ENGINEERING STANDARD FOR
PROCESS DESIGN OF
LOADING AND UNLOADING FACILITIES
FOR
ROAD TANKERS

FIRST REVISION
NOVEMBER 2009

بيبیش اول
دی ۱۳۸۸

DEPUTY MINISTER
OF
ENGINEERING & LOCAL MANUFACTURING
RESEARCH & STANDARDS
FOREWORD

The Iranian Petroleum Standards (IPS) reflect the views of the Iranian Ministry of Petroleum and are intended for use in the oil and gas production facilities, oil refineries, chemical and petrochemical plants, gas handling and processing installations and other such facilities.

IPS is based on internationally acceptable standards and includes selections from the items stipulated in the referenced standards. They are also supplemented by additional requirements and/or modifications based on the experience acquired by the Iranian Petroleum Industry and the local market availability. The options which are not specified in the text of the standards are itemized in data sheet/s, so that, the user can select his appropriate preferences therein.

The IPS standards are therefore expected to be sufficiently flexible so that the users can adapt these standards to their requirements. However, they may not cover every requirement of each project. For such cases, an addendum to IPS Standard shall be prepared by the user which elaborates the particular requirements of the user. This addendum together with the relevant IPS shall form the job specification for the specific project or work.

The IPS is reviewed and up-dated approximately every five years. Each standards are subject to amendment or withdrawal, if required, thus the latest edition of IPS shall be applicable

The users of IPS are therefore requested to send their views and comments, including any addendum prepared for particular cases to the following address. These comments and recommendations will be reviewed by the relevant technical committee and in case of approval will be incorporated in the next revision of the standard.

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Email: Standards@nioc.org
General Definitions:
Throughout this Standard the following definitions shall apply.

Company:
Refers to one of the related and/or affiliated companies of the Iranian Ministry of Petroleum such as National Iranian Oil Company, National Iranian Gas Company, and National Petrochemical Company etc.

Purchaser:
Means the “Company” Where this standard is part of direct purchaser order by the “Company”, and the “Contractor” where this Standard is a part of contract documents.

Vendor And Supplier:
Refers to firm or person who will supply and/or fabricate the equipment or material.

Contractor:
Refers to the persons, firm or company whose tender has been accepted by the company.

Executor:
Executor is the party which carries out all or part of construction and/or commissioning for the project.

Inspector:
The Inspector referred to in this Standard is a person/persons or a body appointed in writing by the company for the inspection of fabrication and installation work.

Shall:
Is used where a provision is mandatory.

Should:
Is used where a provision is advisory only.

Will:
Is normally used in connection with the action by the “Company” rather than by a contractor, supplier or vendor.

May:
Is used where a provision is completely discretionary.
ENGINEERING STANDARD

FOR

PROCESS DESIGN OF

LOADING AND UNLOADING FACILITIES

FOR

ROAD TANKERS

FIRST REVISION

NOVEMBER 2009

استاندارد مهندسی

برای

طراحی فرآیندی تاسیسات بارگیری و تخليه

تانکرهای جاده‌ای

ویرایش اول

آبان 1388

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0. INTRODUCTION

"Process Design of Offsite Facilities for OGP Processes" are broad and contain various subjects of paramount importance. Therefore, a group of Process Engineering Standards are prepared to cover this subject. This group includes the following Standards:

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<tr>
<td>IPS-E-PR-360</td>
<td>&quot;Engineering Standard for Process Design of Liquid and Gas Transfer and Storage&quot;</td>
</tr>
<tr>
<td>IPS-E-PR-370</td>
<td>&quot;Engineering Standard for Process Design of Loading &amp; Unloading Facilities for Road Tankers&quot;</td>
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</table>

This Engineering Standard Specification covers:

"PROCESS DESIGN OF LOADING & UNLOADING FACILITIES FOR ROAD TANKERS"

The loading and unloading facilities in the OGP industries vary with the size and complexity of the plant and the location and requirements of the consumers. Because of seasonal and other variations and product distribution, loading facilities shall be quite flexible and its capacity may far exceed normal plant production.
1. SCOPE

This Engineering Standard Specification covers minimum requirements for process design and engineering of loading and unloading facilities for road Tankers in OGP 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 supplements and amendments) applies.

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.

Note 1:

This standard specification is reviewed and updated by the relevant technical committee on July 2004, as amendment No. 1 by circular No. 237.

Note 2:

This bilingual standard is a revised version of the standard specification by the relevant technical committee on Nov 2009, which is issued as revision (1). Revision (0) of the said standard specification is withdrawn.

Note 3:

In case of conflict between Farsi and English languages, English language shall govern.

2. 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- دانه مکربرد

این منصبه استاندارد مهندسی، حداکثر الگام طراحی فرآیندی و مهندسی تأسیسات بارگیری و تخلیه تانکرهای جادهای در صنایع نفت، گاز و پتروشیمی را پوشش میدهد.

لازم بود ذكر است که دانه کاربرد این استاندارد فقط به کاربرد بارگیری و تانکرهای جادهای محدود می‌شود. علاوه بر این در این کتابچه راهنمای، بخش تخمینی به تخلیه مواد باقی‌مانده احتمالی در تانکرهایی که برای بارگیری می‌آیند، محدود می‌باشد.

این کتابچه راهنمای برای انتخاب است که می‌مکن است توسعه یابد تا در نهایت تمام تأسیسات مرتبط با بارگیری و تخلیه فلای و سایل نقلی جادهای، مخزن واقعی و تأسیسات سالیانی برای بارگیری و تخلیه مخزن کشته را پوشش دهد.

یادآوری 1:

این استاندارد در تیر ماه سال 1383 توسط کمیته فنی مربوطه بررسی و مورد تایید شده به عنوان اصلاحیه شماره 1 طی یخشانه شماره 1382 ابلاغ گردید.

یادآوری 2:

این استاندارد در دو زبانه نسخه بانگلایشی شده استاندارد می‌باشد که در آبان ماه سال 1388 توسط کمیته فنی مربوطه انجام و به عنوان ویرایش (1) ارائه می‌گردد. از آن پس ویرایش (0) این استاندارد منسوخ می‌باشد.

یادآوری 3:

در صورت اختلاف بین متن فارسی و انگلیسی، متن انگلیسی ملاک می‌باشد.

2- مراجع

در این استاندارد به آین نامه ها و استانداردهای تاريخ دار و بدون تاريخ اشاره شده است. این مراجع، تا حذی که در این استاندارد مورد استفاده قرار گرفته اند، بخشی از این استاندارد محسوب می‌شوند. در مراجع تاريخ دار و ویرایش گفته شده ملاک عمل بوده و تغییراتی که بعد از تاريخ ویرایش در آنها داده شده است، پس از توقف بین کارفرما و فروشنده قابل اجرا می‌باشد. در مراجع بدون تاريخ، آخرين ویرایش آنها به اتمام کلیه اصلاحات و پیشنهاد آن ملاک عمل می‌باشد.
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"

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"

NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)

NFPA 70 "National Electrical Code"

IPS (IRANIAN PETROLEUM STANDARDS)

IPS-E-GN-100 "Engineering Standard for Units"

IPS-E-PR-170 "Engineering Standard for Process Flow Diagram"

IPS-E-PR-230 "Engineering Standard for Piping & Instrumentation Diagrams (P&IDs)"

NIST HDBK 44* 7th Ed. ,2007

"Specifications, Tolerances, and other Technical Requirements for Weighting and Measuring Devices"

* Text Book
3. DEFINITIONS AND TERMINOLOGY

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

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

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

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

3.5 Loading Facilities
Facilities consist of pumping and filling installations.

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

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

4. SYMBOLS AND ABBREVIATIONS

<table>
<thead>
<tr>
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<th>Description</th>
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<tr>
<td>DN</td>
<td>Diameter Nominal, in (mm).</td>
</tr>
<tr>
<td>dw</td>
<td>Number of working days per week.</td>
</tr>
<tr>
<td>HVP</td>
<td>High Vapor Pressure.</td>
</tr>
<tr>
<td>LNG</td>
<td>Liquefied Natural Gas.</td>
</tr>
<tr>
<td>LPG</td>
<td>Liquefied Petroleum Gas.</td>
</tr>
<tr>
<td>LVP</td>
<td>Low Vapor Pressure.</td>
</tr>
<tr>
<td>nd</td>
<td>Number of truck per spout per day.</td>
</tr>
<tr>
<td>Nd</td>
<td>Total number of trucks per day.</td>
</tr>
<tr>
<td>ni</td>
<td>Number of simultaneous loading.</td>
</tr>
<tr>
<td>Ns</td>
<td>Number of spouts.</td>
</tr>
</tbody>
</table>

DN Diameter Nominal, in (mm).

dw Number of working days per week.

HVP High Vapor Pressure.

LNG Liquefied Natural Gas.

LPG Liquefied Petroleum Gas.

LVP Low Vapor Pressure.

nd Number of truck per spout per day.

Nd Total number of trucks per day.

ni Number of simultaneous loading.

Ns Number of spouts.
OGP Oil, Gas and Petrochemical.

RVP Reid Vapor Pressure.

q₁ Loading capacity per spout, in (m³/h).

Qₐ Average product rate, in (m³/d).

qₚ Product pumping rate, in (m³/h).

t₁ Loading time per truck (filling only), in (min).

Tₐ Total loading time per truck, in (min).

tₜ Working time, hours per day.

Vₐ Average truck capacity, in (m³).

Vₜ Specific truck capacity, in (m³).

5. UNITS

This Standard is based on International System of Units (SI) as per IPS-E-GN-100, except where otherwise specified.

6. TRUCK LOADING AND UNLOADING

6.1 Loading

6.1.1 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

OGP

RVP

q₁

Qₐ

qₚ

t₁

Tₐ

tₜ

Vₐ

Vₜ

5 - واحدها

ابن استاندارد، برنمانی‌های سامانه بین المللی واحدها (SI) متعلق به استاندارد IPS-E-GN-100 می‌باشد، مگر آنکه در متن استاندارد به اعداد دیگری اشاره شده باشد.

6 - بارگیری و تخلیه کامیون

6.1.1 عیمومی

این مشخصه استاندارد ملاحظاتی برای طراحی فرآیند تاسیسات جدید و تاکیدی که به وسیله خودروهای جاده‌ای در تاسیسات متداول برای فرآورده‌های مختلف، محدود شده است. سه فرم دیلی طراحی شده است. به همین دلیل روش‌های نشان داده شده شامل وضعی‌های است که در همه شرایط لازم نیز نشان داده شده. در زمان طرح‌بری تاسیسات جدید، توصیه مشخص که ساده‌ترین تاسیساتی که فراورده را بطور مور و انجام می‌دهند، ساخته شود. این الگوهای همچنین در بهتری و یا توسط تاسیسات بارگیری موجود برای تانکرهای جاده‌ای می توانند مورد استفاده باشند.

تعیین فرآیند بارگیری محتوای سالانه، اندوزه تانکر و اجزای بارگیری ممکن است ثابت در نظر گرفته شود و فرآیند تامین محاسبه شود.

از لحاظ به دید است چنانچه برای اندوزه تانکر و یا اجزای
tanker size and/or loading assembly then economical evaluation shall be considered for such selections.

6.1.2 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;

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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.

6.1.3 Environmental conservation

6.1.3.1 It is the policy of OGP 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.

6.1.3.2 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

- سامانه‌های تحول و ارسال;

هدف به‌هود استفاده از تأسیسات و ناوگان حمل و نقل جاده‌ای موجود می‌باشد.

برای تأسیسات جدید، اطلاعات فوق ممکن است در دسترس نباشد. در جنین‌های مرکزی سامانه عملیاتی ابتدای تأسیس شود که در آن باید به عوامل مختلف زمینه‌ای در ارتباط با تجربه در صحنه محوی و در شورت با طرح، توجه شود.

6-1-1 حفاظت از محیط زیست

6.1-3-1 سیاست صنعتی نفت، گاز و پتروشیمی این است که فعالیت‌ها را در سطح اقتصادی، ایمنی و زیست محیطی می‌باشد. در اثر نافذی که کامپونهای فلزی با شرایط مصرفی کلیاً داخل بخارات دیگری می‌باشد، کل اندازه‌بخارات دیگری می‌باشد و در زیر عمل می‌باشد که گسترش محیط زیست ملی را تحت تأثیر قرار دهد و لازم است که مشخصات در مرجع طراحی فنی شود که آینه لازم است که یک خط بپردازد برای سامانه جمع‌آوری بخار باید به اهداف بیش از 0.34 بر (مطلق) علاوه بر آن، فرض آینه با حضور سامانه‌های بخار، فضای ایمن در داخل بخارهای کامیون وجود خواهد داشت، درست نخواهد بود. زمانی که فرآورده‌هایی با فشار بخار مختلف از طریق سامانه‌های مشترک بخار با کمپونهای می‌باشد، هوای قابل استفاده ممکن است به داخل بخارهای وارد شود. توصیه می‌شود که سامانه‌های یک طندی و نیازهای ایمنی که آینه خطر در آن تاسیسات مخصوص قابل توجه است، به دقت بررسی شود.

با این وجود به حداکثر رسیدن ناپایداری و انتشار بخارات در طول بخارهای با هدف سقوط آزاد محصول‌های فرآوری و کاهش چت شدن و باشندلی لازم است.

در مناطقی که امکان‌های بیش از این به حداکثر رسیدن انتشار
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:

**a) 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 (b) below.

**b) 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.

### 6.1.3.3 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:

#### - 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.

However, the downspout should not rest “full circle” on the bottom. A “T” deflector or a 45-degree bevel should be used on the end of the downspout. If a deflector is used, it should be designed to prevent the downspout from lifting off the tank bottom when flow starts.
- **Bottom filling:**

Bottom loading minimizes the possibility of electrostatic hazards that could result from improper bonding or positioning of the downspout in top loading. However, in the initial stages of bottom loading, upward spraying of the product can increase charge generation and should be prevented by reducing the filling velocity and using a spray deflector or other similar device.

Such measures have the following advantages:

a) Minimizing the hazard of static electricity, see 6.1.4.2;

b) Minimizing the amount of vapor formation;

c) Reducing product losses;

d) Reducing the fire risk: the concentration of vapor emanating from the compartments will be dissipated faster to below the explosive limit.

### 6.1.3.4 Spillage control

The main items to be considered at the loading facilities are provision of:

- Emergency shut-off valve to prevent or reduce spillage due to overfilling, hose failure, etc.;

- Emergency push-button switch to stop the pumps, activate an alarm, and close all flow control and block valves on the island;

- Adequate drainage and interception arrangements.

### 6.1.4 Health and safety

#### 6.1.4.1 General

Loading facilities are labor intensive (because of numbers of driving personnel) and vulnerable because of emission of vapors. It is the most likely source of accidents in a depot and hence particular attention needs to be paid to working conditions.

#### 6.1.4.2 Static electricity

To minimize the hazard of static electricity it is
essential firstly, to ensure that the vehicle tank and loading equipment are at the same potential. This should be arranged by providing a bonding interlock system connecting the vehicle tanks to the downspout, piping or steel loading rack flow-control valves. If bonding is to the rack, the piping, rack, and downspout must be electrically interconnected. Bonding is usually achieved by means of a bond wire. Grounding the loading system (i.e. rack, piping and downspout) in addition to bonding provides no additional protection from electrostatic ignition. Grounding of metallic loading rack components, however, may be necessary for electrical safety. See NFPA 70.

Secondly, maximum safe flow rates in the loading system should be considered (see Clause 6.1.7.3).

6.1.5 Loading systems

6.1.5.1 General

Ideally, the loading system should be able to fill all compartments of the vehicle without needing to move the vehicle. The spacing between loading systems at the loading island should allow the loading arms or hoses to be operated independently, without interference between each other, or meter heads, and with minimum obstruction of access for the operator.

Appendix A Figs. A.1 through A.7, presents typical lay-outs for filling installations and typical gantry arrangements. In Appendix B Figs. B.1, B.2, B.3 and B.4 typical flow schemes for top and bottom loading systems and corresponding drainage are given. Symbols used for these schemes are generally according to IPS-E-PR-170 and IPS-E-PR-230, but some additional compound symbols or schematic ones are given in the above figures and Figs. B.5, B.6 and B.7 for convenience. These symbols are valid only for illustration purposes, if they have some deviations with those accepted standard symbols as indicated in IPS-E-PR-170 and IPS-E-PR-230.

6.1.5.2 Choice of loading system-top or bottom

The first criteria for selection of loading system is the volatility characteristics of the product. If RVP (Reid Vapor Pressure) of the product at

\[
\text{RVP (Reid Vapor Pressure)} \quad \text{of the product at}
\]

ke در مرهجه اول، اطمینان حاصل شود که مخزن خودرو تجهیزات بارگیری، هم پناه‌سازی هستند. این کار با اتصال سامانه به پایین، نیاز به حرکت خودرو و نیز به حرکت پایین، که در صورتی که کل خزان بزرگją روز سکوی فاصله انجام شود اگر بایا مختص باشد، باید لوله کشی و لوله پرکنی از نظر الکتریکی به هم متمرکب شود. اتصال به انتقال از طریق اتصال بزرگی نقش ویژه خواهد داشت. با این حال اتصال به زمین است افزایش پایه بارگیری، ممکن است به وسیله ای نیاز برای لازم باشد. NFPA 70 را بیشتر بدانید.

اثنیا توصیه می‌شود حداکثر میزان جریان اینم در سامانه بارگیری در نظر گرفته شود (بند 6-1-7-3 (را بیشتر بدانید).

5-1-6 سامانه‌های بارگیری

5-1-6-1 عمومی

در حالت آرامی توصیه می‌شود، سامانه بارگیری قادر به پرکردن تمام بخش‌های خودرو بدون نیاز به حرکت خودرو باشد. فاصله کناری سامانه‌های بارگیری در ناحیه بارگیری باید جاری باشد تا باروری بارگیری بر روی بستگی به طور مستقل و بدون تداخل با یکدیگر یا صفحه نشانگر جریان سنج و با هدایت منبع برای دسترسی مختصی واحدهای فعالیت کنند.

یپوت اف، شکل‌های الف-1 تا الف-2 جامعی نمونه برای تأسیسات بارگیری و نمونه جدیدان داریست را ارائه می‌دهند.

در پیوست ب، شکل‌های α-1-β-3 و α-4 نمونه جزئی نمونه برای بارگیری از بالا و پایین و تخلیه مربوط داده شده است. نشانه‌های استفاده شده در این نمونه‌ها عموماً مطلوب یا امضاپذیر، اما برخی نشان‌های ترکیبی یا توصیه‌ای در شکلهای بالا و شکلهای پایین، β-3 و β-2 برای راحتی داده شده. این نشان‌ها فقط به منظور توصیف معتبر هستند مگر اینکه برخی احرازهای با علامت استاندارد پذیرفته شده در IPS-E-PR-230 و IPS-E-PR-170 باشد.

5-1-6-2 انتخاب سامانه‌های بارگیری- بالا یا پایین

لیست معیار برای انتخاب سامانه بارگیری، مشخصات فراپری RVP (فرش پلاستیک یا Reid RVP) محصول می‌باشد، اگر RVP محصول ساختة در 38 درجه اسکال نیستار از 150°C تا (ملق) یا
TABLE 1 - THE RELATIVE MERITS OF TOP AND BOTTOM LOADING

<table>
<thead>
<tr>
<th>Safety Features</th>
<th>BOTTOM LOADING</th>
<th>TOP LOADING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worksite</td>
<td>Ground level</td>
<td>On platform. Can be made safe by provision of guard rails and access ramps to vehicles, but at extra cost.</td>
</tr>
<tr>
<td>Vapor emissions (no vapor recovery)</td>
<td>Closed manhole covers gives rise to small pressure build-up to operate the vents resulting in marginally less vapor emission.</td>
<td>Open manhole covers therefore slightly greater vapor emission.</td>
</tr>
<tr>
<td>Control of product flow assuming meter preset does not work</td>
<td>Reliance on overspill protection equipment.</td>
<td>Positive visual control by loader assuming 'hold-open' valve is correctly used.</td>
</tr>
<tr>
<td>Product handling equipment</td>
<td>Arms and particularly hoses filled with product are heavier to handle. Generally, hose diameters should be limited to DN 80 (3 inches).</td>
<td>Care is needed to ensure that the down-pipe of loading arms is correctly positioned in each compartment. DN 100 and DN 150 (2 and 6 inches) diameter counter-balanced arms are easily handled.</td>
</tr>
<tr>
<td>Electrostatic precautions</td>
<td>Flow rates restricted to 75% of that for equivalent top loading system.</td>
<td></td>
</tr>
</tbody>
</table>

38°C is higher than 0.55 bar (abs) in summer or 0.83 bar (abs) in winter then bottom loading shall be used.

The second aspect is the requirements to restrict emissions from a specific product which dictates to use bottom loading.

Besides above mentioned limitations, the relative merits of top and bottom loading system are summarized in Table 1.

**Note:** The table compares the relative merits of top and bottom loading. The table includes several factors such as safety features, worksite, vapor emissions, control of product flow, product handling equipment, and electrostatic precautions. Each factor is compared between top and bottom loading, highlighting the advantages and disadvantages of each method.
Environmental Conservation

Mلاحظات زیست محیطی

Vapor recovery (loading bay)

پازیافت بخار (دهانه بارگیری)

Vehicles must be fitted with a vapor recovery manifold connecting each compartment; of sufficient capacity to cope with simultaneous loading of 2, 3 or 4 compartments.

Each product loading arm must be fitted with a vapor sealing head so that vapors are diverted into a vapor recovery system; either (a) on loading arm, or (b) manifold provided for gasoline deliveries to retail outlets. Care must be taken to position collar seal in fill opening. Liquid level sensing equipment must be fitted on loading arms or in each vehicle tank compartment.

Vapor recovery (service stations)

پازیافت بخار (ابستگاه کاربری)

Vehicles already equipped with vapor return manifold for use when loading.

Vehicles must be fitted with vapor return manifold.

Performance

کارآی

Preparation for loading (normal)

آماده کردن برای بارگیری (عادی)

Removal of caps and connecting couplings is contained within small operating envelope.

Greater area of operation because of positioning of manhole covers.

NO significant difference between systems.

Preparation for loading (vapor return)

آماده سازی برای بارگیری (پازیافت بخار)

Additional coupling connection to vapor manifold.

Care must be taken to position arm/vapor head in fill opening.

NO significant difference between systems.

Loading arrangement

تنظیم بارگیری

Simultaneous loading of 2 or more compartments more easily arranged.

Product flow rates

میزان جریان محصول

25% slower per compartment than equivalent top handling system because of electrostatic hazard in certain filling operations.

25 درصد کندتر در فرآیند بارگیری از بالای معادل به خاطر خطر الکتروسیمپتیک ساکن در عملیات
## Costs

### Capital Costs

<table>
<thead>
<tr>
<th>Arabic</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>هزینه سرمایه گذاری</td>
<td>1. Approximately 17% more loading space is required than that of an equivalent top- loading gantry. Additional cost for greater roof area.</td>
</tr>
<tr>
<td>1. تقییاً ۱۷ درصد فضای بارگیری بهتری نسبت به دارایی معادل بارگیری از بالا لازم است. هزینه‌های اضافی برای سطوح بیشتر سقف.</td>
<td></td>
</tr>
<tr>
<td>2. i) All vehicle compartments must be fitted with loading dry-break couplings.</td>
<td></td>
</tr>
<tr>
<td>ii) To minimize over-filling risk, vehicles must be fitted with liquid level sensing equipment.</td>
<td></td>
</tr>
<tr>
<td>iii) Deflectors must be fitted to foot valves to minimize jetting and turbulence.</td>
<td></td>
</tr>
<tr>
<td>iv) Additional product handling equipment on islands. Depending upon by group's requirements, this may be about 30-50 more.</td>
<td></td>
</tr>
</tbody>
</table>

### Maintenance Costs

<table>
<thead>
<tr>
<th>Arabic</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>هزینه تعمیرات</td>
<td>The additional equipment above will require to be maintained/replaced. Out-of-service time of vehicles for maintenance may be increased.</td>
</tr>
<tr>
<td>نگهداری اضافی نیاز به تعمیرات و همگام کردن زمان کار نکردن خودرو به جهت تعمیرات ممکن است افزایش یابد.</td>
<td></td>
</tr>
</tbody>
</table>

### Constraints

<table>
<thead>
<tr>
<th>Arabic</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>محفوظیت</td>
<td></td>
</tr>
</tbody>
</table>

### Vehicle accommodation

<table>
<thead>
<tr>
<th>Arabic</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>مكان خودرو</td>
<td>Can more easily accept range of vehicle capacities and heights (present and future).</td>
</tr>
<tr>
<td>به راحتی طیف وسیعی خودروها با طول اندازه و ارتفاعات مختلف می‌تواند (حال و اینده).</td>
<td></td>
</tr>
</tbody>
</table>

### Compatibility with competitors and Contractors vehicles

<table>
<thead>
<tr>
<th>Arabic</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>توانایی با خودروی رفاه و پیمانکار</td>
<td>All vehicles likely to use loading bays must be fitted with suitable equipment. Industry agreement to adopt similar practices should be encouraged.</td>
</tr>
<tr>
<td>تمام خودروهایی که نیاز به اضافه‌کردن دارند باید با تجهیزات مناسب سطح مجزه شوند. توجه می‌شود موانع و اضطرابات ممکن بخشی از محیط عملیاتی است.</td>
<td></td>
</tr>
</tbody>
</table>

### Compartment outlets full or empty

<table>
<thead>
<tr>
<th>Arabic</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>خروجی بی پایا از بخش‌های مخزن</td>
<td>Possible need to persuade authorities to change law to permit outlet pipes filled with product, otherwise drainage must be arranged with consequent measurement and operational problems.</td>
</tr>
<tr>
<td>نیاز احتمالی به متقاعد کردن مسئولان برای تغییر قانون برای اجازه بی پایا لوله‌های خروجی از محصول در غیر این صورت تخلیه به زمان با در نظر گرفتن مشکلات عملیاتی و انداره‌گری پایست انجام شود.</td>
<td></td>
</tr>
</tbody>
</table>

### Sophistication

<table>
<thead>
<tr>
<th>Arabic</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>پیچیدگی</td>
<td>Less flexible operation. Increased need for greater control of maintenance.</td>
</tr>
<tr>
<td>امکانات عملیاتی کمتر، تعمیرات بیشتر. نیازمند به پایین‌تر تعمیرات.</td>
<td></td>
</tr>
</tbody>
</table>

## Bottom Loading

<table>
<thead>
<tr>
<th>Arabic</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>بارگیری از پایین</td>
<td></td>
</tr>
</tbody>
</table>

## Top Loading

<table>
<thead>
<tr>
<th>Arabic</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>بارگیری از بالا</td>
<td>Additional structure and safety equipment for working platform.</td>
</tr>
<tr>
<td>سازه و تجهیزات ایمنی اضافی برای سکوی کار</td>
<td></td>
</tr>
</tbody>
</table>

### More flexible operation.

<table>
<thead>
<tr>
<th>Arabic</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>امکانات یافتنی بیشتر عملیاتی</td>
<td></td>
</tr>
</tbody>
</table>

**Nov. 2009**

**IPS-E-PR-370(1)**
6.1.6 Control system

6.1.6.1 Control of product flow:

a) Filling by volume

Measurement of product volume governs the amount of product filled into each compartment and this is normally arranged by flow through a positive displacement meter.

However, truck loading racks were designed for use with displacement meters, however, technological advances and blending applications have encouraged the introduction of other meter designs such as turbine and Coriolis meters. When retrofitting existing displacement metering systems with turbine and Coriolis meters, care should be taken to ensure proper application of these technologies. At a minimum, to ensure proper operating performance, meters should be installed according to manufacturers’ recommended practices.

Slowing down and stopping the flow is usually controlled by a preset quantity control device which represents the first line of control. In the event of any emergency, e.g., malfunction of the mechanism, or incorrect setting of the preset, etc. the possibility of a spillover occurs, and a second line of control is necessary. Methods of achieving this are as follows:

a.1) Top filling

The fitting of a 'deadman control' in the form of a 'hold-open' valve also enables the operator-when filling through an open manhole-to watch the level of the product and to stop the flow immediately in any emergency. The valve operating lever (or control rod) must be located so that the filler can see the product in the compartments at high level, while avoiding the vapor plume emitted from the manhole. However, the temptation to tie the hold-open valves in the open position, has resulted in spills over.

This factor, together with the necessity for operators to stand on vehicles while fillings, has led to the increasing use of liquid-level control equipment as a positive secondary means of stopping product flow in an emergency.
access the loading rack platform to the top of the truck is usually afforded by ramps, adjustable stairways, or platforms that are hinged to the side of the loading rack platforms and can be swung down to the top of the truck. A handrail should be provided for the safety of truck loaders standing on top of the truck or platform.

a.2) Bottom filling

With all loading operations at ground level, and vehicle manhole covers remaining closed, the use of an overfill protection system based upon liquid-level detection equipment becomes essential. The system shall be equipped with a preset device to shut off the flow of product after a predetermined amount has been metered. Also, an overfill shutdown system shall be provided in case too large a volume is entered into the preset device or the vehicle compartment is not empty immediately before loading starts.

The liquid-level control equipment should be linked to an interlock system which covers bonding of the vehicle, and access to the products by means of controls on the loading arms. This enhances safety and provides the basis for an automatic control system.

b) Filling by mass

Where the weighbridge is positioned at the loading bay, the filling can be controlled by a preset mechanism operating in two stages before cutting off at the total loaded mass. Only one compartment can be loaded at a time with this method. The requirement of secondary protection against overfilling is met:

- For bottom loading; as for (a.2) above.
- For top loading: use of a 'hold-open' type valve on loading arm with operator standing on gantry platform (NOT VEHICLE) in a position to observe compartment being loaded. For single (or large compartments) it may be

zamani ke ladam ast do ya chend besh in yek zam
byoshod, teyiqin kotev sltma maneb he ganowesel tahanie
umali berya besej shenasin mahcoul he shod tonshin
he moshod.

destansin az sikiy bargaquiri be balei kamion mumola
nowast slt-mqqaddar baheya qabil tonshin ya sakooyahi
ke bhe katar sokooy bargaquiri awoir be emkaan yekin
ast, ke mabeinadn be rozi kamion bainin. Toubicie
he moshod tordahay bari aimeni mendingi bokhn kamion ke
rozi kamion bimek estanadast estiheb shod.

al2-f) prakardan az baiyan

in tamam umalehaye bargaquiri in sltma zamin va besh
baqemadenin maderihe arar roxodoro, astanadz az yek
samanin mohafezaat az sar rez praras tujheza tshixin
sltma mabuy azem mibayast, bane samani baya mgheh he welie
besh tonshin berya besej shenasin mahcoul pes az
adaze/yegi mقاد tayyinin shehe baash. Hminin samaniyin qute
in aher sar rez prar haleini he Fam bezar bezagari ward
dastgah be pronimin shehe ya besh makh mhtoror ro barelashe
bale az shour bargaquiri barex naibad, baya teebik shod.

toubicie mishi wesikeyen kotev sltma maneb he samanieh
ka shaman inaale zaminy mhtoror va destansin be mahcoulat ya
tujheza tshixin rozi bargaquiri miasan, melsh
sheh. Ina mowj tonbati inemini sheh va aseas samanieh
kentil xodakar fara vaeha miken.

b) prakardan jaromi

zamani ke sokiya tayd in dahein bargaquiri qor daade shod,
byoshod naxteh sanko berya tonshin, kentil moshod ke
kar sar melhe qobil az besej shenin gol jam bargaquiri sheh
fagheleh mikenin. Ina roorof qofik by besh in ya zamin
mibeinad bargaquiri shod. azamaat mohafezaat tonshin in miqueb
serrez baya mteka:

- baray bargaquiri az baiyan, mteka peyn (al7) bale.
- baray bargaquiri az baiyan; az bale az by kesh simn "barang derad" rooi
baroyi bargaquiri be hemea vand Mejidiy ho royi sokoi
darisat (neh rooyi xodoro) dar weyitvast estanadast he besh
bargaquiri shode ra masheheh kdn, estanadast shod. Baray by
makh mhtoror (bya besh rahi bezeg) aghr aadheh/berknadeni kar
desirable to fit liquid-level control equipment if the driver/loader has other things to do on the loading platform.

6.1.6.2 Automation
6.1.6.2.1 General
An interlock system whereby product will not flow unless and until:

- The vehicle is properly earthed or bonded;
- The loading arm is in its correct position.

Measurement of product flow into vehicle compartments should be through a positive displacement meter. This enables systems to be developed which capture the data for the product and quantity loaded into a specific vehicle which is required to identify itself before product will flow.

6.1.6.2.2 Provision for automation
The basic equipment which must be available on the loading islands comprises:

- An earth interlock system;
- A positive displacement meter with preset unit and/or 2-stage product flow-control valve, at each product loading point;
- A meter pulse unit transmitting per unit volume;
- Means for taking temperature into account, for example:
  - Temperature compensating meters;
  - Thermometer pocket in product lines for measuring temperature by resistance thermometers or temperature recorders.

Cables for transmission of data on product and flow quantities must be run in separate wiring conduits and not in the same conduit carrying power, lighting and control valve cables.

6.1.7 Process design parameters
6.1.7.1 General
The individual factors that contribute to the total cost of loading vehicles are:

- Keps Seroe Sayaatnabash moktanz amez Korden
  - Woesile Kentr Sall Mab Motalab Baash.
- خودکار کردن
  - که:
    - خودرو بطور صحیح اتصال زمین به وصل شود،
    - بارگیری در موقعیت صحیح قرار داشته باشد.
  - توصیه می‌شود انتقال صورت جریان محصول به یک‌سیاهی مخزن خودرو از طریق جریان سنگ جابجا بیش از انجام گیرد. این کار سامانه‌ها را قادر می‌سازد تا طوری توسعه یابند که اطلاعات محصول و مقدار بارگیری به یک خورود مشخص قبل از شروع جریان محصول در صورت نشانایی شود.
- 2-6-1-6-2-2 تهیه‌دادن برای خودکار کردن
  - تجهیزات اساسی که باید در محوطه بارگیری در دستیور باشد عبارتند از:
    - سامانه همیند انصال زمین;
    - جریان سنگ جابجا مثبت یا واحد پیش نظیه و یا/ایا شیر کنترل جریان محصول دو مرحله‌ای در هر نقطه بارگیری قرار دهند;
    - یک جریان سنگ که به ازای هر واحد حجم یک پالس منقل می‌کند;
    - وسیله‌های برای در نظر گرفتن دما مثل:
      • اندامه گیرهای تصحیح کننده دما;
      • چاهک دما سنگ در خطوط محصول برای اندامه گیری دما توسط دماسنجه‌های مقاومتی با نبات دما.
- عوامل طراحی فرآیند
  - عوامل مشخصی که بر هزینه کلی خودروهای بارگیری اثر می‌گذارند عبارتند از:
- The cost of the loading facilities (capital charges for bays, structures, pumps, lines, meters, weighbridges, etc.);

- The cost of vehicle time while occupying the loading bay and while queuing for a loading bay, or waiting for a loading arm while in the bay (vehicle standing charges);

- Vehicle capacities and dimensions;

- Shift patterns, including staggered starts and night loading. In this context the method of operation can be single or double shift patterns, or 24-hour service, or a combination of these.

Having established the likely future pattern of vehicle arrivals during peak hours, the extent and cost of alternative loading methods and loading rates can be determined and costed, and the economic balance obtained between the cost of vehicle queuing delays and the cost of providing extra loading facilities which will reduce or eliminate them.

6.1.7.2 Peak demand

Any loading facility should be designed to meet the forecast loading demand during peak periods. To calculate the facilities required, it is necessary to determine the quantity to be loaded in the peak hour for each product, at the same time establishing the quantities required for each multi-product vehicle loading combination; and to forecast the future peak demands on which the size (number of loading bays) will be based.

After establishing the total number of loading bays, the effect of major sensitivities should be studied, in particular the reduction of loading bays by one (or more) on the waiting time for all vehicles, and vice versa, in order to ensure that an economic optimum for the whole system is chosen.

6.1.7.3 Product flow rates

Flow rates are generally restricted by safety precautions (i.e., prevention of excessive static electricity generation), also the economic size of pumps, pipework and measuring equipment.

As regards safety precautions, concerning static electricity on flow rates, the rate of flow should be limited, and the system designed to prevent static build-up.

- The economic optimum for the whole system is chosen.

- The method of operation can be single or double shift patterns, or 24-hour service, or a combination of these.

- Shift patterns, including staggered starts and night loading.

Having established the likely future pattern of vehicle arrivals during peak hours, the extent and cost of alternative loading methods and loading rates can be determined and costed, and the economic balance obtained between the cost of vehicle queuing delays and the cost of providing extra loading facilities which will reduce or eliminate them.

6.1.7.2 Peak demand

Any loading facility should be designed to meet the forecast loading demand during peak periods. To calculate the facilities required, it is necessary to determine the quantity to be loaded in the peak hour for each product, at the same time establishing the quantities required for each multi-product vehicle loading combination; and to forecast the future peak demands on which the size (number of loading bays) will be based.

After establishing the total number of loading bays, the effect of major sensitivities should be studied, in particular the reduction of loading bays by one (or more) on the waiting time for all vehicles, and vice versa, in order to ensure that an economic optimum for the whole system is chosen.

6.1.7.3 Product flow rates

Flow rates are generally restricted by safety precautions (i.e., prevention of excessive static electricity generation), also the economic size of pumps, pipework and measuring equipment.

As regards safety precautions, concerning static electricity on flow rates, the rate of flow should be limited, and the system designed to prevent static build-up.
6.1.7.4 Simultaneous loading using two or more arms/hoses

Considerable benefit can be achieved by loading a vehicle using two or more loading arms or hoses simultaneously. The additional cost of meters or loading arms, etc. is usually well compensated by the savings from reduced vehicle time in the bay, and in a reduction in the number of loading bays required.

In the case of top loading, the simultaneous use of two or more arms will result in the need for additional equipment to prevent overfilling which may not be necessary for single arm operation. The cost and other consequences arising from such equipment must be taken into account in the economic comparison.

6.1.7.5 Calculation of number of spouts and pumping capacity

a) General

The determination of the optimum number of spouts for loading facilities is important because it directly affects capital costs of the facilities on the one hand, and operating costs of vehicle fleet on the other hand.

Loading rates and the number of spouts required for each product varies with:

1) Truck size,
2) Number of loading hours per day;
3) Number of loading days per week;

TABLE 2 - FLOW RATE LIMITATION FOR STATIC ELECTRICITY

<table>
<thead>
<tr>
<th>PRODUCT محلول</th>
<th>MAXIMUM LOADING RATE, m³/h میزان بارگیری حداکثر</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top loading بارگیری از بالا</td>
<td>DN 80 (3 inches) 108</td>
</tr>
<tr>
<td>Bottom loading بارگیری از پایین</td>
<td>78</td>
</tr>
</tbody>
</table>
4) Time required for positioning, look-up and depositioning of truck; and
5) Size of loading assemblies.

b) Formulation
For formulation and an example see Appendix C in this Standard Specification.

6.1.7.6 Heating for loading arms
When heated pipelines are used, the pipework up to and including the final valve on the loading arm should be heated. Since heating is often required only in cold weather or during start up, it is economical to consider using thermostatically controlled flame/explosion-proof electric heating.

6.1.8 Equipment
6.1.8.1 General
Typical equipment required for a truck loading operation is shown in Fig. 1.

Air eliminators are used to disengage air and other vapors which would affect the accuracy of metering. Disengaging of vapor is done at about 2 bar (ga) and if there is not at least this amount of static head difference between the air eliminator and the loading spout discharge, a back pressure valve must be provided. This may be a swing-type check valve.

Desurgers are installed in some installations to decrease hydraulic shock resulting from quick shut-off. Strainers are provided to keep dirt and other foreign particles out of the meters, which are normally of the positive-displacement recording type. Set stop valves are used to stop product flow automatically at a predetermined position, look-up and depositioning of truck; and
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indicator is usually a pitot venture, and a straight meter run of at least six pipe diameters is recommended when the controller is downstream of a strainer, globe valve, or short-radius elbow. The loading arm is a mass or spring balanced assembly of pipe and swing joints which will reach various points on trucks of a range of heights. A controlled closing loading valve is included in the assembly. This decreases the flow rate rapidly to a small percentage of capacity, after which shut-off is slow to prevent shock.

Fig. 1- TYPICAL SCHEMATIC DIAGRAM OF USUAL EQUIPMENT NEEDED FOR TANK-TRUCK LOADING

شکل 1- نمودار تجهیزات متدال مورد نیاز برای بارگیری مخزن کامیون
Note:
The symbols shown in this figure have only illustration value.

6.1.8.2 Pumps

6.1.8.2.1 Pumps and loading devices shall be sized to provide rates of flow appropriate to the capacity of the facility. A typical product load capacity consists of a low flow start up (to minimize splashing, vaporization and static electricity build-up), a high flow component, and then a low flow component just prior to shutdown to minimize system shock and the chances of overflow.

The valve that controls the load profile depends on sufficient product pressure and flow to operate properly. Extreme care shall be taken to ensure that the rates of flow are such that the operator can follow the course of loading and unloading at all times and have adequate time to shut down the facility before the tank or tanks are emptied completely or before they are filled beyond their maximum filling height.

6.1.8.2.2 Transfer systems shall be designed such that dangerous surge pressures cannot be generated when the flow in either direction is stopped.

6.1.8.2.3 Provision may be made for forced or natural circulation of cold liquid through the loading facility when it is not in service to minimize relief problems and thermal recycling.

6.1.8.2.4 The pumps should have flat head capacity characteristics to provide a reasonably constant discharge pressure under varying delivery and discharge conditions. Usual pump differentials are 2.5 to 3 bars without major changes in static head.

6.1.8.3 Instruments

6.1.8.3.1 Flow indicators

Sight flow indicators are not required for large installations, but they may be desirable in some instances in which small quantities of liquid transfer are involved. However, care must be taken to ensure that such equipment is adequately designed for the pressure to which it may be subjected. Either the flapper type or rotor type is
satisfactory. The flapper type must be properly installed with respect to direction of flow because it also serves as a check valve.

6.1.8.3.2 Pressure gages

Pressure gages shall be located in a sufficient number of places in the liquid and vapor lines to allow the operator to have a constant check on operating pressure, differentials, and so forth to ensure safe operation.

6.1.8.3.3 Emergency shut-off valves

Emergency shut-off valves shall incorporate all of the following means of closing:

1) Automatic shut-off through thermal (fire) actuation. (When fusible elements are used they shall have a melting point not exceeding 120°C.)


3) Manual shut-off at the installed location.

Installation practices for emergency shut-off valves shall include the following considerations:

a) Emergency shut-off valves shall be installed in the transfer line where hose or swivel piping is connected to the fixed piping of the system. Where the flow is only in one direction, a back-flow check valve may be used in place of an emergency shut-off valve if it is installed in the fixed piping downstream of the hose or swivel piping.

b) Emergency shut-off valves shall be installed so that the temperature sensitive element in the thermally actuated shut-off system is not more than 1.5 meters in an unobstructed direct line from the nearest end of the hose or swivel-type piping connected to the line in which the valve is installed.

c) The emergency shut-off valves or back-flow check valves shall be installed in the plant piping so that any break resulting from a pull will occur on the hose or swivel piping side of the connection while retaining intact the valves and piping on the plant side of the connection. This may be accomplished by the use of concrete bulkheads or equivalent

نبست به جهت جریان به درستی نصب شود زیرا به عنوان یک شیر یک طرفه عمل میکند.

6-1-8-3-2 نشانگر فشار

نشانگر فشار باید در تعداد مکان‌های کافی در خطوط مانند و بخار قرار گیرد تا به متغیرهای ازدحام بررسی پیوسته فشار عملیاتی، اختلافها و همچنین اطمینان از عملیات ایمن را بدهد.

6-1-8-3-3 شیرهای قطع اضطراری

شرهای قطع اضطراری باید در تمام روشهای قطع زیر بکار برده شوند:

1) قطع خودکار از طریق تحریک حرارتی (آتش سوزی).

2) قطع دستی از راه دور.

3) قطع دستی از محل نصب.

نصب شیرهای قطع اضطراری باید شامل ملاحظات زیر باشد:

الف) شیرهای قطع اضطراری باید در خط انتقال در جایی نصب شوند که شیلنگ یا لوله کشی گردان به یک سامانه یا لوله کشی ثابت متصل شده است. جایی که جریان یک طرفه است، استفاده از کارایی طرف جریان به جای شیر قطع اضطراری ممکن است، اگر آن در لوله یا کشی ناتین باین دست یک شیلنگ یا لوله کشی گردان نصب شده باشد.

ب) شیرهای قطع اضطراری باید به نحوی نصب شوند که عنصر حس دمای در سامانه قطع تحریک حرارتی فاصله بسیار از 1/5 متر در خط مستقیم بین دو مانع از نزدیک‌ترین انتهای شیلنگ، از اتصال لوله کشی گردن وصل شده به مسیری که شیر روزآ نصب شده است نداشته باشد.

ج) شیرهای قطع اضطراری باید طرفه جریان- پشت ایستاد در لوله کشی و壹 نصب شوند تا در صورت هرگونه شکستگی ناشی از ضرب دیدن شیلنگ‌ها با اتصال بخش جرخه‌دان لوله کشی شیرها و اتصالات لوله کشی سمت واحد سالم باقی بماند. این کار با استفاده از دیوار بتنی با ماهورنده معادل یا با استفاده از اتصالات ضعیف
anchorage or by the use of a weakness or shear fitting.

6.1.8.3.4 Metering equipment used in loading and unloading

When liquid meters are used in determining the volume of liquid being transferred from one container to another, or to or from a pipeline, such and accessory equipment shall be installed in accordance with the procedures stipulated by the API "Manual of Petroleum Measurement Standards", “Loading Rack and Tank Truck Metering Systems” API MPMS, Chapter 6.2.

6.1.8.3.5 Meter proving

The method used for proving loading rack meters (volumetric prover, pipe prover, or master meter) will determine loading rack design requirements. Following factors should be considered when choosing a proving system:

a) Time constraints
b) Truck lane dimensions
c) Number of meters
d) Availability of product return lines

Meter calibration adjustments should be set via electronic or mechanical calibrators so that the meter totalizer will reflect a meter accuracy that is as close to unity as possible and within the tolerances stated in NIST Handbook 44 by local weights and measures authority, or by internal weights requirements.

6.1.8.4 Hoses and arms

6.1.8.4.1 Hoses and arms for transfer shall be suitable for the temperature and pressure conditions encountered. Hoses shall be provided for the service and shall be designed for a bursting pressure of not less than five times the working pressure. The hose working pressure shall be considered as the greater of the maximum pump discharge pressure or the relief valve setting.

6.1.8.4.2 Provisions shall be made for adequately supporting the loading hose and arm. When determining counter masses, ice formation on uninsulated hoses or arms shall be considered.
6.1.8.4.3 Details on hoses for road and rail tankers for some petroleum products are presented in Appendix D.

6.1.8.4.4 Flexible pipe connections shall be capable of withstanding a test pressure of one and one-half times the design pressure for that part of the system.

6.1.8.4.5 Vehicles

Typical bulk road vehicle dimensions for different truck capacities is presented in Appendix E, Figs. E.1, E.2, and E.3 for reference.

6.2 Truck Unloading

6.2.1 General

Many Points which have been referred to under the subject of loading are applied here as well. Furthermore, in the following Section specific reference is made to discharging of some quantities of products possibly remaining in the tanks before loading again and grounding provisions for the tank trucks and underground tanks.

6.2.2 Grounding provisions

Neither the unloading of tank trucks through open domes by means of suction pipes nor closed system unloading from fixed top or bottom outlets require protection against static sparks. However, the receiving vessel may require electrostatic protection, as may the suction pipe in open-dome unloading if the pipe is conductive and not grounded.

Bonding between tank trucks and underground service station tanks during delivery of product to the tanks is not required provided the hose nozzle is maintained in metallic contact with the grounded tank fill pipe or tight connections are used between the hose and the tank fill pipe. If the tank is nonconductive (i.e., fiberglass) supplemental grounding may be required for the fill pipe.

6.2.3 Discharging unloaded products

Vehicles may sometimes return for loading with a quantity of product remaining on board. Attempts should be made to minimize this, and if it occurs, to check the quantity and grade and then to 'load on to'. Where this cannot be done, the product

6.2.4.1 General

Whenever discharges are made to the atmosphere through an open dome or tank outlet, the following precautions shall be taken to minimize any risk of electrical ignition of the tank contents.

6.2.4.2 Bonding and grounding

Bonding and grounding between tank trucks and underground service station tanks during delivery of product to the tanks is required provided the hose nozzle is maintained in metallic contact with the grounded tank fill pipe or tight connections are used between the hose and the tank fill pipe. If the tank is nonconductive (i.e., fiberglass) supplemental grounding may be required for the fill pipe.

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must be offloaded, and tanks, pipelines and pumps provided as required. Offloading facilities should be located at a separate bay to avoid congestion at the loading bays; a typical arrangement is illustrated in Fig. B.3 of Appendix B.

Such facilities can also be used if vehicle flushing and draining is required, or for special grade changing procedures.

Since quantities to be offloaded should be small, offloading rates do not need to be as fast as loading rates, and rates of about 50 to 80 m³/h are usual. With suitable manifolding, the pump used occasionally to pump out product from the offloading tanks may be used to speed offloading from the vehicle; otherwise gravity discharge into an underground tank is acceptable.
Note:
1) The layout of loading facilities and traffic flow should take account of other activities of bulk vehicles, in particular:
   - Bunkering company-owned vehicles.
   - Washing company-owned vehicles
   - Return of product and pump-off
2) Parking of vehicles overnight must not obstruct movement of vehicles in the loading area during night operations.

Fig. A.1- TYPICAL BULK ROAD VEHICLE FILLING INSTALLATION WITH STRAIGHT GANTRIES AND WAITING AREA
A Installations with sufficient throughput need parking space for empty vehicles, to avoid excessive queuing at office or entrance.

B Recommended location for office.

C Necessary only if excessive queuing can occur.

D Any weighbridge to be sited for convenient use by both incoming and outgoing vehicles.

E Installations with a daily capacity exceeding approximately 400 vehicles may benefit from a system to direct traffic to empty gantries.

F May be used if rapid transmission of documents is required.

Notes:
1) The layout of loading facilities and traffic flow should take account of other activities of bulk vehicles, in particular:
   - Bunkering company-owned vehicles.
   - Washing company-owned vehicles
   - Return of product and pump-off

2) Parking of vehicles overnight must not obstruct movement of vehicles in the loading area during night operations

Fig. A.2- TYPICAL BULK ROAD VEHICLE FILLING INSTALLATION WITH STRAIGHT GANTRIES

شکل الف-2 نمودن تاسیسات پرکردن خودرو جادهای فلهای با داریست های مستقیم
A Installations with sufficient throughput need parking space for empty vehicles, to avoid excessive queuing at office or entrance.
B Recommended location for office.
C Necessary only if excessive queuing can occur.
D Any weighbridge to be sited for convenient use by both incoming and outgoing vehicles.
E Installations with a daily capacity exceeding approximately 400 vehicles may benefit from a system to direct traffic to empty gantries.
F May be used if rapid transmission of documents is required.

Notes:
1) The layout of loading facilities and traffic flow should take account of other activities of bulk vehicles, in particular:
   - Bunkering company-owned vehicles
   - Washing company-owned vehicles
   - Return of product and pump-off
2) Parking of vehicles overnight must not obstruct movement of vehicles in the loading area during night operations.

Fig. A.3- TYPICAL BULK ROAD VEHICLE FILLING INSTALLATION WITH ANGLED GANTRIES

شکل الف - 3 نمونه تأسیسات پرکردن خودرو جاده‌ای فلهای با داربسته‌ی زاویه دار
APPENDIX B

TYPICAL LOADING SYSTEMS FLOW SCHEMES

LOADING OF BULK ROAD VEHICLES BY METER-MECHANICALLY CONTROLLED

Notes:

1) Sight glass should be incorporated only where required by local regulations.

2) Flow limiter protects the meter if one pump is used for more than one meter.

3) Multi-purpose solenoid-operated flow-control valve:
   - Protects the meter if one pump is used for...
more than one meter;
- Operated by meter quantity preset control;
- Shuts off product flow if actuated by overfill prevention system;
- Interlocked with bonding of vehicle to loading equipment.

4) Gate valve, block and bleed.
5) Meter test proving point, self-sealing coupling.
6) Valve assists filter draining/cleaning.
7) Relief valve relieves thermal expansion pressure.
8) For black oils:
   a) Air-eliminating equipment is not required.
   b) Loading line equipment including the loading arm may have to be heated.
   c) Boom type arms with hydraulically-operated valves may be required.
LOADING OF BULK ROAD VEHICLES BY METER-AUTOMATICALLY CONTROLLED

Notes:
1) Sight glass should be incorporated only where required by local regulations.

2) Flow limiter protects the meter if one pump is used for more than one meter.

3) Multi-purpose solenoid-operated flow-control valve:
   - Protects the meter if one pump is used for more than one meter;
   - Operated by meter quantity preset control;
   - Shuts off product flow if actuated by overfill prevention system;
   - Interlocked with bonding of vehicle to loading equipment.

پیاده‌وری ها:
1) توییه می‌شود نشانگر شیشه‌ای فقط جایی که توسط قوانین محلی لازم باشد کار رود.
2) در صورت استفاده از یک تلمبه برای بیش از یک جریان سنج، محدود کندن جریان از جریان سنج حفاظت می‌کند.
3) شیر کنترل جریان با عملکرد سلولونی‌دری چند منظوره
   - اگر یک تلمبه برای بیش از یک جریان سنج استفاده شود از جریان سنج حفاظت می‌کند.
   - توسط کنترل مقدار پیش تنظیم عمل می‌کند.
   - اگر توسط سامانه حفاظت‌سازی سرور بیش از حد شود جریان محصول را قطع می‌کند.
   - با اتصال خودرو به تجهیزات بارگیری همیشه است.
4) Gate valve, block and bleed.
5) Meter test proving point, self-sealing coupling.
6) Valve assists filter draining/cleaning.
7) Relief valve relieves thermal expansion pressure.
8) For black oils:
   a) Air-eliminating equipment is not required.
   b) Loading line equipment including the loading arm may have to be heated.
   c) Boom type arms with hydraulically-operated valves may be required.

Fig. B.2- TYPICAL LOADING SYSTEMS
شکل ب-2 نمونه سامانه های بارگیری
Fig. B.3- SCHEME FOR OPEN OUTLETS

TYPICAL PIPELINE COLLECTION SYSTEMS FOR AIR ELIMINATORS

1. instead of a central collecting tank, small individual tanks may be installed on each gantry stand
2. draining on each filters meters and vehicle tanks should be collected in a small tank trolley for eventual disposal by appropriate down grading
3. where common collecting lines are used these should be segregated to high or low flash point products etc.
Fig. B.4- TYPICAL UNDERGROUND VESSEL FOR SLOPS, WITH CLOSED DRAINAGE FLOW SCHEME

شکل ب-4 شماز نمونه مخزن زیرزمینی برای تخلیه زمینی بسته
Articulated loading arm with hold-open hand-operated loading arm valve for white and black oil products.

LONG RANGE BOOM TYPE LOADING ARM WITH DEFLECTOR AND HOLD-OPEN HAND-OPERATED LOADING ARM VALVE FOR WHITE PRODUCTS.

SHORT RANGE BOOM TYPE LOADING ARM FOR BITUMEN WITH HAND-OPERATED LOADING VALVE.

Telescopic loading lance with ball swivel and hand operated loading valve.

Fig. B.5- SYMBOLS FOR BULK ROAD VEHICLE LOADING ARMS (TOP LOADING)
Articulated loading arm with self-sealing coupling.

Boom type articulated loading arm with self-sealing coupling.

Spring balance type hose loader with self-sealing coupling.

Hinged joint type hose loader with self-sealing coupling.

Hose loader with self-sealing coupling.

Fig. B.6- SYMBOLS FOR BULK ROAD VEHICLE LOADING ARMS AND HOSES (BOTTOM LOADING)
Controlled vent
تخليه هوائي كنترل شده

Flow limiter.
محدود كننده جریان

Check valve.
شرير یک طرفه

Flame arrester
شعله گیر

Hose coupling (female half).
جفت كننده شیلنگی (نیمه مادگی)

Hose coupling (male half).
انتصال شیلنگی (نیمه نری)

Slops tundish with hose couplings.
قیف لجن با جفت كننده شیلنگی

Vacuum-breaker valve.
شیر خلاء شکن

Positive displacement meter
fitted with solenoid-operated multi-purpose valve and limit switch.
اندازه گیر جایگاهی مثبت مجهز به شیر چندمنظوره سلنواویدی و کلید محدود کننده

Positive displacement meter
fitted with preset valve and limit switch.
اندازه گیر جایگاهی مثبت مجهز به شیر پیش تنظیم و کلید محدود کننده

Positive displacement meter
with local indicator.
اندازه گیر جایگاهی مثبت با نشانگر محلی

Air-eliminator with automatic air vent and drain valve.
حذف كننده هوای با تخليه خودکار هوای وشير تخليه زمینی.

Ball swivel.
توپی گردنده

Detonation protector.
محافظ انفجار

Fig. B.7- SYMBOLS FOR BULK ROAD VEHICLE LOADING INSTALLATION FLOW SCHEMES
شکل ب- 7 علائم برای نمودار جریانی تاسیسات بارگیری خودرو جاده‌ای فلما ای
APPENDIX C

FORMULATION AND CALCULATION OF PUMP CAPACITY AND NUMBER OF SPOUTS EXAMPLE TO ITEM 6.1.7.5 b

C.1 Formulation

Having $Q_a$ select $V_T$, $q_1$ then $t_p$ (based on truck size) then,

$$ t_1 = \frac{60V_T}{q_1} $$

(Eq. 1)

$$ T_1 = t_1 + t_p $$

(Eq. 2)

$$ n_d = \frac{60}{t_1 + t_p} $$

(Eq. 3)

$$ N_a = \frac{7Q_a}{n_d \cdot V_T \cdot d_w} $$

(Eq. 4)

$$ n_1 \geq \frac{t}{T_1} \cdot N_a $$

(Eq. 5)

$$ q_p = n_1 + q_1 $$

(Eq. 6)

$$ N_d = n_d \times N_a $$

(Eq. 7)

Note:

Above calculations are based on loading of single product, full and even utilization of spouts. This means, the trucks are always available during the working hours. Otherwise distribution of truck arrivals and availability should be considered and correcting factor for both number of spouts and pumping capacity applied. It is reminded that cost of additional investment and operating cost of loading facilities should be balanced against cost of trucks waiting time.

C.2 Example

Assuming:

$Q_a = 1000 \text{ m}^3/\text{d}$;

$d_w = 5$ and 4 hours working time per day;

$$ V_T = 13.2 \text{ m}^3, q_1 = 70 \text{ m}^3/\text{h}, t_p = 10 \text{ min}; $$

$Q_a = 1000 \text{ m}^3/\text{d}$;

$d_w = 5$ and 4 hours working time per day;

$$ V_T = 13.2 \text{ m}^3, q_1 = 70 \text{ m}^3/\text{h}, t_p = 10 \text{ min}; $$
Then:

$$t_1 = \frac{13.2 \times 60}{70} = 12 \text{ min}$$

$$T_1 = 12 + 10 = 22 \text{ min}$$

$$n_d = \frac{4 \times 60}{22} = 10.9 \text{ take 10}$$

$$N_s = \frac{1000 \times 7}{10 \times 13.2 \times 5} = 10.6 \text{ take 11}$$

$$n_1 \geq \frac{12}{22} \times 11 = 6$$

$$Q_o = 6 \times 70 = 420 \text{ m}^3/\text{h}$$

Total No. of trucks loaded/day:

$$N_d = n_d \times N_s = 10 \times 11 = 110$$
APPENDIX D
HOSE SPECIFICATIONS

D.1 Hoses for Road and Rail Tankers for Petroleum Products

D.1.1 Scope

This part specifies requirements for rubber and plastic hoses and assemblies for carrying gasoline, kerosene, fuel and lubricating oils, including aviation fuels with an aromatic hydrocarbon content of not more than 50% at temperature up to 80°C. All types are suitable for use with a vacuum not exceeding 0.5 bar.

D.1.2 Types and classes

D.1.2.1 Types

Hoses are designated as follows.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type A</td>
<td>Rough bore externally armored hose principally for gravity discharge with a maximum working pressure of 3 bar.</td>
</tr>
<tr>
<td>Type AX</td>
<td>Rough bore composite hose principally for gravity discharge with a maximum working pressure of 3 bar.</td>
</tr>
<tr>
<td>Type B</td>
<td>Rough bore externally armored hose with a maximum working pressure of 7 bar.</td>
</tr>
<tr>
<td>Type BX</td>
<td>Rough bore composite hose with a maximum working pressure of 7 bar.</td>
</tr>
<tr>
<td>Type C</td>
<td>Smooth bore hose with smooth or corrugated exterior principally for gravity discharge with a maximum working pressure of 3 bar.</td>
</tr>
<tr>
<td>Type D</td>
<td>Smooth bore hose with smooth or corrugated exterior with a maximum working pressure of 7 bar.</td>
</tr>
</tbody>
</table>
**Type E**

Smooth bore reeling hose with a maximum working pressure of 7 bar.

**Type F**

Smooth bore reeling hose of controlled dilation for metered delivery with a maximum working pressure of 7 bar.

### D.1.2.2 Classes

Types A, AX, B and BX are divided into the following two classes:

- **class 1** for aviation and other uses;
- **class 2** for non-aviation use.

### D.1.2.3 Dimensions and tolerances

#### D.1.2.3.1 Bore

The bore of the hose shall comply with the nominal dimensions and tolerances given in Table D.1 when measured in accordance with BS 5173: Section 101.1.

<table>
<thead>
<tr>
<th>TYPES A, AX, B BX, C AND D</th>
<th>TYPES E AND F</th>
<th>PERMISSIBLE DEVIATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, AX, B, BX, D and C</td>
<td>F and E</td>
<td></td>
</tr>
<tr>
<td>mm</td>
<td>mm</td>
<td>mm</td>
</tr>
<tr>
<td>---</td>
<td>25</td>
<td>± 1.25</td>
</tr>
<tr>
<td>32</td>
<td>32</td>
<td>± 1.25</td>
</tr>
<tr>
<td>38</td>
<td>38</td>
<td>± 1.5</td>
</tr>
<tr>
<td>51</td>
<td>51</td>
<td>± 1.5</td>
</tr>
<tr>
<td>63</td>
<td>---</td>
<td>± 1.5</td>
</tr>
<tr>
<td>76</td>
<td>---</td>
<td>± 2.0</td>
</tr>
<tr>
<td>102</td>
<td>---</td>
<td>± 2.0</td>
</tr>
</tbody>
</table>

### D.1.2.4 Pressure requirements

The maximum working pressure, proof pressure and minimum burst pressure of hoses shall be as given in Table D.2.
### TABLE D.2 - PRESSURE RATINGS

<table>
<thead>
<tr>
<th>PRESSURE</th>
<th>TYPES A, AX AND C</th>
<th>TYPES B, BX, D, E AND F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum Working</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Proof</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>Minimum burst</td>
<td>12</td>
</tr>
</tbody>
</table>

### D.1.2.5 Performance requirements

Besides pressure requirements, the hose shall have resistance to vacuum of up to 0.5 bar. It shall also have sufficient resistance to materials to be handled.

**Note:**
For further details see BS 3492.

پیامد آوری:
برای جزئیات بیشتر BS 3492 را بپیامد.
APPENDIX E

TYPICAL TRUCK DIMENSIONS

Fig. E.1- TYPICAL 38 - TONNES BULK ROAD VEHICLE

شاکل ۵- نمونه خودرو جادهای فلهاي ۳۸ تنی
Fig. E.2 - TYPICAL BULK ROAD VEHICLE WITH TRAILER

Dimensions in meters

48
Fig. E.3- TYPICAL BULK ROAD VEHICLE-16.5 CUBIC METERS CAPACITY

شکل 5- عرب صنعتی و فلزات نمونه - ظرفیت 16/5 متر مکعب