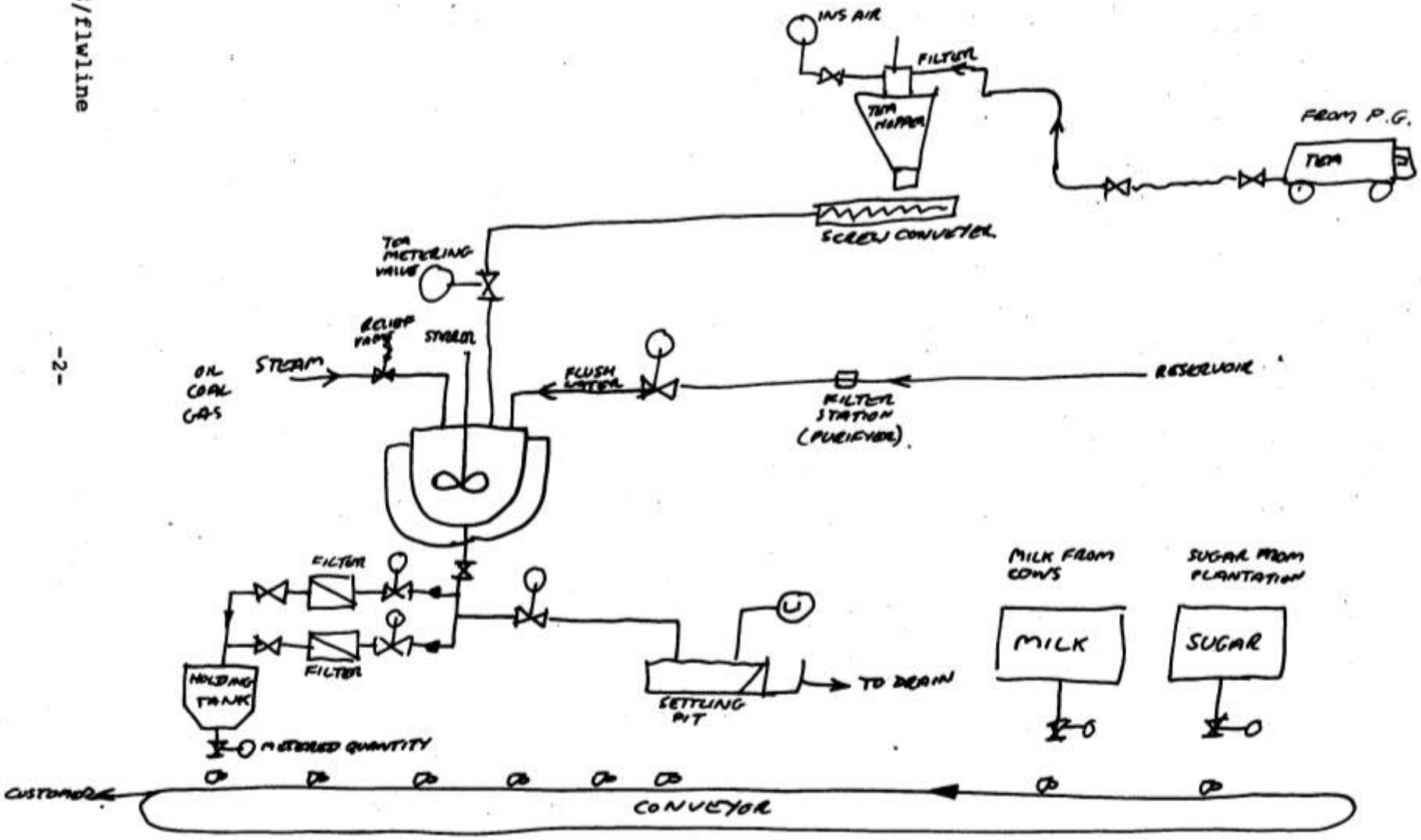
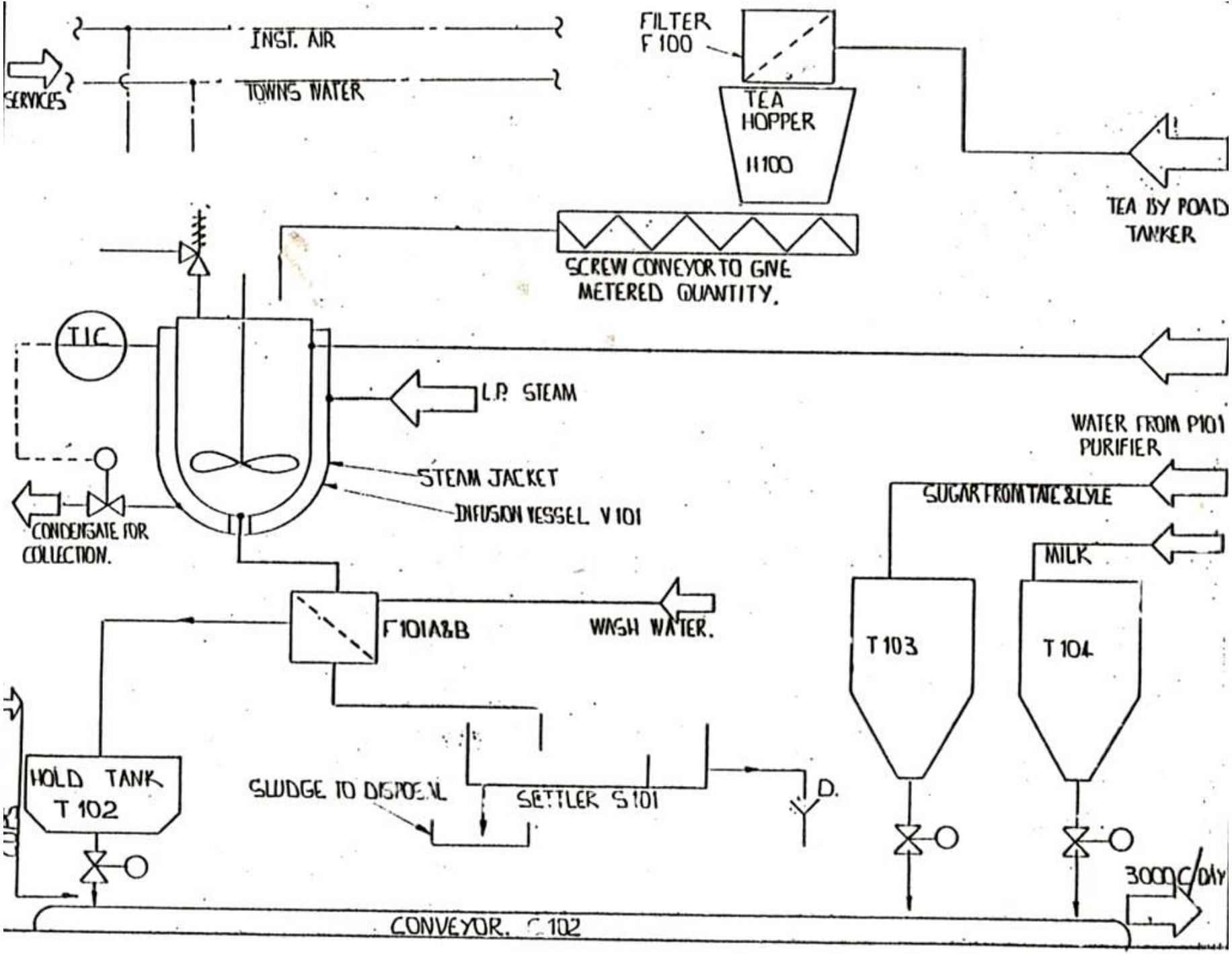
ENGINEERING DRAWING

PART 2

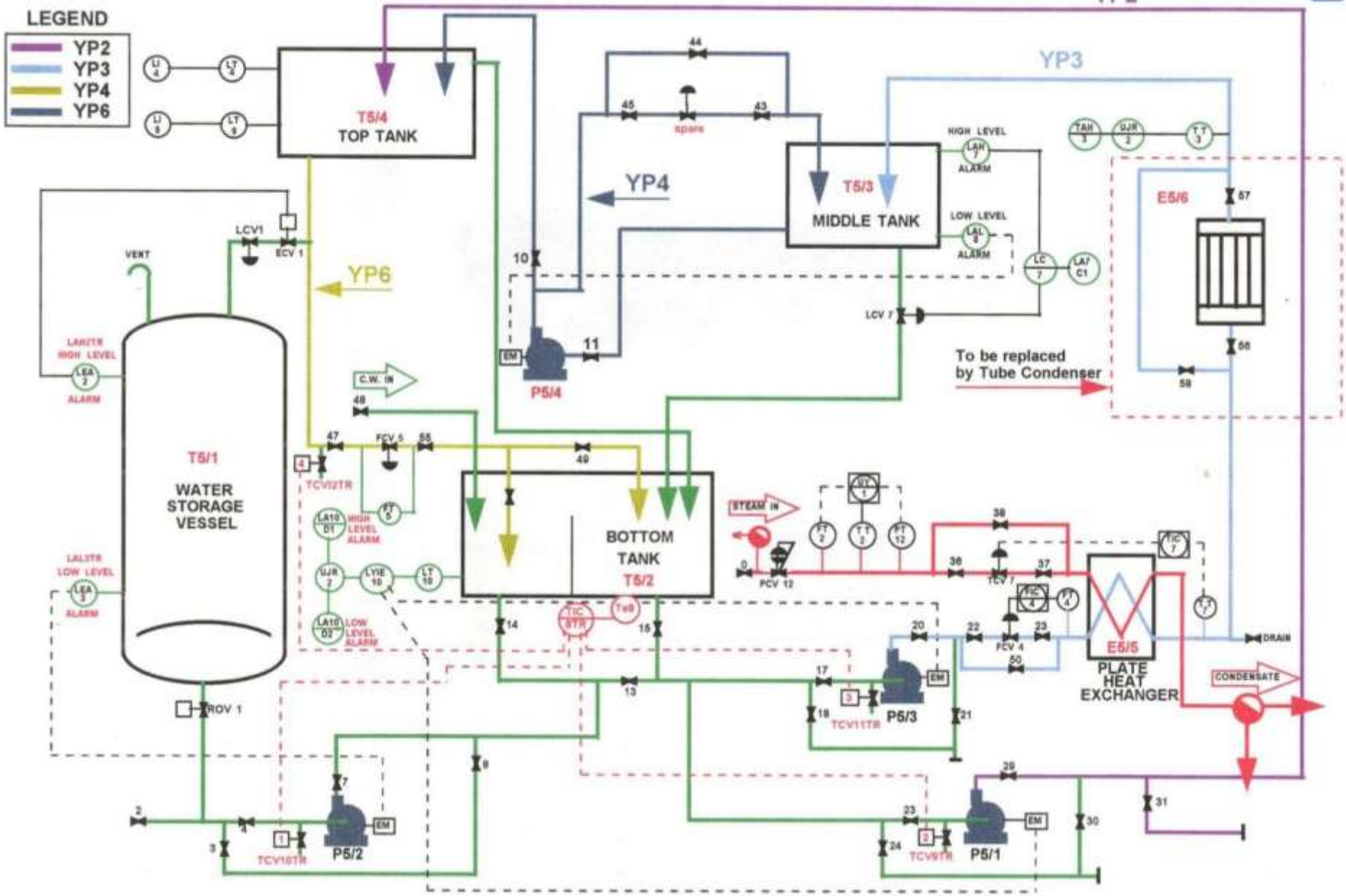
Flow sheets and Line Diagrams

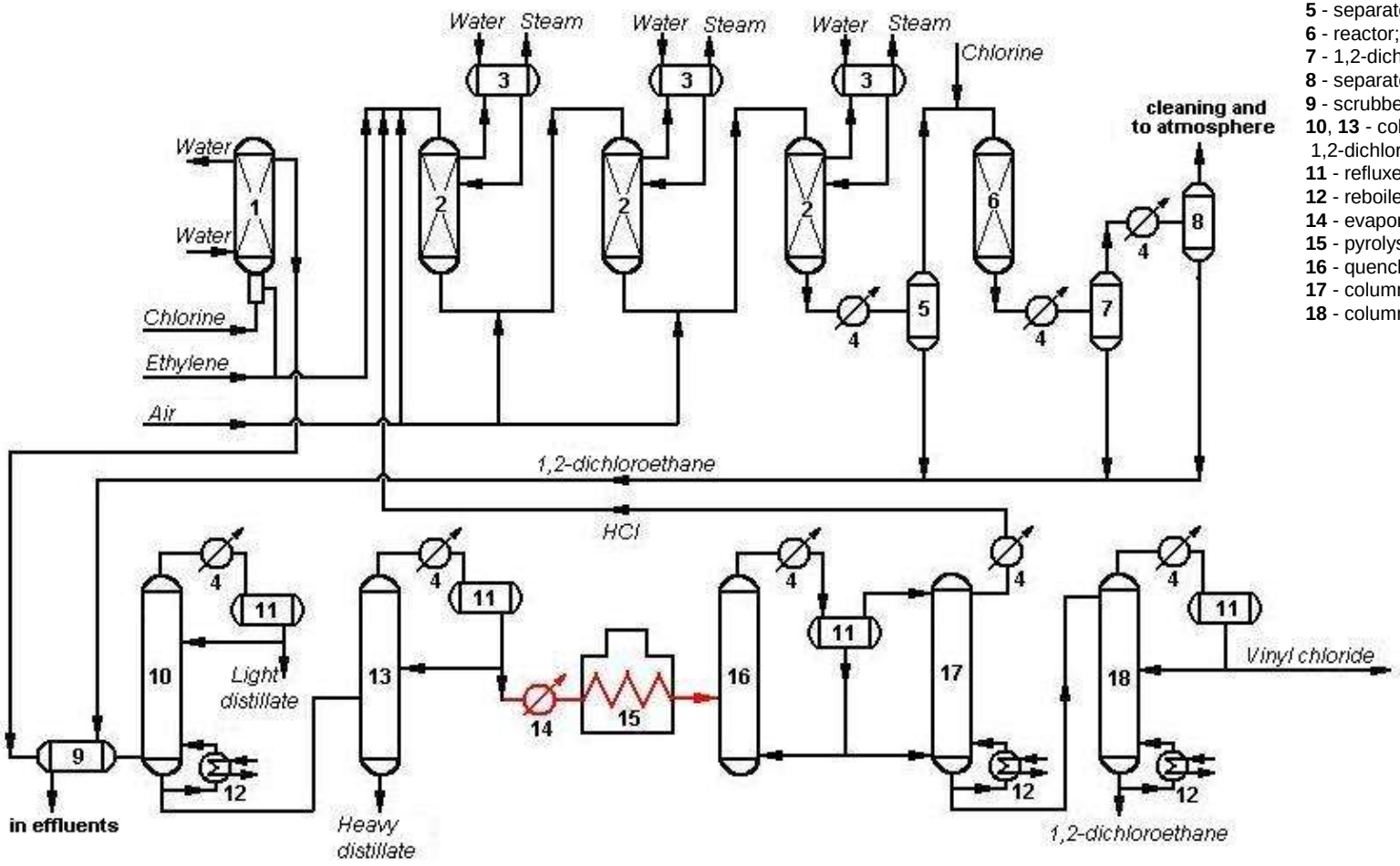
Flow Diagram for production of Tea at 3,000 cups/day.




INST. AIR
SERVICES
TOWNS WATER
FILTER F100
TEA HOPPER 11100
TEA BY ROAD TANKER
SCREW CONVEYOR TO GIVE METERED QUANTITY.
TIC
L.P. STEAM
WATER FROM P101 PURIFIER
STEAM JACKET
INFUSION VESSEL V101
CONDENSATE FOR COLLECTION.
SUGAR FROM TATE & LYLE
MILK
F101A&B
WASH WATER.
T103
T104
HOLD TANK T102
SLUDGE TO DISPOSAL
SETTLER S101
D.
3000 C/DAY
CONVEYOR. C102

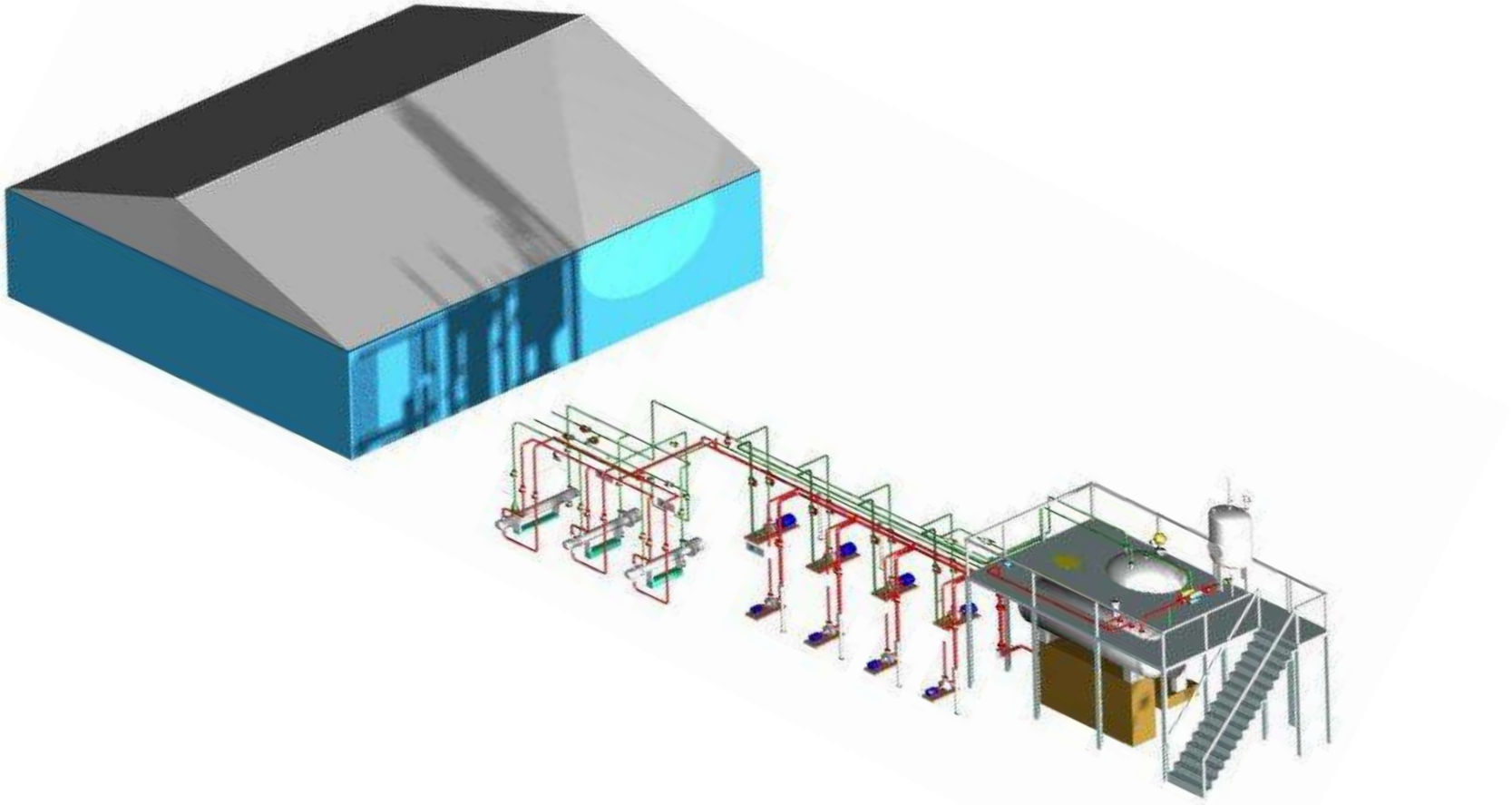
LINE IDENTIFICATION NUMBERS YP2 - YP4 & YP6

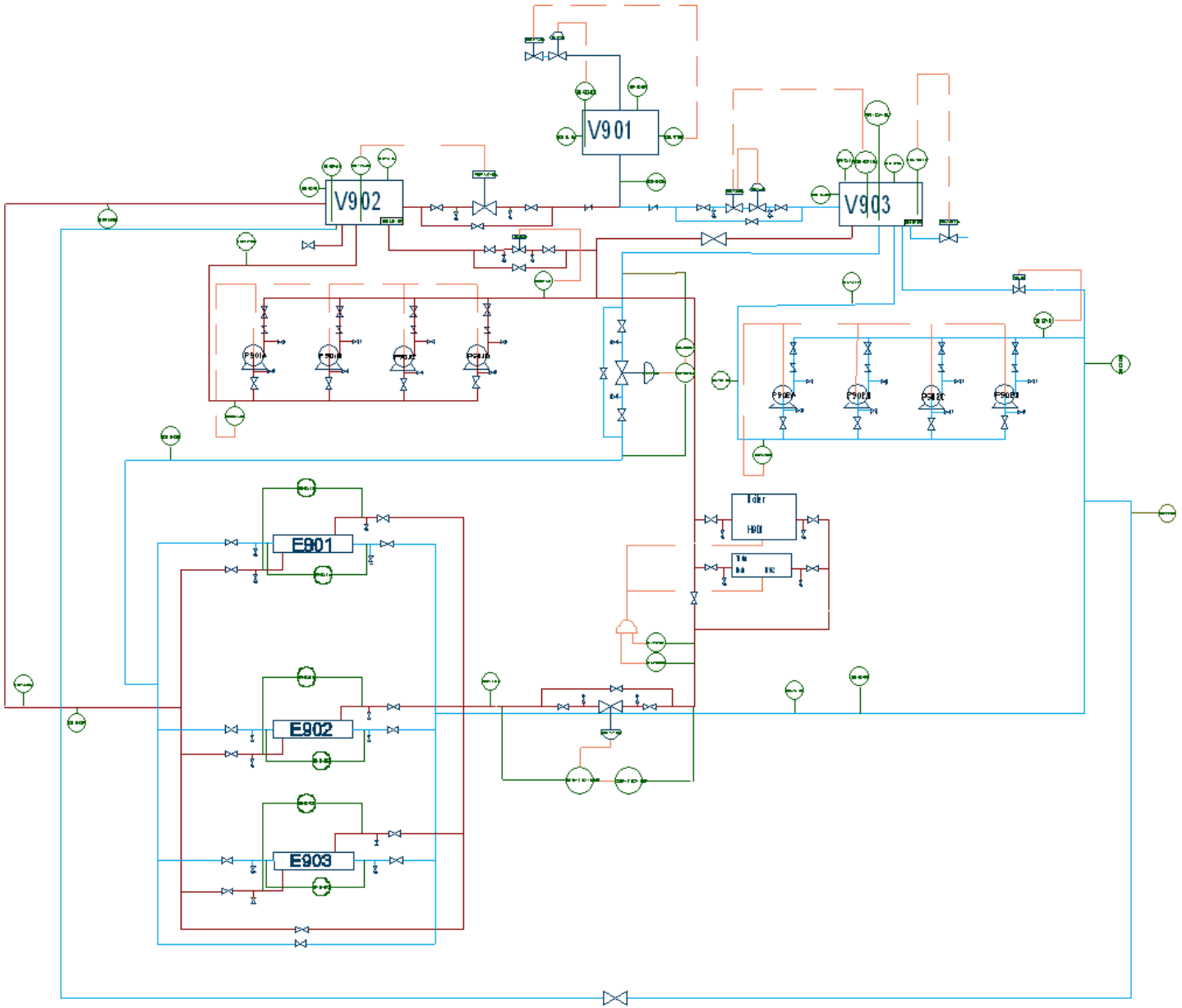




Technological devices and equipment:

1 - direct chlorination reactor;
2 - oxychlorination reactor;
3 - waste heat boiler;
4 - cooled heat exchangers;
5 - separator;
6 - reactor;
7 - 1,2-dichloroethane separator;
8 - separator;
9 - scrubber;
10, **13** - columns for cleaning of 1,2-dichloroethane;
11 - refluxer;
12 - reboiler;
14 - evaporator;
15 - pyrolysis furnace;
16 - quench column;
17 - column for cleaning from HCl;
18 - column for cleaning of Vinyl chloride




V901
V902
V903
E901
E902
E903

THE FLOW SHEET

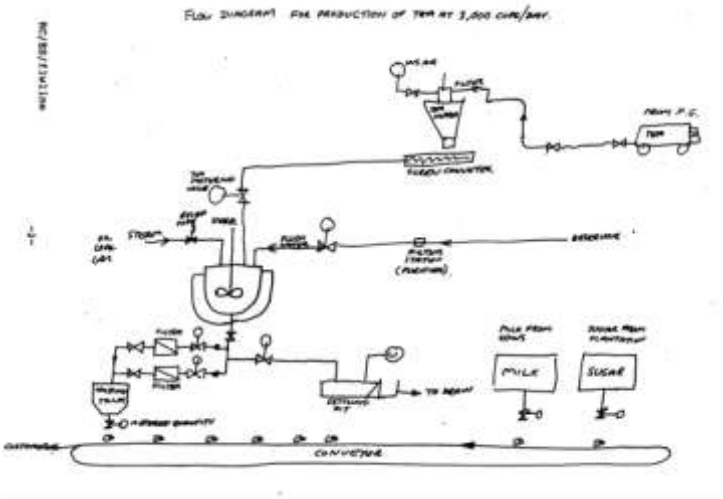
Is a diagrammatic representation of the chemical process to be used and is an indication of the various stages to be built into the plant system.
i.e. reaction, distillation, scrubbing, etc.

It is a basic mass balance diagram with relevant information about quantities, temperatures, pressures and chemicals to be used.

This flow sheet has no vessels, valves or instruments indicated on it.

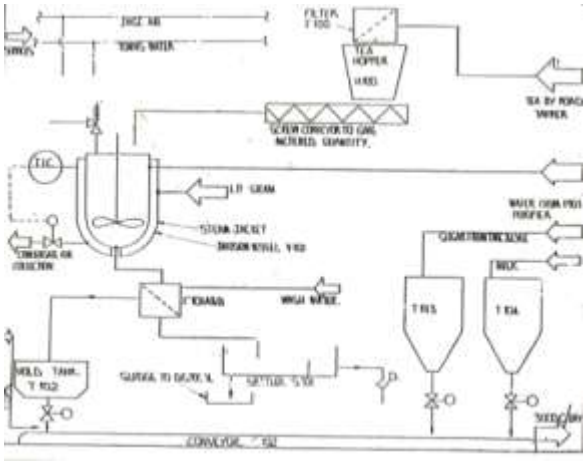
Example of a basic flow sheet for the production of a cup of tea, at a rate of 3,000 cups/hr.

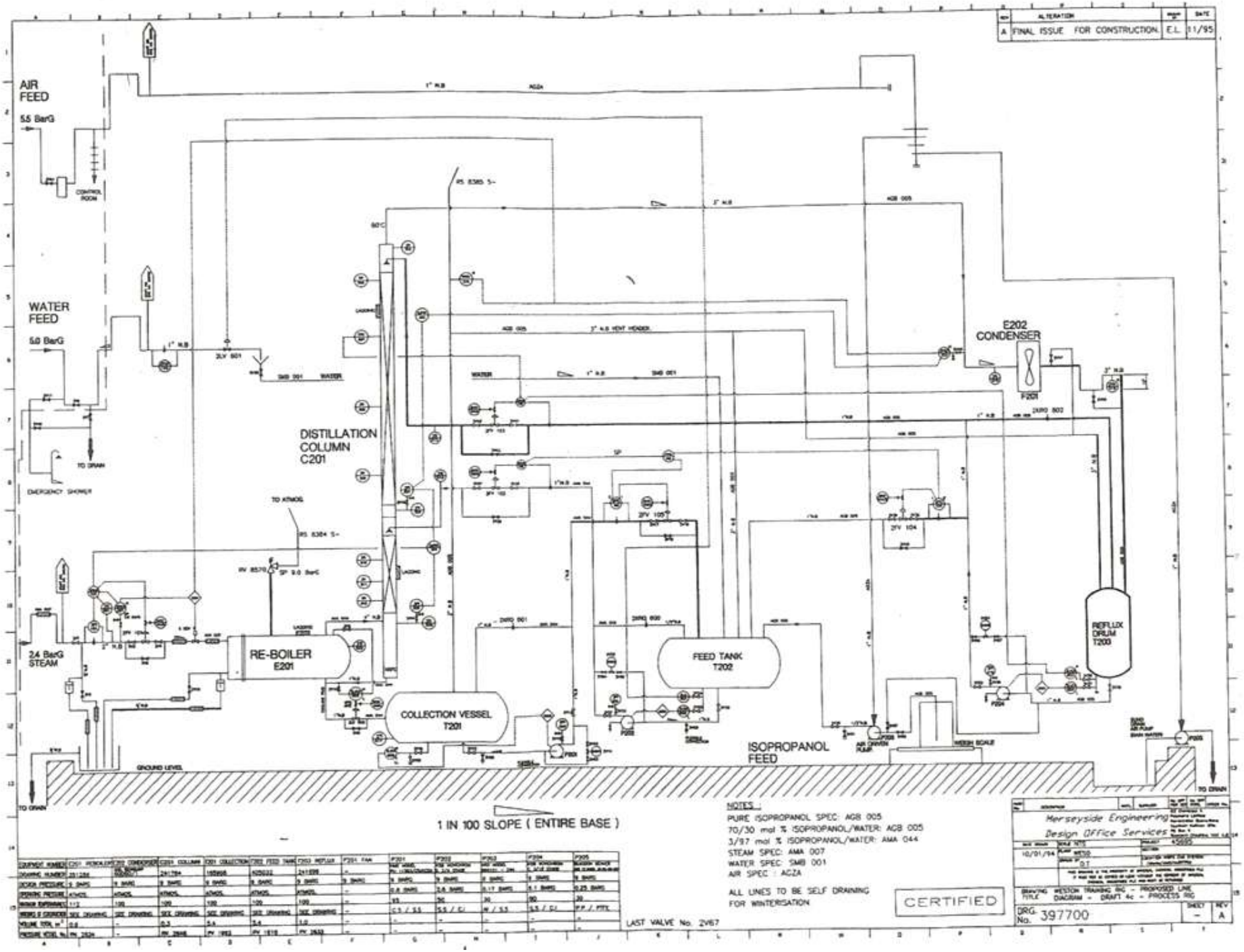
Using information from the flow sheets it is now the responsibility of the Mechanical Design section to produce a line diagram, this is to include all requirement equipment, pipes and valves.



THE LINE DIAGRAM

Basically the line diagram is a two dimensional, pictorial arrangement of the chemical plant, showing all process equipment, pipework, valves, fittings and instruments, which are required for operating the plant.




AIR FEED
5.5 BarG
WATER FEED
5.0 BarG
2.4 BarG STEAM
DISTILLATION COLUMN C201
RE-BOILER E201
COLLECTION VESSEL T201
FEED TANK T202
E202 CONDENSER
REFLUX DRUM T200
ISOPROPANOL FEED
TO DRAIN
GROUND LEVEL
1 IN 100 SLOPE (ENTIRE BASE)
NOTES :
PURE ISOPROPANOL SPEC: AGB 005
70/30 mol % ISOPROPANOL/WATER: AGB 005
3/97 mol % ISOPROPANOL/WATER: AMA 044
STEAM SPEC: AMA 007
WATER SPEC: SMB 001
AIR SPEC : AGZA
ALL LINES TO BE SELF DRAINING FOR WINTERISATION
LAST VALVE No. 2V67
CERTIFIED
A FINAL ISSUE FOR CONSTRUCTION. E.L. 11/95
Merseyside Engineering
Design Office Services
DRG. No. 397700
SHEET –
REV A

The uses of the Line Diagram

In the drawing office;

:Line diagram working parties

:To develop the design of the plant,

:Layout design

:Construction of models

:Determining equipment levels

:Pipework design

In the works:

:Operator training

:Numbering valves

:Commissioning

:Possible fault finding

:Selection of system

:Source of information about equipment,
i.e.
Vessel construction, material,
manufacture, test pressures,
size of branches.

:Planning work .

Others:

:Planning section

:Vessel section

:Machinery section

:Electrical section

:Instrument section

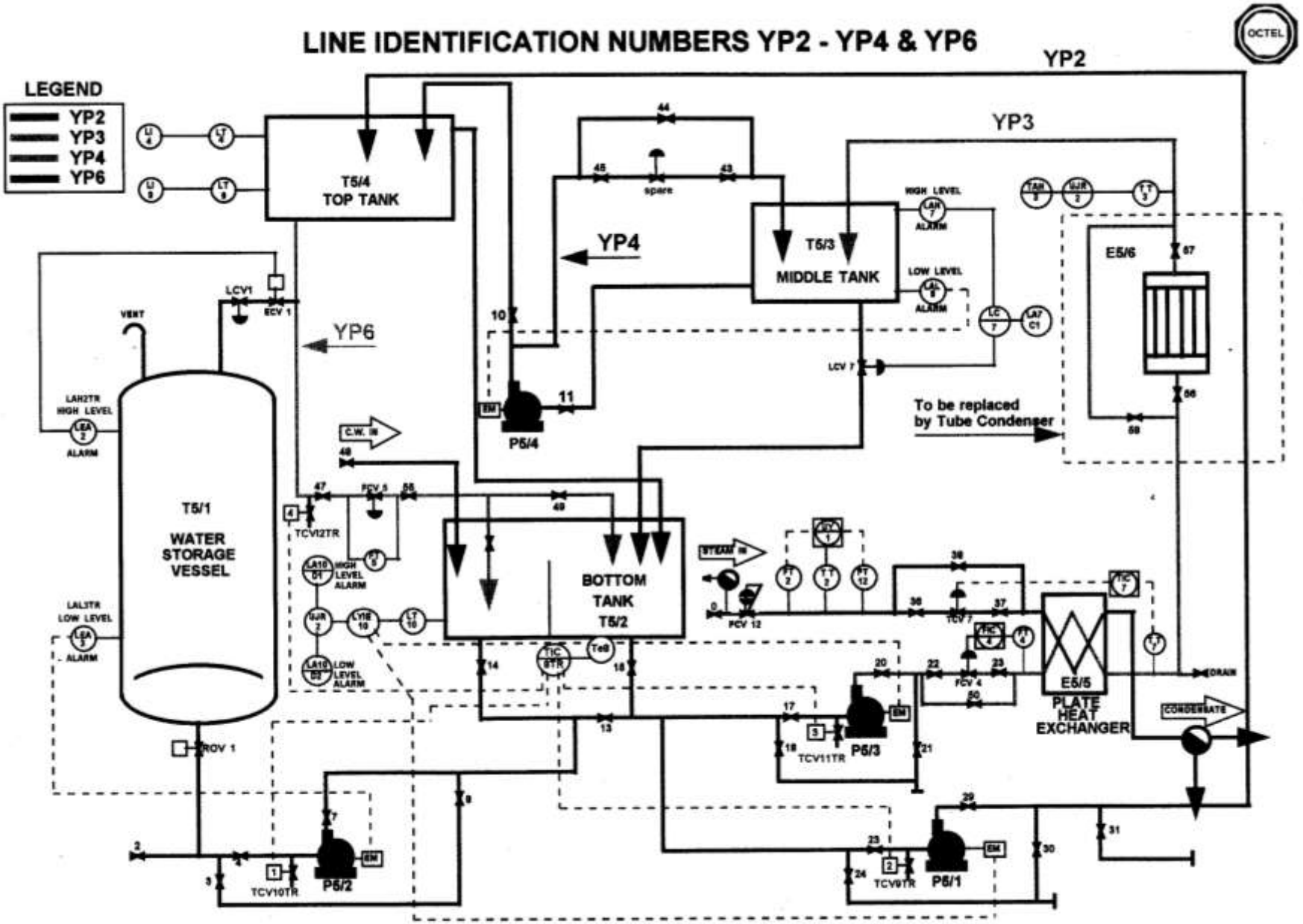
:Estimating section

:Civil section

How many line diagrams do we draw?
Is it normal to divide line diagrams into process sections?

As many as may be required
These can also be split up if they become congested.

LINE IDENTIFICATION NUMBERS YP2 - YP4 & YP6



SUMMARY OF LINE DIAGRAMS

A line diagram must be:-

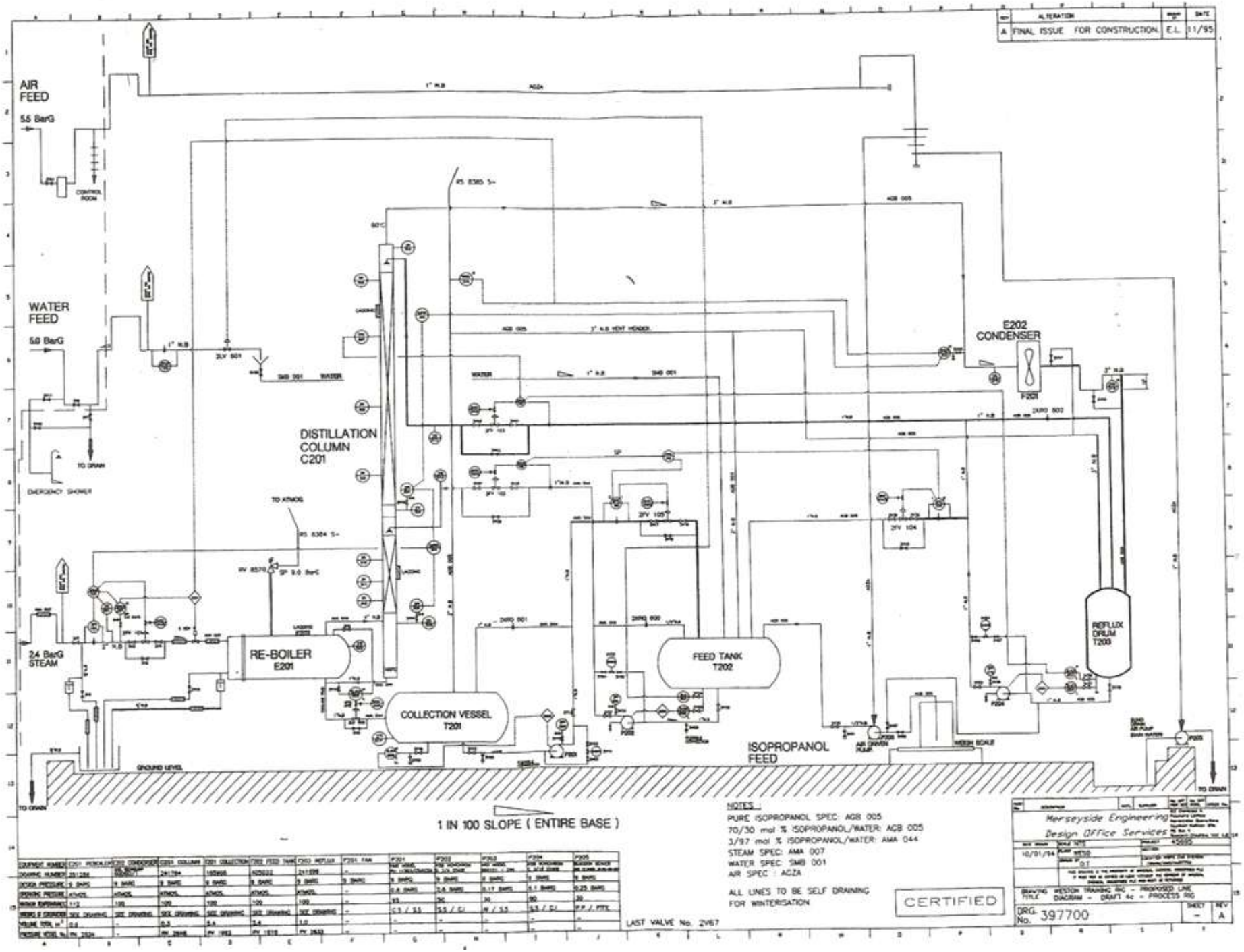
a) Comprehensive:- include all relevant information on PI's pipes etc.

b) Concise:- simple, direct, economical

c) Conventional:- be readily understood (use standard symbols)

d) Contemporary:- be always up to date.

e) Confidential:- Since it contains all the essential features of a process do not give copies out without authority and then only to names on the circulation list.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Merseyside Engineering
Design Office Services
DRG. No. 397700
SHEET –
REV A

CONVENTIONS

a) All horizontal lines continuous, all vertical lines looped.

b) Flow sequence from left to right.

c) Plant items to scale if possible.

d) Vertical scale most important.

e) Show levels where possible.

f) Spread drawing out so that there is space for later additions.
e.g. vessels, pipes, valves with codes and line references.

g) Cross reference to other line diagrams.

PIPELINES

a) Heavy lines for main process flow.

b) Show arrow heads at line junctions not in middle of lines.

c) Indicate flow and fall.

d) Indicate all ‘in line’ items such as valves, spades, filters, etc.

e) Lines continued on other line diagrams should match.

f) Show lagging, tracing, jacketing, line references.

PLANT ITEMS (Equipment)

a) Number equipment as described in Company Engineering Procedures.

b) Names of equipment to be agreed with Process/Plant Engineers.

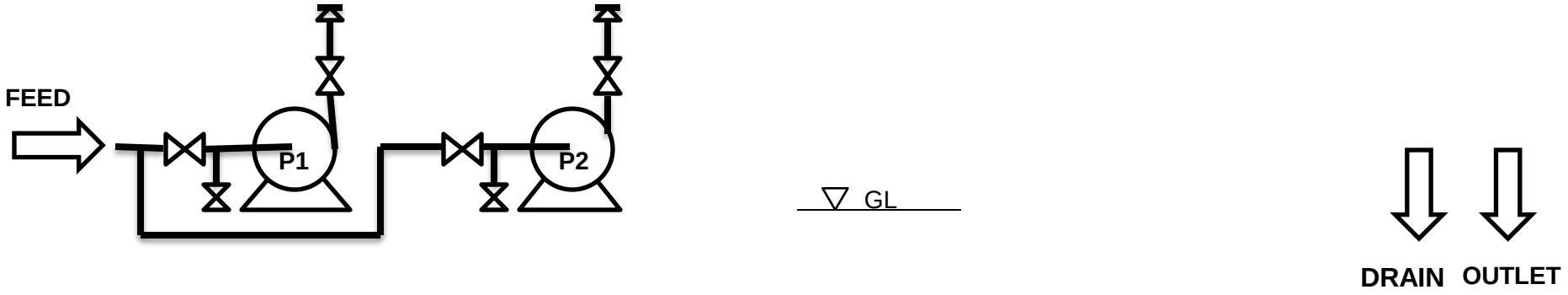
c) Fill in equipment data tables.

d) Existing items or repeats from other line diagrams should be shown chain dotted. This also applies to pipes.

e) Draw new items in bold so that they stand out.

f) Keep details to minimum but show all branch sizes and reference numbers on vessels.

Design a simple piping system to connect pumps to tanks, a common drain and common outlet
Line diagram of 2 pump, 2 tank system
One pump is on standby at any time.
One tank is on standby at any time.



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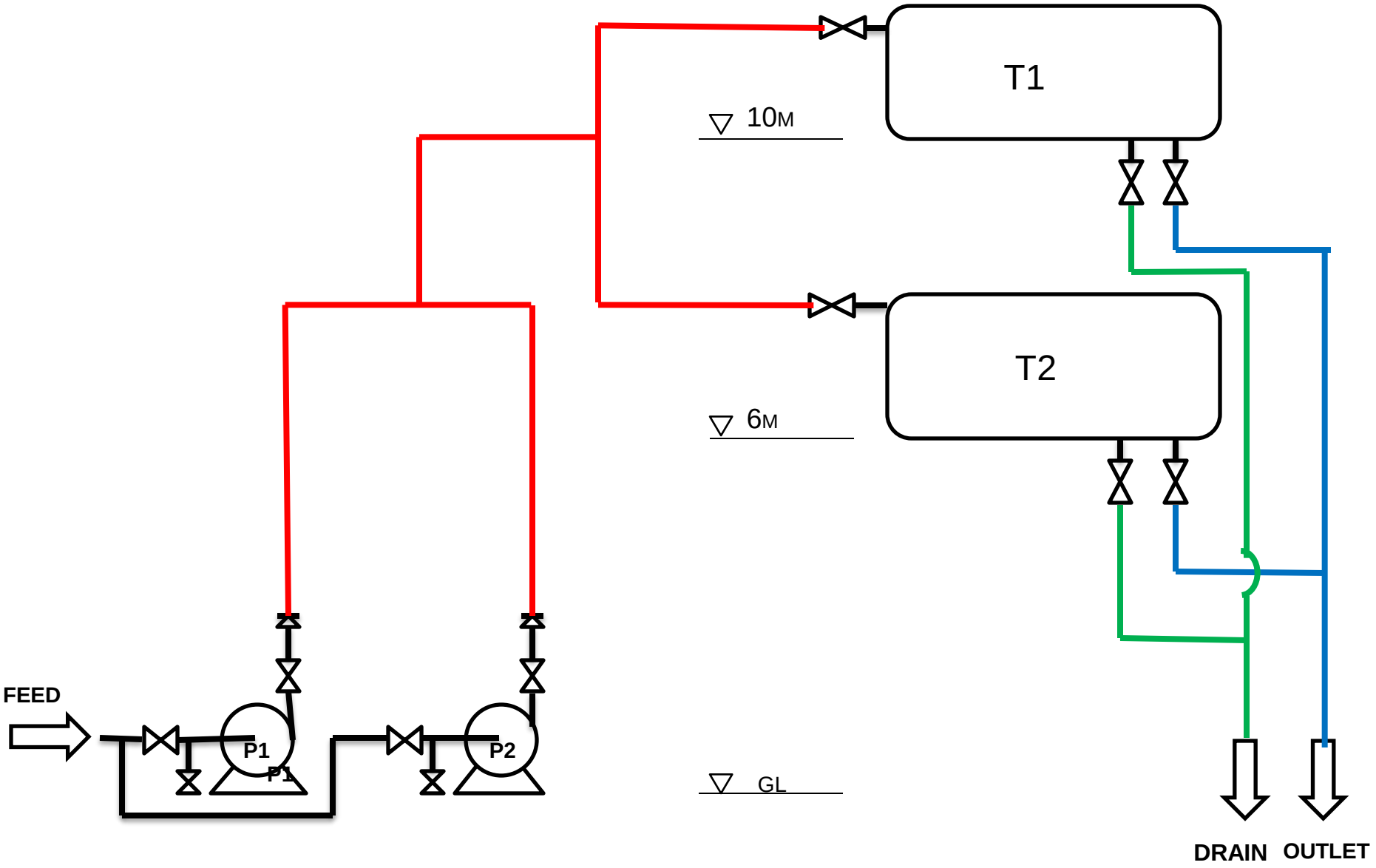

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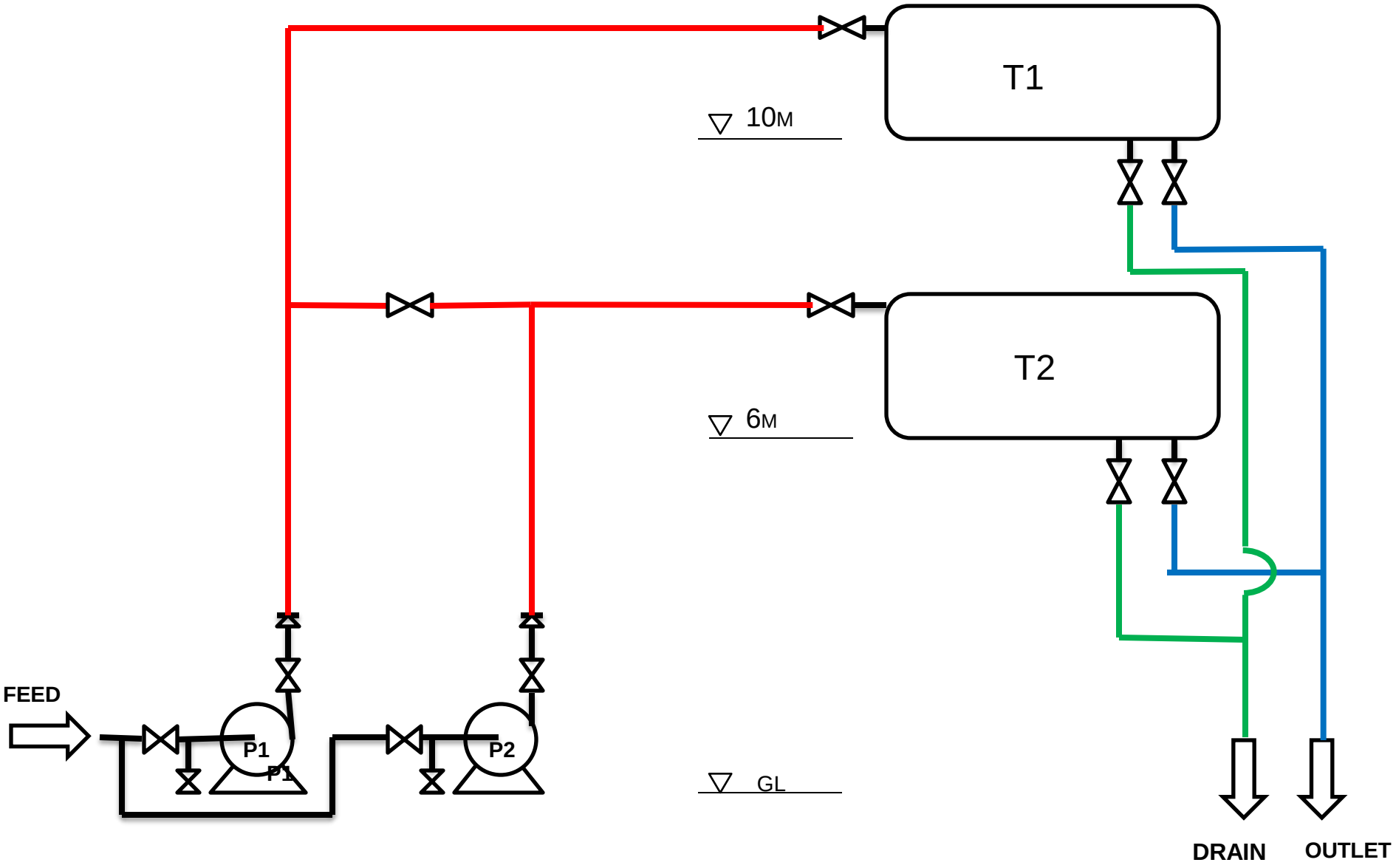


British Standard Specification for

Graphical symbols for general engineering

Part 1. Piping systems and plant

1. Scope

This Part of BS 1553 specifies graphical symbols for use in the creation of flow and piping diagrams for process plant and heating and ventilating installations. It is intended that diagrams employing these symbols should be drawn in accordance with the practice recommended in BS 5070.

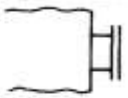
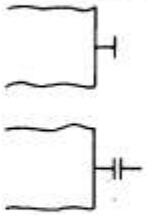
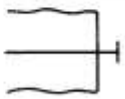
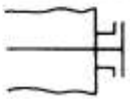
2. References

The titles of the standards publications referred to in this standard are listed on the inside back cover.

3. Symbols (or elements of symbols) used in conjunction with other symbols

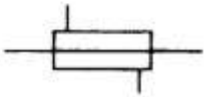
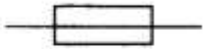
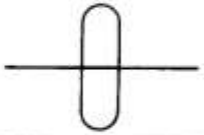
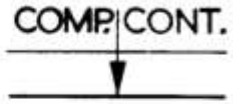
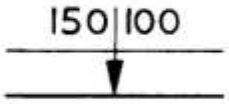
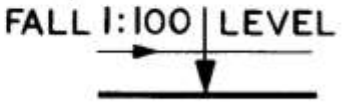
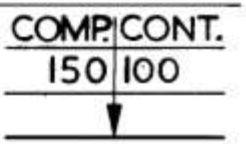
3.1 General

No.	Description	Symbol
3.1.1	Mechanical linkage	
3.1.2	Weight device	
3.1.3	Electrical device	
3.1.4	Vibratory or loading device (any type)	
3.1.5	Spray device	

No.	Description	Symbol
3.1.9	Access point	
3.1.10	Equipment branch: general symbol NOTE. The upper representation does not necessarily imply a flange, merely the termination point. Where a breakable connection is required the branch/pipe would be as shown in the lower symbol.	
3.1.11	Equipment penetration (fixed)	
3.1.12	Equipment penetration (removable)	

4. Basic functional symbols

4.1 Pipelines

4.1.1	Crossing (unconnected) (See appendix A)	
4.1.2	Junction (connected) (see appendix A)	
4.1.3	Heated or cooled NOTE. Heating or cooling medium to be annotated adjacent to symbol	
4.1.4	Jacketed NOTE. Healing or cooling medium to be annotated adjacent to symbol	
4.1.5	Lagged	
4.1.6	Sleeved NOTE. Fluid or fill of the annulus to be annotated adjacent to symbol	
4.1.7	Provision for flexibility (See 4.7 for specific methods)	
4.1.8	Indication of flow direction NOTE. Included angle of arrow = 30°	
4.1.9	Indication of pipe size ϕ150 mm example	
4.1.10	Change in conditions (See symbol 3.1.14) NOTE. Changes in conditions should embrace the arrow Examples: Responsibility change	
	Pipe bore change	
	Change in fall	
4.1.13	Coincident point of change	
4.1.14	Pipe bore change (unspecified)	

4.2 Joints

4.2.1	Butt welded NOTE. The proportions of the weld should be thus: 4 x line thickness	
4.2.2	Soldered or solvent welded	
4.2.3	Screwed