TABLE OF CONTENT

SCOPE

The purpose of this Project Standard and Specification is to ensure consistency of approach to design of equipment across the whole project. The Contractor shall incorporate the design requirements related to the compressor station into the design.

VESSELS

Surge Capacity and Hold-up Volume

1. Drum Surge Capacity and Hold-up Volume

   For drums the surge capacity is arbitrarily defined as the volume between high and low liquid levels.
   If a uniform discharge rate is important, provide the general hold-up times recommended below:

Service	Hold-up Time, Minutes
Feed to Tower or Furnace (feed surge)	
Drum diameter, metres	
- below 1.22	20
- from 1.22 to 1.83, inclusive	15
- above 1.83	10
Reflux to Tower	5
Reflux to De-ethaniser	20
Reflux to De-propaniser	10
Product to Storage	2
Flow to Heat Exchanger	2
Flow to Sewer or Drain	1

   In case hold-up must be provided for both product and reflux, the larger volume is used, not the sum of the two volumes.
   When the discharge rate is unimportant, a nominal hold-up time of approximately two (2) minutes is provided.
   The normal operating level should be taken as the midpoint between the high and low levels. Level control should span between the high and low levels. Where high and low level trips are required, these should be located at a reasonable elevation above and below the high and low levels respectively, to allow operator intervention before a trip occurs.

   <u>Low Liquid Level</u>

   Low liquid level shall be at least 200 mm above the bottom (for horizontal vessels) or bottom tangent line (for vertical vessels).

For water settling, this may need to be increased. Where there may be solids in the drum, which are not to be drawn off, the liquid outlet may be raised and the low liquid level shall be increased accordingly.

High Liquid Level and Vapour Disengagement

For horizontal vessels the HLL is either 300mm or 20% of the drum diameter from the top, whichever is the greater. Note: if a crinkled wire mesh pad is present then HLL is 300 mm from the bottom of the pad.
For vertical vessels, if vapour is present the HLL is 300mm to the bottom of the inlet arrangement. If no vapour is present it is either 15% of the drum diameter or 300mm whichever is the greater.

2. Tower Bottoms Surge Capacity and Hold-up Volume

   The liquid residence time (from the low to high levels) for the design of the bottom section of a column is as follows:

   a. Bottoms as feed to a subsequent tower on level control is five (5) minutes. In general, level control will frequently prove satisfactory to the second of a series of towers.
   b. Bottoms as feed to a subsequent tower on flow control is ten (10) to twenty (20) minutes, when the column is acting as a feed surge drum to another unit. This surge capacity may be obtained by swaging out the hold up section of the column, in some cases.
   c. Bottoms to a heat exchanger and/or tankage are two (2) minutes.
   d. Feed to a fired coil reboiler is the sum of five (5) minutes on the vaporised portion and two (2) minutes on the bottoms product. It is normally desirable that the five (5) minutes on the vaporised portion be employed to establish the normal low level, with the subsequent two (2) minutes on bottoms product used to establish the high liquid level (normally 300mm is the minimum allowed distance between these (levels).

3. Knockout Drum Surge Capacity and Hold-up Volume

   For normal accumulation the following liquid hold up applies:

   a. At low normal accumulation rate

      Liquid drawoff is usually manually controlled . Enough volume should be provided to ensure the frequency of emptying is less than once per shift (i.e. eight (8) hours) or preferably twenty four (24) hours. Generally a nominal height above the lower tangent line (say 200mm) will be adequate.

b. At higher normal accumulation rate

Liquid drawoff is usually under level control. The distance between high and low level is usually made to suit a standard controller range, say 350 mm, (corresponding to controller connections and generally providing hold up time far in excess of the normal requirement of approximately two (2) minutes).

Minimum Auxiliary Nozzle Size

The following list is a guide to the minimum auxiliary nozzle sizes to be used for process design sizing of nozzles (minimum mechanical nozzle size of 2" to be specified during vessel design).

Vessel Volume (m^3)	Vent	Drain	Pumpout	Steamout	Blowdown
1.5	2"	2"	2"	2"	2"
1.5 – 5.6	2"	2""	2"	2"	3"
5.6 – 17	2"	2"	2"	2"	3"
17 – 70	2"	3"	3"	2"	4"
70 and over	2"	3"	3"	3"	4"

Towers and Columns

1. Minimum Tray Spacing

   All distances are mm:

Tower ID	Max Tray Passes	Min Tray Spacing Valve or Sieve
750 to 1800	1	500
1800 to 2700	2	500
2700 to 3300	2	600
3300 to 4800	4	600
4800 to 6000	4	600
> 6000	4	750

   For draw off trays, the spacing is set by the draw off tray design, including hold up.

2. L/D

   Towers with L/D greater than 25 shall be avoided if possible due to support problems.

3. Allowable Pressure Drop Guidelines

Tray Type	In Pressure Service bar per tray
Sieve	0.007
Valve	0.007

HEAT EXCHANGERS

Fouling Factors

Site specific fouling factors will be set as shown below. However, where Licensor has requirements, which are more stringent than this, then Licensor values shall be applied.

- Steam 0.1 $m^{2\circ}C/kW$
- Light Hydrocarbon 0.2 $m^{2\circ}C/kW$
- NGL/Hot Oil/ Tempered Water 0.35 $m^{2\circ}C/kW$
- For Licensed Units, Licensor to specify fouling factors in Front End Engineering Design (FEED) Package

In the absence of specific guidelines TEMA Standards 8th Edition 1999 should be referred to.

Fluid Allocation

To allocate fluids to shell or tube side of an exchanger, the following general principles of fluid allocation shall apply:

a. cooling water on tubeside;
b. high pressure fluid on tubeside;
c. most corrosive fluid on tubeside;
d. higher fouling fluid on tubeside;
e. less viscous fluid on tubeside;
f. large volume of condensing vapours on shellside;
g. single phase fluids both sides put smaller flow on shellside.

The above principles may conflict in some instances and alternative designs shall be investigated. In these cases the most economical design shall be selected.

Shell and Tube Heat Exchangers

1. Pressure Drops

   The pressure drop available shall be specified as below and all hydraulic calculations shall allow for this specified pressure drop.

2. Liquids

Total Pressure Drop (bar) for Liquid Flow Through Shells in Series			
Viscosity cP @ avg. temperature ^oC	One Shell Pressure Drop (bar)	Two Shells Pressure Drop (bar)	Three Shells Pressure Drop (bar)
< 1.0	0.34 – 0.69	0.34 – 0.69	0.69 – 1.03
1.0 to 5.0	0.69	1.03	1.03 – 1.38
5.0 to 10.0	1.03	1.03 – 1.38	1.38
> 10.0	1.38	1.38 – 2.07	2.07

<u>Gases</u>

Pressure Drop (kg/cm^2) for Vapour Flow	
Operating Pressure (barg)	Pressure Drop (bar)
0 – 0.69	Approx. 0.03 - 0.07
> 0.69	0.14 – 0.34

3. Condensers and Reboilers

- For partial condensers allow 0.14 to 0.34 bar.
- For condensers where total isothermal condensation takes place, the pressure drop is usually low or negligible.
- For surface condensers allow 3 - 5 mm Hg for operating pressures about 30 mm Hg.
- For kettle type reboilers the shell side pressure drop is generally termed ‘negligible’.
- For thermosyphon type reboilers (horizontal units, once-thru and recirculating) the exchanger pressure drop must be low and is normally in the region of 0.017 to 0.034 bar, due to “unbaffled” exchanger construction.

<u>Maximum Removable Bundle Weight, Diameter and Tube Length</u>

- Maximum removable bundle weight allowable on site is 20 tonnes.
- Maximum removable bundle diameter allowable on site is 2.0 m.
- For removable bundles a tube length of 6100 mm shall be maximum.