Centrifuges, Belt Presses, Filter Presses
  - Dewatered Sludge up to 40 % Dry Substance
  - Waste
  - Flocculants and Other Dosing Additives

Sewage – WHAT to sell – Hose pumps

- Peristaltic Pumps: ASH

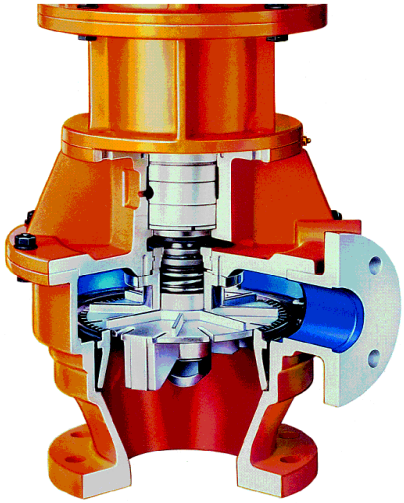
	ASH
Capacity up to	60 m³/h
Diff. Pressure up to	15 bar
Temperature up to	80°C
Viscosity up to	100.000 mPas

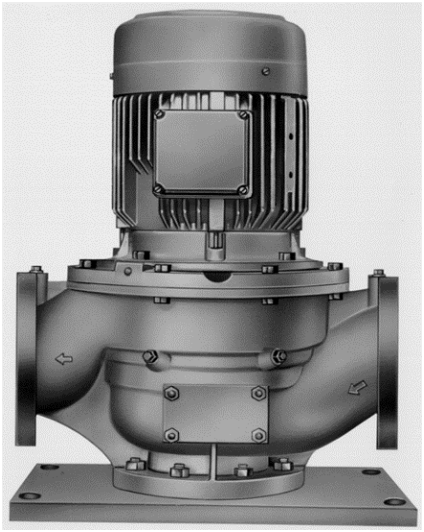
Design Features:

- No shaft seal
- Dry running possible
- Dry self priming
- Patended hose connections
- Asymetrical rotor
- Pump internals lubricated
- Reversible sense of rotation
- Reinforced hoses
- Optional hose break detection

Sewage – WHAT to sell – Macerators

- Macerators: ABM/AM – I/S





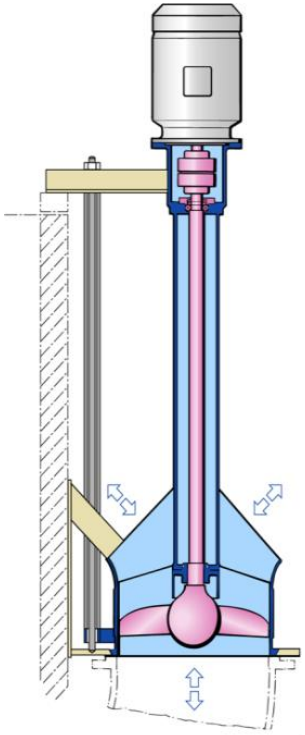
	S	I
Capacity up to	80 m³/h	160 m³/h
Delivery head up to	3 m	- m
Temperature up to	80°C	80 °C
Solid content up to	8%	8%

Design Features:

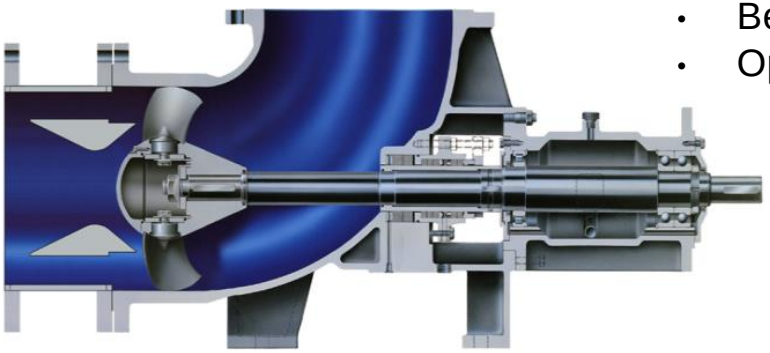
- Bearing bracket or block design
- Inline and end suction design
- Replaceable cutting tips
- Slot size can be customized
- Optional:
  - Seal water supply unit
  - Macerator controller
  - Separator/ stone catcher

Sewage – WHAT to sell – Propeller pumps

- Propeller Pumps
  - For pumping sewage containing nitrate or activated sludge from the nitrification basin to the denitrification basin (recirculation).



	PT	PPR / PG
Capacity up to	4.500 m³/h	50.000 m³/h
Delivery head up to	1,5 m	12 m
Temperature up to	100°C	200 °C
Delivery Head up to	1,5 m	12 m
Nominal diameters from	200 to 700 mm	200 to 1700 mm



Design Features:

- Vertical immersed or elbow-design
- Bearing bracket or block design
- Optional propeller with cutting edges

Sewage – Application Examples

Sewage – WHY it sells

- Circor - Value Proposition

Product Feature/ Product Family	CIRCOR Value Proposition	Customers NBA (Next Best Alternative)	CIRCOR Differentiation
• ALLDUR Stator	• MTBF vs. MTTR	• Short MTTR	• Less repairs, less downtime
• AEB-DE Dosing Pump	• 4 sizes – 1 footprint	• Different pump sizes	• OEM & skid builder friendly
• AE-RG	• Premium pump for dewatered sludge	• Pump + bridge breaker	• No add-on equipment needed
• Oil- lubricated joints	• Long lifetime of joint	• Grease lubricated	• Better lubrication; longer lifetime
• Exchangeable wear parts	• Coupling rod can be repaired	• No exchangeable wear parts	• Less maintenance cost
• Optimized interference fit	• Stable curve +lower starting torque	• Oversized motors	• Lower energy cost
• ALL-Optifix	• Robust and stable performing SIP solution	• FSIP design (Netzsch) • SCT (Seepex)	• Stable pump performance and easy maintenance of complete pump possible
• Broad product portfolio (One Stop Shopping)	• Provide PCP, Macerators, Hose Pumps, Propeller Pumps from one source	• Various	• Easy to do business with; single effort to source many components

Dosing/ Metering

Dosing/ Metering - WHERE to sell

- Dosing and Metering can be a very broad market with various products to be applied to it
  - In our range we sell mainly Zenith and PC pumps into these applications

Global dosing market is about 3,7 Billion $.
Diaphragm: 2,7 B (73%) / Piston: 0,3 B (9%) / Others: 0,6 B (18%)

Dosing/ Metering - WHERE to sell

- Applications for PCP pumps

WATER & WASTEWATER
Polymer, Flocculant

CHEMICAL PROCESS INDUSTRY
Acid, Leachate, Catalysts, Condensate, Additives

PULP & PAPER
Additives, PVOH, Sizing Agent, Starch, Dye, Optical Brightening Agent, Polymer

MINING
Polymer, Tenside, Catalyst

MARINE
Oily water, Urea, Bilge, Seawater

FOOD
Oil, Sauce, Chocolate, Liquor

GENERAL INDUSTRY
Caustic Soda, Glycol, Paints, Glues, Sealants

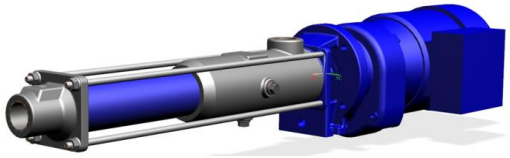
POWER
Urea, Waste Oil, Slop Oil

Broad market base that can be approached as in almost every industry low flow applications are present to add supplementing fluids to the main process

Dosing/ Metering – WHAT to sell - AEB-DE*

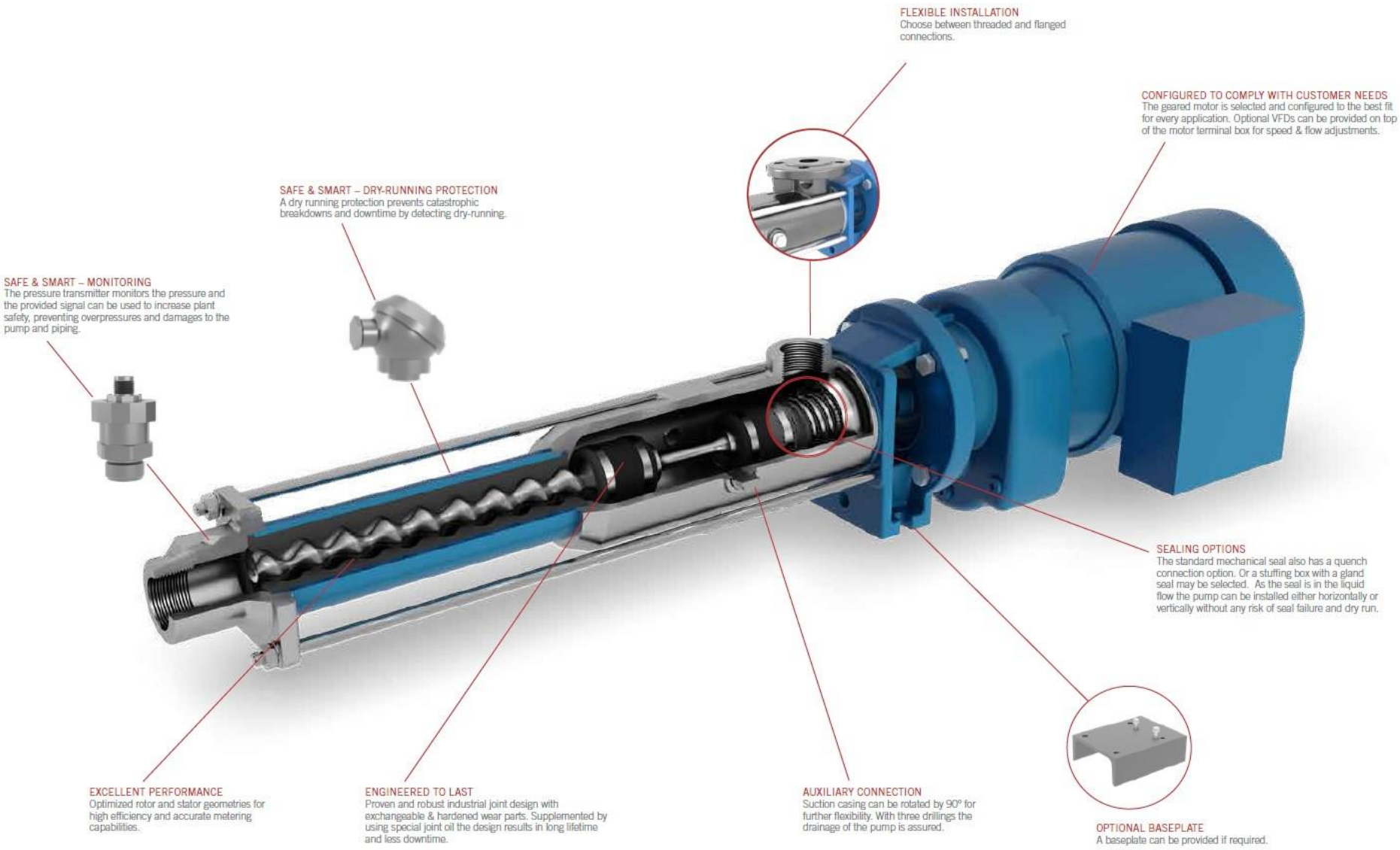
- New Name: AEB … - DE *(e.g. AEB 3N 0002-DE)*
- 4 optimized hydraulics (1.3, 2.3, 5.3, 12.2)
- Standardized materials: All fluid contacted parts in stainless steel
- Pumps are not interchangeable with old version, because old version had different options for connections, different stator length, seal was not in flow, ADBP had a separate construction kit, etc.
- Range of flow rate like current dosing pumps through optimized geometries

Pump Size	Flow rate	Differential pressure
12.2	up to 2000 l/h	12 bar
5.3	up to 850 l/h	24 bar
2.3	up to 330 l/h	24 bar
1.3	up to 170 l/h	24 bar



* Focus here is AEB-DE, but also other industrial PCPs can be used in metering applications where flow is out of the range of AEB-DE.

Dosing/ Metering – WHAT to sell - AEB-DE



Dosing/ Metering – WHAT to sell - AEB-DE

- Key advantages
  - **FOUR** pump sizes **One** Foot Print
  - Compact modular design
    - Difference in rotor, stator, adapters (for small sizes to fit in casings)
  - Optimized geometries for high efficieny and accurate metering cpabilities
  - Mech. Seal is in flow of liquid > safe vertical installation as seal is lubricated and cooled continuously
  - Patented installation of dry run protection (vulcanized sleeve)
  - Pressure sensor can be intergrated into discharge casing

Dosing/ Metering – Application Examples

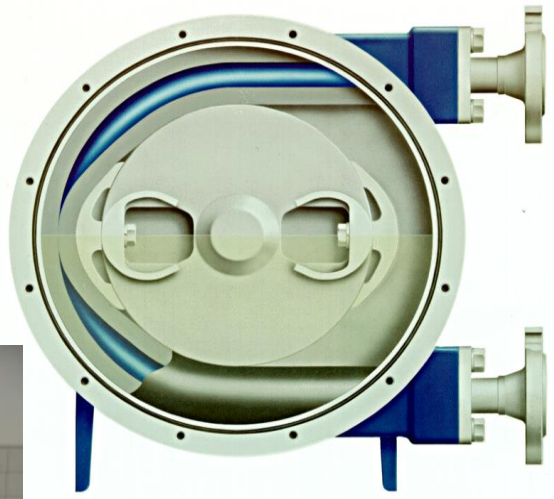
- Polymer Dosing Skids

- Oil/ water Separator

- Urea dosing (Nox reduction)

Dosing/ Metering

- Peristaltic Pumps: ASH



	ASH
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Diff. Pressure up to	15 bar
Temperature up to	80°C
Viscosity up to	100.000 mPas

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Dosing – WHY it sells – PC Pumps

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• Broad product portfolio (One Stop Shopping)	• Provide PCP, Hose Pumps, Gear Pumps from one source	• Various	• Easy to do business with; single effort to source many components

Pulp & Paper

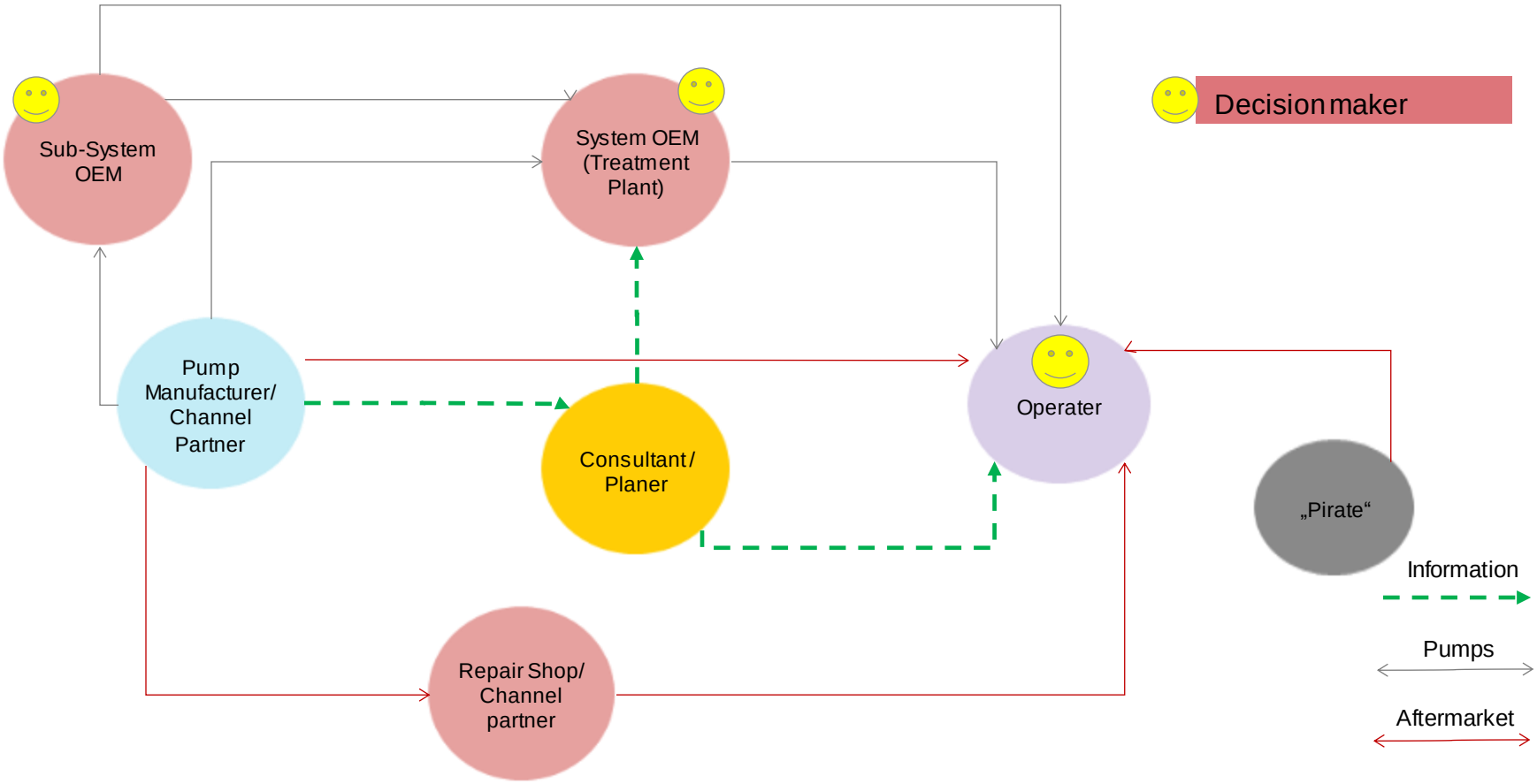
Pulp & Paper – WHERE to sell

- Beside sewage handling, pulp & paper is a very important market for PCPs
  - Facilities are running 24/7
  - Various fluids are pumped that are very abrasive and aggressive
    - Creates a high demand for spare parts and services
  - Based on the huge potential of aftermarket sales, the foremarket is very tough and competitive

It is key to secure the aftermarket business.

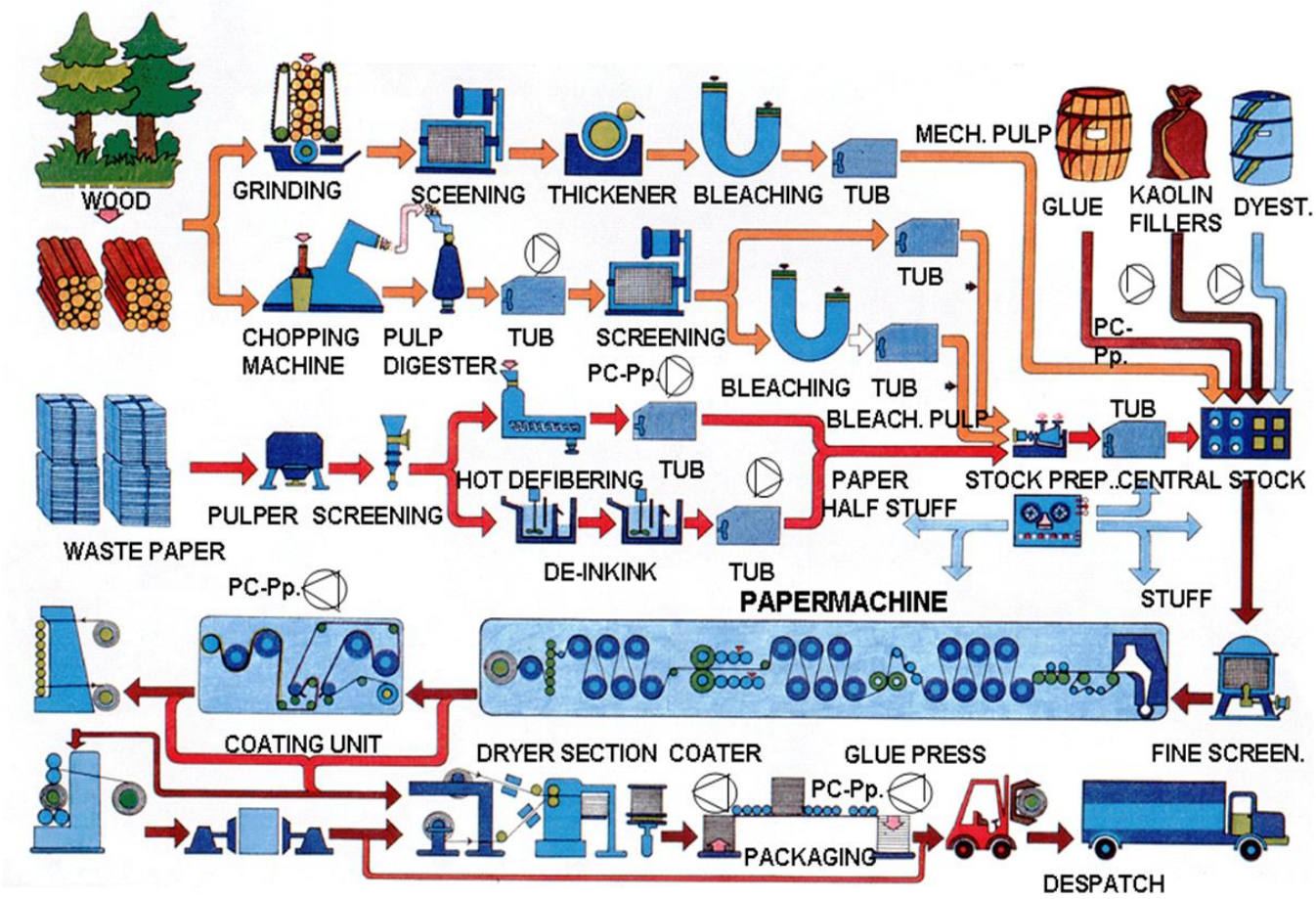
Pulp & Paper – WHERE to sell

Value system is similar to sewage market



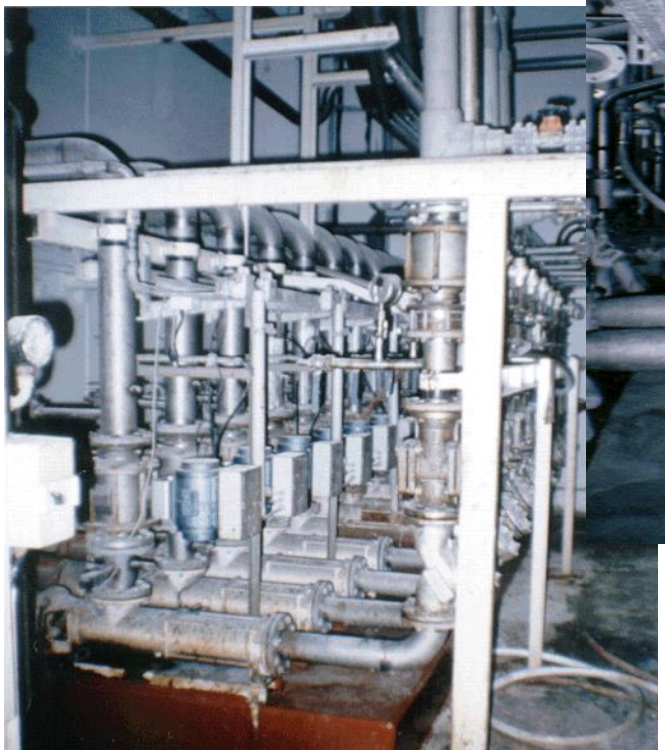
Complex business with a lot of players. It is important to understand where the key decision maker is located.

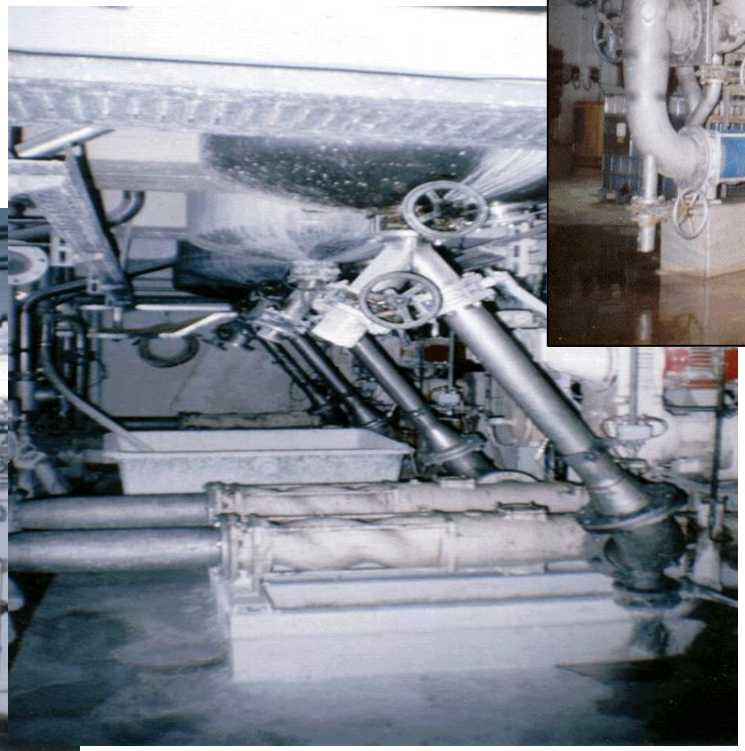
Pulp & Paper – WHERE to sell



We can offer various products in different process steps during paper production

Pulp & Paper – WHERE to sell





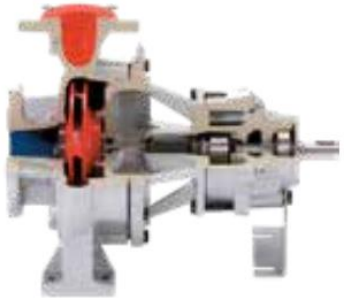
Pulp & Paper – WHAT to sell

TECHNOLOGY	BRAND	FLUID	APPLICATION
 TWIN SCREW	WARREN	LOW OR HIGH CONSISTENCY PULP STOCK / BLEACHED PULP STOCK	TRANSFER / FEED
 THREE SCREW	IMO OR ALLWEILER	FUEL OIL OR LUBE OIL	RECOVERY BOILER FUEL OR ROLL LUBE
 PROGRESSING CAVITY	ALLWEILER	BLACK LIQUOR, GREEN LIQUOR OR WHITE LIQUOR, CAUSTIC SODA, BLACK LIQUOR SOAP STARCH OR LATEX SIZING; PIGMENTS, CALCIUM CARBONATE, TITANIUM DIOXIDE, SATIN WHITE, BENTONITE CLAY, KAOLIN CLAY - EITHER DISPERSED OR CALCINED, POLMER, SLUDGE	COATING, ADDITIVE FEED OR TRANSFER
 INTERNAL GEAR	IMO	HYDRAULIC FLUID OR LUBE OIL	CROWN ROLL OR ROLL LUBE
 PRECISION GEAR	ZENITH	DYE, COATING, ADHESIVE, FRAGRANCE	ADDITIVE TRANSFER / FEED
 CENTRIFUGAL	ALLWEILER	HEAT TRANSFER FLUID	CALENDAR ROLL HEATING
 PERISTALTIC HOSE	ALLWEILER	COATING	RECYCLE COATING EXCESS

Pulp & Paper – WHAT to sell

PROGRESSING CAVITY

- Low shear
- Smooth, pulsation-free flow
- Same pump handles broad viscosity range
- Abrasion resistant



CENTRIFUGAL

- For all heat-transfer oils, even low- viscosity oils
- Durable seals, temperatures to 350C / 662F
- Seals are stable without external cooling
- Replace traditional centrifugal pumps with special seals

THREE-SCREW

- Smooth, pulsation-free flow
- Same pump handles broad viscosity range
- Abrasion resistant
- Consistent flow as pressure changes

TWIN-SCREW

- Moves highest pulp consistency
- Increased production capacity
- Significantly lower operating costs
- Better sustainable design
- Reduced energy costs

Pulp & Paper – WHY it sells

- Circor - Value Proposition

Product Feature/ Product Family	CIRCOR Value Proposition	Customers NBA (Next Best Alternative)	CIRCOR Differentiation
• ALLDUR Stator	• MTBF vs. MTTR	• Short MTTR	• Less repairs, less downtime
• AEB-DE Dosing Pump	• 4 sizes – 1 footprint	• Different pump sizes	• OEM & skid builder friendly
• AE-RG	• Premium pump for dewatered sludge	• Pump + bridge breaker	• No add-on equipment needed
• Oil- lubricated joints	• Long lifetime of joint	• Grease lubricated	• Better lubrication; longer lifetime
• Exchangeable wear parts	• Coupling rod can be repaired	• No exchangeable wear parts	• Less maintenance cost
• Optimized interference fit	• Stable curve +lower starting torque	• Oversized motors	• Lower energy cost
• ALL-Optifix	• Robust and stable performing SIP solution	• FSIP design (Netzsch) • SCT (Seepex)	• Stable pump performance and easy maintenance of complete pump possible
• Broad product portfolio (One Stop Shopping)	• Provide PCP, Hose Pumps, 3-S Pumps, 2-S from one source	• Various	• Easy to do business with; single effort to source many components