



**CEN4415
PROCESS DESIGN I**

FLOW SHEETS

Aim for the Use of Flow Charts:

- They form the **basis** for the designs.
- They are used to **compare the operational performance** of the process.
- They are used for the **preparation of operating manuals**.
- Selection of the **most suitable** process

Main Flow Diagrams Types

1. Block Flow Diagram (**BFD**) and Block Plant Flow Diagram (**BPFD**)
2. Process Flow Diagram (**PFD**)
3. Piping and Instrumentation Diagrams (**P&ID**, Process control, equipment dimensions etc.)

BLOCK FLOW DIAGRAMS (BFDs)

1. Block Flow Process Diagram

- Operations shown by blocks.
- Flow goes from left to right whenever possible (recycles go right to left).
- Critical information unique to process supplied.
- Simplified material balance provided.

2. Block Flow Plant Diagram

Each block represents a complete chemical process.

PROCESS FLOW DIAGRAMS (PFDs)

- Each piece of equipment will have a unique equipment *number* and a *descriptive name*.
- All process flow streams will be shown and identified by a *number*.
- A description of the process conditions and chemical composition of each stream will be included.
- All utility streams supplied to major equipment
- Basic control loops will be shown.

Conventions for Identifying Process Equipment

General Format **XX-YYY A/B**

XX are the identification letters for the equipment classification

C – Compressor or Turbine

E – Heat Exchanger

H – Fired Heater

P – Pump

R – Reactor

T – Tower

TK – Storage Tank

V – Vessel

Y designates an area within the plant

ZZ is the number designation for each item in an equipment class

A/B identifies parallel units or backup units not shown on a PFD

Additional description of equipment is given on top of PFD

Conventions for Identifying Process and Utility Streams

Process Streams	
Diamond symbol located in flow lines.	
Numerical identification (unique for that stream) inserted in diamond.	
Flow direction shown by arrows on flow lines.	
Utility Streams	
lps	Low-Pressure Steam: 3–5 barg (sat)*
mpps	Medium-Pressure Steam: 10–15 barg (sat)*
hps	High-Pressure Steam: 40–50 barg (sat)*
htm	Heat Transfer Media (Organic): to 400°C
cw	Cooling Water: From Cooling Tower 30°C Returned at Less than 45°C [†]
wr	River Water: From River 25°C Returned at Less than 35°C
rw	Refrigerated Water: In at 5°C Returned at Less than 15°C
rb	Refrigerated Brine: In at –45°C Returned at Less than 0°C
cs	Chemical Wastewater with High COD
ss	Sanitary Wastewater with High BOD, etc.
el	Electric Heat (Specify 220, 440, 660V Service)
bfw	Boiler Feed Water
ng	Natural Gas



Equipment Descriptions for PFDs and P&IDs

Equipment Type

Pumps

Towers

Compressors

Heat Exchangers

Heaters (Fired)

Tanks and Vessels

Others

REFERENCES

1. Sinnott, R.K. 1999, *Coulson's & Richardson's Chemical Engineering, Volume 6, Chemical Engineering Design*, ButterWorth Heinemann, Oxford.
2. Turton R., Bailie R.C., Whitin W.C., Shaeiwitz J.A. 1998, *Analysis, Synthesis and Design of Chemical Processes*, Prentice Hall, New Jersey.