



SIEMENS

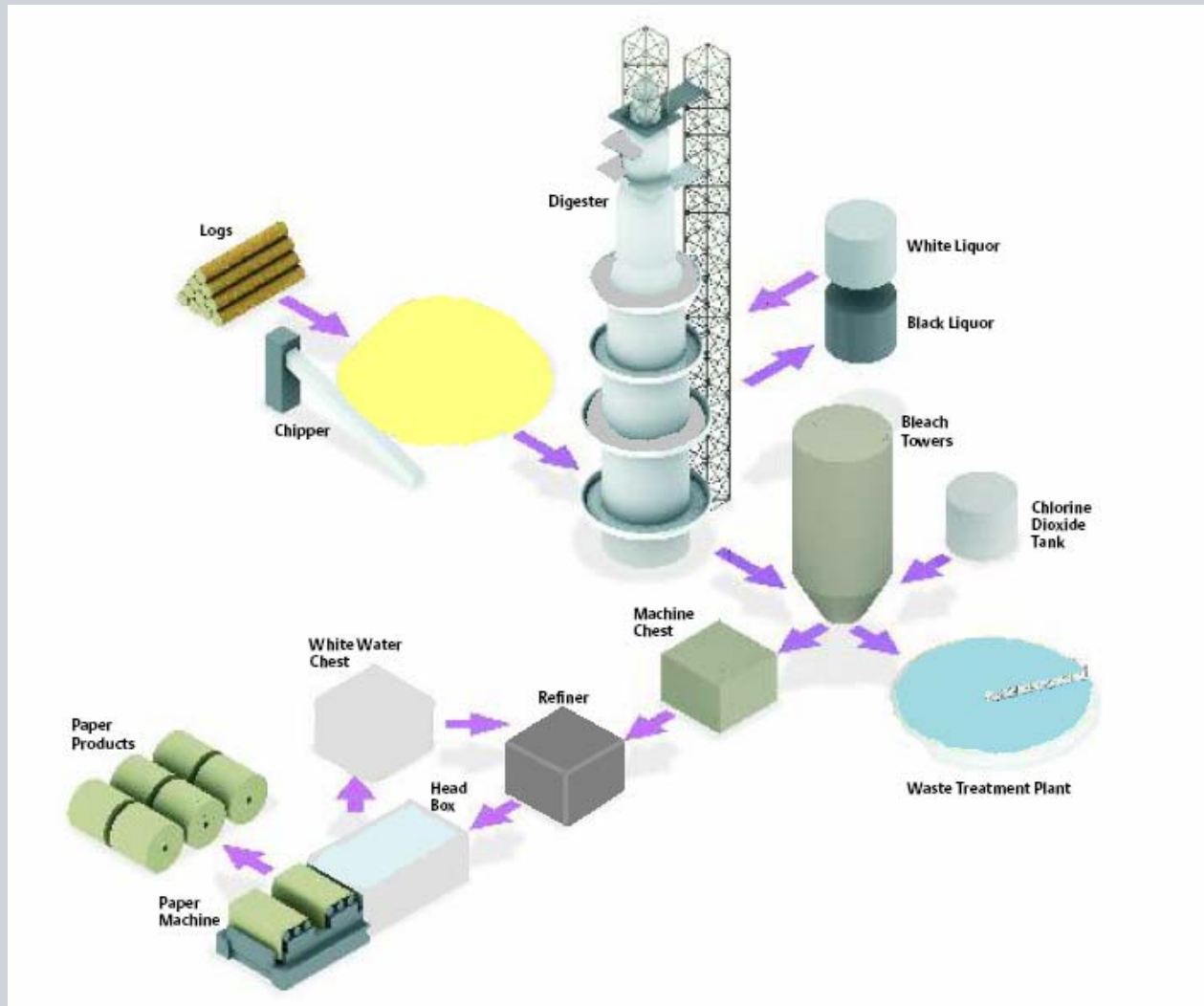
Oil & Gas and Industrial Applications Division

Siemens Answers

Shrikant Amin, E O IP

17.5.2010

Process Overview



Process requirements of Pulp and Paper

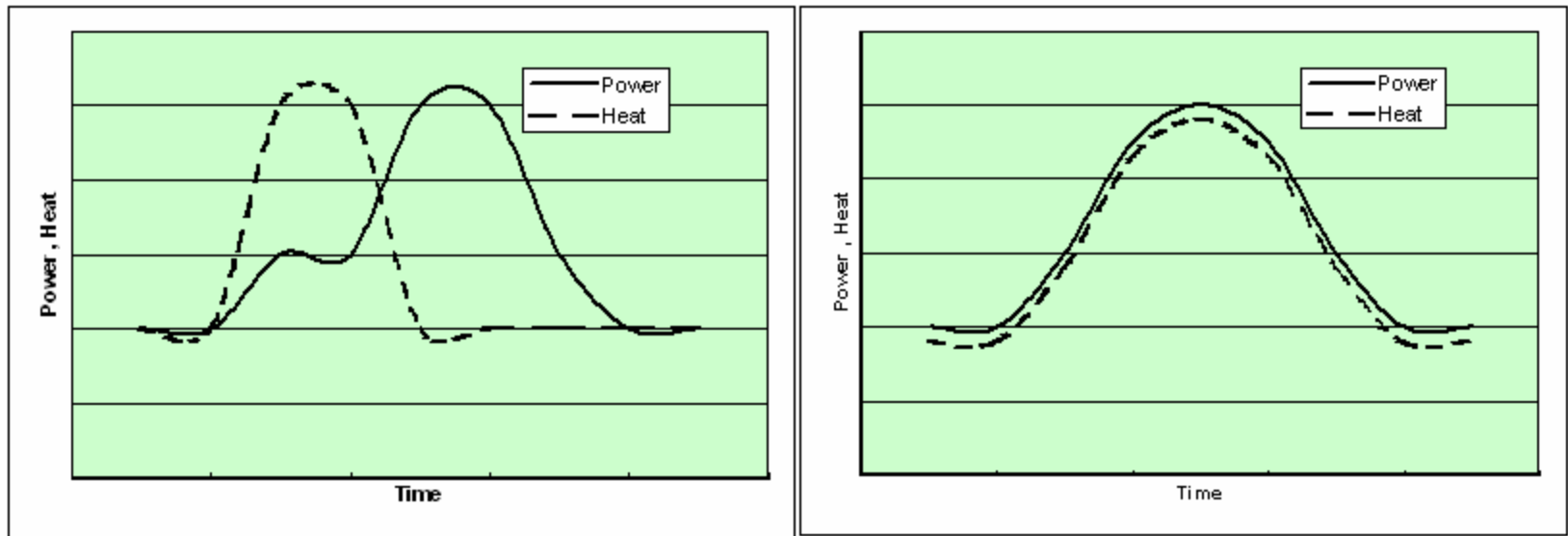
Steam Requirements for Process

- For Digester : 10-14 bar and up to 210 °C
- For Roller heating : 3 to 5 bar and up to 150 °C
- Power requirement 10 - 40 MW

Important Design Input for Turbine Design:

- Steam Parameters and flow requirements to be estimated as close as possible
- Load points to show max flow required in each process bleed.
- Continuous Operating Condition and Maximum Power required.
- Clearly define Turbine operating region

Plant Load cycle



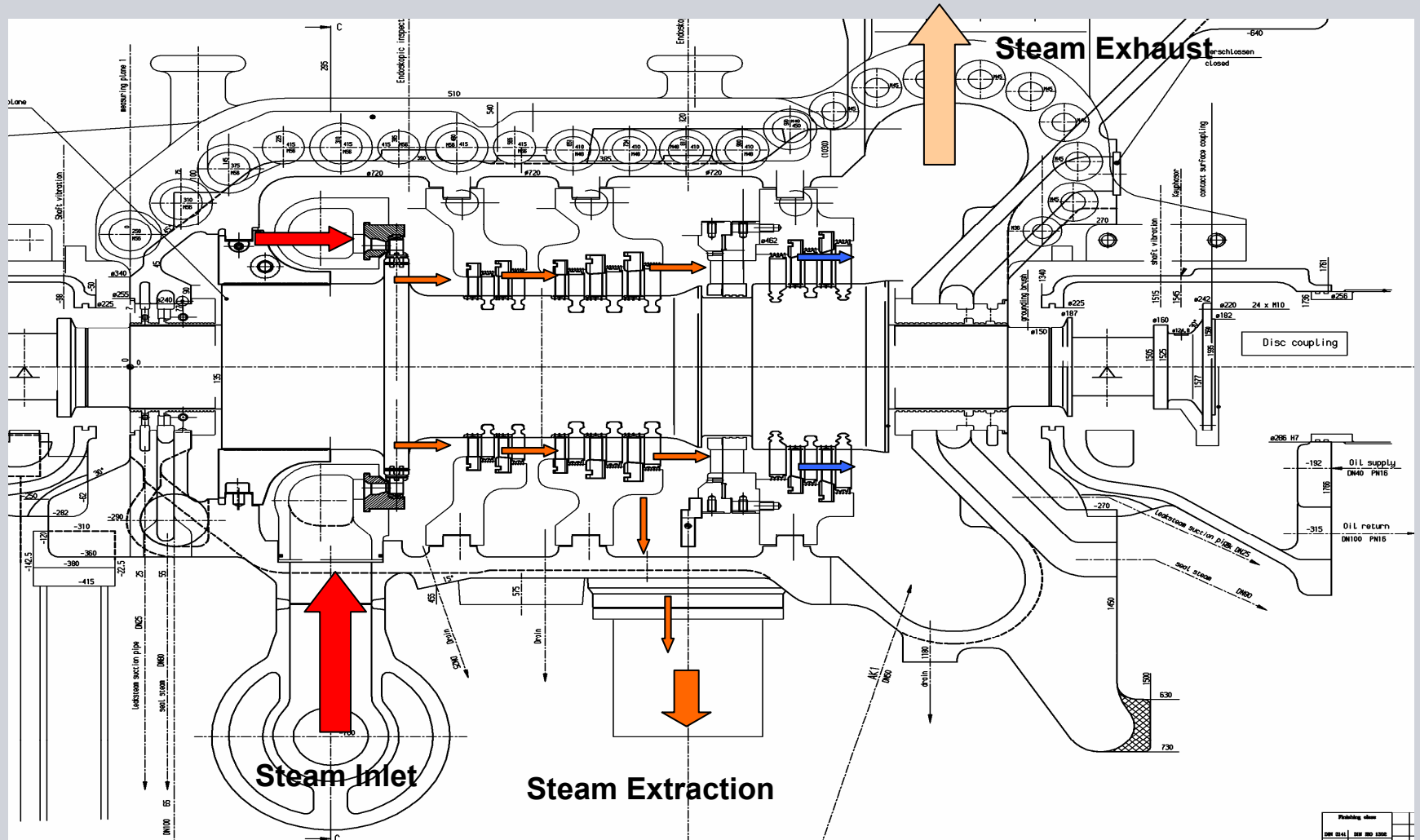
Plant loading Pattern

- Power Load and Heat Load requirement of the Process in phase
- Power Load and Heat Load is out of phase

Types of Machines

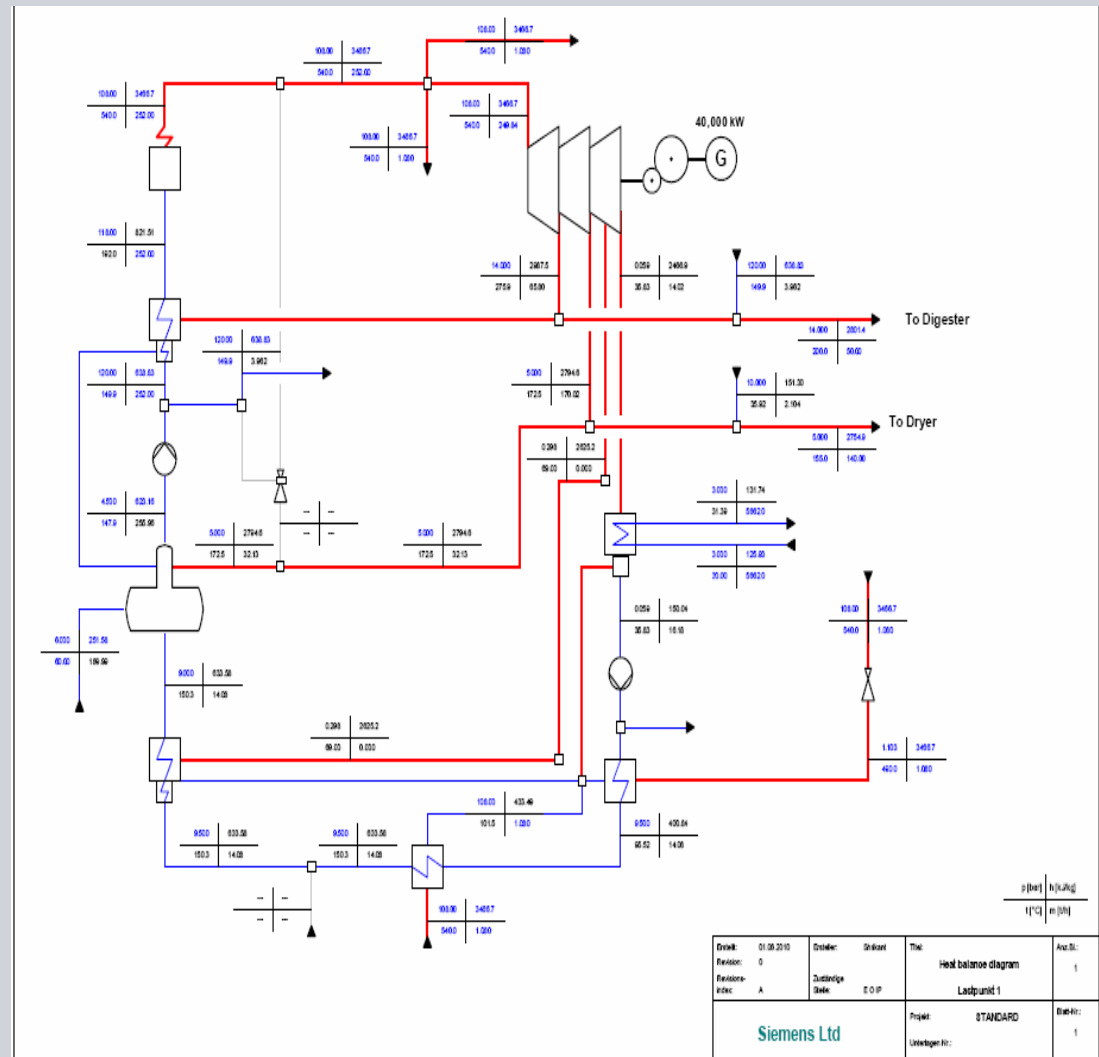
- Extraction backpressure steam turbines
- Double extraction steam Turbines
- Combination of Backpressure and Extraction Condensing steam Turbines.

Extraction Backpressure Steam Turbine



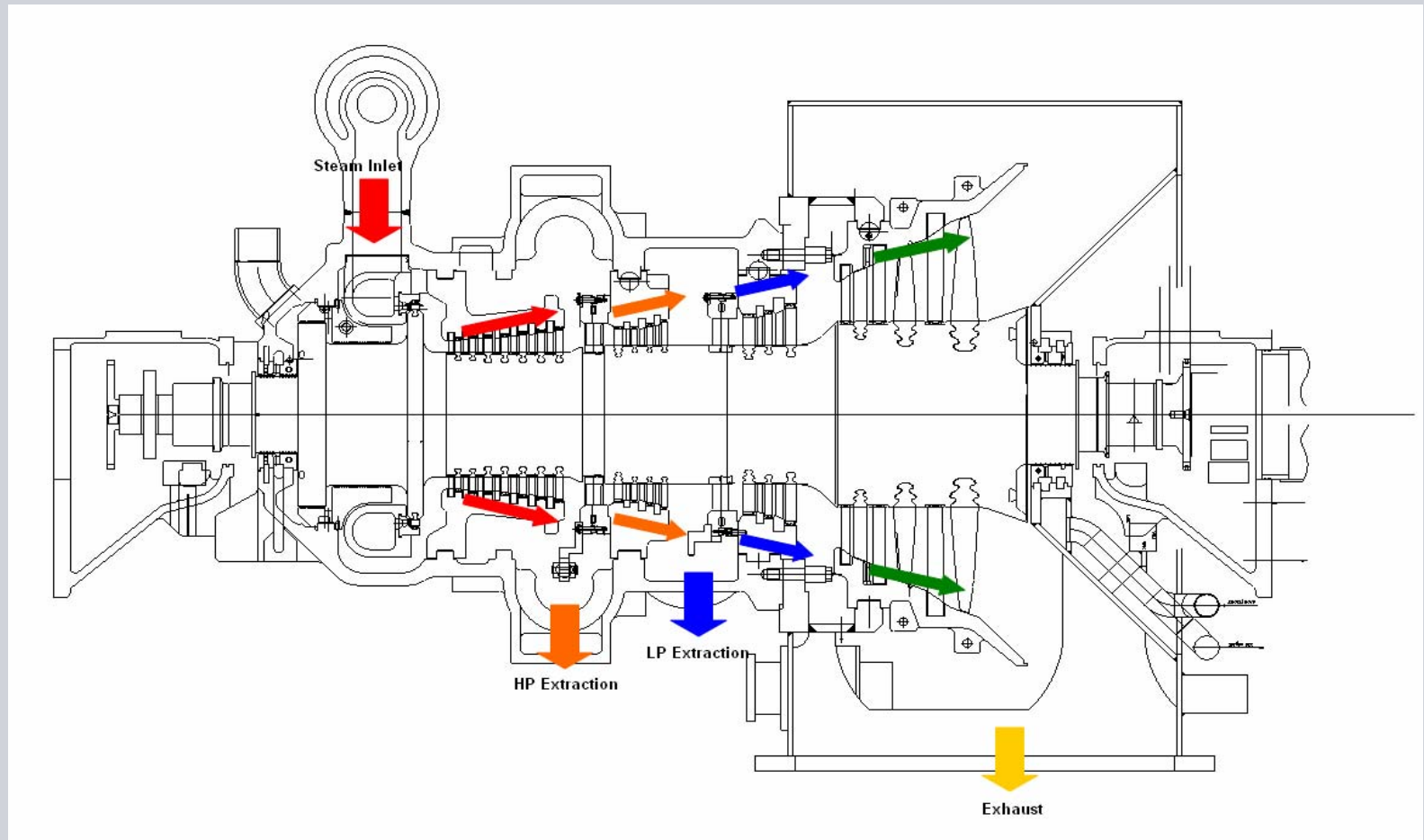
Double Extraction Steam Turbine

- Operating flexibility
- Load can be independent of process flow requirement.
- Heat rejected in condenser
- Initial investment
- Cooling water requirement



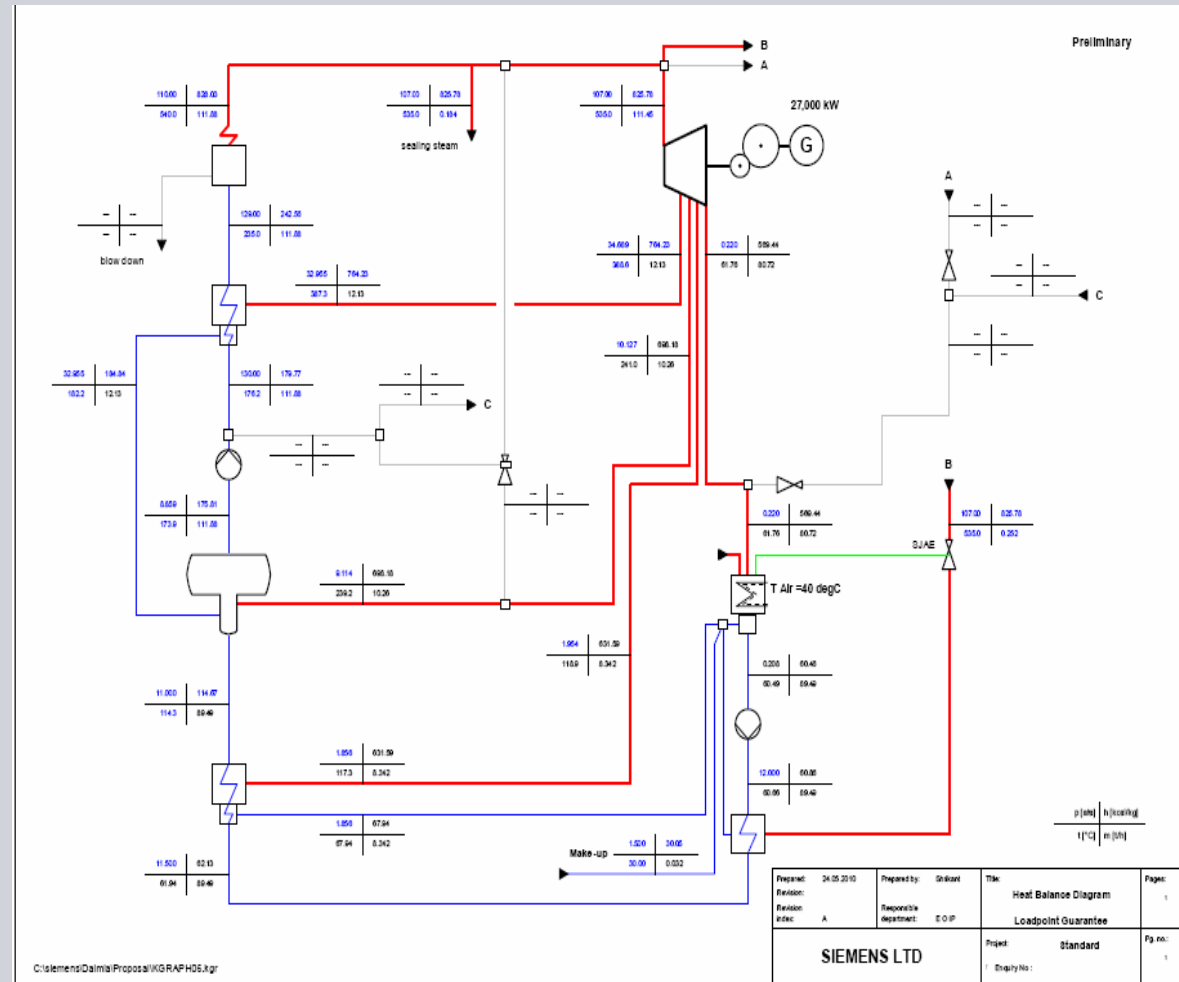
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Double Extraction Steam Turbine

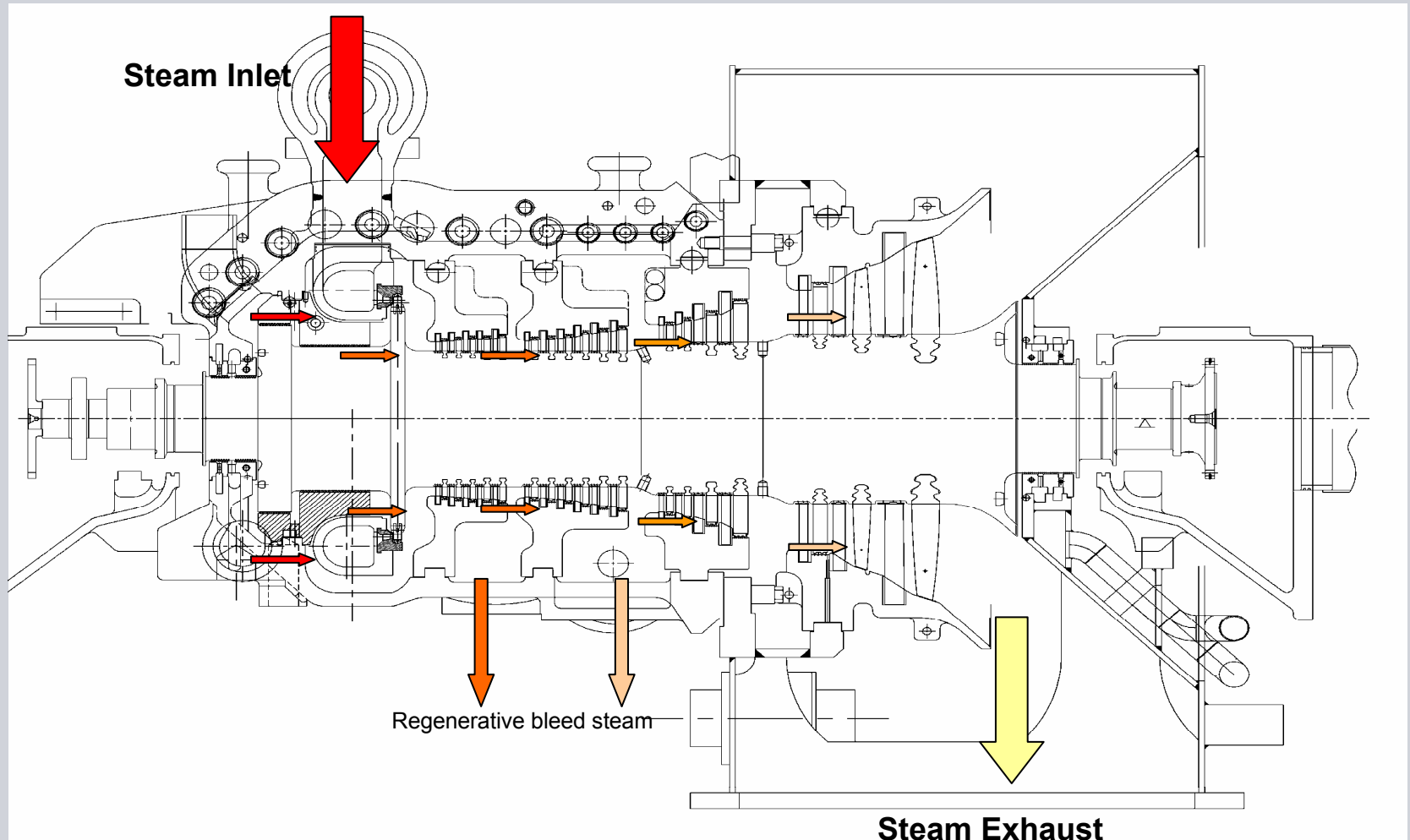


Condensing Steam Turbine

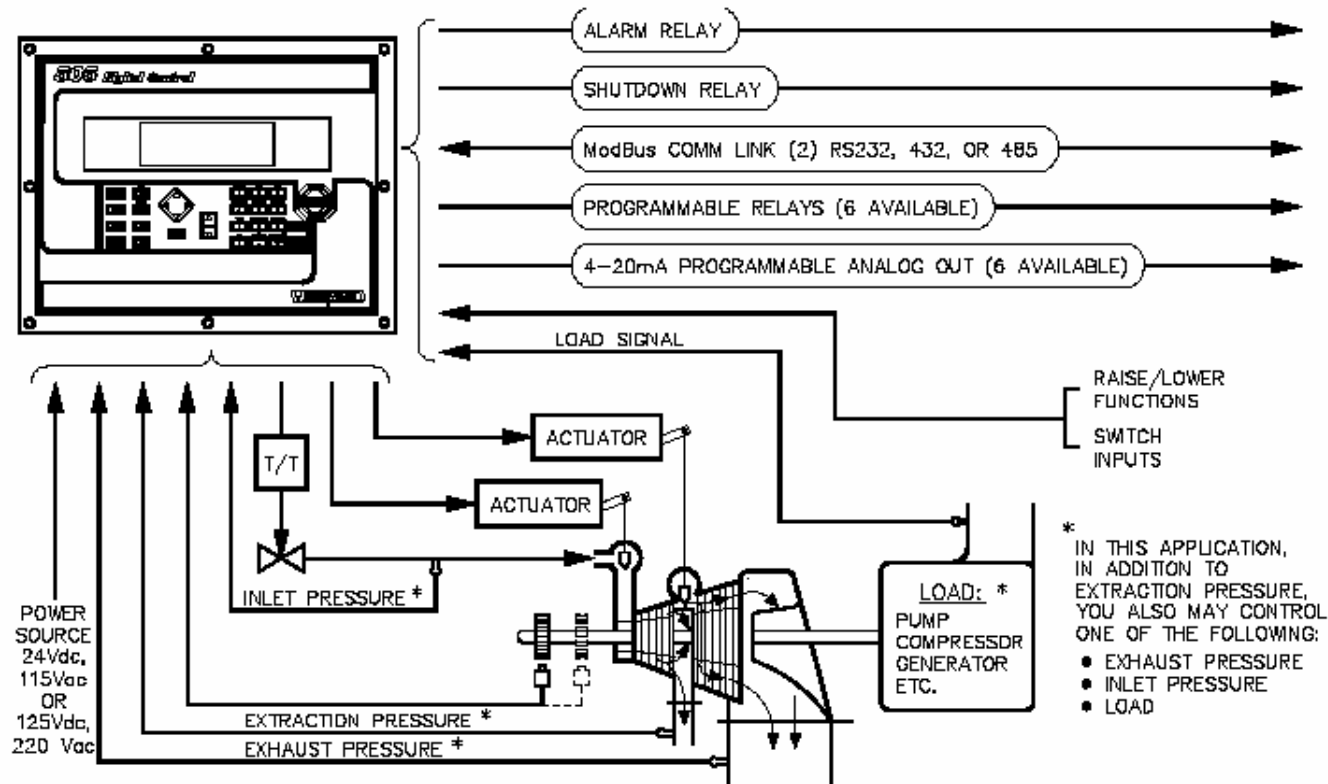
- Power Generation
- Heat rejection in Condenser
- Process bleed results in steam pressure correlated to the inlet mass flow.
- Maximum power generation for a given inlet steam flow.



Condensing Steam Turbine

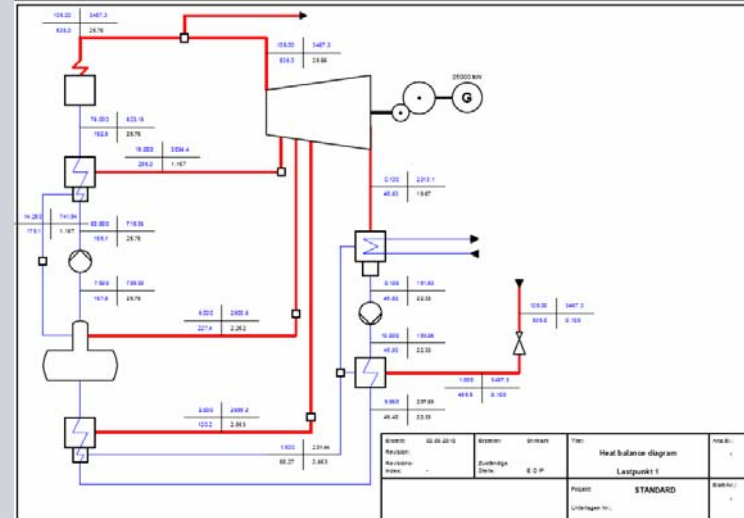
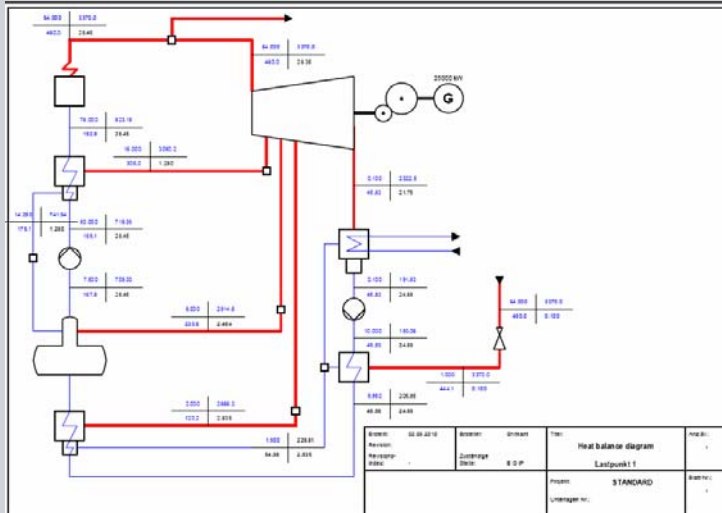


Load and Flow controlling in Extraction machines



Controlled Extraction Steam Turbine

Efficiency of Steam Cycle with respect to Inlet steam parameters

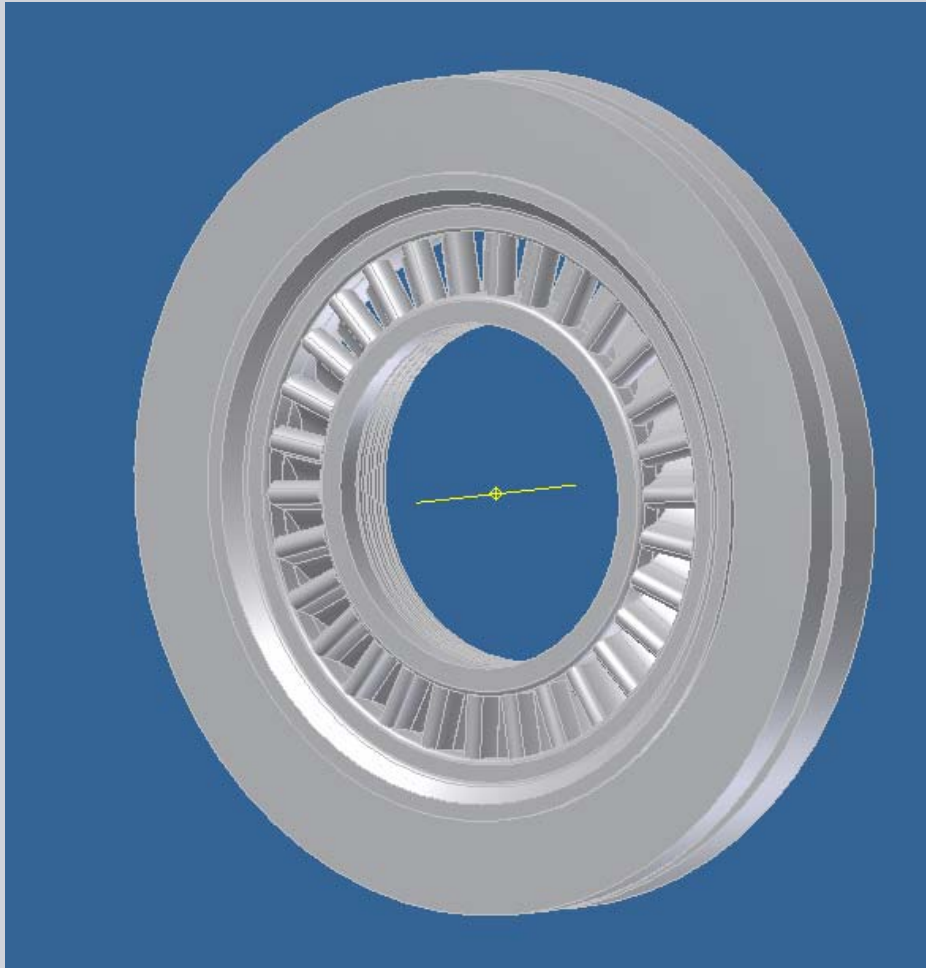


Specific Heat Consumption is the ratio of Heat Supplied from outside the process to generated power

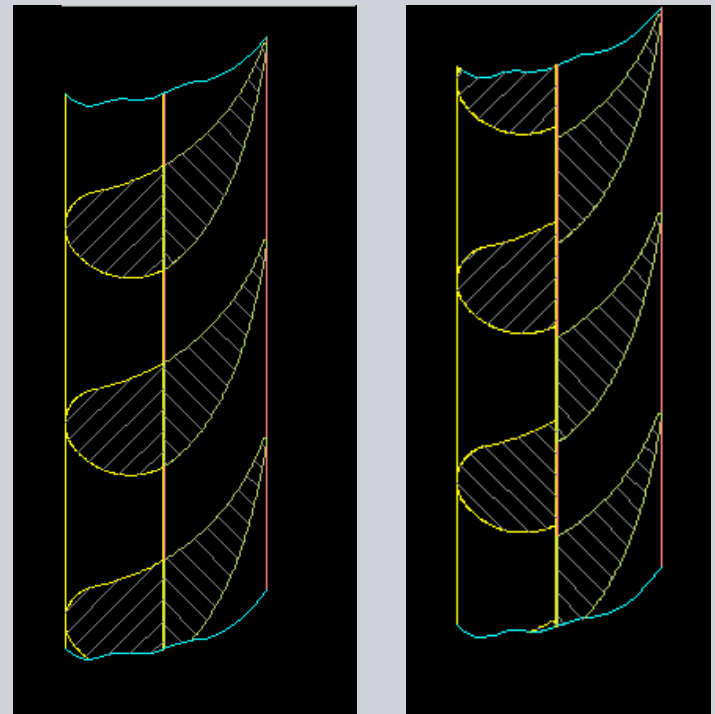
Heat Rate = External heat supply to the cycle / Power Generated.

Specific heat consumption of a 64 bar 480 °C cycle > specific heat Consumption of a 105 bar 535 °C cycle.

Adaptive Stage



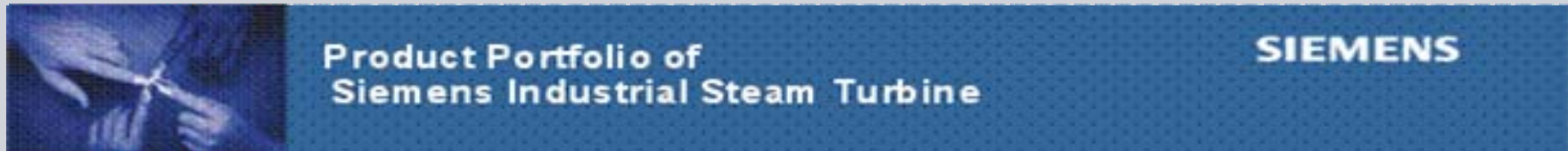
Split nozzle profile arrangement acting as valve.



Adaptive stage Actuator system

Actuator System 3D model

Industrial Steam Turbine Product Portfolio



Type	Output [MW]						Tailor Made	Mech Drive	Steam Parameter
	10	30	50	70	130	150+			
SST -100	█								65 bar 480 °C
SST -200	█	█						█	80 bar 480 °C
SST -300		█	█	█				█	120 bar 535 °C
SST -400			█	█	█				120 bar 520 °C
SST -500	█	█	█	█	█			█	30 bar 350 °C Double Flow
SST -600	█	█	█	█	█		█	█	140 bar 540 °C
SST -700			█	█	█	█			165 bar 585 °C Dual Casing / Reheat
SST -800				█	█	█	█		140 bar 540 °C Centre Admission
SST -900					█	█			165 bar 585 °C Reheat / Non Reheat

Engineering Process

Proposal Stage

1. Preparation of preliminary HMBD as per the requirement of customer.
2. Selection of suitable model & LP blades.
3. Optimization the turbine efficiency by changing nos. of stages and pressures if required.
4. Selection of Balance of plant equipments.
5. Preliminary P& ID and Layout drawings.
6. Costing and commercials.

Engineering Process

Detailed Engineering stage.

1. Optimization of steam flow path.
2. Recalculation of turbine parameters and performance requirements with fixed geometrical details.
3. Manufacturing detailing and drawings.
4. Lateral analysis and bearing design.
5. Torsional analysis for the Power train.
6. Documentation and Preparation of Performance Curves, Characteristic curves, Operating Curves etc.

Thank You