

An aerial photograph of a massive industrial construction project, likely a refinery or chemical plant. The site is filled with a complex network of steel scaffolding, pipes, and structural frameworks. Several large yellow tower cranes are positioned throughout the site, indicating ongoing heavy construction. In the foreground, there are some completed white industrial buildings. The ground is a mix of dirt and paved areas with various construction materials and equipment scattered around.

**HERVE  
BARON**

# The execution of a Complex Project...

**A guided tour**



## The actors

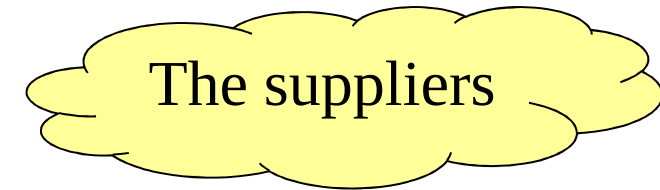


ExxonMobil



Saipem

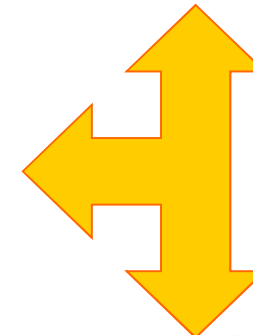
Technip



imagination at work



MITSUBISHI HEAVY INDUSTRIES  
COMPRESSOR CORPORATION



HEAVY INDUSTRIES



Consolidated Contractors Int. Co.



## The phases



Sanction

Sanction

Conceptual evaluation  
+ Pre-Project  
By COMPANY

Basic Engineering  
By ENGINEERING

Project Execution  
by EPC CONTRACTOR

Design



Procurement



Manufacturing



Shipping



Installation



Construction  
& erection



Inspection &  
tests

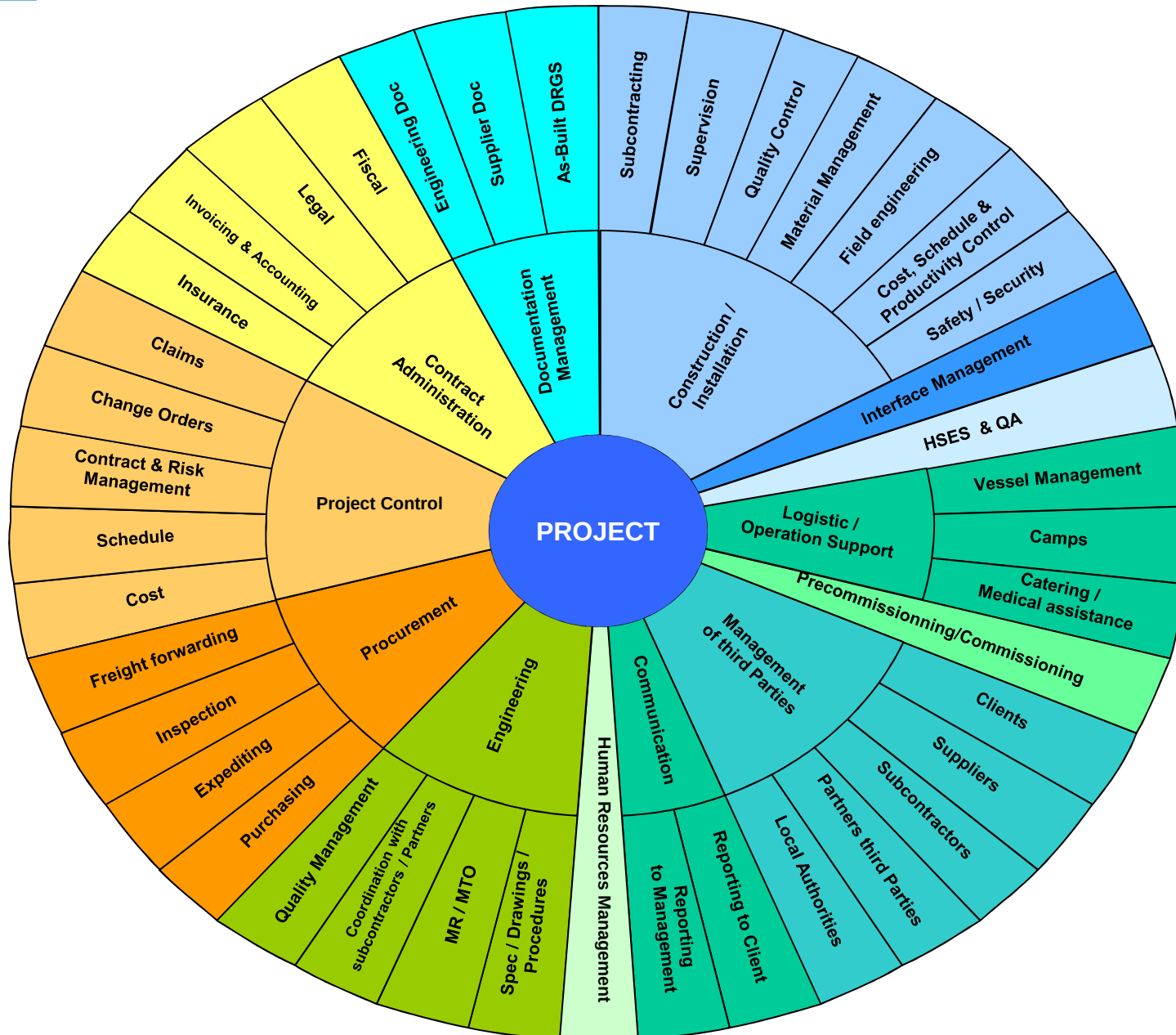


Hand-over



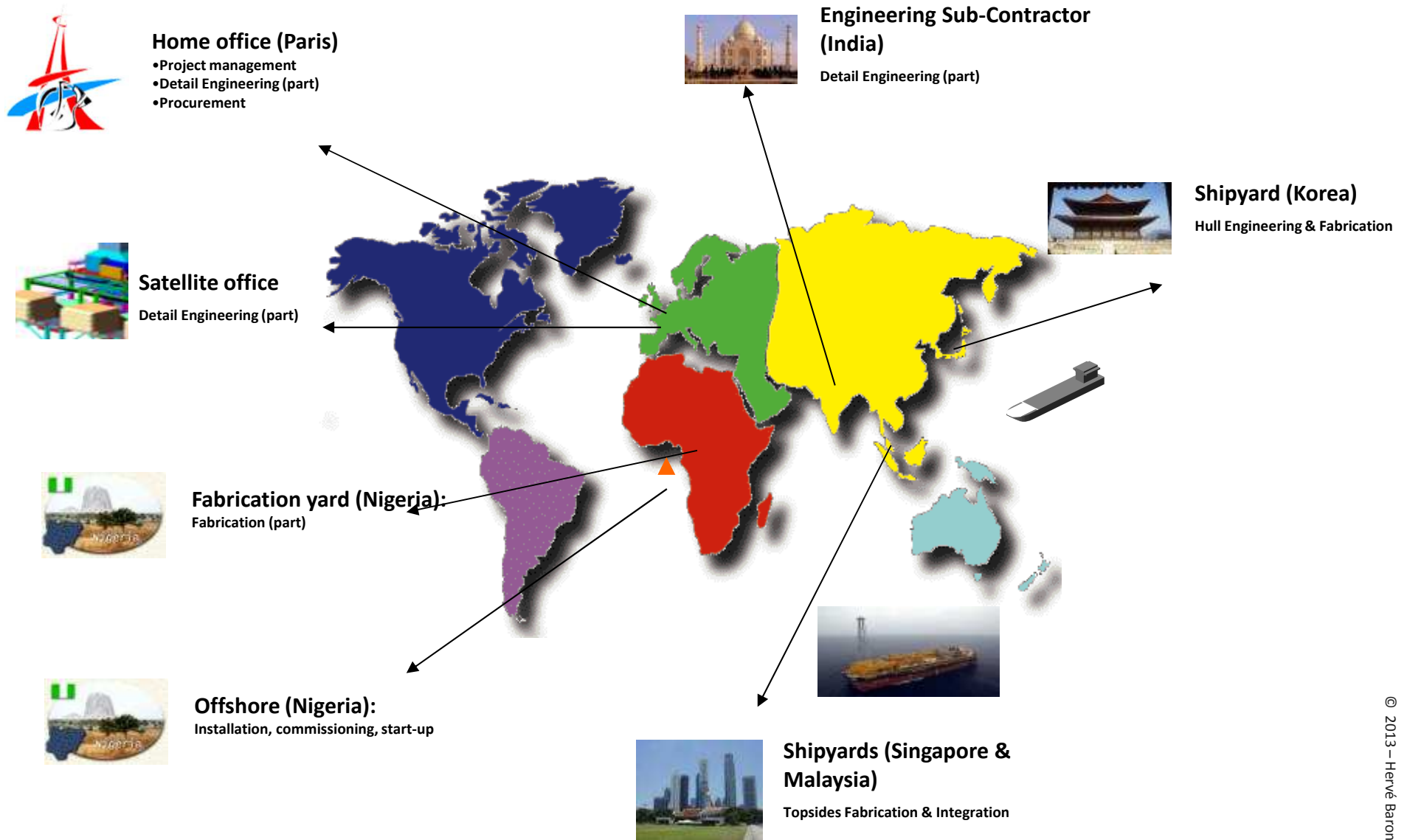


# The multiple sides of a Project





# The multiple sites of a Project



# Project

Engineering

Procurement

Construction





# Project

## Engineering

## Procurement

## Construction



# The facilities design basis

## Process facilities:

Feedstock and products flow

Feedstock composition

Battery limit conditions

Equipment Spare

## Performance:

Products specifications

Energy efficiency, emissions

## Utilities:

Electric power supply

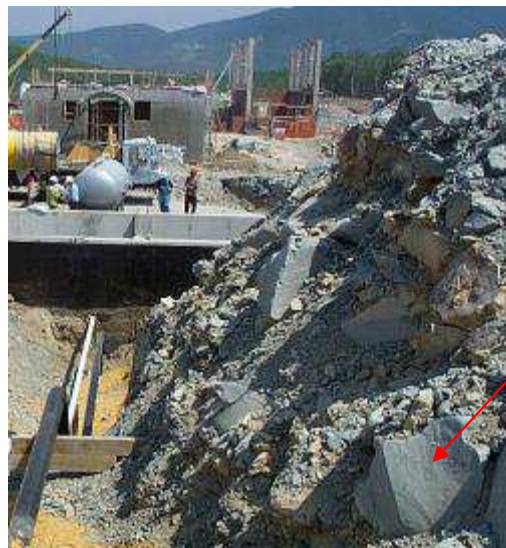
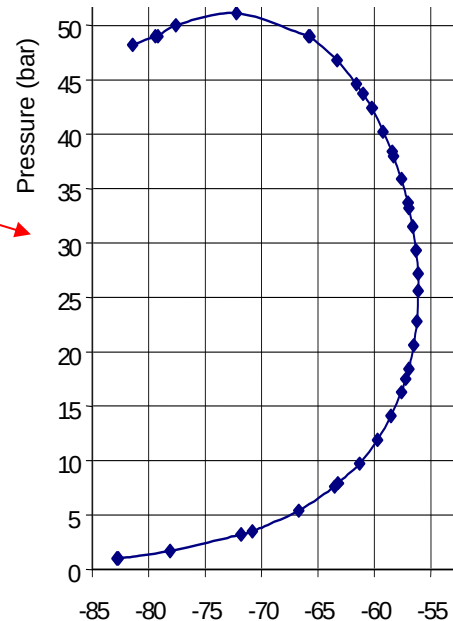
Other utilities

## Systems:

Process control

Fire/gas alarm

Public address, LAN, PABX



## Infrastructure:

Administrative and technical buildings

Control room

Access road

Site fencing, gates, check point

## Design criteria:

% of over design

## Environment data:

Min/max temperature

Rain/snow fall

Wind

Geological conditions

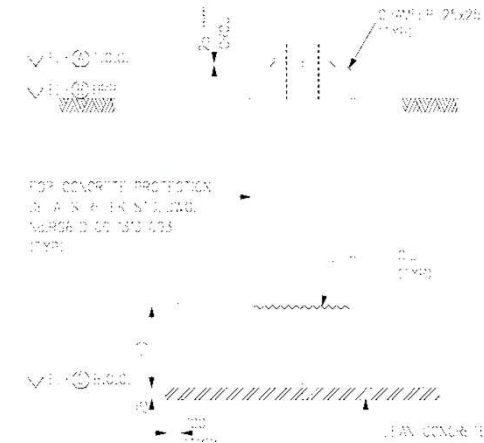
## Applicable codes and standards:

International standards

Local rules



# Engineering in the Project



## Design basis:

- Functional requirements
- Client specifications
- Design codes

## Engineering

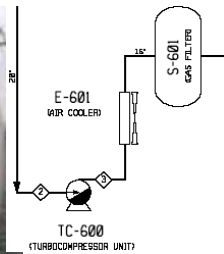
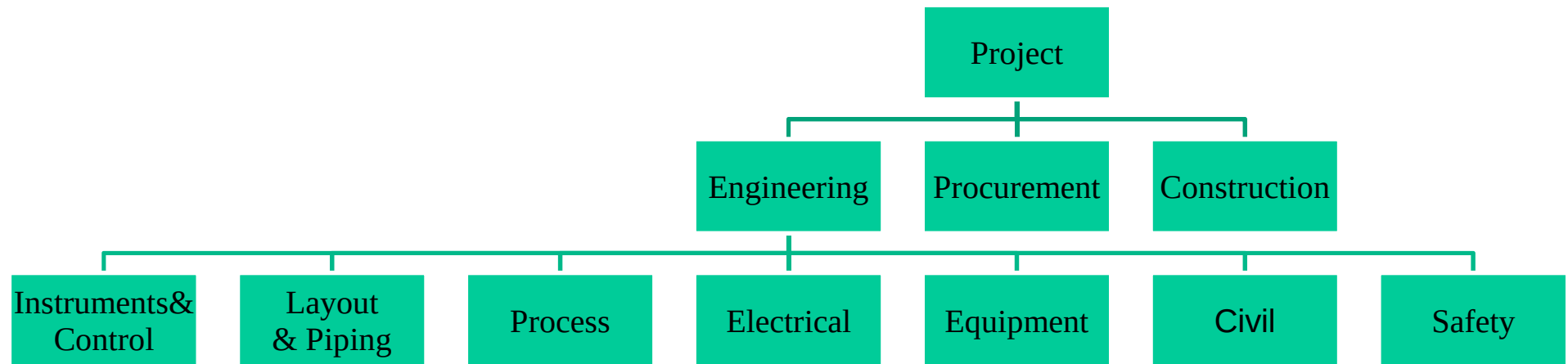
## Documents for Construction:

Construction drawings & specifications

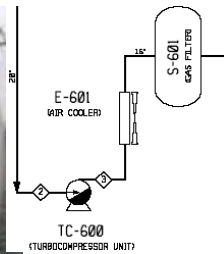
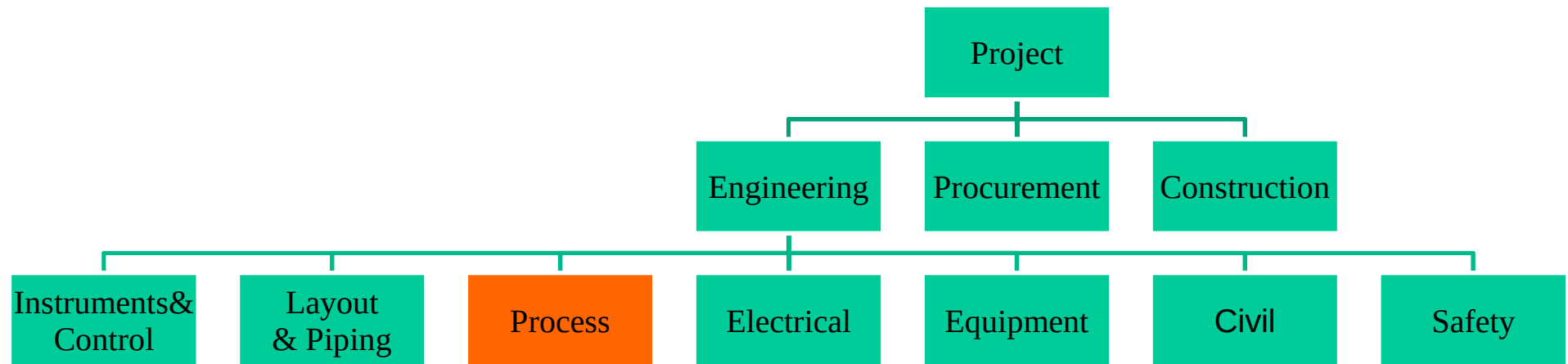
## Documents for Purchase:

bill of quantity & specification

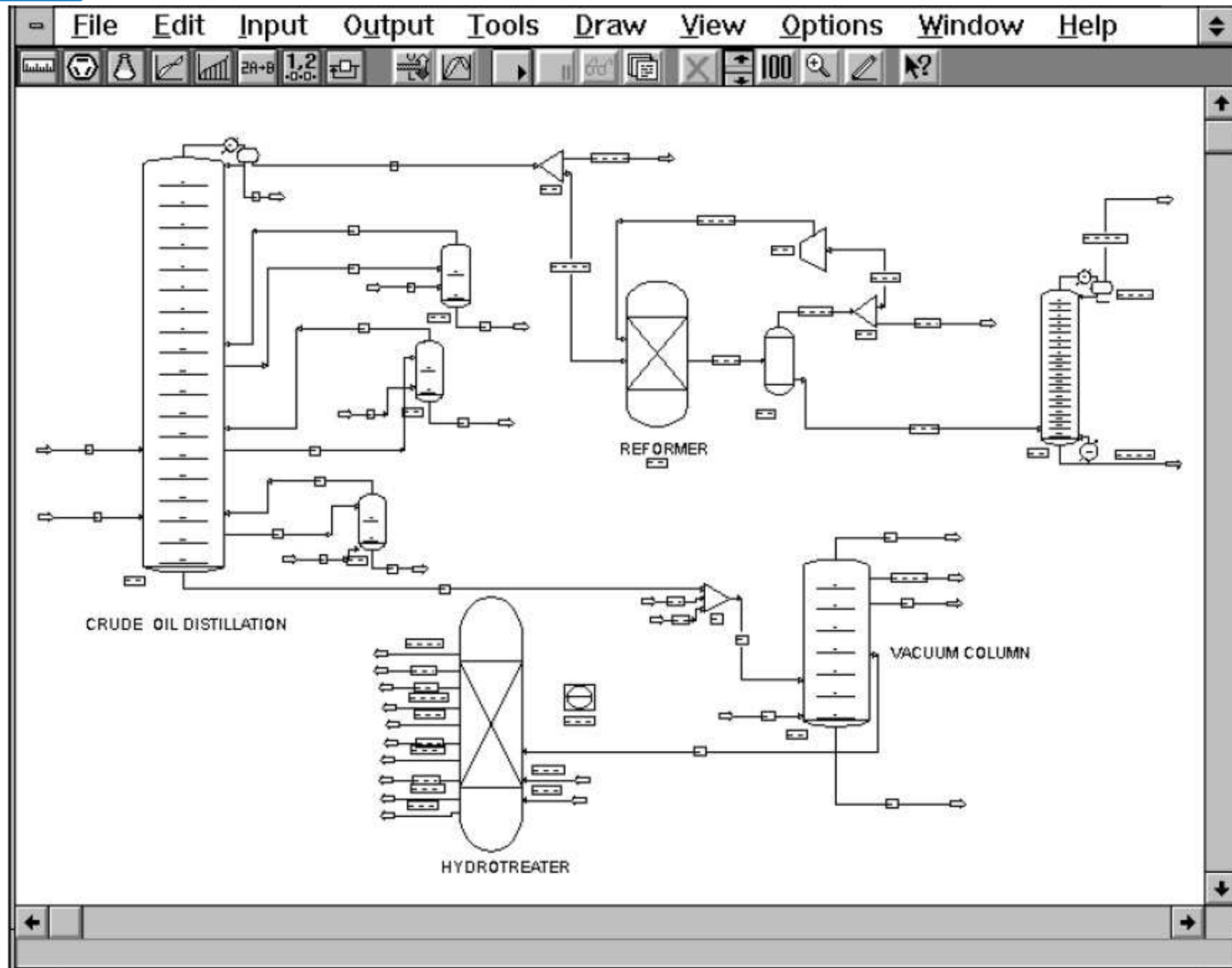
| 1. LIST OF MATERIALS |          |                                           |                                                      |
|----------------------|----------|-------------------------------------------|------------------------------------------------------|
| ITEM                 | QUANTITY | TAG N°                                    | DESIGNATION                                          |
| 1                    | 6        | TC100/TC200<br>TC300/TC400<br>TC500/TC600 | TURBO COMPRESSORS                                    |
| 2                    | 1        |                                           | SET OF STAR-UP & COMMISSIONING SPARE PARTS FOR ITEM1 |
| 3                    | 1        |                                           | SET OF SPECIAL TOOLS FOR ITEM1                       |
| 4                    | 1        |                                           | SET OF 2 YEARS SPARE PARTS                           |





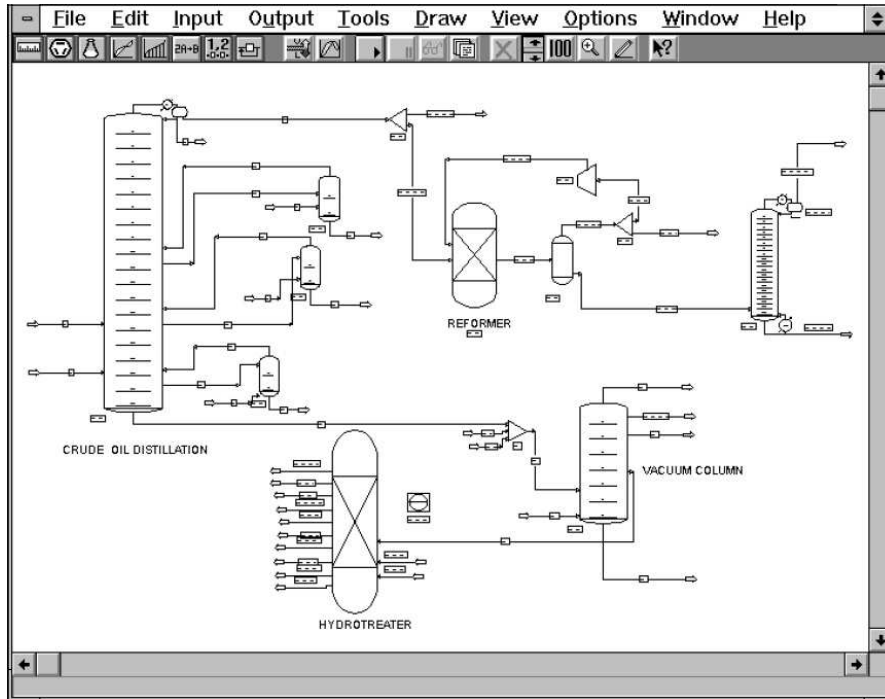


# Process simulations



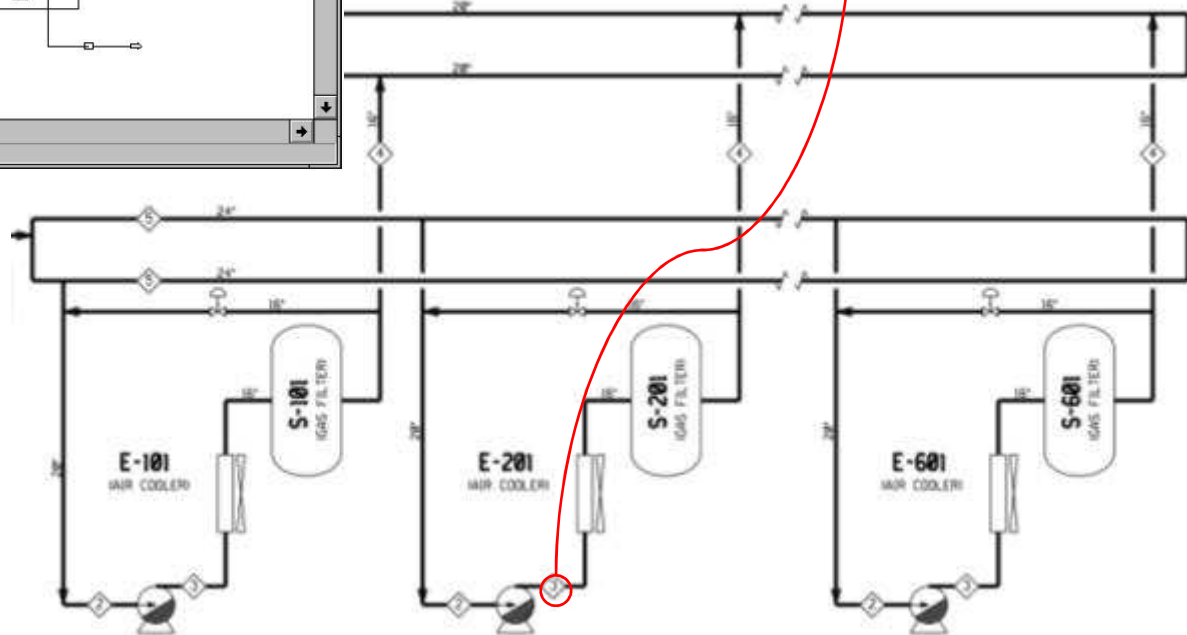
# Thermodynamic calculations

# Heat & Material balance



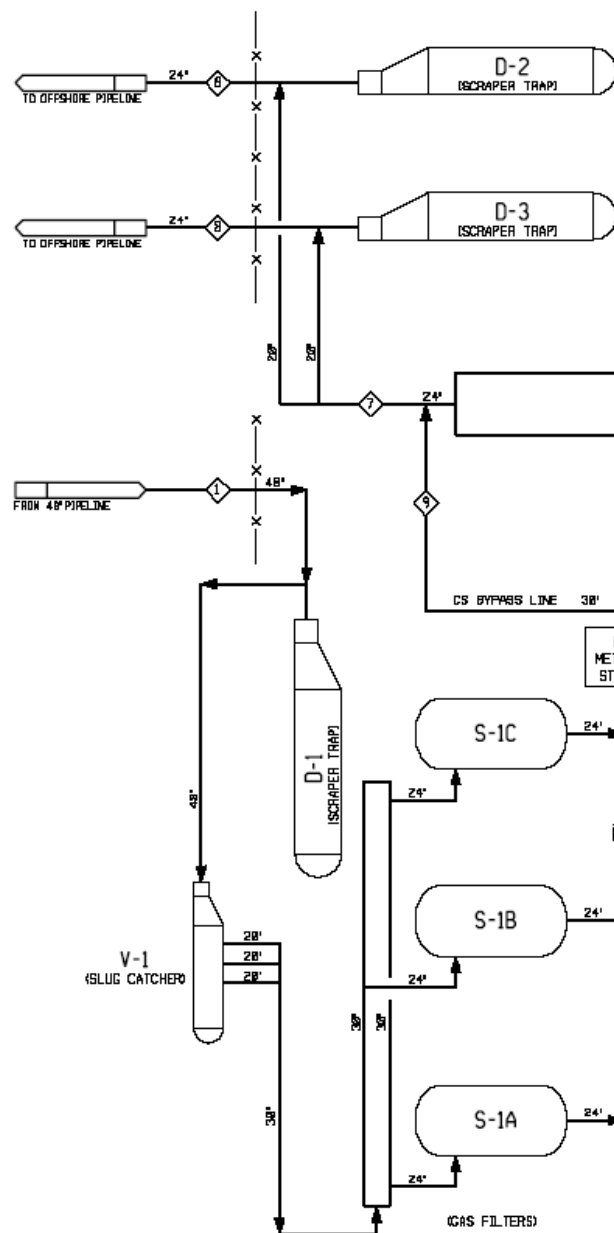
|                     |          |          |          |          |          |          |          |          |
|---------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| SINGLE NUMBER       | 1        | 2        | 3        | 4        | 5        | 6        | 7        | 8        |
| PHYSICAL PROPERTIES | 8.78     | 8.52     | 20.1     | 20.86    | 3.52     | 20.06    | 24.10    | 24.95    |
| TEMPERATURE °C      | 27.25    | 26.4     | 135      | 58.8     | 26.4     | 58.8     | 49.6     | 49.3     |
| TOTAL FLOWRATE Kg/h | 158816   | 345284   | 345284   | 345284   | 630488   | 630488   | 1388886  | 630488   |
| PHASE               | LIQ      | LIQ      | LIQ      | LIQ      | LIQ      | LIQ      | LIQ      | LIQ      |
| COMPOSITION (wt%)   | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 |
| VELOCITY m/s        | 28.67    | 28.67    | 28.67    | 28.67    | 10.526   | 10.526   | 8.210    | 41.05    |
| VELOCITY km/h       | 5.4      | 5.4      | 5.4      | 5.4      | 18.7     | 18.7     | 14.8     | 5.3      |
| VELOCITY ft/s       | 8.010    | 8.010    | 8.010    | 8.010    | 3.014    | 3.014    | 2.521    | 12.21    |
| VELOCITY m/min      | 87.5     | 87.5     | 87.5     | 87.5     | 55.8     | 55.8     | 46.2     | 248.2    |
| VELOCITY ft/min     | 16.52    | 16.52    | 16.52    | 16.52    | 10.52    | 10.52    | 8.52     | 43.02    |
| VELOCITY km/h       | 97.49379 | 97.49379 | 97.49379 | 97.49379 | 97.49379 | 97.49379 | 97.49379 | 97.49379 |
| VELOCITY m/s        | 8.010    | 8.010    | 8.010    | 8.010    | 3.014    | 3.014    | 2.521    | 12.21    |
| VELOCITY km/h       | 8.010    | 8.010    | 8.010    | 8.010    | 3.014    | 3.014    | 2.521    | 12.21    |
| VELOCITY ft/s       | 8.010    | 8.010    | 8.010    | 8.010    | 3.014    | 3.014    | 2.521    | 12.21    |
| VELOCITY m/min      | 87.5     | 87.5     | 87.5     | 87.5     | 55.8     | 55.8     | 46.2     | 248.2    |
| VELOCITY ft/min     | 16.52    | 16.52    | 16.52    | 16.52    | 10.52    | 10.52    | 8.52     | 43.02    |
| VELOCITY km/h       | 97.49379 | 97.49379 | 97.49379 | 97.49379 | 97.49379 | 97.49379 | 97.49379 | 97.49379 |
| VELOCITY m/s        | 8.010    | 8.010    | 8.010    | 8.010    | 3.014    | 3.014    | 2.521    | 12.21    |
| VELOCITY km/h       | 8.010    | 8.010    | 8.010    | 8.010    | 3.014    | 3.014    | 2.521    | 12.21    |
| VELOCITY ft/s       | 8.010    | 8.010    | 8.010    | 8.010    | 3.014    | 3.014    | 2.521    | 12.21    |
| VELOCITY m/min      | 87.5     | 87.5     | 87.5     | 87.5     | 55.8     | 55.8     | 46.2     | 248.2    |
| VELOCITY ft/min     | 16.52    | 16.52    | 16.52    | 16.52    | 10.52    | 10.52    | 8.52     | 43.02    |
| VELOCITY km/h       | 97.49379 | 97.49379 | 97.49379 | 97.49379 | 97.49379 | 97.49379 | 97.49379 | 97.49379 |
| VELOCITY m/s        | 8.010    | 8.010    | 8.010    | 8.010    | 3.014    | 3.014    | 2.521    | 12.21    |
| VELOCITY km/h       | 8.010    | 8.010    | 8.010    | 8.010    | 3.014    | 3.014    | 2.521    | 12.21    |
| VELOCITY ft/s       | 8.010    | 8.010    | 8.010    | 8.010    | 3.014    | 3.014    | 2.521    | 12.21    |
| VELOCITY m/min      | 87.5     | 87.5     | 87.5     | 87.5     | 55.8     | 55.8     | 46.2     | 248.2    |
| VELOCITY ft/min     | 16.52    | 16.52    | 16.52    | 16.52    | 10.52    | 10.52    | 8.52     | 43.02    |
| VELOCITY km/h       | 97.49379 | 97.49379 | 97.49379 | 97.49379 | 97.49379 | 97.49379 | 97.49379 | 97.49379 |

# Process Flow Diagram (PFD)





# Equipment list



D-1

V-1

S-1A/B/C

## INLET FACILITIES

RECEIVING SCRAPER TRAP

SLUG CATCHER

INLET GAS FILTER

## GAS COMPRESSION SYSTEM

TC-100+600

TURBO COMPRESSOR UNIT

E-101+601

GAS AIR COOLER

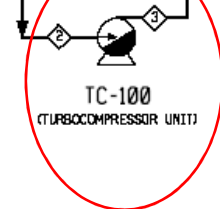
S-101+601

UNIT GAS FILTER

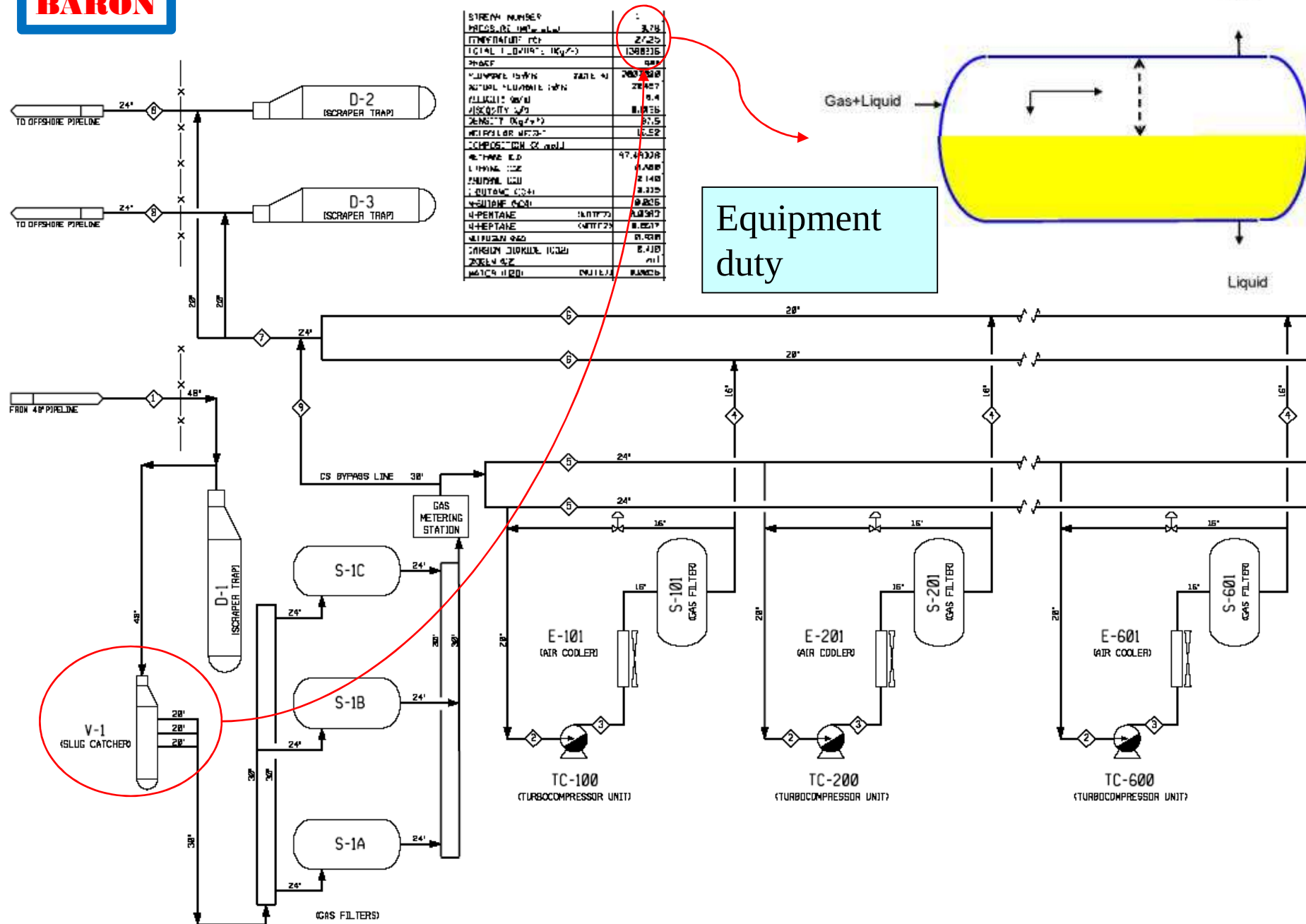
## OUTLET FACILITIES

D-2/3

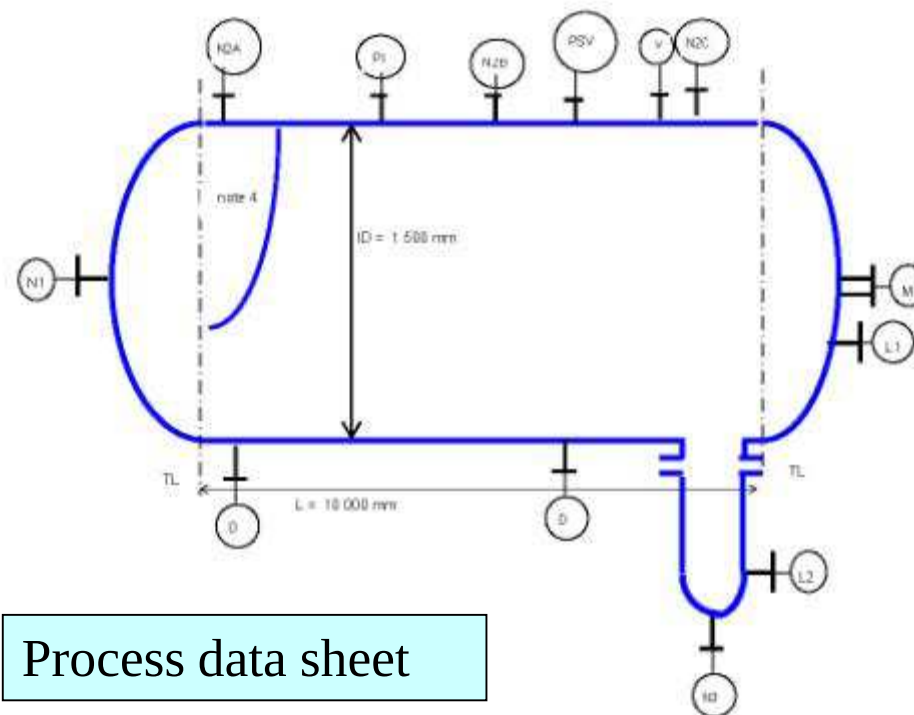
LAUNCHING SCRAPER TRAP



# HERVE BARON



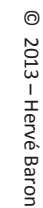
|                                                        |    |                |                          |                  |                                     |
|--------------------------------------------------------|----|----------------|--------------------------|------------------|-------------------------------------|
| SERVICE                                                |    | Slug Catcher   |                          | COLONNE / COLUMN |                                     |
| CONDITIONS OPERATOIRES / OPERATING CONDITIONS          |    |                |                          |                  |                                     |
| FLUIDE / FLUID                                         |    | Natural Gas    |                          |                  |                                     |
| PRESSION DE SERVICE / OPER. PRESSURE                   |    | 9.7            | MPa(a)                   |                  |                                     |
| TEMPERATURE DE SERVICE / OPER. TEMPERATURE             |    | 30             | °C                       |                  |                                     |
| MASSE VOLUMIQUE LIQ. / LIQ. DENSITY                    |    | 1000           | kg/m <sup>3</sup>        |                  |                                     |
| ABRASION, CORROSION, CAUSE / EROSION, CORROSIVE DUE TO |    | note 3         |                          |                  |                                     |
| INFLAMMABLE - EXPLOSIF / FLAMMABLE - EXPLOSIVE         |    | Flammable      |                          |                  |                                     |
| DONNEES DE CONSTRUCTION / CONSTRUCTION DATA            |    |                |                          |                  |                                     |
| PRESSION DE CALCUL / DESIGN PRESSURE                   |    | 10.11          | MPa(a)                   |                  |                                     |
| VIDE - DEPRESSION DE CALCUL / DESIGN VACUUM PRESSURE   |    |                | MPa(a)                   |                  |                                     |
| TEMPERATURE DE CALCUL / DESIGN TEMPERATURE             |    | -20/50         | °C                       |                  |                                     |
| CAPACITE / CAPACITY                                    |    | 10             | m <sup>3</sup>           |                  |                                     |
| MATERIAU / MATERIAL                                    |    | CS             |                          |                  |                                     |
| SUREPAISSEUR DE CORROSION / CORROSION ALLOWANCE        |    | 3              | mm                       |                  |                                     |
| DETENSIONNEMENT / STRESS RELIEVE                       |    | OUI / YES      | <input type="checkbox"/> | NON / NO         | <input type="checkbox"/>            |
| REVETEMENT INTERNE / LINING                            |    | note 6         |                          |                  |                                     |
| EPAISSEUR REVETEMENT / LINING THICKNESS                |    |                |                          |                  |                                     |
| CALORIFUGE / INSULATION                                |    | OUI / YES      | <input type="checkbox"/> | NON / NO         | <input checked="" type="checkbox"/> |
| CONSERVATION CHALEUR / HEAT CONSERVATION               |    |                |                          |                  |                                     |
| PROTECTION PERSONNEL / PERSONNEL PROTECTION            |    |                |                          |                  |                                     |
| EQUIPEMENT INTERNE / INTERNALS                         |    |                |                          |                  |                                     |
| CODE DE CONSTRUCTION / REFERENCE CODE                  |    | ASME VIII div1 |                          |                  |                                     |
| TUBULURES / NOZZLES                                    |    |                |                          |                  |                                     |
| REPÈRE / MARK                                          | Nb | DN / SIZE      | SERVICE                  |                  |                                     |
| PSV                                                    | 1  | 3"             | Relief Valve             |                  |                                     |
| N1                                                     | 1  | 48"            | Inlet                    |                  |                                     |
| N2A/B/C                                                | 3  | 24" (note 7)   | Gas Outlets              |                  |                                     |
| N3                                                     | 1  | 4"             | Liquid Outlet            |                  |                                     |
| V                                                      | 1  | 2"             | Vent                     |                  |                                     |
| D                                                      | 2  | 2"             | Drains                   |                  |                                     |
| PI                                                     | 1  | 2"             | Pressure Gauge           |                  |                                     |
| L1 / L2                                                | 2  | 3"             | Standpipe                |                  |                                     |
|                                                        |    |                |                          |                  |                                     |
| M                                                      | 1  | 24"            | Manhole                  |                  |                                     |



Process data sheet

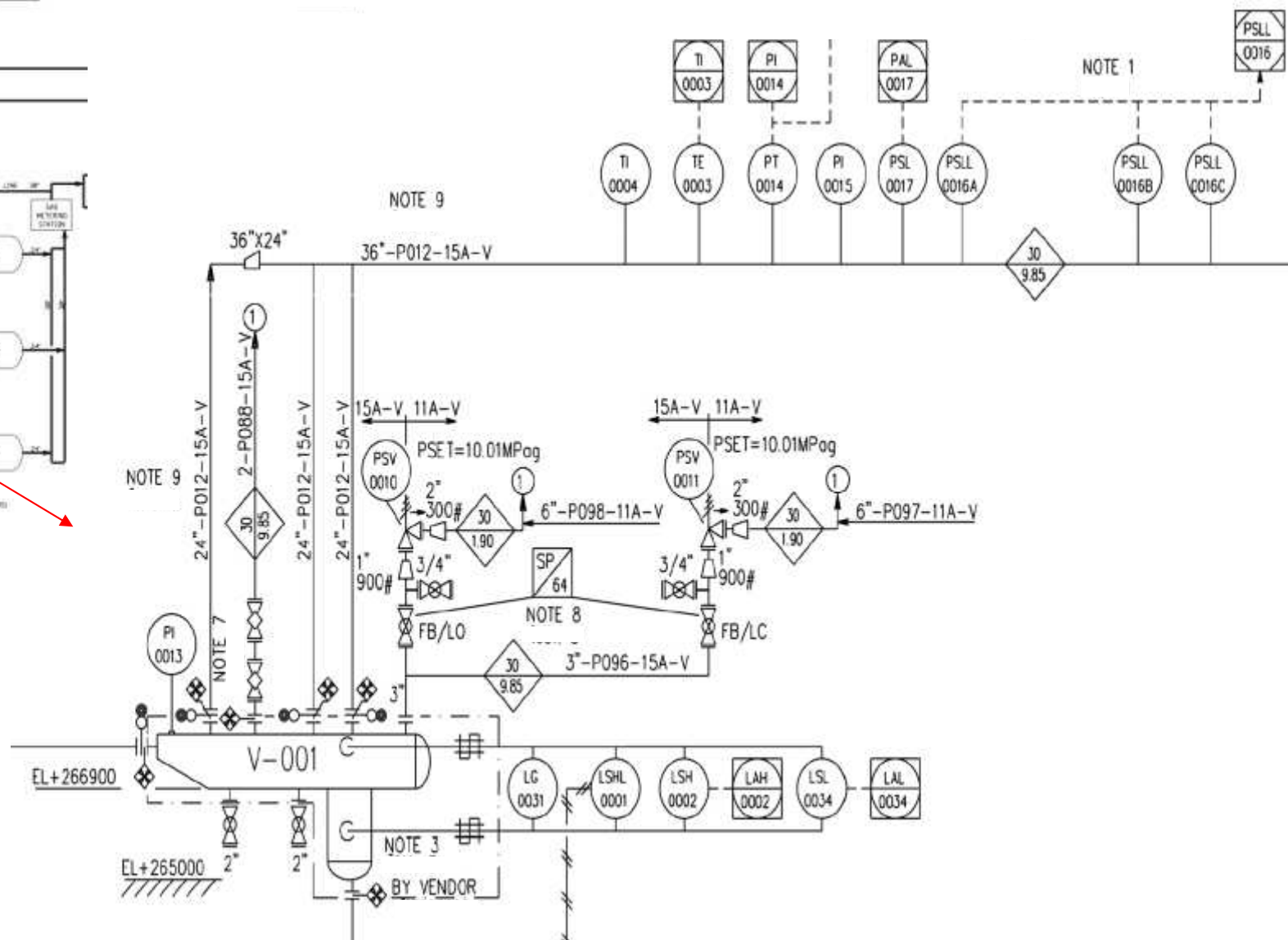
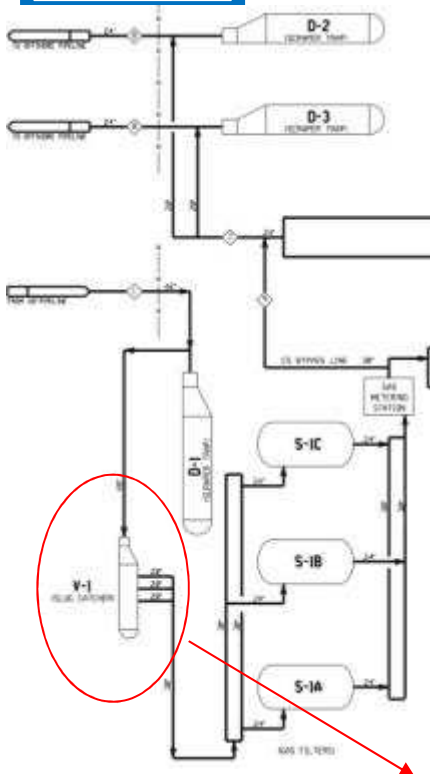


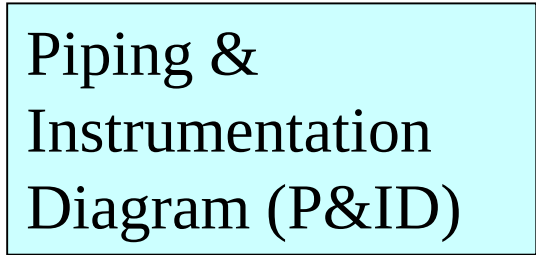




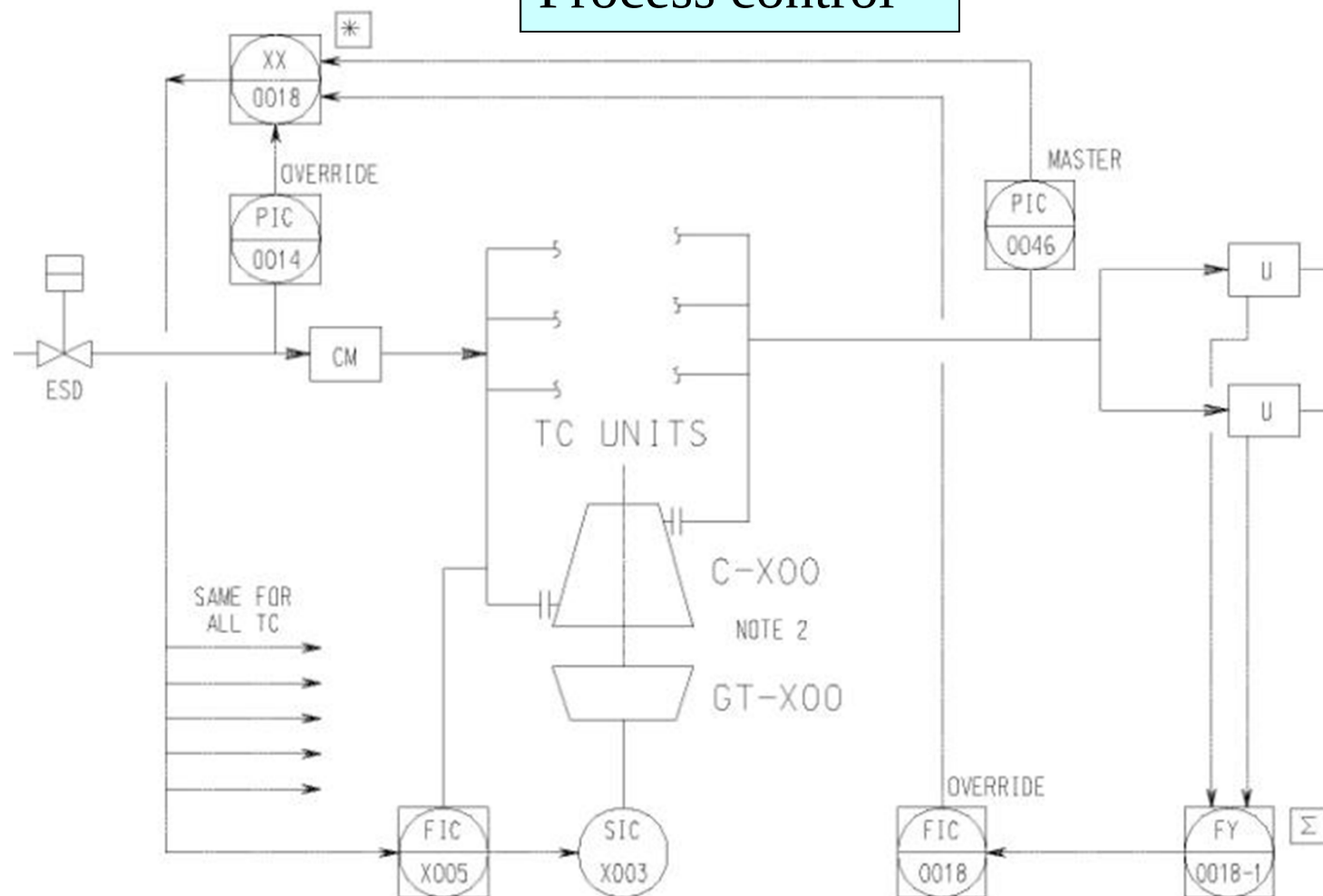
**HERVE  
BARON**

## Piping & Instrumentation Diagram (P&ID)







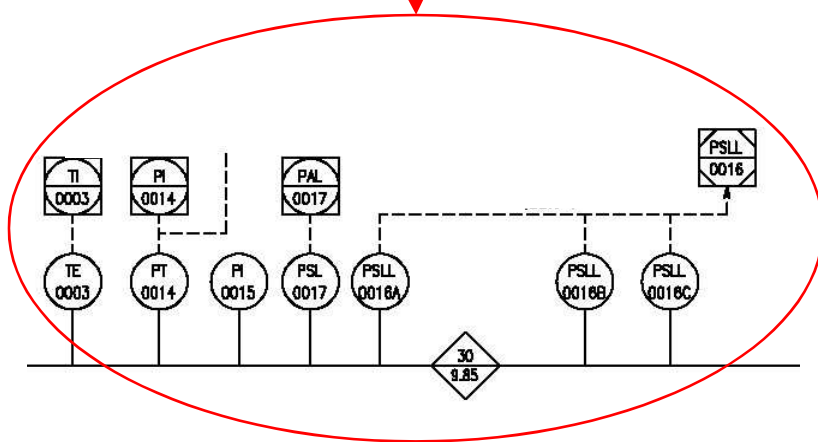
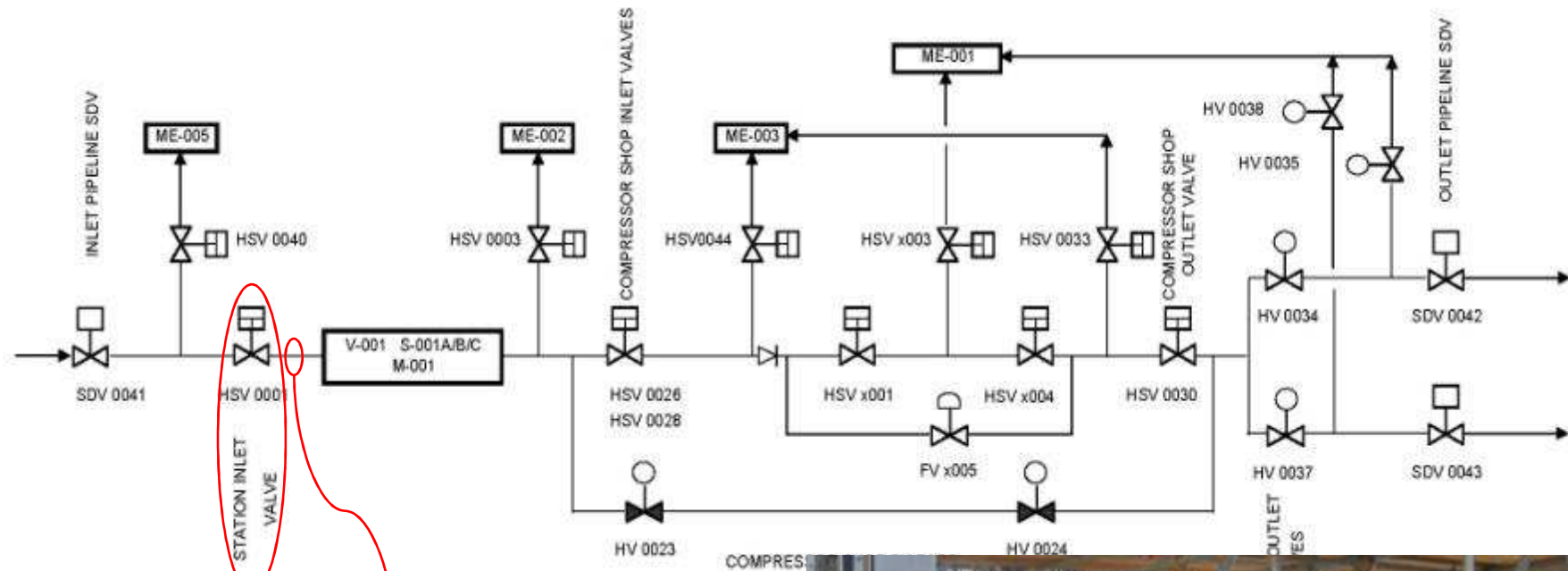


### Station Control

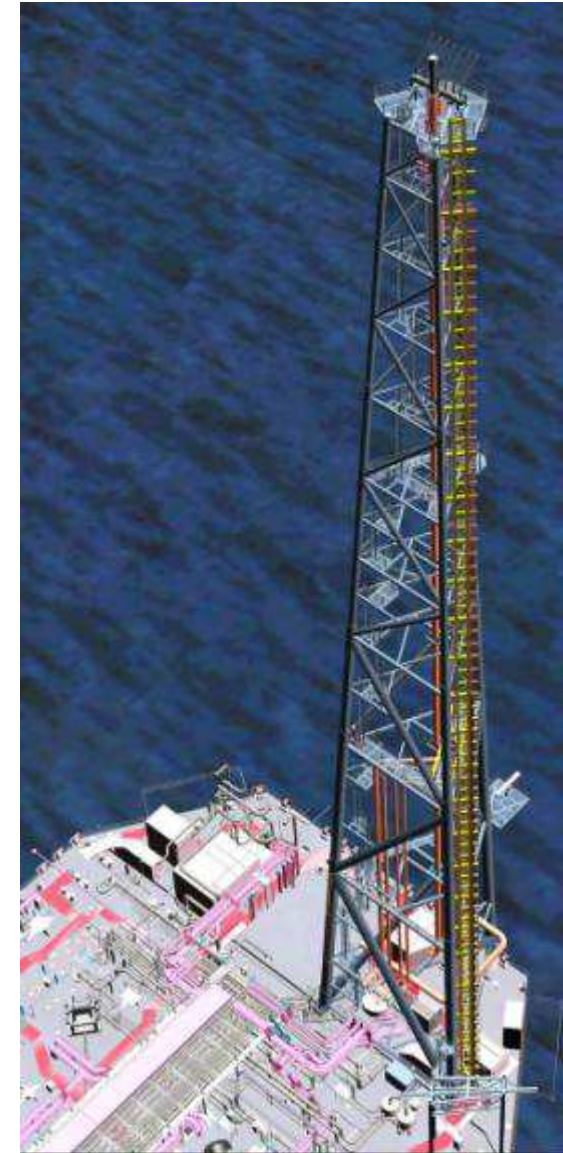
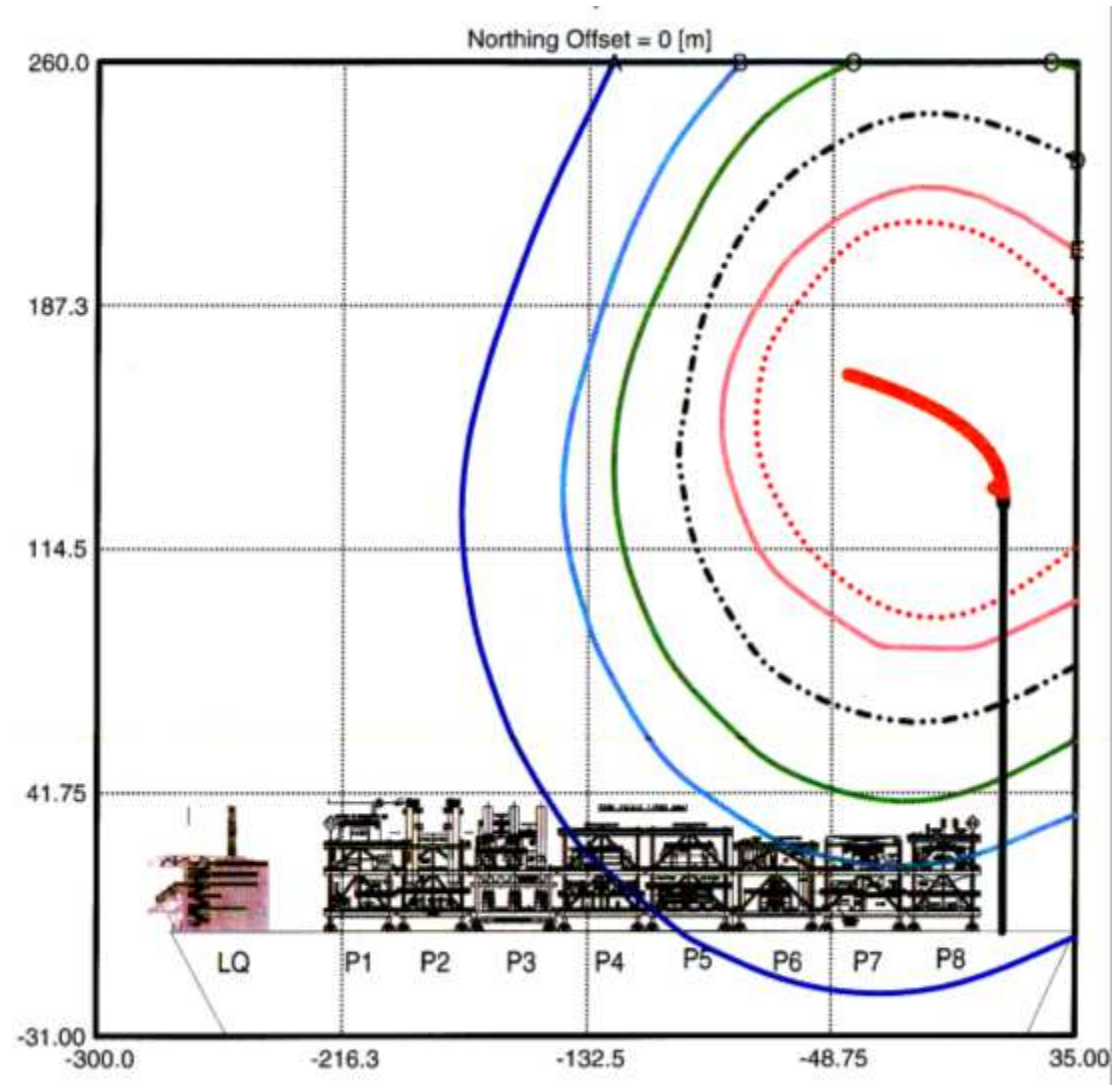
Control of the station shall be carried out, manually or automatically, by adjusting the revolutions of the units, controlling the most critical of the following parameters:

- suction gas pressure (override);
- discharge gas pressure (master);
- gas flow rate (override).

# Emergency shut down



## Emergency relief





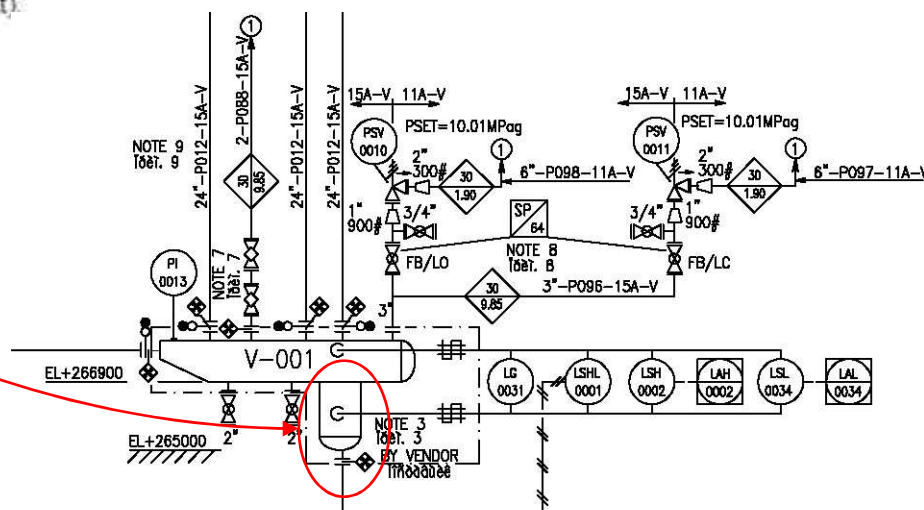
## Initial start-up

### Slug catcher lining-up and liquid sealing

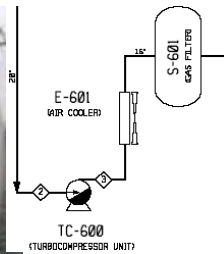
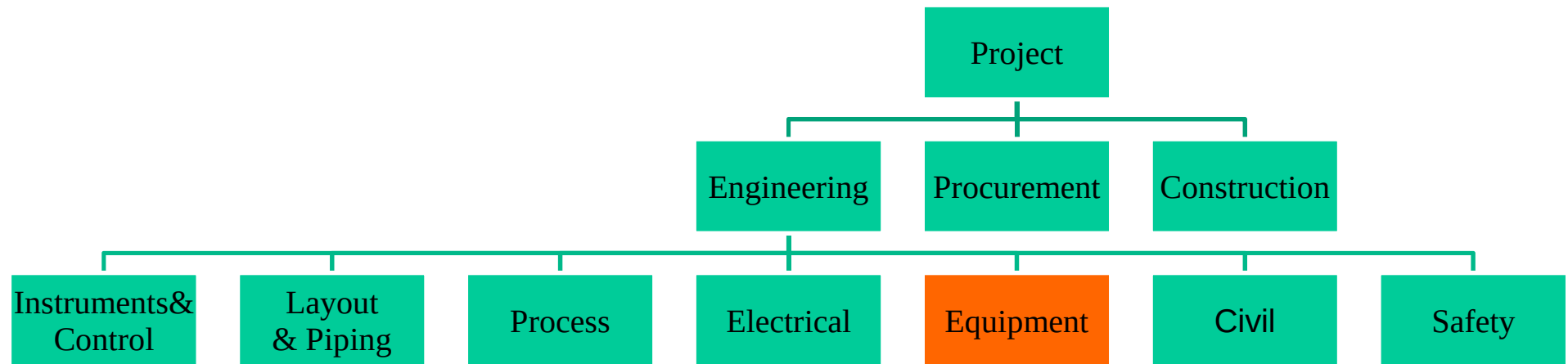
Refer to the following Piping & Instrument Diagram:

- P-3-08512 : Liquid disposal system

- Fill bottom of boot with diesel oil through connection of one of non installed instruments (LSH or LSL) at least up to LSL-0001 (Level Switch Low) in order to avoid gas blow-by through drain line as transported gas expected quality is dry. Blind the connection again. Check that LV is still closed.
- Ensure that all spectacle blinds (one at drum inlet, three at drum outlet) around slug catcher are in open position.
- Close the two 2" plug valves on vent line.
- Close the two 2" plug valves on each drain.
- Ensure that mechanical interlock between the PSV is in right position, i.e. the closure of one isolation valve causes the opening of the other one.
- Close the two 3/4" vent ball valves upstream PSVs.
- Close both 2" ball valve and plug valve on drain line (routed to local pit).
- Ensure that spectacle blind downstream FO-0003 is in open position.
- Open the two 4" ball valves around LV-0001.
- Close both 2" ball valve and plug valve on by-pass of LV.







**HERVE  
BARON**



Rotating machinery





## Pressure vessels





## Heat exchangers





**HERVE  
BARON**

## Packages, Fired Equipment



**HERVE  
BARON**

|                                                                   |                           |                           |             |
|-------------------------------------------------------------------|---------------------------|---------------------------|-------------|
| SERVICE : NATURAL GAS COMPRESSOR                                  |                           |                           |             |
| NOMBRE REQUIS / NUMBER REQUIRED                                   |                           | TOTAL / TOTAL : 6 RUNNING |             |
| OPERATION : CONTINUE / CONTINUOUS                                 |                           | X                         |             |
| PROPRIETES DU FLUIDE / FLUID PROPERTIES                           |                           |                           |             |
| CAS DE MARCHE / RUNNING CASE                                      |                           | mas.mol                   | DESIGN CASE |
| FLUIDE/FLUID                                                      | COMPOSANTS / COMPOUNDS    | MW                        |             |
| MOLAR PERCENT                                                     |                           |                           |             |
| COMPONENT                                                         | DESIGN                    | ALTERNATIVE               |             |
| Methane CH <sub>4</sub>                                           | 97,528                    | 97,721                    |             |
| Ethane (C <sub>2</sub> H <sub>6</sub> )                           | 0,680                     | 0,095                     |             |
| Propane (C <sub>3</sub> H <sub>8</sub> )                          | 0,140                     | 0,025                     |             |
| i-Butane (C <sub>4</sub> H <sub>10</sub> )                        | 0,015                     | 0,005                     |             |
| n-Butane (C <sub>4</sub> H <sub>10</sub> )                        | 0,025                     | 0,005                     |             |
| i-Pentane (C <sub>5</sub> H <sub>12</sub> )                       | 0,018                     | 0,045                     |             |
| n-Pentane (C <sub>5</sub> H <sub>12</sub> )                       | 0,020                     | 0,050                     |             |
| Hexane (C <sub>6</sub> H <sub>14</sub> )                          | 0,022                     | 0,000                     |             |
| Heptane + (C <sub>7</sub> H <sub>16</sub> )                       | 0,013                     |                           |             |
| Nitrogen (N <sub>2</sub> )                                        | 0,930                     | 1,746                     |             |
| Carbon Dioxide (CO <sub>2</sub> )                                 | 0,410                     | 0,280                     |             |
| Oxygen (O <sub>2</sub> )                                          | Nil                       | Nil                       |             |
| COMPRESS. (Z)/COMPRESSIBILITY ASPIREF / SUCTION/DISCH             |                           | 0.876/1.013               |             |
| Cp/Cv ASP/REFOULEMENT / SUCTION/DISCHARGE                         |                           | 1.582/1.485               |             |
| TOXIQUE/TOXIC                                                     |                           | FLAMMABLE X               |             |
| CORROSIF / EROSIF, A CAUSE DE / CORROSIVE / EROSIVE, BECAUSE OF : |                           |                           |             |
| DONNEES DE FONCTIONNEMENT / OPERATING CONDITIONS                  |                           |                           |             |
| ASPIRATION / SUCTION                                              | PRESSION ABS / ABS. PRESS | MPa(a)                    | 8,52        |
|                                                                   | TEMPERATURE               | °C                        | 30          |
|                                                                   | MASSE VOLUMIQUE / DENSITY | kg/m <sup>3</sup>         | 63,97       |
|                                                                   | DEBIT VOL. / FLOWRATE VOL |                           |             |
|                                                                   | NORMAL                    | m <sup>3</sup> /s         | -           |
|                                                                   | CALCUL / DESIGN           | m <sup>3</sup> /s         | 5,99        |
|                                                                   | DEBIT MASSIQUE, NORMAL    | kg/s                      | 383,03      |
|                                                                   | MASS FLOW, NORMAL         |                           |             |
|                                                                   | TEMPERATURE MAXI SERVICE  | °C                        | note 7      |
|                                                                   | MAX OPERATING TEMP.       |                           |             |
| PRESSION ABSOLUE MAXI                                             | MPa(a)                    |                           |             |
| ABSOLUTE PRESSURE MAXI                                            |                           |                           |             |
| REFOULT : PRESSION ABS / DISCH. ABS PRESS                         |                           | MPa(a)                    | 25,5        |
| REGULATION DE DEBIT / FLOW VARIATION                              |                           | %                         |             |

Process data  
sheet

Mechanical  
data sheet

|                                                     |                                          |                                      |             |
|-----------------------------------------------------|------------------------------------------|--------------------------------------|-------------|
| LOCATION: (2.1.8)                                   |                                          |                                      |             |
| X INDOOR                                            | X HEATED                                 | UNDER ROOF                           |             |
| OUTDOOR                                             | UNHEATED                                 | PARTIAL SIDES                        |             |
| X GRADE                                             | MEZZANINE                                |                                      |             |
| ELEC. AREA CLASSIFICATION (2.1.14)                  |                                          | IIA T3                               |             |
| CL                                                  | GR                                       | DIV                                  |             |
| WINTERIZATION REQD.(2.1.8)                          |                                          |                                      |             |
| TROPICALIZATION REQD.(3.4.6.6)                      |                                          |                                      |             |
| SITE DATA:                                          |                                          |                                      |             |
| X ELEVATION (m):                                    | 270 m                                    |                                      |             |
| BAROMETER (Bar abs):                                |                                          |                                      |             |
| X RANGE OF AMBIENT TEMPS (°C):                      | -19/42                                   |                                      |             |
| NOISE SPECIFICATIONS: (2.1.9)                       |                                          |                                      |             |
| X APPLICABLE TO MACHINE:                            | 95dBA inside, 80dBA outside building     |                                      |             |
| ACOUSTIC HOUSING:                                   | YES                                      | X NO                                 |             |
| APPLICABLE SPECIFICATIONS:                          |                                          |                                      |             |
| API 617, CENTRIFUGAL COMPR. FOR GEN. REFINERY SERV. |                                          |                                      |             |
| CONSTRUCTION FEATURES                               |                                          |                                      |             |
| TYPE FABRICATION                                    |                                          | WELDED                               |             |
| MATERIAL                                            |                                          | ASTM A 182F22                        |             |
| MAX. YIELD STRENGTH (N)                             |                                          | >310 N/mm <sup>2</sup>               |             |
| BRINELL HARDNESS: MAX./MIN.                         |                                          | 207 /                                |             |
| X SHAFT:                                            |                                          |                                      |             |
| MATERIAL                                            |                                          | 40 NiCrMo7 (equivalent to AISI 4340) |             |
| DIA. @ IMPELLER (mm)                                |                                          | 163 / 182                            |             |
| DIA. @ COUPLING (mm)                                |                                          | 120                                  |             |
| SHAFT END:                                          |                                          | X TAPERED                            | CYLINDRICAL |
| MAX. YELD STRENGTH (BAR)                            |                                          | 7350                                 |             |
| SHAFT HARDNESS (BNH) (Rc)                           |                                          | <=270 HB                             |             |
| STRESS AT COUPLING (BAR)                            |                                          |                                      |             |
| PAINTING:                                           |                                          |                                      |             |
| X                                                   | MANUFACTURER'S STD.                      |                                      |             |
|                                                     | OTHER: SUBJECT TO CLIENT APPROVAL        |                                      |             |
| SHAFT SEALS:                                        |                                          |                                      |             |
| X                                                   | SEAL TYPE (2.8.3)                        | DRY GAS SEALS                        |             |
| X                                                   | SETTLING OUT PRESSURE (BARG)             | 153,7                                |             |
|                                                     | SPECIAL OPERATION (2.8.1)                |                                      |             |
|                                                     | SUPPLEMENTAL DEVICE REQUIRED FOR CONTACT |                                      |             |
|                                                     | SEALS (2.8.3.2) TYPE:                    |                                      |             |
| X                                                   | BUFFER GAS SYSTEM REQUIRED (2.8.7)       |                                      |             |
| X                                                   | TYPE BUFFER GAS                          | COMPRESSED AIR                       |             |

# Material Requisition

| 1. LIST OF MATERIALS |          |                                           |                                                      |
|----------------------|----------|-------------------------------------------|------------------------------------------------------|
| ITEM                 | QUANTITY | TAG N°                                    | DESIGNATION                                          |
| 1                    | 6        | TC100/TC200<br>TC300/TC400<br>TC500/TC600 | TURBO COMPRESSORS                                    |
| 2                    | 1        |                                           | SET OF STAR-UP & COMMISSIONING SPARE PARTS FOR ITEM1 |
| 3                    | 1        |                                           | SET OF SPECIAL TOOLS FOR ITEM1                       |
| 4                    | 1        |                                           |                                                      |

| 2. APPLICABLE DOCUMENTS                                                                                                                                                                                                                                                                                                                                               | DOCUMENTS                                                                                                                                                |                                                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                       | NUMBER*                                                                                                                                                  | REV                                                      |
| <b>2.1. PROJECT GENERAL SPECIFICATIONS</b><br><br>Technical Specification Centrifugal Compressor<br>Data Sheets Centrifugal Compressor<br>Data Sheets Gas Turbine<br>General spec. for L.V. Switchboards for Packaged Unit<br>Data Sheet for Turbocompressor MCC<br>Turbocompressor Fuel Gas Functional Specification<br>Procedure of Acceptance<br>Turbo compressors | J-7-30001 (MA-E-30001)<br>J-8-30101 (MA-E-30101)<br>J-8-30102 (MA-E-30101)<br>E-7-40011 (EA-E-40011)<br>E-8-40044 (EA-E-40044)<br>P-7-08071 (ZA-E-08071) | Rev. 2<br>Rev. 2<br>Rev. 1<br>Rev. A<br>Rev. 3<br>Rev. 4 |

## 3. QA PROGRAM STANDARD AND INSPECTION REQUIREMENTS FOR VENDORS

**ITEM DESCRIPTION : TURBO COMPRESSORS TC 100/TC 200/TC 300/TC 400/TC 500/TC 600**

### QA PROGRAM

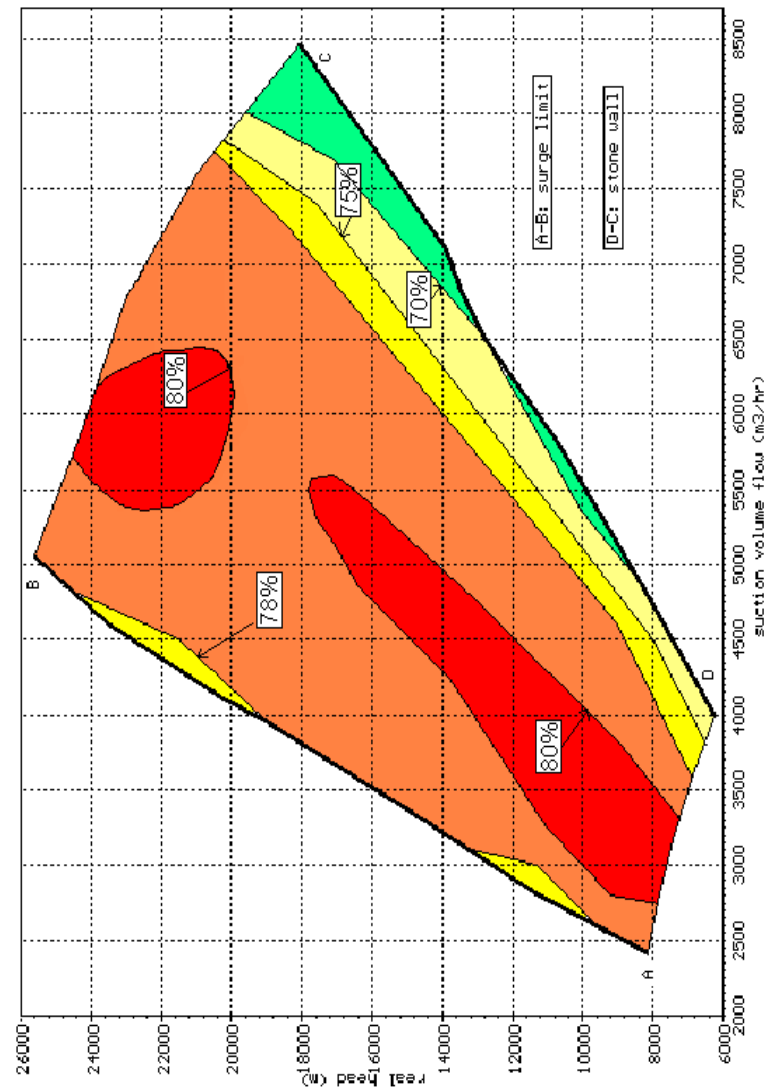
THE FOLLOWING QUALITY ASSURANCE PROGRAM (QA PROGRAM) SHALL BE IMPLEMENTED AND DOCUMENTED IF THE BIDDER IS AWARD

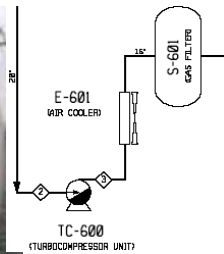
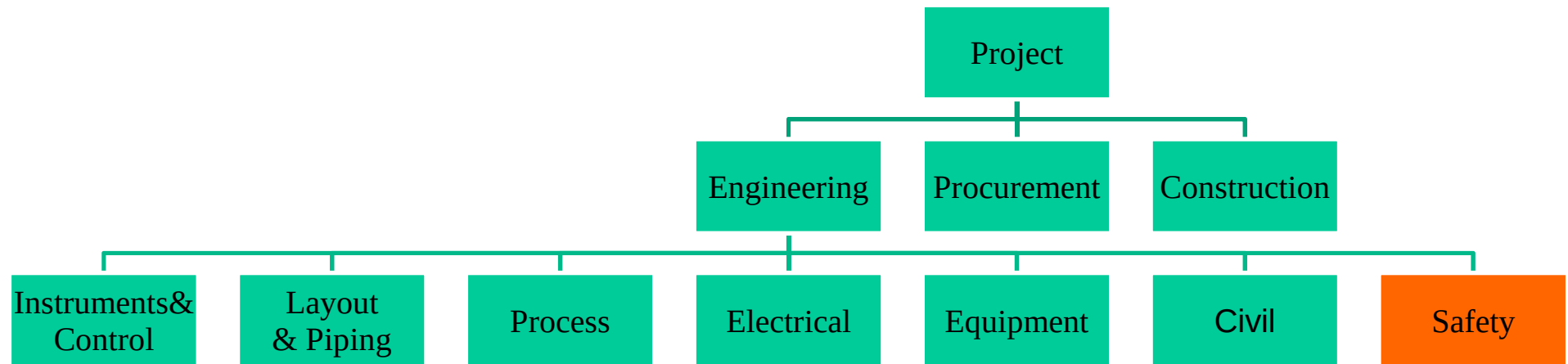
|      |      |       |
|------|------|-------|
| ISO  | 9001 | { X } |
| ISO  | 9002 | { }   |
| ISO  | 9003 | { }   |
| NONE |      | { }   |

## 4. SUPPLIER'S DOCUMENTS – REQUIREMENT SCHEDULE

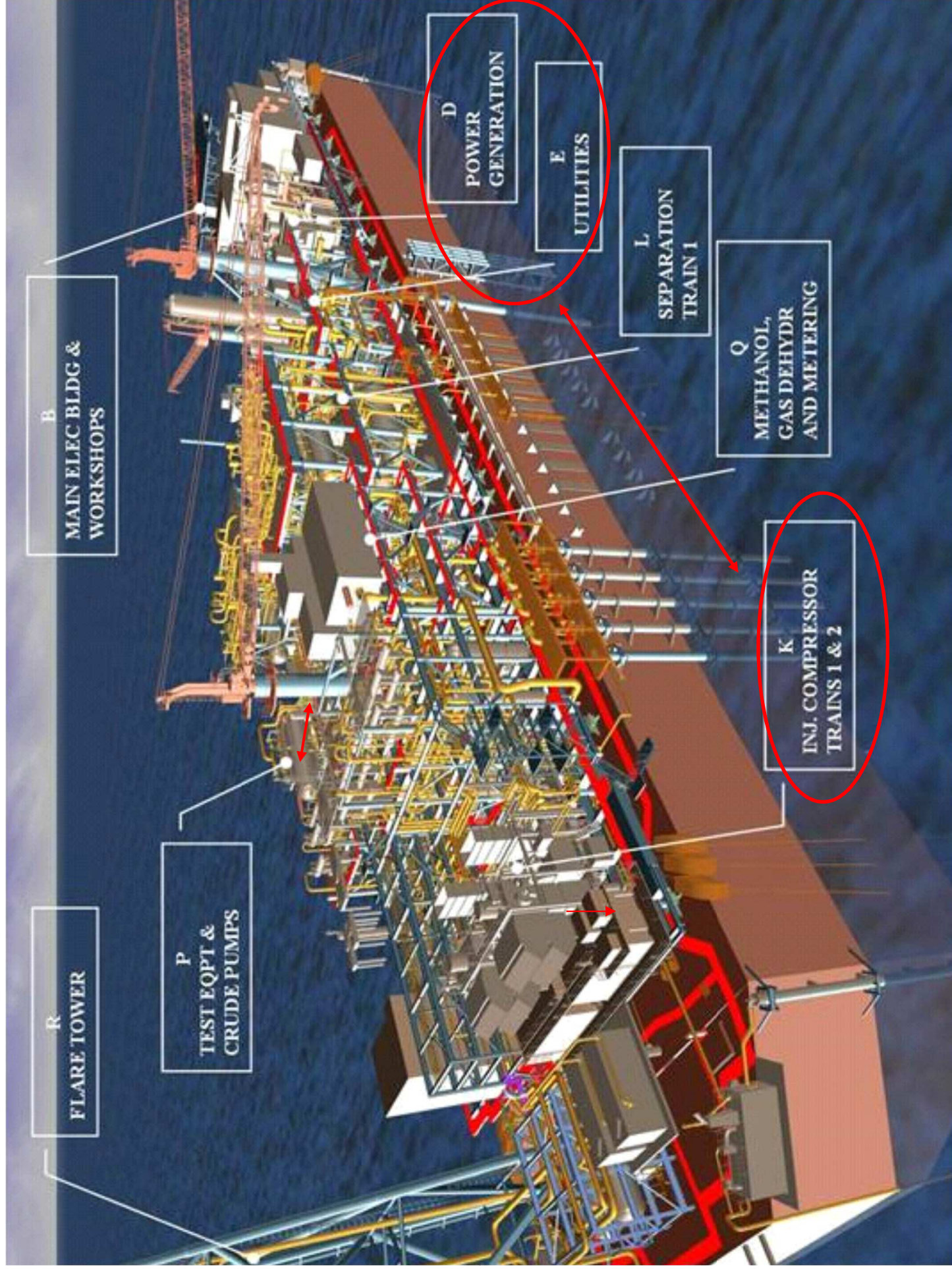
| 4.2. PROCESS AND PERFORMANCE DOCUMENTS |                                                                                                     |   |   |   |   |   |
|----------------------------------------|-----------------------------------------------------------------------------------------------------|---|---|---|---|---|
| TURBO COMPRESSOR                       |                                                                                                     |   |   |   |   |   |
|                                        |                                                                                                     | 0 | 1 | 2 | 3 | 4 |
| 1                                      | DIMENSIONAL OUTLINE DRAWINGS OF TURBOCOMPRESSOR SET*                                                | A |   | B | C | D |
| 2                                      | GENERAL ARRANGEMENT DWG OF TURBOCOMPRESSOR BUILDING WITH INSIDE AND OUTSIDE INSTALLATIONS*          | A |   | B | C | D |
| 3                                      | AIR INLET AND EXHAUST SYSTEMS ARRANGEMENT DRAWINGS*                                                 | A |   | B | C | D |
| 4                                      | LUBE OIL AIR COOLER ARRANGEMENT DRAWINGS*                                                           | A |   | B | C | D |
| 5                                      | TURBOCOMPRESSOR SET FOUNDATION PLAN WITH STATIC AND DYNAMIC LOADS*                                  | A |   | B | C | D |
| 6                                      | FOUNDATION PLAN WITH STATIC AND DYNAMIC LOADS FOR TURBOCOMPRESSOR BUILDING AND OTHER AUX. EQUIPMENT | A |   | B | C | D |
| 7                                      | CUSTOMER MECHANICAL CONNECTIONS LIST AND PLAN WITH MAX. ALLOWABLE LOADS*                            |   |   | B | C | D |





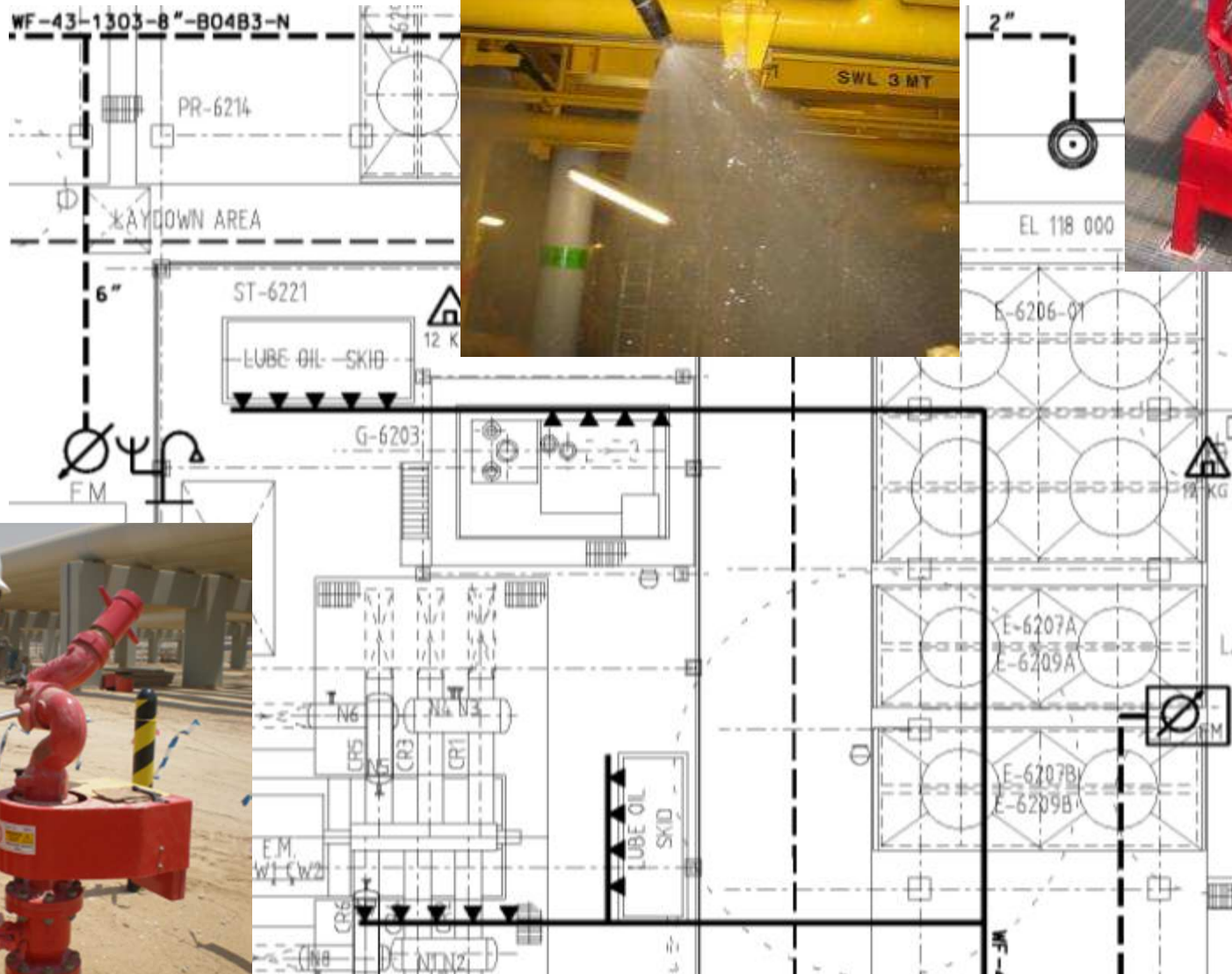








## Fire fighting



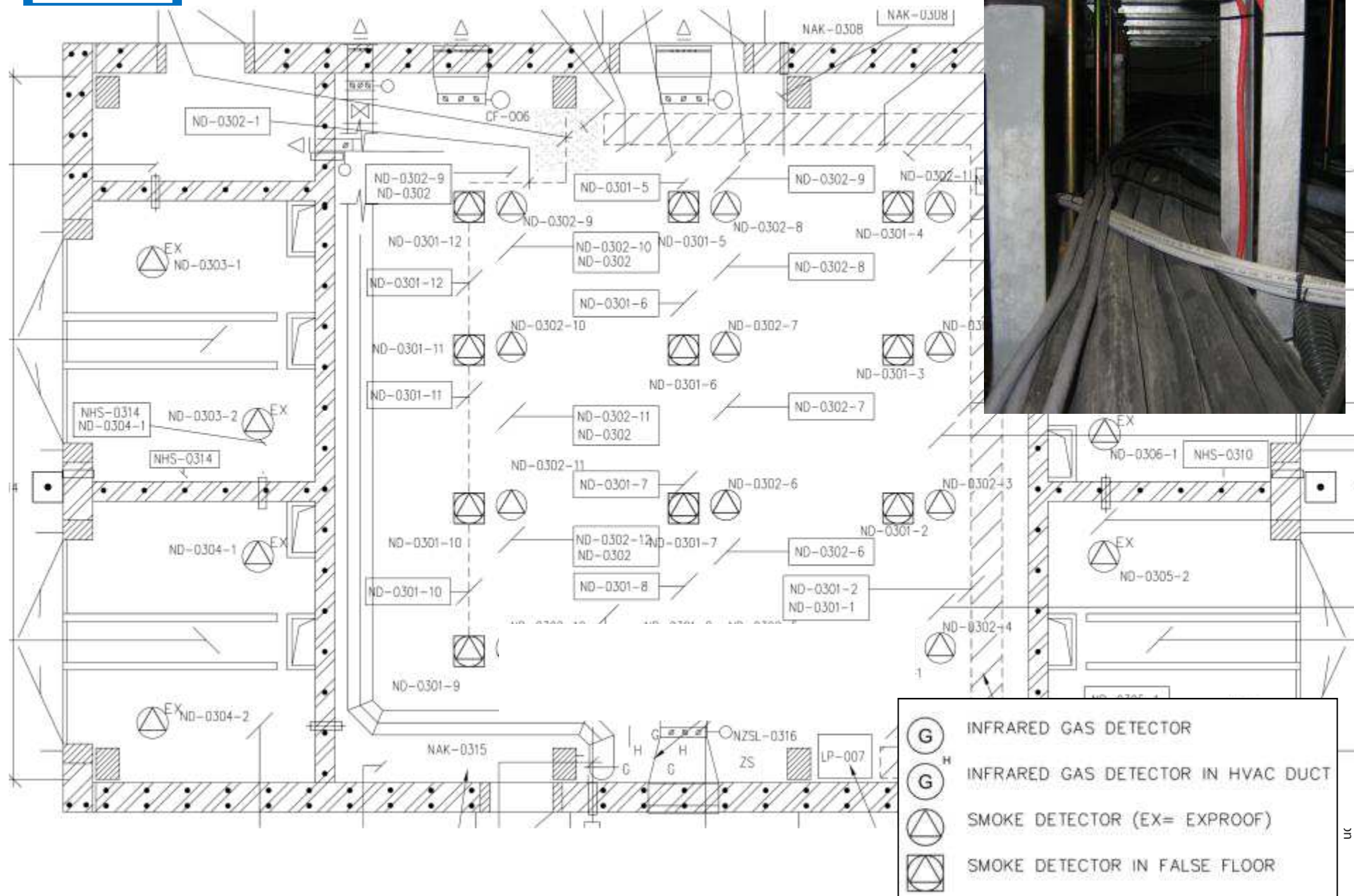
## Passive fire protection





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# Fire & Gas detection layout





## Sources description

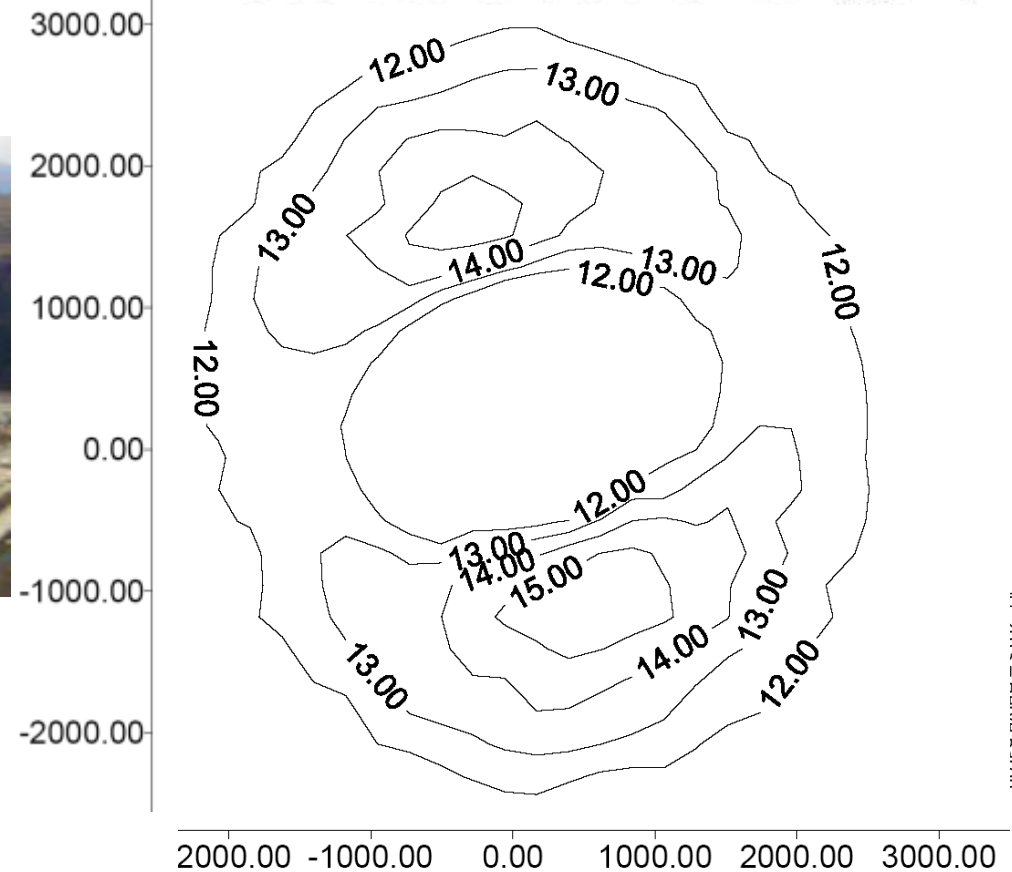
| SOURCE NAME            | Stack Height (m) | Stack diam. (m) | Flue gas temp. (°K) | Flue gas velocity (m/s) | Q <sub>WET</sub> (Nm <sup>3</sup> /h) | NO <sub>x</sub> (g/s) | CO (g/s) |
|------------------------|------------------|-----------------|---------------------|-------------------------|---------------------------------------|-----------------------|----------|
| Turbocompressor TC-100 | 15               | 2.9             | 775                 | 28                      | 206000                                | 2.87                  | 8.60     |
| Turbocompressor TC-200 | 15               | 2.9             | 775                 | 28                      | 206000                                | 2.87                  | 8.60     |
| Turbocompressor TC-300 | 15               | 2.9             | 775                 | 28                      | 206000                                | 2.87                  | 8.60     |
| Turbocompressor TC-400 | 15               | 2.9             | 775                 | 28                      | 206000                                | 2.87                  | 8.60     |
| Turbogenerator TG-001  | 15               | 1.38            | 806                 | 28                      | 45000                                 | 0.63                  | 1.88     |
| Turbogenerator TG-002  | 15               | 1.38            | 806                 | 28                      | 45000                                 | 0.63                  | 1.88     |

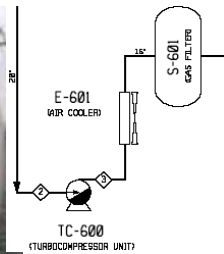
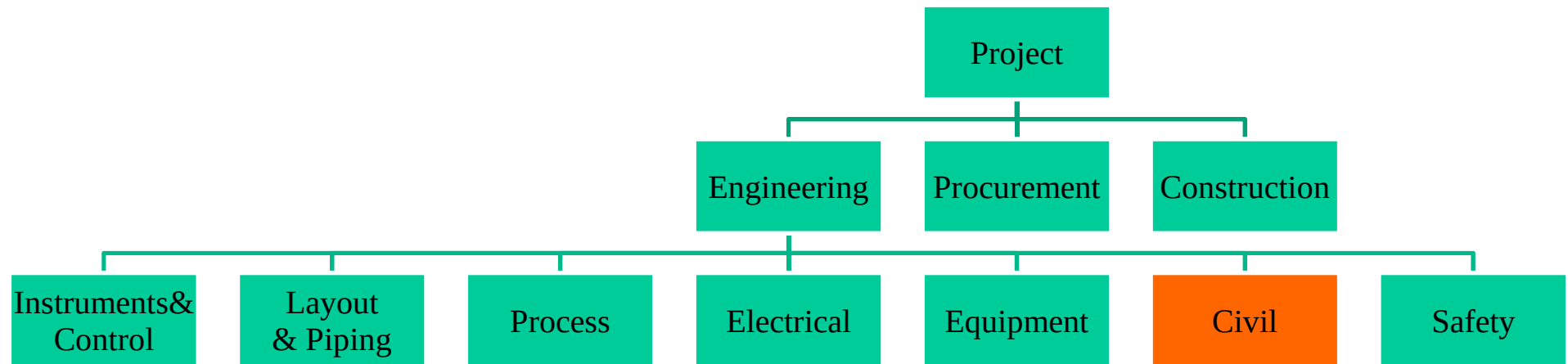
## Coordinates of the sources

|                        | X (m) | Y (m) |
|------------------------|-------|-------|
| Turbocompressor TC-100 | 127   | 365   |
| Turbocompressor TC-200 | 127   | 331   |
| Turbocompressor TC-300 | 127   | 268   |
| Turbocompressor TC-400 | 127   | 235   |
| Turbogenerator TG-001  | 182   | 177   |
| Turbogenerator TG-002  | 190   | 177   |



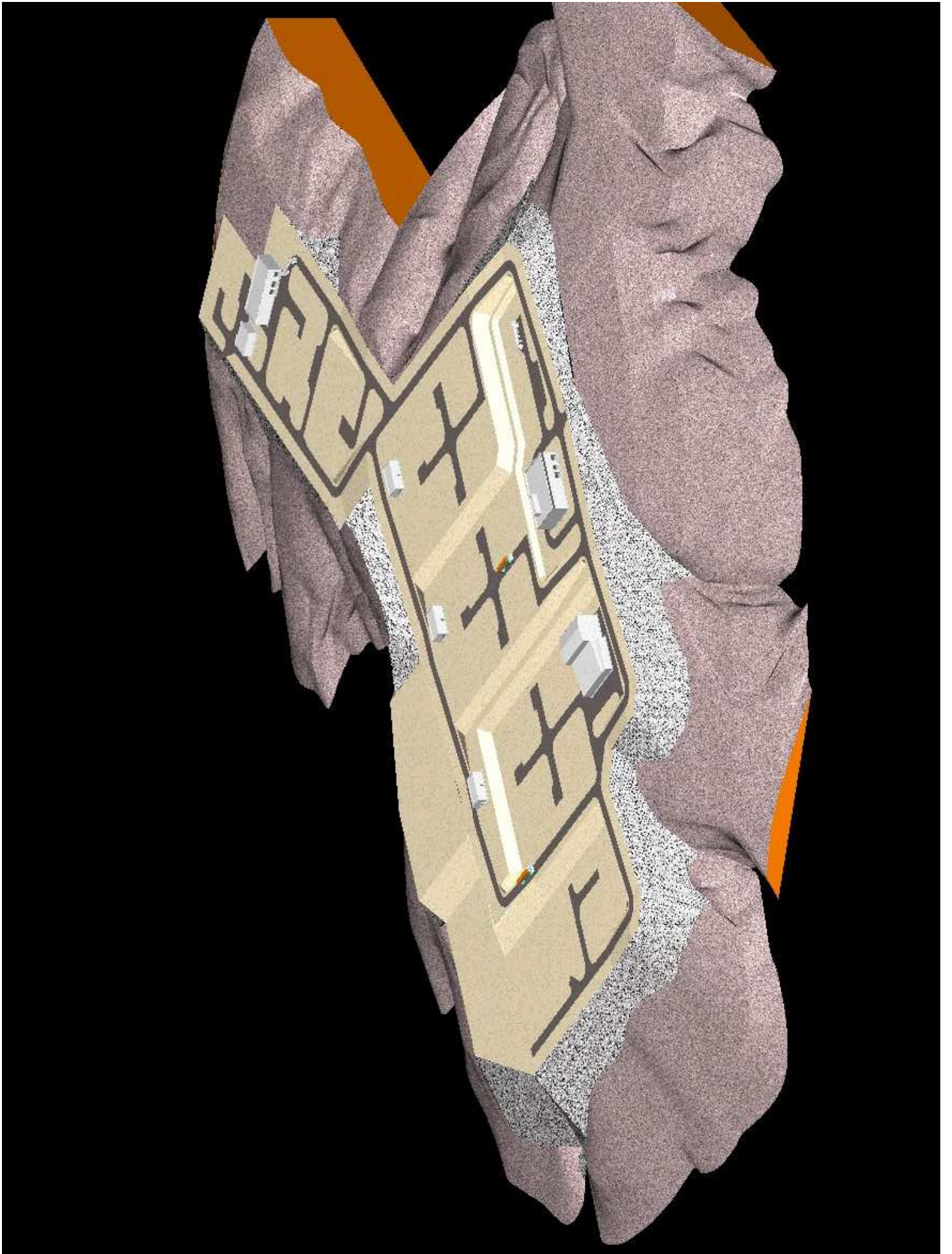
## Ground Concentration of NO<sub>x</sub> (μg/m<sup>3</sup>)

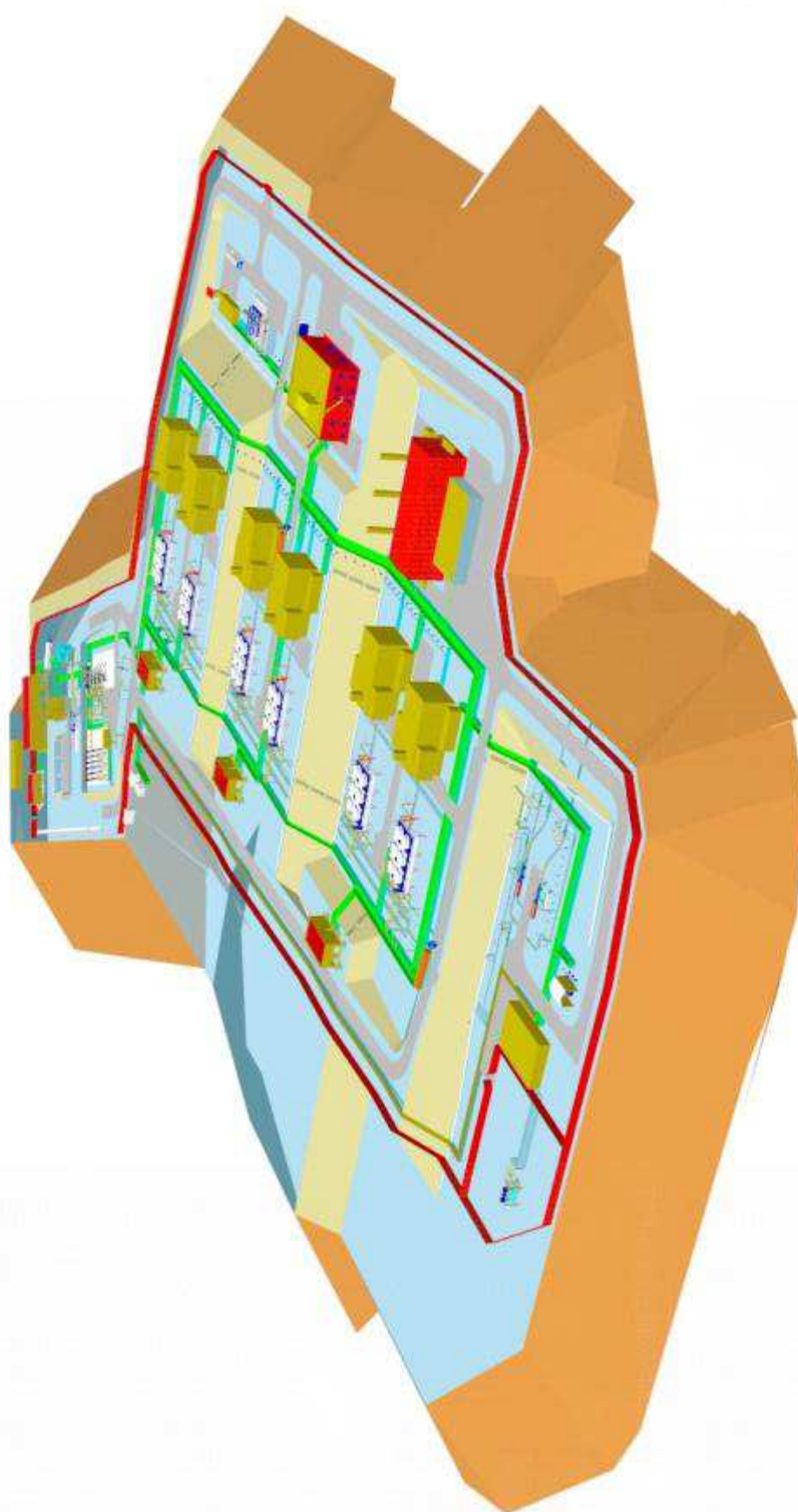
















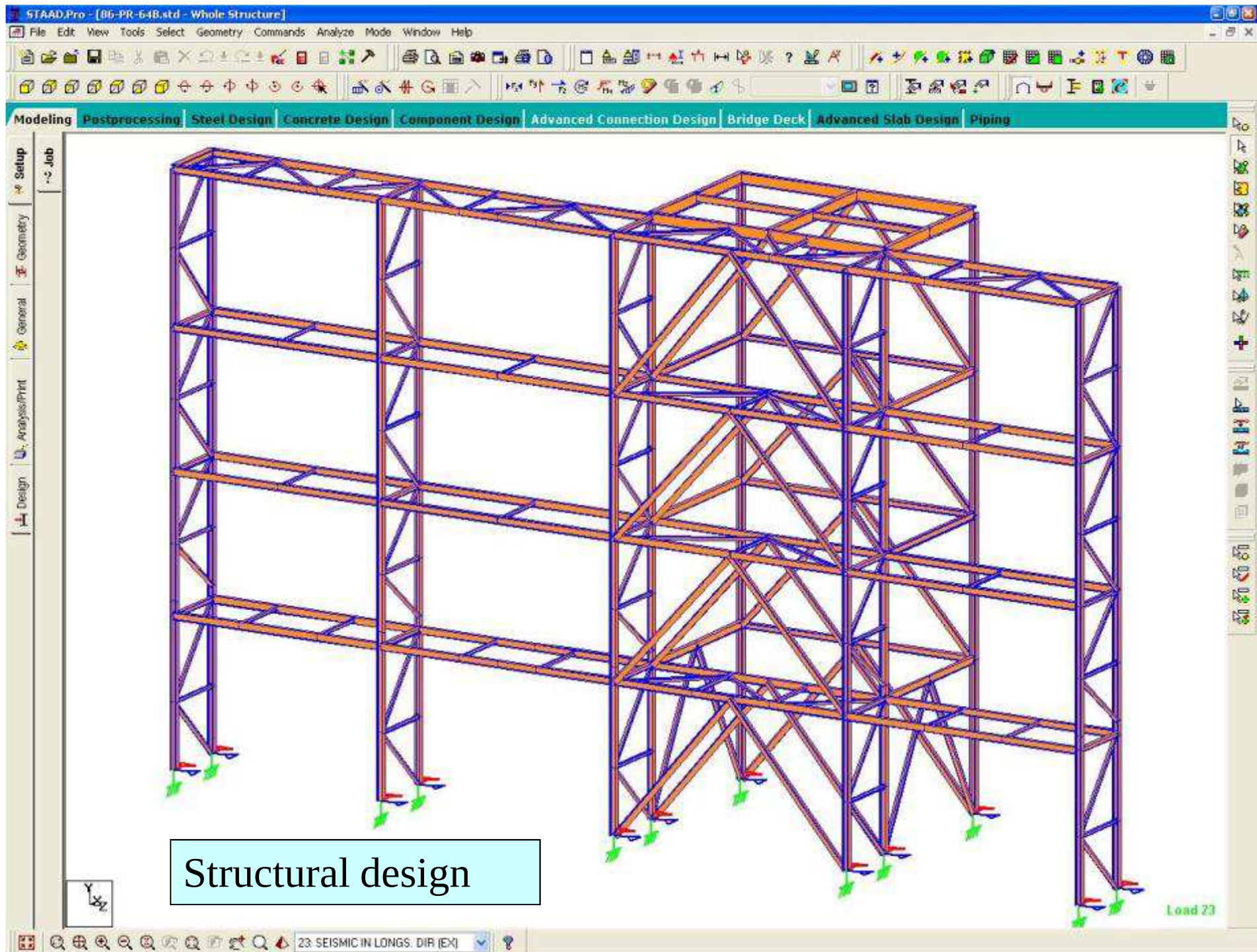






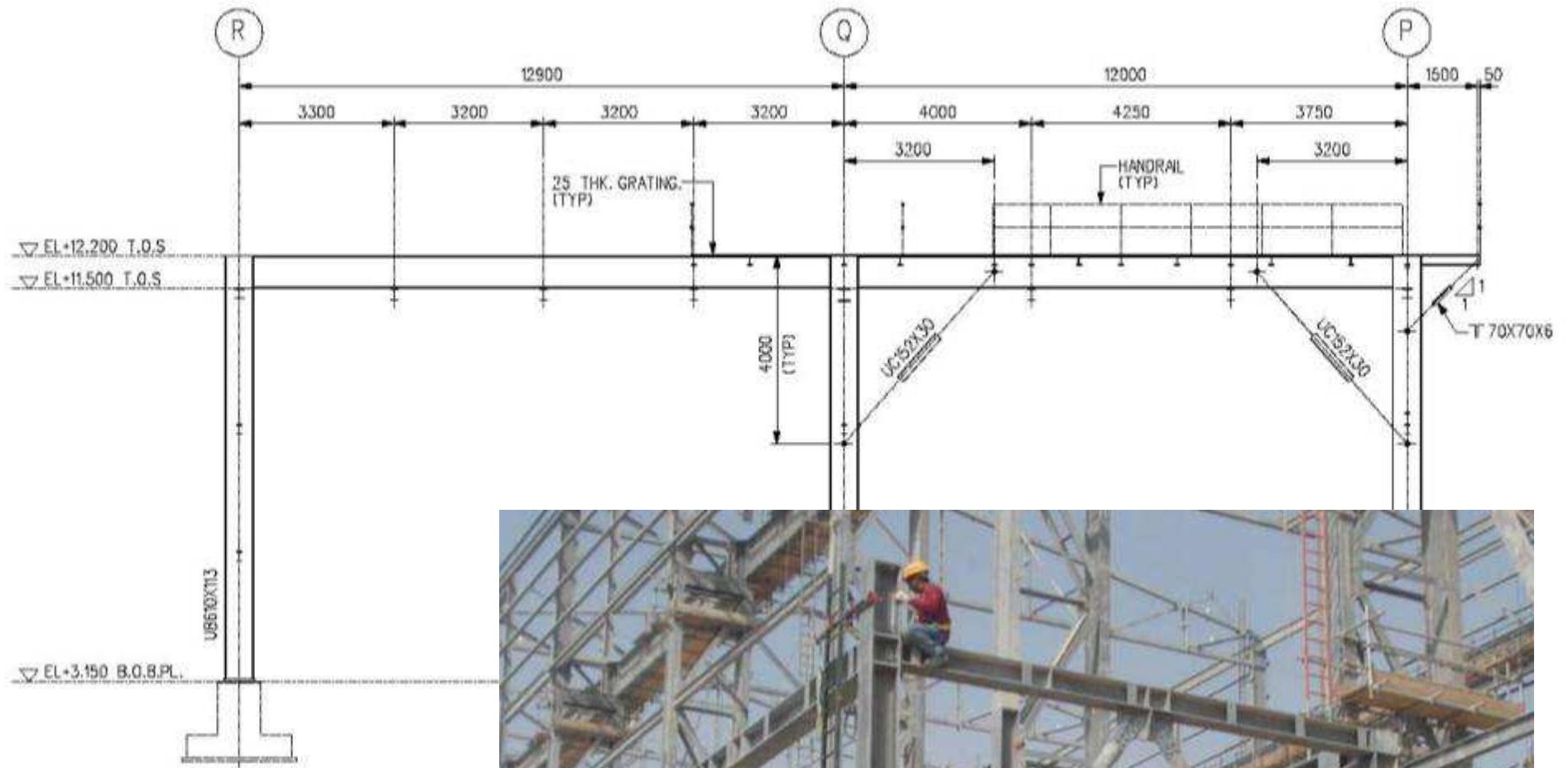
Piping supporting  
structures (pipe-racks)







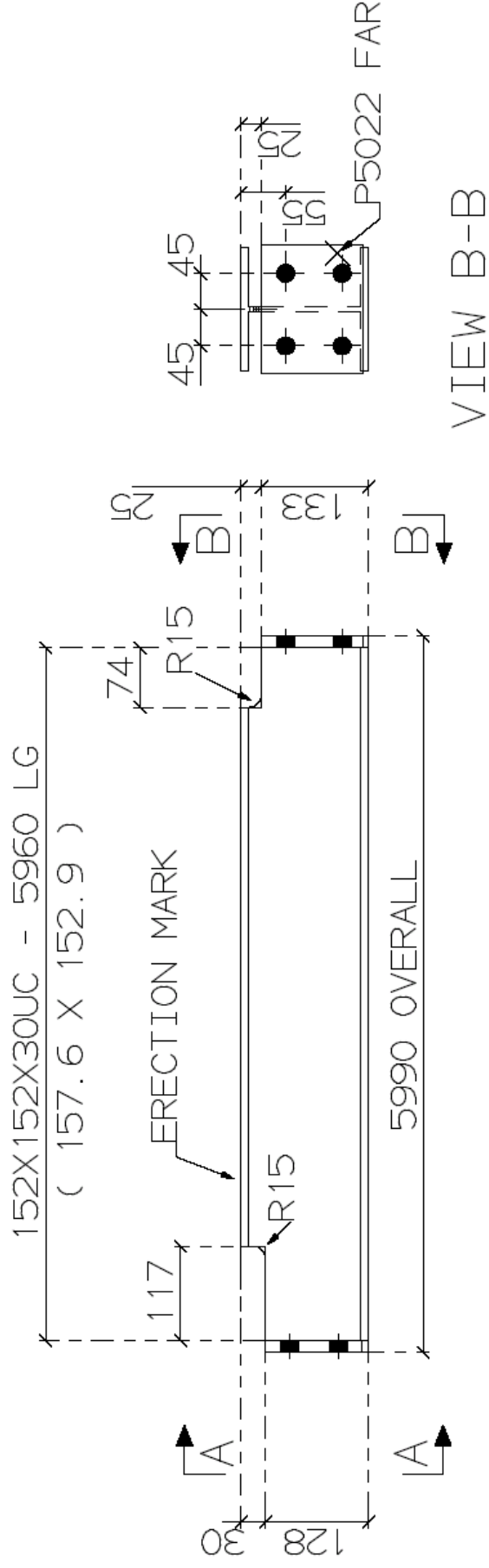




Structural  
drawings

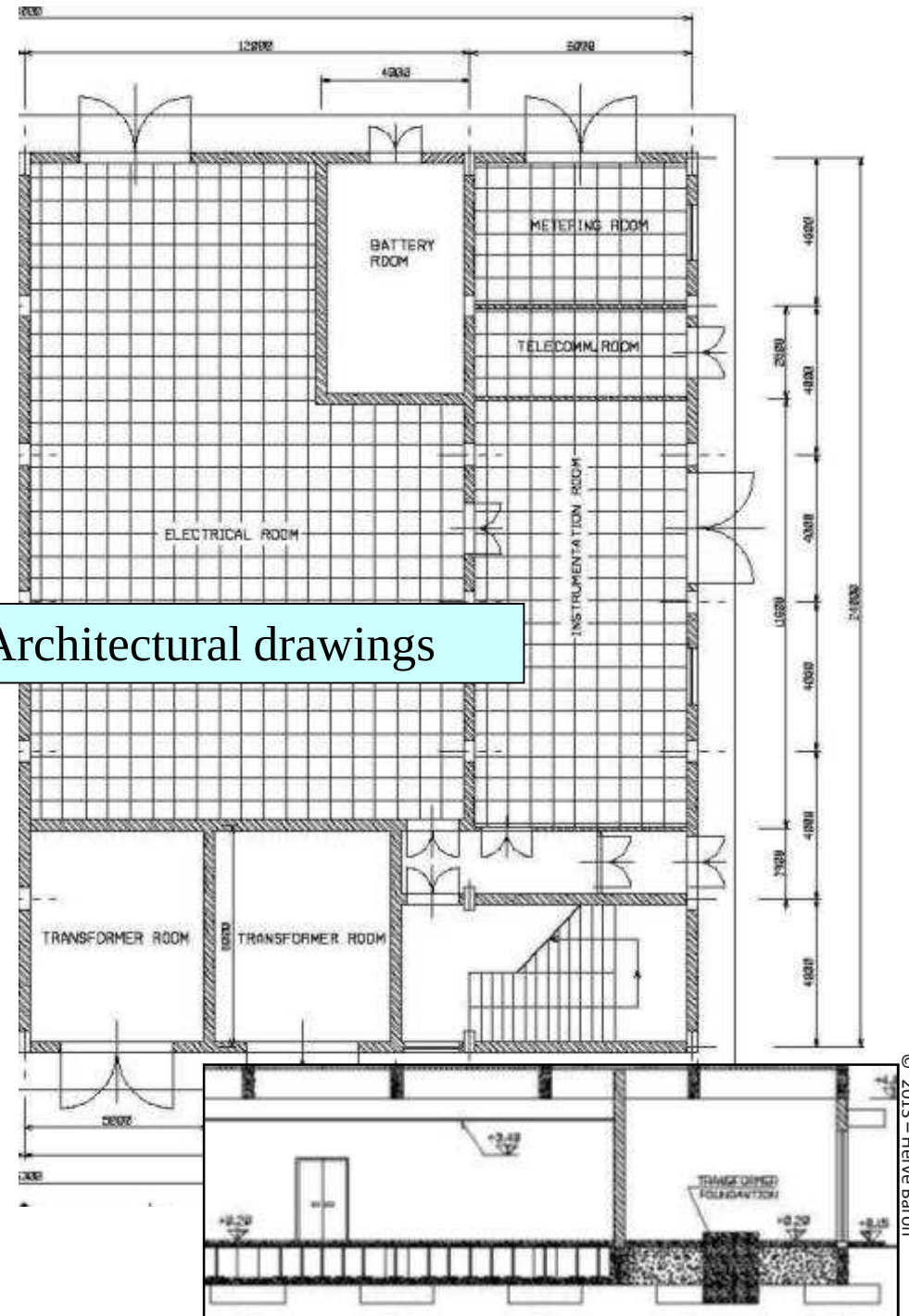






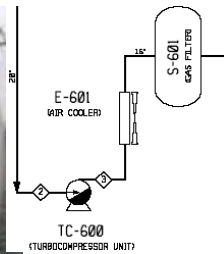
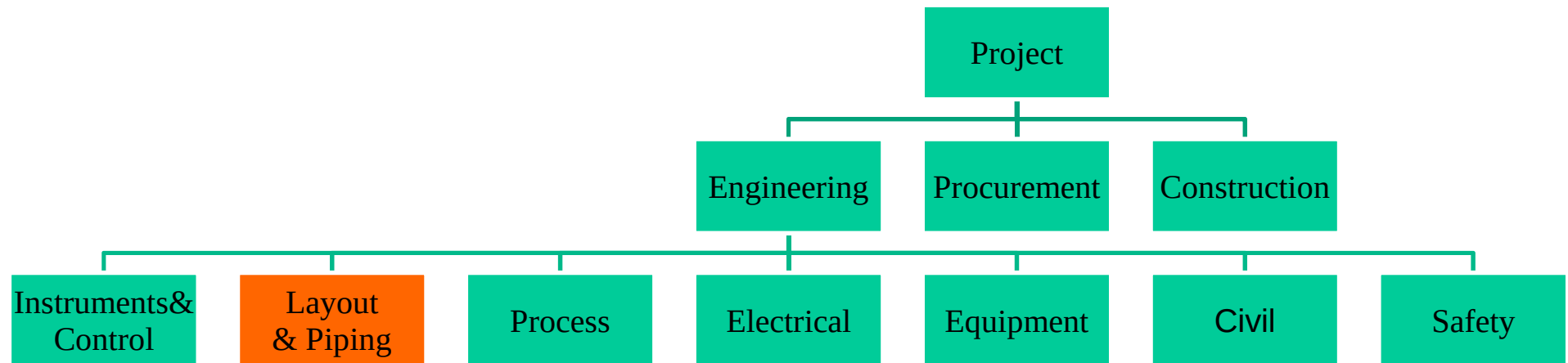


## Architectural drawings

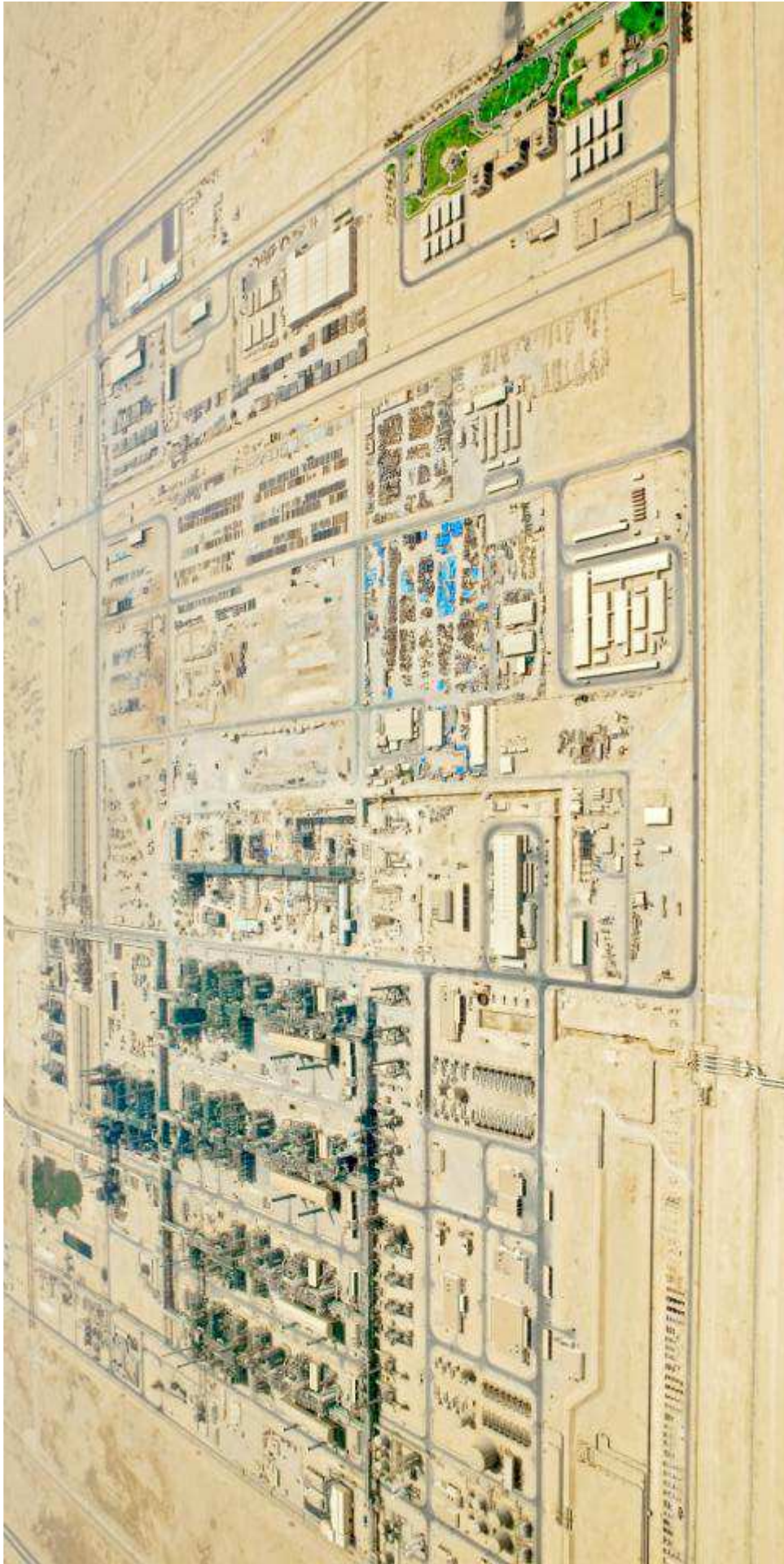




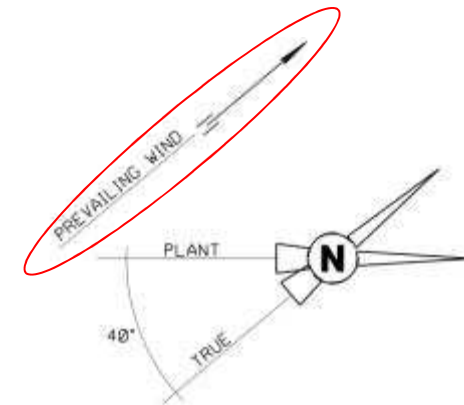
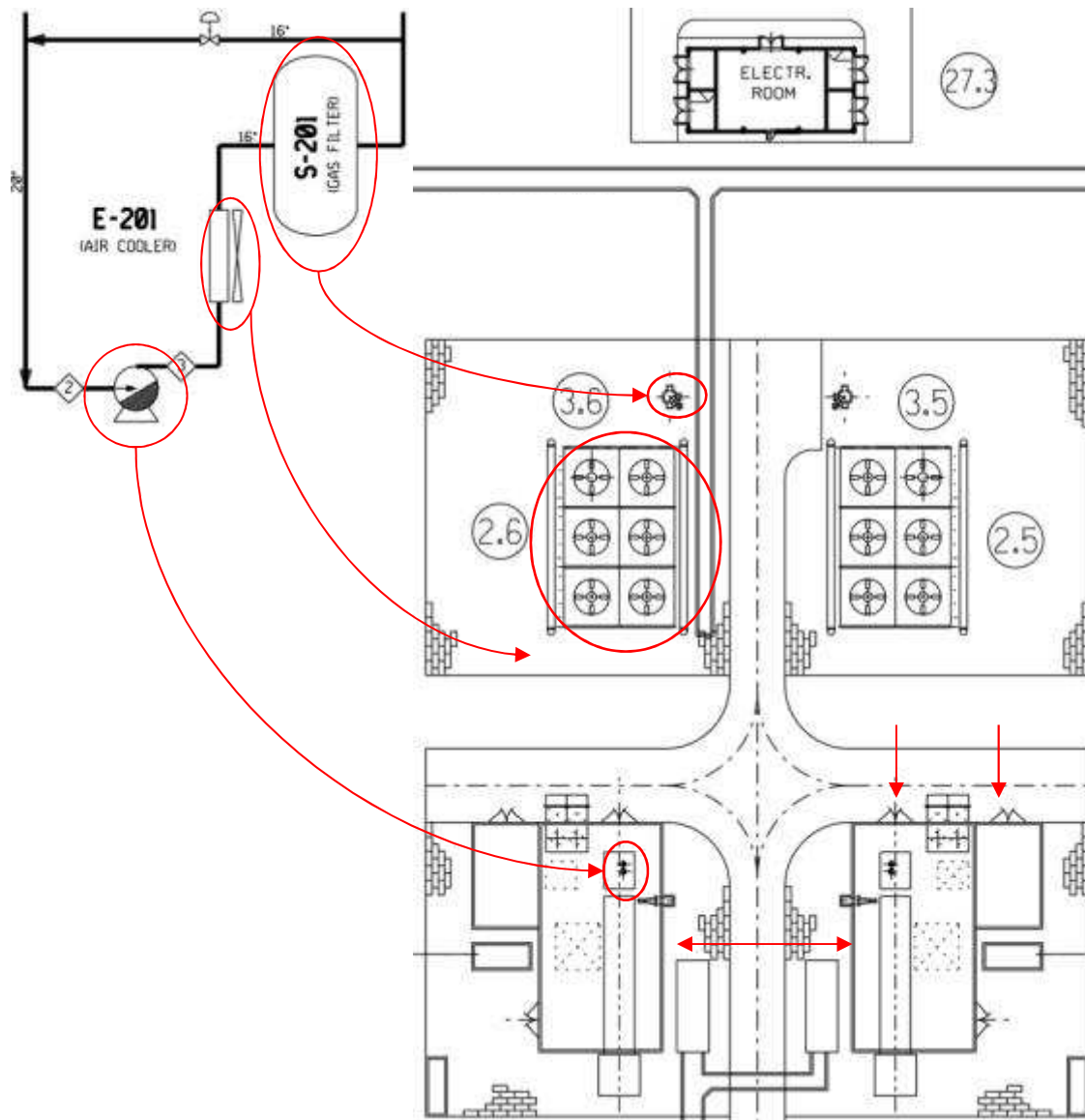








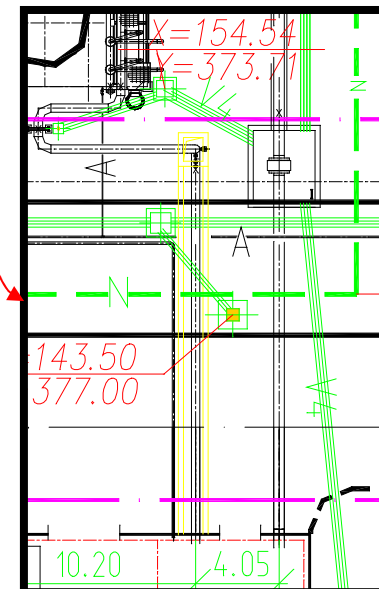
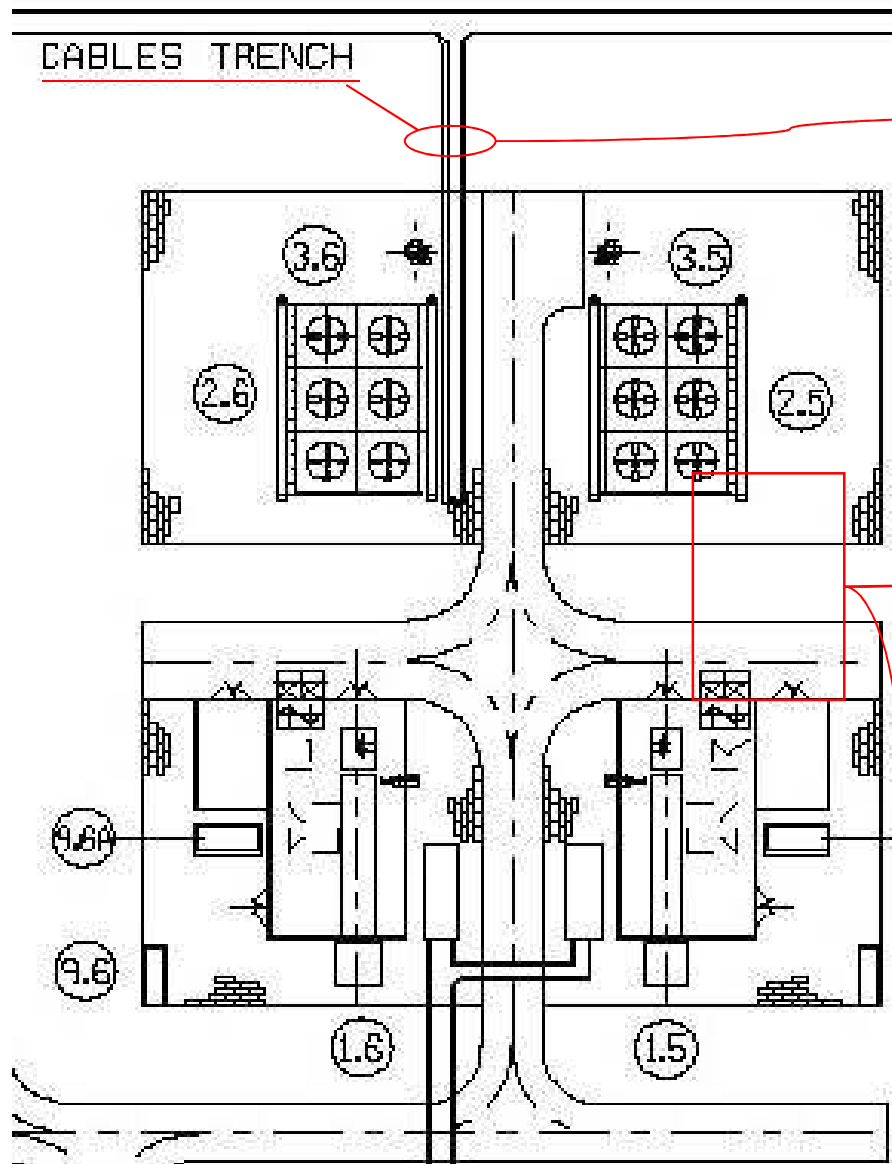
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Layout/  
principles

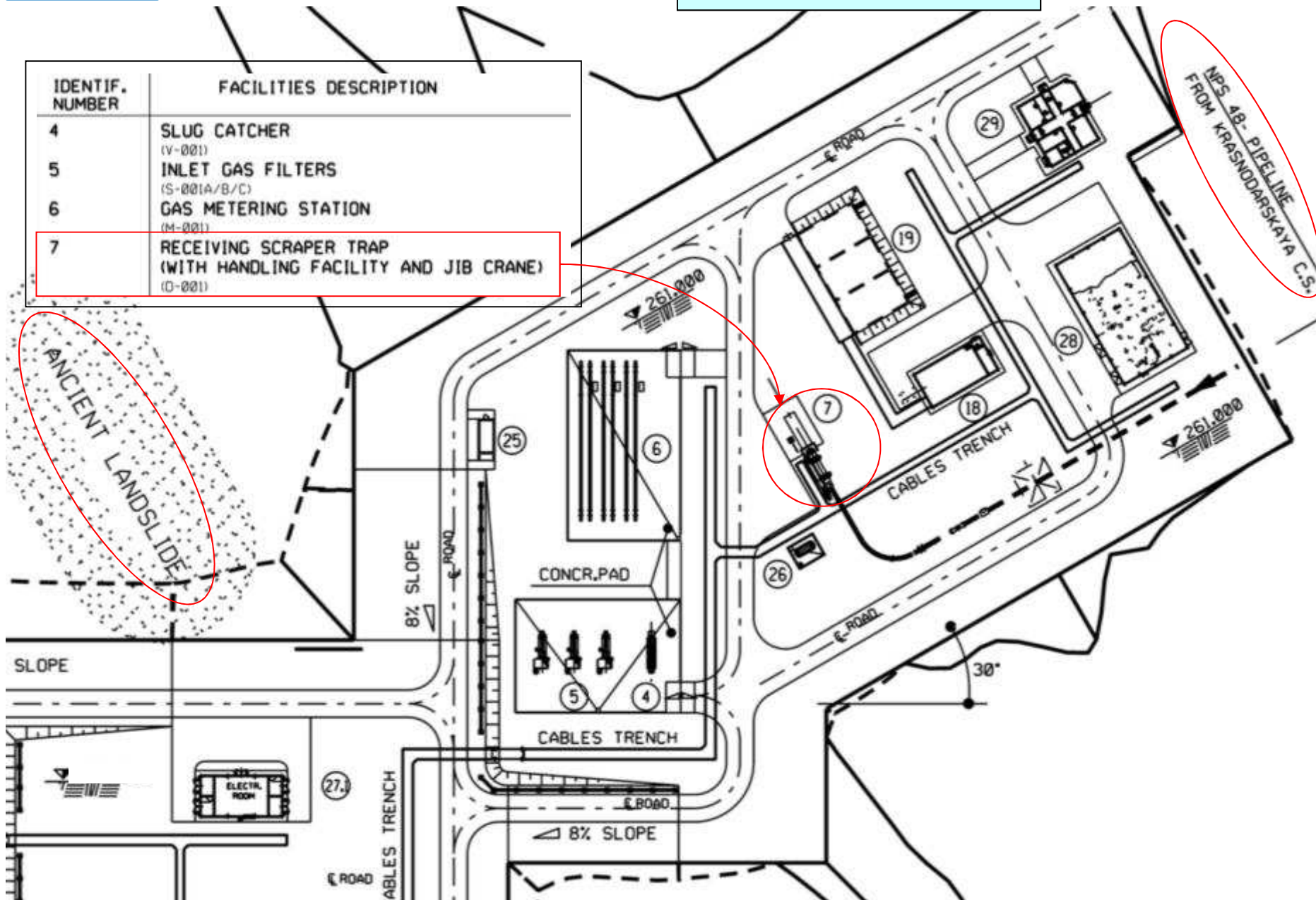


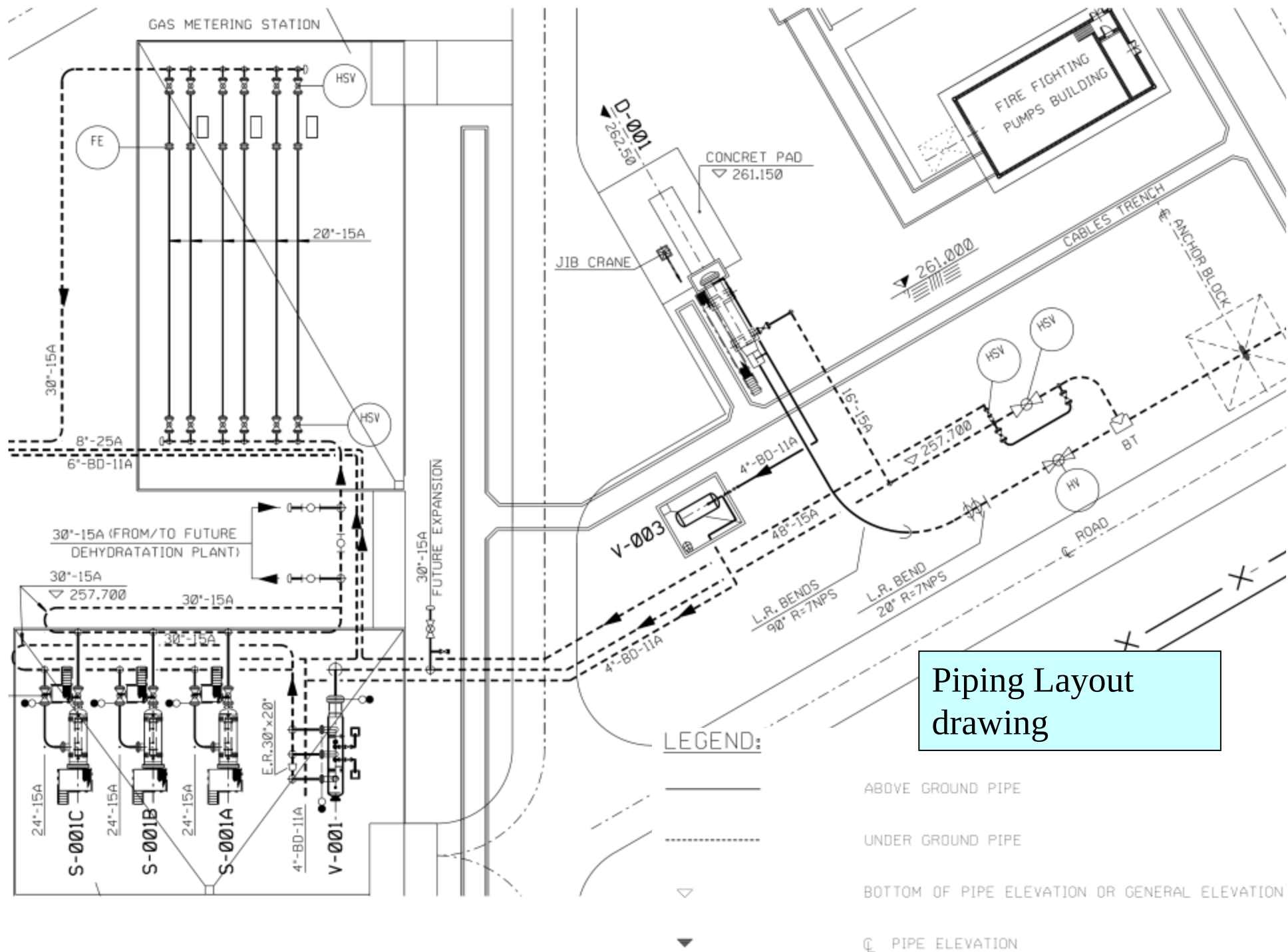
# Layout/consideration for all networks

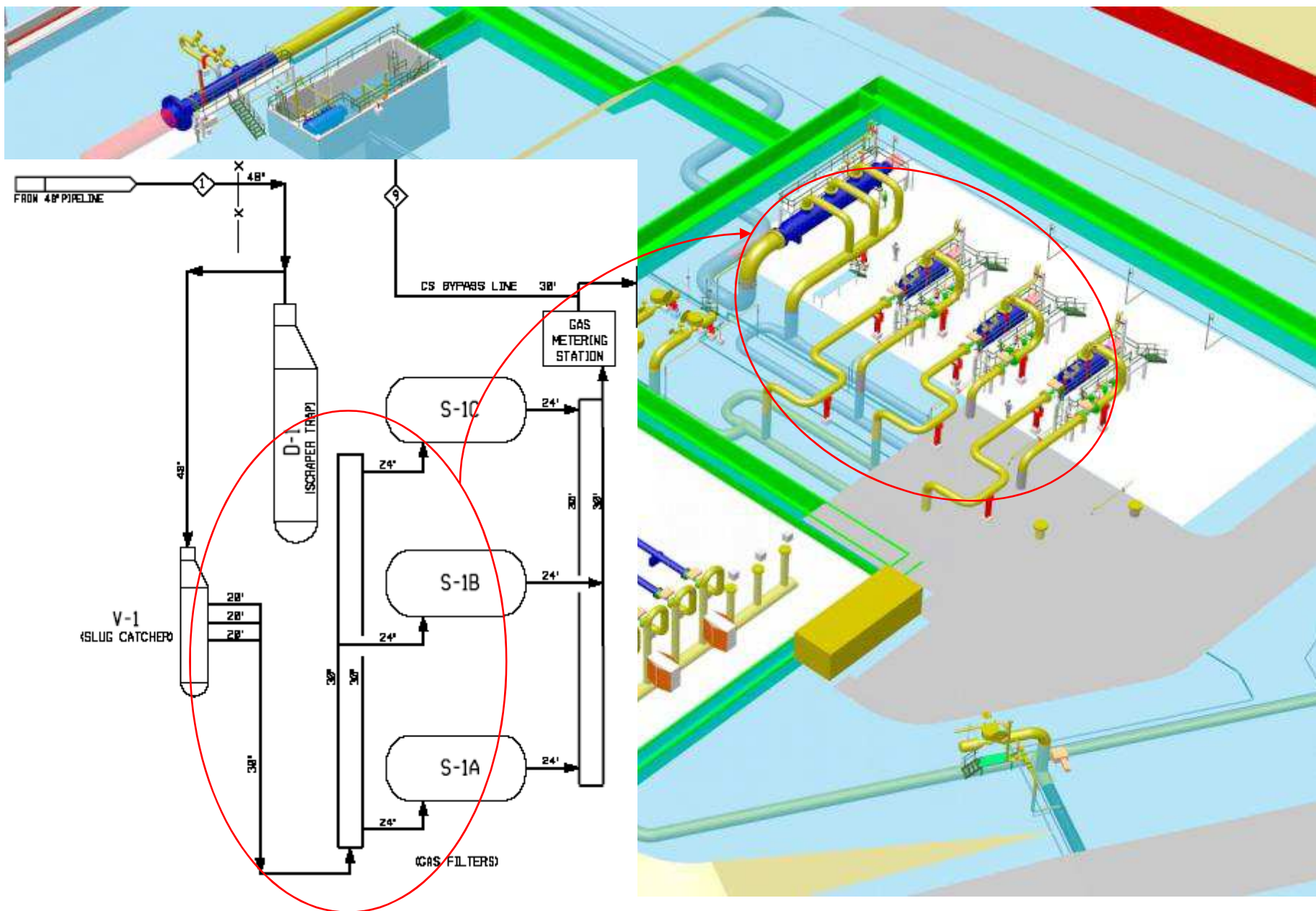




# General Plot Plan

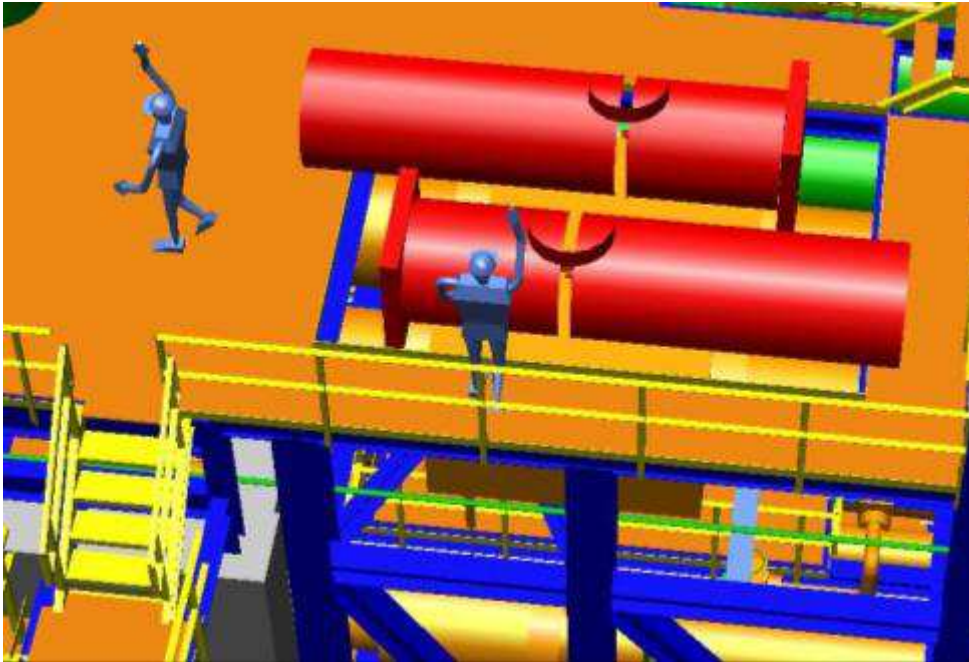






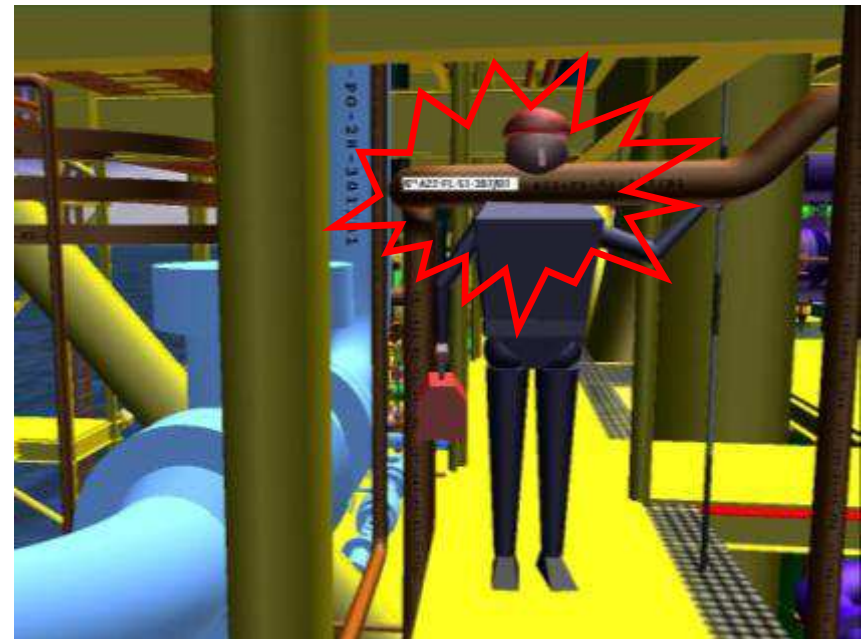


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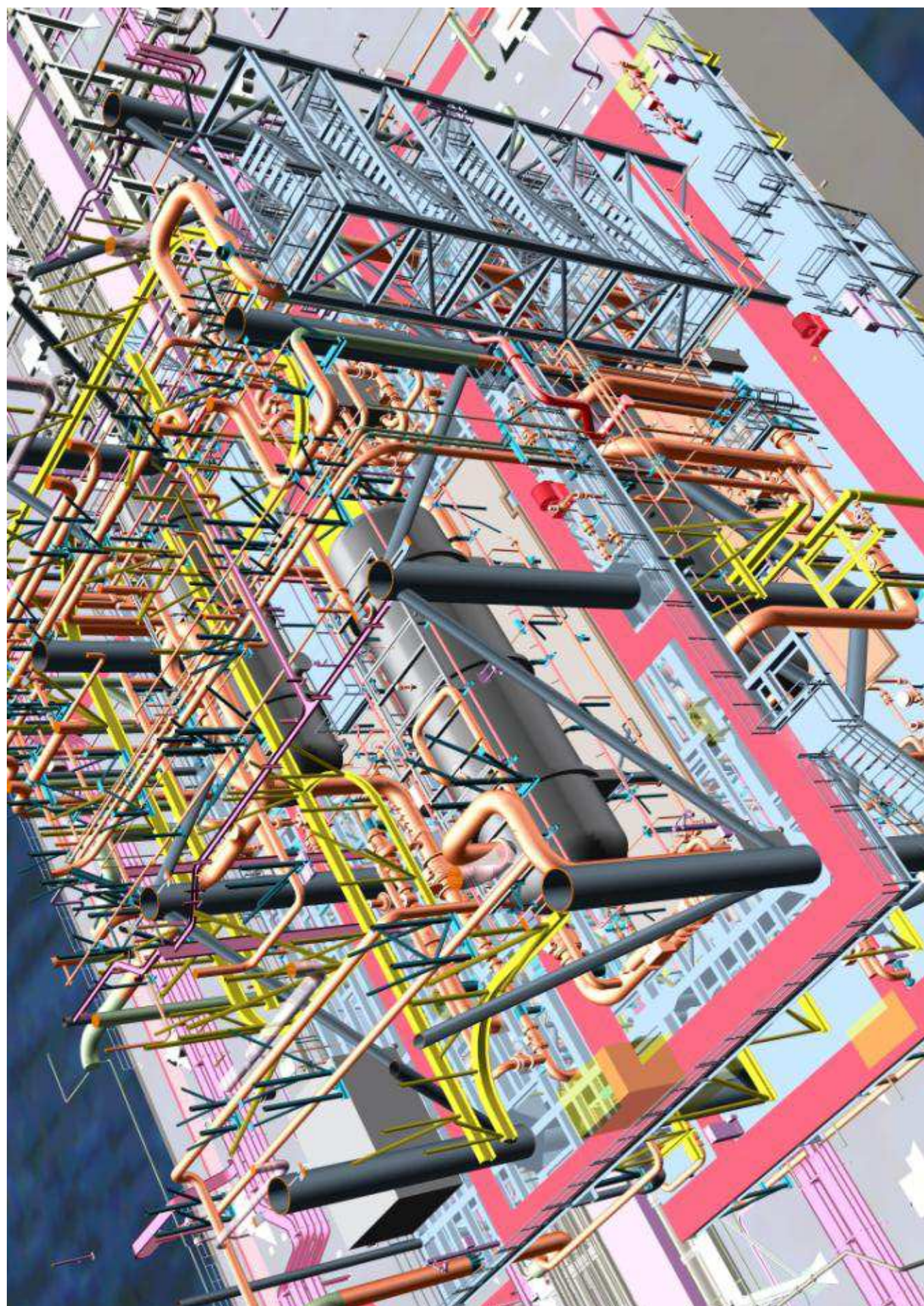
3D model review

3D model clash check



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## ANSI B31.8 (for gas pipelines and compressor stations)

### 841.1 Steel Piping Systems Design Requirements

#### 841.11 Steel Pipe Design Formula

(a) The design pressure for steel gas piping systems or the nominal wall thickness for a given design pressure shall be determined by the following formula (for limitations, see para. 841.111):

$$P = \frac{2St}{D} FET$$

where

$D$  = nominal outside diameter of pipe, in.

$E$  = longitudinal joint factor obtained from Table 841.115A [see also para. 817.13(d)]

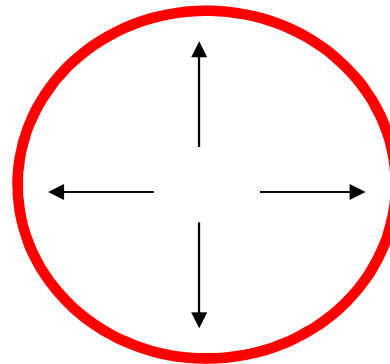
$F$  = design factor obtained from Table 841.114A. In setting the values of the design factor,  $F$ , due consideration has been given and allowance has been made for the various underthickness tolerances provided for in the pipe specifications listed and approved for usage in this Code.

$P$  = design pressure, psig (see also para. 841.111)

$S$  = specified minimum yield strength, psi, stipulated in the specifications under which the pipe was purchased from the manufacturer or determined in accordance with paras. 817.13(h) and 841.112. The specified minimum yield strengths of some of the more commonly used piping steels whose specifications are incorporated by reference herein are tabulated for convenience in Appendix D.

$T$  = temperature derating factor obtained from Table 841.116A

$t$  = nominal wall thickness, in.



API 5L specification

Forty-first edition – APRIL 1995

#### CHEMICAL REQUIREMENTS FOR HEAT ANALYSES (Section 6)

| Type of pipe                  | Grade                  | Carbon<br>maxi % (1) | Manganese<br>maxi % (1) | Phosphorus<br>maxi % | Sulfur<br>maxi % |
|-------------------------------|------------------------|----------------------|-------------------------|----------------------|------------------|
| <b>seamless</b>               |                        |                      |                         |                      |                  |
| Non-expanded or cold expanded | A                      | 0.22                 | 0.90                    | 0.030                | 0.030            |
|                               | B(4)                   | 0.27                 | 1.15                    | 0.030                | 0.030            |
| Non-expanded                  | X42                    | 0.29                 | 1.25                    | 0.030                | 0.030            |
|                               | X46(4), X52(4)         | 0.31                 | 1.35                    | 0.030                | 0.030            |
| Cold expanded                 | X42(4), X46(4), X52(4) | 0.29(2)              | 1.25                    | 0.030                | 0.030            |
| Non-expanded or cold expanded | X56(3,4), X60(3,4)     | 0.26                 | 1.35                    | 0.030                | 0.030            |
|                               | X65, X70, X80          | (by agreement)       |                         |                      |                  |

#### TENSILE REQUIREMENTS (Section 6)

| Grade | Yield strength<br>minimum |     | Ultimate tensile strength<br>minimum |     | Ultimate tensile strength<br>maximum |     | Elongation<br>minimum percent<br>in 2 in. (50.8 mm) |
|-------|---------------------------|-----|--------------------------------------|-----|--------------------------------------|-----|-----------------------------------------------------|
|       | ksi                       | MPa | ksi                                  | MPa | ksi                                  | MPa |                                                     |
| A     | 30.0                      | 207 | 48.0                                 | 331 |                                      |     | See<br>note (1)                                     |
| B     | 35.0                      | 241 | 60.0                                 | 413 |                                      |     |                                                     |
| X42   | 42.0                      | 289 | 60.0                                 | 413 |                                      |     |                                                     |
| X46   | 46.0                      | 317 | 63.0                                 | 434 |                                      |     |                                                     |
| X52   | 52.0                      | 358 | 66.0                                 | 455 |                                      |     |                                                     |
| X56   | 56.0                      | 386 | 71.0                                 | 489 |                                      |     |                                                     |
| X60   | 60.0                      | 413 | 75.0                                 | 517 |                                      |     |                                                     |



## ANSI B31.8 (for gas pipelines and compressor stations)

### 841.1 Steel Piping Systems Design Requirements

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where

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$E$  = longitudinal joint factor obtained from Table 841.115A [see also para. 817.13(d)]

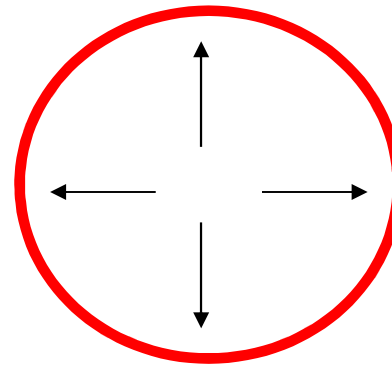
$F$  = design factor obtained from Table 841.114A. In setting the values of the design factor,  $F$ , due consideration has been given and allowance has been made for the various underthickness tolerances provided for in the pipe specifications listed and approved for usage in this Code.

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$T$  = temperature derating factor obtained from Table 841.116A

$t$  = nominal wall thickness, in.



API 5L specification

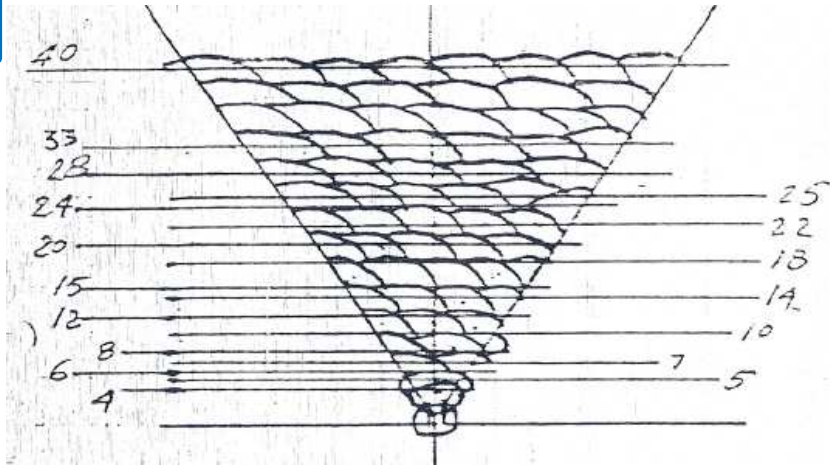
Forty-first edition – APRIL 1995

#### CHEMICAL REQUIREMENTS FOR HEAT ANALYSES (Section 6)

| Type of pipe                  | Grade                   | Carbon<br>maxi % (1) | Manganese<br>maxi % (1) | Phosphorus<br>maxi % | Sulfur<br>maxi % |
|-------------------------------|-------------------------|----------------------|-------------------------|----------------------|------------------|
| <b>seamless</b>               |                         |                      |                         |                      |                  |
| Non-expanded or cold expanded | A                       | 0.22                 | 0.90                    | 0.030                | 0.030            |
|                               | B(4)                    | 0.27                 | 1.15                    | 0.030                | 0.030            |
| Non-expanded                  | X42                     | 0.29                 | 1.25                    | 0.030                | 0.030            |
|                               | X46(4), X52(4),         | 0.31                 | 1.35                    | 0.030                | 0.030            |
| Cold expanded                 | X42(4), X46(4), X52(4), | 0.29(2)              | 1.25                    | 0.030                | 0.030            |
| Non-expanded or cold expanded | X56(3,4), X60(3,4)      | 0.26                 | 1.35                    | 0.030                | 0.030            |
|                               | X65, X70, X80           | (by agreement)       |                         |                      |                  |

#### TENSILE REQUIREMENTS (Section 6)

| Grade | Yield strength<br>minimum |     | Ultimate tensile strength<br>minimum |     | Ultimate tensile strength<br>maximum |     | Elongation<br>minimum percent<br>in 2 in. (50.8 mm) |
|-------|---------------------------|-----|--------------------------------------|-----|--------------------------------------|-----|-----------------------------------------------------|
|       | ksi                       | MPa | ksi                                  | MPa | ksi                                  | MPa |                                                     |
| A     | 30.0                      | 207 | 48.0                                 | 331 |                                      |     | See<br>note (1)                                     |
| B     | 35.0                      | 241 | 60.0                                 | 413 |                                      |     |                                                     |
| X42   | 42.0                      | 289 | 60.0                                 | 413 |                                      |     |                                                     |
| X46   | 46.0                      | 317 | 63.0                                 | 434 |                                      |     |                                                     |
| X52   | 52.0                      | 358 | 66.0                                 | 455 |                                      |     |                                                     |
| X56   | 56.0                      | 386 | 71.0                                 | 489 |                                      |     |                                                     |
| X60   | 60.0                      | 413 | 75.0                                 | 517 |                                      |     |                                                     |



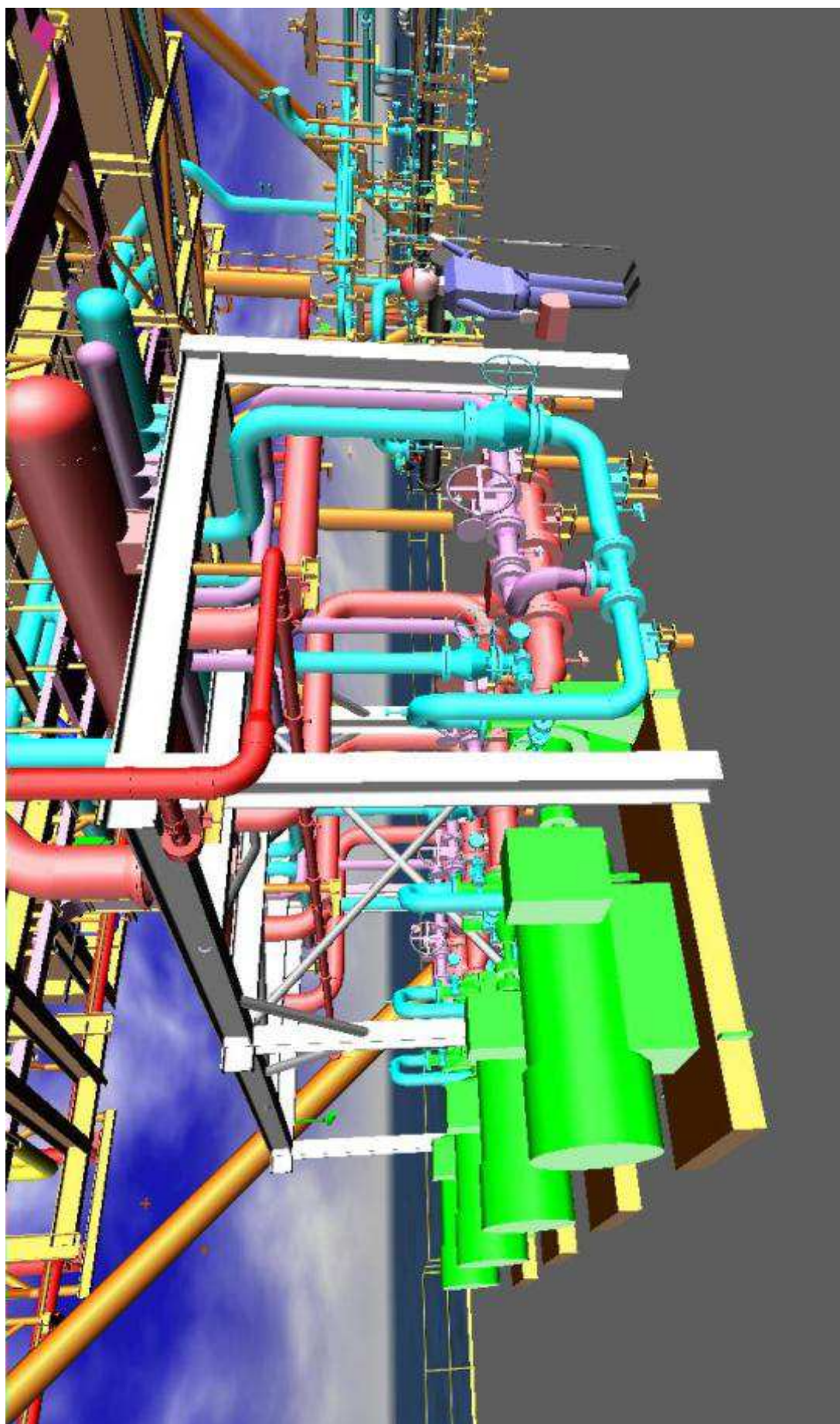
Thickness (mm) Number of passes

|    |    |                      |
|----|----|----------------------|
| 4  | 2  | } +3<br>ROOT<br>PASS |
| 5  | 3  |                      |
| 6  | 4  |                      |
| 7  | 5  |                      |
| 8  | 7  |                      |
| 10 | 9  |                      |
| 12 | 11 |                      |
| 14 | 13 |                      |
| 15 | 14 |                      |
| 18 | 18 |                      |
| 20 | 22 |                      |
| 22 | 25 |                      |
| 24 | 30 |                      |
| 25 | 32 |                      |
| 28 | 38 |                      |
| 33 | 44 |                      |
| 40 | 60 |                      |



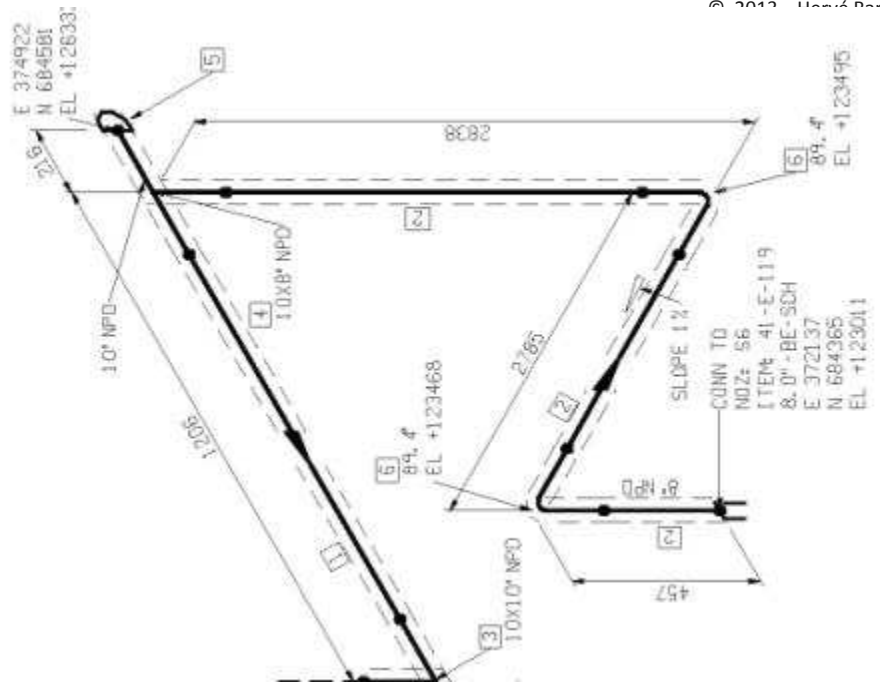
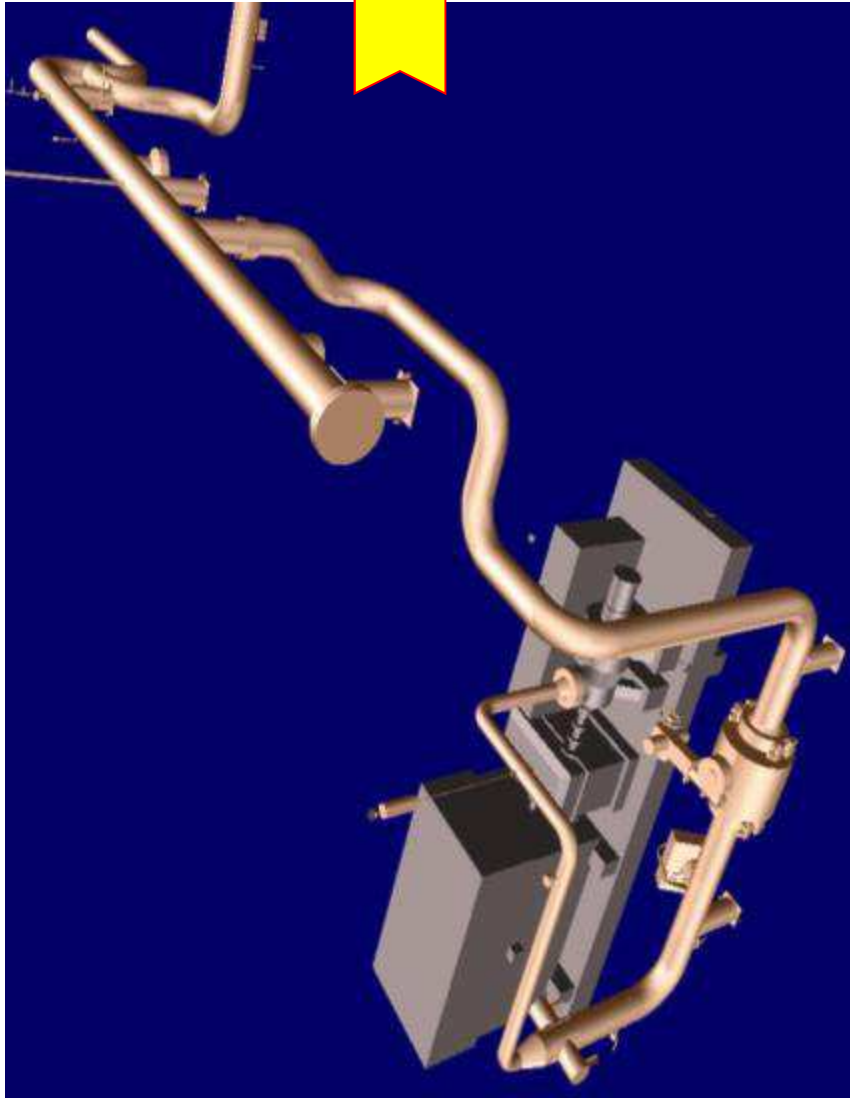




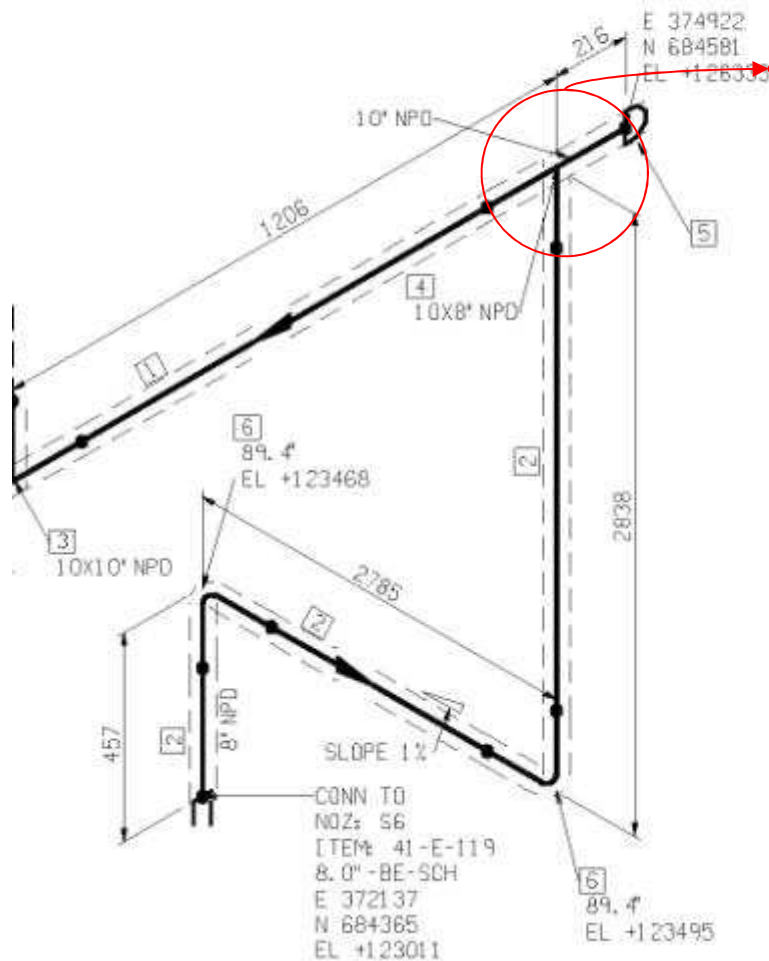








# Isometric drawing

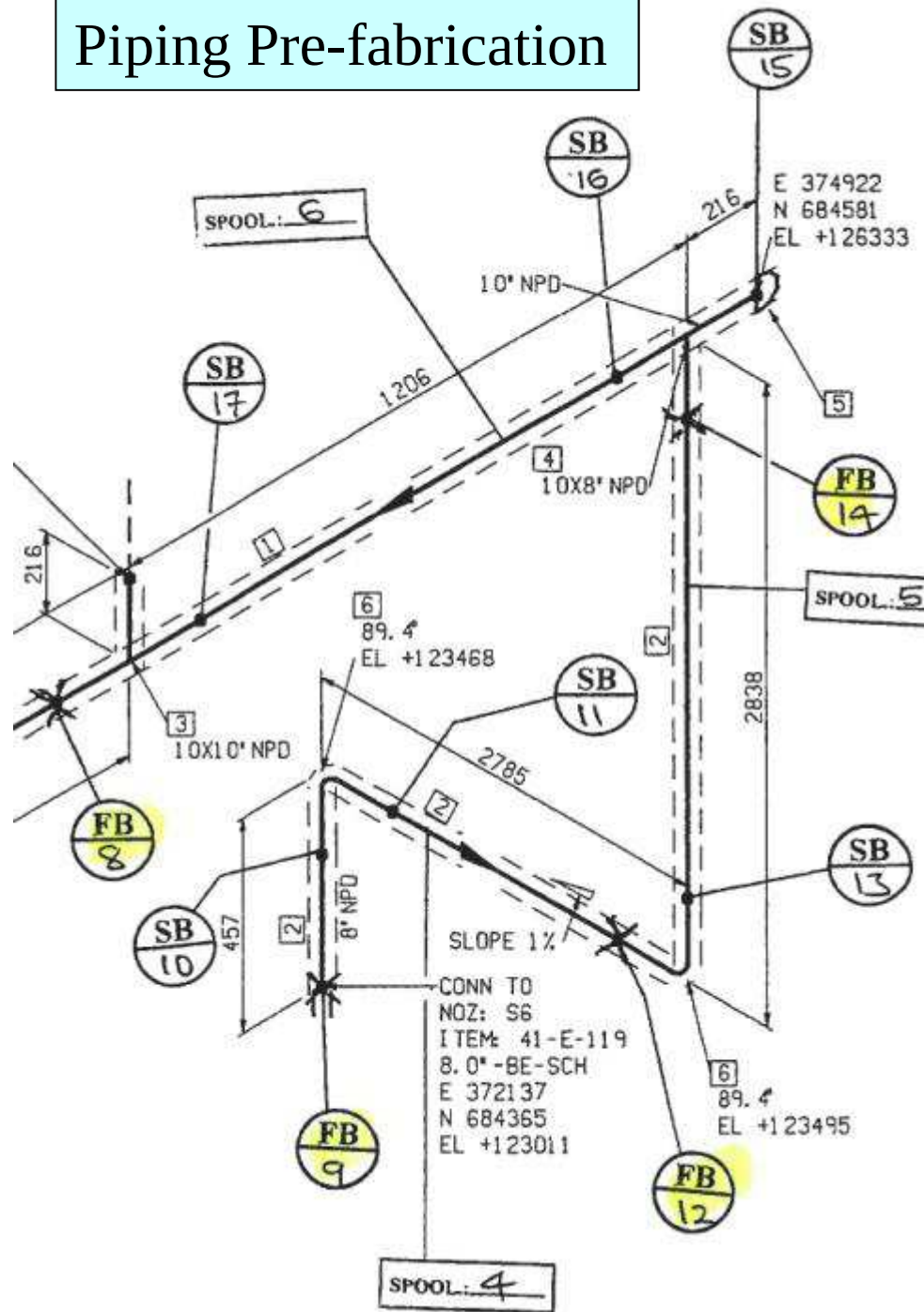


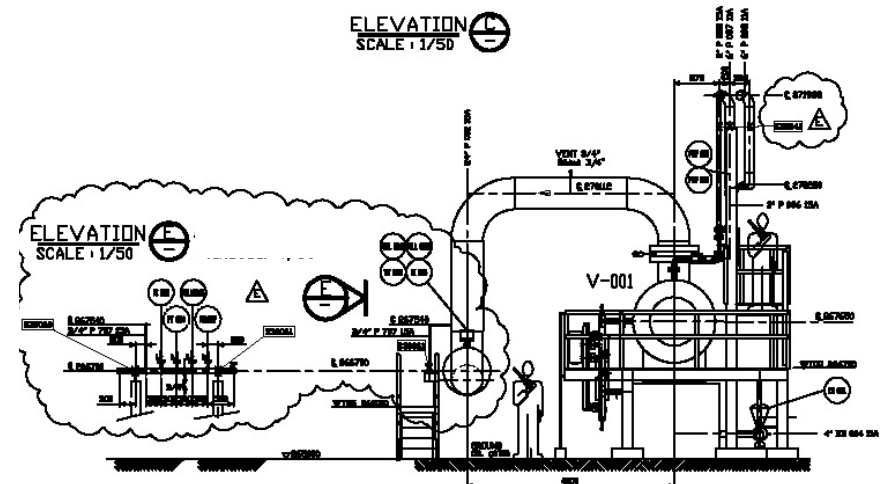
| SHOP MATERIAL   |                                                                                          |           |            |                 |         |
|-----------------|------------------------------------------------------------------------------------------|-----------|------------|-----------------|---------|
| PT NO           | COMPONENT DESCRIPTION                                                                    | DIAM (IN) | IDENT CODE | STOCK CODE      | QTY     |
| <u>PIPE</u>     |                                                                                          |           |            |                 |         |
| 1               | PIPE, ASME B36.10, ASME SA106 GR. B, BE, SEAMLESS, IN 10 X S-120                         | 10        | CI GABM    | PP2CI FHM P0000 | 1956 MM |
| 2               | PIPE, ASME B36.10, ASME SA106 GR. B, BE, SEAMLESS, IN 8 X S-120                          | 8         | C8Q8E9     | PP2CI FHM P0000 | 9338 MM |
| <u>FITTINGS</u> |                                                                                          |           |            |                 |         |
| 3               | EQUAL TEE, ASME B16.9, ASME SA234 GR. WPB, BW, SEAMLESS, IN 10 X S-120                   | 10X10     | CI S4234   | DT12CDRAME10000 | 1       |
| 4               | REDUCING TEE, ASME B16.9, ASME SA234 GR. WPB, BW, SEAMLESS, IN 10 X S-120 / IN 8 X S-120 | 10X8      | CI S4234   | DT12CDRAME10000 | 2       |
| 5               | CAP, ASME B16.9, ASME SA234 GR. WPB, BW, SEAMLESS, IN 10 X S-120                         | 10        | CI C4234   | DLF2CDRAME10000 | 1       |
| 6               | 90 DEG ELBOW LR, ASME B16.9, ASME SA234 GR. WPB, BW, SEAMLESS, IN 8 X S-120              | 8         | C8GAWI     | DE92CDRAME10000 | 4       |



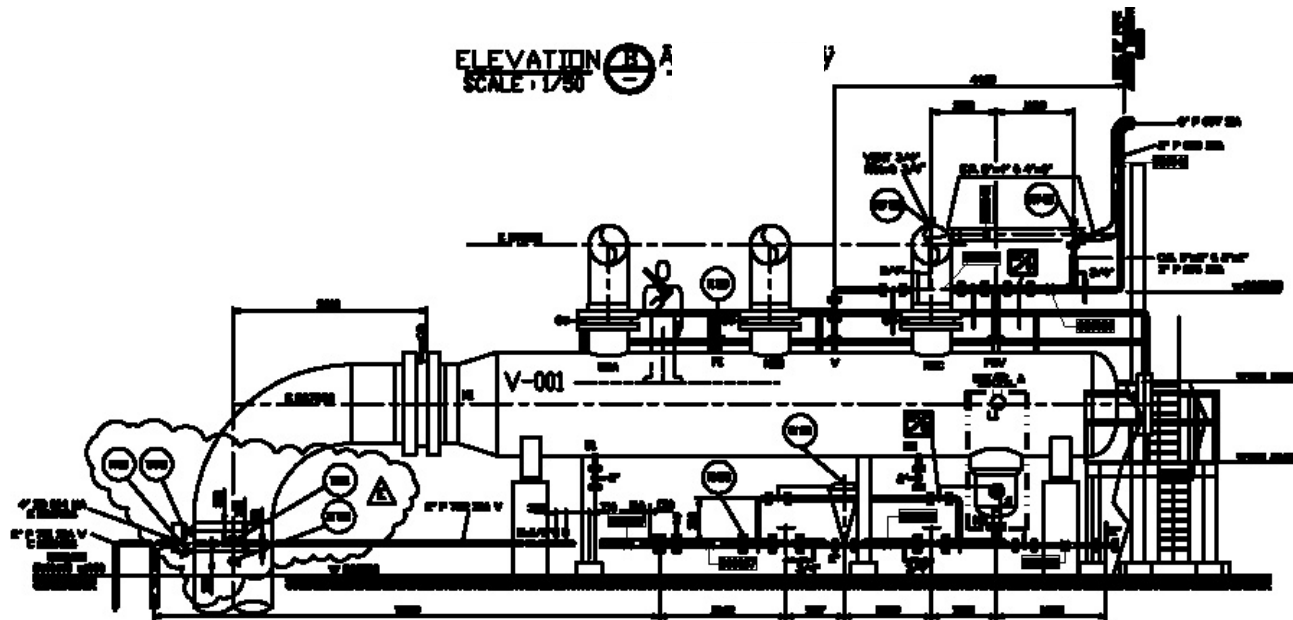


# Piping Pre-fabrication





Piping General Arrangement drawing

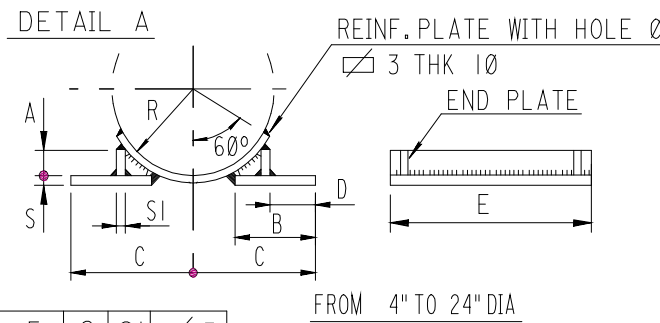
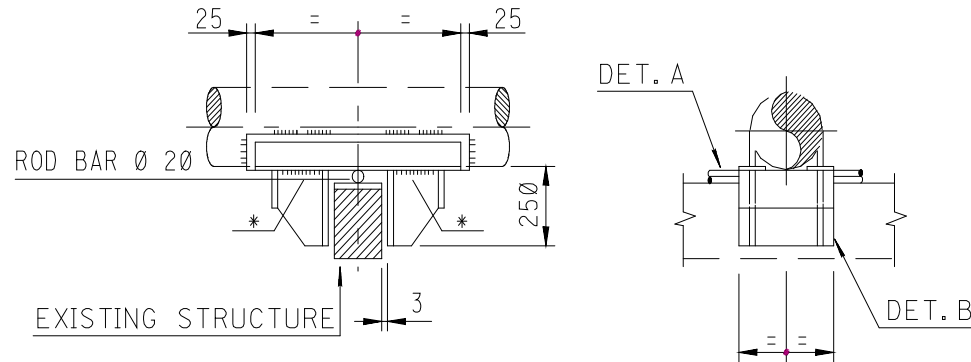




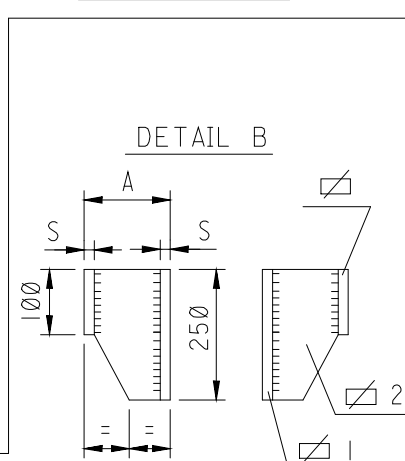


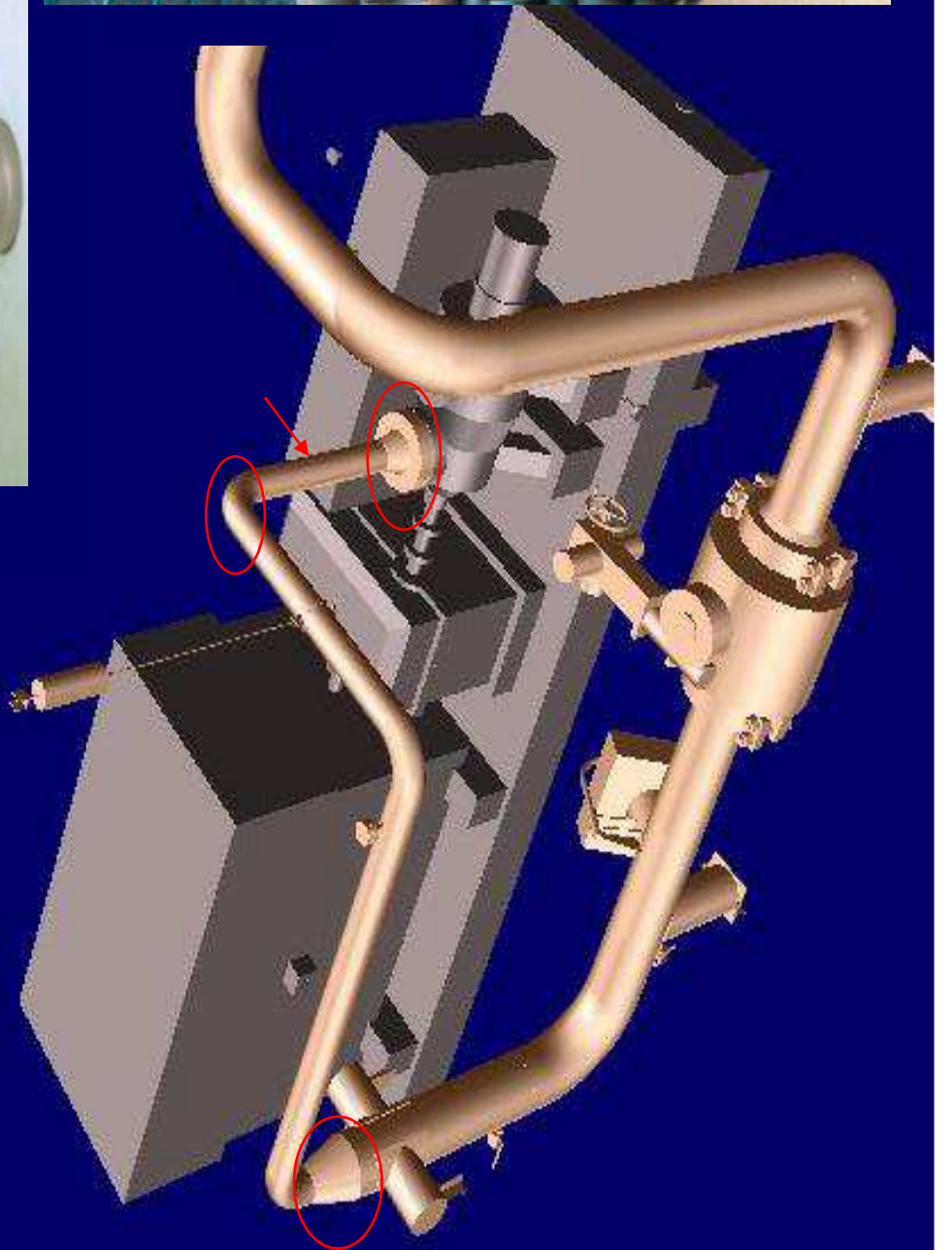
# Standard Pipe Support drawings

LINE STOP  
DETAIL "3"

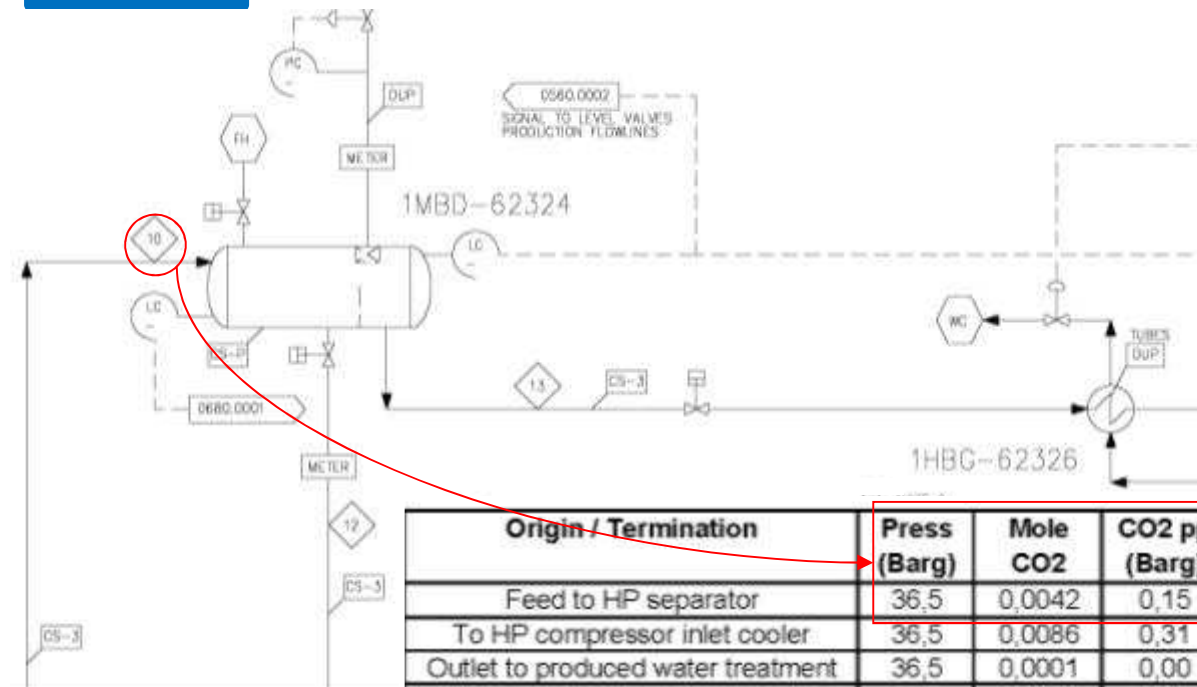


| DIA | R   | A  | B   | C   | D  | E    | S | SI | 3 |
|-----|-----|----|-----|-----|----|------|---|----|---|
| 4"  | 57  | 22 | 55  | 80  | 24 | 1000 | 6 | 6  |   |
| 6"  | 84  | 36 | 72  | 103 | 24 | 1100 | 8 |    |   |
| 8"  | 110 | 47 | 87  | 128 | 24 | 1200 |   |    |   |
| 10" | 136 | 60 | 104 | 150 | 24 | 1300 |   |    |   |
| 12" | 162 | 71 | 119 | 175 | 26 | 1400 |   |    |   |
| 14" | 178 | 79 | 131 | 200 | 27 |      |   |    |   |
| 16" | 203 | 91 | 147 | 220 | 25 |      |   |    |   |
| 18" | 228 | 58 | 144 | 220 | 41 |      |   |    |   |
| 20" | 254 | 64 | 155 | 235 | 37 |      |   |    |   |
| 22" | 279 | 72 | 168 | 252 | 37 |      |   |    |   |
| 24" | 305 | 79 | 184 | 271 | 37 |      |   |    |   |

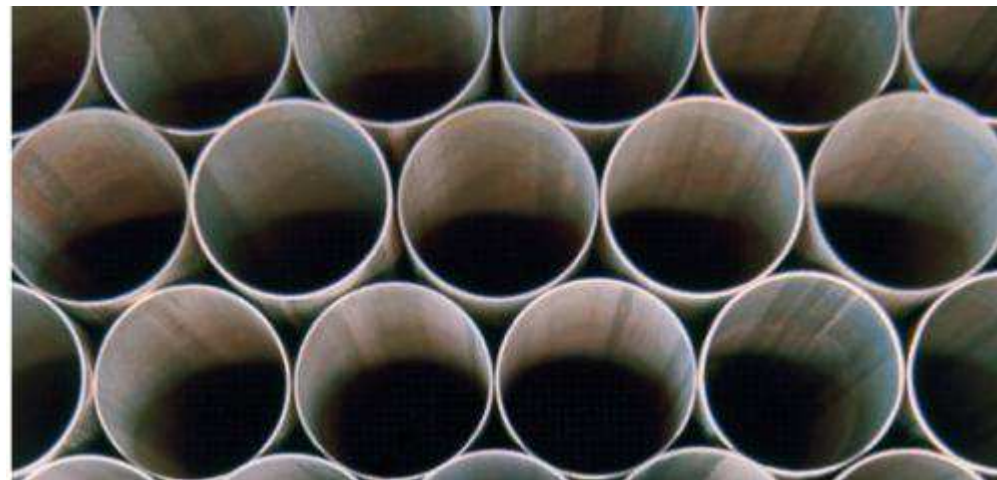




# Material Selection



| Origin / Termination               | Press (Barg) | Mole CO2 | CO2 pp (Barg) | Temp (C) | R (mm/y) | Corrected corrosion rate | Material + CA (mm) |
|------------------------------------|--------------|----------|---------------|----------|----------|--------------------------|--------------------|
| Feed to HP separator               | 36,5         | 0,0042   | 0,15          | 96       | 3,25     | 0.06mm/yr                | CS+3               |
| To HP compressor inlet cooler      | 36,5         | 0,0086   | 0,31          | 96       | 5,93     | 3mm/yr                   | Duplex SS          |
| Outlet to produced water treatment | 36,5         | 0,0001   | 0,00          | 96       | 0,31     | 0.06mm/yr                | CS+3               |
| HP separator to crude oil cooler   | 36,5         | 0,0009   | 0,03          | 96       | 1,31     | 0.02mm/yr                | CS+3               |
| Feed to IP separator               | 3,5          | 0,0009   | 0,00          | 66       | 0,07     | 0.06mm/yr                | CS+3               |





**HERVE  
BARON**

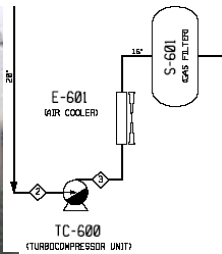
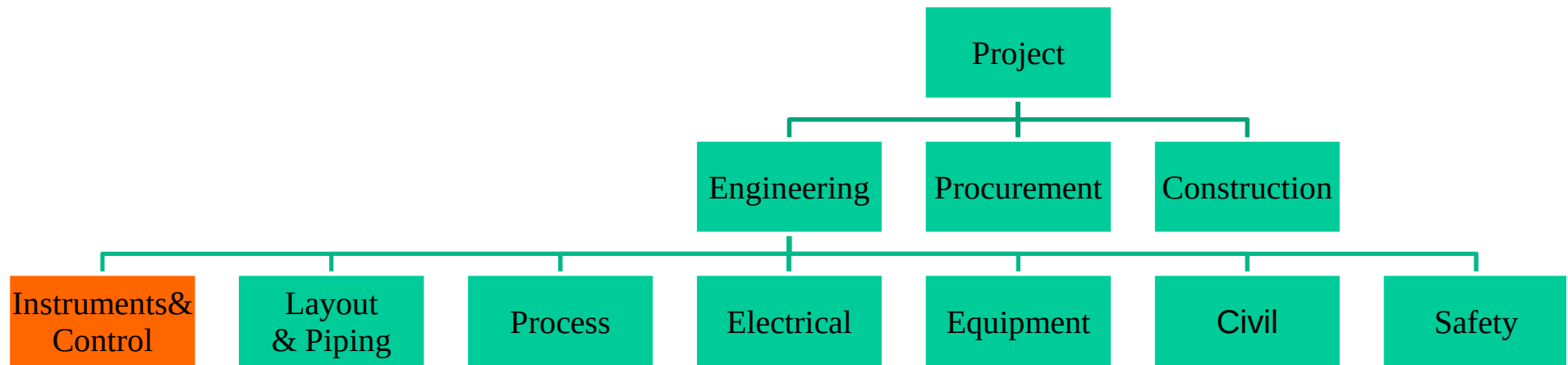
## Material Specification



# Material Specification



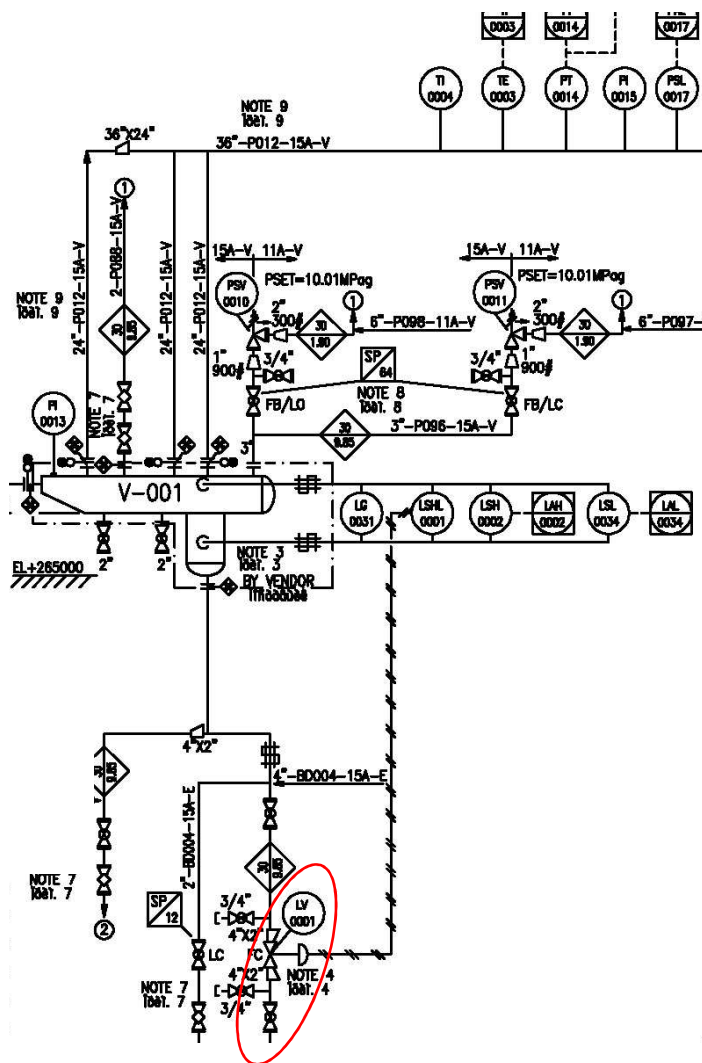
| SERVICE:<br>-DRAIN SYSTEM (BD)<br>-HYDROCARBON GAS (P) |                |                 |       | GENERAL MATERIAL : CARBON STEEL<br>API 5L Gr. B |      |                                                                                                                                                     | RATING :<br>150# RF                                                       |                                | PIPING CLASS :<br>11A |   |
|--------------------------------------------------------|----------------|-----------------|-------|-------------------------------------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------------------------|-----------------------|---|
|                                                        |                |                 |       | Corrosion Allowance = 0                         |      |                                                                                                                                                     |                                                                           |                                | Page : 2/3            |   |
|                                                        |                | DIA             |       | Rating                                          | End  | DESIGNATION                                                                                                                                         | Standard                                                                  | Valve data sheet /<br>Comments | NOTES                 |   |
|                                                        |                | from            | to    |                                                 |      |                                                                                                                                                     |                                                                           |                                |                       |   |
| VALVES                                                 | GATE<br>VALVE  | 2"              | 20"   | 150#                                            | RF   | Bolted bonnet .OS & Y.<br>Body: C.Steel<br>Trim : 13% Cr.                                                                                           | API 600<br>ASME B16-34                                                    | VS 01-2-11A                    | 1-3                   |   |
|                                                        |                | GLOBE<br>VALVES | 1/2"  | 1"1/2                                           | 800# | SW                                                                                                                                                  | Straight Pattern Bolted bonnet .OS & Y<br>Body: C.Steel<br>Trim : 13% Cr. | ASME B16-34                    | VD 01-1-11A           | 1 |
|                                                        | 2"             |                 | 6"    | 150#                                            | RF   | Straight Pattern Bolted bonnet .OS & Y<br>Body: C.Steel<br>Trim : 13% Cr.                                                                           | ASME B16-34                                                               | VD 01-2-11A                    | 1-3                   |   |
|                                                        | CHECK<br>VALVE | 1/2"            | 1"1/2 | 800#                                            | SW   | Ball or Piston-type<br>Body: C.Steel<br>Trim: F6                                                                                                    | BS 5352<br>ASME B16-34                                                    | VDR-10-1-11A                   | 1-3                   |   |
|                                                        |                | 2"              | 20"   | 150#                                            | RF   | Dual plate-type Wafer Lug / Double flanged body<br>Body : C.Steel<br>Trim: 13% Cr.                                                                  | API 594<br>ASME B16-34                                                    | VDR 10-2-11A                   | 1-3                   |   |
|                                                        | BALL<br>VALVE  | 1/2"            | 1"1/2 | 800#                                            | SW   | Full bore, Floating ball-type, with PE Nipples.<br>Body: C.Steel<br>Trim: 13% Cr.<br>Seats/Seals: PTFE / Viton                                      | BS 5351                                                                   | VB 01-1-11A                    | 1                     |   |
|                                                        |                | 2"              | 20"   | 150#                                            | RF   | Full bore, 2 or 3-piece body<br>Bore dia.<=6": Floating ball<br>Bore dia.>=8": Trunnion ball<br>Material same as above except trim: 13%Cr or CS+ENP | API 6D<br>ASME B16-34                                                     | VBF 01-2-11A                   | 1-2<br>3              |   |
|                                                        |                | 2"              | 20"   | 150#                                            | RF   | Reduced bore, 2 or 3-piece body<br>Bore dia.<=6": Floating ball<br>Bore dia.>=8": Trunnion ball<br>Material same as above                           | API 6D<br>ANSI B16-34                                                     | VB 01-2-11A                    | 1-2<br>3              |   |
|                                                        |                |                 |       |                                                 |      |                                                                                                                                                     |                                                                           |                                |                       |   |







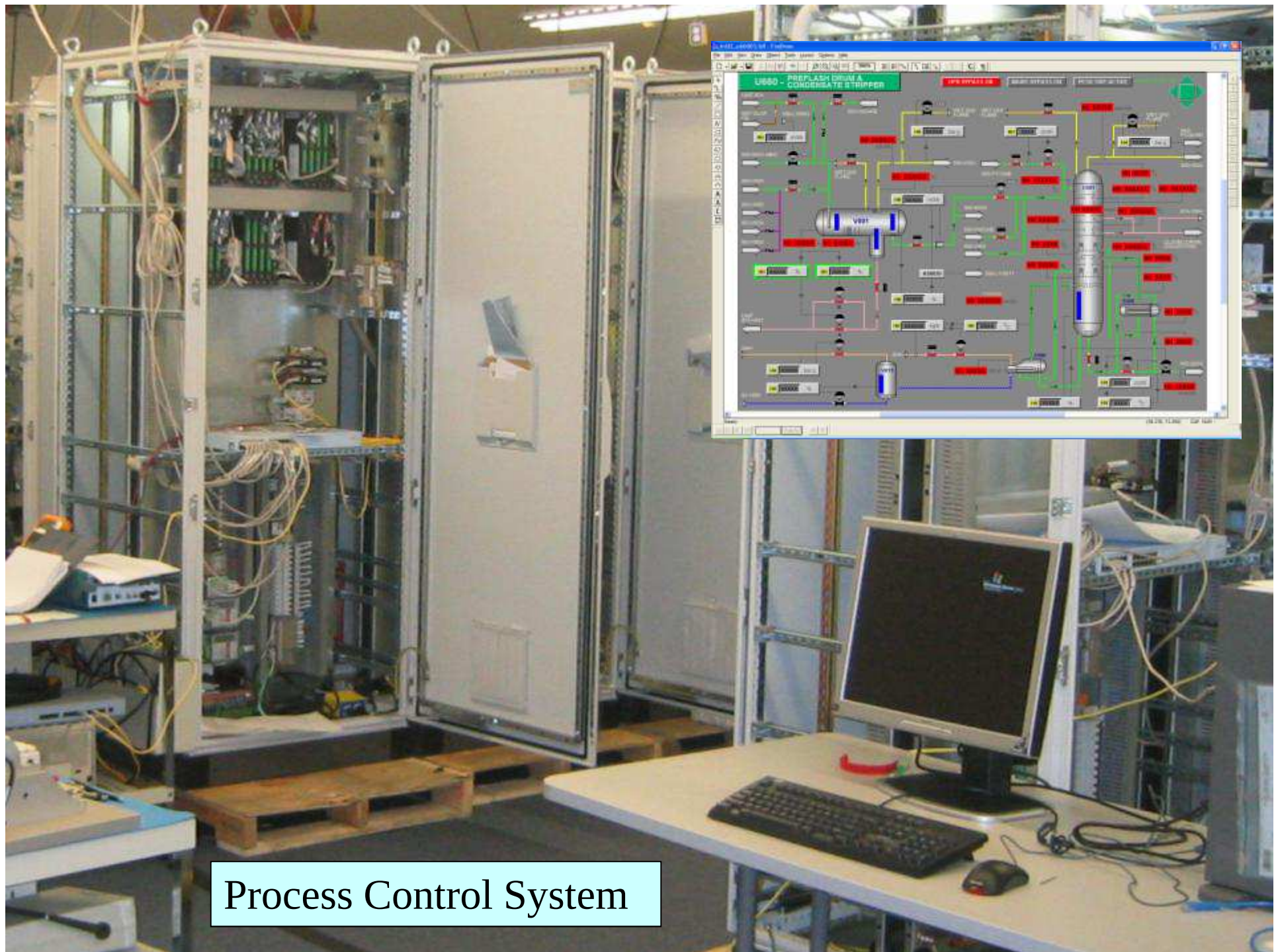
# Instrument data sheet



|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                |                                                                                                                                                                                                                                                                                                                |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TAG                 | Tag No. : 84 FV -6703A<br>PID No. : RG6-D-84-1225-340<br>Service : SM TO 84FL061                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Instrument Type : Air Actuated CV (Globe) E/P positioner<br>Valve Type : Control Globe<br>Valve Service :<br>Quantity Tags : 1 |                                                                                                                                                                                                                                                                                                                |
|                     | Manufacturer Name : FISHER<br>Model No : ET<br>Air Failure Action : FC<br>Max. Shut Off Pressure : 19 bar<br>Leakage Class : IV (standard)<br>Material Corrosion Requirement :                                                                                                                                                                                                                                                                                                                                                    | 53<br>54<br>55<br>56<br>57<br>58<br>59<br>60<br>61<br>62                                                                       | Manufacturer : FISHER Model : 667-4<br>Type of Actuator : spring & diaphra Size : 70<br>Material<br>Case : Yoke : Stem :<br>Mechanical Design Pressure : 4.1 barg<br>Actuator Force Design Pressure :<br>Required Air Supply Pressure : 4.5 barg<br>Stroke Speed : within 10 seconds<br>Travel Indicator : Yes |
| VALVE GEN.          | Line<br>Line No. : 84SM-60020-8"-3S1-1<br>Line Size 8 in Schedule: 30<br>Service Class: 3S1 Insulation Thickness :<br>Design Pressure : 18 / bar-g<br>Design Temperature : 270 / °C<br>Notes for Line :<br>Instrument Air Supply<br>Mechanical Design Pressure : 10.8<br>Operating Pressure(Max/Min) : 12.6 / 11.6 bar-g<br>Dew Point Temperature : -40 °C<br>Enclosure<br>Electrical Hazardous Protection<br>Class : Zone 2, IIB T3 Type : Ex n (SOV: Ex d)<br>Certificate : ATEX<br>Weather Protection : IP65/NEMA 4X<br>Notes: | 63<br>64<br>65<br>66<br>67<br>68<br>69<br>70<br>71<br>72<br>73<br>74<br>75<br>76                                               | ACTUATOR<br>PAINT<br>VALVE ACC.                                                                                                                                                                                                                                                                                |
|                     | Positioner Type : Electropneumatic Smart (HART)<br>Manufacturer : Fisher Model :<br>Input Signal Type : 4-20mA DC<br>Gauges : Supply, Output Bypass :<br>Notes : Tag No: 84FVY-6703A                                                                                                                                                                                                                                                                                                                                              | 77<br>78<br>79<br>80<br>81<br>82<br>83<br>84<br>85                                                                             | PNEUMATIC ACC.                                                                                                                                                                                                                                                                                                 |
| GENERAL DESIGN DATA | Body Size : 6 in<br>Rating : 300# Conn Type : RF Flange<br>Flange Face Finish : 125-250 Ra<br>Face to Face Dimension : 472,9<br>Body/Bonnet Material : A216-WCC<br>Type of Bonnet : Plain<br>Flow Direction : Up<br>Corrosion Allowance : 1.2 mm<br>Gasket Material : Single graphite Packing Mat.: laminated<br>Notes : packing flange material: 316 SST                                                                                                                                                                         | 86<br>87<br>88<br>89<br>90<br>91<br>92<br>93<br>94<br>95<br>96<br>97<br>98<br>99<br>100                                        | ELECTRICAL ACC.                                                                                                                                                                                                                                                                                                |
|                     | Trim Type : Metal 301 Size : 5 3/8<br>Trim Construction :<br>Rated Cv : 129 Rated Travel : 3"<br>Characteristic : Whisper3-C1/Linear<br>Material<br>Plug / Ball / Disc : 17-4PH SST<br>Seat : 410 SST<br>Cage / Guide : 416 SST<br>Stem : 316 SST                                                                                                                                                                                                                                                                                 |                                                                                                                                |                                                                                                                                                                                                                                                                                                                |

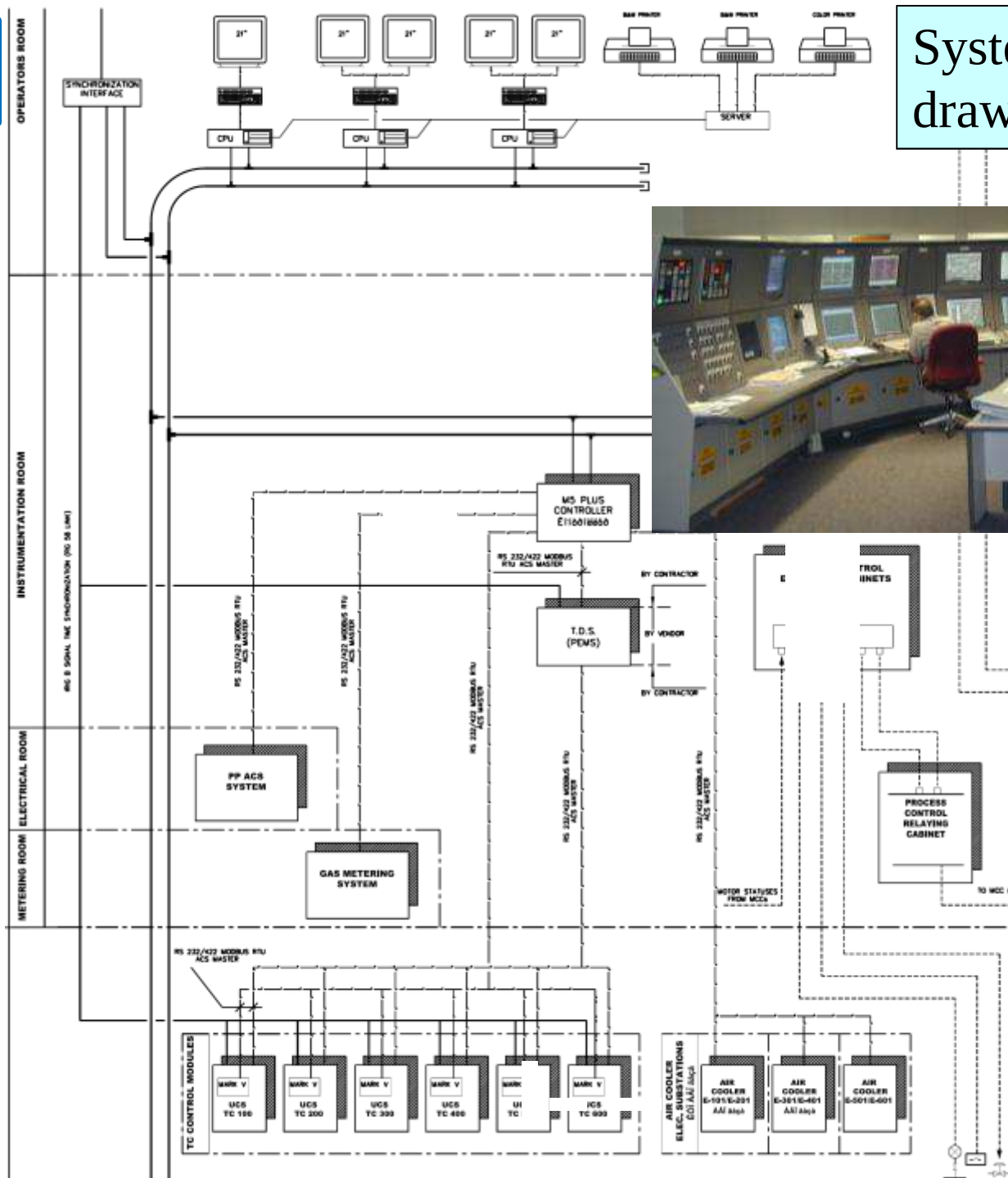




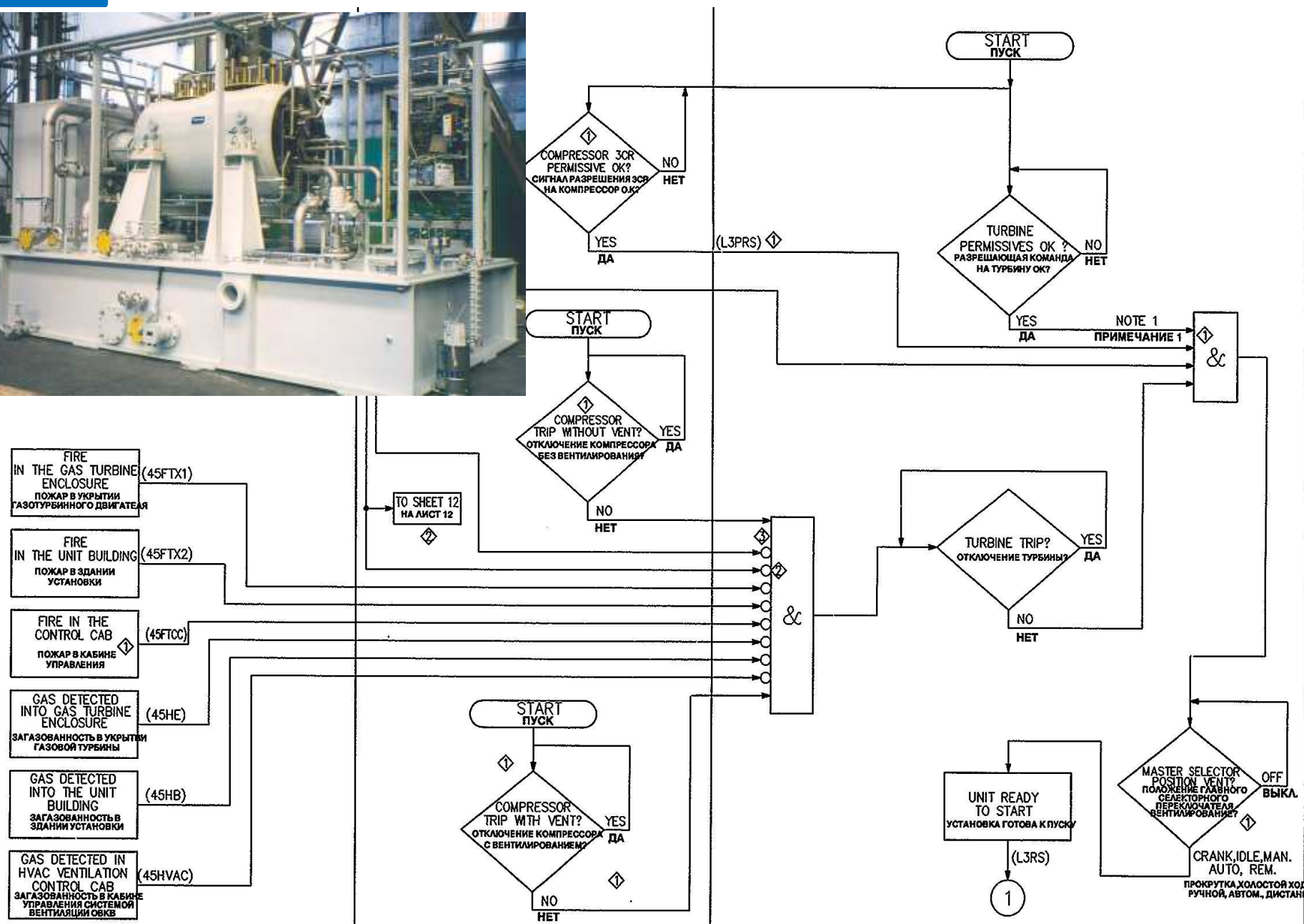




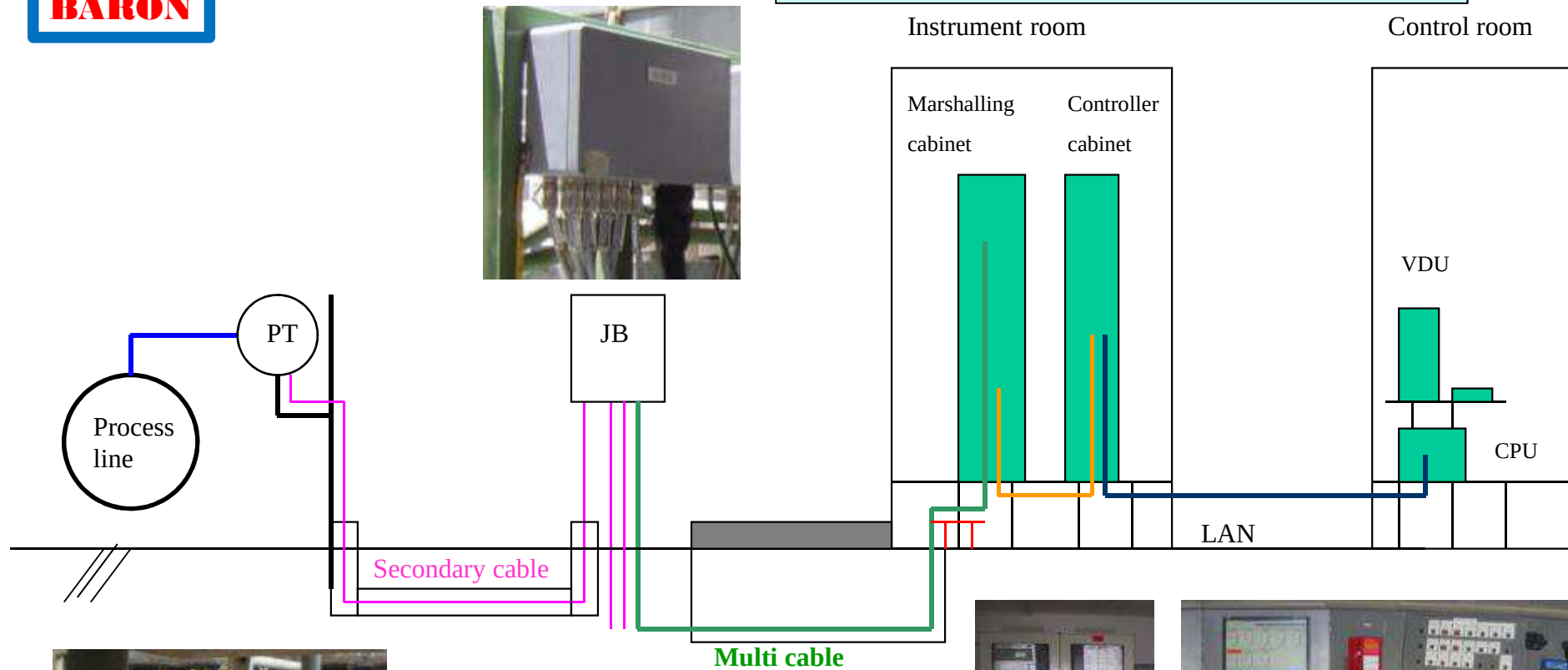
# System architecture drawing



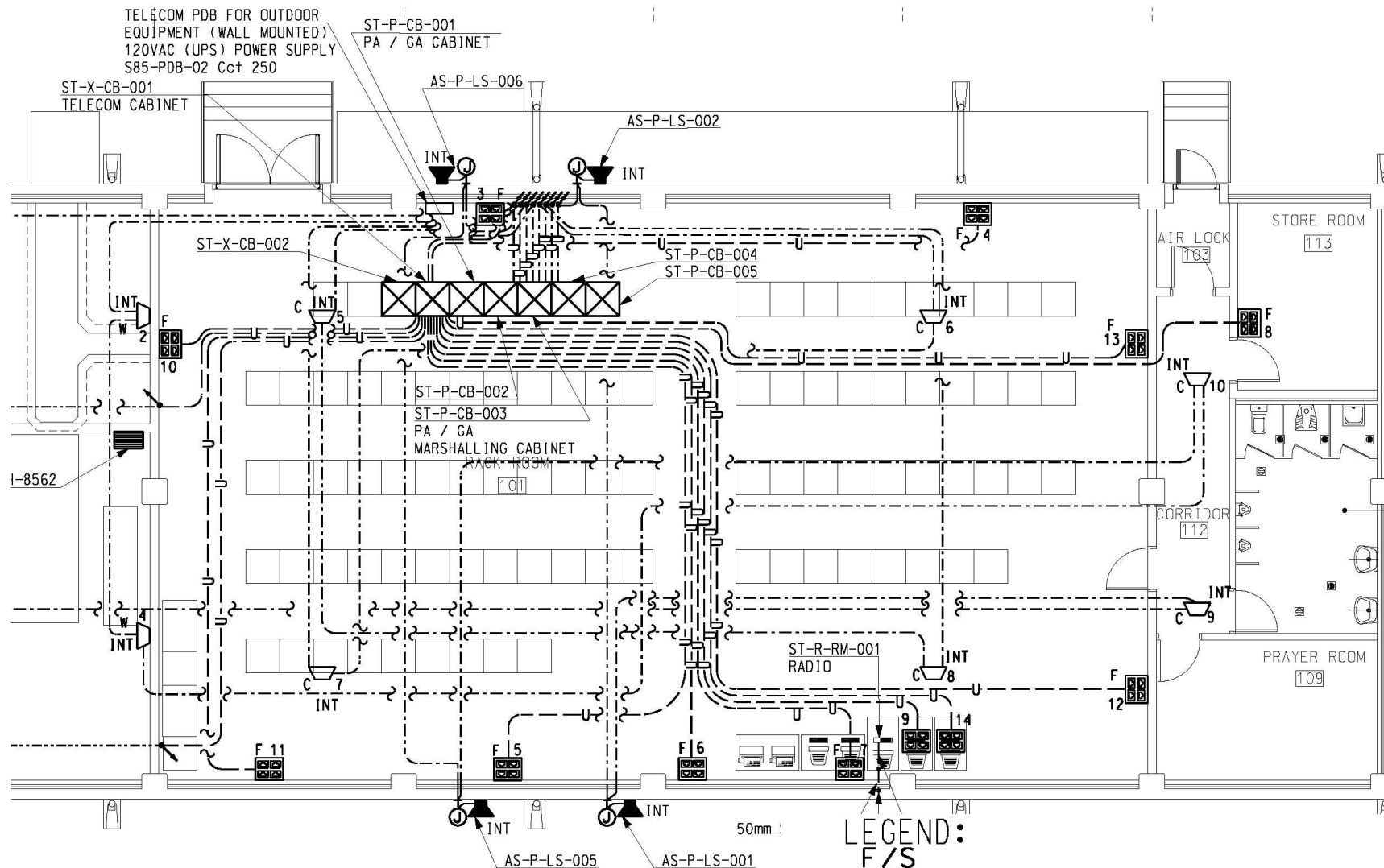
## Mechanical Equipment Control



# The instrumentation hardware

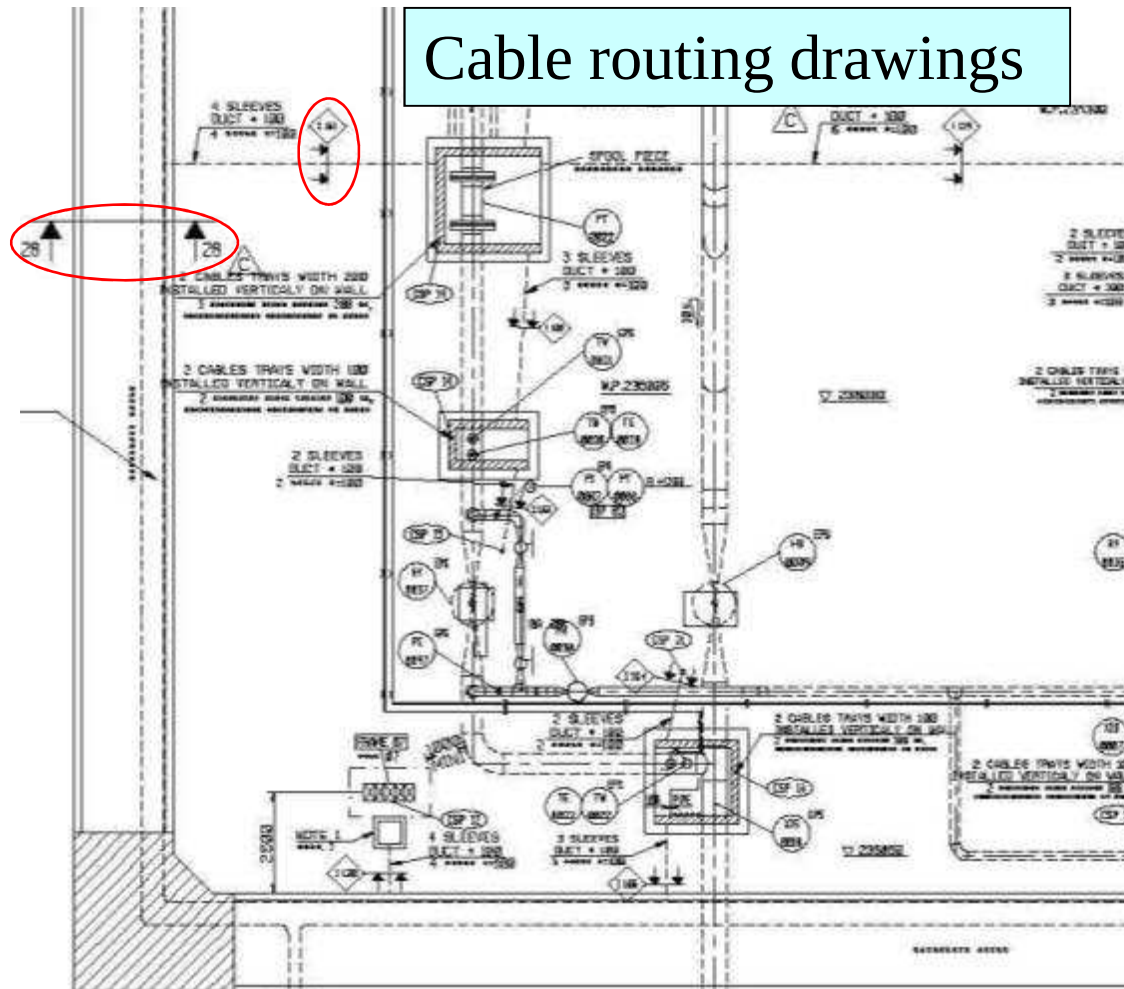






Building detail drawing/  
Telecom and PAGA layout

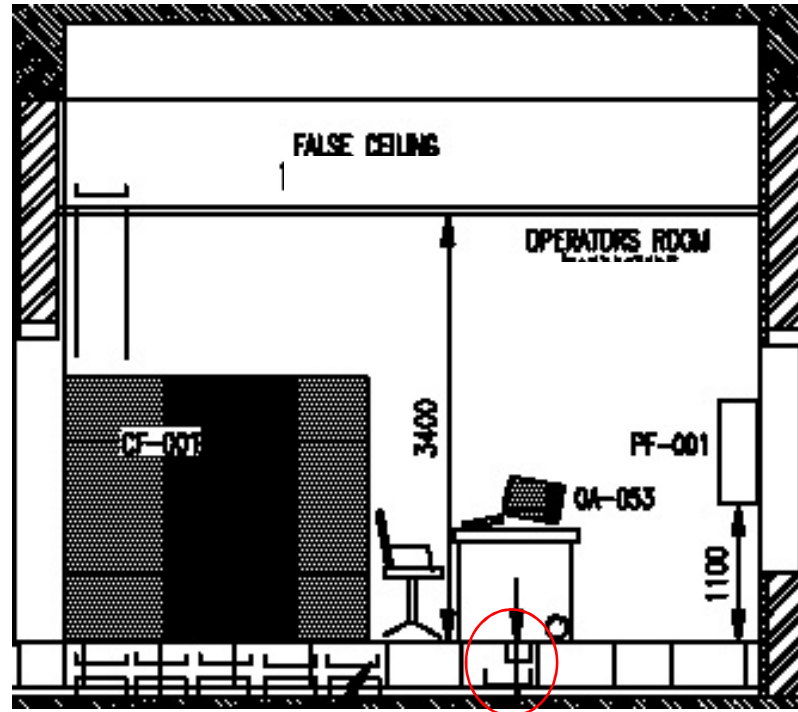
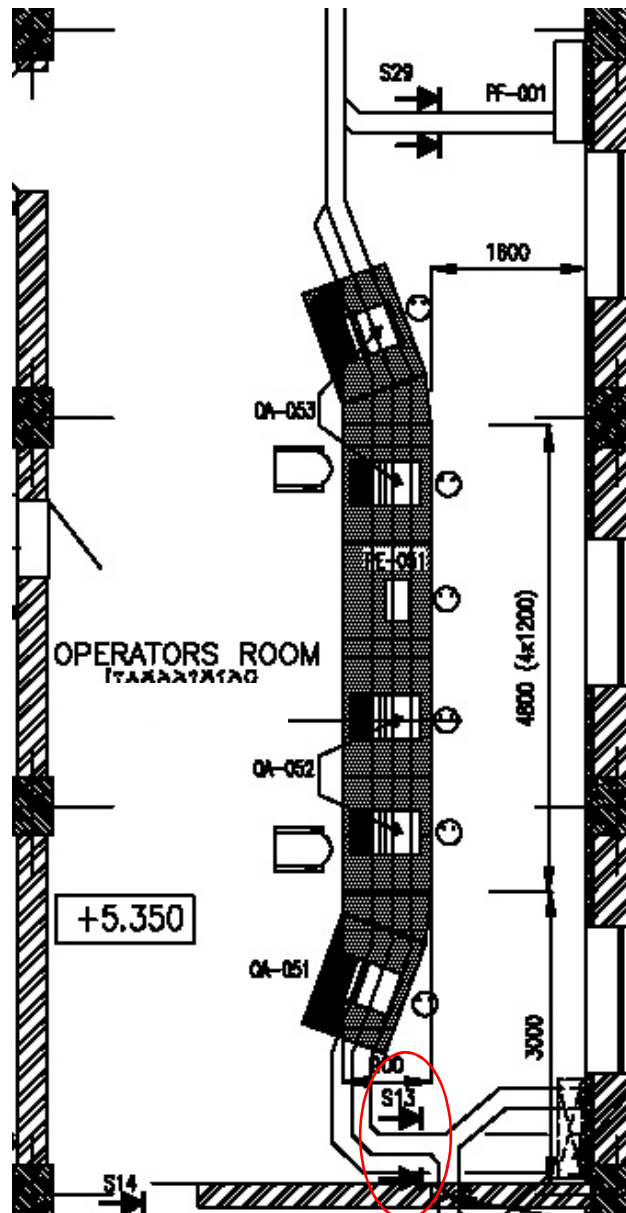
## Cable routing drawings



| CABLES TAG | CABLES TYPE    | SUPPLY BY (1) | FROM   | LOCATION<br>FRAME or OTHER | TO     | LOCATION<br>FRAME or OTHER | LENGTH<br>m | ROUTING<br>CROSS SECTIONS              |
|------------|----------------|---------------|--------|----------------------------|--------|----------------------------|-------------|----------------------------------------|
| CC-004     | A-T-1-19-P-2-0 | CONTRACTOR    | JC-004 | PIS D-002                  | CA-052 | INSTRUM ROOM               | 370         | 1121-1119-1161-28-1B-11-9-44-4-2-1-96  |
| CC-005     | A-T-1-12-P-2-0 | CONTRACTOR    | JC-005 | FILTER-SEPARATOR           | CA-052 | INSTRUM ROOM               | 440         | 1127-38B-36-36A-71-35-35B-65-34-3-1-96 |
| CC-006     | A-T-1-12-P-2-0 | CONTRACTOR    | JC-006 | FILTER-SEPARATOR           | CA-052 | INSTRUM ROOM               | 440         | 1127-38B-36-36A-71-35-35B-65-34-3-1-96 |
| CC-007     | A-T-1-7-P-2-0  | CONTRACTOR    | JC-007 | STATION INLET VALVES       | CA-052 | INSTRUM ROOM               | 370         | 1103-1190-36A-71-35-35B-65-34-3-1-96   |
| CC-008     | A-T-1-7-P-2-0  | CONTRACTOR    | JC-008 | DIESEL GENERATOR           | CA-052 | INSTRUM ROOM               | 120         | 850-30-30B-20                          |
| CC-009     | A-T-1-7-P-2-0  | CONTRACTOR    | JC-009 | FIRE WATER                 | CF-004 | FIRE BUILDING              | 100         |                                        |
| CC-101-1   | A-T-1-19-P-2-0 | CONTRACTOR    | JC-101 | AERO E-101                 | UA-101 | S/S ELECTRICAL 27-1        | 180         |                                        |

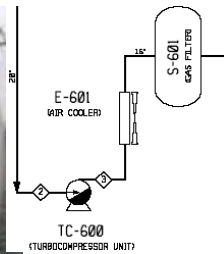
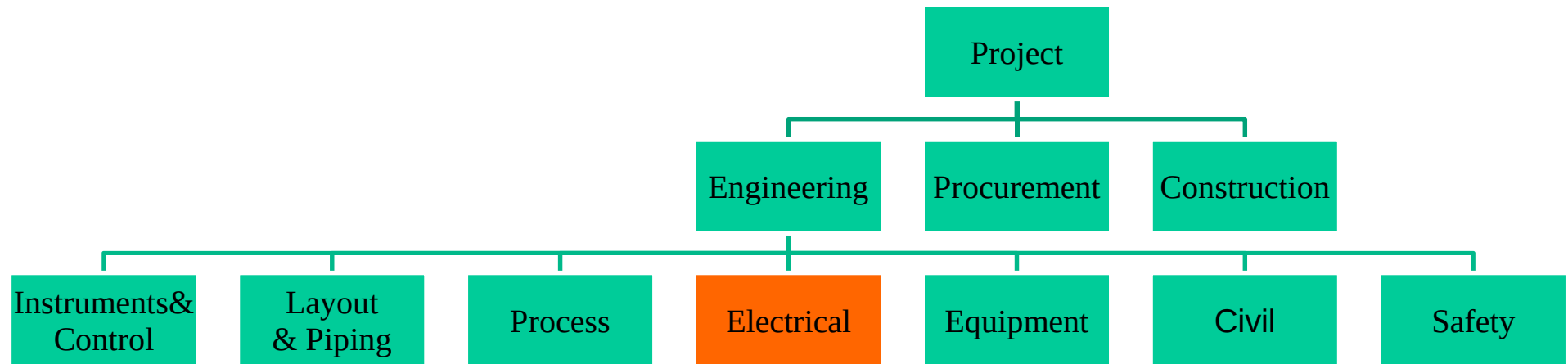
Cable list





Cable routing inside technical room







| LV Motor Control Center TG-MCC-002 (V=400/230V) |                                        |       |           |        |            |           |                           |
|-------------------------------------------------|----------------------------------------|-------|-----------|--------|------------|-----------|---------------------------|
| Equipment No.                                   | Description                            | Vital | Essential | Normal | Restarting | Duty Type | ABSORBED<br>LOAD<br>( A ) |
|                                                 |                                        |       |           |        |            |           | kVA - kW                  |
| TG-002                                          | Turbo Gen. (starting)                  |       |           |        |            |           |                           |
| 88CR                                            | Turb. Gen. Start. Motor                |       |           |        |            | C         | 160                       |
| 23QT-1                                          | Lube Oil tank heater                   |       |           |        |            | C         | 7.50                      |
| 23QT-2                                          | Lube Oil tank heater                   |       |           |        |            | C         | 7.50                      |
| 23FG-1                                          | Fuel Gas Electric Heater               |       |           |        |            |           | 60                        |
| 88BA-1                                          | Turbine enclosure Ventilation duty fan |       |           |        |            | C         | 13.50                     |
| 88BA-2                                          | Turbine enclosure Ventilation duty fan |       |           |        |            |           | 13.50                     |
| 88FC-1                                          | Oil Cooler Fan Motor                   |       |           |        |            |           | 3.10                      |
| 88FC-2                                          | Oil Cooler Fan Motor                   |       |           |        |            |           | 3.10                      |
| 88FC-3                                          | Oil Cooler Fan Motor                   |       |           |        |            |           | 3.10                      |
| 23WK-1                                          | Heater OFF-LINE washing skid           |       |           |        |            |           | 4.00                      |
| 88TW-1                                          | Water wash pump motor OFF-LINE skid    |       |           |        |            |           | 2.20                      |
| 88QA                                            | Aux. Lube Oil Pump Moto                |       |           |        |            | D         | 10.00                     |
| 88QV                                            | Lube Oil vapour separator motc         |       |           |        |            | C         | 1.50                      |
| DCP-A                                           | Direct current supply panel side I     |       |           |        |            | C         | 25.00                     |
| DCP-B                                           | Direct current supply panel side I     |       |           |        |            | C         | 6.50                      |

## Electrical consumer list

| Item                                                                                          | LV MCC MCC-002 (V=400/230V) |                                         | CONSUMED LOAD       |                       |                |
|-----------------------------------------------------------------------------------------------|-----------------------------|-----------------------------------------|---------------------|-----------------------|----------------|
|                                                                                               | Equipment No.               | Description                             | Continuous<br>( E ) | Intermittent<br>( F ) | Spare<br>( G ) |
|                                                                                               |                             |                                         | kW                  | kW                    | kW             |
| 1                                                                                             | LP003-1                     | Fire Fighting pump Bldg Light&Small Pwr | 10,0                |                       |                |
| 2                                                                                             | LP003-2                     |                                         |                     |                       |                |
| 3                                                                                             | HSV-0011                    | Valve for gas metering station          |                     | 1,3                   |                |
| 4                                                                                             | HSV-0012                    | Valve for gas metering station          |                     | 1,3                   |                |
| 5                                                                                             | PM-032A                     | Fire Fighting Jockey Pump               | 5,2                 |                       |                |
| 6                                                                                             | PM-032B                     | Fire Fighting Jockey Pump               |                     |                       | 5,2            |
| <b>Maximum of normal running plant load :</b> kW = 16,7<br>( Est. $1 \cdot E + 0.6 \cdot F$ ) |                             |                                         | 15,2                | 2,6                   | 5,2            |
| <b>Peak Load</b> kW = 17,2<br>( Est. $1 \cdot E + 0.6 \cdot F + 0.1 \cdot G$ )                |                             |                                         |                     |                       |                |

## Electrical Load Summary

### NOTES:

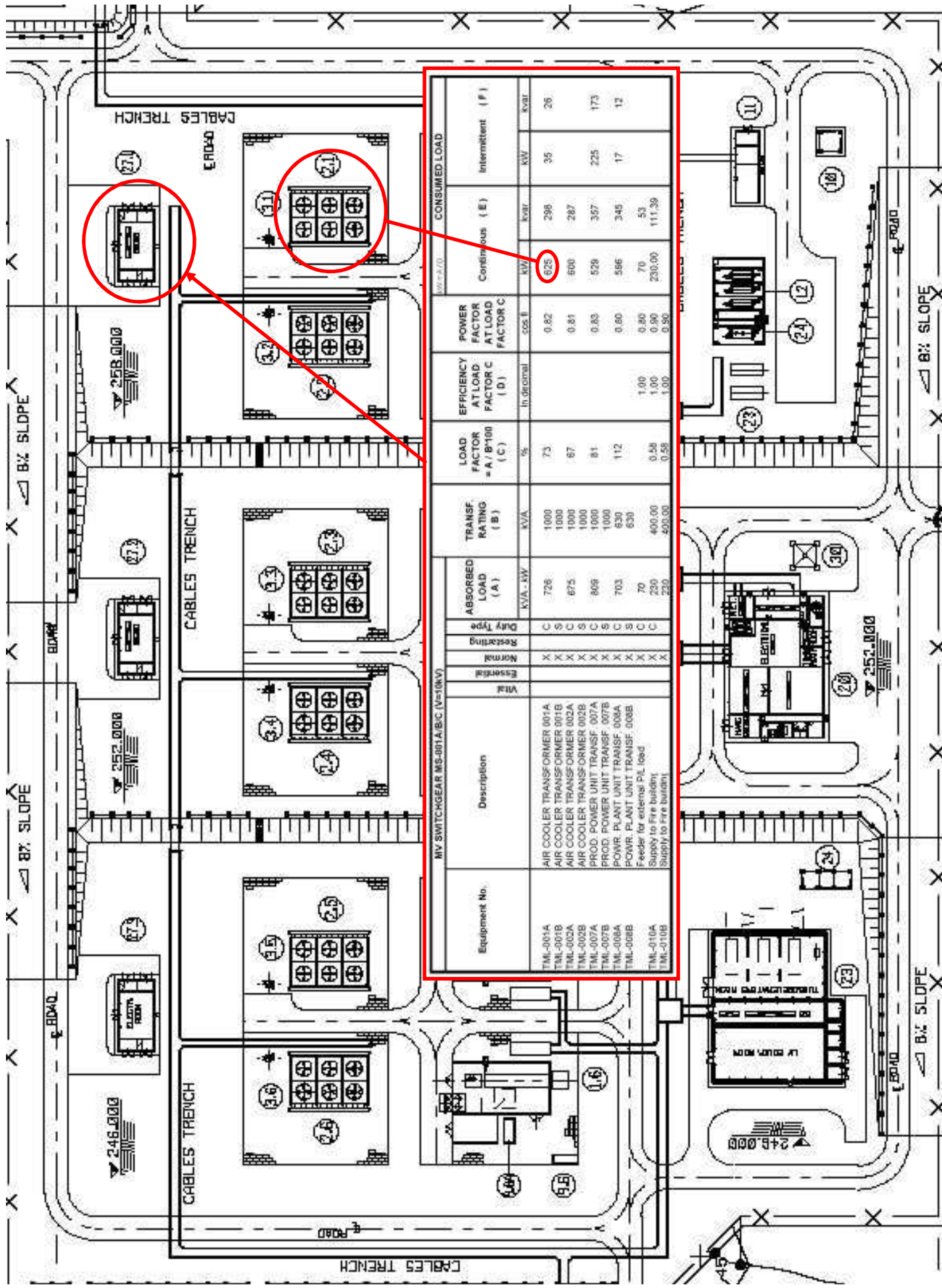
#### Consumed Loads:

E - "Continuous"; loads of machines or consumers which operate continuously when the plant is in operation, except for breakdowns.

F - "Intermittent "; machines or consumers with a start-stop cycle: pumping, storage, loading...

G - "Spare"; machines or consumers which act as a spare for other machines and which do not therefore normally operate when the plant is in operation.

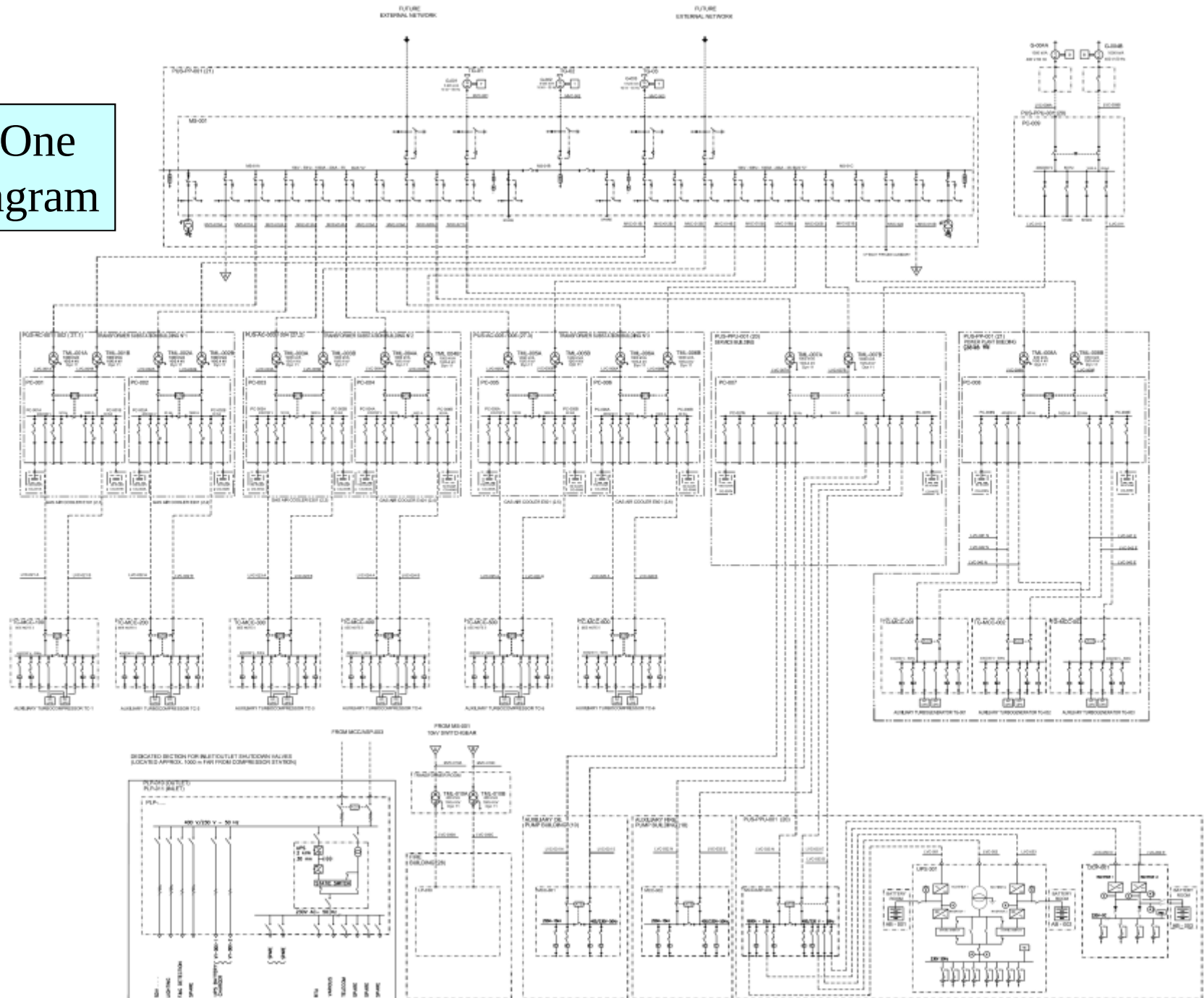




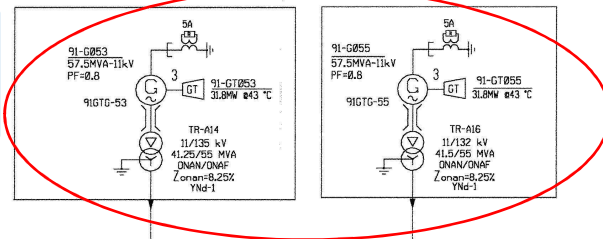
| Equipment No. | Description                   | Vital | ABSORBED LOAD (A) |          | TRANSF. RATING (B) | LOAD FACTOR = A / B*100 (C) | EFFICIENCY AT LOAD FACTOR C (D) | POWER FACTOR AT LOAD FACTOR C | CONSUMED LOAD  |                  |        |        |
|---------------|-------------------------------|-------|-------------------|----------|--------------------|-----------------------------|---------------------------------|-------------------------------|----------------|------------------|--------|--------|
|               |                               |       | Duty Type         | KVA - kW |                    |                             |                                 |                               | Continuous (E) | Intermittent (F) | kvar   | kvar   |
| TML-001A      | AIR COOLER TRANSFORMER 001A   | X     | Restating         | 726      | 1000               | 73                          | In decimal                      | 0.82                          | 625            | 35               | 296    | 26     |
| TML-001B      | AIR COOLER TRANSFORMER 001B   | X     | Restating         | 726      | 1000               | 73                          |                                 | 0.82                          | 625            | 35               | 296    | 26     |
| TML-002A      | AIR COOLER TRANSFORMER 002A   | X     | Restating         | 675      | 1000               | 67                          |                                 | 0.81                          | 500            | 287              | 287    | 173    |
| TML-002B      | AIR COOLER TRANSFORMER 002B   | X     | Restating         | 675      | 1000               | 67                          |                                 | 0.81                          | 500            | 287              | 287    | 173    |
| TML-007A      | PROD. POWER UNIT TRANSF. 007A | X     | Restating         | 808      | 1000               | 81                          |                                 | 0.83                          | 528            | 357              | 345    | 12     |
| TML-007B      | PROD. POWER UNIT TRANSF. 007B | X     | Restating         | 808      | 1000               | 81                          |                                 | 0.83                          | 528            | 357              | 345    | 12     |
| TML-008A      | POWR. PLANT UNIT TRANSF. 008A | X     | Restating         | 703      | 630                | 112                         |                                 | 0.80                          | 586            | 70               | 53     | 111.39 |
| TML-008B      | POWR. PLANT UNIT TRANSF. 008B | X     | Restating         | 703      | 630                | 112                         |                                 | 0.80                          | 586            | 70               | 53     | 111.39 |
| TML-010A      | Feeder for external P/L load  | X     | Restating         | 70       | 400.00             | 0.58                        | 1.00                            | 0.80                          | 70             | 230.00           | 111.39 | 0.90   |
| TML-010B      | Supply to Fire building       | X     | Restating         | 230      | 400.00             | 0.58                        | 1.00                            | 0.80                          | 230.00         | 111.39           | 0.90   | 0.90   |

**HERVE  
BARON**

## General One Line Diagram

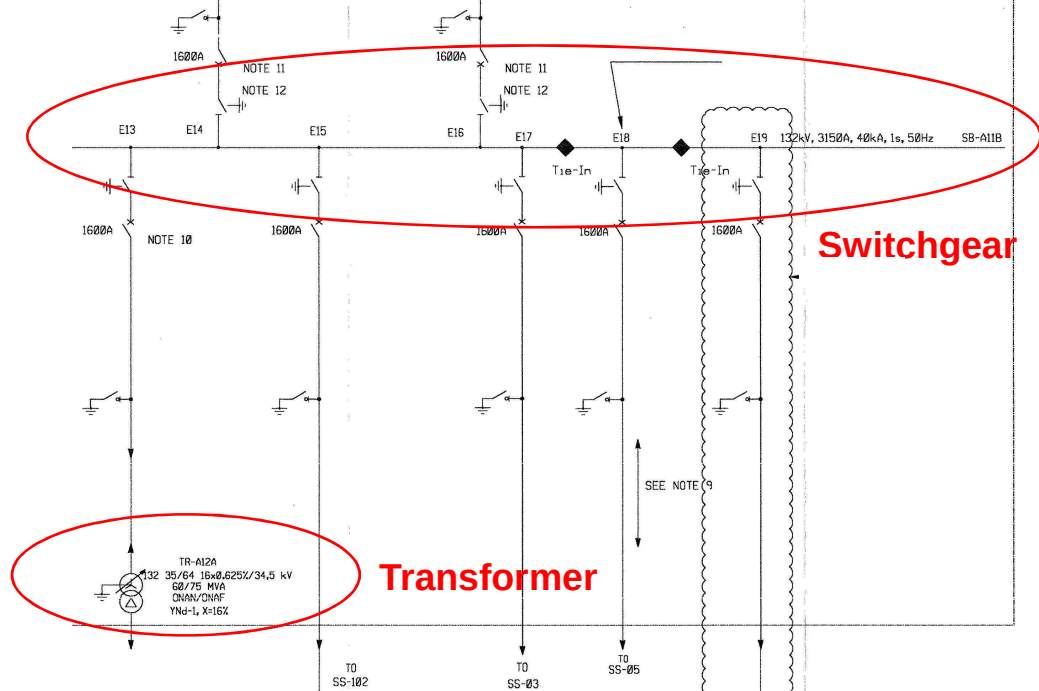


**HERVE  
BARON**



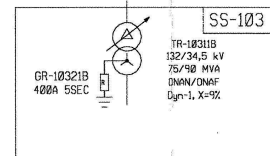
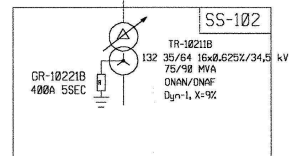
**Generators**

**Single line diagram**



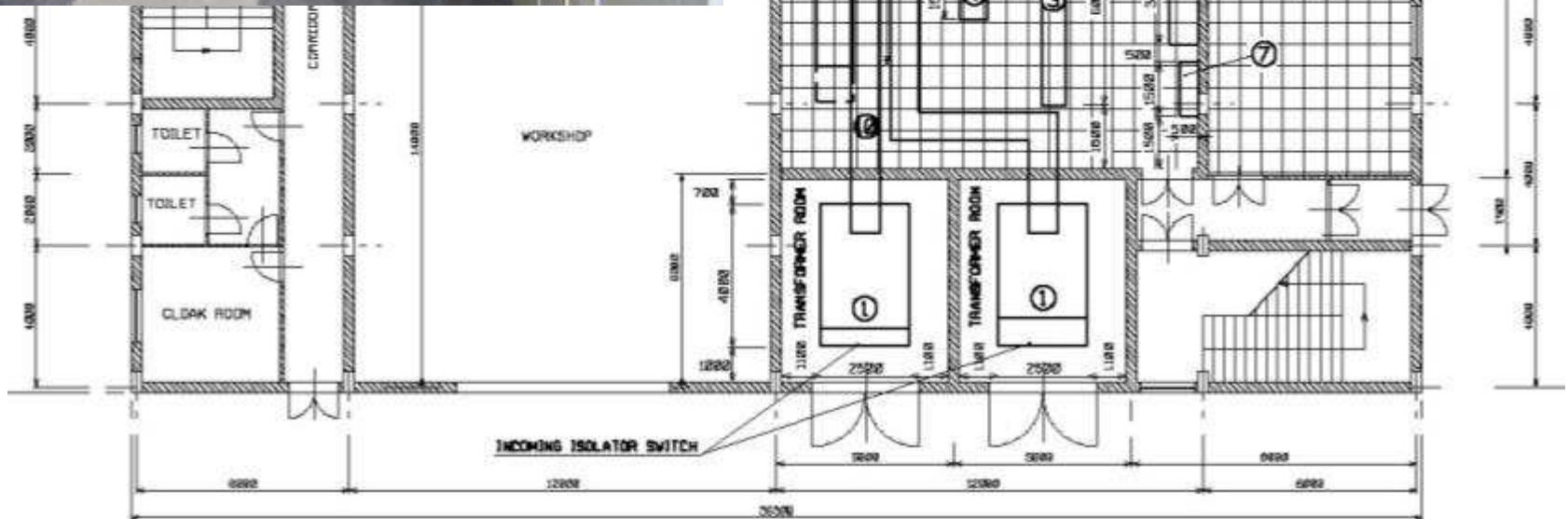
**Switchgear**

**Transformer**



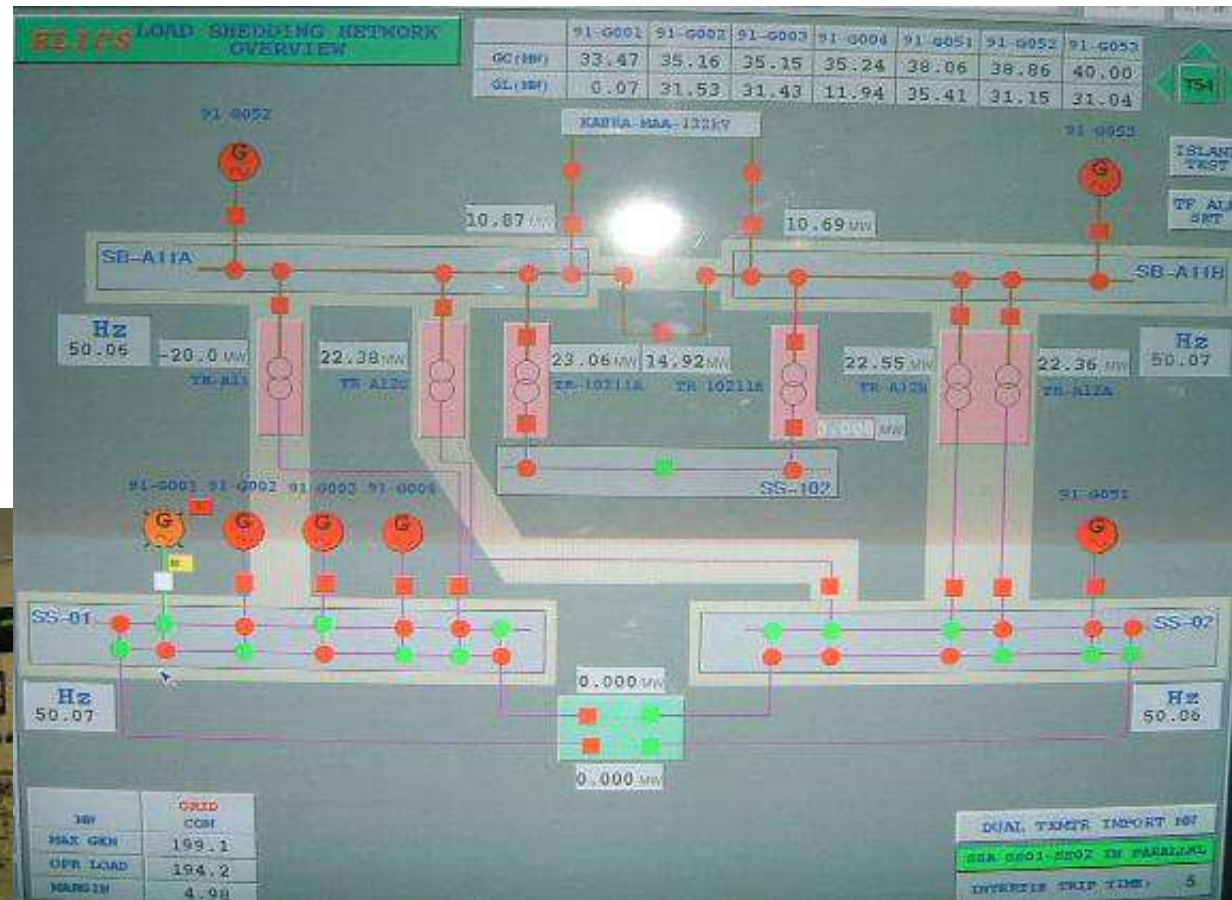


# Electrical equipment layout



**HERVE  
BARON**

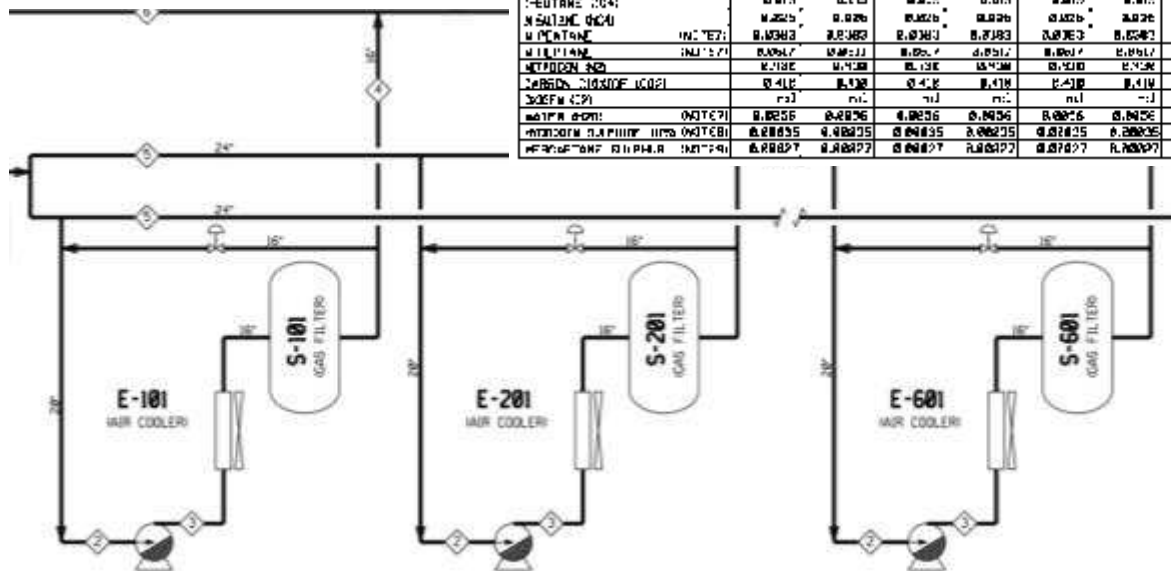
## Electrical Control System



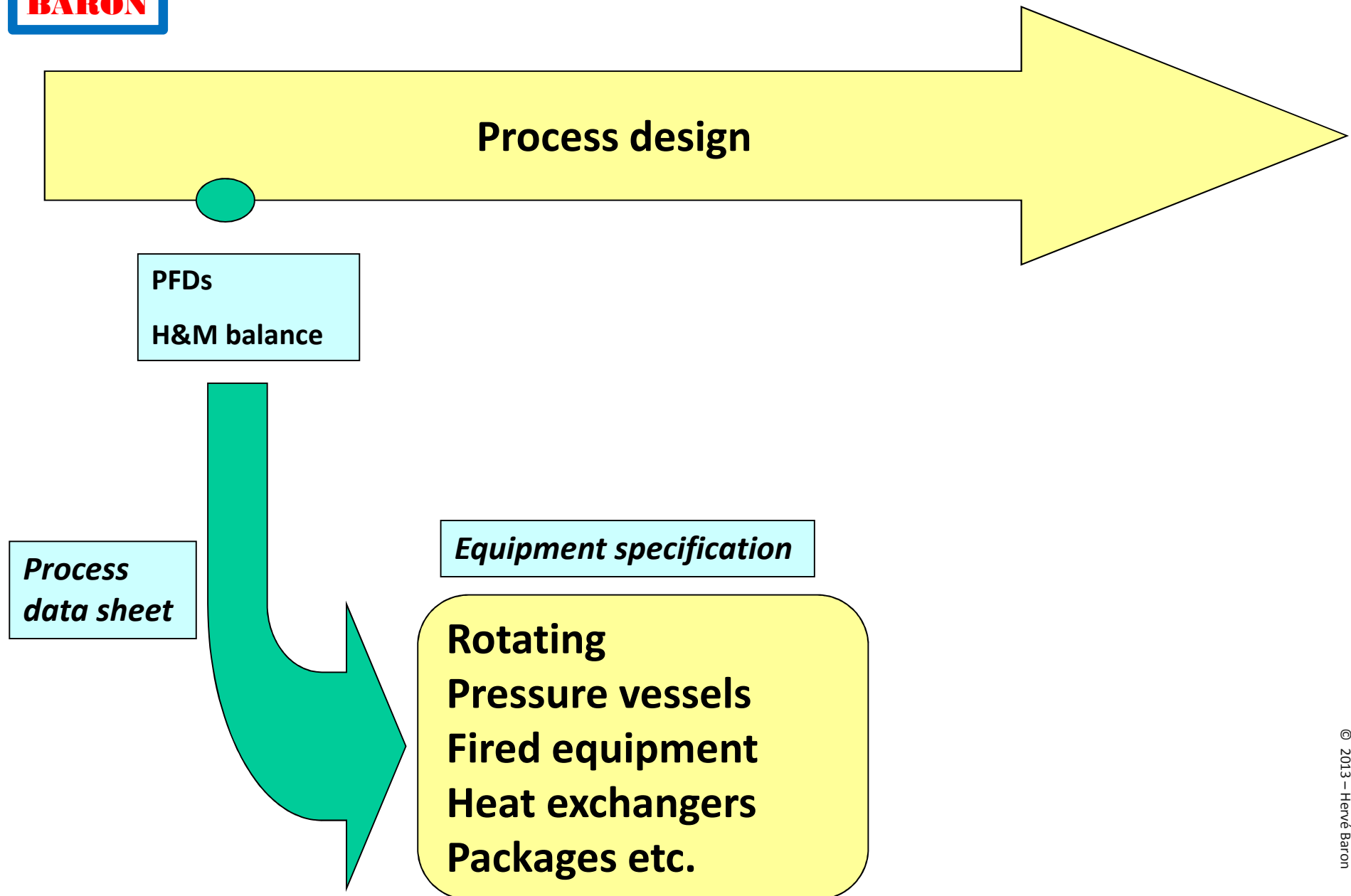
# Process design

PFDs  
H&M balance

| STREAM NUMBER         | 1      | 2      | 3      | 4      | 5      | 6      | 7       | 8      |
|-----------------------|--------|--------|--------|--------|--------|--------|---------|--------|
| MASS FLOW RATE (kg/h) | 136816 | 345284 | 345284 | 345284 | 530488 | 698408 | 1388816 | 698408 |
| TEMPERATURE (°C)      | 27.25  | 26.4   | 27.3   | 27.06  | 3.52   | 27.06  | 24.75   | 24.95  |
| COMPOSITION (wt %)    |        |        |        |        |        |        |         |        |
| ETHANE                | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| PROPANE               | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| BUTANE                | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| PENTANE               | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| HEXANE                | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| HEPTANE               | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| OCTANE                | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| NONANE                | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| DECANE                | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| UNSATURATED           | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| WATER                 | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| ACID                  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| BASE                  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| SOLVENT               | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| INERT                 | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| LOSS                  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| WASTE                 | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| RECYCLE               | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| STEAM                 | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| CONDENSATE            | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| REFRIGERANT           | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| HEATING               | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| Cooling               | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| Heat loss             | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| Heat gain             | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| Heat balance          | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| Energy balance        | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| Mass balance          | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |
| Process design        | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000   | 0.000  |

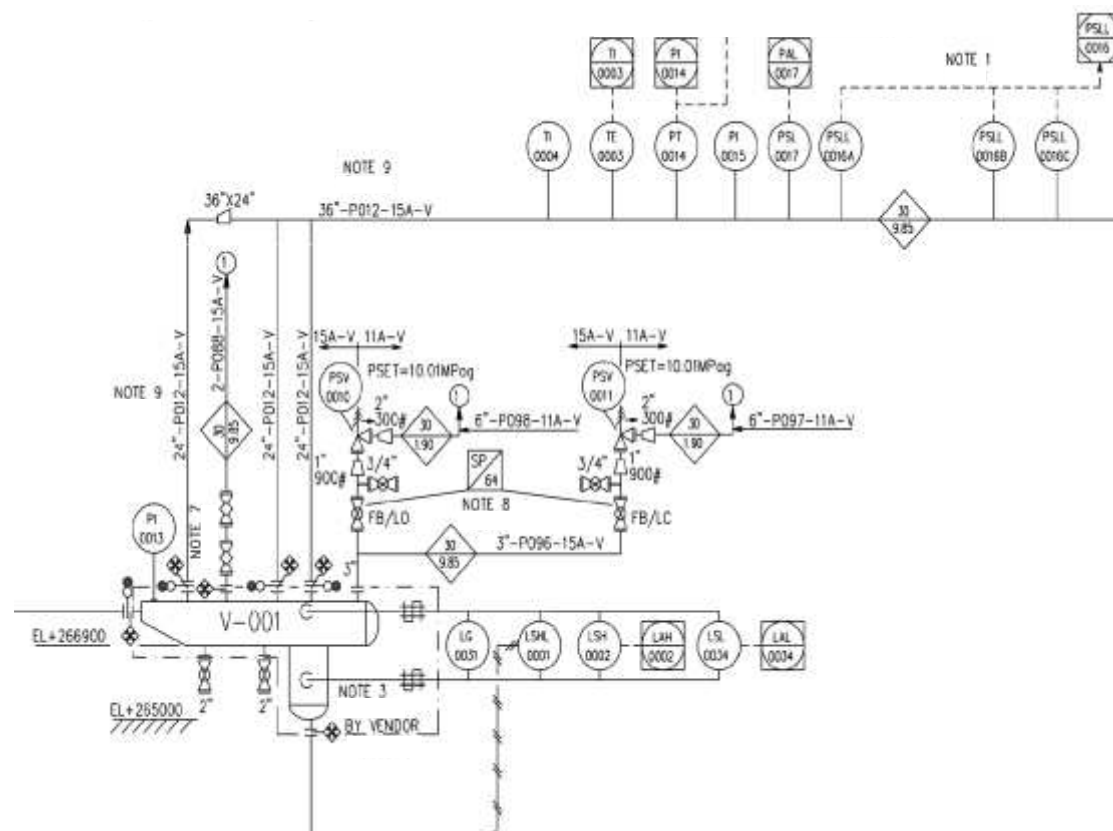


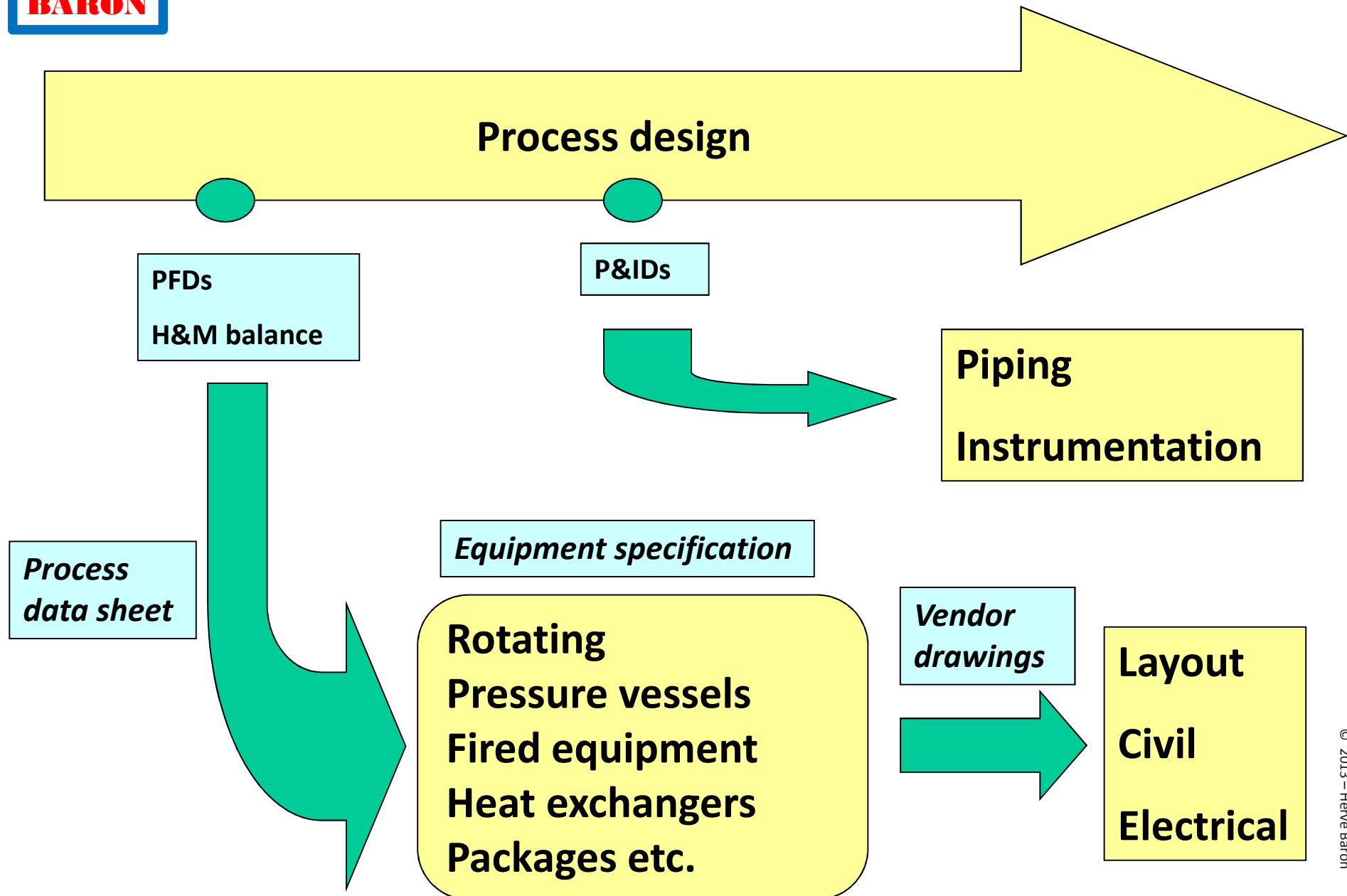




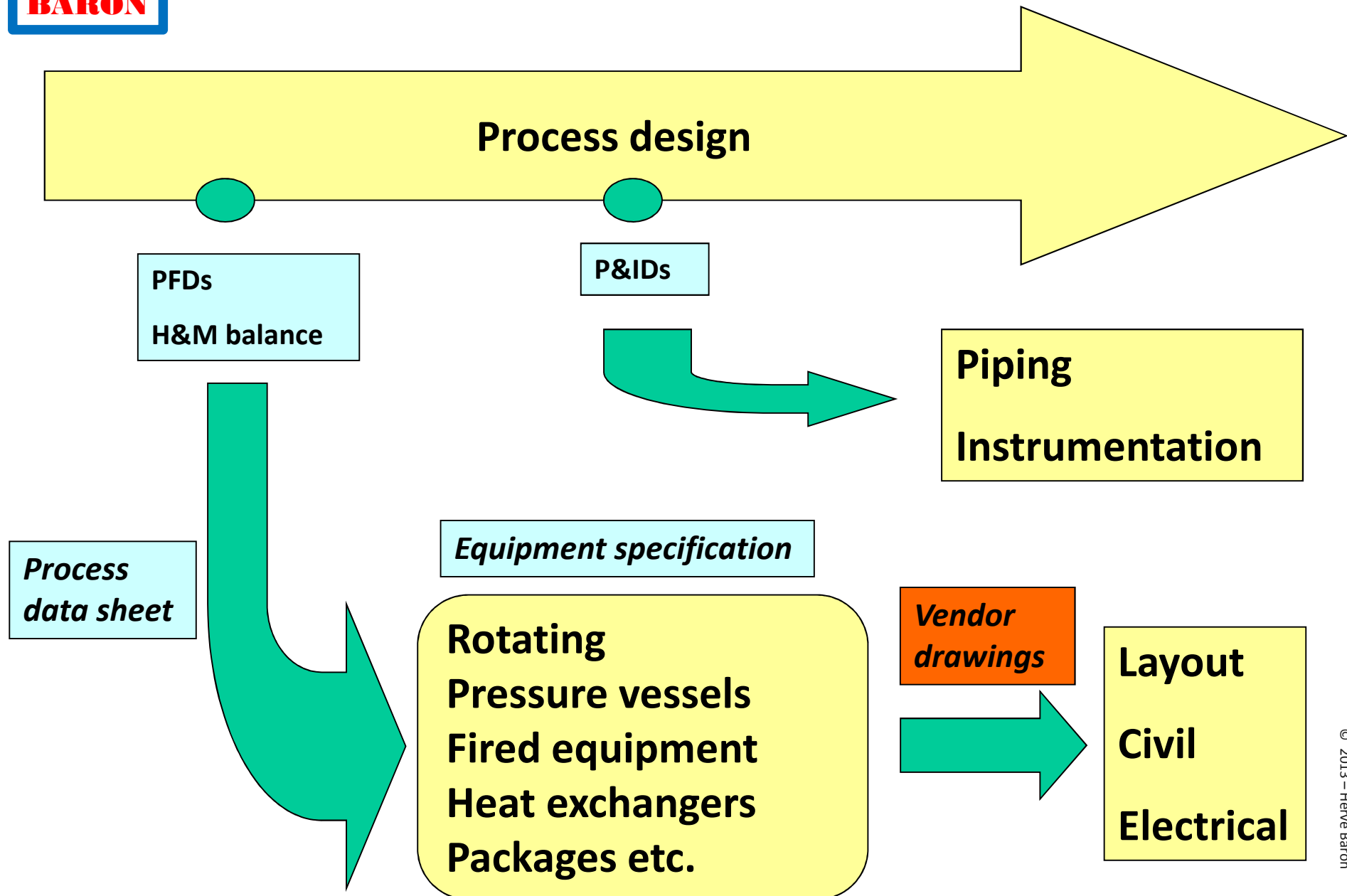
## H&M balance

## P&IDs









Electrical

Layout

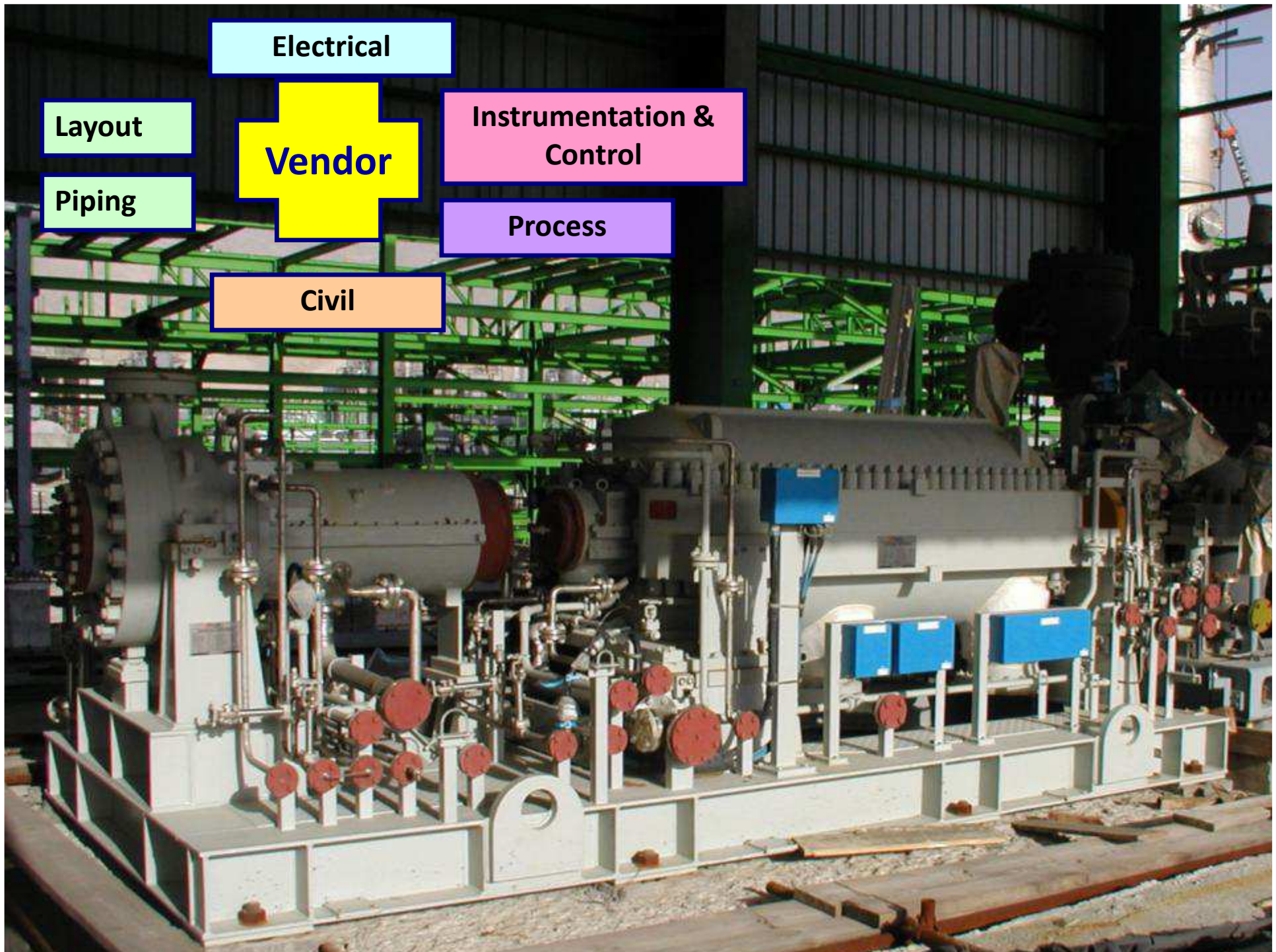
Vendor

Instrumentation &  
Control

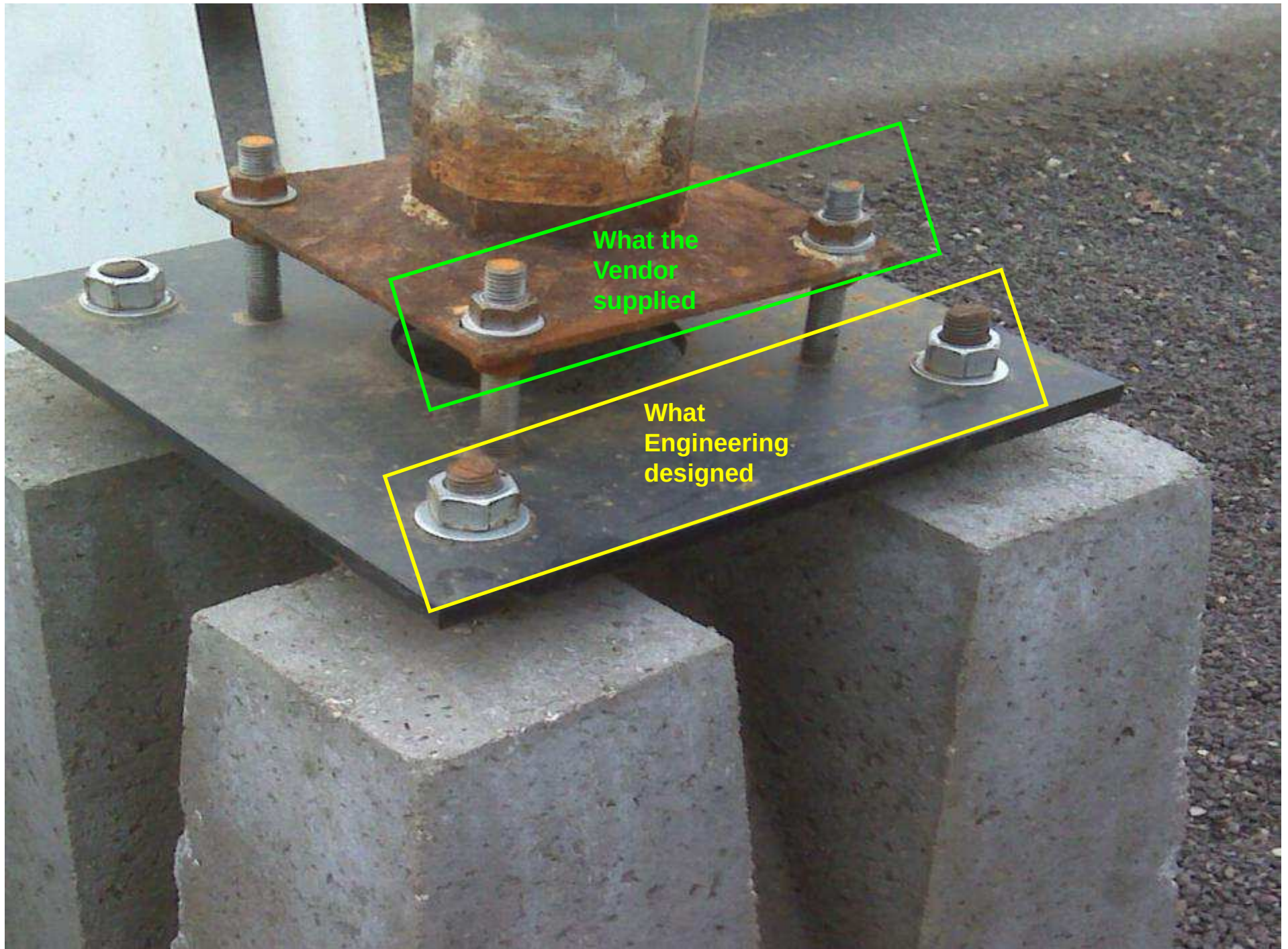
Piping

Process

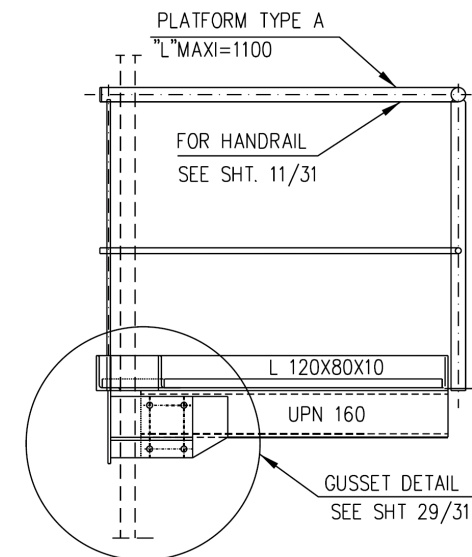
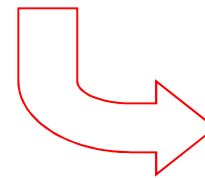
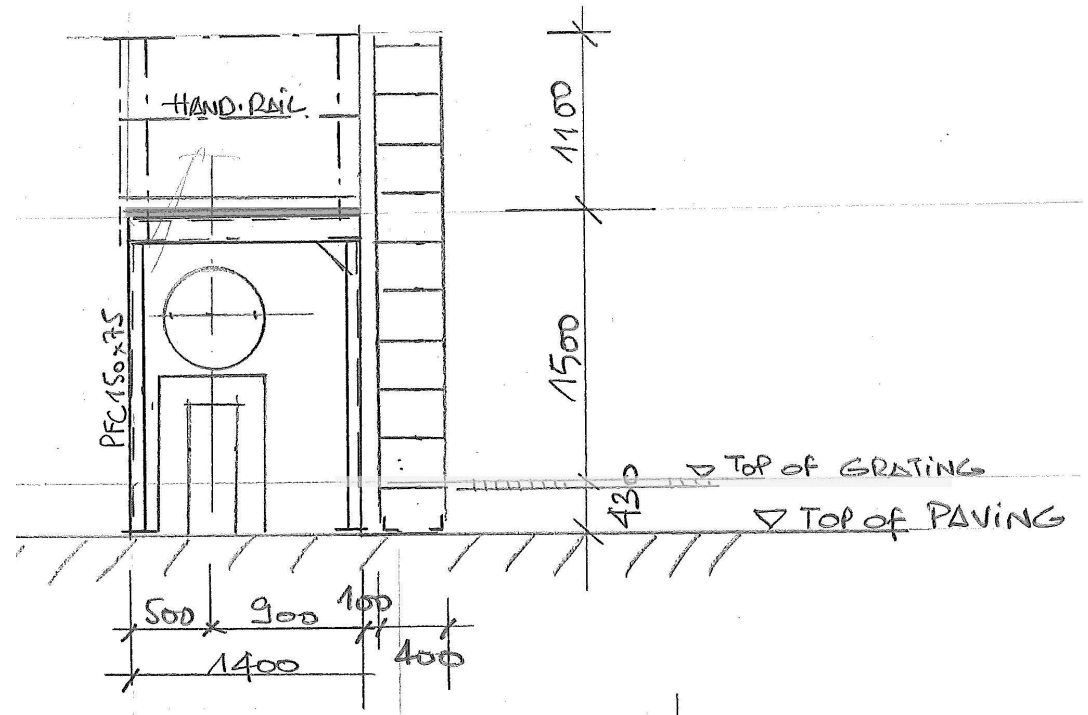
Civil







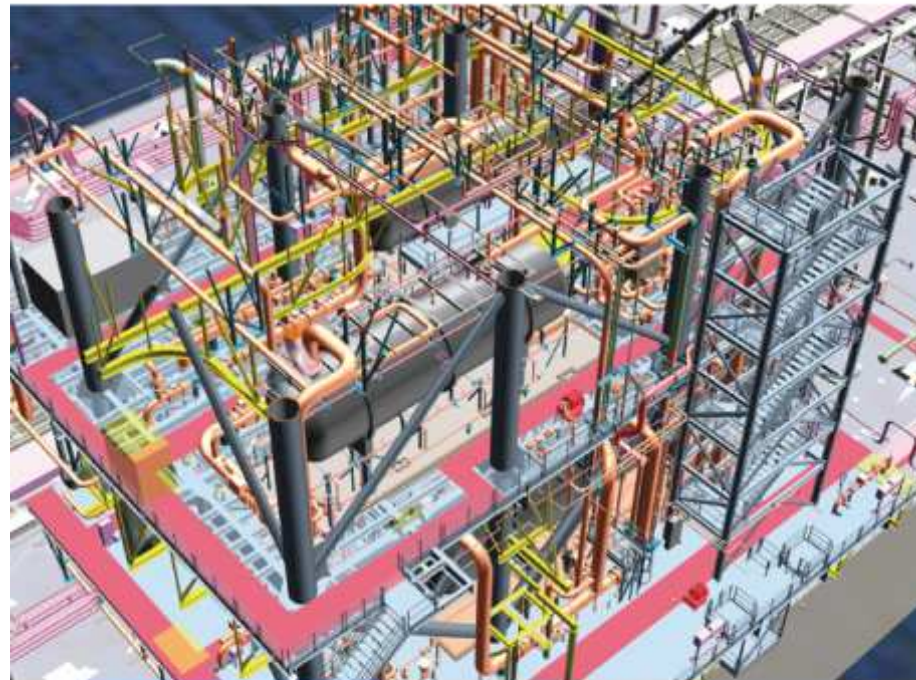




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Hervé Baron



Editions TECHNIP

**A unique synthesis for the busy Project professional**  
**200 pages, 250 illustrations**

# Project

Engineering

Procurement

Construction







## Procurement / Steps

Inquiry (Call for Tender)

Short listing

Bid analysis

Clarifications

Negotiations

Purchase Order

Expediting

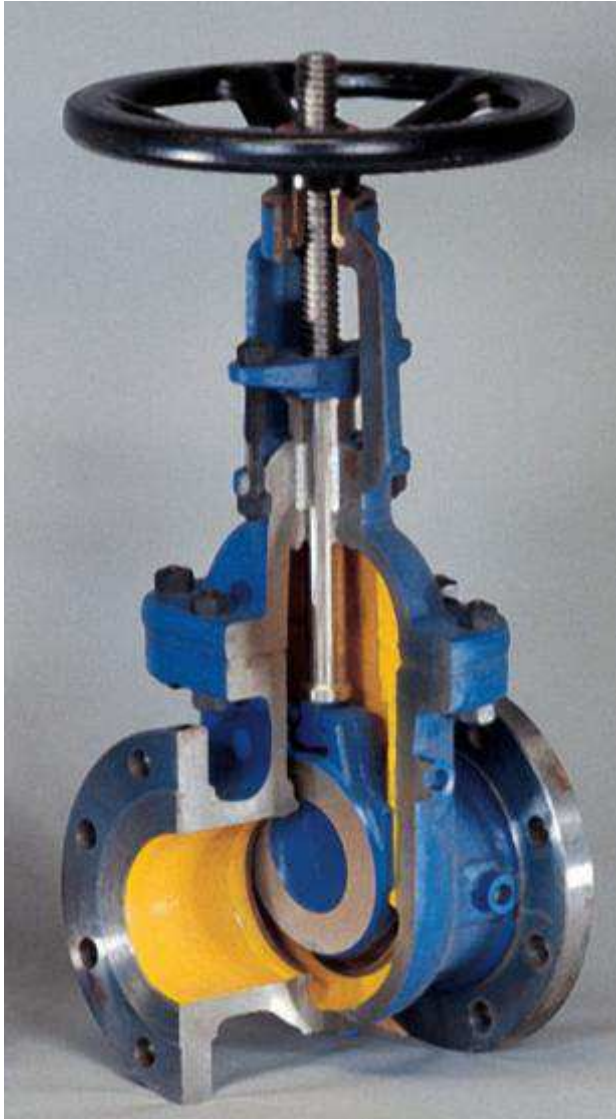
Inspection

Delivery

Warranty Period



## Procurement / Supplier selection criteria



Technical Compliance

Price

Qualification of supplier

Schedule

Load of workshop

References

References with final Client

Financial situation

Annual turn-over

Internal feed-back



# Procurement

|                                    |                                                          |                                   |                                  |
|------------------------------------|----------------------------------------------------------|-----------------------------------|----------------------------------|
| Rated flow rate                    | 27m3/h + miniflow requirements                           | 27 + 11                           | 27 + 15                          |
| Discharge pressure @ max           | 4.3barg                                                  | 4.3                               | 4.3                              |
| Material                           | CS                                                       | Impeller 316L SS / Body Cast Iron | Impeller 304 SS / Body Cast Iron |
| Control panel                      | IP 55                                                    | IP 55                             | IP 55                            |
| Equipment of control panel         | pump selection, stop on low level, Auto /manu/O selector | yes                               | yes                              |
| Motor cable gland                  | required                                                 | Yes                               | ?                                |
| Pressure gauge @pump discharge     | Required                                                 | yes                               | yes                              |
| Pressure switch                    | Required                                                 | yes                               | yes                              |
| Pump motor                         | IP55                                                     | yes                               | Yes                              |
| Pump driver installed power        | 7.5kW                                                    | 7.5                               | 5.5                              |
| Power supply                       | 415V / 3ph/ 50Hz                                         | 400V / 3ph / 50Hz                 | 400V / 3ph / 50Hz                |
| Control voltage of circuit control | 240 Vac                                                  | ?                                 | ?                                |
| Isolation valves                   | 2 for each pump                                          | Yes                               | Yes                              |
| Manifolds                          | 2                                                        | Yes                               | Yes                              |
| Check valves                       | 2 @ pump discharge                                       | Yes                               | Yes                              |

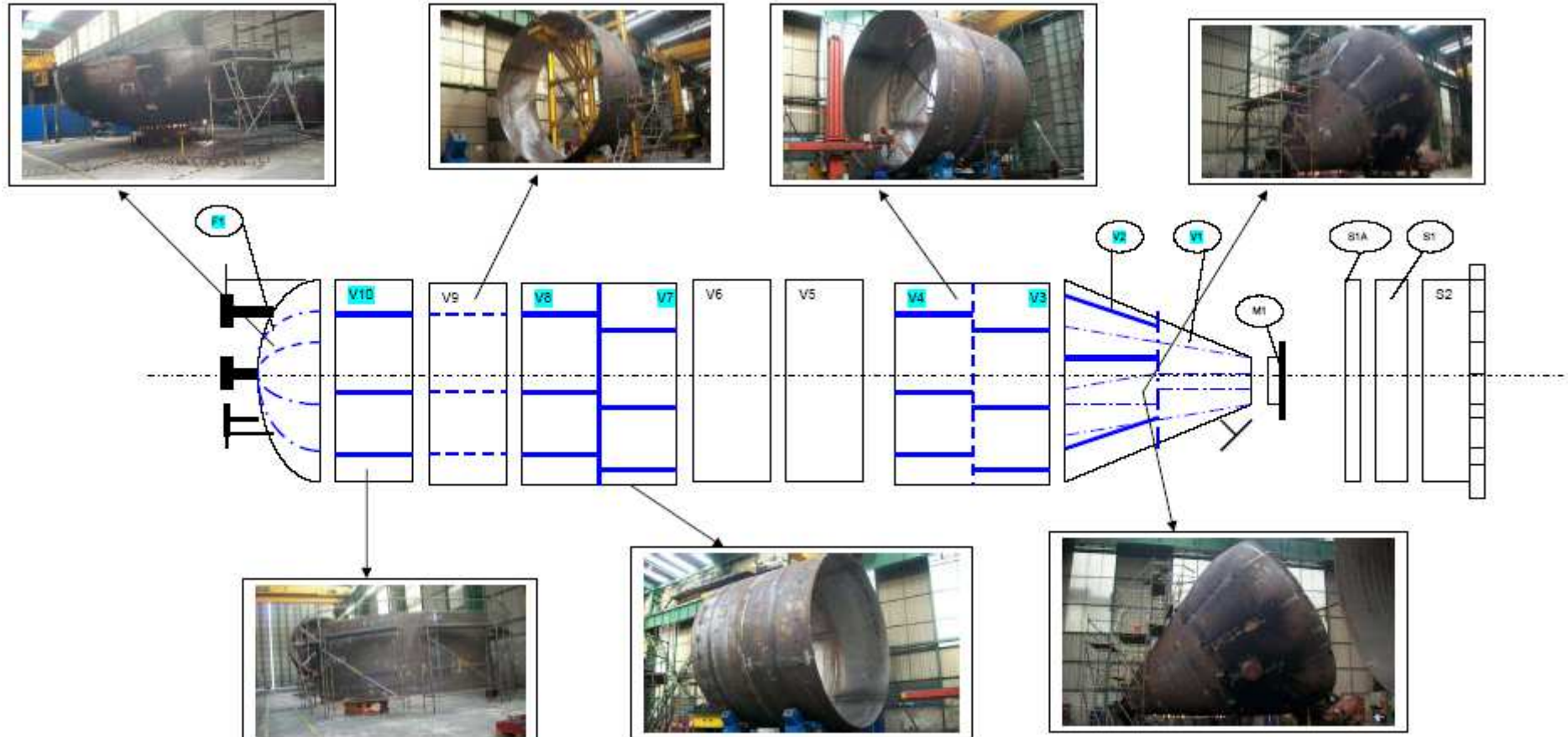
|                                                                                                                                                                                                                                                             |                                                                                                                 |                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| <b>GENERAL TERMS AND CONDITIONS :</b> GTC1_2_ANG_rev0 (for simple PO)                                                                                                                                                                                       | Agreed                                                                                                          | Agreed                                                                           |
| <b>PRESERVATION, PACKING, MARKING &amp; SHIPPING INSTRUCTIONS :</b> PP 606                                                                                                                                                                                  | Agreed / standard packing                                                                                       | Agreed / standar packing                                                         |
| <b>SITE SERVICE CONDITIONS FOR SUPPLIER'S SPECIALIST :</b> PP 608                                                                                                                                                                                           | Agreed                                                                                                          | Agreed                                                                           |
| <b>PURCHASE ORDER DRAFT</b>                                                                                                                                                                                                                                 | Agreed                                                                                                          | Agreed                                                                           |
| <b>VENDORS QUALITY MANAGEMENT SYSTEM REQUIREMENTS :</b> 9833N-0000-JSM-501                                                                                                                                                                                  | Agreed                                                                                                          | Agreed                                                                           |
| <b>MECHANICAL GUARANTEE:</b>                                                                                                                                                                                                                                | 24 months from date of delivery                                                                                 | 12 months from date of commissioning or 18 months from date of delivery          |
| <b>PAYMENT TERMS and CONDITIONS :</b><br>Terms: 20 % AR<br>80 % Delivery according to agreed Incoterm + Certificate of origin + Final documentation<br>Conditions : at 45 days after the end of the month of the date of issue of the corresponding invoice | - 20% AR<br>- 75% Delivery of the supply<br>- 5% Final documentation<br><br>Agreed - except for 1st installment | - 20% AR<br>- 60% Delivery DDP on site<br>- 20% Erection of supply<br><br>Agreed |
| <b>LATE DELIVERY PENALTIES :</b><br><br>EQUIPMENT : 1% the first 2 weeks, 2% the following, maxi 10%<br><br>Aggregate maxi : 10%                                                                                                                            | 0,5% per week<br><br>Maxi 5%                                                                                    | Agreed - based on supply delivery on site (erection excluded)<br><br>Agreed      |
| <b>SUB-SUPPLIER(S) LIST</b>                                                                                                                                                                                                                                 | Calpeca                                                                                                         | ITT / LOWARA                                                                     |

# Expediting



| Job   | Descr                | Weight   | Drawing Office | Planning | Fabricated | Sub Treatment | Treated | Loaded   | % Fabricated | % Galvanized | % Delivered |
|-------|----------------------|----------|----------------|----------|------------|---------------|---------|----------|--------------|--------------|-------------|
| 60307 | 80-PR-13E            | 65.3864  | 0              | 0        | 0          | 0             | 0       | 65.3864  | 100.0%       | 100.0%       | 100.0%      |
| 60308 | 80-PR-12E            | 32.6998  | 0              | 0        | 0          | 0             | 0       | 32.6998  | 100.0%       | 100.0%       | 100.0%      |
| 60310 | 80-PR-19 (Pat -01)   | 56.1923  | 0              | 0        | 0          | 0             | 0       | 56.1923  | 100.0%       | 100.0%       | 100.0%      |
| 60311 | 80-PR-18             | 234.6891 | 0              | 0        | 0.6278     | 47.7529       | 0       | 178.7163 | 76.4%        | 76.2%        | 76.2%       |
| 60312 | 80-PR-27 (part - 02) | 83.2827  | 0              | 0        | 0          | 0             | 0       | 83.2827  | 100.0%       | 100.0%       | 100.0%      |
| 60313 | 80-PR-19 (Pat -03)   | 126.7195 | 0              | 0        | 0          | 5.0505        | 0       | 121.669  | 96.0%        | 96.0%        | 96.0%       |
| 60314 | 80-PR-19 (Pat -02)   | 145.2883 | 0              | 0        | 10.2572    | 0.6449        | 0       | 129.3894 | 96.1%        | 89.1%        | 89.1%       |

# Expediting





# Inspection

**Technip**

## INSPECTION RELEASE CERTIFICATE

|                                                                                                                                                                                                                                                                                                                                                                                                               |                  |                   |                      |                                                       |  |                                                                                                                                                                                                                                                                                                                                                           |  |                                |  |            |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------------------|----------------------|-------------------------------------------------------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------|--|------------|--|
| N° Chrono CD<br>0-013                                                                                                                                                                                                                                                                                                                                                                                         |                  | ACHIEVEMENT<br>PO |                      | CODE MAT.<br>8959N                                    |  | N° ordre<br>1300                                                                                                                                                                                                                                                                                                                                          |  | N° Chrono IRC<br>PHO-0-013 -17 |  | AVI<br>602 |  |
| FOURNISSEUR / Supplier - (NOM, ADRESSE / Name, Address)<br>Phocenne<br>Vitrolles - 13742<br>France                                                                                                                                                                                                                                                                                                            |                  |                   |                      |                                                       |  |                                                                                                                                                                                                                                                                                                                                                           |  |                                |  |            |  |
| CLIENT : WRG                                                                                                                                                                                                                                                                                                                                                                                                  |                  |                   |                      | SITE : Wilhelmshaven                                  |  |                                                                                                                                                                                                                                                                                                                                                           |  | REF. : PL 0013                 |  |            |  |
| LE MATERIEL CI-APRES DESIGNÉ<br>The hereafter designated material                                                                                                                                                                                                                                                                                                                                             |                  |                   |                      |                                                       |  |                                                                                                                                                                                                                                                                                                                                                           |  |                                |  |            |  |
| <input checked="" type="checkbox"/> A EYE INSPECTE LE :<br>Has been inspected the : <input checked="" type="checkbox"/> VOIR DETAIL SUR LISTE JOINTE /<br>NE SERA PAS INSPECTE PAR NOS SOINS<br>Inspection has been waived                                                                                                                                                                                    |                  |                   |                      |                                                       |  |                                                                                                                                                                                                                                                                                                                                                           |  |                                |  |            |  |
| REQUISITION N° 1300 0602 0                                                                                                                                                                                                                                                                                                                                                                                    |                  |                   |                      |                                                       |  |                                                                                                                                                                                                                                                                                                                                                           |  |                                |  |            |  |
| Revision<br>N°                                                                                                                                                                                                                                                                                                                                                                                                | POSTE<br>Part n° | ITEM N°           | QUANTITE<br>Quantity | DESIGNATION DU MATERIEL /<br>Designation of Equipment |  |                                                                                                                                                                                                                                                                                                                                                           |  |                                |  |            |  |
|                                                                                                                                                                                                                                                                                                                                                                                                               |                  |                   |                      | Material described by MCS 17 (1 page)                 |  |                                                                                                                                                                                                                                                                                                                                                           |  |                                |  |            |  |
| LA LIVRAISON DU MATERIEL EST<br>The equipment delivery is                                                                                                                                                                                                                                                                                                                                                     |                  |                   |                      |                                                       |  |                                                                                                                                                                                                                                                                                                                                                           |  |                                |  |            |  |
| <input type="checkbox"/> PARTIELLE<br>Partially done <input type="checkbox"/> COMPLETE<br>Completed                                                                                                                                                                                                                                                                                                           |                  |                   |                      |                                                       |  |                                                                                                                                                                                                                                                                                                                                                           |  |                                |  |            |  |
| OBSERVATIONS / Remarks :                                                                                                                                                                                                                                                                                                                                                                                      |                  |                   |                      |                                                       |  |                                                                                                                                                                                                                                                                                                                                                           |  |                                |  |            |  |
| Inspection release issued after review of material certificates at Technip office                                                                                                                                                                                                                                                                                                                             |                  |                   |                      |                                                       |  |                                                                                                                                                                                                                                                                                                                                                           |  |                                |  |            |  |
| A REMPLIR PAR LE FOURNISSEUR<br>To be filled in by the Supplier<br>Supplier confirms that:<br>- All NCR's issued, have been solved and close-out reports issued<br>- No CR's remain outstanding<br>- All requirements of the PO/Requisition have been met<br>- All documentation (drawings, calculation notes, welding books....) has reached "No comment" status<br>- Manufacturer's data report is complete |                  |                   |                      |                                                       |  |                                                                                                                                                                                                                                                                                                                                                           |  |                                |  |            |  |
| CACHET DU FOURNISSEUR / NOM / SIGNATURE et DATE<br>SUPPLIER, stamp / Name / Signature and Date<br>21 AOUT 2009                                                                                                                                                                                                                                                                                                |                  |                   |                      |                                                       |  | EMETTEUR TECHNIP - Nom, Signature et Date<br>TECHNIP'S Representative Name, Signature and Date<br>TECHNIP INSP. DEPT<br>SZCZEPANSKI Philippe N°103<br><input checked="" type="checkbox"/> WITNESS<br><input checked="" type="checkbox"/> REVIEW<br><input checked="" type="checkbox"/> ACCEPTED<br><input type="checkbox"/> NOT ACCEPTED<br>Aug. 21, 2009 |  |                                |  |            |  |

## CONTROL AND CONFORMITY CERTIFICATE

PAGE : 1 / 1

2009/08/20 WILHELMSHAVENER RAFFINERIEGESELL

V/Ref. : 8735V-0000-1300-  
(V/Ref. )  
N/Réf. : 33420/10  
(O/Ref. )

We hereby certify that materials required of the above reference, have been manufactured and controlled according to the up to date specifications.

| Quantité<br>Quantity                                                                                                                                                                                                                                | Description<br>Description                                                                                                                                                               | Quantité<br>Quantity |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| 085R                                                                                                                                                                                                                                                | SPRAL WOUND GASKET, ASME B16.20<br>304/ GRAPHITE, RAISED FACE AS PER B16.5<br>150 LBS, INNER AISI 304/ OUTER CARBON<br>STEEL, LOW SEATING STRESS DESIGN,<br>DIA. 6" CLASS 150<br>450C280 | 2,00                 |
| GEORE CONJECT<br>20 AOUT 2009<br>TECHNIP                                                                                                                                                                                                            |                                                                                                                                                                                          |                      |
| TECHNIP INSP. DEPT<br>SZCZEPANSKI Philippe N°103<br><input checked="" type="checkbox"/> WITNESS<br><input checked="" type="checkbox"/> REVIEW<br><input checked="" type="checkbox"/> ACCEPTED<br><input type="checkbox"/> NOT ACCEPTED<br>21.8.2009 |                                                                                                                                                                                          |                      |

## Item D-6130B (FCP n° 71.993B)

### 1.- Plate cutting

Monitoring plate cutting works on Plate n° 126417 for shell can V10, as follows:

- Pre-heat plates up to 220°C aprox. using full gas burners. Temperature checked with tempilsticks (150°C) by Production and digital thermometer by QC people.
- Cutting plate on lateral sides. Checking pre-heat T° (165°C) as above.

### 2. – Shell section V3-V4 fit-up

Shell section V3-V4 have been assembled. The following inspections have been performed:

- a) Circ seam V3-V4: Inspection of "peel back" on bevel end edges. Clad plate has been removed 12 mm minimum and no visual defect is observed on bevel end edge. Total removal of clad plate was spot checked using a "copper sulphate pentahydrate" solution
- b) Circ seam V3-V4: Visual and dimensional of fitup. No damage was found and dimension was in accordance with dwgs 71-0993-001A rev. 2 / Weld detail 2 and 71-0993-011 rev. 1.

### 3.- Welding activities

#### 3.1.- Welding parameters

Performed in process inspection of welding, as follows:

- Cone V2: Long seams L3, L8 (SMAW/outside)
- Nozzle N1B: Inside weld overlay (FCAW)
- Flange nozzle M1: Flange face o/v (ESW/1° layer)
- Shell can V7: Insulation supports to shell (SMAW)
- Head F1: Long seam L11 (SAW/inside)
- Confirmed that welders have the applicable WPS
- Confirmed that supplier was utilizing the correct weld consumable
- Confirmed the correct pre-heat and interpass maintenance, using full gas burners. T° checked with tempilstick (welder) and digital thermometer (QC people)
- Confirmed (by spot) the correct welding parameters (volts, amperes, travel speed) by spot checking.

#### 3.2.- Back gouging surface

Cone V2: Long seams L5, L6, L9 & L10

100% visual inspection after arc air back gouging, confirming the compliance with applicable weld procedure and drawings.

#### 3.3.- Welder qualifications (WQR)

| Name           | TAG n° | Welding process | Type of weld | Range qualified  | Qualification date | NoBo approval | Comments |
|----------------|--------|-----------------|--------------|------------------|--------------------|---------------|----------|
| Ramón A. López | 59     | ESW             | Weld overlay | Above 25mm thick | 19/09/03           | YES           | (1)      |

(1) "Welder log" has been reviewed confirming continuity on welding process during last two years

Also see reports #13, 15

#### 3.4.- Welding consumables control

Inspection performed on welding consumable warehouse for checking the storage, records and control of applicable welding consumables.

Welding electrodes are stored in a stationary oven. This oven is identified to be containing electrodes of this job only.

Filler material (ESW, SAW, FCAW & GTAW) and flux bags are maintained in a clean and dry area.

### 4.- Nozzle dimensional control

Dimensional control of flange N2 (36"-WN-300# RTJ) after weld overlay and face machining. Face finishing (roughness and RTJ groove.); face & RTJ dimension (weld overlay thickness, OD and height); and ID weld overlay thickness were checked and found in compliance with ASME 16. 5 and dwg. 71.0993-005B rev. 2



## Shipping





**Shipping**



## Shipping





# Project

Engineering

Procurement

Construction





**HERVE  
BARON**

## Earthworks





# Pipeline



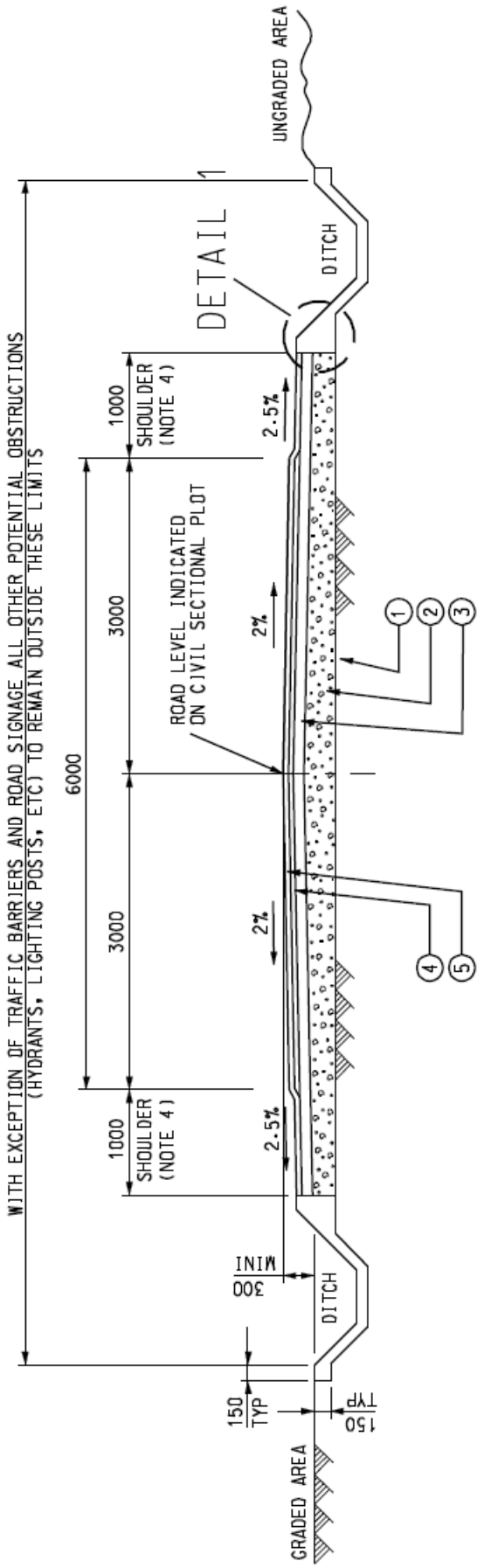


# Pipeline





**Roads**

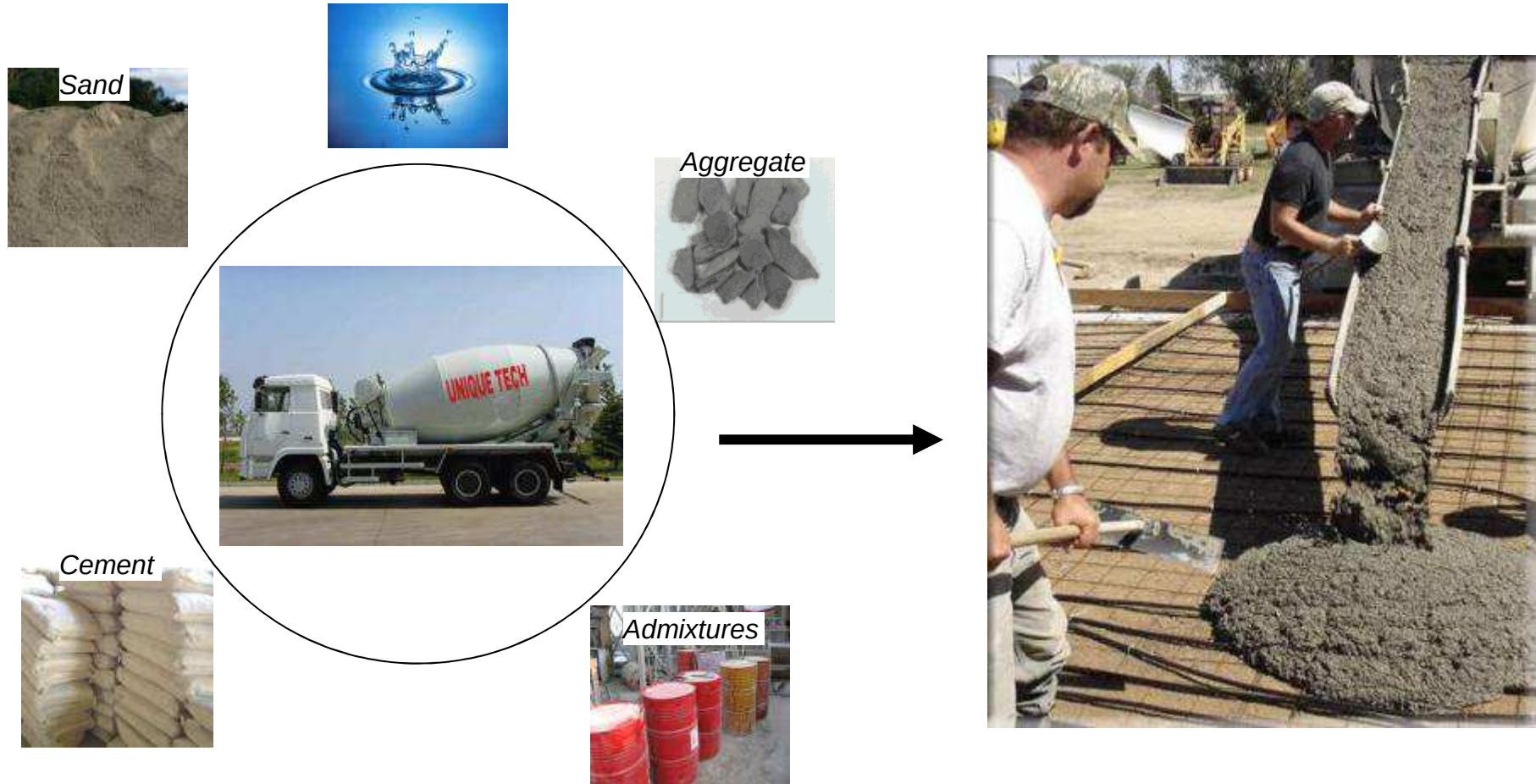


SECTION ROAD TYPE "A"

# Buildings



# Civil Works





## Civil Works





## Civil Works





## Civil Works





## Civil Works



## Civil Works





## Pre-fabrication





# Erection





## Underground networks



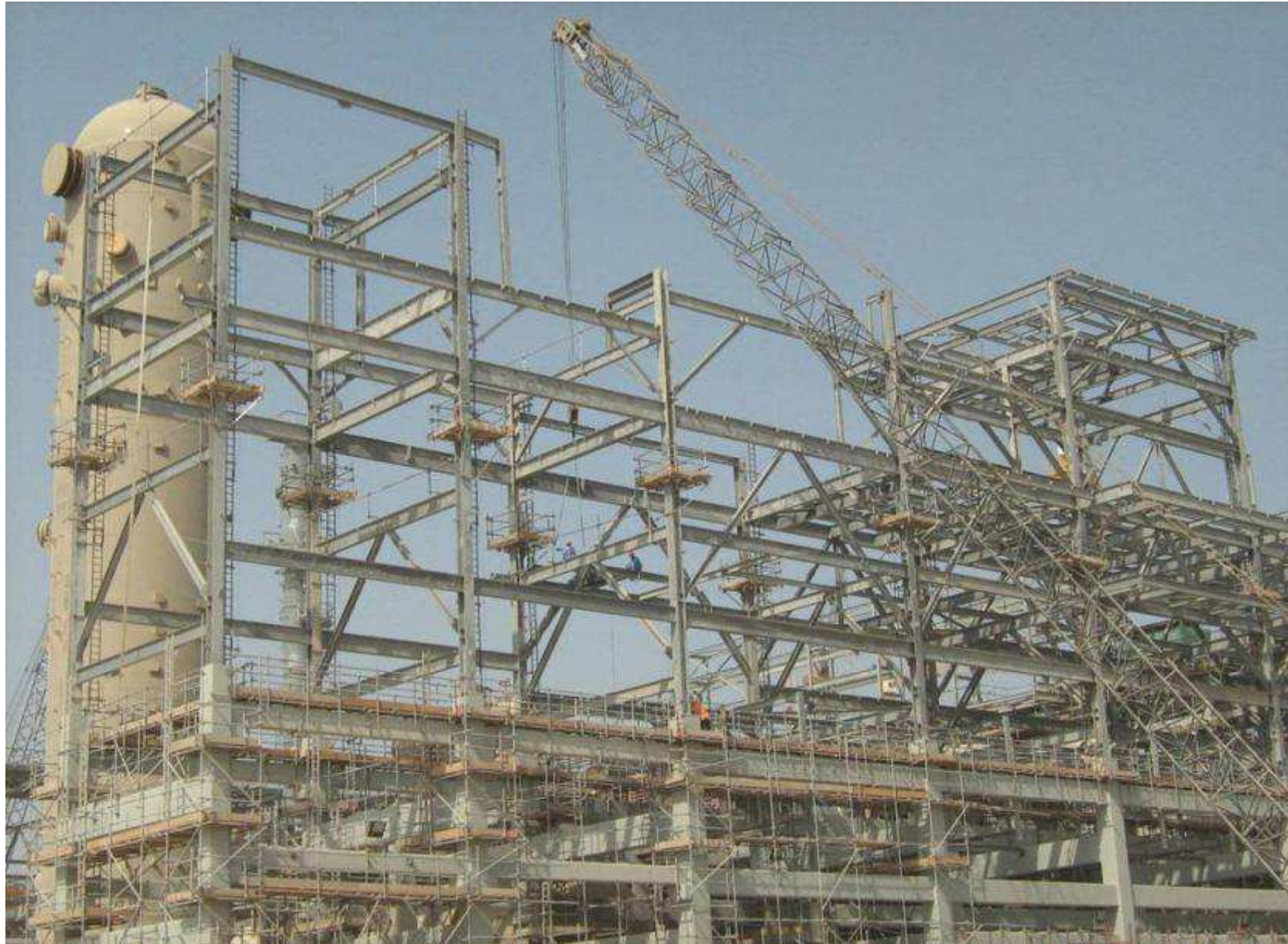


## Plant erection





## Steel structure erection



## Equipment installation





## Equipment installation



## Piping Pre-fabrication





## Piping erection





## Piping erection



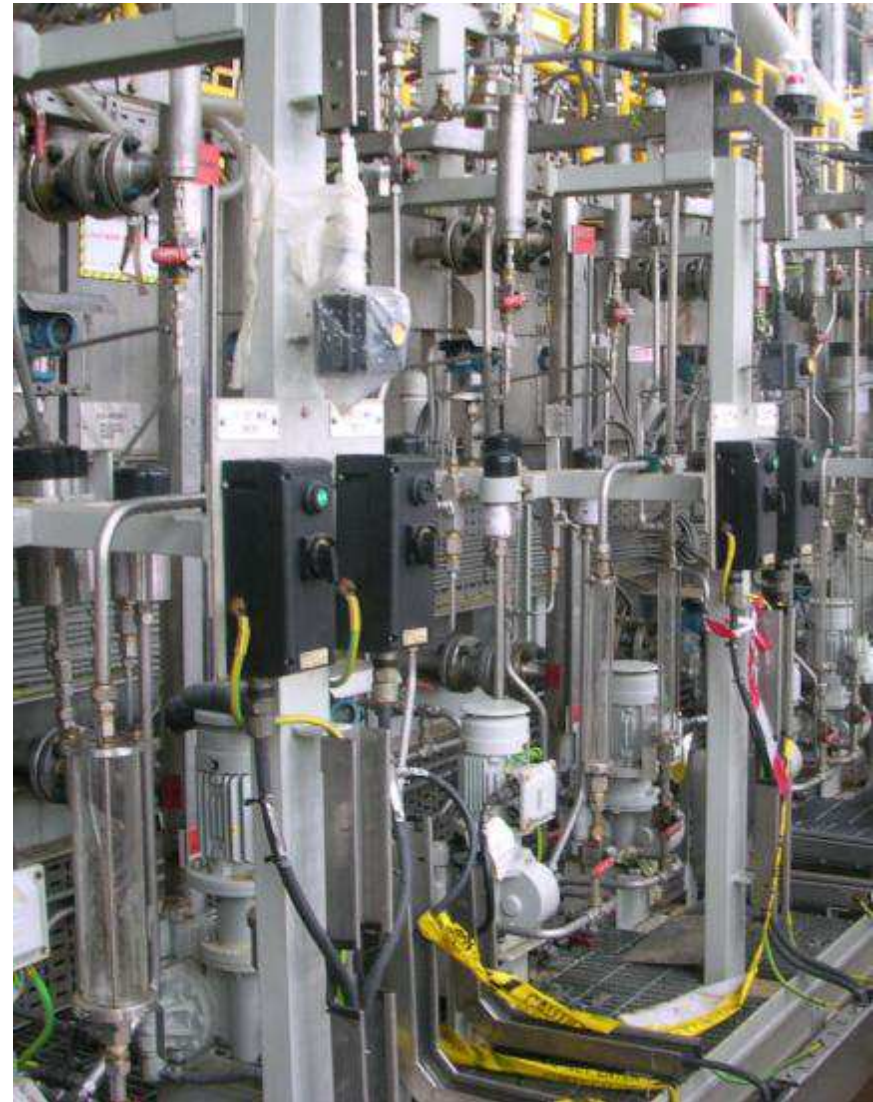


## Field Instrumentation Installation





## Electrical equipment connection





## Cable pulling



## Arrangement of Technical rooms





## Cable connections



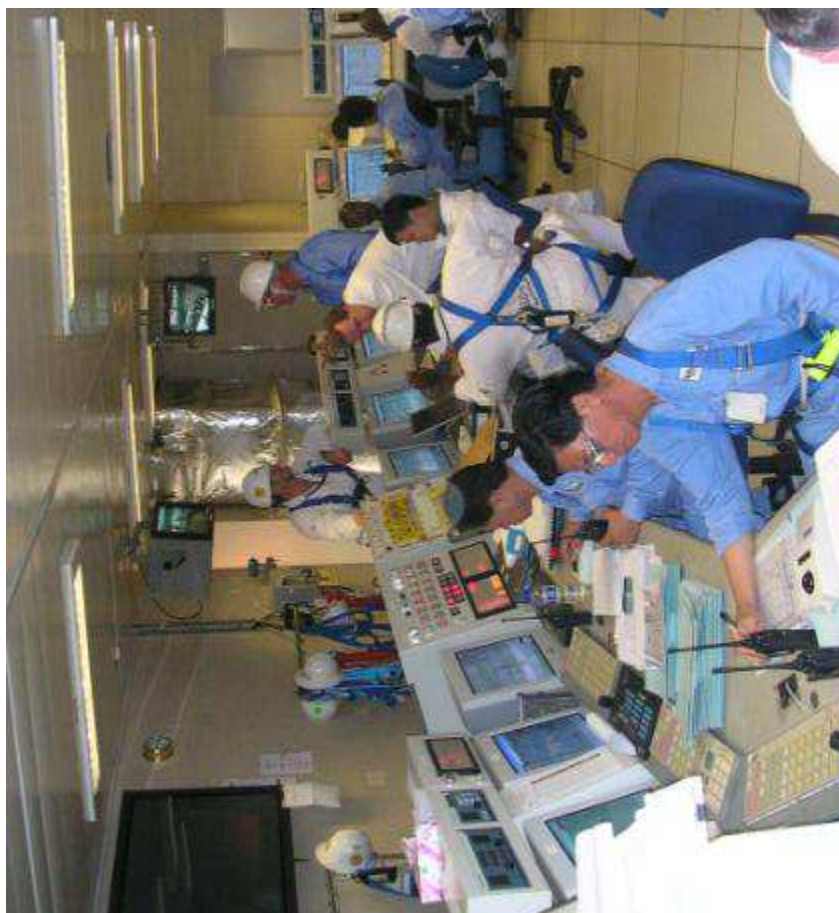
## Other Systems Field Equipment Installation





## Control room consoles installation

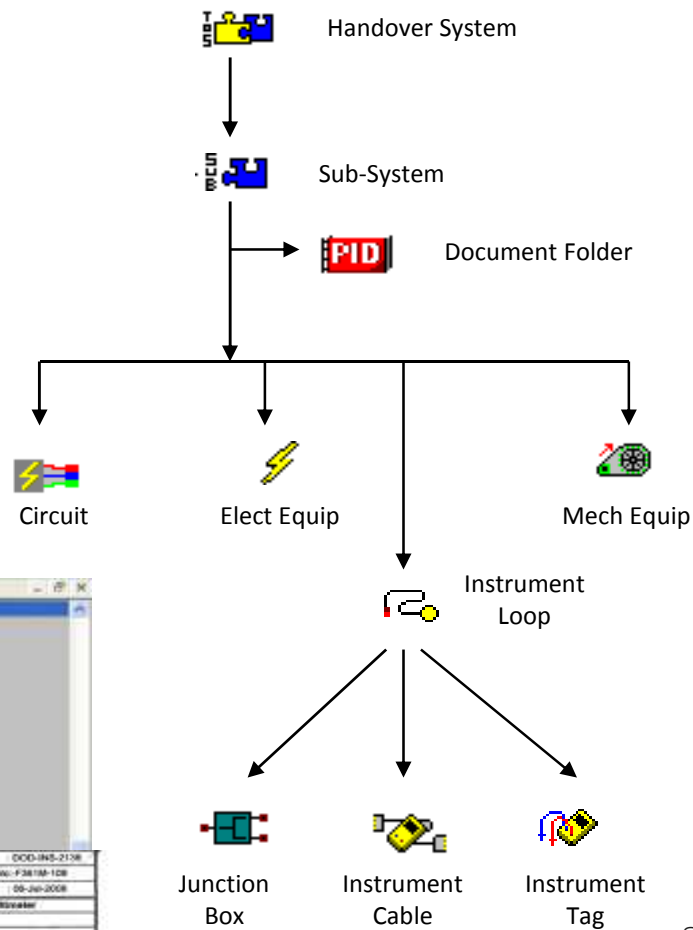
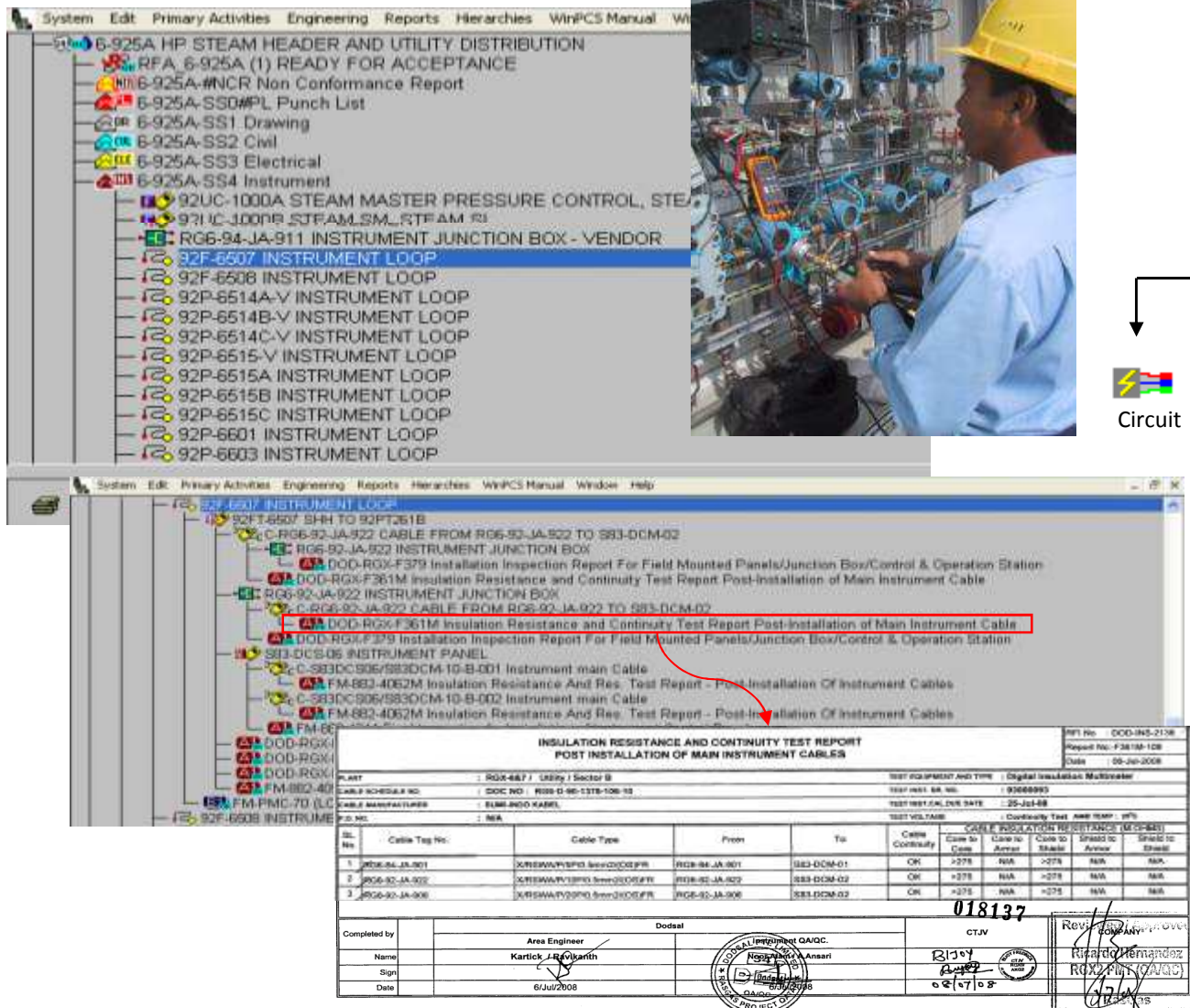




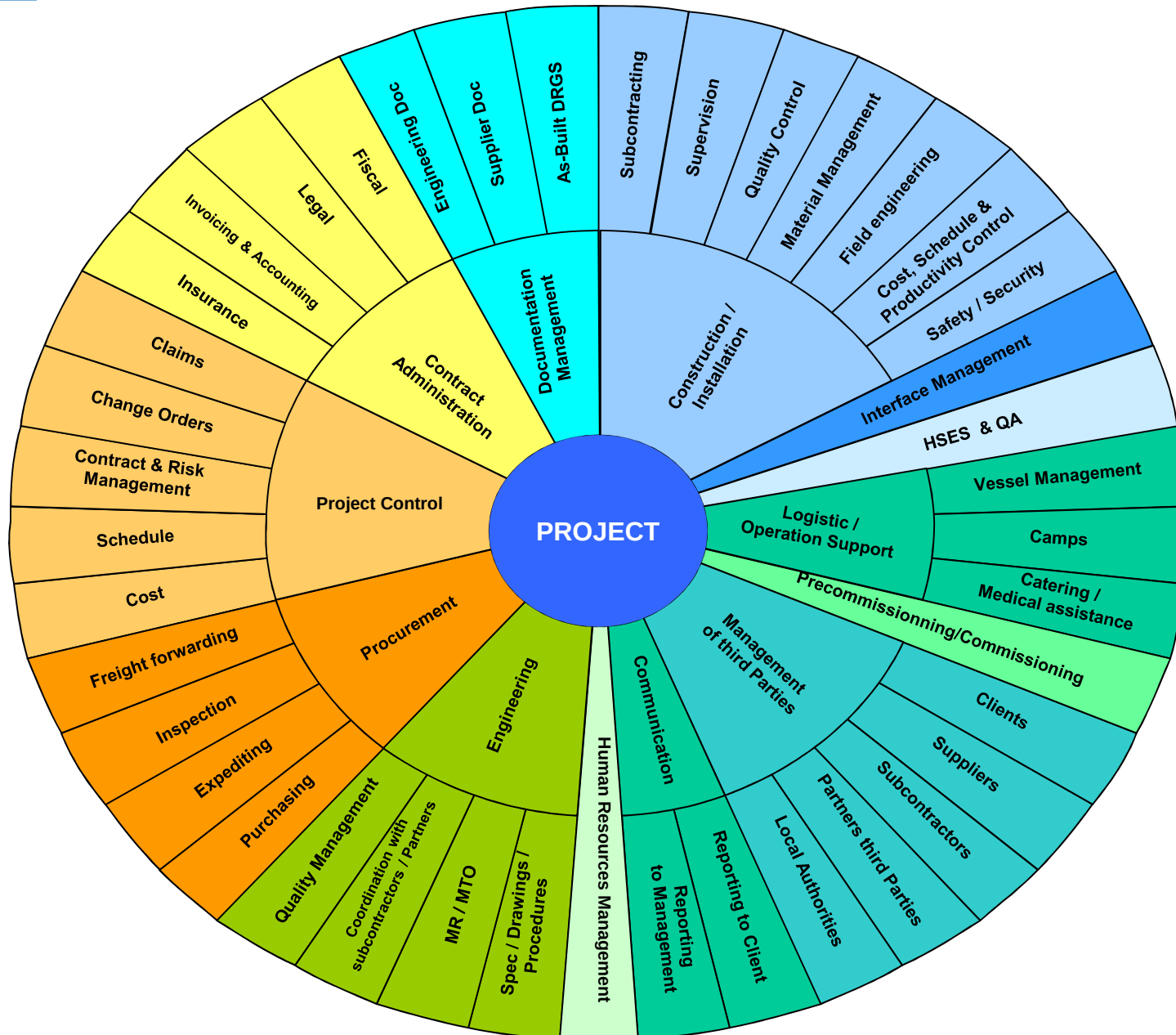
Testing



# Commissioning

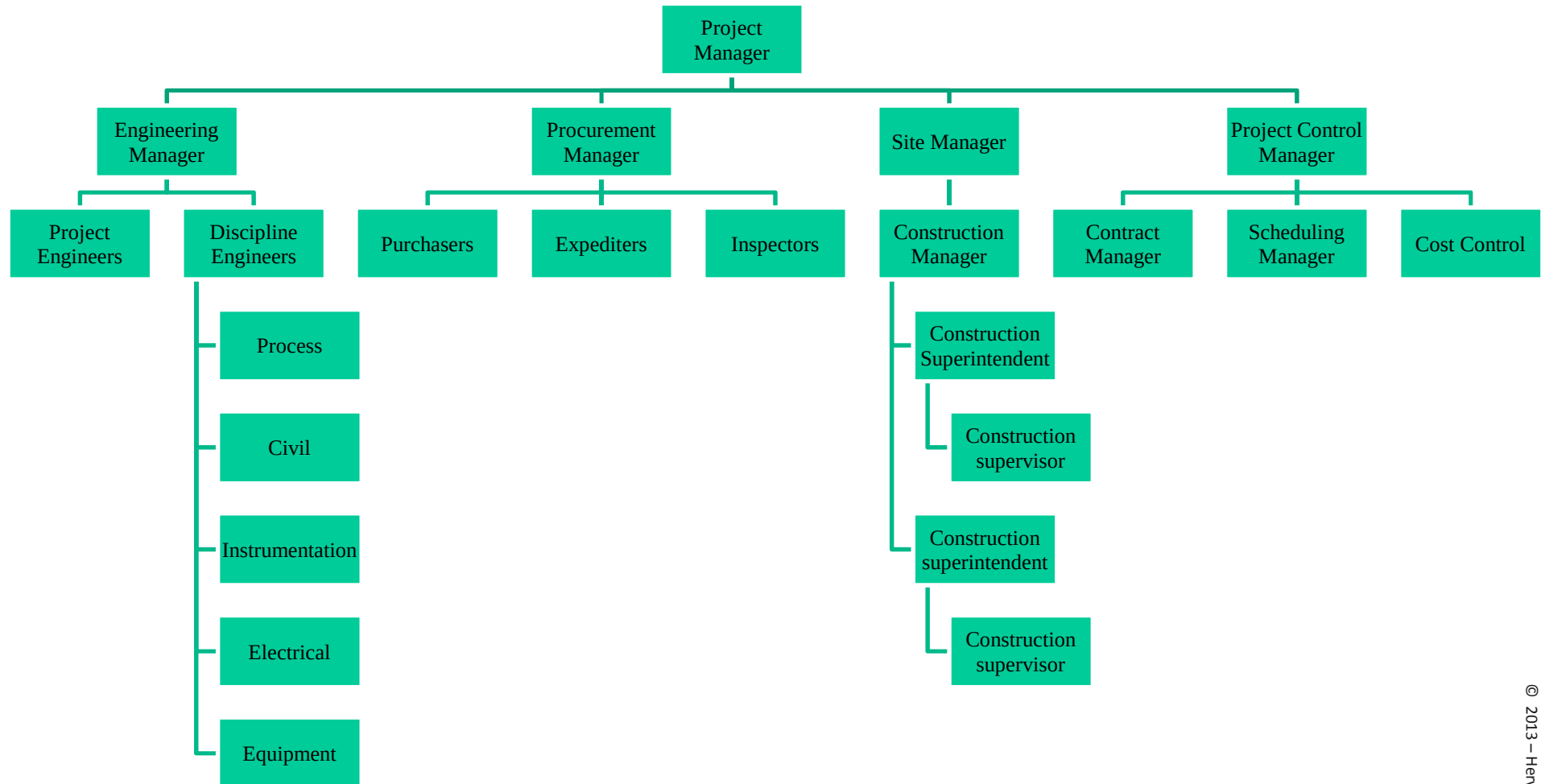


# The multiple sides of a Project





# Project Organisation



# Project procedures

| List of Project Procedures                                       |
|------------------------------------------------------------------|
| QA Assurance Manual                                              |
| Communications procedure                                         |
| Communications Procedure                                         |
| Planning & Progress Control Procedure                            |
| Purchasing plan                                                  |
| Meetings Procedure                                               |
| Reporting Procedure and examples                                 |
| Engineering Procedure with examples of MDR & Dwgs & spec formats |
| Procurement Procedure                                            |
| Subcontracting Procedure                                         |
| Progress Control Procedure                                       |
| Invoicing Procedure & Register                                   |
| Precommissioning/commissioning procedure                         |
| QA/QC procedures                                                 |
| Safety Manual & HSE Program                                      |
| Contract Close out procedure                                     |
| Insurance Claims Procedure                                       |
| CADD Procedure                                                   |
| Change Order procedure                                           |
| Project Execution plan (including construction execution plan)   |
| Warranty work                                                    |
| List of Project Procedures                                       |
| Document Identification and Numbering Procedure                  |
| Calendar procedure                                               |
| Vendor and Subcontractor Final Documentation                     |
| Interface Management Plan                                        |
| Project Risk Management Procedure                                |





## Project temporary facilities



## Project temporary facilities





## Project temporary facilities



**HERVE  
BARON**

## Project temporary facilities



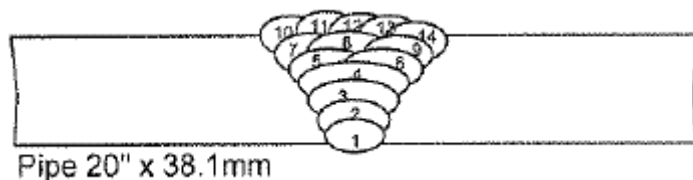
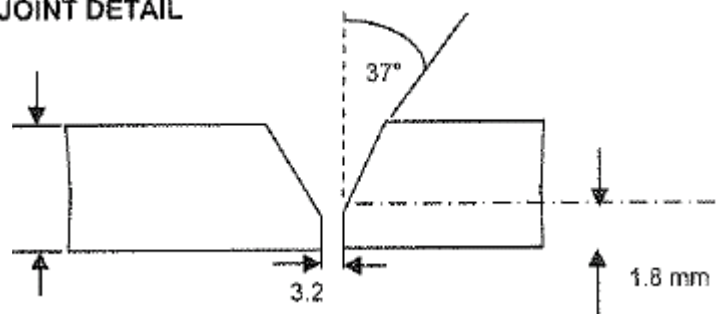


## Project temporary facilities



# Construction Procedures

**JOINT DETAIL**



## WELDING PROCEDURE SPECIFICATION (IN ACCORDANCE WITH ASME IX & ASME B31.3/B31.8)

|                                                              |                                                                                                                                                                                                                                                                                                                                                                                     |                                          |                                                 |
|--------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|-------------------------------------------------|
| <b>POSITIONS [QW-405]</b>                                    |                                                                                                                                                                                                                                                                                                                                                                                     | <b>POST WELD HEAT TREATMENT [QW-407]</b> |                                                 |
| Position(s) of Groove:                                       | ALL                                                                                                                                                                                                                                                                                                                                                                                 | Temperature Range:                       | 610°C - 665°C                                   |
| Welding Progression:                                         | UP HILL                                                                                                                                                                                                                                                                                                                                                                             | Time Range:                              | ONE HOUR MINIMUM / INCH<br>3.95 HOURS (MAXIMUM) |
| Position(s) of Fillet:                                       | ALL                                                                                                                                                                                                                                                                                                                                                                                 | <b>GAS [QW-408]</b>                      |                                                 |
| <b>PREHEAT [QW-406]</b>                                      |                                                                                                                                                                                                                                                                                                                                                                                     | Percent Composition                      |                                                 |
| Preheat Temperature:                                         | Min. 93°C                                                                                                                                                                                                                                                                                                                                                                           | Gas(es)                                  | (Mixture) Flow Rate                             |
| Interpass Temp.                                              | Max. 250°C                                                                                                                                                                                                                                                                                                                                                                          | Argon 99.9%                              | NA 6-16 Ltr/Min.                                |
| Preheat Maintenance:                                         | NA                                                                                                                                                                                                                                                                                                                                                                                  | Shielding:                               | NA NA NA                                        |
| (Continuous Special Heating where applicable to be recorded) |                                                                                                                                                                                                                                                                                                                                                                                     | Purging:                                 | NA NA NA                                        |
|                                                              |                                                                                                                                                                                                                                                                                                                                                                                     | Trailing:                                | NA NA NA                                        |
|                                                              |                                                                                                                                                                                                                                                                                                                                                                                     | Backing:                                 | NA NA NA                                        |
| <b>ELECTRICAL CHARACTERISTICS [QW-409]</b>                   |                                                                                                                                                                                                                                                                                                                                                                                     |                                          |                                                 |
| Current (A.C. or D.C.):                                      | DC                                                                                                                                                                                                                                                                                                                                                                                  | Polarity:                                | GTAW (-VE) & SMAW (+VE)                         |
| Amperes (Range):                                             | SEE BELOW TABLE                                                                                                                                                                                                                                                                                                                                                                     | Volts (Range):                           | SEE BELOW TABLE                                 |
| Tungsten Electrode (Size & Type):                            | 2% THORIATED SIZE $\phi$ 2.00 / 2.40mm                                                                                                                                                                                                                                                                                                                                              |                                          |                                                 |
| Mode of Metal Transfer for GMAW:                             | NA                                                                                                                                                                                                                                                                                                                                                                                  |                                          |                                                 |
| Electrode Wire Feed Speed Range:                             | NA                                                                                                                                                                                                                                                                                                                                                                                  |                                          |                                                 |
| <b>TECHNIQUE [ QW-410]</b>                                   |                                                                                                                                                                                                                                                                                                                                                                                     |                                          |                                                 |
| String or Weave Bead:                                        | STRING & WEAVE                                                                                                                                                                                                                                                                                                                                                                      |                                          |                                                 |
| Orifice or Gas Cup Size:                                     | 8 - 13mm                                                                                                                                                                                                                                                                                                                                                                            |                                          |                                                 |
| Initial and Interpass Cleaning (Brushing, Grinding, etc.):   | GRINDING / BRUSHING                                                                                                                                                                                                                                                                                                                                                                 |                                          |                                                 |
| Method of Back-gouging:                                      | SEE "OTHER"                                                                                                                                                                                                                                                                                                                                                                         |                                          |                                                 |
| Oscillation:                                                 | NA                                                                                                                                                                                                                                                                                                                                                                                  |                                          |                                                 |
| Contact Tube to Work Distance:                               | MULTIPLE                                                                                                                                                                                                                                                                                                                                                                            |                                          |                                                 |
| Multiple or Single Pass (Per Side):                          | SINGLE                                                                                                                                                                                                                                                                                                                                                                              |                                          |                                                 |
| Multiple or Single Electrodes:                               | SEE BELOW TABLE                                                                                                                                                                                                                                                                                                                                                                     |                                          |                                                 |
| Travel Speed (Range):                                        | NOT ALLOWED                                                                                                                                                                                                                                                                                                                                                                         |                                          |                                                 |
| Peening:                                                     |                                                                                                                                                                                                                                                                                                                                                                                     |                                          |                                                 |
| Other:                                                       | 1. When required, e.g. irregular root, root concavity, incomplete penetration etc. on the root and where access permits, the root may be back welded using the GTAW or SMAW parameters below.<br>Preparation to ensure Fusion shall be by power grinder. (see Page No 4 for Back Weld Details)<br>2. Minimum 2 Passes for all pressure retaining welds including sockets & fillets. |                                          |                                                 |



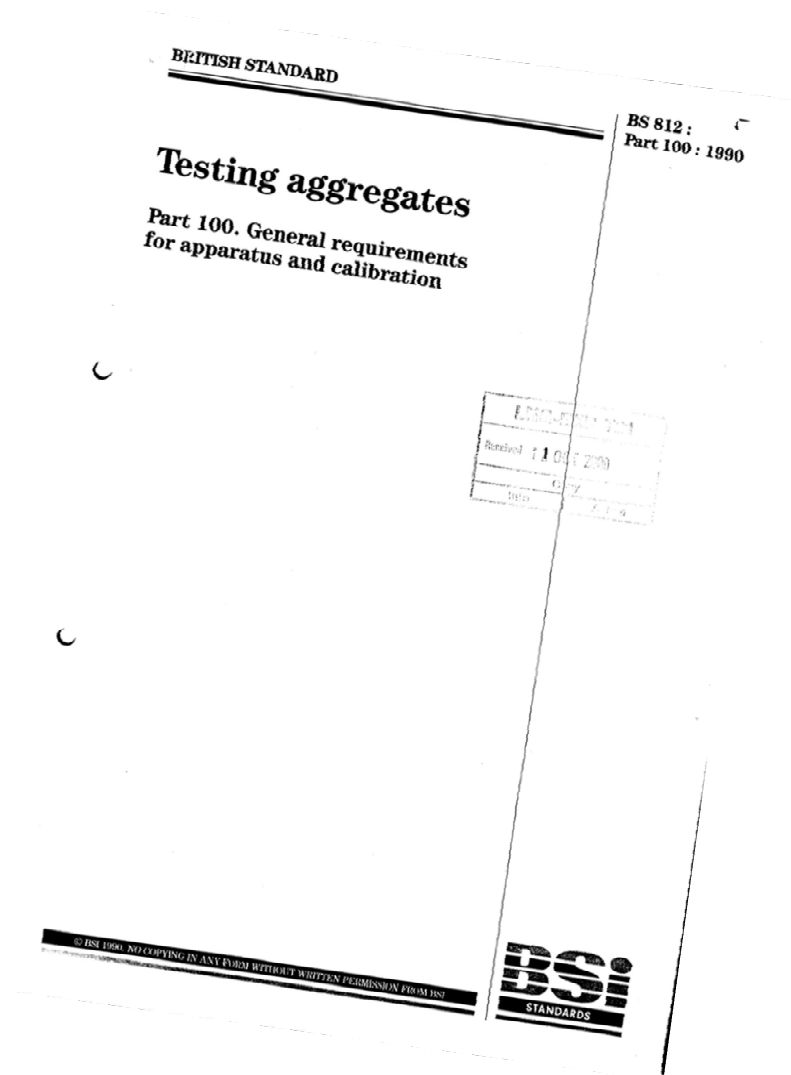
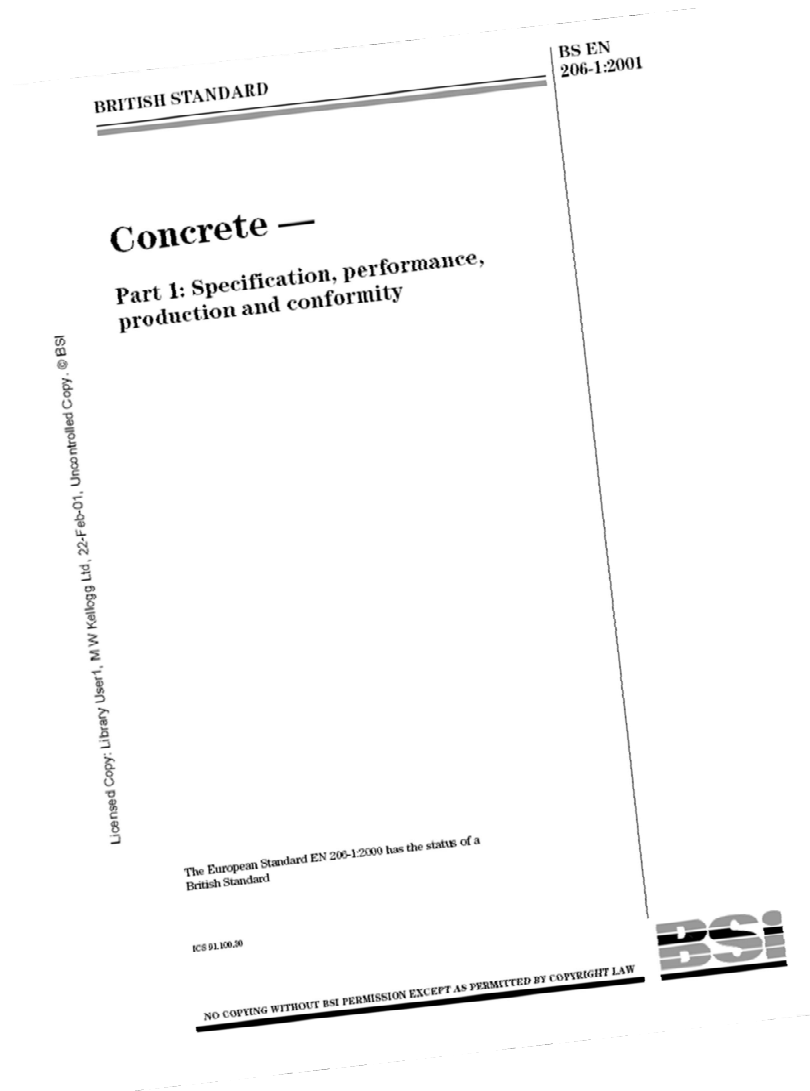
**WELDING PARAMETER TABLE [QW-409]**

| Weld Layer(s) | Process | Filler Metal |             | Current |       |             | Volt Range | Travel Speed Range mm/min | MAX Heat Input in KJ/mm |
|---------------|---------|--------------|-------------|---------|-------|-------------|------------|---------------------------|-------------------------|
|               |         | Class        | Dia (mm)    | Type    | Polar | Ampr. Range |            |                           |                         |
| ROOT          | GTAW    | E70S-6       | 2.0 / 2.4   | DC      | -VE   | 80-120      | 10-15      | 50-80                     | 0.83                    |
| HOT           | SMAW    | E7018-1      | 2.5/3.2     | DC      | +VE   | 60-100      | 20-30      | 80-130                    | 1.42                    |
| FILL          | SMAW    | E7018-1      | 2.5/3.2/4.0 | DC      | +VE   | 70-175      | 20-30      | 80-130                    | 2.70                    |
| CAP           | SMAW    | E7018-1      | 2.5/3.2/4.0 | DC      | +VE   | 65-145      | 20-30      | 80-160                    | 2.70                    |





# Quality Control





# Quality Control



Temperature



Conc temp on pouring of  
footings span 3 & 4 land side  
of gulf section - Sea Wall

Slump



Sampling



## Quality Control

**REJECTED**





## Cost Control

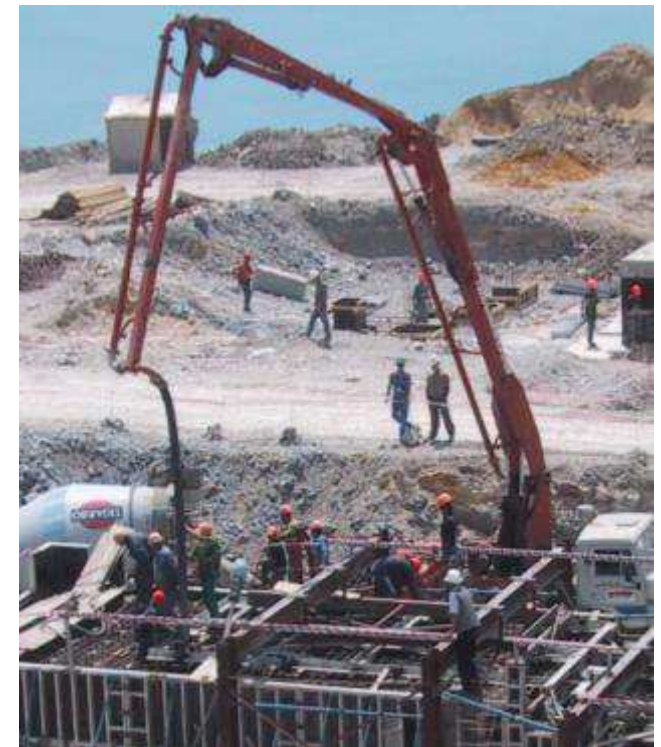
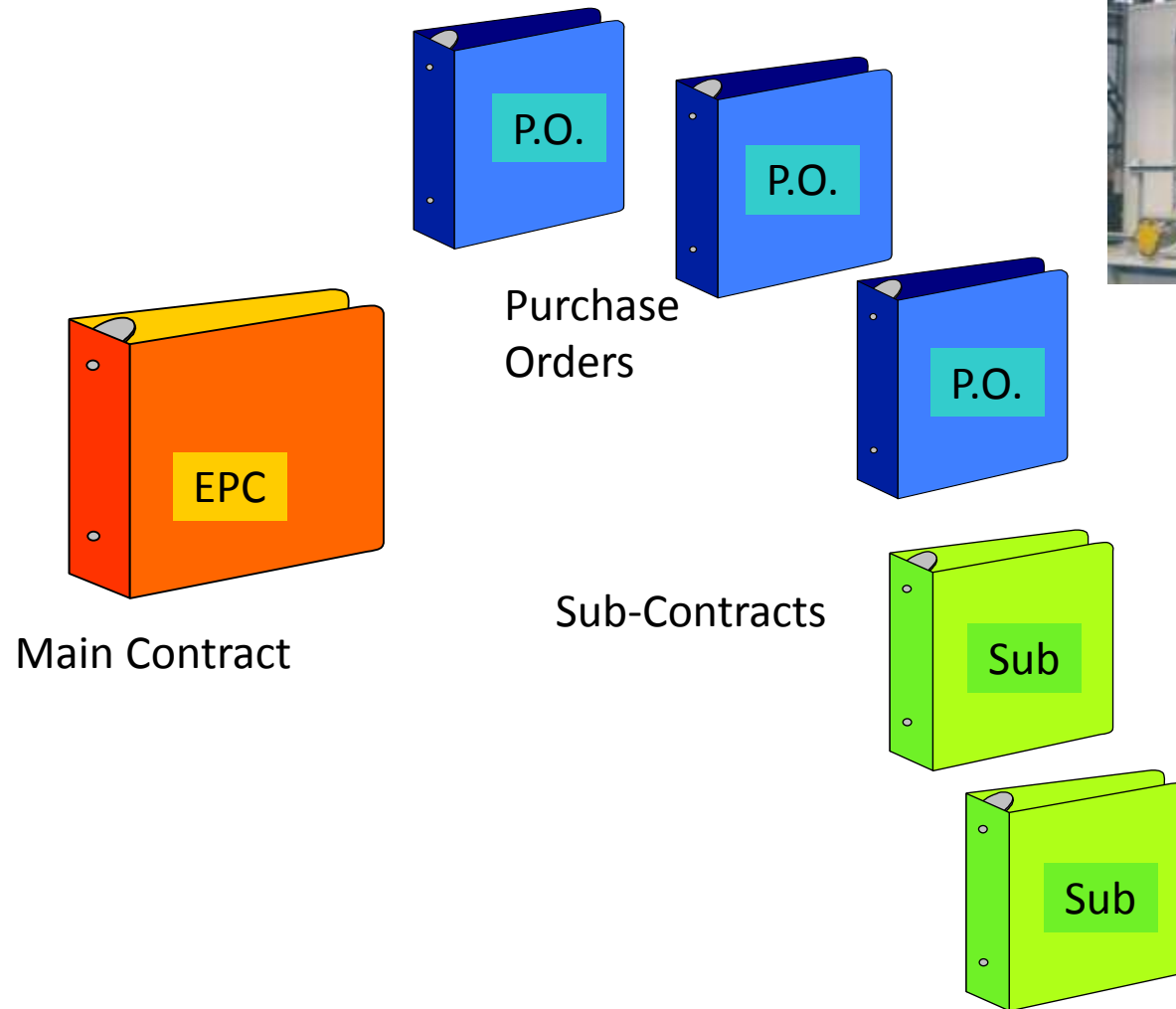
|                                  | budget | spent | to go | forecast |
|----------------------------------|--------|-------|-------|----------|
| Item                             | A      | B     | A-B   | C        |
| engineering manhours             |        |       |       |          |
| main equipment                   |        |       |       |          |
| bulk materials                   |        |       |       |          |
| construction                     |        |       |       |          |
| offices                          |        |       |       |          |
| camps, temporary site facilities |        |       |       |          |
| contingencies                    |        |       |       |          |
| Risk                             |        |       |       |          |
| TOTAL COST                       |        |       |       |          |



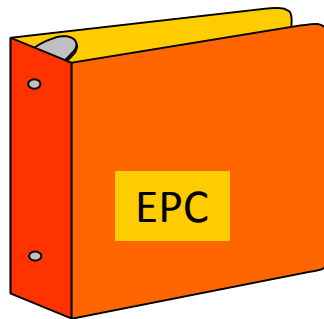




# Contracts



# Contracts



Main Contract

Terms and  
Conditions

Price

Schedule

Performance  
guarantees

Technical  
basis

Specifications,  
codes & stds



# Contracts

# E



## Contracts



# EP





## Contracts



# E P C



## Contracts



---

$$\Sigma + x\%$$



**HERVE  
BARON**

## Construction contracts



**Civil**





## Construction contracts

### Mechanical





## Construction contracts



E&I

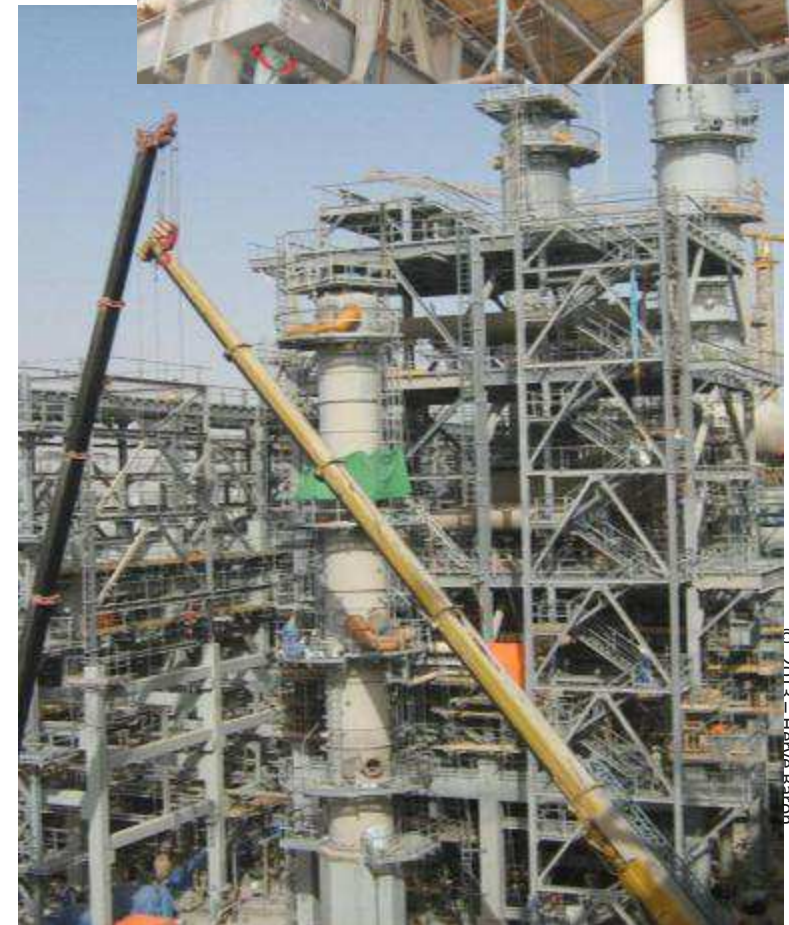




## Construction contracts

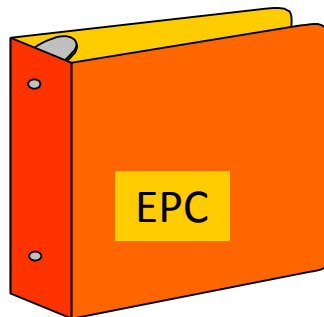


## General Contractor





# Contracts Terms and Conditions



Main Contract

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| ARTICLE 19 - GUARANTEES AND WARRANTIES                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
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|                                                                                      | <b>ARTICLE 7 - INDEPENDENCE OF CONTRACTOR</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                                      | CONTRACTOR declares and warrants that he is fully experienced and technically competent to perform the WORK and that he is properly financed, organized and equipped to perform such WORK.                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                      | CONTRACTOR shall manage, control and direct the WORK as an independent contractor and perform all obligations and duties under the CONTRACT at his own cost, risk and responsibility, in due compliance with the WORK TIME SCHEDULE and with the provisions of the CONTRACT.                                                                                                                                                                                                                                                                                                                                                                                |
|                                                                                      | COMPANY shall have the right to inspect CONTRACTOR as to the results which it wishes to obtain from the WORK and to inspect the WORK at all stages of execution in order to ascertain that these results are being obtained and that WORK is being carried out in accordance with CONTRACT requirements, but shall not have the right to direct the execution of the WORK except as provided for under provisions of the CONTRACT covering defective performance by CONTRACTOR and/or Take-over by COMPANY.                                                                                                                                                 |
|                                                                                      | CONTRACTOR's failure to perform any obligations shall always be at its sole cost and risk. Omissions or actions of COMPANY and/or inspecting authorities or agencies, including any comments or absence thereof, presence or absence of representatives at any time including during tests and inspections, issuance of certificates other than FINAL ACCEPTANCE CERTIFICATE (subject to surviving obligations and liabilities under the CONTRACT or at least, payments, APPROVAL and the like, shall not release CONTRACTOR in any way from any of its obligations and liabilities under the CONTRACT or at least, nor imply acceptance of defective WORK. |
|                                                                                      | CONTRACTOR shall remain solely responsible and liable for compliance with the CONTRACT by all SUBCONTRACTORS, and COMPANY's rights and interests shall not be affected in any way or their scope however reduced due to any subcontracting.                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                                                                                      | CONTRACTOR shall not represent COMPANY or act for or on behalf of COMPANY or in its name without COMPANY's prior written consent and then only as and when mutually agreed by the PARTIES. Relations with third parties shall be subject to procedures previously agreed to by COMPANY. No employee, servant or agent of CONTRACTOR shall be deemed in any way to be an employee, servant or agent of COMPANY.                                                                                                                                                                                                                                              |



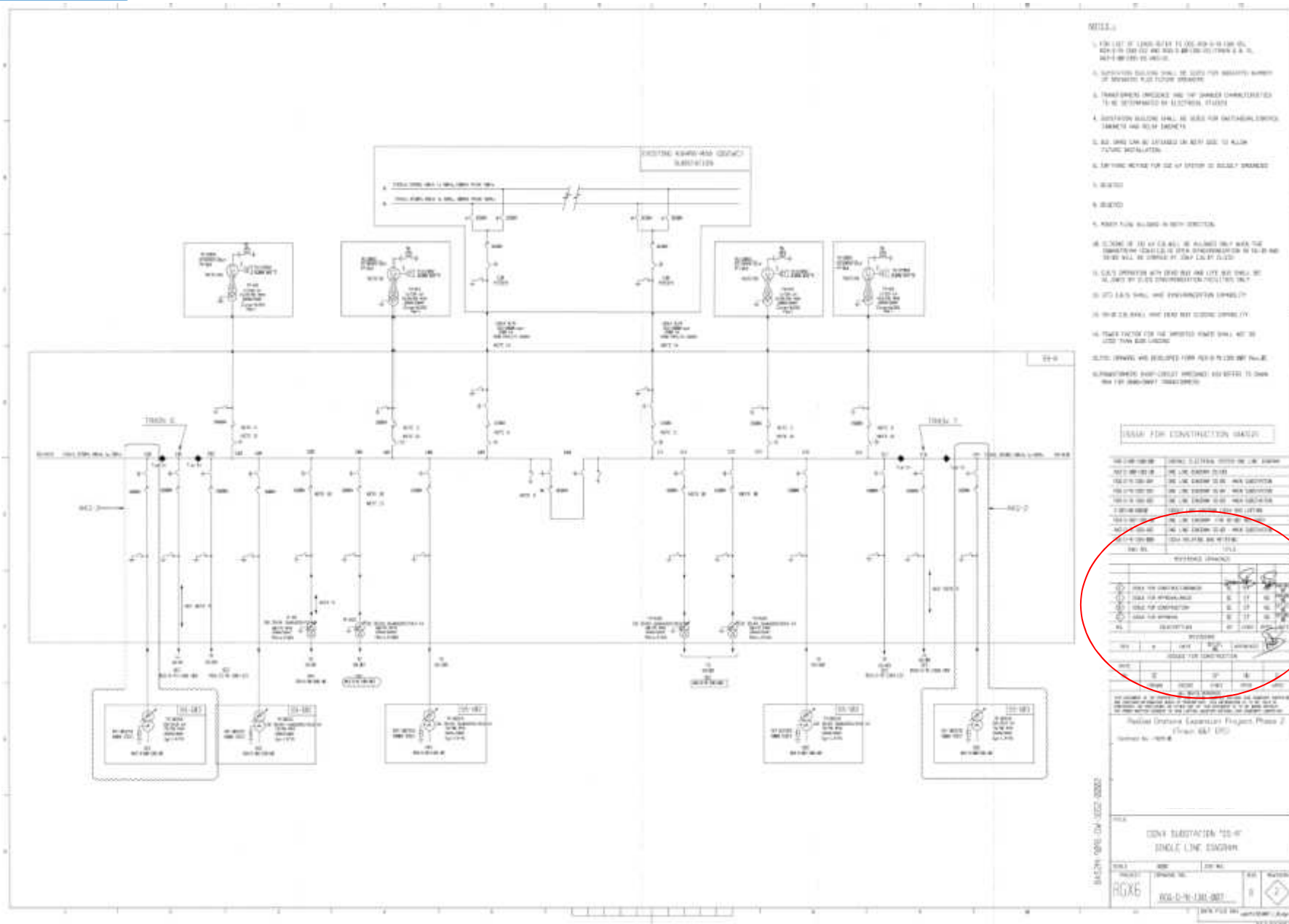
**Obligations of the 2 parties**

**Limit of liability**

**Penalties in case of bad performance**

**Conflict resolution**

## Quality Assurance (QA)





## Quality Assurance (QA)

|                         |                              |      |                |          |                |
|-------------------------|------------------------------|------|----------------|----------|----------------|
|                         |                              |      |                |          |                |
| 2                       | ISSUE FOR CONSTRUCTION(AKG2) | SC   | EP             | HQ       | MAY.09,<br>'07 |
| 1                       | ISSUE FOR APPROVAL(AKG2)     | SC   | EP             | HQ       | NOV.08,<br>'06 |
| 0                       | ISSUE FOR CONSTRUCTION       | SC   | EP             | HQ       | OCT.27,<br>'06 |
| E                       | ISSUE FOR APPROVAL           | SC   | EP             | HQ       | SEP.05,<br>'06 |
| NO.                     | DESCRIPTION                  | BY   | CHKD           | APVD     | DATE           |
| REVISIONS               |                              |      |                |          |                |
| REV                     | 0                            | DATE | OCT.27,<br>'06 | APPROVED |                |
| ISSUED FOR CONSTRUCTION |                              |      |                |          |                |

## RESULTS

- [illegible]

ISSUE FOR CONSTRUCTION MARKETS

[illegible][illegible][illegible]

|                        |      |      |    |         |
|------------------------|------|------|----|---------|
| NO.                    | DATE | TIME | BY | REMARKS |
| HOUSE FOR CONSTRUCTION |      |      |    |         |
| NO.                    | DATE | TIME | BY | REMARKS |

|      | 1990 | 1995 | 2000 | 2005 | 2010 |
|------|------|------|------|------|------|
| 1990 |      |      |      |      |      |
| 1995 |      |      |      |      |      |
| 2000 |      |      |      |      |      |
| 2005 |      |      |      |      |      |
| 2010 |      |      |      |      |      |

**TABLE 1**

Das Internationale Zentrum für Frauenstudien (IWiF) ist ein Zusammenschluss von 12 von 1994 bis 1996 gegründeten Frauenstudienzentren in Lateinamerika, die sich zum Ziel gesetzt haben, die Geschlechterforschung in Lateinamerika zu fördern und zu koordinieren. Das Zentrum ist ein Zusammenschluss von 12 von 1994 bis 1996 gegründeten Frauenstudienzentren in Lateinamerika, die sich zum Ziel gesetzt haben, die Geschlechterforschung in Lateinamerika zu fördern und zu koordinieren.

Revised Graduate Curriculum Framework, Phase 2

Flanagan, M.K.J. (1992)

Received 24 April 2006

1. *Journal of Management Studies*, 1991, 28, 1.

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2001

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|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--------|
| 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 | 2044 | 2045 | 2046 | 2047 | 2048 | 2049 | 2050 | 2051 | 2052 | 2053 | 2054 | 2055 | 2056 | 2057 | 2058 | 2059 | 2060 | 2061 | 2062 | 2063 | 2064 | 2065 | 2066 | 2067 | 2068 | 2069 | 2070 | 2071 | 2072 | 2073 | 2074 | 2075 | 2076 | 2077 | 2078 | 2079 | 2080 | 2081 | 2082 | 2083 | 2084 | 2085 | 2086 | 2087 | 2088 | 2089 | 2090 | 2091 | 2092 | 2093 | 2094 | 2095 | 2096 | 2097 | 2098 | 2099 | 2100 | 2101 | 2102 | 2103 | 2104 | 2105 | 2106 | 2107 | 2108 | 2109 | 2110 | 2111 | 2112 | 2113 | 2114 | 2115 | 2116 | 2117 | 2118 | 2119 | 2120 | 2121 | 2122 | 2123 | 2124 | 2125 | 2126 | 2127 | 2128 | 2129 | 2130 | 2131 | 2132 | 2133 | 2134 | 2135 | 2136 | 2137 | 2138 | 2139 | 2140 | 2141 | 2142 | 2143 | 2144 | 2145 | 2146 | 2147 | 2148 | 2149 | 2150 | 2151 | 2152 | 2153 | 2154 | 2155 | 2156 | 2157 | 2158 | 2159 | 2160 | 2161 | 2162 | 2163 | 2164 | 2165 | 2166 | 2167 | 2168 | 2169 | 2170 | 2171 | 2172 | 2173 | 2174 | 2175 | 2176 | 2177 | 2178 | 2179 | 2180 | 2181 | 2182 | 2183 | 2184 | 2185 | 2186 | 2187 | 2188 | 2189 | 2190 | 2191 | 2192 | 2193 | 2194 | 2195 | 2196 | 2197 | 2198 | 2199 | 2200 | 2201 | 2202 | 2203 | 2204 | 2205 | 2206 | 2207 | 2208 | 2209 | 2210 | 2211 | 2212 | 2213 | 2214 | 2215 | 2216 | 2217 | 2218 | 2219 | 2220 | 2221 | 2222 | 2223 | 2224 | 2225 | 2226 | 2227 | 2228 | 2229 | 2230 | 2231 | 2232 | 2233 | 2234 | 2235 | 2236 | 2237 | 2238 | 2239 | 2240 | 2241 | 2242 | 2243 | 2244 | 2245 | 2246 | 2247 | 2248 | 2249 | 2250 | 2251 | 2252 | 2253 | 2254 | 2255 | 2256 | 2257 | 2258 | 2259 | 2260 | 2261 | 2262 | 2263 | 2264 | 2265 | 2266 | 2267 | 2268 | 2269 | 2270 | 2271 | 2272 | 2273 | 2274 | 2275 | 2276 | 2277 | 2278 | 2279 | 2280 | 2281 | 2282 | 2283 | 2284 | 2285 | 2286 | 2287 | 2288 | 2289 | 2290 | 2291 | 2292 | 2293 | 2294 | 2295 | 2296 | 2297 | 2298 | 2299 | 2300 | 2301 | 2302 | 2303 | 2304 | 2305 | 2306 | 2307 | 2308 | 2309 | 2310 | 2311 | 2312 | 2313 | 2314 | 2315 | 2316 | 2317 | 2318 | 2319 | 2320 | 2321 | 2322 | 2323 | 2324 | 2325 | 2326 | 2327 | 2328 | 2329 | 2330 | 2331 | 2332 | 2333 | 2334 | 2335 | 2336 | 2337 | 2338 | 2339 | 2340 | 2341 | 2342 | 2343 | 2344 | 2345 | 2346 | 2347 | 2348 | 2349 | 2350 | 2351 | 2352 | 2353 | 2354 | 2355 | 2356 | 2357 | 2358 | 2359 | 2360 | 2361 | 2362 | 2363 | 2364 | 2365 | 2366 | 2367 | 2368 | 2369 | 2370 | 2371 | 2372 | 2373 | 2374 | 2375 | 2376 | 2377 | 2378 | 2379 | 2380 | 2381 | 2382 | 2383 | 2384 | 2385 | 2386 | 2387 | 2388 | 2389 | 2390 | 2391 | 2392 | 2393 | 2394 | 2395 | 2396 | 2397 | 2398 | 2399 | 2400 | 2401 | 2402</ |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--------|

CODE SUBSTITUTION: 22-67

SINGLE LINE SYSTEM

0.0

|         |        |         |
|---------|--------|---------|
| TABLE 3 | CONT'D | TABLE 4 |
|---------|--------|---------|

[illegible]

|      |                             |        |  |
|------|-----------------------------|--------|--|
| HG86 | Volume 80, No. 1, June 1987 | \$5.00 |  |
|------|-----------------------------|--------|--|

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2018, 11:2: 2018-0000000000000000

DATE: 01/01/2000

# Quality Assurance (QA)

## Email

Subject : temporary irrigation system - Outcomes of the meeting with CPY

History:  This message has been replied to and forwarded.

Good morning,

The meeting was held with CPY last Monday afternoon.  
You will find attached presentation



Temporary Irrigation System - Early Works.ppt

Below is CPY decision: GRP tank(s)

### TECHNICAL QUERY SHEET

|                |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SUBCONTRACT N° | : | _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| SUBCONTRACTOR  | : | _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| TQS N°         | : | _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| DISCIPLINE     | : | <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> <div>             piling<br/>mechanical<br/>instrumentation<br/>others           </div> <div>             civil-works<br/>piping<br/>HVAC           </div> <div>             sewage<br/>painting<br/>Architectural           </div> <div>             road<br/>tracing           </div> <div>             paving<br/>Insulation<br/>Quality Control           </div> <div>             structural<br/>electrical<br/>commissioning           </div> </div> |

|                  |   |       |
|------------------|---|-------|
| Site area        | : | _____ |
| Equip / Item Tag | : | _____ |
| Doc. Reference   | : | _____ |
| Attachements     | : | _____ |

#### QUESTION

☐ Deviation request    ☐ Clarification request

|                 |        |        |
|-----------------|--------|--------|
| SUBCONTRACTOR : | Date : | Visa : |
|-----------------|--------|--------|

#### ANSWER

☐ Approved    ☐ Not Approved    ☐ Refer to text

COMPANY's approval is required only for deviation request to COMPANY's documents/requirements.

|               | CONTRACTOR | COMPANY (for deviation) |
|---------------|------------|-------------------------|
| Name          |            |                         |
| Date          |            |                         |
| Company stamp |            |                         |
| Signature     |            |                         |

## Email vs Technical Query...



# Quality Assurance (QA)

**Email**

Subject : temporary irrigation system - Outcomes of the meeting with CPY

History: This message has been replied to and forwarded.

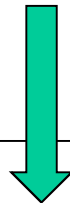
Good morning,

The meeting was held with CPY last Monday afternoon.



Temporary Irrigation System - Early Works.ppt

Below is CPY decision: GRP tank(s)



Unformal/Unrecoverable!

Email vs Technical Query...

Formal/Recoverable!



| TECHNICAL QUERY SHEET                                                                                                        |            |                                                                                                                                                                                                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SUBCONTRACT N°                                                                                                               | :          |                                                                                                                                                                                                                                                                                                                              |
| SUBCONTRACTOR                                                                                                                | :          |                                                                                                                                                                                                                                                                                                                              |
| TQS N°                                                                                                                       | :          |                                                                                                                                                                                                                                                                                                                              |
| DISCIPLINE                                                                                                                   | :          | <div> <div> piling<br/>mechanical<br/>instrumentation<br/>others </div> <div> civil-works<br/>piling<br/>HVAC </div> <div> sewage<br/>painting<br/>Architectural </div> <div> road<br/>tracing </div> <div> paving<br/>Insulation<br/>Quality Control </div> <div> structural<br/>electrical<br/>commissioning </div> </div> |
| Site area                                                                                                                    | :          |                                                                                                                                                                                                                                                                                                                              |
| Equip / Item Tag                                                                                                             | :          |                                                                                                                                                                                                                                                                                                                              |
| Doc. Reference                                                                                                               | :          |                                                                                                                                                                                                                                                                                                                              |
| Attachments                                                                                                                  | :          |                                                                                                                                                                                                                                                                                                                              |
| <b>QUESTION</b> <input type="checkbox"/> Deviation request <input type="checkbox"/> Clarification request                    |            |                                                                                                                                                                                                                                                                                                                              |
|                                                                                                                              |            |                                                                                                                                                                                                                                                                                                                              |
| SUBCONTRACTOR                                                                                                                | :          | Date :<br>Visa :                                                                                                                                                                                                                                                                                                             |
| <b>ANSWER</b> <input type="checkbox"/> Approved <input type="checkbox"/> Not Approved <input type="checkbox"/> Refer to text |            |                                                                                                                                                                                                                                                                                                                              |
|                                                                                                                              |            |                                                                                                                                                                                                                                                                                                                              |
| <small>COMPANY's approval is required only for deviation request to COMPANY's documents/requirements.</small>                |            |                                                                                                                                                                                                                                                                                                                              |
|                                                                                                                              | CONTRACTOR | COMPANY (for deviation)                                                                                                                                                                                                                                                                                                      |
| Name                                                                                                                         |            |                                                                                                                                                                                                                                                                                                                              |
| Date                                                                                                                         |            |                                                                                                                                                                                                                                                                                                                              |
| Company stamp                                                                                                                |            |                                                                                                                                                                                                                                                                                                                              |
| Signature                                                                                                                    |            |                                                                                                                                                                                                                                                                                                                              |

# Quality Assurance (QA)

**Email**

Subject : temporary irrigation system - Outcomes of the meeting with CPY

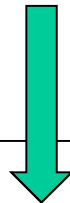
History: This message has been replied to and forwarded.

Good morning,

The meeting was held with CPY last Monday afternoon.

Temporary Irrigation System - Early Works.ppt

Below is CPY decision: GRP tank(s)



Unformal/Unrecoverable!

Email vs Technical Query...

Formal/Recoverable!



| TECHNICAL QUERY SHEET                                                                                                        |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------------------------------------------------------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SUBCONTRACT N°                                                                                                               | :          | _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| SUBCONTRACTOR                                                                                                                | :          | _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| TQS N°                                                                                                                       | :          | _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| DISCIPLINE                                                                                                                   | :          | <div style="display: flex; justify-content: space-between; font-size: small;"> <div>                     piling<br/>mechanical<br/>instrumentation<br/>others                 </div> <div>                     civil-works<br/>piping<br/>HVAC                 </div> <div>                     sewage<br/>painting<br/>Architectural                 </div> <div>                     road<br/>tracing                 </div> <div>                     paving<br/>Insulation<br/>Quality Control                 </div> <div>                     structural<br/>electrical<br/>commissioning                 </div> </div> |
| Site area                                                                                                                    | :          | _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Equip / Item Tag                                                                                                             | :          | _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Doc. Reference                                                                                                               | :          | _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Attachments                                                                                                                  | :          | _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>QUESTION</b> <input type="checkbox"/> Deviation request <input type="checkbox"/> Clarification request                    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                                                                              |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| SUBCONTRACTOR                                                                                                                | :          | Date : _____<br>Visa : _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>ANSWER</b> <input type="checkbox"/> Approved <input type="checkbox"/> Not Approved <input type="checkbox"/> Refer to text |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                                                                              |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| COMPANY's approval is required only for deviation request to COMPANY's documents/requirements.                               |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                                                                              | CONTRACTOR | COMPANY (for deviation)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Name                                                                                                                         |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Date                                                                                                                         |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Company stamp                                                                                                                |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Signature                                                                                                                    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

Think of somebody trying to find out what was CPY decision in 3 years time...



# Quality Assurance (QA)

PESD 94-Y061A

| CAUSE |  |  |  |  | EFFECT |  |  |  |  | 94UZ-6866A |  |  |  |  |  |  |  |  |  |  |  |  |  | Item/Tag |  | DESCRIPTION |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Item/Tag |  | DESCRIPTION |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Item/Tag |  | DESCRIPTION |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Item/Tag |  | DESCRIPTION |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Item/Tag |  | DESCRIPTION |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Item/Tag |  | DESCRIPTION |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Item/Tag |  | DESCRIPTION |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Item/Tag |  | DESCRIPTION |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Item/Tag |  | DESCRIPTION |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Item/Tag |  | DESCRIPTION |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Item/Tag |  | DESCRIPTION |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Item/Tag |  | DESCRIPTION |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Item/Tag |  | DESCRIPTION |  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6.2

## Notes:

- 1 - Analogic values and timers to be adjusted on site.
- 2 - Inhibition alarms bits will be set or reset in Start and Stop Sequences

**SITE MASTER**

# Document Control

| Document number | Title<br>Название |                                                    | Revision<br>Ревизия |
|-----------------|-------------------|----------------------------------------------------|---------------------|
| A 1             | 48104             | Service building instrument. rooms cables routing  | B                   |
| A 2             | 48102             | Trouble shooting diagrams                          | D                   |
| A 3             | 48134             | F&G system architecture drawing                    | E                   |
| A 4             | 50100             | Instrument index                                   | B                   |
| A 7             | 50003             | Spec for instrument installation works and service | C                   |
| A 8             | 50960             | Instrument Data sheets for temperature switches    | B                   |
| A 9             | 50110             | Requisition for pressure relief valves             | B                   |
| M 1             | 62059             | General plot plan                                  | B                   |
| M 2             | 62020             | Piping details standard                            | C                   |
| M 2             | 62070             | Piping general arrangement Area 1                  | D                   |
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| M 6             | 60000             | Pipes and fittings thickness calculation           | A                   |
| M 6             | 62351             | Calculation note CN1 - piping stress analysis      | A                   |
| M 7             | 60001             | General piping specification                       | C                   |
| M 8             | 60103             | Data sheets for station piping material            | B                   |
| M 9             | 60200             | Requisition for pipes                              | F                   |

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| 1             | Installation drawings      |
| 2             | Detail drawings            |
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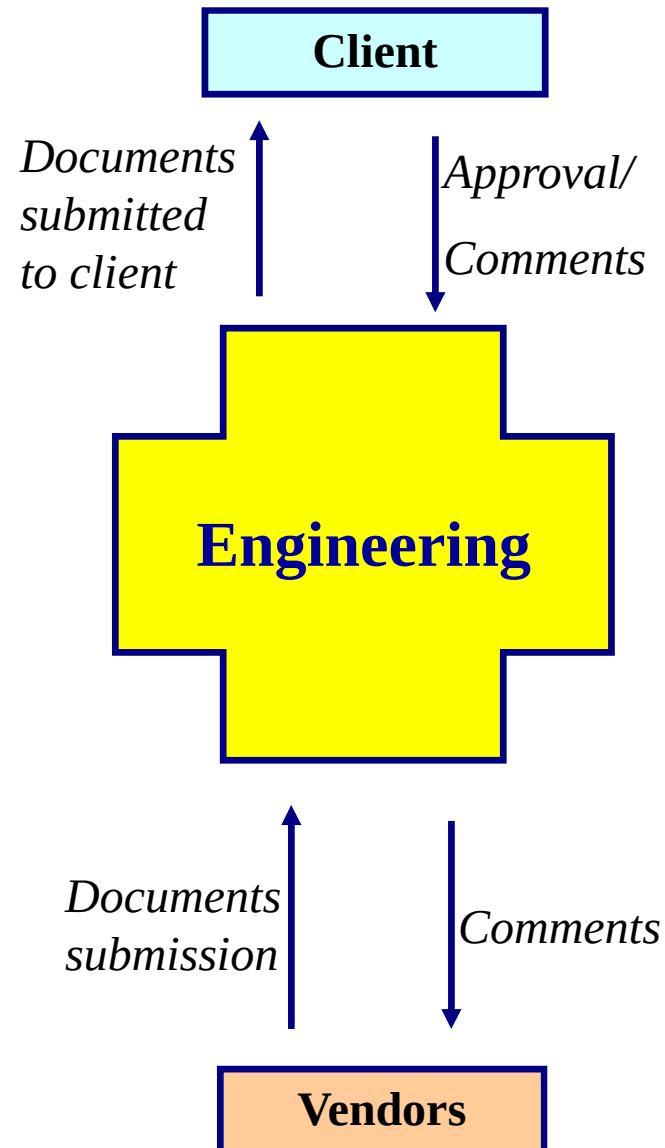
| Discipline code |                           |
|-----------------|---------------------------|
| A               | Instrumentation & Control |
| C               | Civil engineering         |
| E               | Electrical                |
| G               | Project general documents |
| J               | Mechanical                |
| K               | Safety                    |
| M               | Piping & Layout           |
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|                    |                  |                        |                   |                     |                         |                          |                        |         |               |                 |               |                 |       |      |           |            |                           |                           |           |            |           |                     |                            |          |          |
| PROCESS            | DIAGS            | x                      | x                 |                     | x                       | x                        | x                      | x       | x             | x               | x             | x               |       |      |           | x          | x                         | x                         |           | x          | x         |                     | x                          | x        |          |
|                    | LIST             | x                      | x                 | x                   | x                       | x                        | x                      | x       | x             | x               | x             |                 | x     |      | x         | x          | x                         | x                         |           | x          |           |                     | x                          | x        |          |
|                    | PHILOS           | x                      | x                 |                     | x                       | x                        | x                      | x       | x             |                 | x             |                 | x     |      | x         | x          | x                         | x                         |           | x          |           |                     |                            | x        |          |
|                    | SPEC             |                        | x                 |                     | x                       | x                        | x                      | x       | x             |                 | x             |                 |       |      |           | x          | x                         | x                         |           | x          |           |                     |                            | x        |          |
|                    | DS               |                        | x                 |                     | x                       | x                        | x                      | x       | x             |                 | x             |                 |       |      |           | x          | x                         | x                         |           | x          | x         |                     |                            | x        |          |
|                    | REQUIS           |                        | x                 | x                   | x                       |                          |                        | x       |               |                 |               |                 |       |      |           |            |                           |                           |           |            |           |                     |                            | x        |          |
|                    |                  |                        |                   |                     |                         |                          |                        |         |               |                 |               |                 |       |      |           |            |                           |                           |           |            |           |                     |                            |          |          |
| CIVIL              | LAYOUT           | x                      | x                 |                     | x                       | x                        | x                      | x       | x             |                 |               | x               | x     | x    | x         | x          | x                         |                           |           | x          |           | x                   | x                          | x        | x        |
|                    | DWGS             |                        | x                 |                     | x                       | x                        | x                      |         | x             |                 |               | x               | x     |      | x         | x          | x                         |                           |           |            |           |                     | x                          | x        | x        |
|                    | DWGS             |                        | x                 |                     | x                       |                          |                        |         |               |                 |               |                 | x     |      |           |            |                           |                           |           |            |           |                     | x                          | x        |          |
|                    | MTO              |                        | x                 |                     | x                       |                          |                        |         |               |                 |               |                 | x     |      |           |            |                           |                           |           |            |           |                     | x                          | x        |          |
|                    | CALC             |                        | x                 |                     | x                       |                          |                        |         |               |                 |               |                 | x     |      |           |            |                           |                           |           |            |           |                     | x                          | x        |          |
|                    | SPEC             |                        | x                 |                     | x                       |                          |                        |         |               |                 |               |                 | x     |      |           |            |                           |                           |           |            |           |                     | x                          | x        | x        |
|                    | DS               |                        | x                 |                     | x                       |                          |                        |         |               |                 |               |                 |       | x    |           |            |                           |                           |           |            |           |                     | x                          | x        |          |

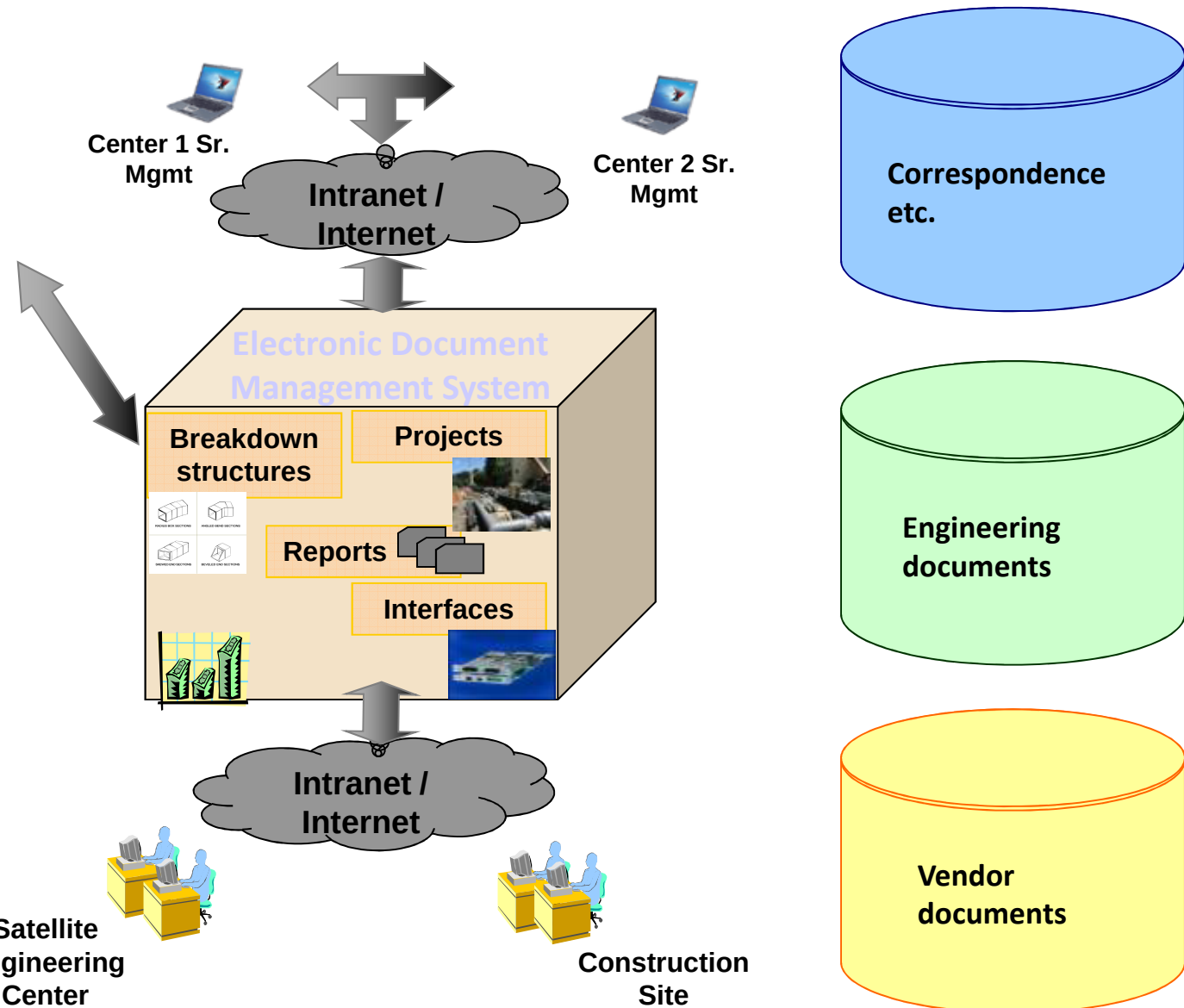
## Document Control



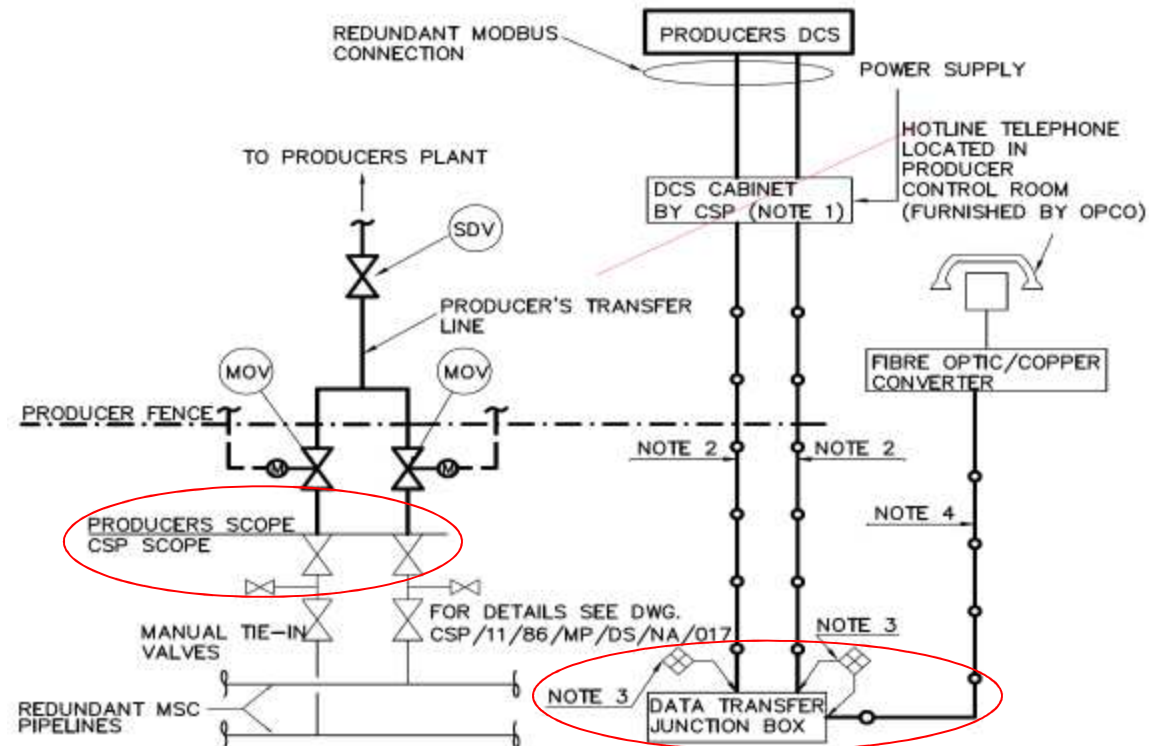


# Electronic Document Management System

| Date       | Day | Time In    | Time Out   | Submitted By       | Approved |
|------------|-----|------------|------------|--------------------|----------|
| 06/03/2008 | Fri | 8:57:00 AM | 5:57:00 PM | Girish Kanchalagau |          |
| 08/03/2008 | Sun |            |            | Girish Kanchalagau |          |
| 10/03/2008 | Mon | 9:44:00 AM | 6:15:00 PM | Girish Kanchalagau |          |
| 11/03/2008 | Tue | 9:08:00 AM | 7:02:00 PM | Girish Kanchalagau |          |
| 12/03/2008 | Wed | 09:00:00   | 19:45:00   | Girish Kanchalagau | Forc     |
| 13/03/2008 | Thu | 9:25:00 AM | 6:25:00 PM | Girish Kanchalagau |          |
| 14/03/2008 | Fri | 9:05:00 AM | 6:05:00 PM | Girish Kanchalagau |          |
| 15/03/2008 | Sat | 9:38:00 AM | 6:08:00 PM | Girish Kanchalagau |          |
| 16/03/2008 | Sun |            |            | Girish Kanchalagau |          |
| 17/03/2008 | Mon |            |            | Girish Kanchalagau |          |
| 18/03/2008 | Tue |            |            | Girish Kanchalagau |          |



# Interface Management



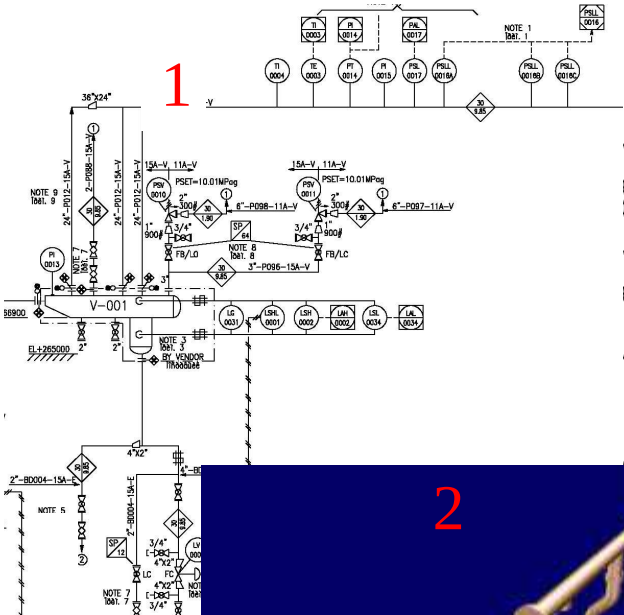
## NOTES:

1. DCS HARDWARE PROVIDED BY CSP. PRODUCER IS RESPONSIBLE FOR HOOKUP, TESTING, COMMISSIONING AND MAINTENANCE. CSP TO SUPPORT TESTING AND COMMISSIONING.
2. REDUNDANT FIBRE OPTIC DATA HIGHWAY CABLES PROVIDED AND TERMINATED BY PRODUCER.
3. PRODUCER PERFORMS FIBRE OPTIC TIE-IN TO JUNCTION BOX PROVIDED BY CSP.



# Scheduling

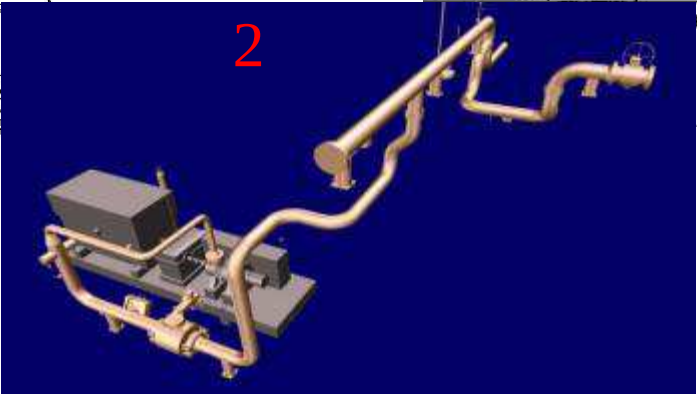
| PROJECT SCHEDULE                         | MONTH |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |    |    |    |    |  |   |  |  |  |  |
|------------------------------------------|-------|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|----|----|----|----|--|---|--|--|--|--|
|                                          | 7     | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 5 | 2 | 33 | 34 | 35 | 36 |  |   |  |  |  |  |
| PLANT START-UP                           |       |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |    |    |    |    |  | ▼ |  |  |  |  |
| PIPING PRE-FABRICATION & INSTALLATION    |       |   |   |    |    |    |    |    |    |    |    |    |    |    |    | 4  |    |    |    |    | X  | X  | X  | X  | X | X | X  | X  | X  | X  |  |   |  |  |  |  |
| PIPING MATERIAL & DRAWINGS AT SITE       |       |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | ▼  |    |    |    |    |    |   |   |    |    |    |    |  |   |  |  |  |  |
| PIPING MATERIAL MANUFACTURING & SHIPPING |       |   |   |    |    |    |    |    |    |    |    |    | X  | X  | X  | X  | X  | X  |    |    |    |    |    |    |   |   |    |    |    |    |  |   |  |  |  |  |
| PURCHASE OF PIPING MATERIAL              |       |   |   |    |    |    |    |    |    |    | ▼  |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |    |    |    |    |  |   |  |  |  |  |
| TECHNICAL & COMMERCIAL CLARIFICATIONS    |       |   |   |    |    |    |    | 3  |    | X  | X  |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |    |    |    |    |  |   |  |  |  |  |
| CALL FOR TENDER FOR PIPING MATERIAL      |       |   |   |    | 2  |    |    | ▼  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |    |    |    |    |  |   |  |  |  |  |
| PREPARE PIPING MATERIAL TAKE-OFF         |       |   | 1 |    |    |    |    | X  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |    |    |    |    |  |   |  |  |  |  |
| PIPING ROUTING STUDIES                   |       |   |   | X  | X  | X  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |    |    |    |    |  |   |  |  |  |  |
| PIPING & INSTRUMENTATION DIAGRAMS (PIDs) |       |   | ▼ |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |    |    |    |    |  |   |  |  |  |  |



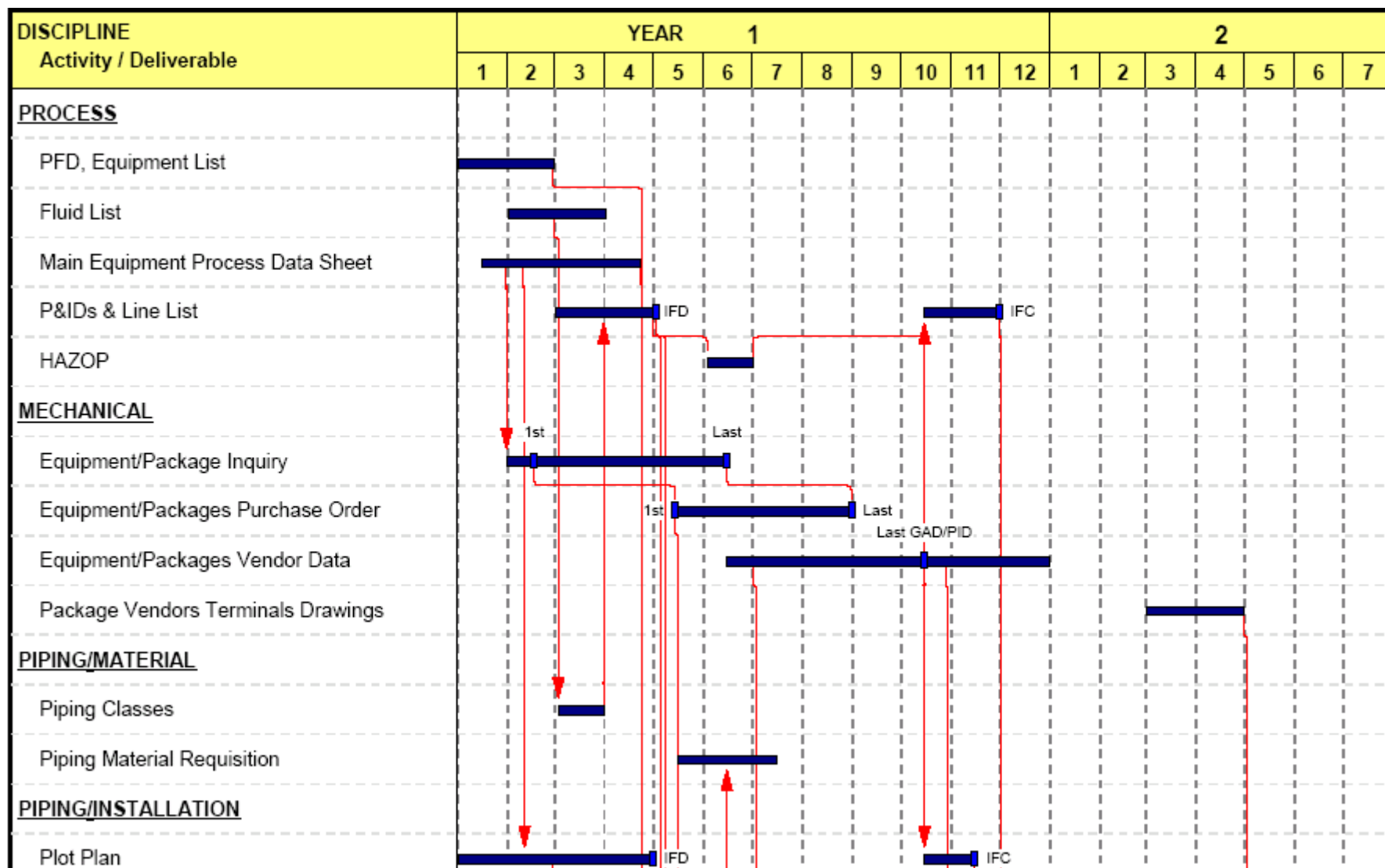
3

| SIGMA CODE<br>CLIENT CODE | large<br>diam.                    | small<br>diam.<br>/length | QUANTITIES<br>TO BE SUPPLIED |          | BALANCE<br>TO BE SUP<br>A - B |
|---------------------------|-----------------------------------|---------------------------|------------------------------|----------|-------------------------------|
|                           |                                   |                           | New<br>A                     | Old<br>B |                               |
| S P I P E                 |                                   |                           |                              |          |                               |
| TE04170                   | API5LGRB -ANSIB36-10 -BW -SCH40 - |                           |                              |          |                               |
| P                         | 2                                 |                           | 1248                         | 212      | 34                            |
| TE04900                   | API5LGRB -ANSIB36-10 -PLAIN END   |                           |                              |          |                               |
| P                         | 3/4                               |                           | 6                            | 6        | 0                             |
| P                         | 1                                 |                           | 6                            | 6        | 0                             |
| P                         | 1 1/2                             |                           |                              |          |                               |

4



# Scheduling





## Progress Monitoring



*How would you measure progress?*



# Progress Monitoring

## ENGINEERING MILESTONES

| ID (from P3) | DESCRIPTION                                  | BASE LINE     |                | CURRENT SCHEDULE As of 26/11/10 |                 |              |               | Variance Plan vs Forecast (Cal. Days) |
|--------------|----------------------------------------------|---------------|----------------|---------------------------------|-----------------|--------------|---------------|---------------------------------------|
|              |                                              | Planned Start | Planned Finish | Forecast Start                  | Forecast Finish | Actual Start | Actual Finish |                                       |
| P099M01E00   | Plot Plan AFD1 (Unit Plot Plans)             |               | 16-Aug-10      |                                 | 17-Aug-10       |              | 17-Aug-10     | +1                                    |
| P099M01E05   | Last P&ID's issued for HAZOP                 |               | 02-Jul-10      |                                 | 29-Jul-10       |              | 29-Jul-10     | +27                                   |
| P099M01E10   | Issue Piping MTO & MR IFI (Based on Re-Feed) |               | 18-May-10      |                                 | 18-May-10       |              | 18-May-10     | +0                                    |
| P099M01E15   | Start HAZOP                                  | 05-Jul-10     |                | 05-Jul-10                       |                 | 05-Jul-10    |               | +0                                    |
| P099M01E20   | LLI Equipment G.A.D.'s (Last)                |               | 07-Sep-10      |                                 | 13-Oct-10       |              | 13-Oct-10     | +36                                   |
| P099M01E22   | Issue IARs Engineering only 2011 S/D         |               | 27-Jul-10      |                                 | 20-Nov-10       |              |               | +116                                  |
| P099M01E25   | All engineering for 1st Tie-ins AFC          |               | 26-Nov-10      |                                 | 10-Dec-10       |              |               | +14                                   |
| P099M01E30   | 1st Model Review                             |               | 20-Sep-10      |                                 | 29-Sep-10       |              | 29-Sep-10     | +9                                    |
| P099M01E40   | Plot Plan AFC                                |               | 25-Feb-11      |                                 | 28-Feb-11       |              |               | +3                                    |
| P099M01E45   | Process P&ID's AFC issued                    |               | 08-Mar-11      |                                 | 11-Mar-11       |              |               | +3                                    |
| P099M01E50   | 2nd Model Review                             |               | 10-Dec-10      |                                 | 28-Jan-11       |              |               | +49                                   |
| P099M01E55   | Model Review AFC                             |               | 15-Mar-11      |                                 | 15-Mar-11       |              |               | +0                                    |
| P099M01E60   | Piping Isometrics 50% Complete               | 08-Aug-11     |                | 08-Aug-11                       |                 |              |               | +0                                    |

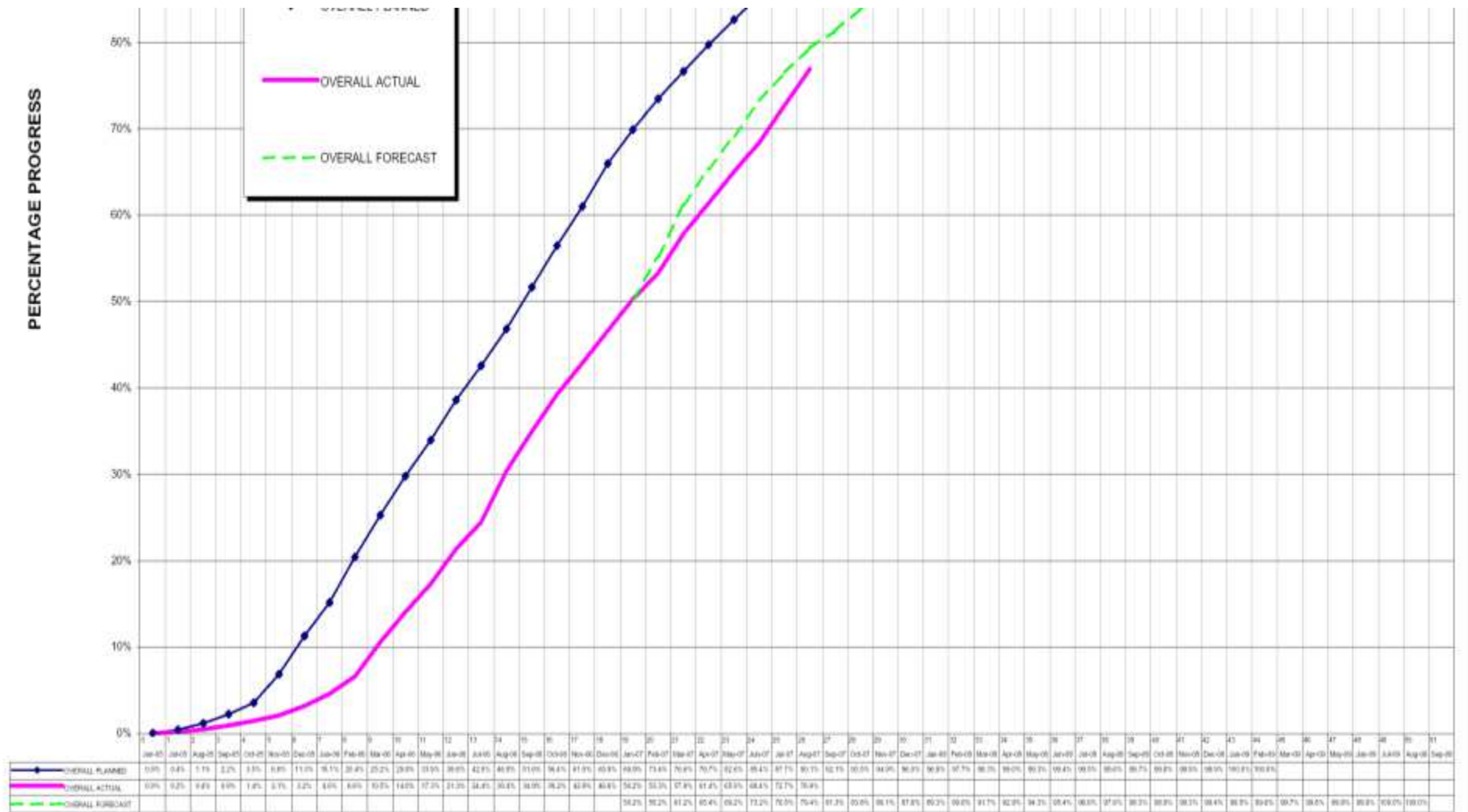
| Description                     | Electrical | Instrument | Telecom | Grand total |
|---------------------------------|------------|------------|---------|-------------|
| Total cable quantity (nos.)     | 5 377      | 3 221      | 1 213   | 9 811       |
| Quantity pulled (nos.)          | 4 438      | 2 442      | 167     | 7 047       |
| Balance quantity to pull (nos.) | 939        | 779        | 1 046   | 2 764       |
| Total glands (nos.)             | 10 754     | 6 442      | 2 426   | 19 622      |
| Total termination (nos.)        | 10 754     | 6 442      | 2 426   | 19 622      |
| Completed gland (nos.)          | 5 280      | 2 991      | 108     | 8 379       |
| Completed termination (nos.)    | 5 267      | 3 120      | 108     | 8 495       |
| Balance to gland (nos.)         | 5 474      | 3 451      | 2 318   | 11 243      |
| Balance to terminate (nos.)     | 5 487      | 3 322      | 2 318   | 11 127      |



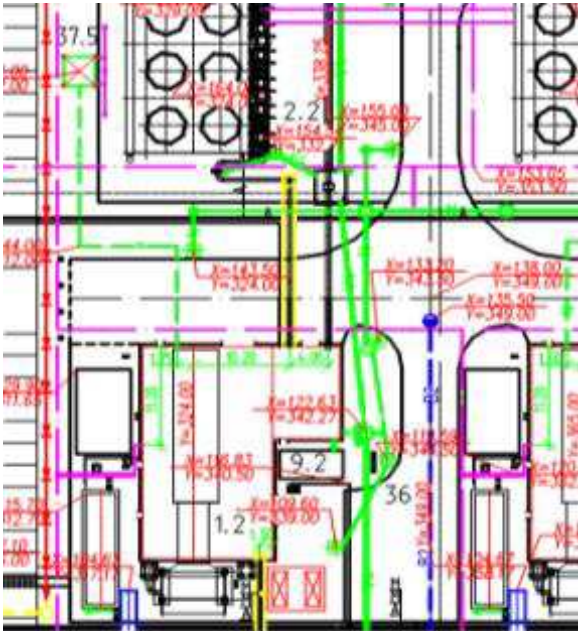
## Progress Monitoring

| Discipline               | Weekly Progress |       |         |        |        |        |         |
|--------------------------|-----------------|-------|---------|--------|--------|--------|---------|
|                          | weight %        | Plan  |         | Actual |        | Delta  |         |
|                          |                 | Week  | Cumm.   | Week   | Cumm.  | Week   | Cumm.   |
| Civil                    | 24.44%          | 0.15% | 99.21%  | 0.08%  | 96.56% | -0.06% | -2.65%  |
| Steel Structure Erection | 8.23%           |       | 100.00% | 0.59%  | 93.08% | 0.59%  | -6.92%  |
| Equipment installation   | 6.07%           | 0.18% | 99.74%  | 0.61%  | 90.98% | 0.43%  | -8.76%  |
| Piping                   | 45.93%          | 1.48% | 92.30%  | 1.64%  | 74.45% | 0.16%  | -17.85% |
| Painting                 | 1.71%           | 0.85% | 94.34%  | 0.80%  | 90.42% | -0.05% | -3.92%  |
| Insulation               | 5.87%           | 2.75% | 27.93%  | 0.33%  | 4.68%  | -2.42% | -23.25% |
| Fire proofing            | 0.16%           | 4.35% | 42.78%  | 0.71%  | 2.83%  | -3.64% | -39.95% |
| Electrical               | 3.48%           | 1.70% | 83.07%  | 0.77%  | 70.41% | -0.93% | -12.66% |
| Instrumentation          | 4.12%           | 2.95% | 67.87%  | 1.01%  | 68.50% | -1.94% | 0.63%   |
| Overall Total            | 100%            | 1.09% | 89.92%  | 0.96%  | 78.06% | -0.13% | -11.86% |

## Progress Monitoring

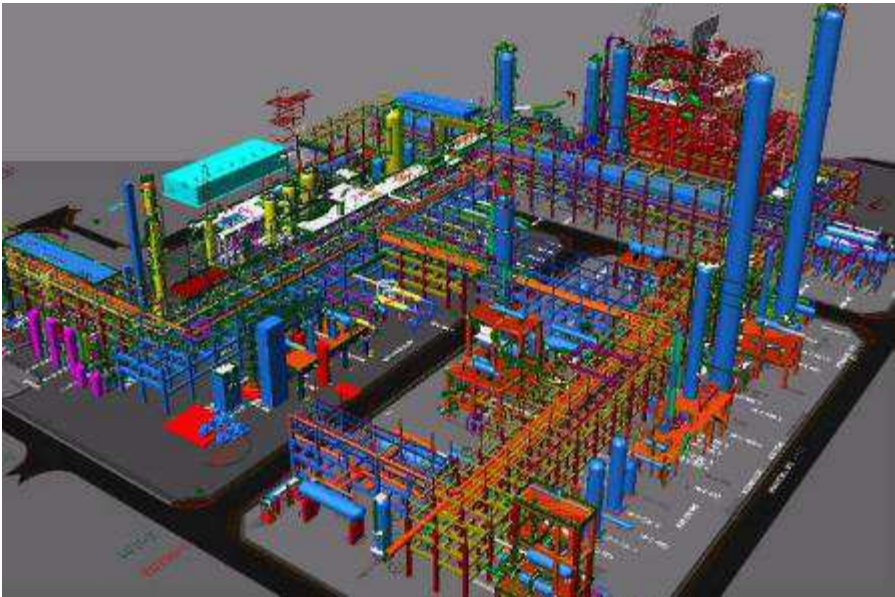




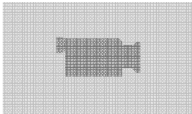


15 years ago: 2D

Today: 3D

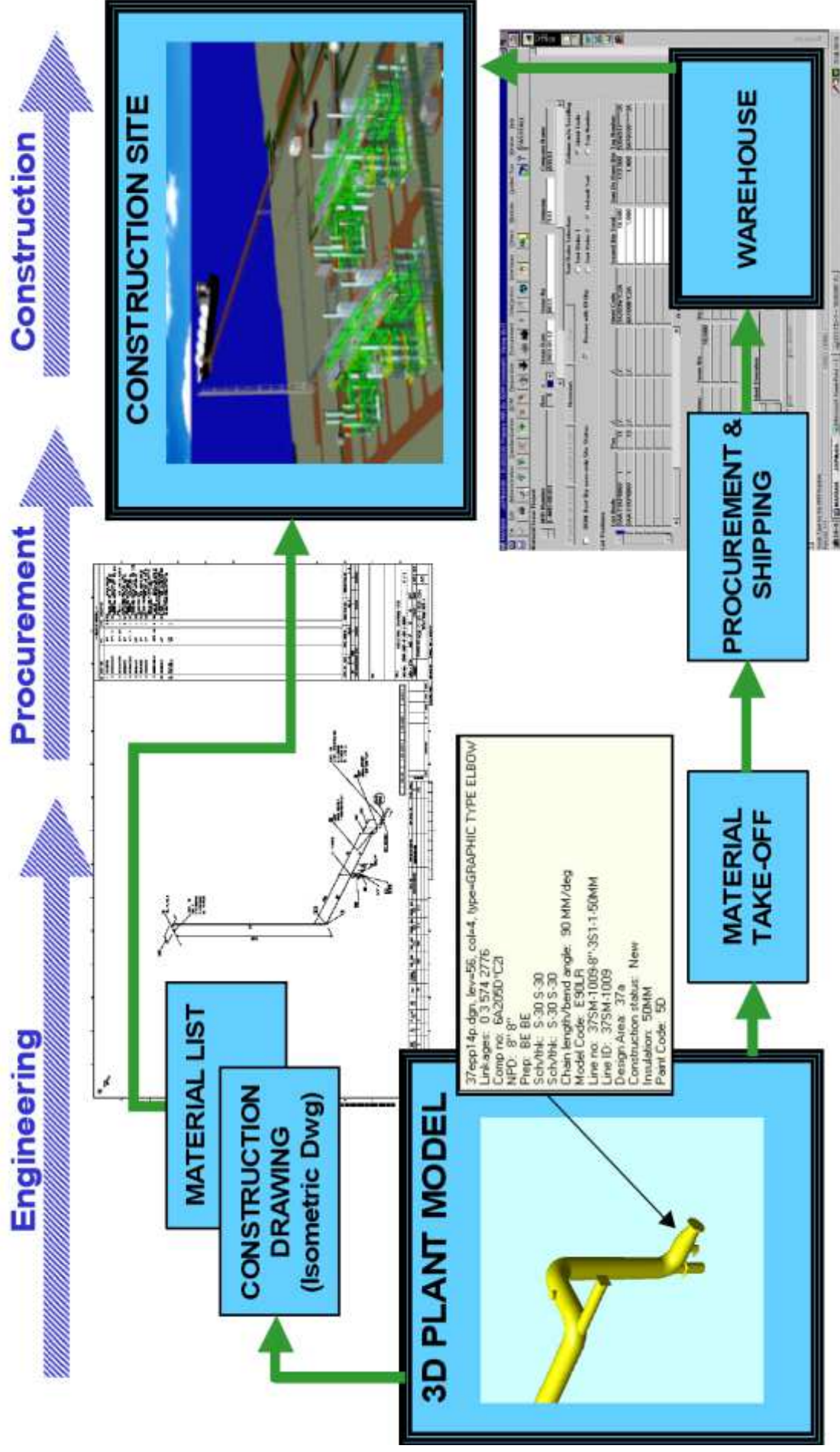


Tomorrow:  
3D & data



Property
Name
Description
Select column heading to compare

| Property                                    | Last In Value     | DDS               | PID           |
|---------------------------------------------|-------------------|-------------------|---------------|
| Cylinder height                             | 3 in              | 3 in              |               |
| Face 1 to centerline dimension              | 4.5 in            | 4.5 in            |               |
| Face-to-face dimension                      | 9 in              | 9 in              |               |
| Heat-tracing requirement                    | <b>               |                   | <b>           |
| Instrument dimensional group                | Valve_Rack & Pini | Valve_Rack & Pini |               |
| Instrument function modifier                | BV                | BV                | BV            |
| Instrument location                         | Field             | Field             |               |
| Instrument loop suffix                      | <b>               | <b>               | <b>           |
| Instrument process function                 | Control Valve     | Control Valve     | Control Valve |
| Instrument subtype                          | Control valve     | Control valve     | Control valve |
| Instrument tag prefix                       | <b>               | <b>               | TigerUnit     |
| Instrument tag sequence number              | 12827             | 12827             | 12827         |
| Instrument tag suffix                       | <b>               | <b>               | <b>           |
| Instrument type                             | CV                | CV                | CV            |
| Measured variable                           | A                 | A                 | A             |
| Name                                        | ABV-12827         | ABV-12827         | ABV-12827     |
| Nominal diameter                            | 4 in              | 3 in              | 4 in          |
| Object Configuration                        | <b>               | <b>               | <b>           |
| Operation height                            | 3 in              | 3 in              |               |
| The flow-direction of this item is relevant | False             |                   | False         |
| Unique key                                  | <b>               | <b>               | <b>           |



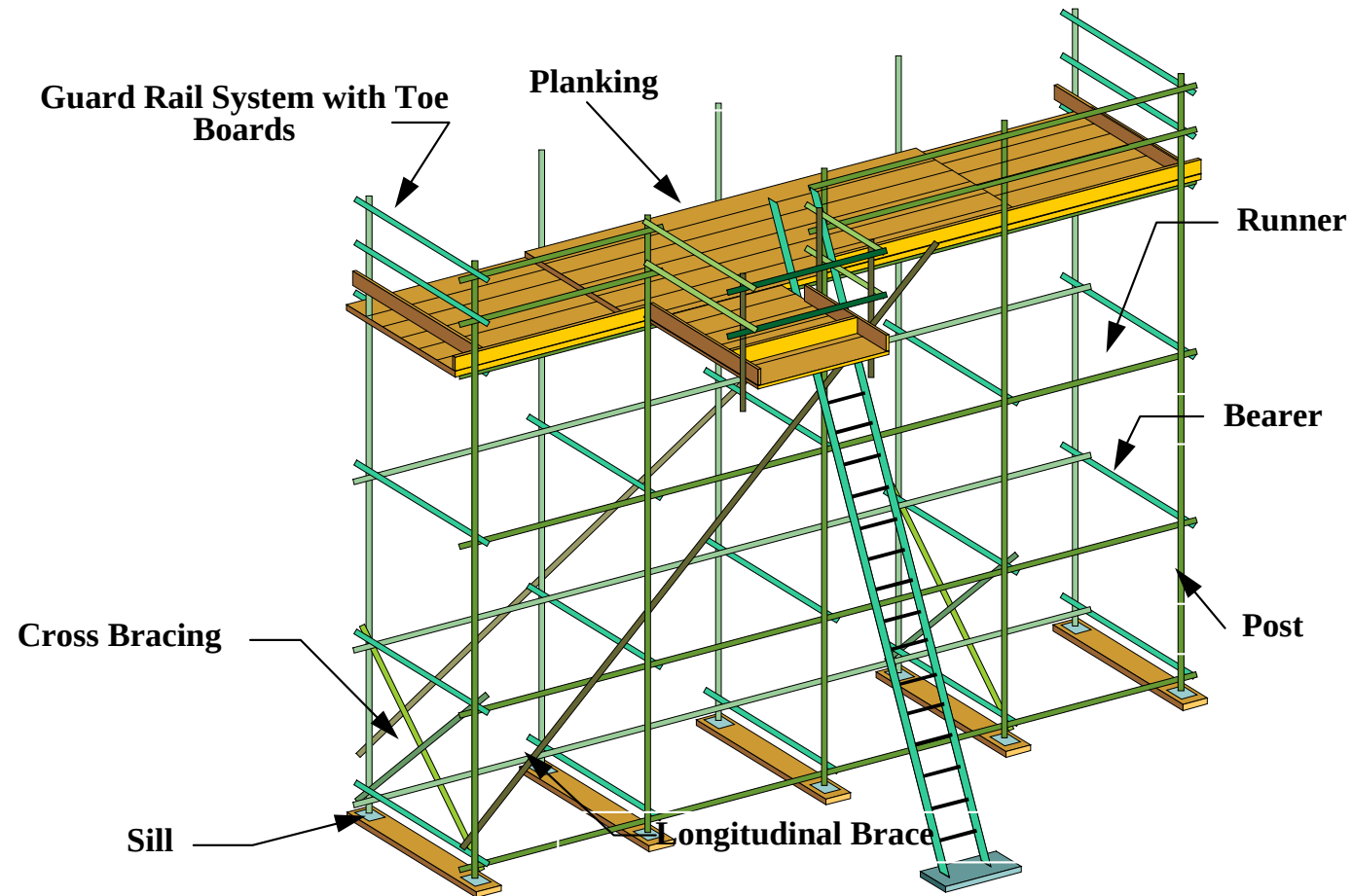


# Safety





## Safety

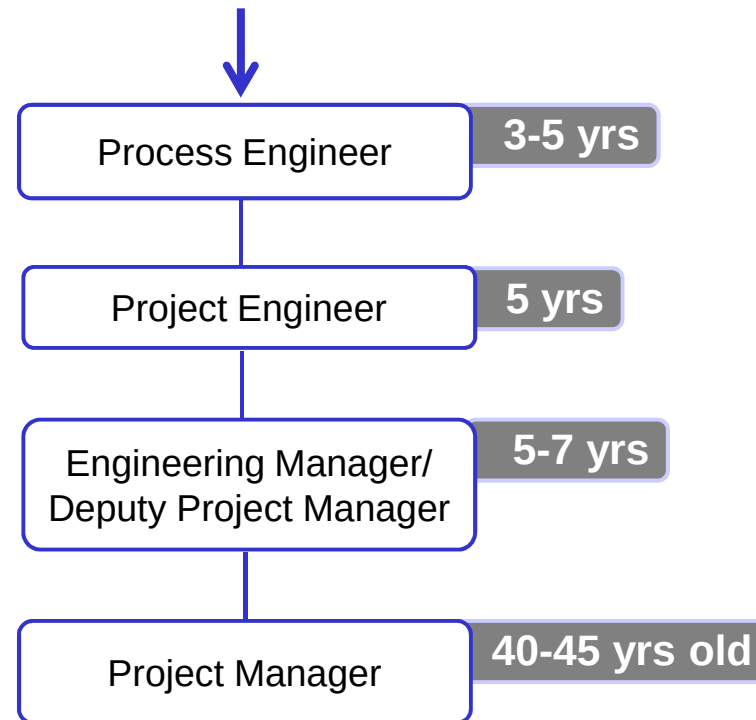


# Safety



## Human resources / career path

Graduate Engineer, 25 years old

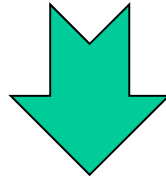


Note: the career pattern shown here is a very fast track one to the PM position... One would enjoy oneself just as well taking more time!



## Beyond this presentation...

- Share my **new developments**
- Find my other **on-line** and **classroom training**



<http://www.toblog.fr/en/baron.html>



### Engineering resources website

Published Saturday 26/01/2013

Here is a place you MUST visit.

It is packed with useful Engineering resources:

- course manuals in various engineering disciplines,
- glossaries,
- newsletters with lots of technical goodies,
- and much more...

Have a look:

<http://iadelltd.com/engdocument.html>

Great Job, Jack. Keep it up!

[Comments\(0\)](#)

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