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PROCESS DESIGN OF LOADING AND UNLOADING FACILITIES FOR ROAD TANKERS

(PROJECT STANDARDS AND SPECIFICATIONS)

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SCOPE

This Project Standards and Specifications covers minimum requirements for process design and engineering of loading and unloading facilities for road Tankers in Oil and Gas Industries.

It should be noted that the scope of this Standard is limited to liquid applications and road tankers only. Furthermore in this manual the unloading part is limited to probable discharges of the products remaining in the tankers that arrive for loading.

This manual forms part of a series that may be developed ultimately to embrace all facilities connected with bulk loading and unloading of road vehicles, rail tank wagon and on-shore facilities for loading/discharging of water bore craft.

REFERENCES

Throughout this Standard the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

1. API (American Petroleum Institute)

   API RP 2003 "Protection Against Ignitions Arising Out of Static, Lighting and Stray Currents"

   API MPMS "Manual of Petroleum Measurement Standards", "Loading Rack and Tank Truck Metering Systems"

2. BSI (British Standards Institution)

   BS SP 3492 "British Standard for Road and Rail Tanker Hoses and Hose Assemblies for Petroleum Products, Including Aviation Fuels"

   BS 5173 "Methods of test for rubber and plastics hoses and hose assemblies Part 102: Hydraulic pressure tests Section 102.8 Pressure impulse test for rigid helix reinforced thermoplastics hoses"

3. NFPA (National Fire Protection Association)

   NFPA 70 "National Electrical Code"

4. Text Book

   NIST HDBK 44 7th Ed. ,2007 "Specifications, Tolerances, and other Technical Requirements for Weighting and Measuring Devices"

DEFINITIONS AND TERMINOLOGY

Filling Installations - Facilities for truck loading from entering time up to leaving.

Gantry - A framework on a loading island, under or besides which one or two loading bays with some articulated loading arms/hoses are arranged.

Loading Arm/Hose - A piping or hose arrangement for filling in a truck.

Loading Bay - An inlet for trucks to stay under product loading.

Loading Facilities - Facilities consist of pumping and filling installations.

Loading Island - A raised area over which loading arms/hoses and related facilities are installed.

Spout - An outlet for loading through an arm or a hose, identical with "loading point".

SYMBOLS AND ABBREVIATIONS

SYMBOL/ABBREVIATION	DESCRIPTION
DN	Diameter Nominal, in (mm).
d_w	Number of working days per week.
HVP	High Vapor Pressure.
LNG	Liquefied Natural Gas.
LPG	Liquefied Petroleum Gas.
LVP	Low Vapor Pressure.
n_d	Number of truck per spout per day.
N_d	Total number of trucks per day.
n_l	Number of simultaneous loading.
N_s	Number of spouts.
OGP	Oil, Gas and Petrochemical.
RVP	Reid Vapor Pressure.
q_1	Loading capacity per spout, in (m^3/h).
Q_a	Average product rate, in (m^3/d).
q_p	Product pumping rate, in (m^3/h).
t_1	Loading time per truck (filling only), in (min).
T_1	Total loading time per truck, in (min).
t_d	Working time, hours per day.
t_p	Preparation time of a truck, in (min).
V_a	Average truck capacity, in (m^3).
V_T	Specific truck capacity, in (m^3).

UNITS

This Standard is based on International System of Units (SI) except where otherwise specified.

TRUCK LOADING AND UNLOADING

Loading

1. General

   This Standard Specification is limited to provision of, process design of new facilities for loading of bulk road vehicles at normal installations for different products. For this reason, the designs shown include features which will not be necessary in all situations; and when new facilities are planned it is recommended that the simplest facilities that will efficiently perform the filling operation should be constructed. These requirements can also be used for the modernization and/or extension of existing loading facilities for road tankers.

   Specifying the yearly average loading capacity, the size of tanker and loading assembly may be fixed and pump capacity will be calculated.
   It should be noted that in case there is freedom in tanker size and/or loading assembly then economical evaluation shall be considered for such selections.

2. Loading facilities in the context of the overall distribution system

   The importance of bulk vehicle loading facilities as part of the total distribution complex must be fully realized when plans are made for the construction of new facilities, or the modernization and extension of existing arrangements. It is therefore necessary to examine the operation of the distribution system in order to optimize both its efficiency and the size of the loading facilities.

   The latter are an integral part of the distribution system and should not be studied in isolation; changes in the system and/or operating procedures can have a considerable effect upon vehicle loading requirements. In this context the objective must be to optimize the number of loading bays, and product loading spouts per bay, in relation to the overall distribution system, capital investment and operating expenditure.

   Firstly, the cost of own and Contractor's vehicles should be assessed for the time spent (vehicle standing charges) while:

   - Queuing for a loading bay;
   - Waiting for a loading arm while in the bay;
   - Being loaded in the bay.

Secondly, for existing installations the traffic flow must be studied to establish the present arrival patterns of vehicles at the loading facilities and hence the peak loading periods. The types of delivery such as urban, country, and over long distances, will influence arrival patterns.

Application of simple methods planning techniques to these operations will show whether efficiency can be improved by changes in:

- Working hours;
- Shift patterns;
- Staggered starting times;
- Night loading;
- Dispatching and delivery systems;

The objective being to improve utilization of existing facilities and of the existing road transport fleet.

For new installations the above information may not be available. In such cases an operational system must be established in which the various factors mentioned are carefully considered in relation to practice in the local industry, and in consultation with the designers.

3. Environmental conservation

   a. It is the policy of Oil and Gas industries to conduct their activities in such a way that proper regard is paid to the conservation of the environment. This not only means compliance with the requirements of the relevant legislation, but also constructive measures for the protection of the environment, particularly in respect of avoidance containment of spillages.

   b. Vapor recovery system

      The recovery of product vapors such as gasoline is of interest for economic, safety and environmental reasons. In most locations where bulk lorries are loaded, the total gasoline vapor emissions have not been considered a significant factor affecting the quality of the local environment. Nevertheless, at the design stage, system should be reviewed to see if it becomes necessary to install a vapor collection system return line for poisonous, hazardous and high vapor pressure products. [RVP > 0.34 bar (abs)]

In addition, it is not safe to assume that the presence of a vapor recovery system will ensure a safe atmosphere within the tank truck compartments. When different vapor pressure products are being loaded using a common vapor recovery system, a flammable atmosphere may be introduced into the compartments. Such systems should be carefully reviewed to determine whether this hazard is significant at the particular facility.

However, it is essential to minimize the generation, and hence the emission of vapors during loading by eliminating the free fall of volatile products and reducing jetting and splashing.

In areas where action has been required by National authorities to minimize vapor emissions at loading facilities, bulk vehicles may have to be filled with a closed vapor system; this entails the following modifications to loading arrangements:

i) Top loading

As the majority of loading facilities in service are top loading, the best solution would be to replace (or modify) the existing loading arms so that when volatile products are loaded, the manhole is sealed and vapors are diverted into a vapor return system. The latter may be either integral with the loading arm or a vapor manifold on the vehicle connected to all the tank compartments which would be similar to the system described in (ii) below.

ii) Bottom loading

Bulk vehicles equipped for bottom loading require a pipe connection from the vapor emission vent of each compartment into a vapor recovery manifold, which should terminate in a position which is easily accessible from ground level for use at both the loading bay or retail outlets as required. The coupling connections for liquid and vapor must be different types.

c. Reduction of vapor emissions

Apart from installing a full vapor recovery system, considerable reduction in vapor emissions can be achieved by avoiding free fall and splashing of volatile products in top and bottom filling operations, as follows:

i) Top filling:

The loading arms should be designed to reach the end compartments of a vehicle tank in such a manner that the down pipe can penetrate vertically to the bottom of the compartment.