ENGINEERING STANDARD

FOR

DRAIN AND SEWER SYSTEMS OUTSIDE BUILDINGS

FIRST EDITION

NOVEMBER 2013

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 are based on internationally acceptable standards and include 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.

Standards and Research department

No.17, Street14, North kheradmand

Karimkhan Avenue, Tehran, Iran.

Postal Code-1585886851

Tel: 88810459-60 & 66153055

Fax: 88810462

Email: Standards@ nioc.ir

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, National Petrochemical Company and National Iranian Oil Refinery And Distribution Company.

PURCHASER :

Means the “Company" where this standard is a part of direct purchaser order by the “Company”, and the “Contractor” where this Standard is a part of contract document.

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.

CONTENTS: PAGE No.

0. INTRODUCTION

This Engineering standard “SEWERAGE AND SURFACE WATER DRAINAGE SYSTEM” is prepared to be used as a guidance on the planning and design of the said system.

Note:

Use of metric units is obligatory.

1. SCOPE

This engineering Standard is the minimum requirement and sets out general design considerations for predicting the magnitude of peak flows of surface water, generated within an urban area during rainfall plus normal and incidental surface water flows from different sources that finds its way into the surface water drainage system.

Note 1:

This standard specification is reviewed and updated by the relevant technical committee on July. 1998. The approved modifications by T.C. were sent to IPS users as amendment No. 1 by circular No 24 on July. 1998. These modifications are included in the present issue of IPS.

Note 2:

This standard specification is reviewed and updated by the relevant technical committee on Oct. 2006. The approved modifications by T.C. were sent to IPS users as amendment No. 2 by circular No 290 on Oct. 2006. These modifications are included in the present issue of IPS.

Note 3:

This is a revised version of this standard, which is issued as revision (1)-2013. Revision (0)-1993 of the said standard specification is withdrawn.

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.

IPS (IRANIAN PETROLEUM STANDARDS)

IPS-E-CE-390	"Engineering Standard for Rain and Foul Water Drainage of Buildings"
IPS-E-PI-240	"Engineering Standard for Plant Piping Systems"
IPS-M-CE-345	"Material Standard for Water Supply & Sewerage Equipment"
IPS-E-GN-100	"Engineering Standard for Units"
IPS-D-CE-250	"Brick Sanitary Manhole"
IPS-D-CE-251	"Concrete Sanitary Manhole"
IPS-D-CE-252	"Manhole Covers & Frames Heavy Gray Cast Iron 600 Diameters"

BSI (BRITISH STANDARDS INSTITUTION)

BS EN 752: 2008	"Drain and Sewer Systems Outside Buildings"

3. DEFINITIONS AND TERMINOLOGY

For detailed definition and terminology used in the Text See Section 3 of BS EN 752: 2008.

4. UNITS

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

5. DESIGN PRINCIPLES

5.1 General

The basis of the design stage should be the action plan. Design is the process of defining the project in sufficient detail so that instructions can be given to others for the system to be constructed or maintained.

The design process includes the following stages:

- Conception;
- Preliminary topographical, geotechnical and other investigations;
- Preliminary calculations to check the feasibility of the proposed approach;
- Refinement of the general concept;
- More detailed calculations;
- Production of detailed drawings or specifications;

The design process is typically iterative.

Designers should take into account the practicability of safely constructing, operating and maintaining the system.

The design shall fulfil the objectives and meet the functional requirements and the action plan . Specific requirements shall be considered in case of rehabilitation.

Together with the functional requirements the financial and economic aspects of the various options shall also be considered before reaching a decision as to the preferred solution. The above matters shall be considered in terms of their implications on the whole life cost.

5.2 Type of Systems

There are two types of wastewater to be collected and transported by the system; foul wastewater and surface water.

Two options are available as follows:

- Combined system – where both types of wastewater are mixed;
- Separate system – where each type of wastewater is collected and transported in a dedicated sewer;
- Variants of these basic systems are also possible;

The selection of a system will mainly depend upon:

- National or local water management policies;
- Type of system which presently exists and how it is expected to evolve;
- Possible future changes in the catchment;
- Capacity and quality of receiving waters;
- Nature of influents to the system;
- Need for prior treatment;
- Topography;

- Ground characteristics;
- Treatment plant;
- Economic considerations;
- Other local conditions;

5.3 Layout and Profile

The design of the system shall ensure that the layout and profile meets all relevant functional requirements including:

- Maintainability;
- Protection of occupational health and safety;
- Not endangering adjacent structures and utility services;

The layout and profile will be influenced by topography, the character of developments served, existing and future flows from the catchment, the suitability of receiving waters or receiving wastewater treatment plant and the adequacy of any existing system to accept the design flow.

Economical design is usually achieved when drains and sewers follow the natural falls of the ground. Where practicable they should be laid at such gradients as will prevent excessive accumulation of solid matter in the invert. The route shall be selected so as not to impair the stability of structures.

Access chambers should be sited in locations where they can be reached by operator personnel and equipment. Access should also be provided for excavation to repair a sewer, if this were to be necessary. Circumstances can make the pumping of wastewater either necessary or advisable and should be considered alongside the long-term energy commitments and the whole life costs involved.

Positive and negative pressure systems are relatively independent of gradient and the depth of cover. In certain circumstances they are alternatives to, or can form part of, systems operating essentially under gravity.

Where an appropriate sewer is not available and cannot immediately be provided, provision for local treatment of wastewater shall be provided.

5.4 Hydraulic Design

5.4.1 General

The Hydraulic design of the system shall ensure that the design meets all relevant functional requirements including:

- Protection from flooding;
- Maintainability;
- Maintaining the flow;

5.4.2 Foul drains and sewers

The design flows for drains and sewers comprise:

- Domestic wastewater flows;
- Authorised trade effluent flows.

Extraneous water flows may be included in the calculation where these flows cannot be avoided. Design flows should be calculated in accordance with section 9 of BS EN 752: 2008

The hydraulic capacity of the pipelines shall be calculated in accordance with relevant section of BS 752: 2008 Surcharging is undesirable in foul gravity drain and sewer systems. Foul drains and sewers should therefore be designed to run at less than pipe full conditions.

Rising mains shall be designed to carry the required design flows in self-cleansing conditions without using excessive energy. The retention time should also be limited so that septicity does not occur. (See relevant Section of BS EN 752: 2008).

Detailed design of Hydraulic Design of Foul Drains and Sewers is described in Section 9 of BS EN 752: 2008.

5.4.3 Surface water drain and sewers

5.4.3.1 General

Surface water drains and sewers collect and transport runoff generated within a catchment area during rainfall, for safe discharge into a receiving water or treatment plant. The magnitude of peak flows depends on the intensity and duration of rainfall, the size and configuration of impermeable areas and measures taken to reduce surface water. The topography, soil type and its permeability have also to be considered when estimating the flows emanating from other areas.

Surface water drains and sewers are dimensioned in order to limit flooding. It is usually impracticable to avoid flooding from very severe storms. A balance therefore has to be drawn between cost and the political choice of the level of protection provided. The level of protection should be based on a risk assessment of the impact of flooding to persons and property. The level of protection should be specified in performance criteria for flooding frequencies or design storm events used in calculation. The design criteria shall be based on the performance criteria.

The hydraulic capacity of surface water drains and sewers shall limit surcharge to nationally or locally prescribed levels and frequencies taking into account backwater levels.

Surface water drains and sewers shall be designed so that the effect of any flooding caused by storms in excess of the nationally or locally prescribed flooding frequencies causes the minimum of impact to persons and property.

Storage should be provided (e.g. by use of detention tanks and ponds) to minimise the hydraulic impact on receiving waters.

Other techniques can be used to reduce the runoff entering the drain and sewer system either in addition to or as a substitute to the use of drains and sewers. These techniques are based on one or more of the following principles:

- Infiltration systems;
- Minimising the area of impermeable surfaces connected to the drain and sewer system;
- Time lag and attenuation of the flow;

In setting hydraulic design performance criteria for surface water sewers, allowance shall be made for the design methods that are likely to be used. In all cases the scale of the consequences of flooding should be taken into account.

For surface water drains and sewers, design flows for the surface water pipelines will be runoff. No allowance shall be made for any other wastewater component.

5.4.3.2 Surface water inlets

Surface water inlets shall be designed in order to ensure an adequate transfer of runoff from impermeable areas into the surface water drains and sewers.

5.4.3.3 Design criteria

Design criteria shall take into account any changes in flows expected over the design life of the

drain or sewer system if these changes are not otherwise taken into account in the design. The potential effects of climate change should be considered. This is to ensure that the sewer continues to meet the performance criteria over the design life of the system.

The frequency of an event may be expressed either as a return period or a probability of occurrence in any one-year period.

Surcharge frequencies and depths in surface water drains and sewers shall be limited to any nationally or locally prescribed values having regard to:

- Whether there are any connected basements not protected by anti-flooding valves, effluent lifting stations or pumping stations;
- Whether the surcharge is likely to lead to flooding of basements;

Design flooding frequencies should be set in order to manage the risk of flooding, having regard to both the frequency and consequences of flooding.

National or local regulations or the relevant authority can specify design storm frequencies or design flooding frequencies or both. Different design criteria may be set for combined and separate systems.

The designer shall assess risk of flooding in events that exceed the design flood frequency, taking into account both the consequences of the flooding and the frequency. Flow routes for excess flows should be investigated to determine the consequences and where possible, the design should be changed to minimize the impact. Where the risk of flooding cannot be reduced by these means the design frequency should be decreased.

The nature of design criteria will depend on the type of design methods used.

For more information see relevant section of BS EN 752: 2008.

5.4.4 Detailed design of manholes

5.4.4.1 General

For design guidance's refer to relevant section of BS EN 752: 2008 and IPS Standard Drawing No. IPS-D-CE-250, 251, 252.