

# Design of Process Systems

## Master Checklists

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# Critical Variables Underlying Process System Design

- Temperature – full range of conditions in the system.
- Pressure (Heads) – full range of conditions in the system.  
Pressure vessels, pressure piping and other pressured items such as jackets, etc.
- Chemicals and varying concentrations – as also for compatibility with pumps, other equipment and piping in the system.
- Pressure rating of all equipment in the process at the maximum system temperature.
- For plastic based systems the inter-relationship between the temperature, rated pressure and the chemical compatibilities requires a careful review for all equipment and piping, as the inter-relationships are complex.
- Required flow ranges and special flow control requirements for operational time cycles, and especially batches management for residence times and other system needs.

## Process Systems Design – Equipment Selection Stages

**Prepare** information analysis, systems analysis, scope analysis, risk analysis for each equipment type and stage

**Start** with batch volume, SG, viscosity for each process stage; state suspended solids details if present

**Select** materials for vessel and internals. Standard is 304 SS (stainless steel), but process must be evaluated

**Select** the basic equipment type, from the viscosity, power consumption guidelines and industry experience

**Select** motor power and choose RPM recommended for the said equipment chosen or consult specialist supplier

**Select** basic internals - propeller, turbine or blade and choppers, screens, etc as standard for said process

**Check** that there are no issues of crystallization, floating light liquids, foaming or de-aeration to consider

**Check** equipment details and review scope analysis studies for total system design; prepare upgraded scope

**Check** all design details as to whether a full HAZOP is required for any item of the process design

**Review total system design with equipment specialist suppliers to enable detailed quotations/pricing.**

# General Process Design Risk Check-list Part 1

- Full description of the process including reactions is to be assessed for risks.
- Full requirements as key objectives of the process system are to be detailed and assessed. Any run-away conditions that may arise are to be given special assessment attention.
- All equipment within the boundaries (battery limits) of the total system are to be listed with pertinent details (initial designs) and any areas of high risk in function thereof.
- All key personnel to be consulted for sign off of the system and initial signed general arrangement drawings are to be prepared.
- All special process requirements especially details that may be unique to the relevant process must be listed including materials. Risk of failure from materials to be assessed.
- A summary spreadsheet of risks of all nature and types is to be prepared and assessed in detail with risk ratings in a formal risk matrix.

## General Process Design Risk Check-list Part 2

- Details of any hazardous products to be handled or hazardous situations that may arise to be fully described, detailed and assessed.
- Where exceptionally high risk situations may arise and a HAZOP has been implemented this must be provided to the lead design party.
- Special and unique features of the products and special performance needs of the equipment that may impact on risk to be detailed and assessed.
- If the system is required to operate at pressure and temperature conditions that may lead to registration as a system that is a pressure vessel – these details must be fully provided and presented to the lead design party.
- A review of risks and hazards that are unique to each item of equipment is to be made and assessed with specialist suppliers for a risk prevention design.