پروژه‌های طراحی و مهندسی، خرید و ساخت(EPC)
در پروژه های نفت، گاز و پتروشیمی

تهیه و تنظیم:بهروز بهمن زنگی

فهرست مطالب

مقدمه

- مقدمه
  - تلاش و کوشش در هر جایگاهی از صنعت بدون آگاهی از فرآیندهای کاری مرتبط بینش فرد را محدود به چارچوب صرفا جایگاه خود نموده و هر نوع ابتکار عملی نیز به فعالیتهای داخل هر زنجیره یا بخش از تولید ارزش در سازمانها محدود خواهد شد.
  - بدیهی است هر چه آگاهی افراد از چرخه تولید ارزش درپروژه ها و سازمانها بیشتر باشد نوع ابتکار عمل فرا سازمانی و بخشی نیز که به افزایش بهره وری و تولید ارزش افزوده منجر خواهد شد بیشتر است.

روشهای مدیریت و اجرای پروژه‌های زیربنائی

- 1- روش امانی
  - مدیریت و اجرای طرح توسط نیروهای متخصص و ماشین‌آلات خود کارفرما

کاربرد در پروژه‌های کوچک

- 2- روش دوعاملی
  - کارفرما، پیمانکار

Package ،Design & Build ،Turnkey ،

- 3- روش متعارف(سنتی/مرسوم)
  - 3 عاملی: کارفرما، مشاور، پیمانکار

جهت طرحهای معمولی با اندازه و پیچیدگی متوسط و یا پروژه های بزرگی که کارفرما دانش و نیروی لازم جهت راهبری آنرا داشته باشد

- 4- روش چهارعاملی(Project Management)
  - کارفرما، پیمانکار، مشاور، مدیریت پیمان(EPCM)

روشهای مدیریت و اجرای پروژه‌ها(ادامه)

- 5- روش تامین مالی، طرح، ساخت و راهبری(Finance, Design, Build)
  - بیشتر، روشهای تامین مالی هستند
    - ساخت، بهره‌برداری، واگذاری(Build, Operate & Transfer or BOT)
    - ساخت، تملک، بهره‌برداری(Build, Own & Operate or BOO)
    - ساخت، تملک، بهره‌برداری، واگذاری(Build, Own, Operate & Transfer or BOOT)
    - ساخت، اجاره و واگذاری(Build, Lease & Transfer or BLT)

منابع مالی

- منابع مالی جهت سرمایه‌گذاری
  - **نقدی**
    - تامین کلیه هزینه‌ها بصورت نقدی توسط کارفرما
  - اوراق مشارکت
    - در صورت تائید سوددهی طرح توسط بانک توزیع‌کننده اوراق
  - **فاینانس**
    - استفاده از سرمایه‌گذاری خارجی بصورت اخذ وام
    - درصورت دارا بودن توجیه اقتصادی و امکان استفاده از خطوط اعتباری بیمه

    بطور مثال وام 80٪ ارزش قرارداد، بازپرداخت 5ساله با نرخ سود 8تا 10درصد
  - **بیع متقابل**
    - برگشت سرمایه از محل فروش محصول

پروژه‌های EPC

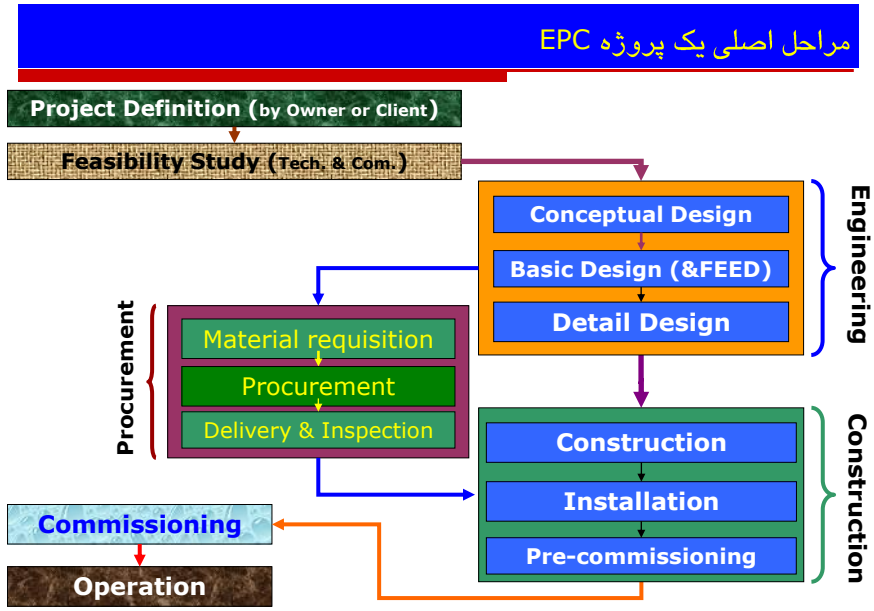
فازهای اصلی یک پروژه EPC

- خدمات طراحی مهندسی(Engineering)
  - طراحی فرایند، ساختمانها، تاسیسات زیربنائی، خطوط ارتباطی و ...
- تدارکات و تامین تجهیزات(Procurement)
  - مذاکره و تامین تجهیزات فنی، ماشین‌آلات، دستگاهها و مخازن موردنیاز
- ساخت، نصب و راه اندازی(Construction)
  - ساخت نقشه‌ها، نصب تجهیزات خریداری شده و راه‌اندازی آنها

مراحل یک پروژه EPC

مراحل یک پروژه EPC

- زایش طرح یا طراحی مفهومی یا فاز صفر(Conceptual Design)
- طراحی مهندسی پایه(Basic Design)
- طراحی تطبیقی(Front-End)
- طراحی مهندسی تفصیلی(Detail Design)
- تدارکات یا خرید (Procurement)
- ساخت(Construction) و نصب(Installation)
- راه‌اندازی آزمایشی(Pre-commissioning)
- راه اندازی(Commissioning)
- و در نهایت بهره‌برداری(Operation)



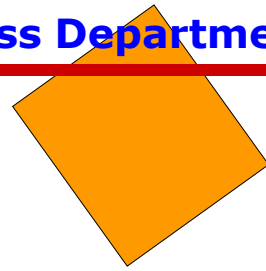
EMO TRANS
Customized Global Logistics

INCOTERMS 2000

Responsibility Matrix - Obligations of Importer (Buyer) and Exporter (Seller)

	"E" Departure	"F" Main Carriage Unpaid			"C" Main Carriage Paid				"D" Arrival				
Service	EXW Ex-Works	FCA Free Carrier	FAS Free Alongside Ship	FOB Free Onboard	CFR Cost of Goods & Freight	CIF* Cost Insurance & Freight	CPT Carriage Paid To	CIP* Carriage Insurance Paid to	DAF Delivered At Frontier	DES Delivered Ex Ship	DEQ Delivered Ex Quay	DDU Delivered Duty Unpaid	DDP Delivered Duty Paid
OBLIGATION AND CHARGES													
Warehouse Services	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Export Packing	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Loading at Point of Origin	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Inland Freight	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Port Receiving Charges	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Export Clearance/Handling	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Ocean/Air Freight	Buyer	Buyer	Buyer	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Charges at Foreign Port / Foreign Airport	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Seller	Seller	Seller
Customs Clearance	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Seller
Customs Duties	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Seller
Delivery Charges to Final Destination	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Seller	Seller

Process Department



Process Department

- Process
- Utility
- Safety

Process Department

- Process is the First Department that the Projects will be started with.
- The Best Process Skim Will be Designed by Process.

Scope of Services

- ✓ Feasibility Study
- ✓ Conceptual Design
- ✓ Basic Engineering Design
- ✓ Front End Engineering Design (FEED)
- ✓ Detail Engineering
- ✓ Procurement Services
- ✓ Proposal Preparation for E,EP,EPC Projects
- …..

Activities List

- Part I: Engineering
  - Philosophies
    - ✓ Process Basis of Design
    - ✓ Process Sizing Criteria
    - ✓ Utility Design Philosophy
    - ✓ Operating and Control Philosophies
    - ✓ ….

Activities List

- Part I: Engineering
  - ✓ Philosophies
  - Process Simulation

Activities List

- Part I: Engineering
  - ✓ Philosophies
  - Process Simulation
    - Design Softwares

Activities List

- Part I: Engineering
  - ✓ Philosophies
  - Process Simulation
    - Design Softwares
      - HYSYS

Activities List

- Part I: Engineering
  - ✓ Philosophies
  - Process Simulation
    - Design Softwares
      - ✓ HYSYS
      - ✓ Provision
      - ASPEN+

Activities List

- Part I: Engineering
  - ✓ Philosophies
  - Process Simulation
    - Design Softwares
      - ✓ HYSYS
      - ✓ Provision
      - ✓ ASPEN+

Activities List

- Part I: Engineering
  - ✓ Philosophies
  - ✓ Process Simulation
  - ✓ Heat and Material Balance Table
  - ✓ Drawings
    - ✓ Process Flow Diagram (PFD)
    - ✓ Utility Flow Diagram (UFD)
    - ✓ Piping and Instrument Diagram (P&ID)
    - ✓ Block Flow Diagram
    - ….

Activities List

- Part I: Engineering
  - ✓ Philosophies
  - ✓ Process Simulation
  - ✓ Heat and Material Balance Table
  - ✓ Drawings
  - ✓ Process Data Sheets for Equipments and Packages
    - ✓ Process Data sheet for pump
    - ✓ Process Data Sheet for column
    - ✓ Process Data sheet for air cooler
    - ✓ Process Data sheet for storage tank
    - ✓ ….

Activities List

- Part I: Engineering
  - ✓ Philosophies
  - ✓ Process Simulation
  - ✓ Heat and Material Balance Table
  - ✓ Drawings
  - ✓ Process Data Sheets for Equipments and Packages
  - ✓ Process Calculation

Activities List

- Part I: Engineering
  - ✓ Philosophies
  - ✓ Process Simulation
  - ✓ Heat and Material Balance Table
  - ✓ Drawings
  - ✓ Process Data Sheets for Equipments and Packages
  - Process Calculation
    - ✓ Line Sizing Calculation
    - ✓ Vessel Sizing Calculation
    - ✓ Pump Sizing Calculation
    - ✓ Flare Calculation
    - ✓ ….

Activities List

- Part I: Engineering
  - ✓ Philosophies
  - ✓ Process Simulation
  - ✓ Heat and Material Balance Table
  - ✓ Drawings
  - ✓ Process Data Sheets for Equipments and Packages
  - ✓ Process Calculation
  - Lists

Activities List

- Part I: Engineering
  - ✓ Philosophies
  - ✓ Process Simulation
  - ✓ Heat and Material Balance Table
  - ✓ Drawings
  - ✓ Process Data Sheets for Equipments and Packages
  - ✓ Process Calculation
  - Lists
    - ✓ Equipment List
    - ✓ Utility Summary
    - ….

Activities List

- Part I: Engineering
  - ✓ Philosophies
  - ✓ Process Simulation
  - ✓ Heat and Material Balance Table
  - ✓ Drawings
  - ✓ Process Data Sheets for Equipments and Packages
  - ✓ Process Calculation
  - Lists
    - ✓ Equipment List
    - ✓ Utility Summary
    - ✓ ….

Activities List

- Part I: Engineering
  - ✓ Philosophies
  - ✓ Process Simulation
  - ✓ Heat and Material Balance Table
  - ✓ Drawings
  - ✓ Process Data Sheets for Equipments and Packages
  - ✓ Process Calculation
  - ✓ Lists
  - ✓ Operating Manual

Activities List

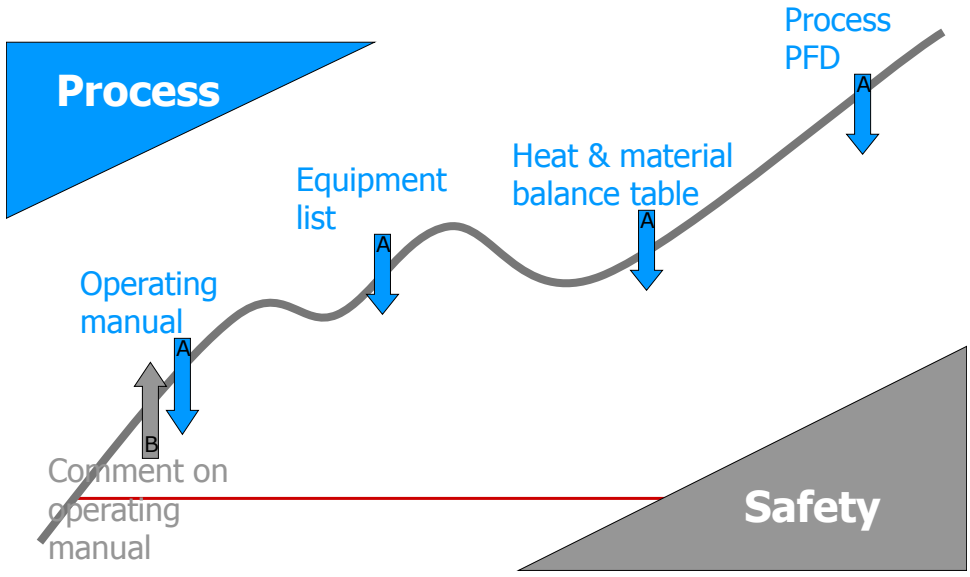
- Part II: Procurement Services

  - ✓ Fill Out TBA Form According to Process Information
  - ✓ Clarification Meeting with Vendors
  - ✓ Vendor Documents Check

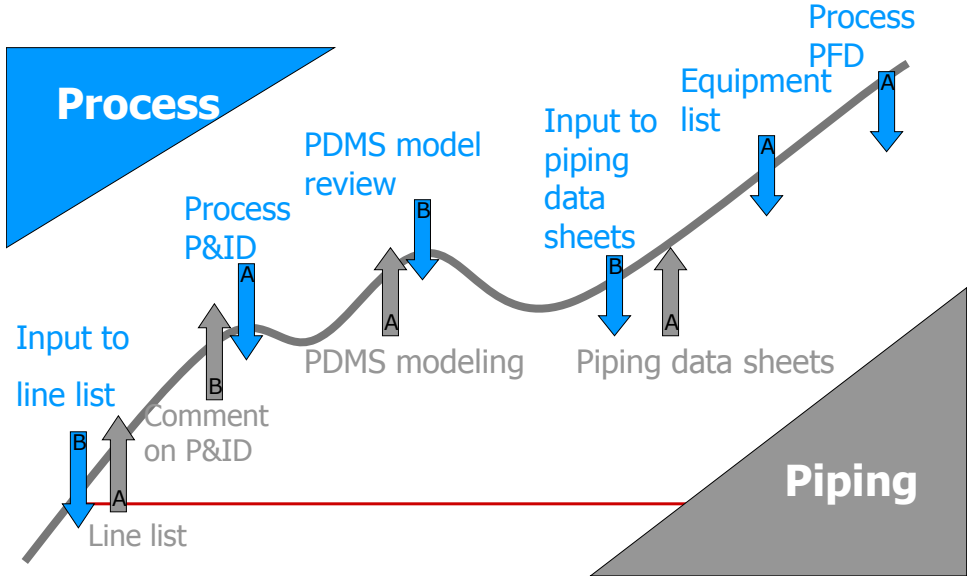
Interfaces with Other Disciplines

- Piping
- Mechanical
- Machinery
- Instrument
- Electrical
- Civil

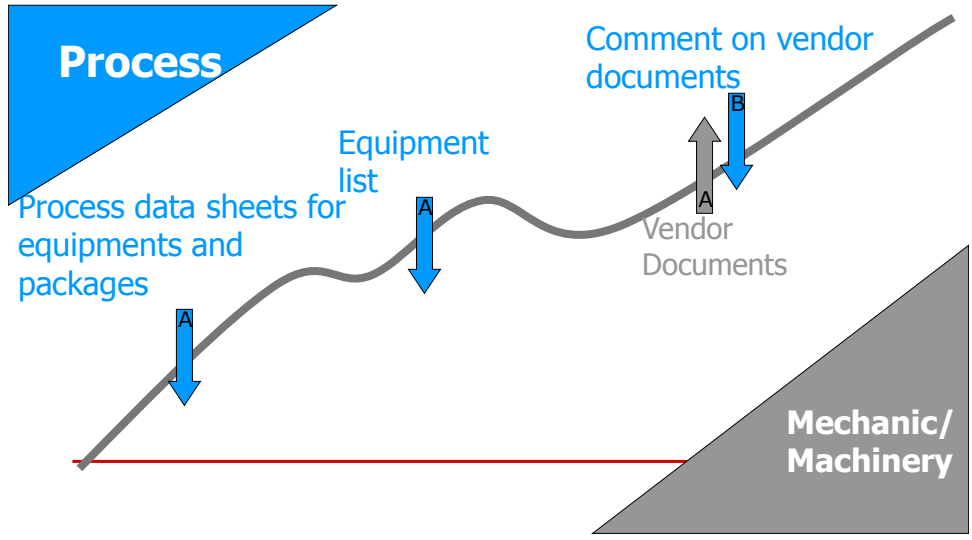
Interfaces Inside Process Department



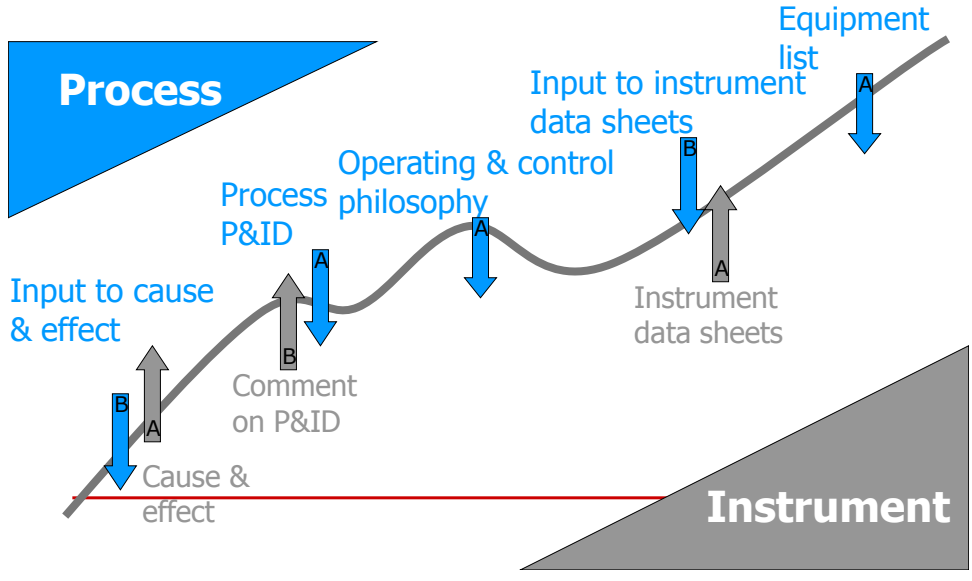
Interfaces with Other Disciplines



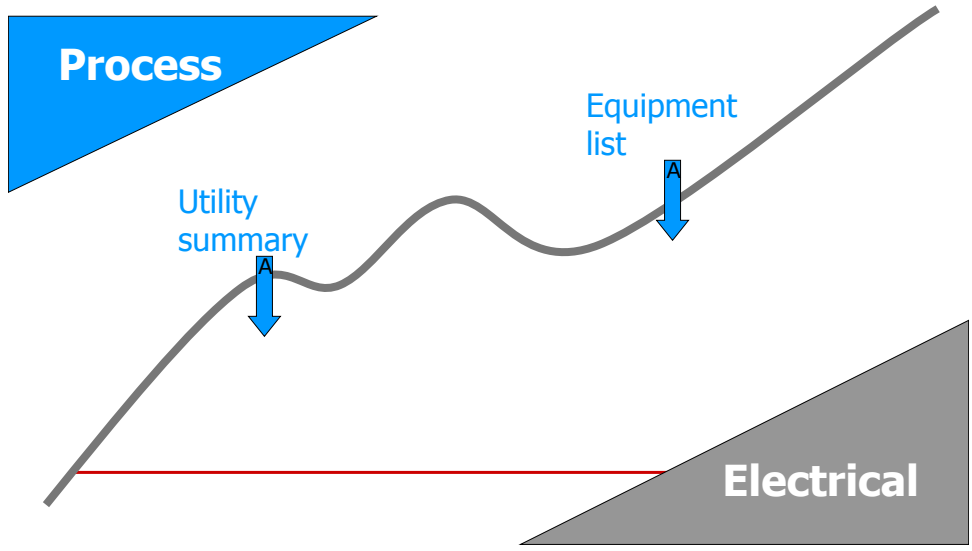
Interfaces with Other Disciplines



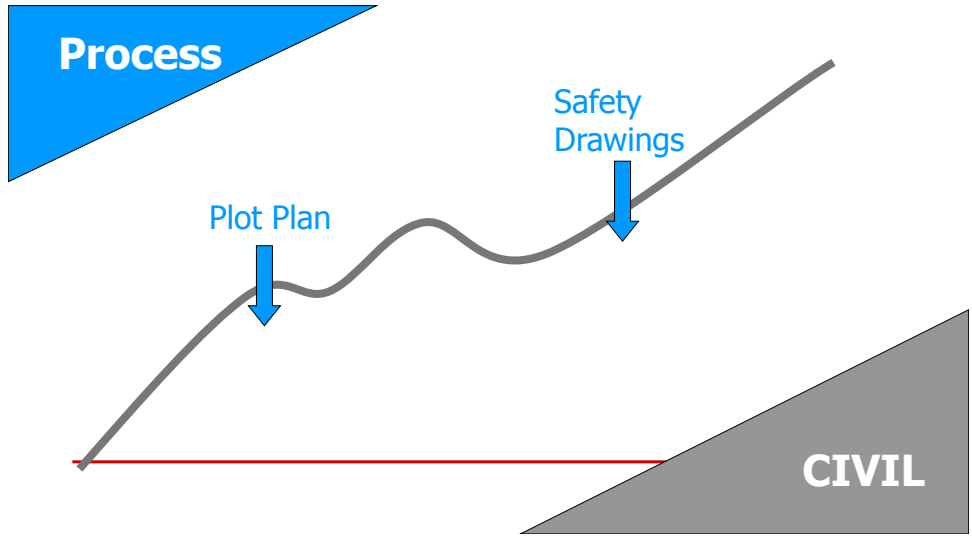
Interfaces with Other Disciplines



Interfaces with Other Disciplines



Interfaces with Other Disciplines



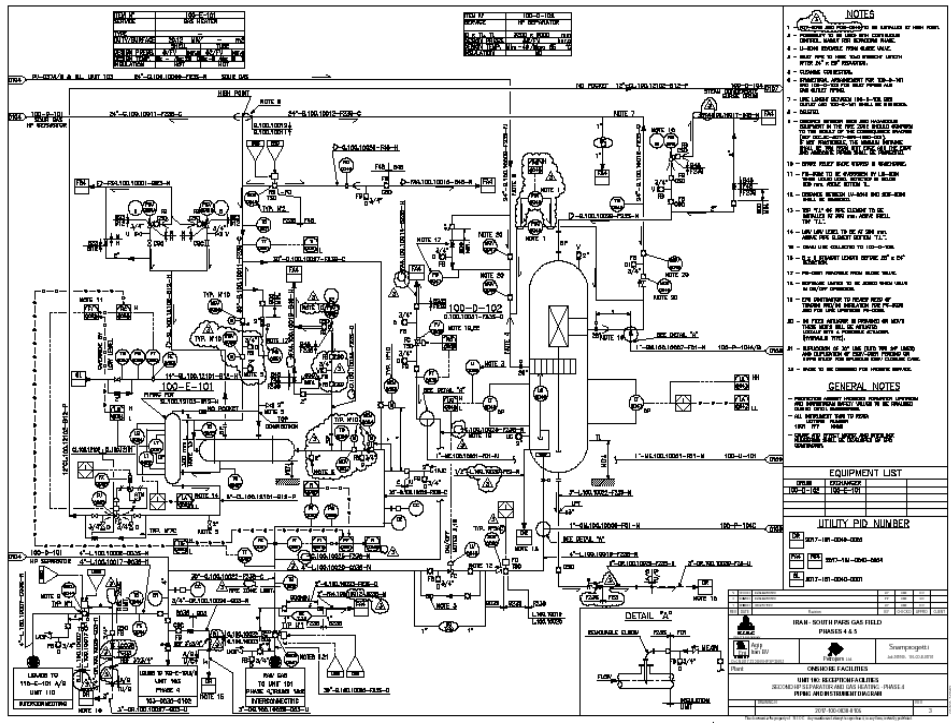
Piping

Piping Department:

- Material
- Design
- Stress and Support
- 3D Model Data Center

ISSUED DOCUMENTS BY MATERIAL SECTION

1. Piping Material Specification (Classification)
2. Line Lists
3. Specifications and Data sheets
4. Piping Welding Specification
5. Welding Procedure Specification
6. Painting, Coating & Wrapping and Insulation Specification
7. Piping Material Take Off (B.O.M)
8. Material Requisition
9. Technical Bid Analysis
10. P & ID Mechanization (Piping-Process)



Design

ISSUED DOCUMENTS BY DESIGN SECTION

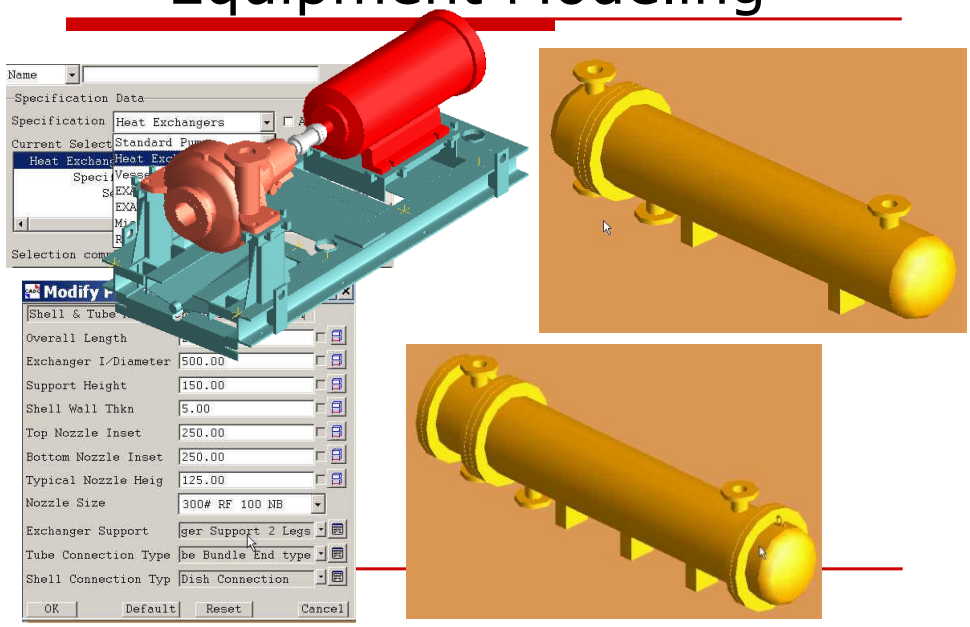
- 1.Overall Project Plot Plan
- 2.General Plot Plan
- 3.Key Plan
- 4.Unit Plot Plan
- 5.Assemble Drawing
- 6.Nozzle Orientation
- 7.Single Line Pipe Rack
- 8.Piping Design Criteria
- 9.Isometric Drawing
- 10.Piping Arrangement

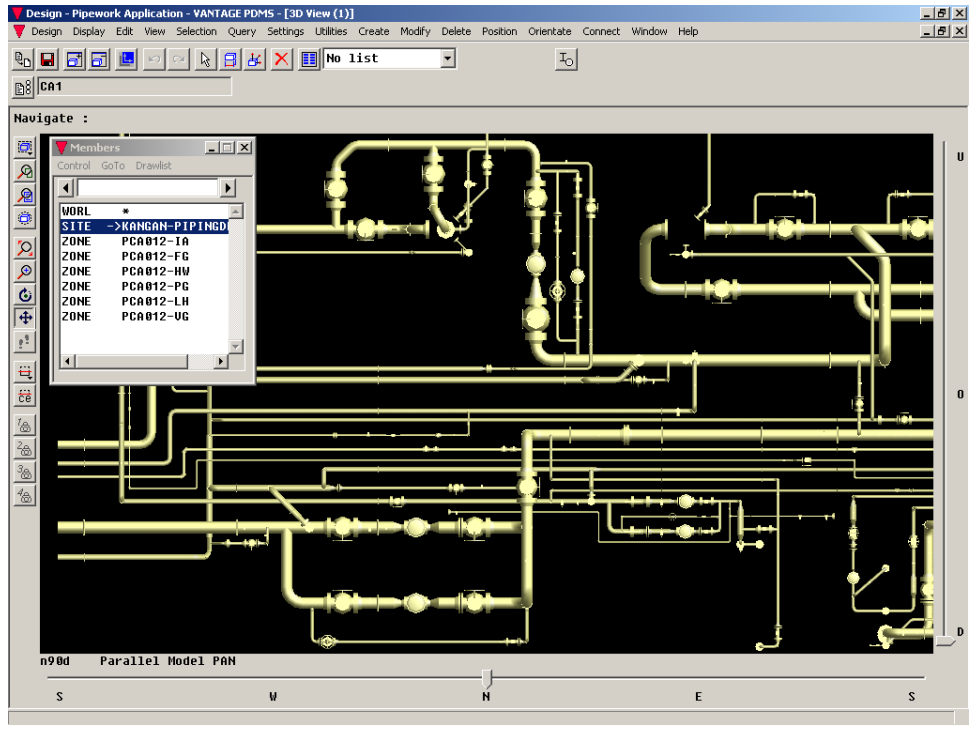
Piping

3D MODEL DESIGN

GENERAL PLOT PLAN

Equipment Modeling





Piping

Stress & Support

ISSUED DOCUMENTS BY STRESS & SUPPORT

- 1.Flexibility Analysis Specification
- 2.Standard Support
- 3.Stress Calculation
- 4.Clip & Bracket on Tower and Tank
- 5.Special Pipe Support Drawing
- 6.Load of Pipe Rack
- 7.Support List
- 8.Support Material Take Off
- 9.Material List for Spring Support
- 10.Material Requisition

Piping

3D Model Data Center

Piping

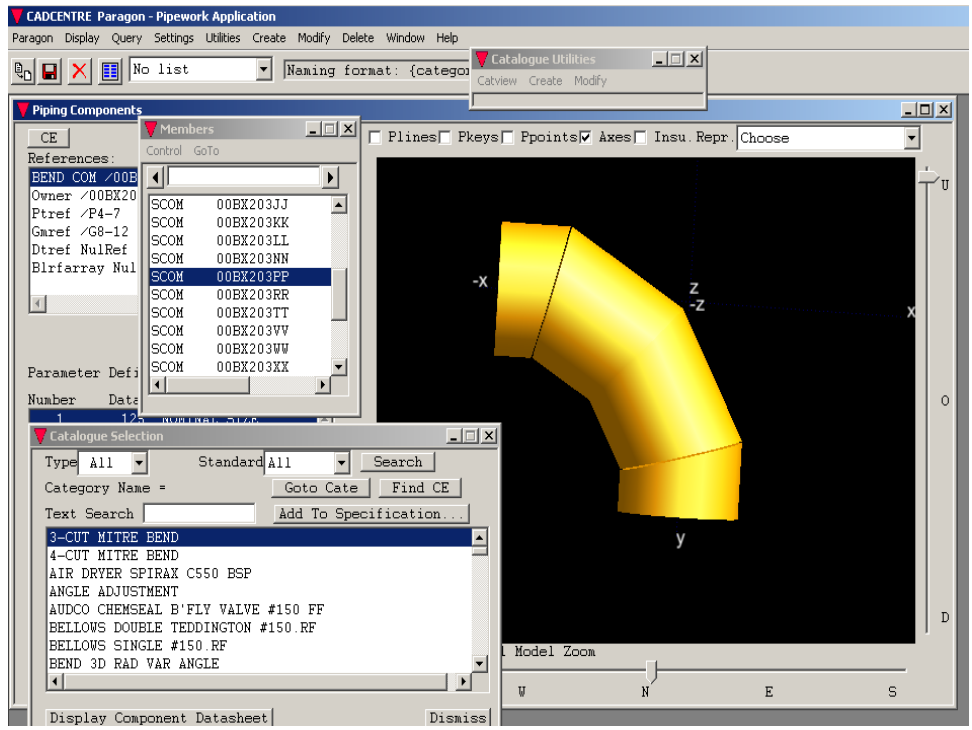
PDMS
(Plant Design Management System)

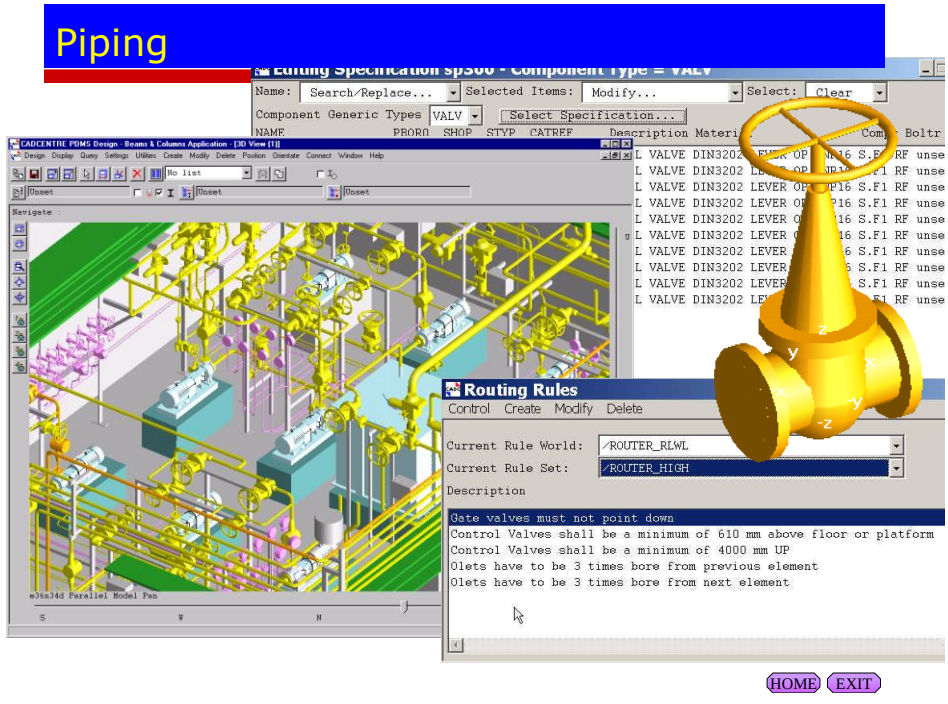
This software is an advanced and intelligent software which is used in design of the plant systems. In this software, lines and equipments,structure are shown in three dimensional pictures and designer can see the actual design which has been made, contemporary. So,the probability of error and mistake decreases.

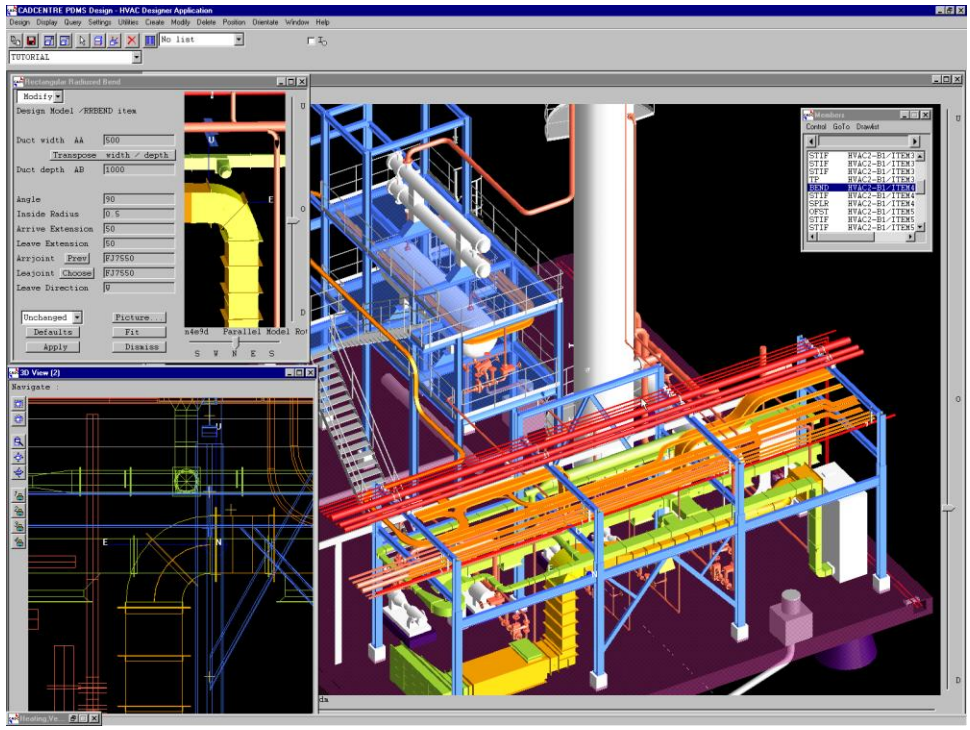
Piping

- *Major* Activities In 3DM.D.C Section:

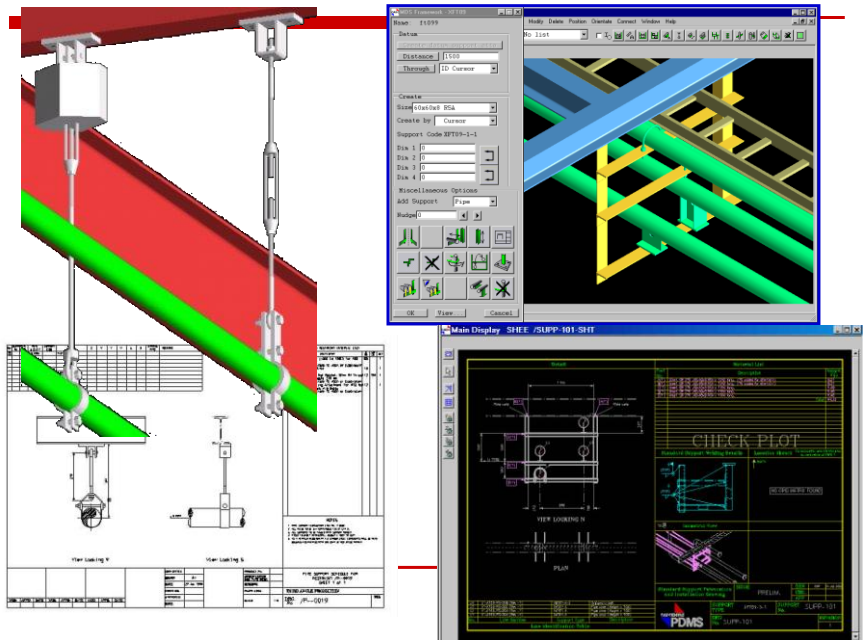
- 1.Catalogue(Material)
- 2.Draft Administration(Design)
- 3.Isometrics Administration(Design)
- 4.Reporting(Material-Support-Design)
- 5.3D Model R&D(Material-Support-Design)
- 6.Model Review

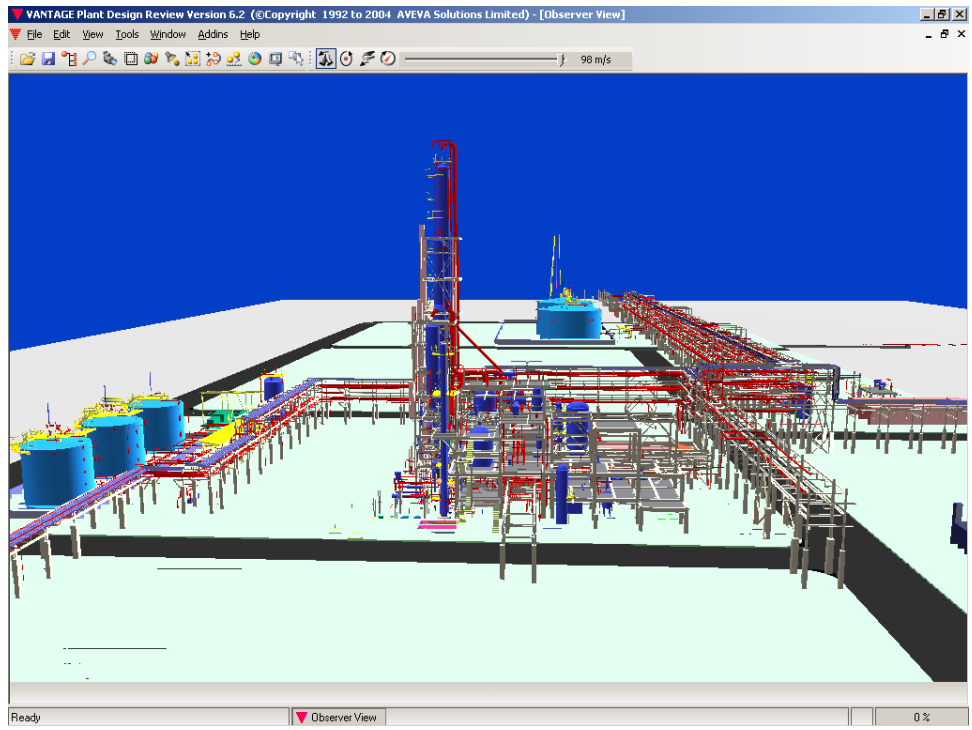

CADCENTRE Paragon - Pipework Application
Paragon Display Query Settings Utilities Create Modify Delete Window Help
No list
Naming format: {categor
Catalogue Utilities
Catview Create Modify
Piping Components
CE
References:
BEND COM /00E
Owner /00BX20
Ptref /P4-7
Gmref /G8-12
Dtref NulRef
Blrfarray Nul
Parameter Defi
Number Data
Members
Control GoTo
SCOM 00BX203JJ
SCOM 00BX203KK
SCOM 00BX203LL
SCOM 00BX203NN
SCOM 00BX203PP
SCOM 00BX203RR
SCOM 00BX203TT
SCOM 00BX203VV
SCOM 00BX203WW
SCOM 00BX203XX
Plines Pkeys Ppoints Axes Insu. Repr.
Choose
-X
z
-Z
x
y
U
O
D
Model Zoom
W N E S
Catalogue Selection
Type All
Standard All
Search
Category Name =
Goto Cate
Find CE
Text Search
Add To Specification...
3-CUT MITRE BEND
4-CUT MITRE BEND
AIR DRYER SPIRAX C550 BSP
ANGLE ADJUSTMENT
AUDCO CHEMSEAL B'FLY VALVE #150 FF
BELLOWS DOUBLE TEDDINGTON #150.RF
BELLOWS SINGLE #150.RF
BEND 3D RAD VAR ANGLE
Display Component Datasheet
Dismiss

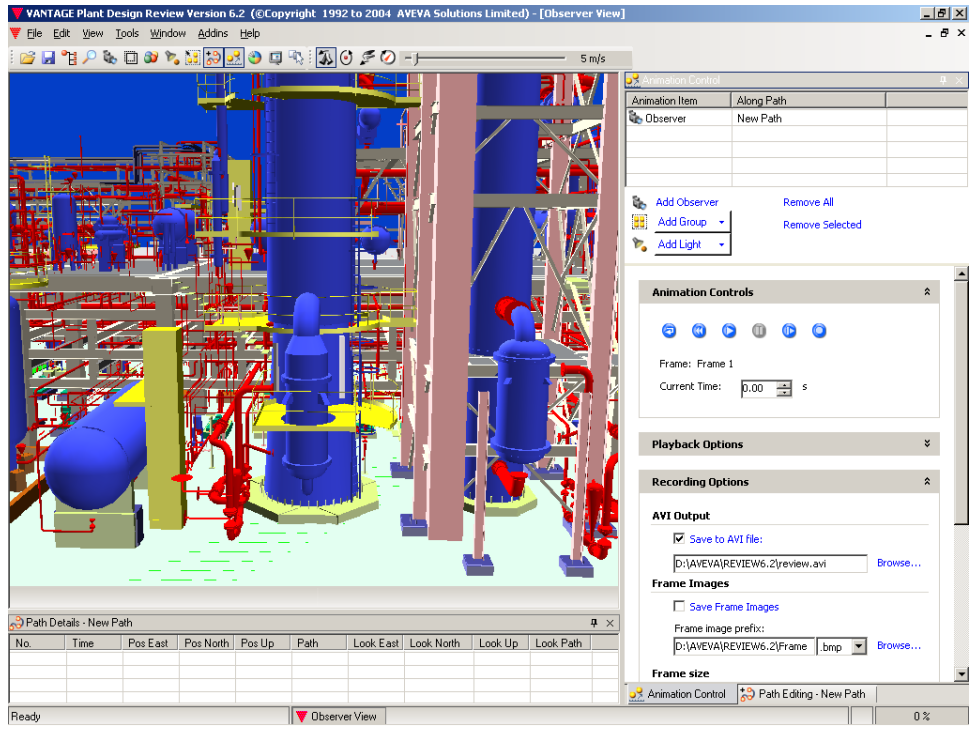

Piping
Editing Specification sp300 - Component Type = VALV
Name: Search/Replace...
Selected Items: Modify...
Select: Clear
Component Generic Types VALV
Select Specification...
NAME PROR SHOP STYP CATREF Description
L VALVE DIN3202
CADCENTRE PDMS Design - Beams & Columns Application - [3D View (1)]
Routing Rules
Control Create Modify Delete
Current Rule World: /ROUTER_RLWL
Current Rule Set: /ROUTER_HIGH
Description
Gate valves must not point down
Control Valves shall be a minimum of 610 mm above floor or platform
Control Valves shall be a minimum of 4000 mm UP
Olets have to be 3 times bore from previous element
Olets have to be 3 times bore from next element
HOME
EXIT


CADCENTRE PDMS Design - HVAC Designer Application
Design Display Query Settings Utilities Create Modify Delete Position Orientate Window Help
No list
TUTORIAL
Rectangular Reduced Bend
Modify
Design Model /RRBEND item
Duct width AA 500
Transpose width / depth
Duct depth AB 1000
Angle 90
Inside Radius 0.5
Arrive Extension 50
Leave Extension 50
Arrjoint Prev FJ7550
Leajoint Choose FJ7550
Leave Direction 0
Unchanged
Picture...
Defaults
Fit
Apply
Dismiss
n4e9d Parallel Model Rot
S W N E S
3D View [2]
Navigate
Members
Control GoTo Drawlist
STIF HVAC2-B1/ITEM3
STIF HVAC2-B1/ITEM3
STIF HVAC2-B1/ITEM3
TP HVAC2-B1/ITEM3
BRNCH HVAC2-B1/ITEM3
STIF HVAC2-B1/ITEM4
SPLR HVAC2-B1/ITEM4
OPST HVAC2-B1/ITEM5
STIF HVAC2-B1/ITEM5
STIF HVAC2-B1/ITEM5

Pipe Supports







Civil, Structure, Architecture, HVAC Department

Civil Department

- Civil
  - ✓ Site preparation
  - Underground
    - Pit
      - Valve pit
      - Equipment pit
      - Process pit

Civil Department

- Civil
  - ✓ Site preparation
  - Underground
    - ✓ Pit
    - ✓ Cable trench
    - ✓ Drainage pipe and channels
    - ✓ Duct bank
    - Man hole & catch basin

Civil Department

- Civil
  - ✓ Site preparation
  - ✓ Underground
  - Foundations

Civil Department

- ✓ Civil
- Structure
  - ✓ Steel
  - ✓ Concrete
  - Building
    - Blast proof
    - Non- blast proof

Civil Department

- ✓ Civil
- ✓ Structure
- ✗ HVAC
- Architecture
  - Building
    - Industrial
      - Blast proof
      - Non blast proof

Civil Department

- ✓ Civil
- ✓ Structure
- ✗ HVAC
- Architecture
  - Building
    - ✓ Industrial
    - Non-industrial

Civil Department

- ✓ Civil
- ✓ Structure
- ✗ HVAC
- ✓ Architecture
- MTO and Cost Estimation
  - Preparing MTO & tender documents
  - Marketing and proposal

Civil Department

- ✓ Civil
- ✓ Structure
- ✗ HVAC
- ✓ Architecture
- ✓ MTO and Cost Estimation
- Field Engineering Services

Activities List

- Part I: Engineering

Activities List

- Part I: Engineering
  - ✓ Specifications
  - ✓ Data sheet (HVAC)
  - Calculation (civil, structure,…)
    - Loading
    - Analysis
      - Design softwares
        - STAAD PRO, STAAD III
        - SAFE
        - SAP 2000
        - ETABS 2000

Activities List

- Part I: Engineering
  - ✓ Specifications
  - ✓ Data sheet (HVAC)
  - Calculation (civil, structure,…)
    - ✓ Loading
    - ✓ Analysis
    - Design

Activities List

- Part I: Engineering
  - ✓ Specifications
  - ✓ Data sheet (HVAC)
  - Calculation (civil, structure,…)
    - ✓ Loading
    - ✓ Analysis
    - ✓ Design
    - ✓ Calculation note
    - Drawing (Auto cad)

Activities List

- Part I: Engineering
  - ✓ Specifications
  - ✓ Data sheet (HVAC)
  - ✓ Calculation (civil, structure,…)
  - Drawings (AutoCAD)
    - Layout (architecture, HVAC, civil)
    - Detail drawings (architecture, civil, structure)

Activities List

- Part I: Engineering
  - ✓ Specifications
  - ✓ Data sheet (HVAC)
  - ✓ Calculation (civil, structure,…)
  - ✓ Drawings (AutoCAD)
  - ✓ PDMS Modeling
  - X steel

Activities List

- Part II: Procurement Services
  - ✓ Material take off
  - ✓ Tender documents (civil work, piling)
  - ✓ Installation tender
  - ✓ Inquiry documents (steel structure, bolt and nut, anchor bolt)
  - ✓ Technical bid analysis
  - Vendor documents review

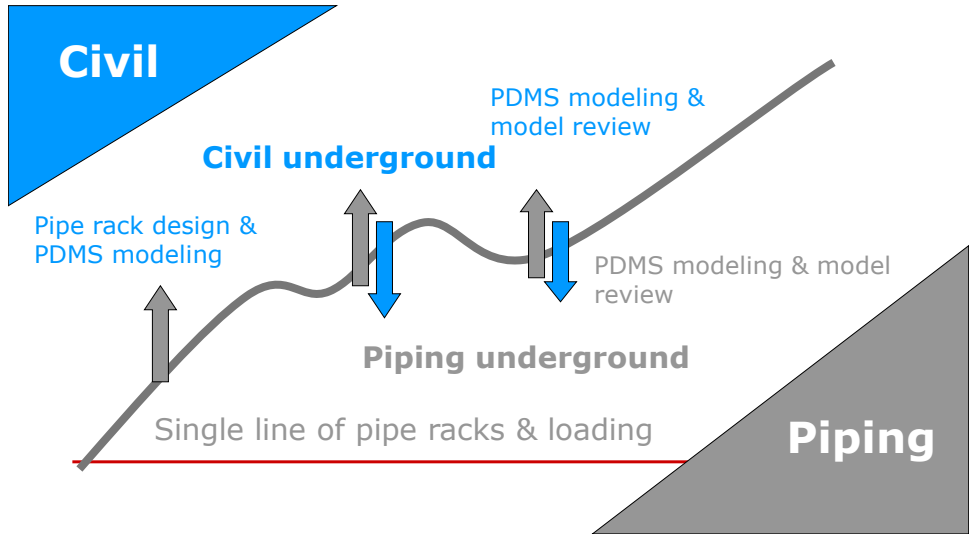
Activities List

- Part III: Other Discipline Document Review
  - ✓ Plot plan
  - ✓ Equipment list
  - ✓ Single line for pipe racks
  - ✓ Loading for pipe racks
  - ✓ Mechanical drawing (machinery, fix)
  - ✓ Instrument drawing
  - ✓ Electrical drawing
  - ✓ Safety drawings
  - ✓ Telecommunication drawings
  - PDMS model review

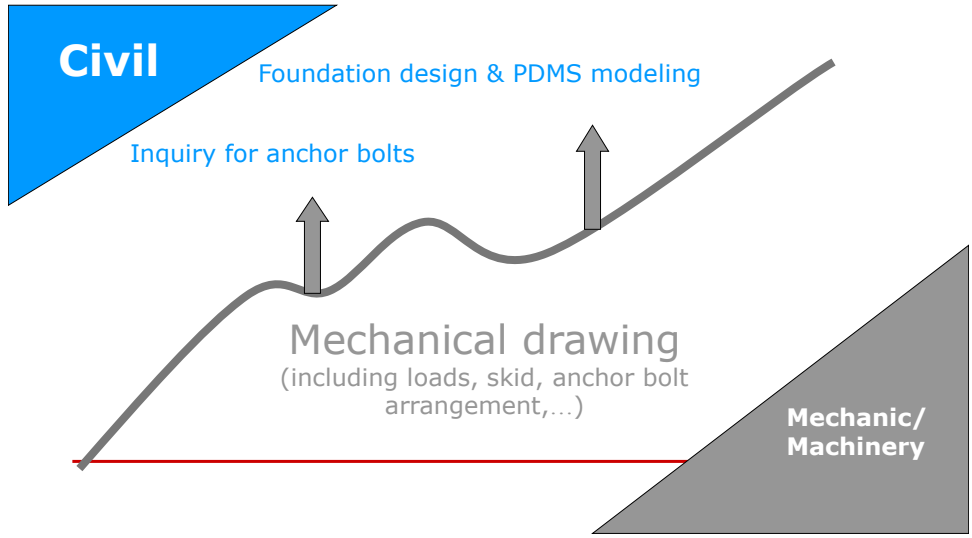
Interfaces with Other Disciplines

- Piping
- Mechanical
- Machinery
- Instrument
- Electrical
- Safety
- Telecommunication

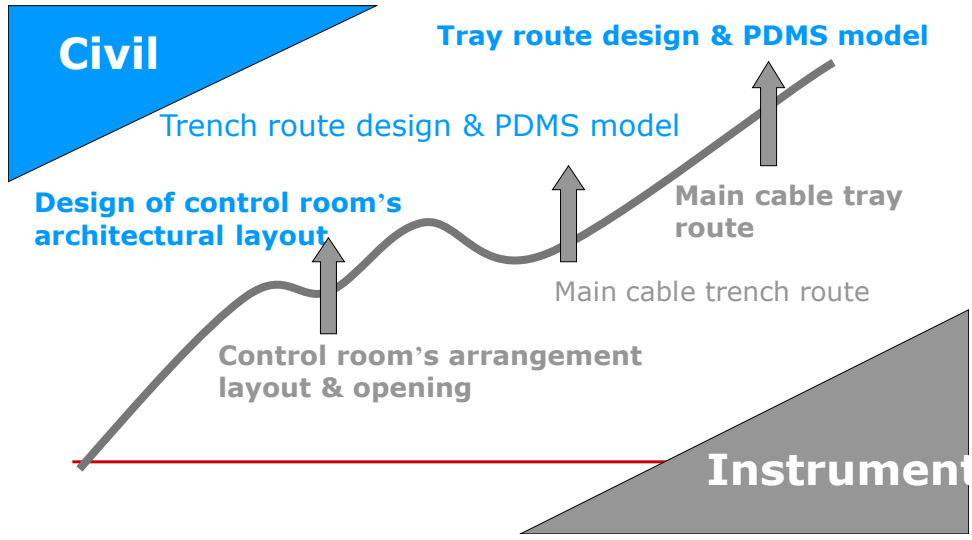
Interfaces with Other Disciplines



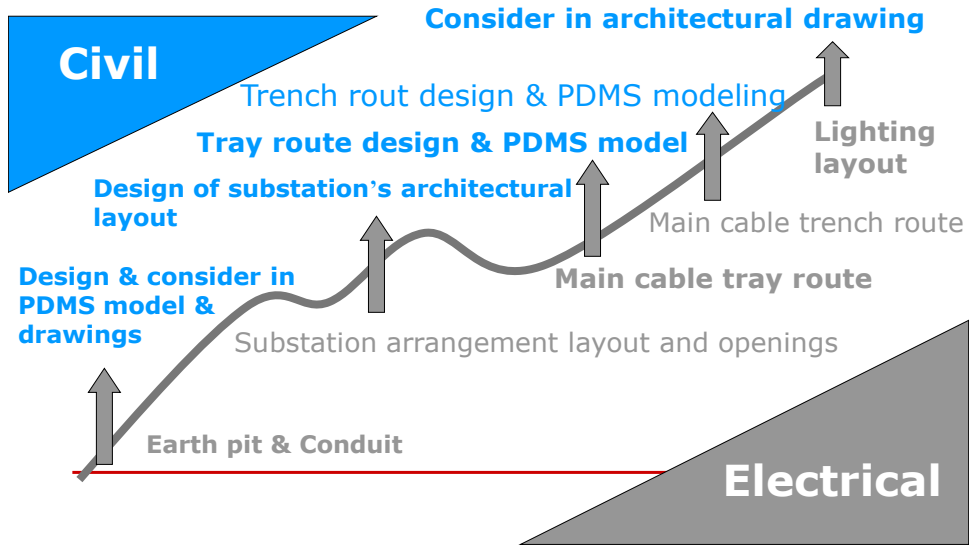
Interfaces with Other Disciplines



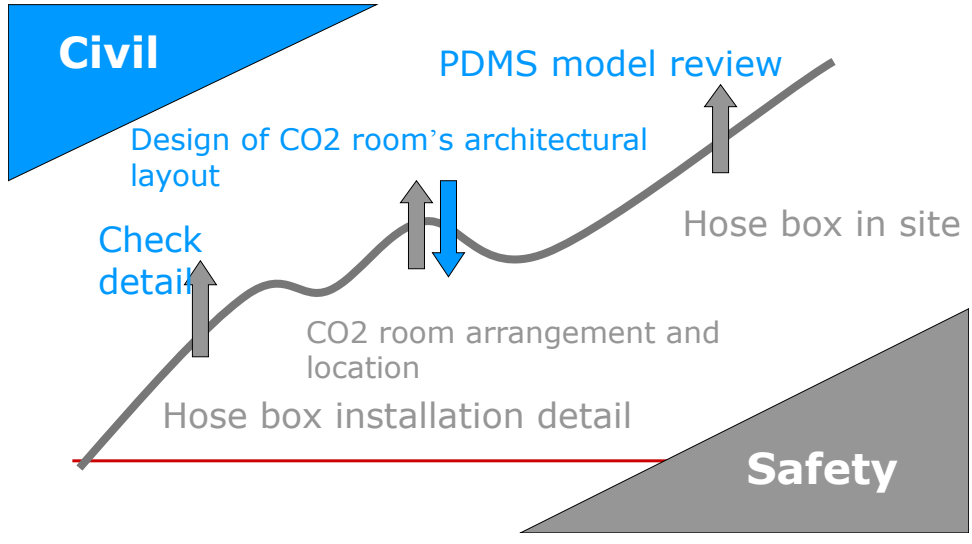
Interfaces with Other Disciplines



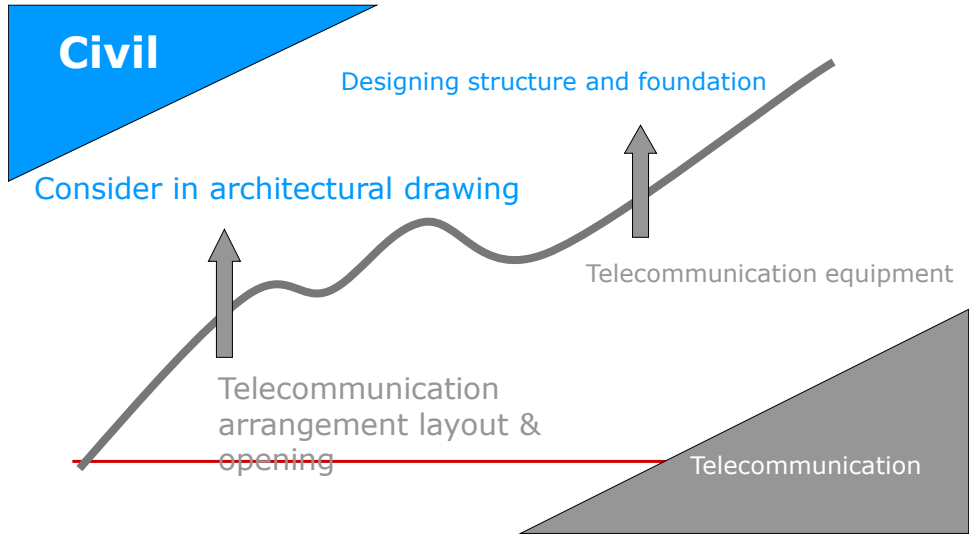
Interfaces with Other Disciplines



Interfaces with Other Disciplines



Interfaces with Other Disciplines



Electrical & Telecommunication

Content

- Content
- Organization Chart
- Activities
- Interface With Other Department

Activities list

- Part 1 : Engineering
  - **Basic**
    - ✓ **Electrical Design philosophy**
    - ✓ **Consumer Lists**
    - ✓ **Calculation Notes**
    - ✓ **Specifications**
    - ✓ **Single Line Diagrams**
    - ✓ **Arrangement & Routing**

Activities list

Part 1 : Engineering

- **Basic**
- **Detail**
  - ✓ Calculation Notes
  - ✓ Data Sheets
  - ✓ Drawings
  - ✓ Electrical Equipment Arrangement
  - ✓ Installation Details
  - ✓ Material Take Off

Activities list

Part 2 : Procurement services

- ✓ Material Requisition
- ✓ Technical Bid Analysis
- ✓ **Vendor Document Checking**
- ✓ **Factory Acceptance Test**

Activities list

- **Part 3 : Proposals**
  - ✓ **ITB Review**
  - ✓ **M.T.O.**
  - ✓ **Man hour Estimation**

Interfaces with the other disciplines

- **Process/Safety**
- **Civil**
- **Piping**
- **Instrument**
- **Machinery & Mechanical**

Interface with Process/Safety

Process/Safety

- Design Safety Philosophy
- Hazard Study Report
- Fire Fighting And Safety
- Process Flow Diagram
- Shutdown Philosophy
- Piping & Instrumentation Diagram
- Electrical Load List
- Hazardous Materials Schedule

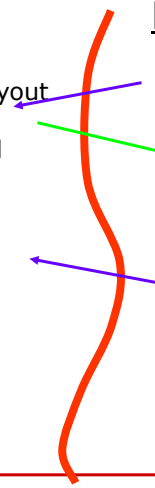
Electrical & Telecom.

- Hazardous Area Classification

Interface with Piping

Piping

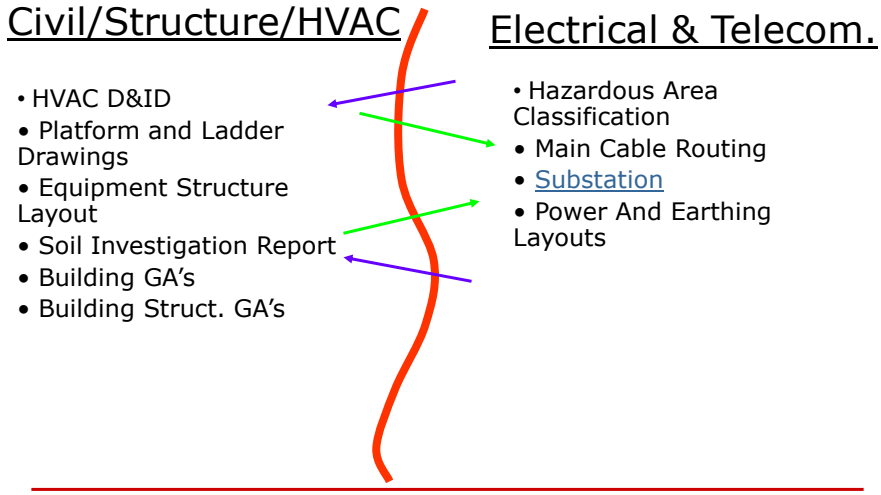
- Plot Plan and Plant Layout Design
- Piping Design / Model



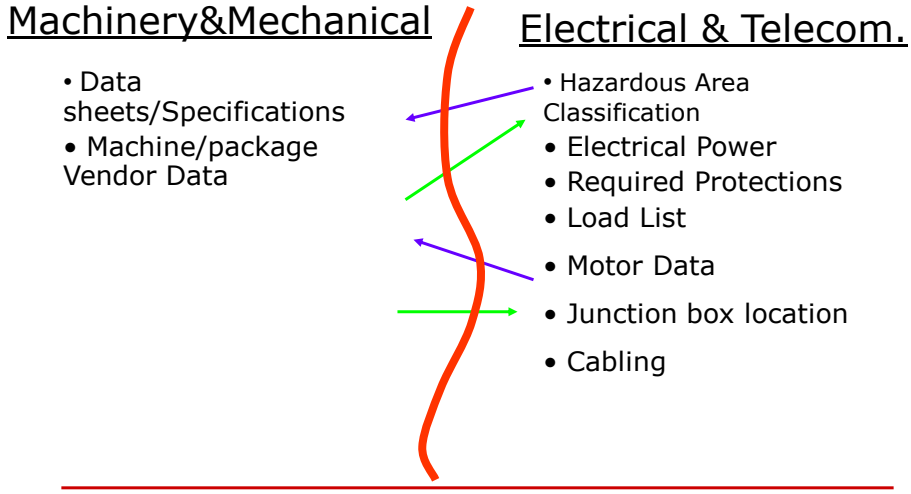
Electrical & Telecom.

- Hazardous Area Classification
- Main Cable Routing
- Power And Earthing Layout

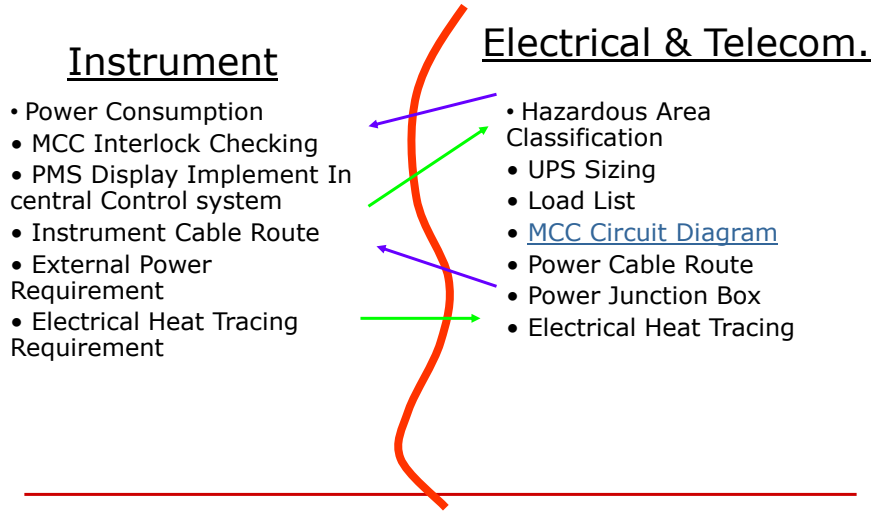
Interface with Civil



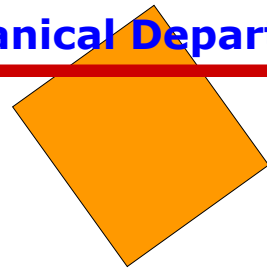
Interface with Machinery



Interface with Instrument



Mechanical Department



Activities

- Activities Related to Marketing Projects
- Basic/Detail Engineering and Engineering Procurement Services (Main Activity of Mech. Dep.)
- INSPECTION
- ISO Related Activities
- Holding Training Courses

Mechanical Department

Mechanical Department is involved with 4 main groups of fixed equipment:

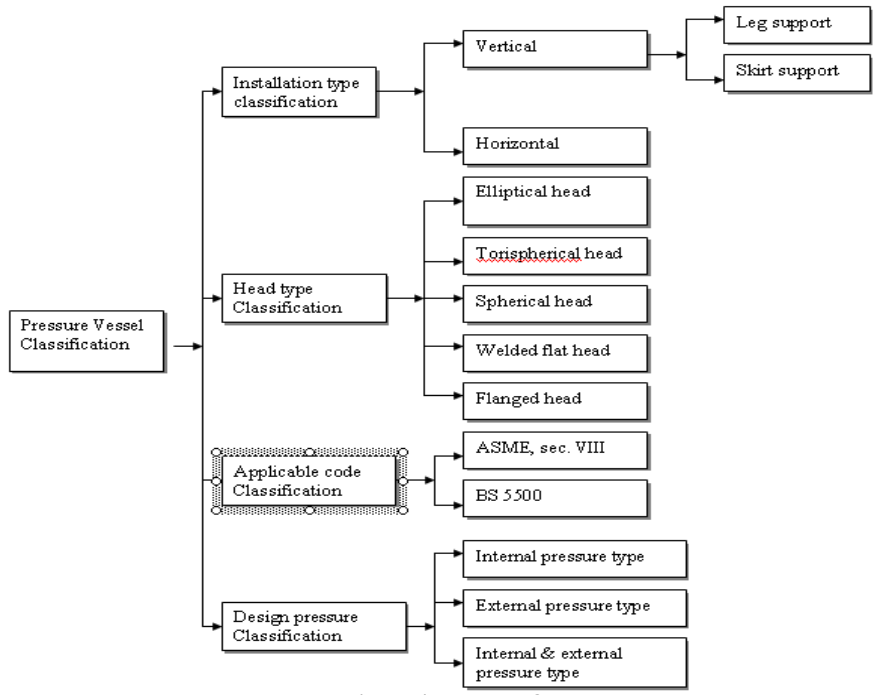
- **Pressure Vessels**
- **Storage Tanks**
- **Silos**
- **Heat Exchangers (Including Shell &Tube H.E., Air Coolers, Plate Type, Spiral,…)**

Mechanical Fixed Equipment

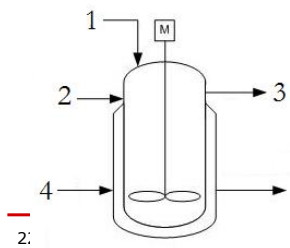
- **Pressure Vessels:**
- **Drums:**

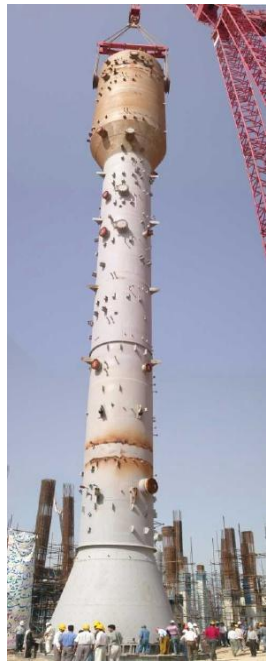
- Stainless Steel Drums
- Carbon Steel Drums
- Special Materials Drums

Supply of All Special internals by others



- **Pressure Vessels:**
- **Reactors:**
- - Stainless Steel
- - Carbon Steel
- - Special Materials
- Supply of All Special internals by others

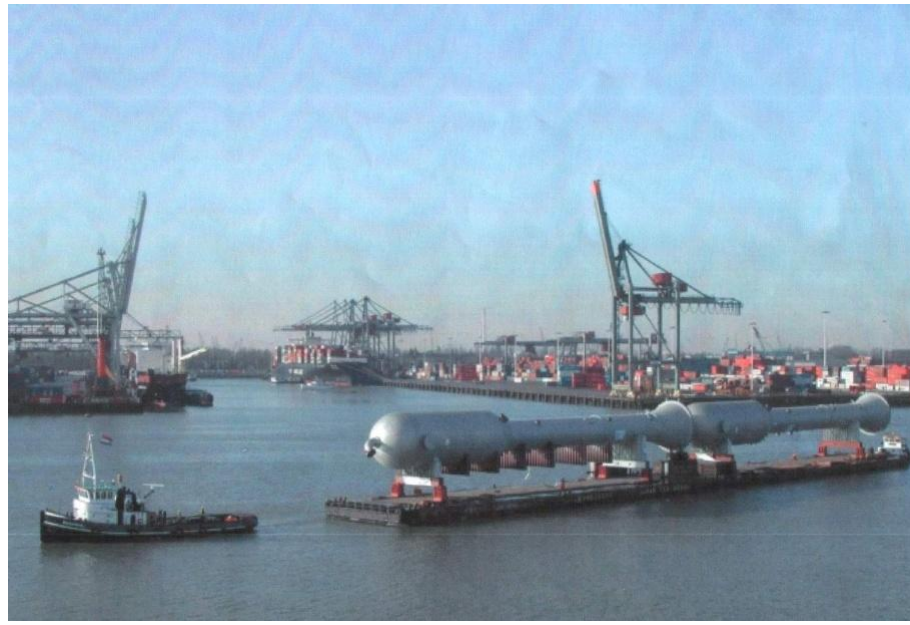




Mechanical Fixed Equipment

- **Pressure Vessels:**
- **Columns/Towers:**

Supply of column internals by others

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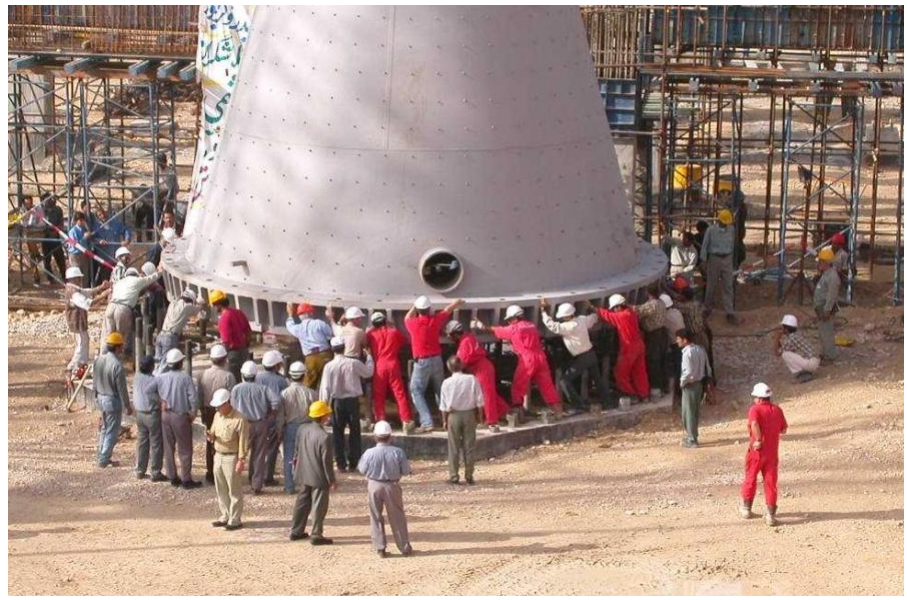
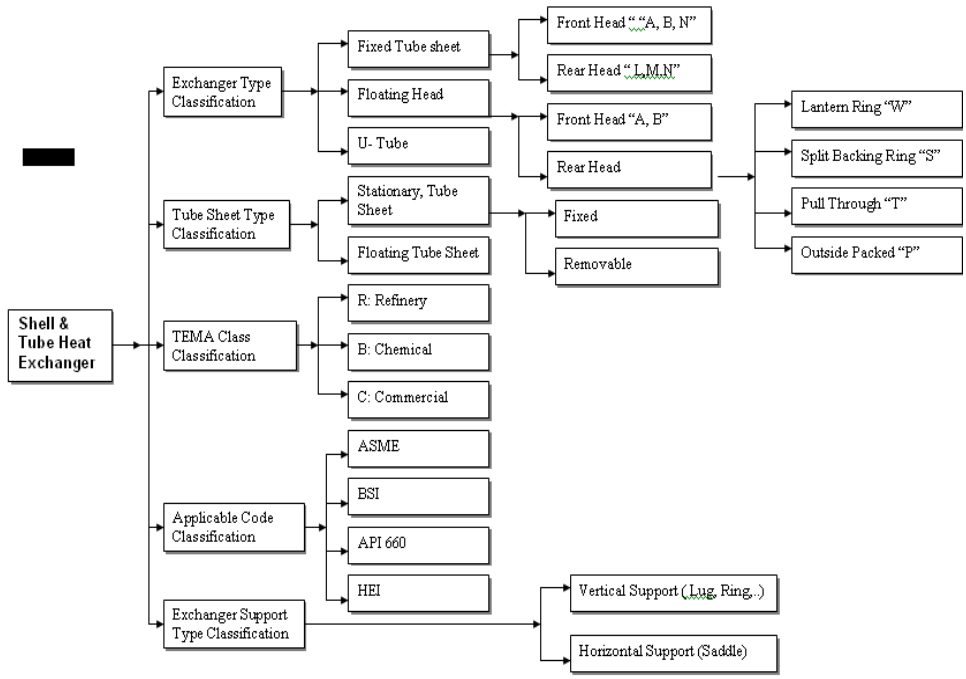
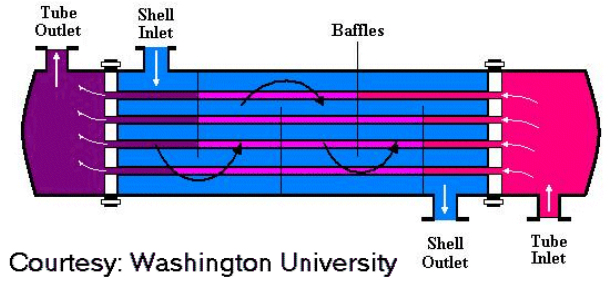


Spherical Storage Tank

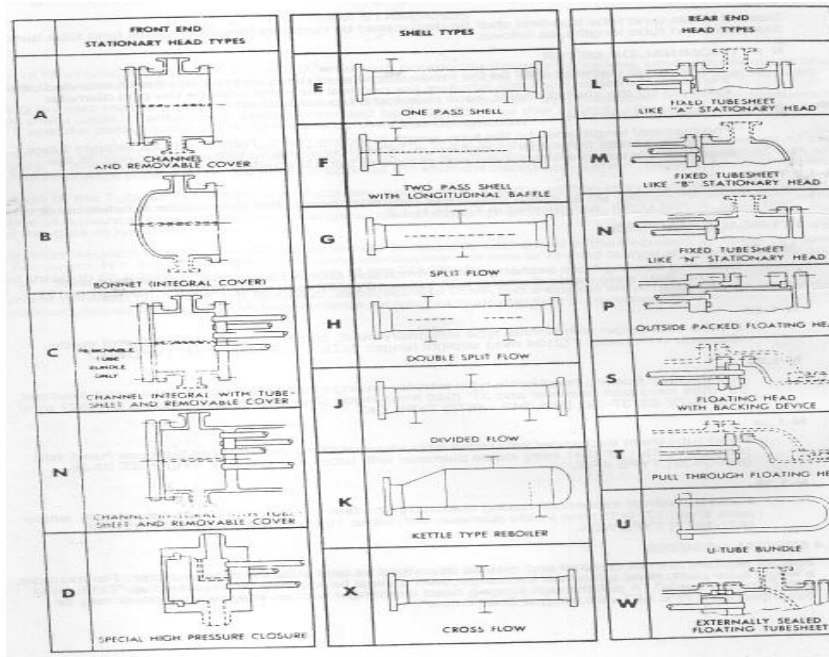

Shell & Tube Heat Exchanger
Exchanger Type Classification
Fixed Tube sheet
Floating Head
U- Tube
Front Head " "A, B, N"
Rear Head " L,M,N"
Front Head "A, B"
Rear Head
Lantern Ring "W"
Split Backing Ring "S"
Pull Through "T"
Outside Packed "P"
Tube Sheet Type Classification
Stationary, Tube Sheet
Floating Tube Sheet
Fixed
Removable
TEMA Class Classification
R: Refinery
B: Chemical
C: Commercial
Applicable Code Classification
ASME
BSI
API 660
HEI
Exchanger Support Type Classification
Vertical Support (Lug, Ring..)
Horizontal Support (Saddle)

Shell & Tube Heat Exchangers

- مبدل های حرارتی دستگاه های‌ی هستند که به کمک آنها می توان در اثر تماس غی‌ر مستقی‌م دو سی‌ال، سی‌الی را گرم ی‌ا سرد نمود.



Courtesy: Washington University



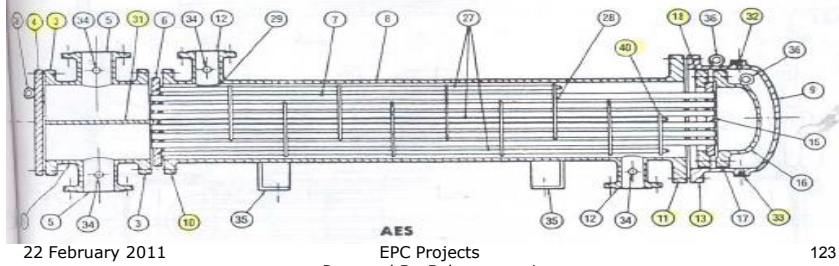
N-2 NOMENCLATURE OF HEAT EXCHANGER COMPONENTS

For the purpose of establishing standard terminology, Figure N-2 illustrates various types of heat exchangers. Typical parts and connections, for illustrative purposes only, are numbered for identification in Table N-2.

TABLE N-2

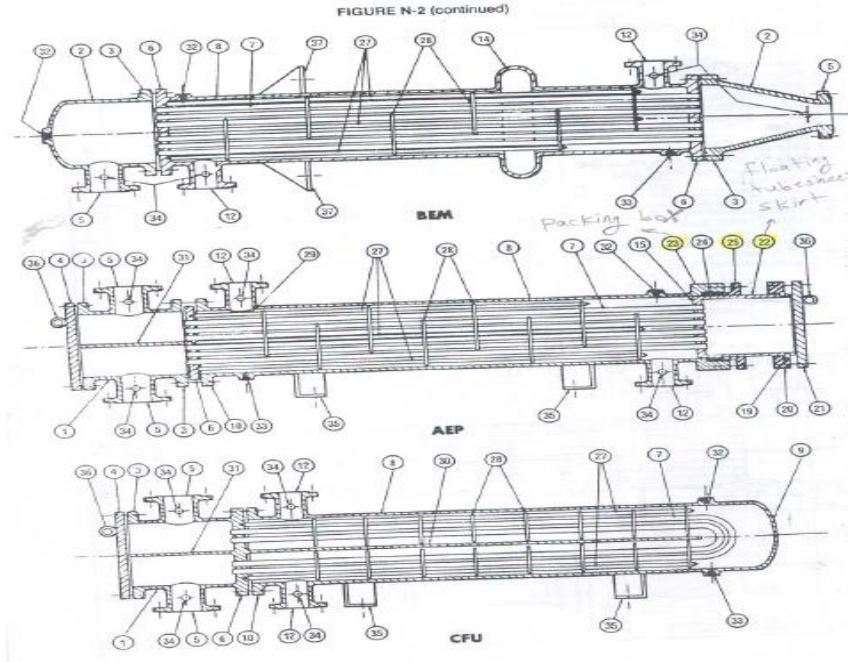
1. Stationary Head-Channel
2. Stationary Head-Bonnet
3. Stationary Head Flange-Channel or Bonnet
4. Channel Cover
5. Stationary Head Nozzle
6. Stationary Tubesheet
7. Tubes
8. Shell
9. Shell Cover
10. Shell Flange-Stationary Head End
11. Shell Flange-Rear Head End
12. Shell Nozzle
13. Shell Cover Flange
14. Expansion Joint
15. Floating Tubesheet
16. Floating Head Cover
17. Floating Head Cover Flange
18. Floating Head Backing Device
19. Split Shear Ring
20. Slip-on Backing Flange
21. Floating Head Cover-External
22. Floating Tubesheet Skirt
23. Packing Box
24. Packing
25. Packing Gland
26. Lantern Ring
27. Tierods and Spacers
28. Transverse Baffles or Support Plates
29. Impingement Plate
30. Longitudinal Baffle
31. Pass Partition
32. Vent Connection
33. Drain Connection
34. Instrument Connection
35. Support Saddle
36. Lifting Lug
37. Support Bracket
38. Weir
39. Liquid Level Connection
40. Floating Head Support

FIGURE N-2



AES

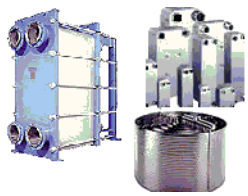
FIGURE N-2 (continued)

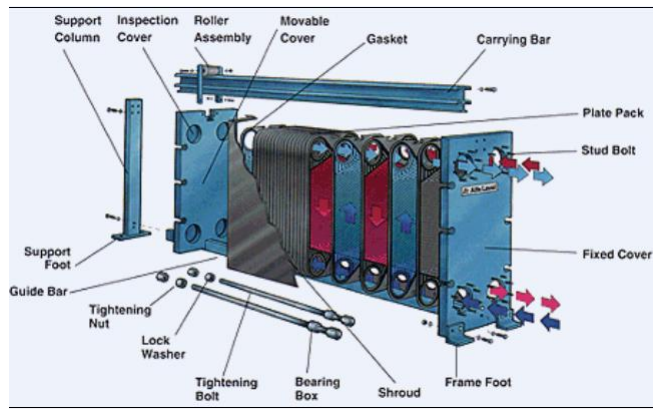



Different Types of Heat Exchangers

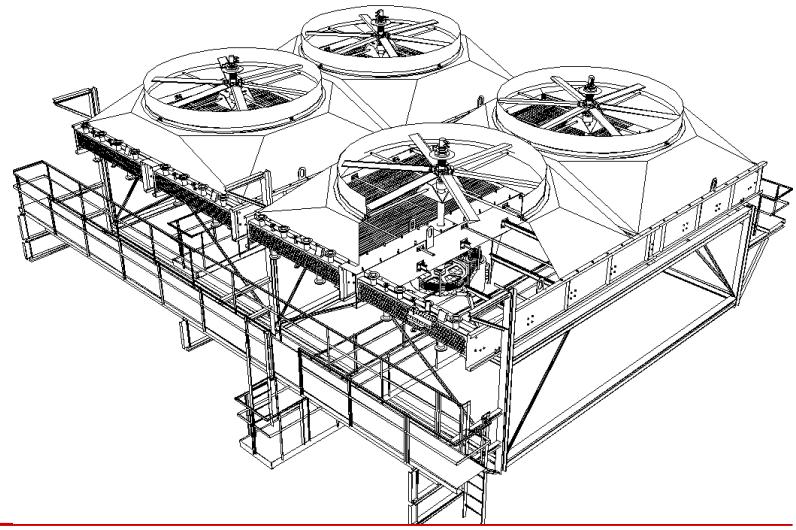
Kettle Type H.Exchangers

Plate Type H.Exchangers





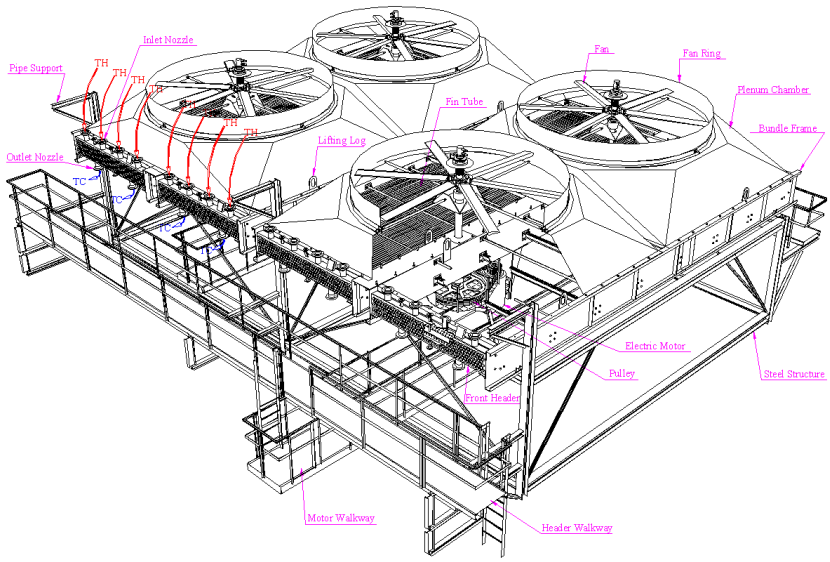
❑ آشنائی مقدماتی با کولرهای هوائی

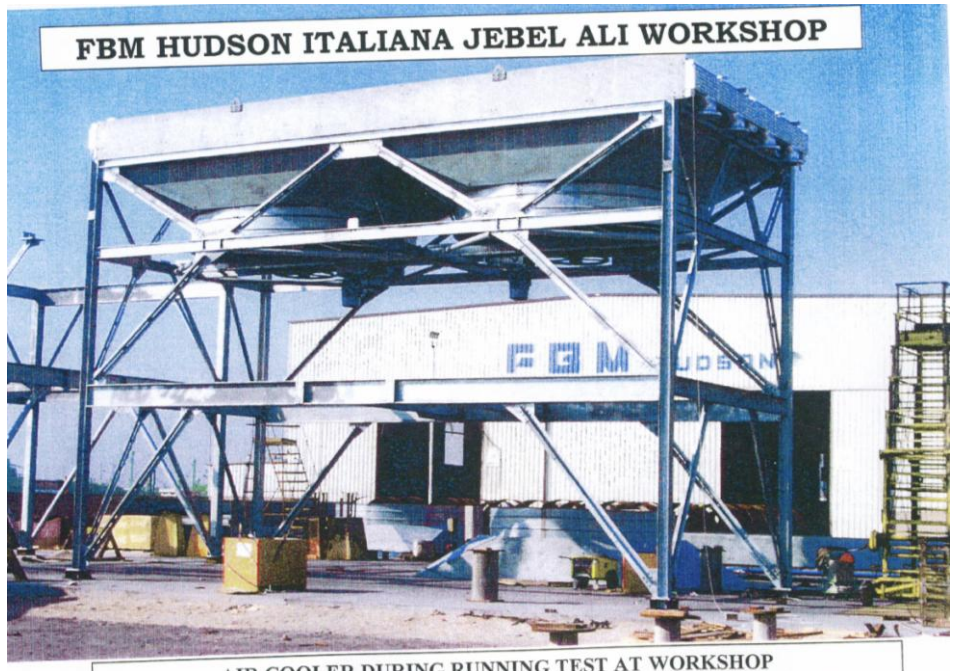


مقایسه کولرهای هوائی و مبدل های حرارتی لوله و پوسته

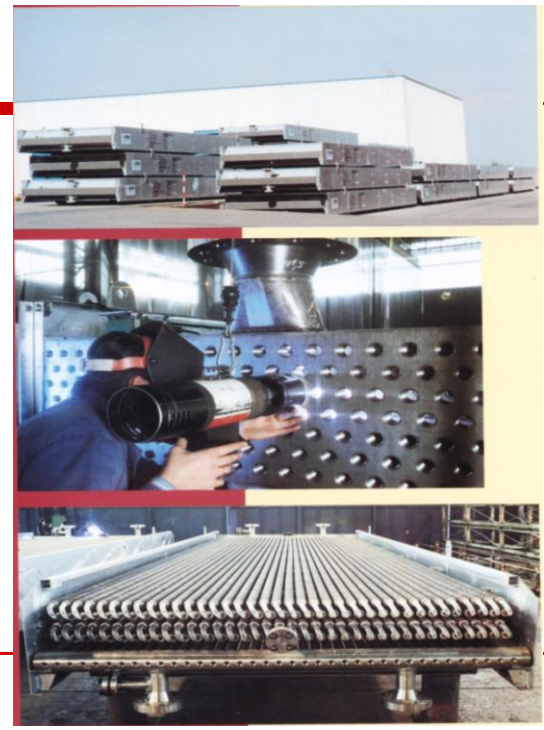
موارد	نکات
قابلیت دسترسی به ماده خنک کننده	هوا با کمیت نامحدود همیشه در دسترس است
انتخاب محل دستگاه	در استفاده از هوا به عنوان خنک کننده، انتخاب نامحدود است ولی دستگاه با خنک کننده آبی باید با منبع آب منطبق باشد.
انتخاب موقعیت کولر	اگر امکان گردش هوا نباشد، کولرهای هوائی در ساختارهای بزرگی از قبیل ساختمان ها و سازمان های زنجیره ای بزرگ نمی تواند نصب شود. موقعیت مبدل پوسته و لوله (آبی) کمترین محدودیت را دارد.
فضا (فقط برای کولر)	با وجود اینکه از فضای زیرین در کولرهای هوائی ممکن است برای تجهیزات و مخازن استفاده شود، فضای قابل ملاحظه بیشتری در آنها اشغال می شود.
خرابی دستگاه	خنک کننده آبی در وضعیت خرابی کاملاً از سرویس خارج (Shut Down) می شود ولی در کولرهای هوائی بعضی از تمهیدات خنک کننده برقرار است.
اثر آب و هوا (جو)	دمای هوا سریع تر و با نوسانات بیشتری نسبت به آب تحت تأثیر خورشید و تغییرات جوی است در نتیجه کنترل و تست کردن آن سخت تر است. در بعضی از مناطق با زمستان سرد، طراحی با دقتی مضاعف برای جلوگیری از انجماد سیالات مورد نیاز است.

- شناسایی قطعات اصلی





AIR COOLER DURING RUNNING TEST AT WORKSHOP
PROJECT - TECHNIP / ARAMCO – HARADH GAS PLANT, SAUDI ARABIA



Storage Tanks

Storage Tanks are usually classified according to their design code as follows:

1- API-650 Tanks

1.1- Floating Roof (Internal or External Floating Roof)

1.2- Fixed Roof (Supported Roofs and Self-Supported Roofs)

2- API-620 Tanks

2.1- Single Wall (Supported Roofs and Self-Supported Roofs)

2.2- Double Wall

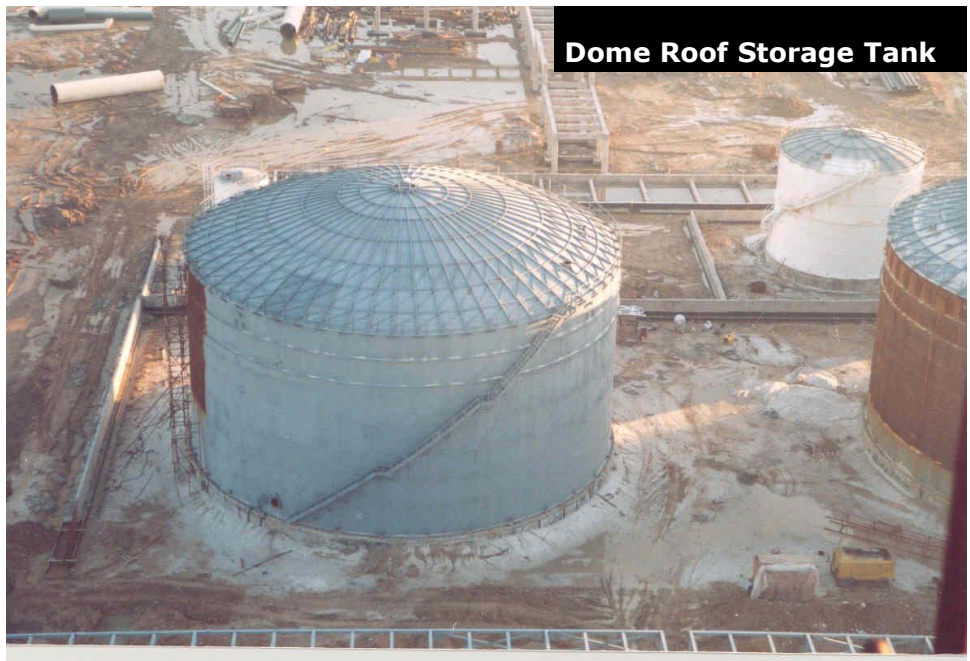
3- BS-7777 Tanks

3.1- Single Containment

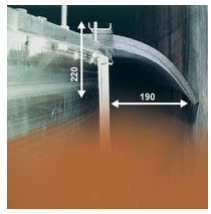
3.2- Double Containment

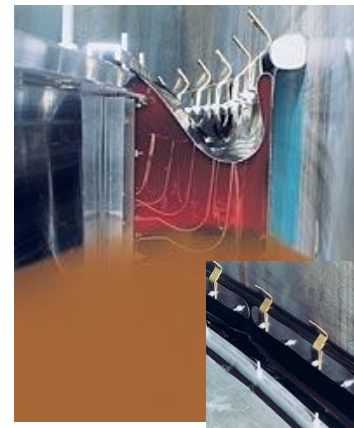
3.3- Full Containment

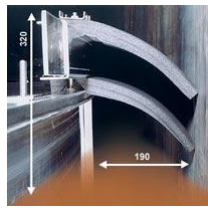

Cone Roof Storage Tanks

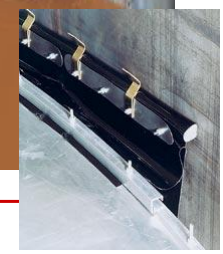

Dome Roof Storage Tank

Sealing of Floating Roof Tank

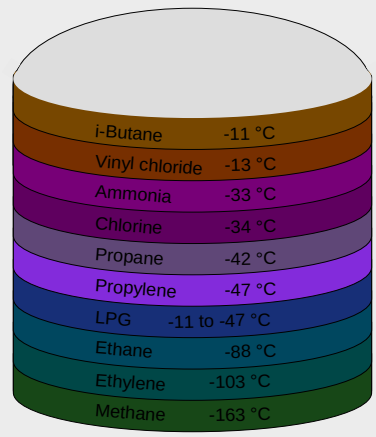








Liquefied gases with evaporating temperatures*

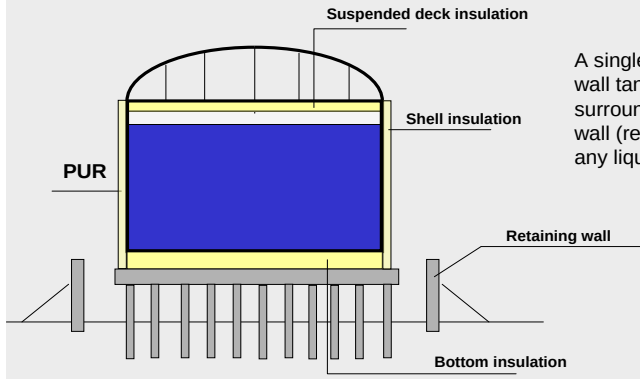


* at ambient pressure

A company of ThyssenKrupp Technologies Uhde

ThyssenKrupp

Single containment



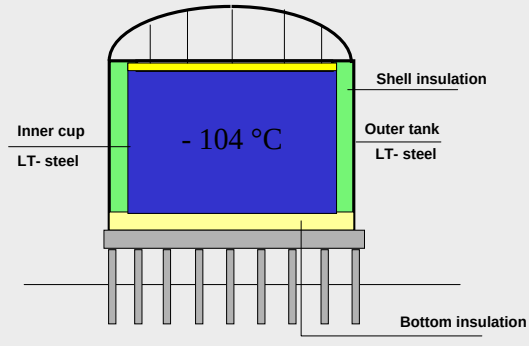
A single containment is a single wall tank and has to be surrounded by a low bund wall (retaining wall) to contain any liquid leakage

A company of ThyssenKrupp Technologies Uhde

ThyssenKrupp

Prepared By:Bahmanzangi

Double containment



The inner cup and the outer tank have been designed to store the cold liquid.

In the event of failure of the inner cup, the liquid will be kept in the outer tank.

The outer tank will also accommodate the insulation. In the case of leakage the outer tank could not keep the gas product when being heated by the contact with the outer tank.

Stored liquid: Ethylene at -104 °C

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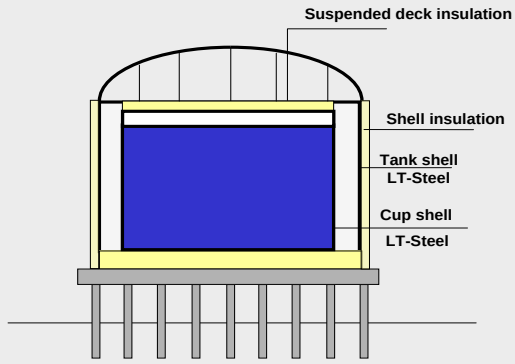
ThyssenKrupp

Prepared By:Bahmanzangi

Full containment



With regard to the cup in tank system a non-polluting storage tank with insulated collecting space has been developed.

In the event of failure of the inner cup, the outer tank can accommodate the product so that no liquid or gaseous product comes into contact with the atmosphere.

Stored liquid: Toxic liquids like ammonia at -33 °C

A company of ThyssenKrupp Technologies Uhde

ThyssenKrupp

Prepared By:Bahmanzangi

Silos


Silos

Silos' Vendor selection

- Manufacturer with Reliable Technology for Aluminum Equipments

  - Zeppelin Germany
  - Ellimetal Belgium
  - Jansens & Dieperink Netherland


Prefabricated Materials


Fabrication
85t Crane
250t Crane


Site Fabrication
Time Duration for Site Fabrication
Plan 9 Months (based on Initial Plan with Foreign Welders)
Actual 12 Months (with employing Iranian Welders and site unexpected events)

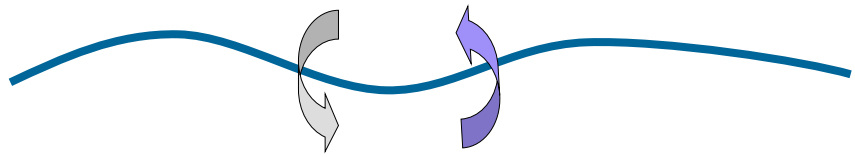

SITE TRANSPORTATION
Globetrotter


KATO

Interfaces Between Mechanical Eng. Dep. and Other Disciplines

Mechanical Dep.

Mechanical Spec.s, Equipment Weights, Mechanical DWG/ Data Sheets, Vendor Proposal, Vendor Documents



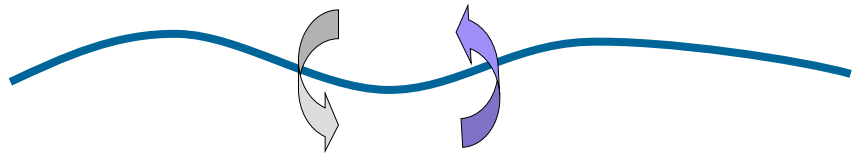
Foundation Plan, Steel Structure/Racks/Shelters, Equipment/ Equipment Foundation

Civil / Structure / Building

Interfaces Between Mechanical Eng. Dep. and Other Disciplines

Mechanical Dep.

Mechanical Spec.s, Mechanical DWG/ Data Sheets, Material Requisition Vendor Proposal, Vendor Documents



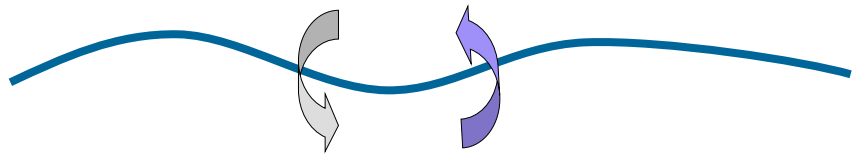
Design Spec., Data Sheet, Typical Detail Drawing, Nozzle Information Drawing, Control System Block Diag., Fire&Gas Detection System Diag.

Instrument

Interfaces Between Mechanical Eng. Dep. and Other Disciplines

Mechanical Dep.

Mechanical Spec.s, Mechanical DWG/ Data Sheets, Vendor Documents



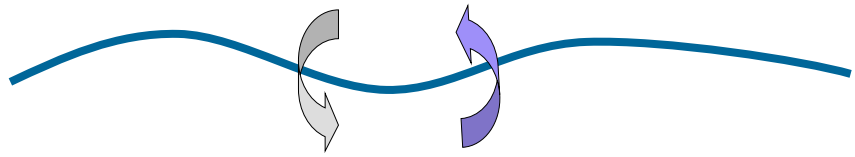
Data Sheets, Vendor Drawing

Machinery

Interfaces Between Mechanical Eng. Dep. and Other Disciplines

Mechanical Dep.

Mechanical Spec.s, Mechanical DWG/ Data Sheets, Vendor Proposal, Vendor Documents



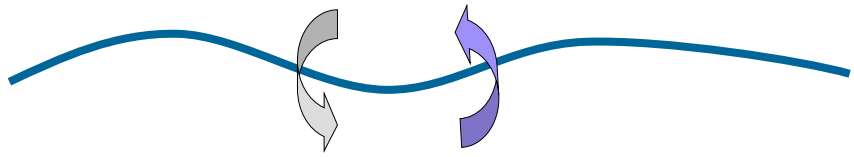
Unit Plot Plan, Steam Tracing Schedule, Ladder&Platform, Pipe Support List, Nozzle Orientation

Piping

Interfaces Between Mechanical Eng. Dep. and Other Disciplines

Mechanical Dep.

Mechanical Spec.s, Equipment Weights, Mechanical DWG/ Data Sheets, Material Requisition, Vendor Proposal, Vendor Document



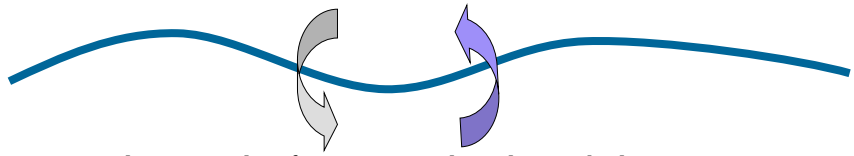
PFD, P&ID, Process Data Sheets, Process Design Basis, UFD, Safety Layouts & Drawing, Passive Fire Protection, Foam System P&ID, Fire Water P&ID

Process and Safety

Interfaces Between Mechanical Eng. Dep. and Other Disciplines

Mechanical Dep.

Mechanical Spec.s, Mechanical DWG/ Data Sheets, Material Requisition, Vendor Proposal, Vendor Documents



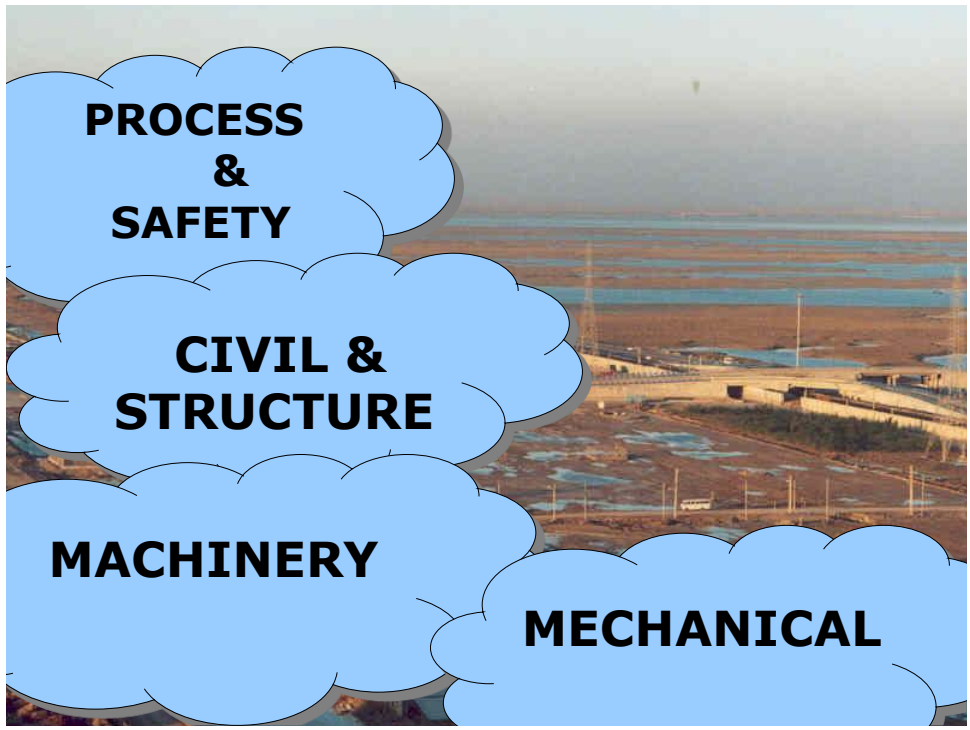
Hazardous Area Classification, Grounding Plan, Cathodic Protection System, Electrical Heat Tracing System, Overall Hazard Area Clarification

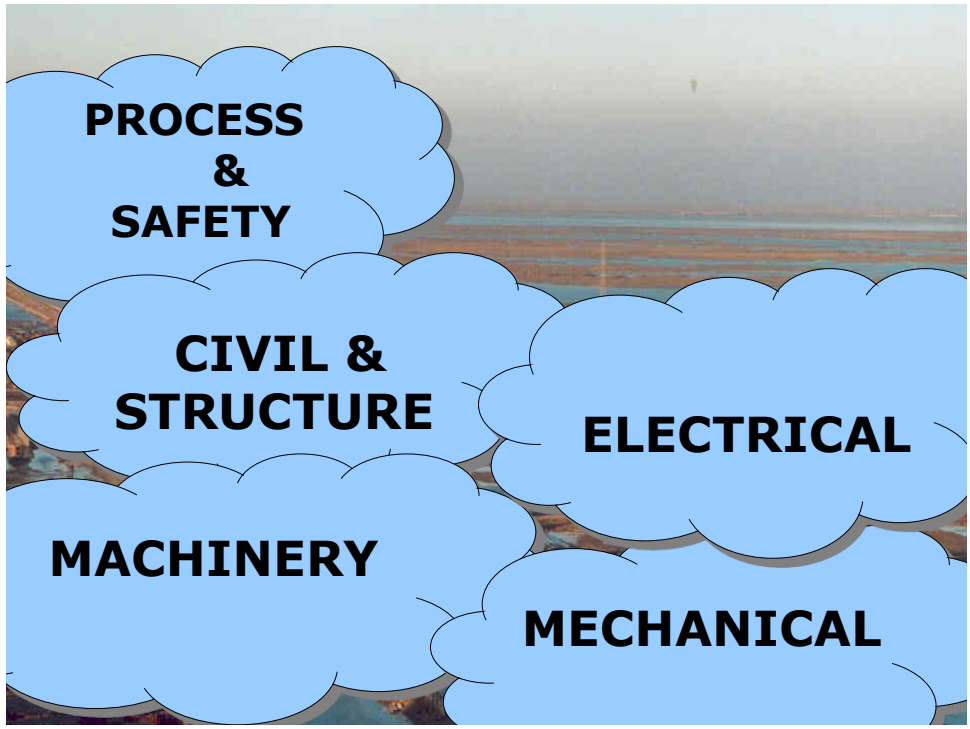
Electrical

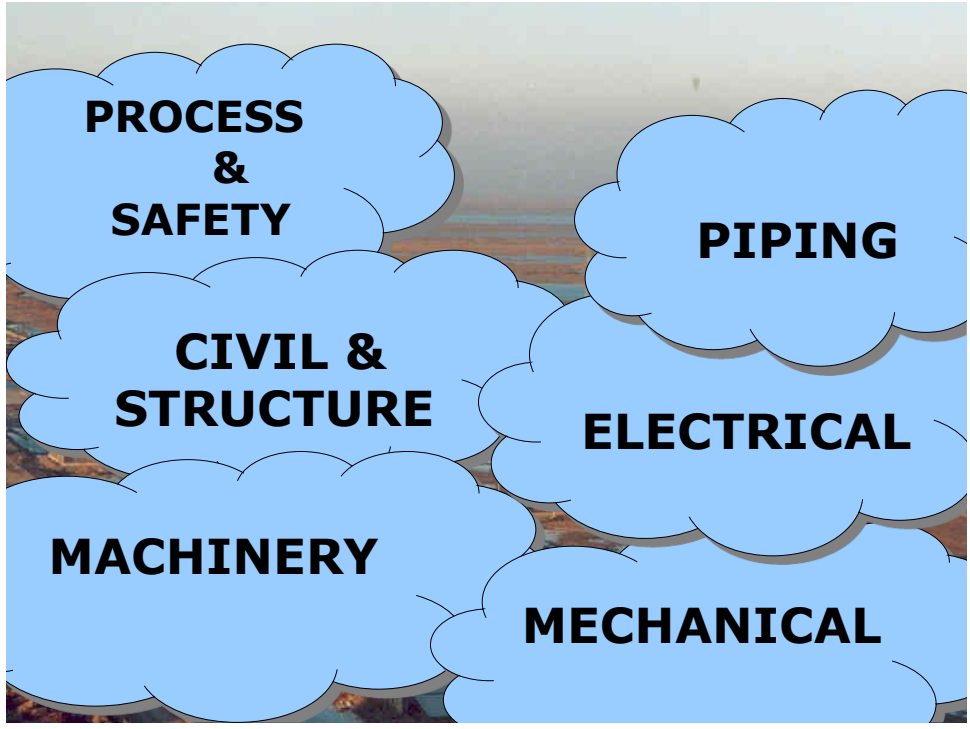

PROCESS
&
SAFETY

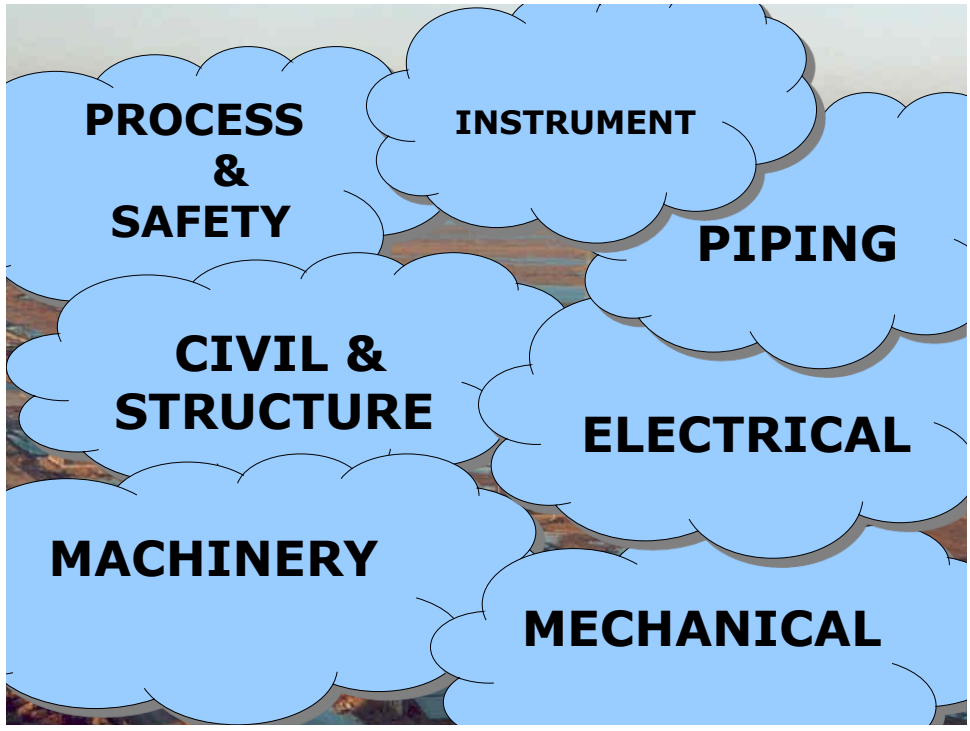

PROCESS
&
SAFETY
CIVIL &
STRUCTURE


PROCESS
&
SAFETY
CIVIL &
STRUCTURE
MACHINERY


PROCESS
&
SAFETY
CIVIL &
STRUCTURE
MACHINERY
MECHANICAL


PROCESS
&
SAFETY
CIVIL &
STRUCTURE
ELECTRICAL
MACHINERY
MECHANICAL


PROCESS
&
SAFETY
PIPING
CIVIL &
STRUCTURE
ELECTRICAL
MACHINERY
MECHANICAL


PROCESS
&
SAFETY
INSTRUMENT
PIPING
CIVIL &
STRUCTURE
ELECTRICAL
MACHINERY
MECHANICAL

با آرزوی توفیق برای کلیه همکاران