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22151 East 91st Street
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Ph: +1-918-258-8551
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www.zeeco.com

Please Return to : sales@zeeco.com
Tel : +1-918-258-8551

TRUCK LOADING VRU – INQUIRY DATA SHEET
(NON-BALANCED TYPE)

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.

The following questionnaire is for truck loading applications in which the vapours displaced from the trucks are NOT balanced back to the storage tanks, ie the vapour flow directly and only to the vapour recovery unit. – A terminal in which the tanks are fitted with Internal Floating Roofs (IFRs) would full in this category.

1. PRODUCT DATA

- Product Held In Tanks : ____________________
- Products : ie Gasoline / Diesel: ____________________
- Reid Vapour Pressure : (*Please provide for each product*): ____________________
- Product Temperatures: (Please provide for each product).
  Summer Max / Summer Ave / Winter Max: ____________________
- Vapour Concentration (*if known*) : Design / Max /Norm : ____________________

2. VRU Emissions Requirement: ie (35g/Nm^3 / 10g/Nm^3 / 150mg/Nm^3 / other): ______________

3. Loading Rack Information.

- Number of Loading Spots connected to the vapour recovery manifold (ie number of trucks that can be loaded simultaneously) : ____________________
- Number of Loading Arms per loading Spot that can be connected to a truck simultaneously): ____________________
- Blanket Gas (Nitrogen, air/no blanket, etc) :____________________

4. Filling Rates

- Maximum Fill Rate Per Loading Arm. : ______________________________
- Maximum loading pump rate, per pump per product : _____________

  For example : Gasoline and Diesel can be loaded on the gantry. There are two pumps supplying gasoline to the gantry and one pump for diesel. What is the pumping rate for each pump/product.
- Notes :

5. Loading Profile

If you have the following information please provide :

Refer to the definitions of each parameter in the above sections.

	Loading Profile Parameter	Product 1 (ie Gasoline)	Product 2	Product 3	Totals
1	Product				
2	Max Instantaneous Flow Qi (ie m^3/min)				
3	Max Volume Loaded in 15 mins; Q_{15}				
4	Max Volume loaded in 1 hour				
5	Max Volume loaded in 4 hours				
6	Max Volume loaded daily				

6. Absorbent / Properties

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

7. Ambient Conditions

- Temperature : Max Summer / Ave Summer / Min Winter : _____________________________
- Recognised Site Design Temperatures : ____________________________
- 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 _________________

8. **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):_________

- 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 Road Truck Filling Operations

The following details are intended for applications in which road trucks are filled and the vapours displaced directly to a Vapour Recovery Unit (VRU); ie the vapours are not displaced into a balanced vapour manifold system.

The selection of a correctly sized Vapour Recovery Unit is important in order to ensure that the unit is neither undersized nor oversized for the terminal. Over sizing would result in a VRU that has excessive power requirements, whereas a VRU that are undersized run the risk of i) running with higher emissions limits than permitted and/or ii) limiting the loading operations and the terminal.

There are a number of key factors that are necessary for correctly sizing a VRU. These are detailed below. If these details are not readily available, with our experience, knowing some basic data about the terminal we can develop a reasonably accurate loading profile. These would include:

- Number of loading spots that can be used simultaneously.
- Number of loading arms that can simultaneously be used per loading spot.
- Maximum liquid flow rate per loading arm.
- Maximum size of the trucks loaded at the terminal.

LOADING PROFILE DATA REQUIRED FOR AN ACCURATE VRU DESIGN.

Qi. MAXIMUM INSTANTANEOUS VAPOUR FLOW RATE

This is the maximum flow rate that can be loaded at the loading racks simultaneously. The figure is used to determine the back pressure that the vapour collection system and VRU would apply to the loading racks. Based on flow rate we would determine the profile of the VRU's carbon beds and the size of vapour inlet piping.

Some judgement must be made when determining the Qi rate. It would easy to say for example that there are four loading racks, each with 5 loading arms, that can each load at say 2.4m^3/min. This would amount to a maximum flow of :

4 (Loading Spots) x 5 (arms) x 2.4m^3/min (/arm) =48m^3/min.

This would be considered a high Qi and not realistic. Whereas the situation could occur from time to time, in order to maintain the size of the equipment at a reasonable level it is accepted practice to take into account the varying flow patterns at the loading rack. ie that it is unlikely a truck would have all five loading arms connected and filling at the full rate and even more unlikely that all four bays would have all five loading arms connected filling at the maximum rate. The realistic situation is that if all the bays are occupied it is unlikely all the arms would be connected and flowing at the maximum rate. It has become the accepted norm to consider, for design purposes a maximum Qi of 3.5 connected arms per loading spot, ie

Qi : 4 (Loading Spot) x 3.5 (arms) x 2.4m^3/min (/arm) = 33.6m^3/min

<u>QC, CYCLE RATE.</u>

This parameter is used to calculate the amount of carbon required in the carbon beds. Typically for a truck loading unit the VRU cycle period would be set at 15minutes, that is each carbon bed can absorbed vapours at the full design hydrocarbon concentration and for 15minutes.

For a truck loading operation it would be a mistake to simply multiply the Qi, maximum instantaneous rate, by 15. This would give a very oversized carbon bed. The typical approach is to consider the number and volume of trucks that can be loaded on the racks in a 15 minute period. Typically it is considered the norm to be able to fill a 35 to 38m^3 truck at each loading spot every 15 minutes. Therefore for a four spot rack the Qc would be :

Qc : 4 (Loading Spots) x 35m^3 (Maximum Volume of trucks) = 140m^3 Loaded in 15 minutes.

<u>Q4 FOUR HOUR LOADED VOLUME.</u>

This parameter is used to help us select the correct size vacuum pump for the system. It gives us an indication of the how much the loading racks are utilised over a four period. Typically this volume / figure would be provided from the terminal's loading data. If this is not readily available then we can make a reasonable estimation that would provide a VRU design that was reasonably sized.

For a truck loading operation we typically would consider a 75% utilisation rate, so for the example I have been using this would amount to :

Q4 : 140m^3 (Qc) x 16 (15mins in 4 hours) x 75% (utilisation rate) = 1680m^3 loaded in 4 hours

<u>QD. VOLUME OF PRODUCT LOADED DAILY.</u>

As with the Q4 figure this is helped to select the vacuum pump. We would also anticipate the terminal providing this data. Here again through, if not provided I would make a determination of the Qd figure based on the maximum volume of product loaded daily being 2.5 times the Q4 rate.

Naturally the better the loading profile data the better the design of the VRU. Certainly for the Qi and Qc figures using our estimating approach would give well sized vapour piping and carbon beds. However to be absolutely sure that the vacuum pumps are properly sized the Q4 and Qd loading rates should be verified and amended, where appropriate, by the terminal.