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SHIP LOADING VRU – INQUIRY DATA SHEET

DATE : _____

PROJECT REFERENCE NUMBER : _____

CUSTOMER : _____

END USER: _____

JOBSITE LOCATION : _____

REQUIRED DATE OF QUOTE : _____

ANTICIPATED DATE OF AWARD : _____

REQUIRED SHIP DATE / DELIVERY TIME : _____

NOTE : PLEASE PROVIDE AS MUCH INFORMATION AS POSSIBLE. IF YOU ARE NOT ABLE TO PROVIDE ALL OF THE INFORMATION WE WILL MAKE AN ASSUMPTION BASED ON OUR EXPERIENCE AND KNOWLEDGE OF SIMILAR SYSTEMS.

1. **PRODUCT DATA**
   - Product Held In Tanks :_____
   - Multiple Products : _____
   - Reid Vapour Pressure: (*Please provide for each product*). _____
   - Product Temperatures: (Please provide for each product).
     Summer Max / Summer Ave / Winter Max: _____
   - Product Composition (if available): Please provide as separate sheet.
   - Vapour Composition (*if available*): Please provide as separate sheet.

2. **VRU Emissions Requirement:** i.e., (35g/Nm^3 / 10g/Nm^3 / 150mg/Nm^3 / other):_____

3. **Ship Data.** (*Please provide data for each tank included in the system*).
   - Number of ships loaded simultaneously : _____
   - Total Volume loaded : _____
   - Loading Rates: Start of Loading / Normal Max / End of Loading:
     _____ / _____ / _____
   - Pressure Relief Valve Set Points: Pressure / Vacuum Settings:
     _____ / _____
   - Blanket Gas (Nitrogen, ship exhaust, air/no blanket, etc) :_____

5. Absorbent / Properties

- Absorbent : _____
- Absorbent Properties : Reid Vapour Pressure : Summer / Winter / Intermediate : _____
- Temperature : Max Summer / Max Winter : _____
- Composition: (*Provide separately if available*).

6. Ambient Conditions

- Temperature : Max Summer / Ave Summer / Min Winter / Design Temp :_____
- Maximum Wet Bulb Temperature: _____
- Site Location / Elevation : Coastal / Inland / Elevation above sea level : _____
- Site Latitude : _____
- Site Wind Design Code / Wind Speed _____
- Site Seismic Design Code / Parameters_____

7. Available Utilities

- Electricity :
  Power: _____V _____ Phase _____Hz
  Control: _____V _____ Phase _____Hz
- Instrument Air (Yes/No) :_____
  Min Pressure: _____
  Max Pressure: _____
- Hazardous Area Classification (ie, Class 1, Div 2, Group D) :_____

8. Equipment Design

- Liquid Seal Drum (yes/no) : _____
  ASME Code Stamp (yes/no):_____
- Dock Safety Unit (yes/no): _____
  Coast Guard Approval (yes/no)_____
- Detonation Arrestor (yes/no) : _____
- Dedicated Local PLC or Site DCS Control : _____
- Customer Approved Vendors for Specific Items (PLC, Detonation Arrestor, etc):_____
  _____
- Available Plot Space : _____

Questionnaire – Supporting Notes

1.0 VRU DESIGN DATA SHEET

The design of a vapour recovery unit is specific to the application in which it is used. A properly designed VRU system is important in order to ensure that the unit is neither undersized nor oversized for the terminal, i.e. a system that is appropriately sized for the current and planned future needs. Oversizing would result in a VRU that has excessive power requirements, whereas a VRU that is undersized runs the risk of i) running with higher emissions limits than permitted and/or ii) limiting the loading operations and the terminal.

This Questionnaire/Data Sheet, aims to request a range of data that the VRU designer can utilise to design an appropriately sized VRU.

VAPOUR RECOVERY SYSTEM – USEFUL NOTES

There are many applications where a vapour recovery unit might be used, these are typically:

- Terminals where truck or rail wagon loading is undertaken.
- Terminals where tank filling is undertaken and vapours from these tanks need to be processed.
- Marine terminals where ships are either loaded or unloaded into storage tanks.
- Applications where perhaps a combination of the above are undertaken.

In terms of the VRU design the above applications can be categorised into two primary design approaches:

- Truck Loading Application. This group would generally cover Truck loading and Rail Loading Applications, in which there is NO vapour balancing with the product storage tanks, ie there is no means for the vapours from the trucks to flow back to the tanks.

  For this design approach the product loading and hence vapour flow fluctuates dramatically throughout the operating period. These fluctuations should be accounted for in the design.

- Continuous Duty Application. This group would apply to ship loading, tank filling and breathing and also balanced vapour systems. In these applications the vapour flow rate tends to be continuous for prolonged periods of time. The VRU must be able to account for this demanding vapour flow.

In order to develop an appropriate design a good understanding of the application in which the VRU will be used is required. The following requested data will assist in this process.

It would be very beneficial if as much data as possible can be provided. Naturally there is some data that is an essential minimum that should be provided however where other information is not available we can generally make reasonable assumptions to complete these design process.

2.0 SHIP LOADING OPERATIONS

A ship loading operation is what would be defined as continuous duty in terms of the VRU design basis, loading rates tend to be high, continuous and last for several hours.

Many vessel when prior to loading are vented, ie the holds are to all intent clean of hydrocarbons in either in the vapour phase or as a liquid. This is however not always the case, there are some locations in which during unloading operations at the ships destination vapour from the tanks, into which the product is unloaded, will balance the vapours back into the ship. Where this is the case the hydrocarbon concentration in the ships holds may be rich in hydrocarbons.

Ship Loading Details

Product Loading Rates : At the start of loading and end of loading the loading rates are usually ramped up and ramped down over a period. As the VRU designed it would be beneficial to know what the ram pump and ramp down loading rates are and over what period.

In addition it would be beneficial to be aware of the total or typical loading and typical total volumes loaded.

Vapour Growth. Vapour Growth is a phenomenon that arise at the start of loading and results due to the vapour space above the liquid being loaded becoming saturated with hydrocarbons. It usually higher at the start of loading as a result of the initial disturbances at the liquid surface.

Vapour Growth results in higher vapour flow rates displaced from the vessel than the actual loading rate. The vapour growth rate can be determined through the modelling of equilibrium conditions in the vessel. However the US Coast Guard Regulations 33 CFR Part 154, require that a vapour growth rate of 25% of the product loading rates be used in the design of the VRU and vapour manifold systems.

As the loading period continues, the vapour growth rates tend to diminish.

Hydrocarbon Concentration. The hydrocarbon concentrations in the vapour phase also tend to vary throughout the loading period, with the opposite trend to the vapour growth, in that they tend to rise. This phenomena occurs as the atmosphere in the vessels holds tend to be very stratified, ie the concentration at the liquid surface will be saturated, whereas closer to the top of the vessels holds the concentration is approaching saturation at a much slower rate.

If the information is available please provide an indication of the hydrocarbon concentration or composition at the start of loading and end of loading. – If the information is not available we will make an assumption based on our knowledge and experience.

Products Loaded. We do need to have a good understanding and knowledge of the products being loaded. For products such as gasoline, naphtha's and condensates it is usually enough to know the vapour pressure and product temperature. For products such as crude oil, the assay would usually be required.

US Coast Guard Regulations. Reference is made above to the USCGR regulations, 33 CFR Part 154. These are a set of regulations specific only to the USA related to the safe handling of the vapour stream, rather than the emission regulations.