

# پلتفرم اختصاصی مهندسی کنترل



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بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ

## گرافیک و نقشه خوانی

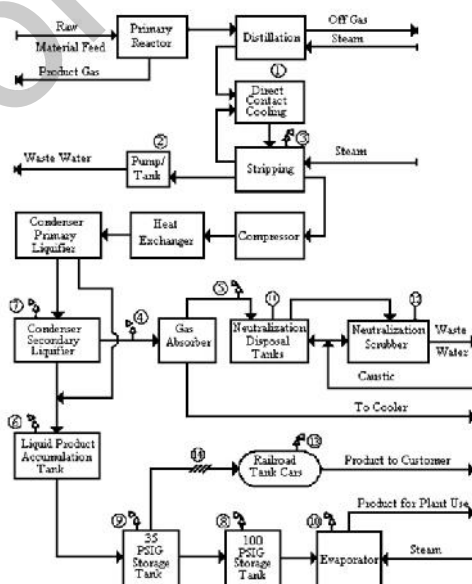
بخش: نقشه خوانی

تعیین و تنظیم:

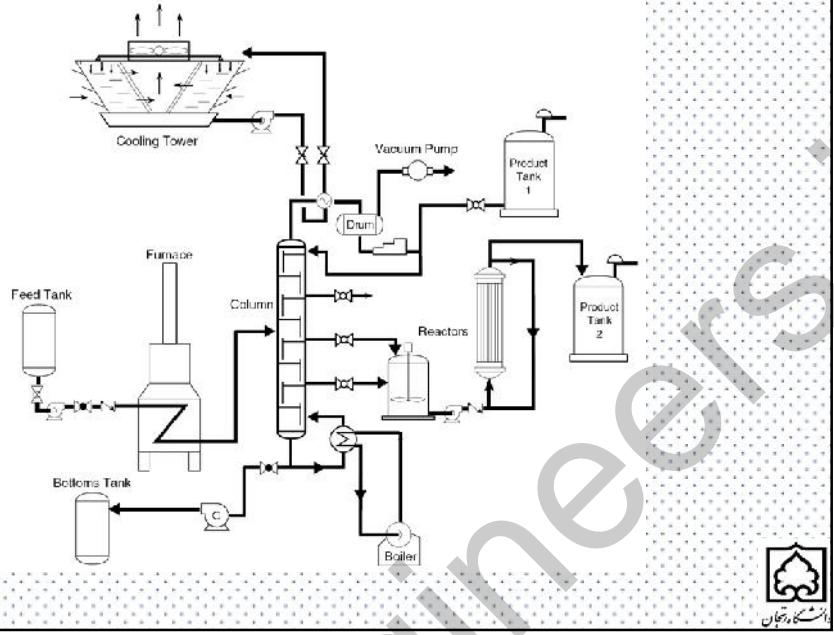
رحمت ... پور عطا  
میر سعید سید دراجی (عضو هیات علمی دانشگاه زنجان)



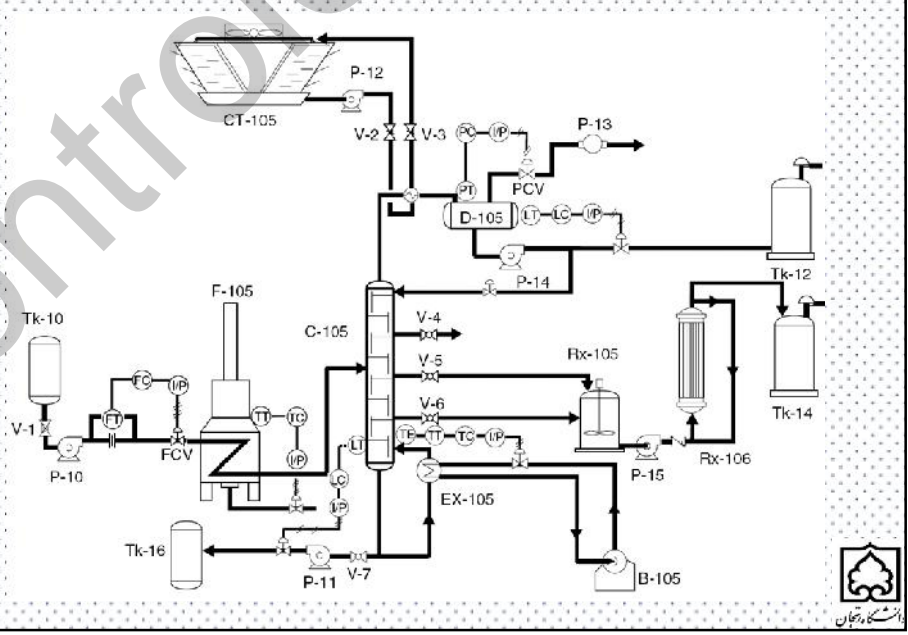
### Block Flow Diagram (BFD)



### Process Flow Diagram (PFD)



### Process and Instrument Diagram (P&ID)



## *Process and Instrument Symbols*

### **Valves**



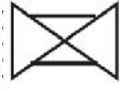
Gate Valve



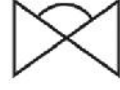
Needle



Ball



Plug



Diaphragm



Globe Valve



Butterfly



Three-Way Valve

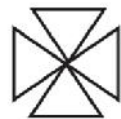


## *Process and Instrument Symbols*

### **Valves**



Check Valve



Four-Way

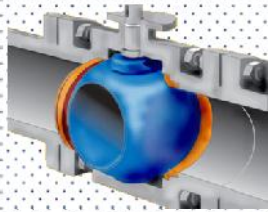
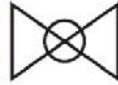


Angle



*Process and Instrument Symbols*

Ball Valve (شیر توپی)



v



*Process and Instrument Symbols*

Butterfly Valve (شیر پروانه‌ای)

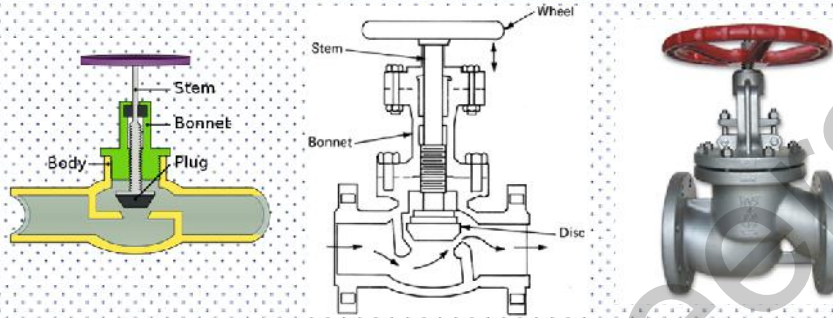


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## Process and Instrument Symbols

Globe Valve (شیر ساچمه‌ای)



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## Process and Instrument Symbols

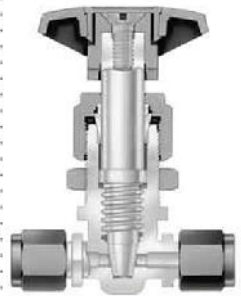
Gate Valve (شیر دروازه‌ای)



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### Process and Instrument Symbols

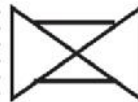
Needle valve (شیر سوزنی)



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### Process and Instrument Symbols

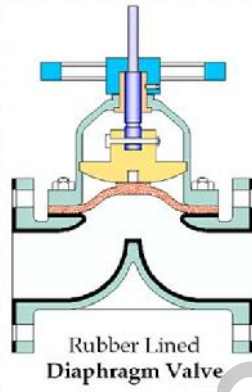
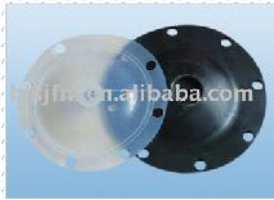
Plug Valve (شیر مجرا بند یا سماوری)



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## Process and Instrument Symbols

### Diaphragm Valve

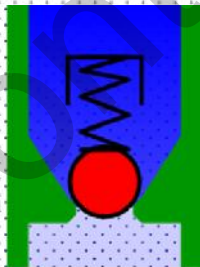


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## Process and Instrument Symbols

### Check Valve (شیر یکطرفه)



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## Process and Instrument Symbols

### Pumps & Compressors

#### Pumps & Compressors

#### Positive Displacement Pumps

پمپهای جابجایی مثبت

Rotary دورانی

Reciprocating

تناوبی

#### Centrifugal Pumps

پمپهای گریز از مرکز

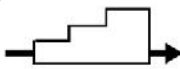


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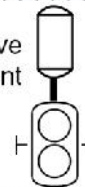
## Process and Instrument Symbols

### Pumps

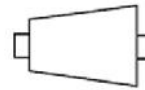
Positive Displacement



Positive Displacement



Centrifugal Pumps



Turbine



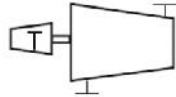
۱۶

## Process and Instrument Symbols

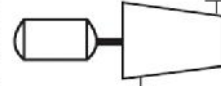
### Compressors



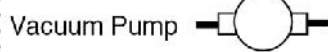
Centrifugal Compressor



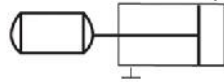
Centrifugal Compressor (Turbine Driven)



Centrifugal Compressor



Vacuum Pump



Reciprocating Compressor



Rotary Compressor



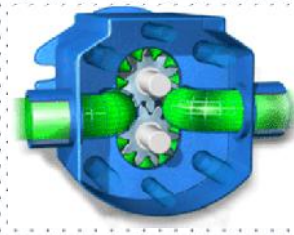
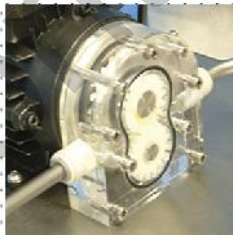
Rotary Screw Compressor



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## Process and Instrument Symbols

### Positive Displacement : Rotary



Positive Displacement



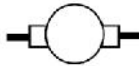
Gear Pump

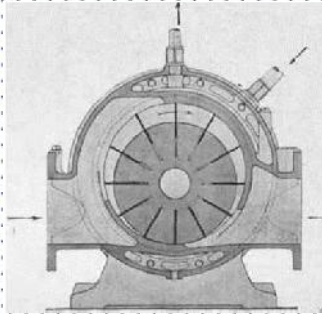


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## Process and Instrument Symbols

### Positive Displacement : Rotary

Vacuum Pump 

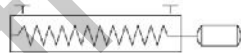


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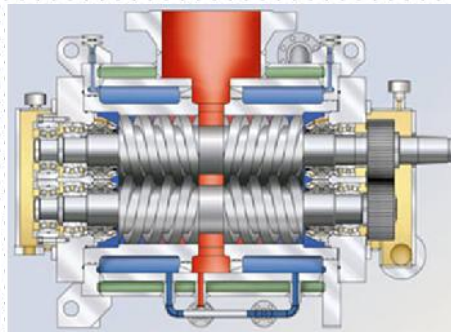
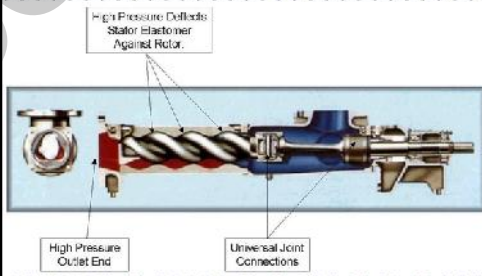
## Process and Instrument Symbols

### Positive Displacement : Rotary



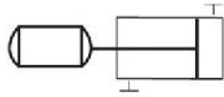
Rotary Screw  
Compressor

Screw Pump 

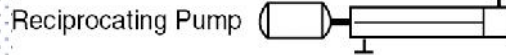


## Process and Instrument Symbols

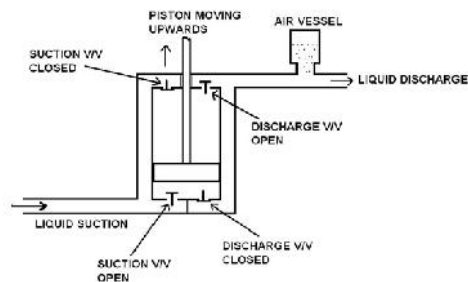
### Positive Displacement: Reciprocating



Reciprocating Compressor



Reciprocating Pump



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## Process and Instrument Symbols

### Centrifugal

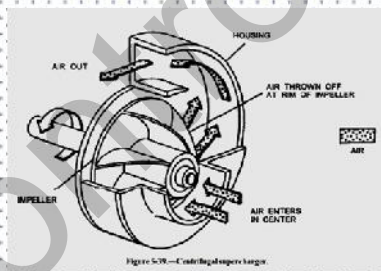
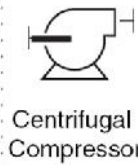
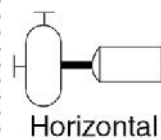


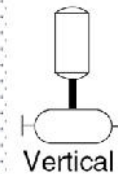
Figure 5.78—Cedar Rapids Corp. Logo



Centrifugal Compressor



Horizontal



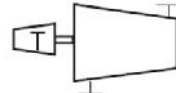
Vertical



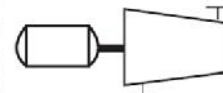
۲۱

## Process and Instrument Symbols

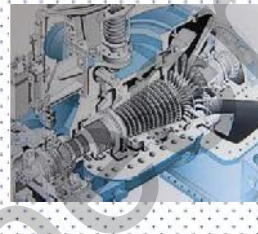
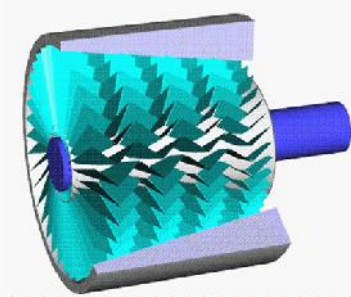
### Centrifugal



Centrifugal Compressor  
(Turbine Driven)



Centrifugal  
Compressor



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## Process and Instrument Symbols

### Heat Exchangers



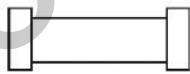
Hairpin Exchanger



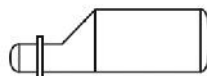
U-Tube  
Heat Exchanger



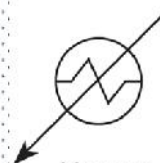
Shell & Tube Heat Exchanger



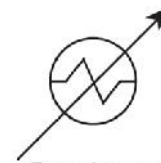
Single Pass  
Heat Exchanger



Reboiler



Heater



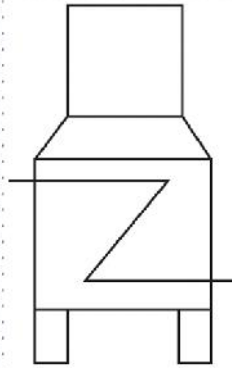
Condenser

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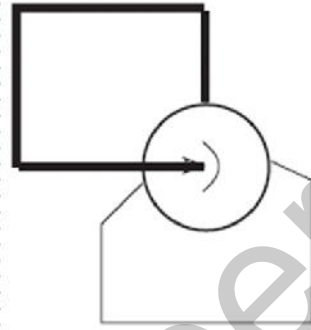


*Process and Instrument Symbols*

**Furnace And Boiler**



**Furnace**



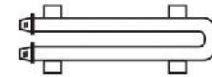
**BOILER**

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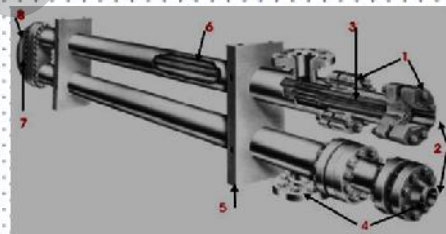


*Process and Instrument Symbols*

**Heat Exchangers**



**Hairpin Exchanger**



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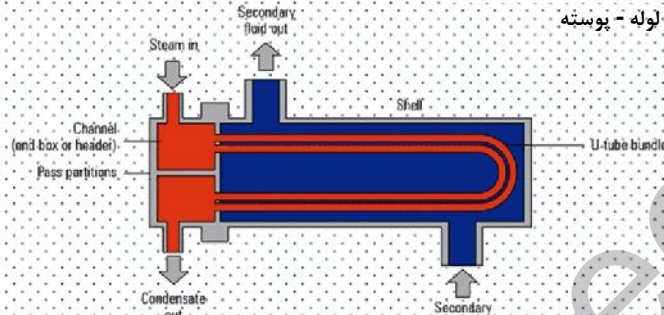


## Process and Instrument Symbols

### Heat Exchangers



Shell & Tube Heat Exchanger



مبدل های حرارتی لوله - پوسته

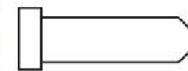
shell and tube heat exchanger

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## Process and Instrument Symbols

### Heat Exchangers



U-Tube Heat Exchanger

#### Tubes

Available in Copper, 90/10 Cu-Ni, 316 Stainless Steel, Admiral or Carbon Steel. Tubes are not expanded.

#### Shells

Rugged shell available in Steel and 316 Stainless Steel. Minimum clearances between shell and baffles reduce by-pass and maximize heat transfer.



#### Supports

Movable, fabricated Carbon Steel available on all sizes.

#### Baffles

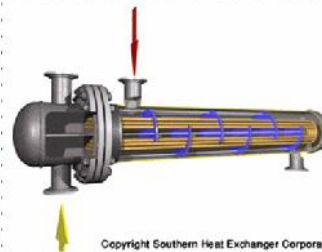
Precision punched baffles assure effective circulation by providing minimum clearances between the tubes and tube holes. Baffle cuts and spacing for each diameter are consistent with best practices. Standard available material includes Carbon Steel, Brass and 316 Stainless Steel.

#### Heads

Heads available in Cast Iron, Brass, 316 Stainless Steel or Fabricated Carbon Steel.

#### Tube sheets

Thick Carbon Steel, 316 Stainless Steel or 90/10 Cu-Ni tube sheets.



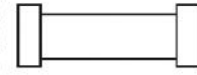
Copyright Southern Heat Exchanger Corporation

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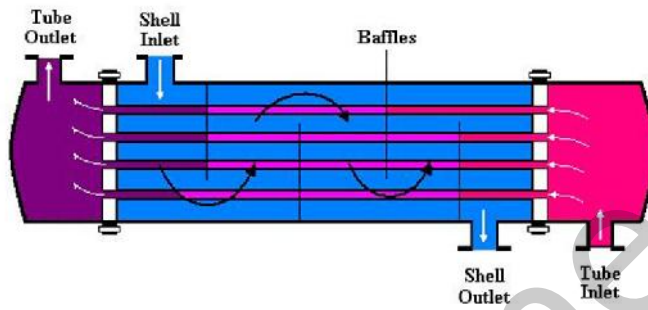


## Process and Instrument Symbols

### Heat Exchangers



Single Pass Heat Exchanger

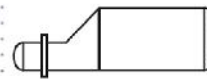


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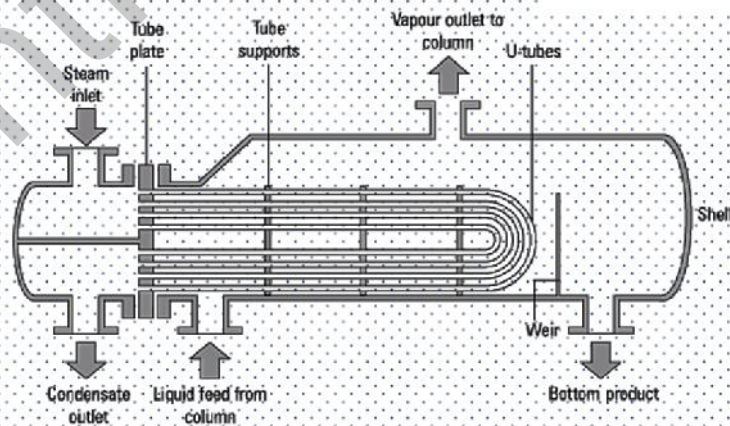


## Process and Instrument Symbols

### Heat Exchangers



Reboiler



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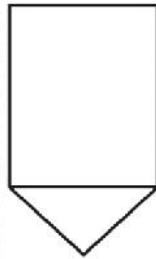


## Process and Instrument Symbols

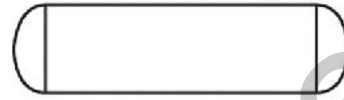
### Vessels



Tank



Bin



Drum or Condenser

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## Process and Instrument Symbols

### Vessels

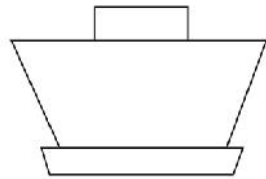


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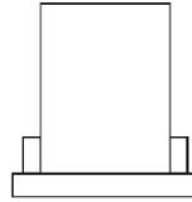


## Process and Instrument Symbols

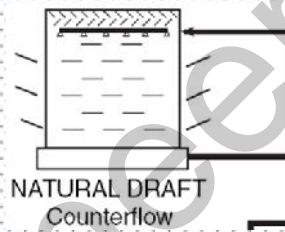
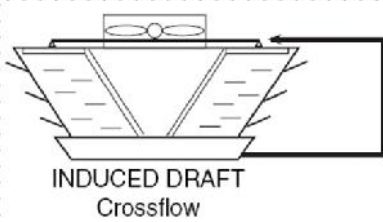
### Cooling Tower



Induced-Draft Cooling Tower



Forced-Draft Cooling Tower

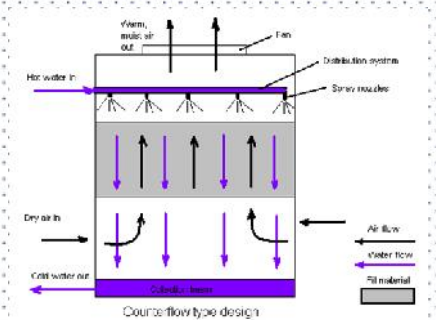
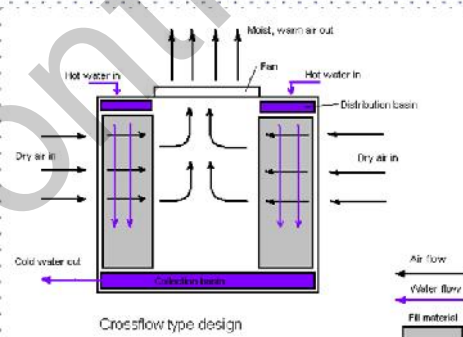


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## Process and Instrument Symbols

### Cooling Tower

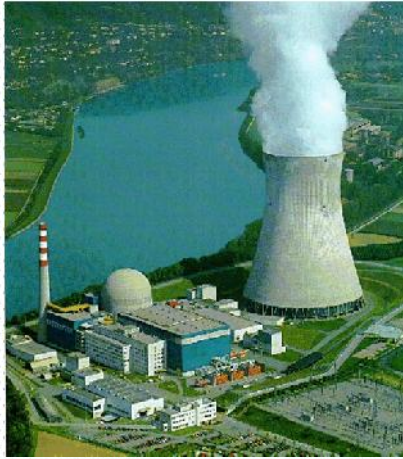


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## Process and Instrument Symbols

### Cooling Tower

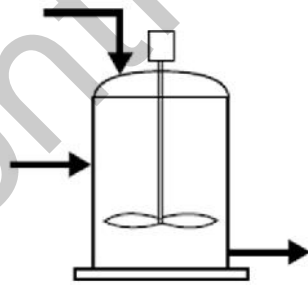


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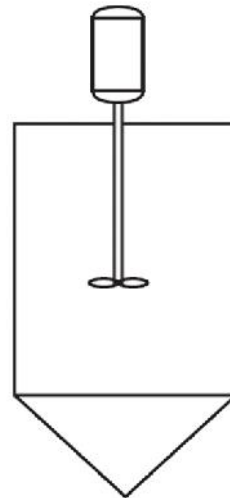
## Process and Instrument Symbols

### Reactor



Mixing Reactor

Mixer



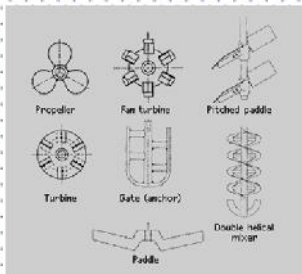
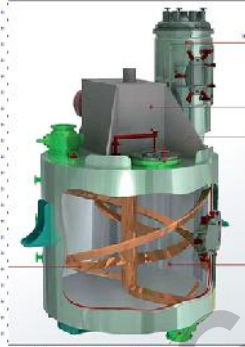
Mixing Reactor

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## Process and Instrument Symbols

### Reactor



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Impeller Selection



## Process and Instrument Symbols

### Tower

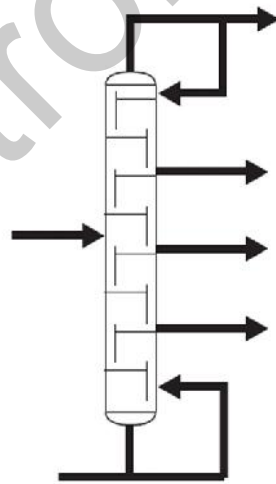
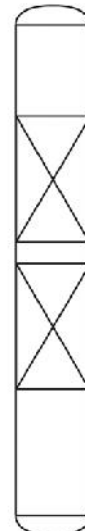


PLATE TOWER



Tower



Tower with Packing

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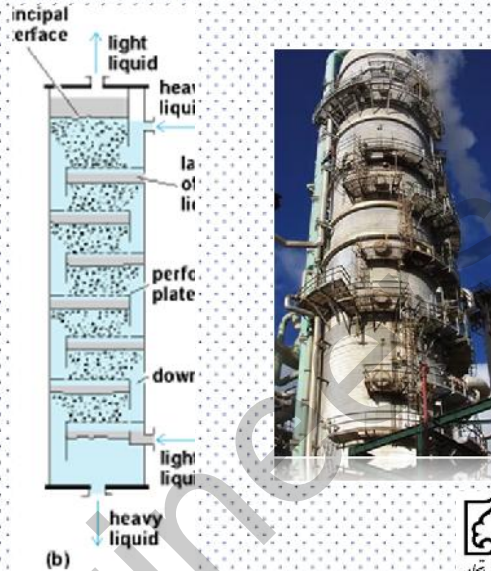


## Process and Instrument Symbols

### Tower



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(b)

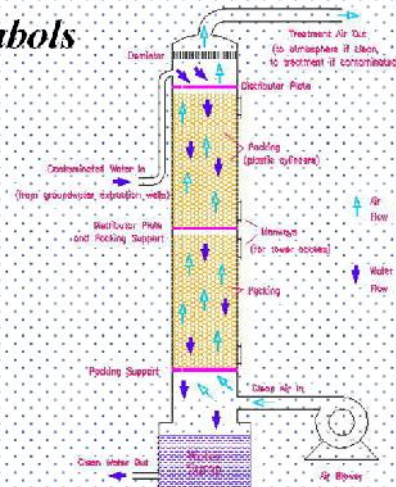


## Process and Instrument Symbols

### Tower



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## *Process and Instrument Symbols*

### **Line Symbols**

Future Equipment	-----
Major Process	—————
Minor Process	—————
Pneumatic	——// // // ——
Hydraulic	——L L L ——
Capillary Tubing	——X X X X X ——
Electromagnetic Signal	——~~~~~——
Electric	-----

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## *Process and Instrument Symbols*

### **Instrument Symbols**

























(TI) Temp Indicator	(FI) Flow Indicator
(TT) Temp Transmitter	(FT) Flow Transmitter
(TR) Temp Recorder	(FR) Flow Recorder
(LI) Level Indicator	(PI) Pressure Indicator
(LT) Level Transmitter	(PT) Pressure Transmitter
(LC) Level Controller	(PRC) Pressure Recording Controller

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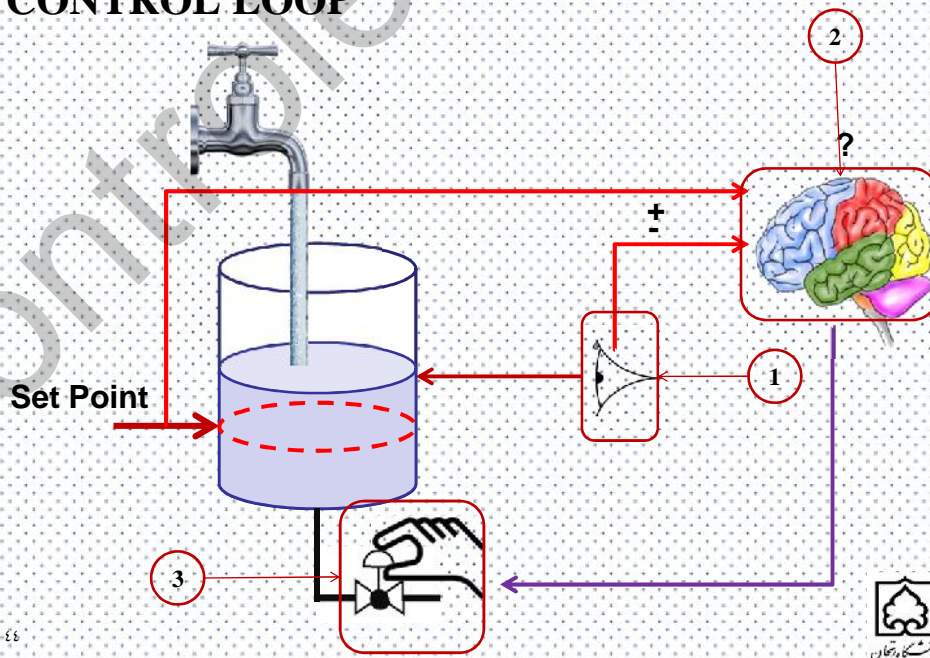
## Process and Instrument Symbols

### Instrument Symbols

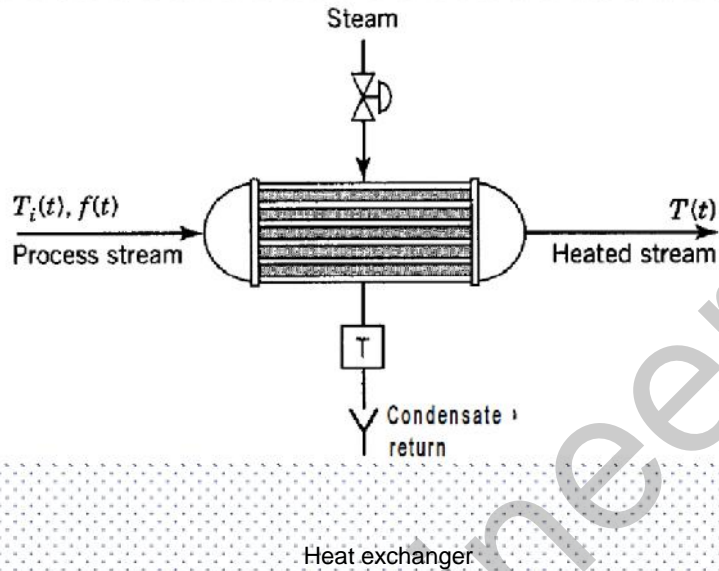
 TI Temp Indicator	 FI Flow Indicator	 Transducer
 TT Temp Transmitter	 FT Flow Transmitter	 Pressure Indicating Controller
 TR Temp Recorder	 FR Flow Recorder	 Pressure Recording Controller
 TC Temp Controller	 FC Flow Controller	 Level Alarm
 LI Level Indicator	 PI Pressure Indicator	 Flow Element
 LT Level Transmitter	 PT Pressure Transmitter	 Temperature Element
 LR Level Recorder	 PR Pressure Recorder	 Level Gauge
 LC Level Controller	 PC Pressure Controller	 Analyzer Transmitter



## CONTROL LOOP



## CONTROL LOOP

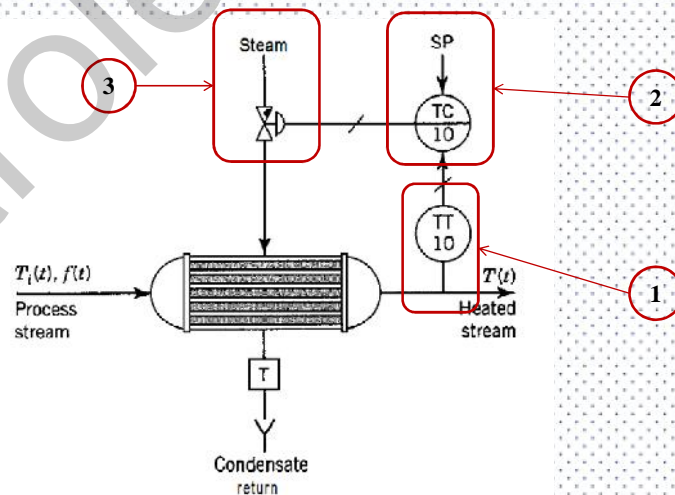


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## CONTROL LOOP

Heat exchanger control system



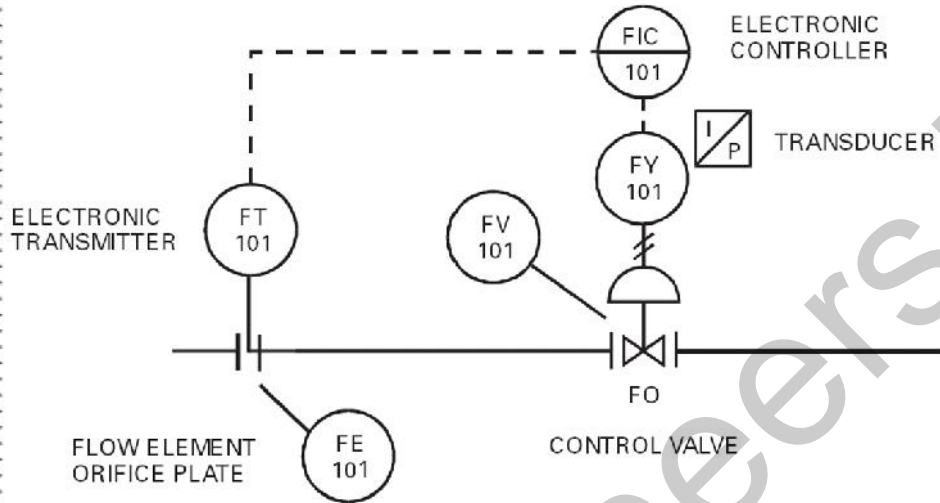
1. Sensor/transmitter Also often called the primary and secondary elements.
2. Controller The "brain" of the control system.
3. Final control element Often a control valve but not always. Other common final control elements are variable-speed pumps, conveyors, and electric motors.

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## CONTROL LOOP



AN ELECTRONIC CONTROL LOOP - CONTROLLING FLOW

## Process Flow Diagram

