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Construction and installation of ductile iron pipeline system

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 21052 was prepared by Technical Committee ISO/TC 5, *Ferrous metal pipes and metallic fittings*, Subcommittee SC 2, *Cast iron pipes, fittings and their joints*.

Construction and installation of ductile iron pipeline system

1 Scope

This International Standard specifies the requirements and guidelines for the installation of buried and above ground ductile iron pipeline system conforming to ISO 2531, ISO 7186 and ISO 16631.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final values, observed or calculated, expressing the result of a test or analysis, should be rounded off in accordance with ISO standard. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

2 Normative references

The following referenced documents are referred to in this document. The latest edition of the referenced document (including any amendments) applies.

ISO 2531, *Ductile iron pipes, fittings, accessories and their joints for water applications*

ISO 7186, *Ductile iron products for sewerage applications*

ISO 16631, *Ductile iron pipes, fittings, accessories and their joints compatible with plastic (PVC or PE) piping systems, for water applications and for plastic pipeline connections, repair and replacement*

piping systems, for water applications and for plastic pipeline connections, repair and replacement

ISO 21799, *External corrosion protection system for Ductile iron pipes and fittings*

ISO 10802, *Ductile iron pipelines — Hydrostatic testing after installation*

ISO 10803, *Design method for ductile iron pipes*

ISO 6708, *Pipework components — Definition and selection of DN (nominal size)*

ISO 9001, *Quality management systems — Requirements*

3 Terms and definitions

For the purposes of this document, the definitions in ISO 2531 and the following apply:

3.1
maximum allowable operating pressure(PMA)
maximum internal pressure, including surge, which a component can safely withstand in service

3.2
allowable operating pressure (PFA)
maximum internal pressure, excluding surge, which a component can safely withstand in permanent service

3.3
Allowable site test pressure (PEA)
maximum hydrostatic pressure that a newly installed component can withstand for a relatively short duration, when either fixed above ground level and backfilled underground, in order to measure the integrity and tightness of the pipeline

Note 1 to entry: This test pressure is different from the system test pressure, which is related to the design pressure of the pipeline.

3.4
design pressure(DP)
maximum operating pressure of the system or of pressure zone fixed by the designer considering future developments but excluding surge.

3.5
maximum design pressure (MDP)
maximum operating pressure of the system or of the pressure zone fixed by the designer considering future developments and including surge, where:

3.6
operating pressure (OP)
internal pressure which occurs at a particular time and at a particular point in the water supply system.

3.7
surge
rapid fluctuations of pressures caused by flow alterations over short periods of time.

3.8
system test pressure (STP)
hydrostatic pressure applied to newly laid pipeline in order to ensure its integrity and leak tightness.

3.9
gravity system
system where flow and/or pressure are caused by the force of gravity. There are two kinds of such systems:

— pressurized gravity system, where the pipeline operates full;

— non-pressured gravity system, where the pipeline operates partially full;

3.10
local main
water main which connects principal main(s) with service pipes.

3.11
principal main
water main serving as a principal distributor within the supply area, normally without direct consumer connections

3.12
pumped or gravity system
systems where the gravity system and the pumped system are used, either separately or in combination, to provide the flow and/or pressure.

3.13
service pipe
water pipe which supplies water from the local main to the consumer.

3.14
trunk main
water main which interconnects source(s), treatment works, reservoir(s) and/or supply areas, normally without direct consumer connection(s)

3.15
water distribution system
part of the water supply system comprising pipelines, service reservoirs, pumping stations and other assets by which the water is distributed to the consumers. It begins at the outlet from water treatment works (or source, if there is no treatment) and ends at the point of connection to the consumer's installation.

3.16
accessories
any casting other than a pipe or fitting, which is used in a pipeline

EXAMPLE 1 Glands and bolts for mechanical flexible joints

EXAMPLE 2 Glands, bolts and locking rings or segments for restrained joints

Note 1 to entry: The term accessory is not relevant for valves or hydrants of any type.

3.17
ferrule
component used to connect the service pipe to a main, usually capable of shutting off the flow of water to the service pipe.

3.18
fitting
component, other than pipe, which allows pipeline deviation, change of direction or bore. In addition, flanged socket pieces and collars, couplings are defined as fittings.

3.19
joint
connection between the ends of pipes and/or fittings in which as gasket is used to effect a seal

3.20
valve
component isolating or controlling flow and pressure, e.g. isolating valves, control valve, air release valve, non – return valve, hydrant.

3.21
aggressive soils
soil which could have a corrosion or other adverse effect on a component and which requires special consideration with respect to protective measures.

3.22
nominal laying length
length by which a pipeline progresses when an additional pipe is installed.

4 Occupational safety and health requirements

During the execution of the works local regulations on occupational safety and health should be followed including the instructions of the manufacturer of the pipeline and pipeline components.

5 Requirements for water supply systems

The water quality in the potable water supply system shall satisfy the requirements of the national regulations, where applicable. Such requirements will not be applicable to pipes conforming to ISO 7186.

6 Materials in contact with water intended for human consumption

When used under the conditions for which they are designed, in permanent or in temporary contact with water intended for human consumption, ductile iron pipes, fittings and their joints shall not have detrimental effects on the properties of that water for its intended use.

Ductile iron pipeline systems, including pipes, fittings, accessories and joints, consist of various materials, when used for conveying water intended for human consumption, the materials in contact with the water shall meet the relevant requirements of the national standards or regulations in the country of use with respect to effect on water quality.

7 Input control, transport, handling and storage of pipeline components and inspection

7.1 Input control

Immediately after the arrival of the pipeline and pipeline components including fittings and accessories should be checked for the markings, suitability for the use in the defined project and should be inspected for the followings:

— Deformations or dent

— Cracks

— Damage to the pipe ends

— Damage to the external coating and internal lining

Items requiring repair should be identified and stored separately.

7.2 Transport, handling and storage and inspection of pipeline components

7.2.1 Transport

Following precautions should be taken during transport and handling of pipe and pipeline components:

— suitable support for the pipes should be provided, which should be resistant and durable, with timbers under the lower layers of the pipes as well as between the other layers.

— pipes should be secured at the sides and at the ends to prevent any longitudinal movement, to avoid damage in the event of a lorry or truck suddenly braking.

— no part of the pipes should be unsupported with provision of the wooden props.

— pipes should be kept in balanced condition with two parallel rows of good quality timbers fastened to the floor.

— slings or rubber protected hooks should be used for the loading and unloading of the pipes.

NOTE Wherever applicable, national regulations should be followed.

7.2.2 Handling

Sufficient care shall be taken during handling of the pipe to avoid damage to the pipes, pipe lining and coating. Following general guidelines may be followed for the handling of the pipes

7.2.2.1 Pipes in bundled condition

Pipes shall be lifted with one bundle at a time by a suitable method for example using slings or by use of forklift;

7.2.2.2 Pipes in loose condition

For pipe in loose condition, the pipes should be lifted by use of appropriately shaped hooks coated with rubber or a similar material to avoid damage to the lining and coating. Sufficient care shall be taken to avoid rolling of the pipes, which may cause damage to the pipe lining and coating.

7.2.3 Storage

Storage of pipes at site should be done considering the local national regulation and should follow all the safety norms.

Following precautions should be taken into account, while storing the ductile iron pipes:

— Pipes should be stored so that they do not come in contact with harmful substances like solids, liquids, gases.

— They are therefore also not be stored directly on the ground, but on appropriate materials;-

— Pipes should be protected suitably so that they are not internally contaminated with soil, mud, dirt, water or the like by use of suitable method like end caps;

— Support and stack heights should be chosen so that damage and permanent deformation or damage to the external protection does not occur.

Manufacturer's recommendations should be followed for the storage of pipes. However, in general the suggested methods of storage are described below:

7.2.3.1 Storage of non– bundled pipes: parallel stacking

For storage of non-bundled pipes, parallel stacking method should be used, using wooden battens between rows. Following precautions should be taken for the storage of pipes:

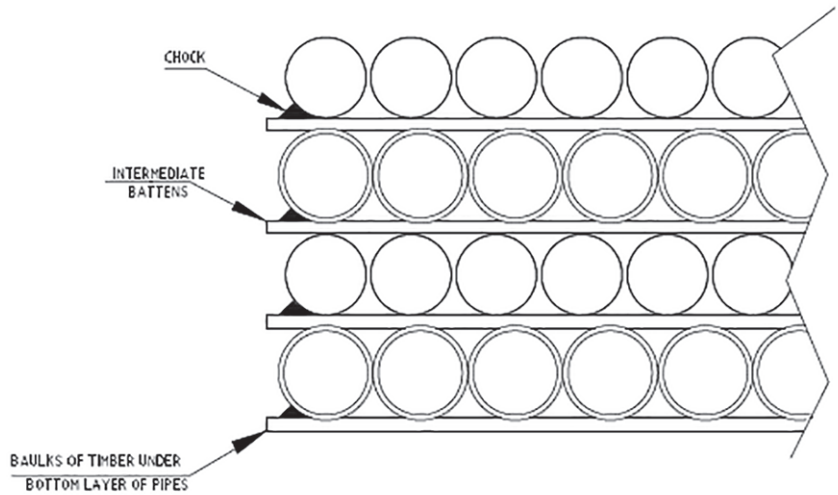

Figure 1 — Parallel stacking of pipes

- stacking area should have a foundation so as to have smooth movement of vehicles and easy access to the top layer;
- pipes should be stacked on wooden battens positioned suitably from each end of the pipe;
- the socket of the pipes in each successive layer should be reversed and the battens should of sufficient thickness to avoid metal to metal contact (Figure 3);
- an adequate number of blocks should be wedged under the outer of pipes of each layer, so as to ensure stability;

7.2.3.2 Storage of non– bundled pipes: pyramid stacking

This method of storing is suggested from the safety point of view and cost of materials used for storing. This method of storage require end lifting of pipes with hooks and a number of pipes can be lifted using multiple hooks.

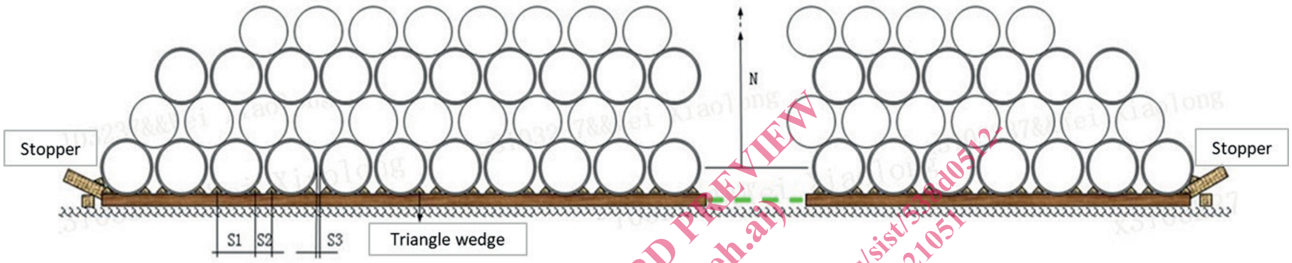

Figure 2 — Pyramid stacking of pipes

The bottom layer is laid on two timbers, arranged in parallel, one being 1 m from the socket end and the other 1 m from the spigot end. The pipes are also parallel with one another. The pipes at the two ends are secured at the sockets and spigots with large wooden wedges nailed to the timbers. Strong stopper shall be used at both ends of bottom layer to avoid stock collapse. Dimensions of S1, S2 and S3 shall be decided to ensure proper socket segregation of pipes in the same tier.

The upper layers consists of pipes laid alternatively, socket to spigot, with the sockets in one tier overhanging the spigots of the pipes in the tier below. All the sockets of one tier overhang the spigots of the tier below by approximately 10 cm, thus avoiding the deformation of the spigots.

7.2.3.3 Storage of non– bundled pipes: square stacking

In this method, in the bottom layer, the tier of first layer is similar to pyramid stacking, but the sockets should be alternatively turned to one side and then to the other side. In addition the sockets should overhang the spigots of adjacent pipes by the whole socket length, plus 5 cm. In the upper layers, each tier consists of parallel pipes, alternating as in the bottom layer. The pipes in one tier are placed perpendicular to the pipes in the tier below. Further, the spigots of the pipes are naturally wedged in by the sockets of the pipes in the tier immediately below. This method keeps packing material to be minimum, but due to the stack formation, implies individual lifting of pipes by their ends.

The maximum number of layers for each size and type of pipes shall be decided based on the consideration of no deformation in the spigot due to load above. It is suggested to follow manufacturer's recommendations. However suggested no of layers for stacking in different methods of stacking is given below:

