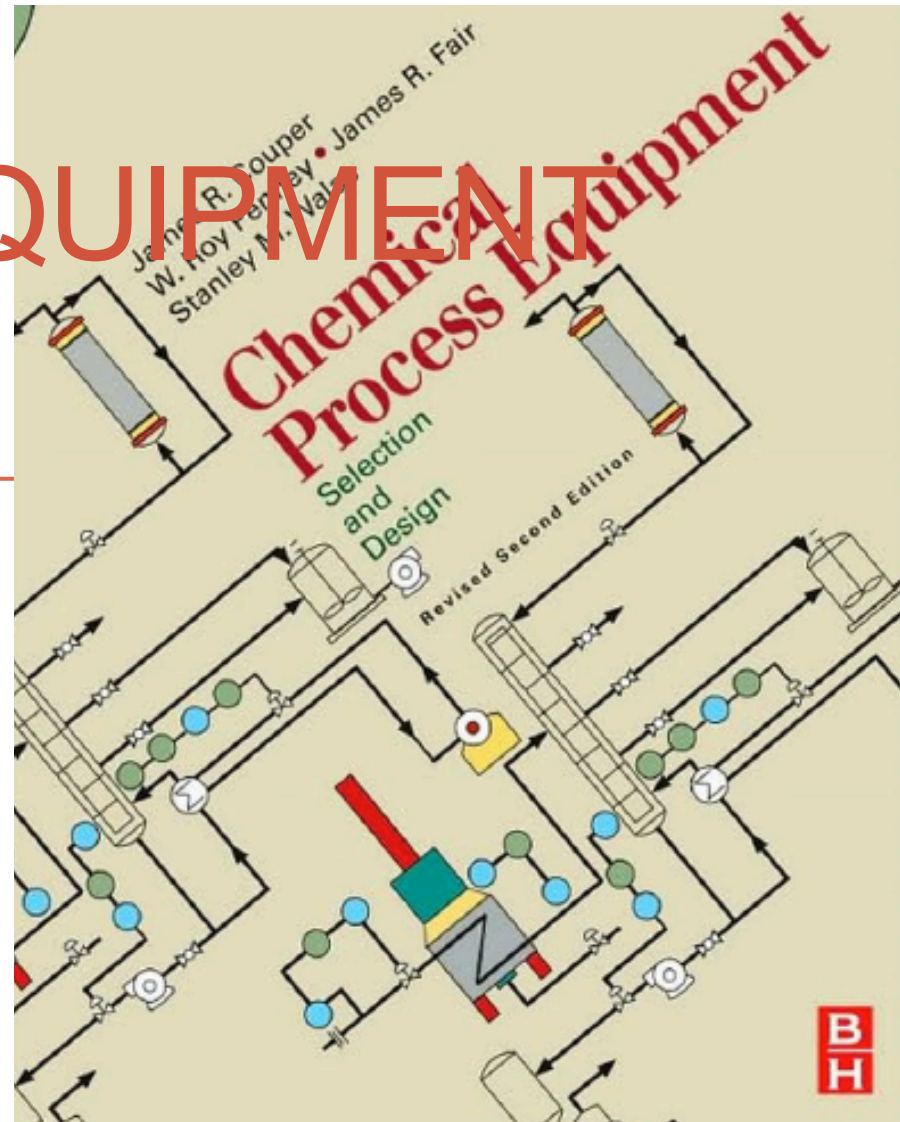


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# CHOOSING EQUIPMENT

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## **Choosing Equipments (refer: flow diagram, AIK):**

- main equipments**
- supporting equipments**

## **Considering:**

- Logical flow : gravity, forced, high pressure**
- Logical process.**

## **Main equipments :**

- storage equipments: for raw mat'ls and products**
- equipment of optimizing operating conditions: reactor, separators, crusher and grinders, sievers, mixers, HE (heater, cooler, boiler, evaporator, condensor, burner, furnace, etc), compressors.**

## **Supporting equipments :**

- transportation means: conveyor, elevator, pump**
- instrumentations**
- waste diposal, utilities.**

# EQUIPMENT SPECIFICATION

Before a manufacturer is contacted, the engineer should evaluate the design needs and prepare a preliminary specification sheet for the equipment. This preliminary specification sheet can be used by the engineer as a basis for the preparation of the final specifications, or it can be sent to a manufacturer with a request for suggestions and fabrication information. Preliminary specifications for equipment should show the following:

1. Identification
2. Function
3. Operation
4. Materials handled
5. Basic design data
6. Essential controls
7. Insulation requirements
8. Allowable tolerances
9. Special information and details pertinent to the particular equipment, such as materials of construction including gaskets, installation, necessary delivery date, supports, and special design details or comments

# EQUIPMENT IN A PLANT

EQUIPMENT FOR  
STORAGE

EQ FOR OPTIMUM  
PROCESS  
(TREATMENT-  
REACTOR-  
SEPARATOR)

EQ FOR  
TRANSPORTATION

EQ FOR HEAT  
TRANSFER

## Storage equipments for raw materials/products:

- Tank
- Silo
- Bunker
- Bin
- Ware house
- Open field.

## Equipment of optimizing operating conditions:

### Reactors

- Continuous : tube, STR, jacketted,
- Batch.

### Separators

- Varied, depend on the nature (physical properties, etc) of the processed materials.

# SEPARATION EQUIPMENTS

## Physical Properties (in Addition to Diffusivity) on Which Separation Processes Are Based

- **Property**
- **Vapor pressure**
- **Solubility**
- **Solubility and density**
- **Chemical affinity (Van der Waal bonding)**
- **Adsorption and electrical charge**
- **Electric charge**
- **Molecular size and shape**
- **Vapor pressure and velocity**
- **Velocity**
- **Particle size.**



## Separations Based on the Property

- **Distillation, sublimation, evaporation**
- **Crystallization, gas absorption, leaching**
- **Liquid extraction**
- **Adsorption, hypersorption, chromatography, foam separation**
- **Ion exchange**
- **Electrodialysis, electrolytic ion exchange**
- **Molecular sieves, membrane permeation**
- **Molecular distillation**
- **Gaseous diffusion, thermal diffusion**
- **Filtration, sieves.**

## Separation process :

- **Sedimentation**
- **Liquid filtration**
- **Membrane separation process**
- **Centrifugal separation**
- **Leaching**
- **Distillation**
- **Absorption of gases**
- **Liquid-liquid extraction**
- **Evaporation**
- **Crystallisation**
- **Drying**
- **Adsorption**
- **Ion exchange**
- **Chromatographic separation.**

**The order in which separations are performed can vary, but some general rules can be set forth.**

- First the corrosive or hazardous materials should be separated out.**
- Next, the separation steps that remove large quantities of materials or divide a stream into two or more large-volume streams should be considered. These steps, by reducing the amount of material in a stream, reduce the size of the following separation equipment.**

# **Equipment Selection**

## **Solid-solid separations**

- **Screening (sieving)**
- **Liquid-solid cyclones**
- **Hydroseparators and sizers (classifiers)**
- **Hydraulic jigs**
- **Tables**
- **Classifying centrifuges**
- **Dense-medium separators (sink and float processes)**
- **Flotation separators (froth-flotation)**
- **Magnetic separators**
- **Electrostatic separators.**

## **Liquid-solid (solid-liquid) separators**

**1 Thickeners and clarifiers**

**2 Filtration**

**3 Centrifuges**

**4 Hydrocyclones (liquid-cyclones)**

**5 Pressing (expression)**

**6 Solids drying.**

## **Separation of dissolved solids**

**1 Evaporators**

**2 Crystallisation.**

## **Liquid-liquid separation**

**1 Decanters (settlers)**

**2 Plate separators**

**3 Coalesces**

**4 Centrifugal separators.**

## **Separation of dissolved liquids**

**Solvent extraction leaching.**

## **Gas-solids separations (gas cleaning)**

**1 Gravity settlers (settling chambers)**

**2 Impingement separators**

**3 Centrifugal separators (cyclones)**

**4 Filters**

**5 Wet scrubbers (washing)**

**6 Electrostatic precipitators.**

## **Gas-liquid separators**

- Vertical separators
- Horizontal separators.

## **Crusher and grinders (comminution equipment)**

- crushers: Jaw Crusher, Blake Crusher
- grinders
- mills: ball mills, colloid mills.

## **Sievers**



## Mixing equipment

- 1 Gas mixing
- 2 Liquid mixing
- 3 Solids and pastes.

## Heat-transfer Equipment

### Shell and tube exchangers:

- Condensation outside or inside horizontal tubes
- Condensation of steam, of mixtures
- Desuperheating and sub-cooling
- Condensation inside and outside vertical tubes
- Reboilers and vaporisers.

# HEAT TRANSFER EQUIPMENTS

**Plate heat exchangers**  
**Spiral heat exchangers**  
**Direct-contact heat exchangers**  
**Finned tubes**  
**Double-pipe heat exchangers**  
**Air-cooled exchangers**  
**Fired heaters (furnaces and boilers).**

**Heat transfer to vessels**

- 1 Jacketed vessels**
- 2 Internal coils**
- 3 Agitated vessels.**

# TRANSPORTATION EQUIPMENTS

# Compressors

## Transportation means :

- **Conveyor**
- **Elevator**
- **pump**

## **Conveyor :**

- **open**
- **closed**
- **dragged**
- **carried**

## **Open conveyor:**

- belt : continuous, segmented**
- wagon**

## **Closed conveyor:**

- pipe, duck, canal**
- zipped**
- screw**
- pneumatic**

## **Elevator**

- centrifugal discharge**
- positive discharge**
- high capacity cont. disch**

## **Pump**

- centrifugal**
- piston**
- vane**
- hytor**
- heat pump**
- peristaltic**

## Instrumentations

- **Pressure control**
- **Temperature control**
- **Flow control.**

## Waste disposal, utilities

- **varied, depend on the process**