Tata Steel Technical Standard

S1930002 Additional requirements for designing oxygen installations

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Information and changes

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Standardization:

Index

1. INTRODUCTION 4
2. SCOPE 5
3. SAFETY 6
4. DESIGN OF OXYGEN SYSTEMS 7
4.1. General 7
4.2. Design data 7
4.3. P&ID 7
4.4. HAZOP 7
4.5. Calculations 7
4.5.1. Process-flow calculation 7
4.5.2. Pipe stress calculation 7
4.5.3. External loads 7
4.6. Pressure rating 8
4.7. Connections 8
4.8. Pipeline route 8
4.9. Utility points 9
4.10. Valve stations 9
4.10.1. General 9
4.10.2. Shielding 9
4.10.3. Service 10
4.11. Blow off and venting facilities 11
4.12. Protection against excessive oxygen concentration 11
4.13. Grounding and Connecting Components 12
4.14. Cathodic protection 12
4.15. Civil structures 12
4.15.1. General 12
4.15.2. Equipment set up in the open air 12
4.15.3. Equipment installed in buildings 12
4.16. Pipe components 13
4.16.1. General 13
4.16.2. Flange connections 13
4.16.3. Curves 13
4.16.4. T pieces and Y pieces 13
4.16.5. Confirmation and support 13
4.17. Valves 14
4.17.1. General 14
4.17.2. Location 14
4.17.3. Safety or quick shut-off valves 14

4.17.4. Hoses & hand lances 14
4.17.5. Commissioning facilities 14
4.18. Buffer tanks 15
4.18.1. General 15
4.18.2. Setup and shielding. 15
4.18.3. Construction and execution 15
4.19. Instrumentation 16
4.19.1. General 16
4.19.2. Connections 16
4.19.3. Measuring leads 16
4.19.4. Manifolds and manual valves. 16
4.19.5. Pressure measurement 16
4.19.6. Temperature measurement 16
4.19.7. Quantity Measurement 16
5. REFERENCES 17
6. DECLARATION 18

1. INTRODUCTION

This Tata Steel Standard is intended as a supplement to Tata Steel Standard S1930001 and sets out requirements for the design of new and to be modified oxygen installations.

2. SCOPE

The scope of this standard concerns installations, installation parts and spaces (e.g. oxygen measuring houses, cable tunnels) that serve for the storage, transport and use of gaseous oxygen and oxygen-air mixtures from 25 volume % oxygen with a pressure ≤ 25 bar(g) and temperatures between - 10 °C and +40 °C.

Applications outside this area will have to be assessed on a case-by-case basis. In these cases, the Oxygen Committee must be contacted, which will issue a binding advice on those special cases.

3. SAFETY

For general safety aspects see Tata Steel Standard S1930001.

Due to the hazardous nature of oxygen, when designing oxygen installations, particular attention must be paid to:

- The accessibility and clarity;
- Shielding the installation against harmful external influences and protecting operating personnel, passers-by and surrounding installations;
- Preventing mix-ups or misconnections with regard to other media;
- The possibility that periodic inspections and purging can take place without risk and with a minimum of time loss;
- Preventing elevated oxygen concentrations in confined spaces or low-lying areas (oxygen is heavier than air);
- The presence of sufficient ventilation options;
- Preventing vortices, pressure surges and temperature increases as much as possible;
- The maximum allowable velocities in connection with the applied pressure and the materials used;
- Preventing the presence of solid particles in the oxygen installation;
- Applying construction materials with reduced ignition risk in those cases where necessary;
- The right choice of sealing and gasket material, as well as lubricants, with a view to non-combustibility;

4. DESIGN OF OXYGEN SYSTEMS

4.1. General

Due to the special properties of oxygen, specific design requirements apply to oxygen systems. To ensure a safe design, all steps listed below must be followed.

Designs of new oxygen installations or the design of changes or repairs to existing oxygen installations should always be submitted to the Oxygen Committee.

4.2. Design data

For oxygen installations on the Tata Steel site, which meet the criteria mentioned in chapter 2, the correct design data must be determined, using Tata Steel Standard S1475001.

If the oxygen installation to be designed does not meet the criteria stated in Chapter 2, the Oxygen Committee must be contacted in order to determine the correct design data.

4.3. P&ID

A process diagram (P&ID) must always be made for a new or modified oxygen system.

4.4. HAZOP

A HAZOP must always be performed on the basis of a new or modified P&ID.

4.5. Calculations

4.5.1. Process-flow calculation

A process flow calculation should always be performed for a new or modified piping system, to verify that the maximum allowable rate of oxygen in the piping system is not exceeded. In addition, the calculation may be necessary to determine the pressure drop across the pipe section.

4.5.2. Pipe stress calculation

If the standard design code is applied (EN 15001-1), a pipe stress calculation is usually not necessary. Such a calculation should only be made if due to special circumstances, such as temperature changes, large expansion or displacement of the pipeline.

4.5.3. External loads

When an underground pipeline system passes a road or railway, a calculation must be carried out for this. In case of an intersection with a normal road, a calculation can be performed in accordance with NEN 3650 with traffic class E600 (600 kN/m^2) according to EN 1433. When the pipeline passes a railway, special load requirements apply in connection with the extremely high loads caused by heavy transport. Depending on the situation, load requirements apply as stated in Tata Steel Guideline R3280501 and the calculation can be carried out in combination with the applied design code.

If the calculation shows that the maximum permissible load is exceeded, a casing pipe can be used. This casing pipe must also be calculated on the basis of the above method.

4.6. Pressure rating

The pressure rating to be applied is at least PN16 at a design pressure <10 bar(g) and PN40 up to a design pressure of 25 bar(g). For higher pressures This applies to all components. In the event of a higher design pressure, consultation must take place with the Oxygen Committee.

4.7. Connections

The basic principle for oxygen systems is that the number of connections is kept to a minimum.

The connections should preferably be made as welded connections.

Flange connections are permitted for appendages and in those cases where this is desired for connection for interchangeable parts (hoses), blowing, cleaning or inspection. Flanged valves are preferred over threaded valves.

Threaded connections may be used up to a maximum diameter of DN25 (1”). Only special oxygen-compatible Teflon tape should be used as sealing material for threaded connections.

Clamp connections may be used up to a maximum diameter of DN15 (1/2”).

4.8. Pipeline route

Oxygen pipelines should never be installed under acid and oil pipelines. In addition, it is undesirable to place oxygen pipelines under pipelines that can condensate (for example cooling water pipes).

The pipes must be placed as far as possible from:

- Pipelines and equipment containing flammable liquids and gases
- Pipelines and equipment operating at high temperatures
- Power cables

If oxygen pipelines are projected in a pipeline route, they should be flanked as much as possible by pipelines with a non-hazardous medium.

Underground pipelines should be kept outside dangerous zones as much as possible.

At intersections with LV or HV power cables, a sufficient distance (0.5 to 1 meter) must be maintained and the pipelines and cables must cross each other at right angles.

Pipelines must be routed into buildings above ground. In those cases where this is not possible, care should be taken to ensure that oxygen from a leaking oxygen pipeline cannot enter the space from below.

When designing piping systems, care should be taken to avoid high velocities and vortices of the oxygen in the pipeline as much as possible. The possibility of accumulation of dust and dirt in stationary pipelines must also be avoided.

Connections for testing and blowing out from oxygen during repairs and inspections must be provided with a blanking device (blind flange, plug).

When designing pipeline networks, the subdivision by means of valves must be such that the periodic removal of solid particles from the pipelines by means of blowing out is possible. Important here is:

- The least possible interruption of the oxygen supply to the consumers
- The presence of closing and blinding facilities;
- The choice of a suitable place for venting, because of dust and noise disturbance as well as gas hazard.

4.9. Utility points

Utility points with hose connections for hand tools in factories and halls on the Tata Steel IJmuiden site must be distinguished from other media by means of clear markings.

The design of the hose connection must be such that incorrect connection of devices for other media is excluded.

For constructive details, see drawings F45846 and F46734.

4.10. Valve stations

4.10.1. General

A valve station must be made for all valves used from DN25 and larger. Valve stations should be designed taking into account fire resistance, avoidance of closed space (pits), shielding of the operating of valves and venting.

4.10.2. Shielding

All valves with a diameter greater than or equal to DN25 in pipes with an operating pressure ≥1 bar(g) must be shielded in such a way that, in the event of an oxygen fire, it is ensured that persons and surrounding installations are protected against the consequences of the fire.

For valves with a diameter from DN25 to DN50, it may be sufficient to use a metal plate for the shield. For valves with a diameter larger than DN50, concrete walls must be installed. For civil details of this type of valve stations see section 4.15

Shielding per system is permitted if valves are present in series in the same pipeline (i.e. multiple valves within the same protected area).

Appendages are here understood to mean all shut-off, control and safety devices with manual valves or remote control, as well as safety valves.

If several oxygen systems are present in the same area, they must be shielded from each other in such a way that maintenance and inspection of a system is possible, without the personnel present being affected by flash fires from other systems.

When entering the space between valves and shielding is necessary for maintenance or inspection, this space shall be provided with at least two exits, preferably diagonally placed, as shown in figures 1 and 2.

These exits and mutual passages must have a minimum width of 700 mm.

The distance from the center of a valve to the hole in the wall for the spindle extension should be approximately 80 cm. With a greater distance, the spindle extension will become too long and the measuring lines to the pressure gauges on the outside of the wall will also become too long.

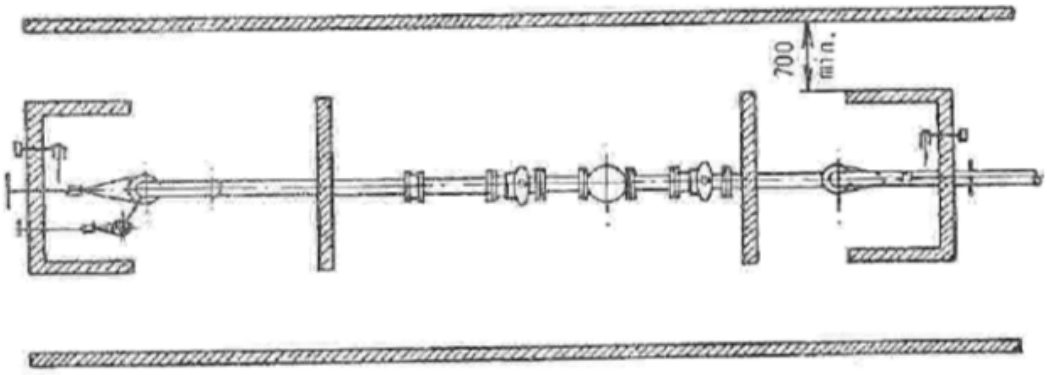

Figure 1 - Shielding of valves (A)

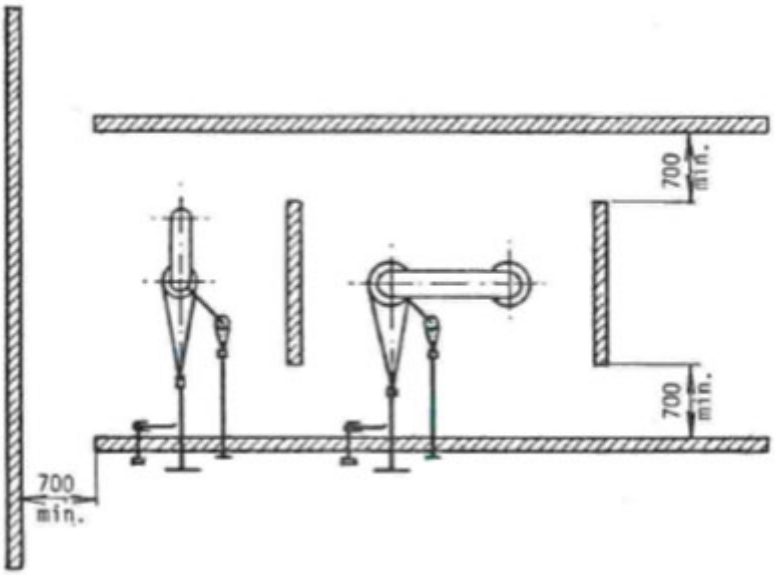

Figure 2 - Shielding of valves (B)

4.10.3. Service

All valves from DN25 must be operable from outside the shield using extension spindles. For examples of extension spindles see drawing 463205.

4.11. Blow off and venting facilities

Blow off and venting facilities may not terminate within 1 meter of buildings. When attaching to the facade, this may be deviated from, provided the oxygen is vented from the building. The distance above ground level must be at least 4 meters. The location of blow-off pipes is shown in figure 4.

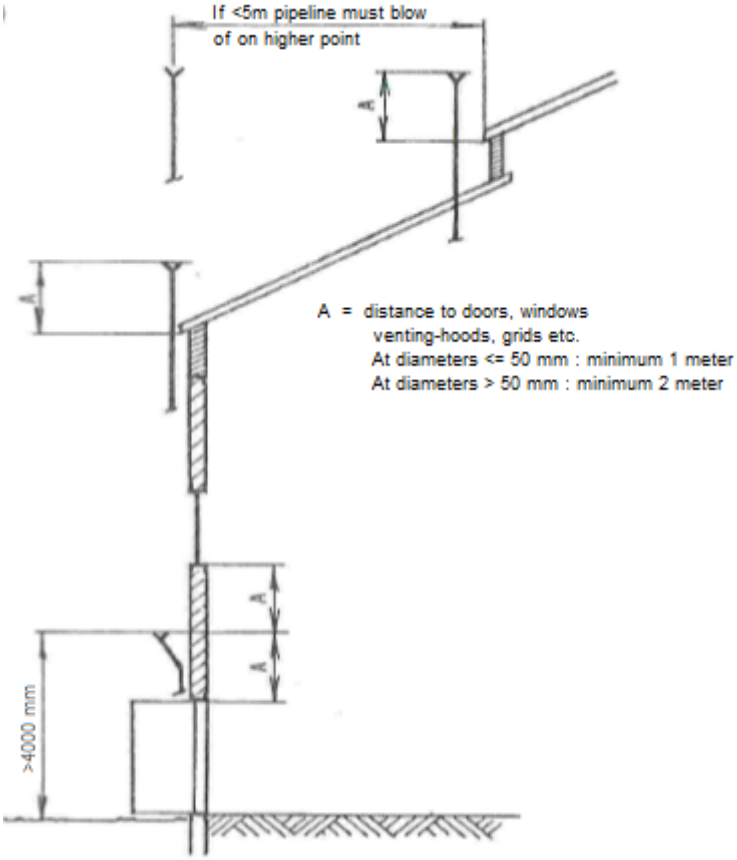

Figure 3 – Location of blow-off pipes

The oxygen must be blown away in an upward direction and further in such a way that persons cannot be hit by the jet. Raining into the vent should be prevented and oxygen should also be prevented from entering sewers or low-lying areas. The above also applies to safety relief pipes.

The blow-off pipeline must be carried out in accordance with drawing F45845 in a banana shape and a minimum diameter of DN50. The blowing direction preferably towards the north-east, to prevent raining in. When an existing blow-off pipeline is replaced, it should also become a banana-shaped blow-off.

4.12. Protection against excessive oxygen concentration

Pipes and equipment may only be located in buildings and enclosed spaces if good ventilation and fire resistance can be sufficiently guaranteed. For further information, reference is made to the civil provisions referred to in this standard.

Measuring and regulating elements and quick shut-off valves must be able to be made pressure-free (per system) by means of a separately installed and shielded block valve.

If the quick shut-off valve also functions as a block valve, the above provision is not necessary.

Oxygen equipment that is not built into main pipes (analysis equipment and transmitters) should preferably be installed separately from the valve or control groups.

4.13. Grounding and Connecting Components

Pipe systems, pressure vessels, etc. must be connected conductively and electrically earthed to avoid electrostatic charging.

Flange connections must be electrically bridged to avoid potential differences. This can be done using an electrostatic flange jumper or stainless steel plate. An electrostatic flange jumper is preferred over a stainless steel plate.

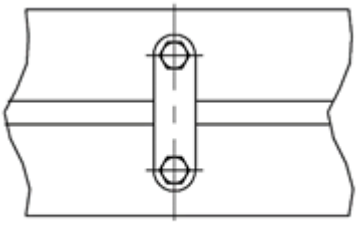

Figure 4 - Example of a stainless steel plate over a pair of flanges

4.14. Cathodic protection

Cathodic protection does not have to be applied to the northern part of the Tata Steel IJmuiden site (north of the Van Deldenweg). In some places on the southern site, the conditions for not having to apply cathodic protection are in principle not met. Tata Steel ensures that cathodic protection does not have to be applied by means of an intensified inspection regime on the underground piping systems.

4.15. Civil structures

4.15.1. General

Oxygen installations can be installed in buildings as well as in the open air. In connection with the risks associated with the use of oxygen, a number of facilities are required in the field of construction.

4.15.2. Equipment set up in the open air

Shut-off valves and measuring and control equipment must be shielded in accordance with the provisions in paragraph 4.10. In general, this will also provide sufficient protection against external mechanical damage (for example collision by vehicles). If necessary, additional measures must be taken against this.

For civil construction details of shieldings see drawing A35000 sheet 540, 545, 550, 555 & 560 (previously 350000 sheet 319 to 323).

The space in and around installations must be kept free of vegetation and combustible substances. The bottom must be finished with non-combustible material, preferably non-porous.

4.15.3. Equipment installed in buildings

Closed spaces such as measurement rooms, containing oxygen equipment ,must be made of non-combustible material. In open spaces, floors and walls nearby oxygen equipment

should be made of non-combustible material.

For shielding installation parts, the in paragraph 4.10 indicate guidelines apply. Buildings, in which oxygen pipelines or equipment are present, must be sufficiently ventilated, taking into account the fact, that oxygen is heavier than air.

Closed spaces, where increased oxygen concentration is possible due to the presence of valves or measuring and control equipment, must be equipped with a forced overpressure ventilation with a capacity of 10 times the volume of the room per hour and an alarm if the ventilation fails.

In buildings or parts thereof, where oxygen equipment is set up, the following provisions must be made:

- There must be more than one exit or access. Doors must be able to be opened from the inside under all circumstances;
- There should be no obstacles between the equipment and the doors;
- The room must be sufficiently lit for the required work and for the visibility of the doors. The light switches should be installed outside the room;
- At least one side of the equipment must have a walking and working area of at least 1 meter width, which is free of obstacles;
- Outside the room there must also be a walkway from the doors of at least 1 meter wide. The escape route must be free of obstacles;
- Floors and walls in the vicinity of an oxygen installation must be closed and flat;
- Water drains to the sewer in the vicinity of oxygen installations must be fitted with a proper water seal with venting.

4.16. Pipe components

4.16.1. General

All pipe components must meet the requirements stated in the pipe spec. For the correct pipe spec see the Tata Steel Cross Index Piping.

4.16.2. Flange connections

The number of flange connections should be kept to a minimum. Flange connections in underground pipes are not allowed. The pressure stage normally depends only on the design pressure and temperature of the system, but for uniformity only pressure stage PN40 is used.

4.16.3. Curves

Steel bends must have a radius of (minimum) 5x the diameter

Stainless steel bends must have a radius of (minimum) 2.5x the diameter

4.16.4. T pieces and Y pieces

T pieces and Y pieces are defined per application by the responsible designer. Y-pieces are in principle not allowed, unless there are very good reasons to use them. In that case, consultation must take place with the Oxygen Committee.

4.16.5. Confirmation and support

Components for support, fastening or suspension may only be attached to these pipes by means of clamps (i.e. not welding). These should preferably be metal cap brackets with a plastic layer between the pipe and the bracket. A point of attention is that no galvanic corrosion can occur between the pipe and the support.

4.17. Valves

4.17.1. General

For functional and qualitative requirements of valves, reference is made to Tata Steel Guideline R1740101. This mainly concerns requirements with regard to material, execution and connection. All valves must be fitted with a correct pressure rating.

The number of valves must be kept to a minimum.

4.17.2. Location

Valves must be installed above ground and, if greater than or equal to DN25, be shielded from the environment.

Manual valves used as block valves should preferably be installed in a vertical pipe section, such that the most common flow direction is from bottom to top.

4.17.3. Safety or quick shut-off valves

Pipelines to installations larger than DN50 must be fitted with a calamity valve outside the installation (possibly outside the building), which can quickly block the oxygen supply in the event of a disaster. This can be a manual valve, but also a controlled quick-closing valve.

These valves must be able to be closed on the spot. In the case of a controlled quick-closing valve, it must also be possible to close it from other logical locations (eg a central panel).

Buffer tanks with a combined volume of >250 m^3 must be able to be separated from the system by means of remotely operated quick shut-off valves.

In the above cases, quick shut-off valves must be used with a closing time of maximum 2 seconds.

4.17.4. Hoses & hand lances

For the material, design and connection of hoses, reference is made to Tata Steel Standard S1930201.

Where oxygen is blown using a hand lance, the lance holder must be made of bronze. The connections of lance, lance holder and hose must be made in such a way that oxygen leakage is excluded.

When using the hand lance, it must be possible to close the oxygen supply in an emergency by means of a quick shut-off valve in the oxygen network.

4.17.5. Commissioning facilities

In order to avoid high speeds, pressure surges and vortices when putting systems in and out of operation as much as possible, manual valves from DN100 and a working pressure ≥1 bar(g) must be provided with a bypass pipe with a DN25 valve according to figure 5.

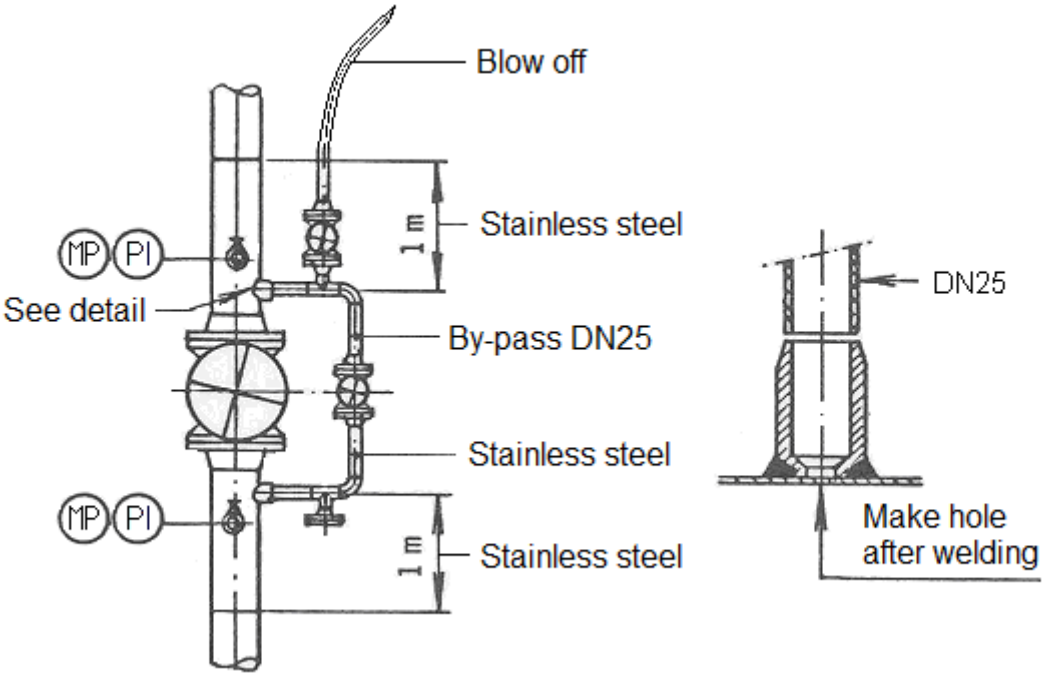

Figure 5 - Bypass pipeline around manual valves

A manometer must be placed on both sides of each valve, which is provided with a bypass pipe. For pipe diameters DN150 and larger, a measuring point must also be installed on both sides of the valve.

In the case of a remotely operated quick shut-off valve, provisions must be provided to prevent the valve from opening in the event of an unbalanced pressure difference across this valve.

4.18. Buffer tanks

4.18.1. General

Buffer tanks with a design pressure greater than 0,5 bar(g) belong to the pressure equipment regime. For requirements see Tata Steel Standard S1300401.

4.18.2. Setup and shielding.

Because a large amount of oxygen under pressure contains great risks, buffer tanks should be installed outside buildings.

4.18.3. Construction and execution

Given the fluctuations in pressure in the oxygen systems, it is necessary to design the tanks not only for static but also for dynamic loads. The expected loads will have to be measured or estimated. Reference is also made to EN 13445.

The number of flanges on the tank must be kept to a minimum to avoid leakage. The buffer tanks must be designed in such a way that the inflowing and outflowing oxygen cannot set the substance deposited on the bottom in motion.

4.19. Instrumentation

4.19.1. General

In general, the same requirements apply to instrumentation installed indoors as well as outdoors that can come into contact with oxygen as for other parts of the installation.

4.19.2. Connections

The requirements as stated in paragraph 4.7 of this standard apply to the construction and implementation of connections.

4.19.3. Measuring leads

Measuring lines must be made of stainless steel.

4.19.4. Manifolds and manual valves.

The material of the valve blocks and manual valves to be used for the instrumentation may only be made of brass, bronze or Monel.

4.19.5. Pressure measurement

A connection for a pressure measurement must be made according to drawing 666907. The material of the connection stubs must be the same as that of the pipe.

4.19.6. Temperature measurement

A connection for a temperature measurement must be made according to drawing 666907. The material of the stubs must be the same as that of the pipe. The protective sleeve for the temperature element must be made of stainless steel. The insertion length depends on the diameter of the pipe and the available standard lengths of the protective sleeve in accordance with DIN 43770/43763. The sealing ring between connection and protective sleeve must be made of annealed copper.

4.19.7. Quantity Measurement

The choice of measuring device is determined by its suitability for measuring in oxygen. The measuring device must be connected to the pipe system by means of a conductor to prevent electrostatic charging.

5. REFERENCES

In this Tata Steel standard reference is made to

Tata Steel standards:

S1300401	Order, execution and inspection for new construction, repair or modification of pressure equipment
S1930001	General rules and regulations for oxygen installations
S1475001	General requirements for determining design code and design/operating conditions of new or to be modified/repaired piping systems
S1930201	Hoses and Couplings

Tata Steel guidelines:

R1740101	Order description closing devices
R3280501	Calculation of underground pipes

Drawings / reports:

463205	Extension spindles for valves
666907	Stubs and valves for pressure and temperature measurements
A35000	Screen walls at valves (page 540, 545, 550, 555 & 560)
F45845	Blow off for gaseous media
F45846	Utility points GA-GZ-LP-WL
F46734	Branches on oxygen pipelines

Other references:

"Umgang mit Sauerstoff", Leaflet M034, Berufsgenossenschaft der Chemischen Industrie, Jedermann-Verlag, latest edition

Bundesanstalt für Materialforschung und -prüfung (BAM)

"Liste der nichtmetallischen Materialien, die von der BAM zum Einsatz in Anlagenteilen für Sauerstoff als geeignet befunden worden sind", latest edition.

DIN 43770, DIN 43763, EN 1433, EN 15001-1, EN 13445, NEN 3650,

6. DECLARATION

Version 1.2:

Logo changed

Version 2.0:

Completely new version