Tata Steel Technical Standard

S1930001 General rules and prescriptions for oxygen installations

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Information and changes

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Standardization:

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1. INTRODUCTION

In Tata Steel Regulations QHSE 1.06 it has been established that all installations for the storage, transport and consumption of oxygen must comply with a number of safety regulations according to national and European standards, supplemented by Tata Steel Standards.

This Tata Steel Standard sets out the requirements for the previously mentioned installations that are not, or not clearly, found in the national and European standards.

The starting point for the design, construction and operation of oxygen installations are a number of Tata Steel Standards specially written for oxygen. These standards are based on the standards NEN-EN 15001-1 and NEN-EN 15001-2, document EIGA IGC Doc 13-20-E and experiences with oxygen installations at Tata Steel IJmuiden.

These and all Tata Steel Standards mentioned in this standard are mandatory to apply. The Technical Guidelines are strong recommendations. Deviation from the Guidelines are only allowed when explicit permission has been given by the Oxygen Committee and this has been formally recorded.

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 and up, with a pressure ≤ 25 barg and temperatures between – 10 °C and +40 °C.

The standard sets requirements for the design, manufacture, operation and maintenance of the previously mentioned installations.

Installations that are connected with or may come into contact with such systems (such as nitrogen or air systems used for purging oxygen systems) also fall partially within the scope of the oxygen standards. In such cases, this only concerns the requirements regarding the cleanliness of the installations.

Within Tata Steel there are a number of special applications for oxygen which are described in appendices A and B. Applications outside the aforementioned scope will have to be assessed on a case-by-case basis. In these cases, the Oxygen Commission must be contacted, which will issue a binding opinion on those special cases.

3. SAFETY

3.1. General

Many materials, including most metals, burn very quickly in an oxygen-rich atmosphere when ignited. Because of this effect, it is extremely important to prevent a fire. Oxygen systems are not subject to ATEX regulations.

See EIGA IGC Doc 13-20-E for comprehensive information on the dangers of oxygen and the fight against oxygen fires.

3.2. Limit on number of components

In an oxygen system, any component can be a hazard. It is therefore essential to keep the number of components as low as possible. By minimizing the number of components, the risk of leakage is also as small as possible. Extra flange pairs to simplify the installation of new piping are therefore not permitted. There are also components that pose great dangers. Examples of this are filters, check valves or valves with a reduced diameter. The installation of such appendages requires permission from the Oxygen Committee.

3.3. Shielding oxygen systems

Oxygen systems should be shielded from the environment as much as possible. Shielding is desirable in particular at the location of appendages and from DN25 upwards it is therefore mandatory to place a shield. For standard shielding see Tata Steel Standard S1930002.

3.4. Venting

The implementation and location of vents must always be coordinated with the responsible designer and responsible asset manager. Safety vents of oxygen should always be located in the open atmosphere in the absence of combustible materials. For execution see Tata Steel Standard S1930002.

4. SYSTEM DESIGN, CHOICE OF COMPONENTS

4.1. General

The design code for oxygen piping is NEN-EN 15001-1. In addition, a number of additional requirements apply, which are described in this and other Tata Steel Standards written for oxygen. These standards are based on the mentioned design code, NEN-EN 15001-2 and EIGA IGC Doc 13-20-E.

Tata Steel Standard S1475001 must be used to determine the correct design temperature and pressure of the oxygen system.

4.2. Allowable speeds

Due to the risks associated with the use of high flow rates in oxygen systems, the flow rate is limited. The stated permitted speeds refer to the maximum speeds occurring during normal operation, maintenance and foreseeable malfunctions. That is, at the highest take-off at the maximum permissible operating pressure. The flow rate is calculated using the average speed over the cross-section of the pipe. The values calculated in this way must not exceed the values in figure 1.

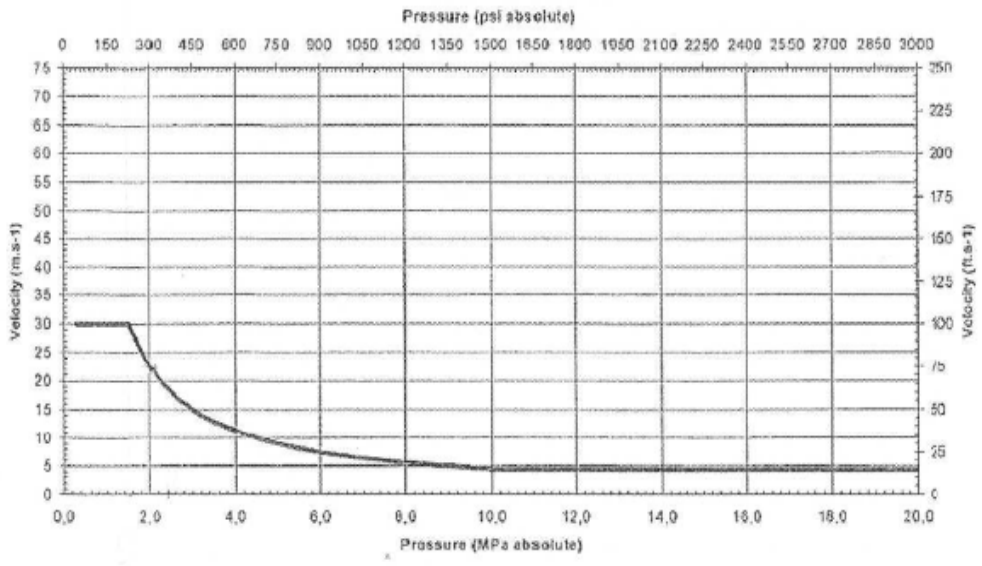

Figure 1 - Maximum permitted flow rates in m/s

Speeds mentioned in figure 1 are allowed in clean and periodically cleaned systems.

The speeds from the table may only be used in steel pipes if the following components are used in these pipes:

- Steel bends with r (radius) ≥ 5xD (diameter)
- Stainless steel bends with r (radius) ≥ 2,5xD (diameter), where the connecting pipework must consist of stainless steel material up to 1 meter away from the bend
- Stainless steel T-pieces (angled, no Y-pieces) with a long “crotch” radius, where the connecting pipework up to 1 meter away from the T-piece must consist of stainless steel material

If the above conditions are not met, the speed should be limited to 5 m/s.

Maximum speed in 20 bar oxygen network : 22,5 m/s
Maximum speed in 8 bar oxygen network : 30,0 m/s

The basic principle for the design of oxygen systems is that the flow velocity should not exceed 20 m/s.

If one wishes to deviate from the prescribed gas speed, one should consult with the Oxygen Committee.

4.3. Material

4.3.1. General

Copper and copper alloys offer the best guarantee against ignition and against continued ignition once started. These materials should therefore preferably be used for appendages.

Stainless steel offers less protection than copper, but has the advantage over (carbon) steel that no rust is formed, which reduces the chance of solid particles in the pipework. The risk of ignition is slightly lower than with steel.

The use of materials of organic origin, other than in seals and hoses, is not permitted due to flammability.

The use of aluminum or aluminum alloys for pipes and fittings is prohibited.

Non-metallic materials may only be used if they have been approved for oxygen by the "Bundesanstalt für Materialforschung und -prüfung (BAM)" and are included in the so-called BAM list (Merkblatt M 034-1): *"Liste der nichtmetallischen Materialien, die von der BAM zum Einsatz in Anlagenteilen für Sauerstoff als geeignet befunden worden sind", latest edition.*

4.3.2. Material pipes and fittings

Both steel and stainless steel can be used as material. Copper and copper alloys are not used for welding reasons. Paragraph **Fout! Verwijzingsbron niet gevonden.** should be consulted for the relationship between pressure in the system, flow rate and material. Pipe sections in which high speeds inevitably will occur (higher than allowed according section **Fout! Verwijzingsbron niet gevonden.**), must be made of stainless steel with a minimum wall thickness of 6.35 mm *). This applies in particular to: drain pipes, vent pipes, bypass pipes and discharge pipes from safety devices.

**) With this wall thickness and maximum design pressure of 25 barg, there are no more speed limits. Stainless steel will then not ignite due to the collision of particles on the wall (particle impingement). The wall thickness is taken from appendix B of EIGA IGC 13-20.*

4.4. Pipework, appendages and other components

4.4.1 Pipework

The choice of material to be applied must be in accordance with the requirements mentioned in paragraph **Fout! Verwijzingsbron niet gevonden.**.

The routing from the pipework should be kept as simple as possible and should be kept as far away from other pipework as possible.

Pipework in gutters and tunnels should be avoided. If this is not possible, the pipework in the gutter or tunnel may not contain any flanges or valves.

The pipe components to be used are specified in pipe specifications. These are mandatory for oxygen applications. Tata Steel Cross Index Piping must be used to determine the correct pipe specification.

4.4.2 Appendages

Only valves, control valves, instruments and other components specially designed for use in oxygen systems and that have been proven to be reliable, may be used.

See the table below for a selection of valves allowed on the Tata site. For the use of valves from another manufacturer, contact must be made with the Oxygen Commission to obtain permission for use. For the purchase of oxygen fittings greater than or equal to DN100, approval must in all cases be obtained from the Oxygen Committee.

Function	Manufacture	Type	Diameter	Pres.rating	Base material
Block valve	Brooksbank	Ball valve	>=DN80	PN40	Monel
	Böhmer *1)	Ball valve	<=DN25	PN40	Bronze/brass
	Habonim	Ball valve	<=DN100	PN40	Bronze
	Red Poort	Ball valve	All diameters	PN40	Monel
	Vinco valves	Ball valve	DN15	PN40	Bronze
	Manfredi *2)	Gate valve	>=DN150	PN40	Bronze
	Shipham *2)	Gate valve	>=DN150	PN40	Bronze
Control valve	Gäbler	quick-closing valve	All diameters	PN40	Bronze
	Hora	Control valve	>=DN150	PN40	Bronze
	Vetec	Quick closing valve/ control valve	All diameters	PN40	Bronze

*1) *Böhmer valves above DN25 are no longer made in bronze*

*2) *Manfredi & Shipham valves can no longer be purchased new.* However, they are still overhauled if possible by the company Severn

4.4.3. Hoses and Couplings

For hoses and couplings see Tata Steel Standard S1930201.

4.4.4. Filters

The use of filters should be avoided. If application is unavoidable, this must be submitted to the Oxygen Committee for approval.

4.4.5. Gaskets

For permitted gaskets on the Tata site see Tata Steel Guideline R1850101. An important requirement for these gaskets is that these must be BAM-certified *3) and are therefore suitable for oxygen applications.

Possible gaskets are:

- Klinger SIL C-4400
- Klinger SIL C-4430
- Frenzelit Novapress UNIVERSAL

Although graphite is permitted according to the BAM, this gasket causes problems when removed, because it will "stick" to the flange and loose particles can end up in the pipe. Therefore graphite based gaskets should not be used.

4.4.6. Lubricants

Only lubricants that are BAM certified *3), may be applied. The use of these agents should be kept to a minimum.

Only permitted for lubricant on bolted connections *4):
Berulub OX 40 EP or Berulub OX 100 EP

**3) BAM-certified does not mean that the gasket or lubricant must be included in the so-called BAM list. It concerns the BAM certificate.*

**4) In the past, Molykote Z was often used at Tata Steel. However, this is expressly <u>not</u> permitted.*

4.5 Design of oxygen systems

For additional requirements for the design of oxygen systems see
Tata Steel Standard S1930002.

5. PRESERVATION & MARKING

5.1. Pipework preservation

An external corrosion protection with high mechanical strength must be applied. For above-ground steel and stainless steel pipes, the type of preservation is given in Tata Steel Standard S3105601. The medium color for oxygen is RAL 5010 (dark blue). There is no obligation to conserve stainless steel pipes. Underground pipes must be provided with an external PE coating, as prescribed in the applicable pipe specification for underground pipes.

5.2. Pipework marking

In addition, all oxygen lines must be clearly marked as such. For marking details see Tata Steel Standard S1768101.

5.3. Oxygen-buffers/storage tanks

Storage tanks up to 10 m^3 must be preserved entirely in medium color (RAL 5010). For larger formats, you can choose to preserve the storage tank in off-white (RAL 1013), with a horizontal blue band (RAL 5010). In all cases, the word “ZUURSTOF” (oxygen) must be marked on the storage tank in white letters. The size of the band and the letters depend on the size and location of the buffer or tank. The type of preservation is specified in Tata Steel Standard S3105601.

5.4. Oxygen stations

5.4.1. Concrete walls

When valves are shielded by concrete walls, these walls should be properly preserved with a general epoxy concrete paint to make it clear that it is an oxygen station. The walls should be preserved in the color RAL 9003 (white). A horizontal blue band (RAL 5010, height 30 cm) must be painted on the outside of the walls at 1.5 meters above the ground. The word “ZUURSTOF” (RAL 1013, text height 20 cm) must be written in this band on all sides of the station in white letters.

5.4.2. Steel/stainless plates

Valves with a diameter of DN25 to DN50 can be shielded using a steel or stainless steel plate. The sheet must be preserved in the medium color (RAL 5010) and the word “ZUURSTOF” must be applied to the sheet in white letters (RAL 1013). The size of the letters depends on the size and location of the plate. The type of preservation is specified in Tata Steel Standard S3105601.

5.4.3. Scheme

At oxygen stations (or other valve groups) a sturdy and weather-resistant diagram (P&ID) should be placed, showing which appendages are in the station and the flow of oxygen.

6. ORDERING, PACKING AND LABELING

6.1. Order specifications

6.1.1. General

The pipe specifications contain the requirements for pipe components and fittings. These are mandatory for oxygen applications. The correct pipe specification can be selected by using Tata Steel Cross Index Piping.

6.1.2. Removing mill scale from carbon steel pipes

The mill scale must be removed by pickling and passivation.

6.2. Packing

The materials, pipes or components must be delivered free of rust and free of oil and grease (see next chapter). Holes and ends of pipes and components must always be properly sealed with blind flanges, metal or plastic caps/plugs during transport and delivery. Sealing with adhesive tape is prohibited.

For details on packaging see Tata Steel Guideline R1740401.

For packaging from hoses see Tata Steel Standard S1930201.

6.3. Labeling

The supplier must clearly label the packaging of all materials and equipment with the text:: "CLEANED FOR OXYGEN SERVICE".

7. REQUIREMENTS FOR CLEANING

Parts that are installed in an oxygen installation must be supplied by the supplier free of oil and grease, with a declaration of purity and provided with a “CLEANED FOR OXYGEN SERVICE” label. Before a part is used, it must be checked whether the declaration of purity is present. If contamination is established or there is doubt about the cleanliness, the part must still be made free of oil and grease. Until installation, the components must be well protected against contamination (seal the pipes/fittings/appendages, packaging valves well).

Before installing the parts, open parts of the existing installation (for example a pipe at the location of a valve to be replaced) should be checked for cleanliness, as much as possible. The parts should be inspected by two methods. The first inspection is a visual check and with the second method you can opt for an inspection with UV light or by means of a so-called “water break test”.

7.1. Visual check with white light

This is the simplest method to detect the presence of dirt or the like. to detect. With this method small particles, dust, oil, grease and moisture can be detected. The parts to be inspected must have a sufficiently bright level of artificial light or natural daylight (≥800 lux).

7.2. Inspection by UV-light

A UV light with a wavelength of about 0,37 µm can be used in a dark environment at a distance of about 10 to 20 cm from the surface to be inspected. Many common but not all hydrocarbons or organic oils fluoresce under UV light. The intensity of the reflection of the different substances is very different. Since not all fabrics fluoresce under UV light, it is impossible to rely solely on the result of this inspection.

7.3. Water break test

Drinking water or distilled water should be sprayed as horizontally as possible on the surface to be inspected. If the amounts of oil or fat are very small, a continuous layer of water will form, which will remain intact for a few seconds. If there are larger amounts of oil or grease on the surface, the water will quickly condense into small droplets.

7.4. Detection limits

Test methods	Quantities to be observed
Visual check with white light	500 - 1700 mg/m2
UV-light	40 - 1500 mg/m2
Water break test	30 - 60 mg/m2

7.5. Acceptance criteria

Maximum allowable amount of foreign matter:

- Oil, grease, cleaning agents, organic substances: < 500 mg/m2;
- No visible rust, welding spatter, particles of dust, fibers or loose parts;
- No visible presence of moisture (no drops, vapor or condensation).

8. INSTALLATION

8.1. General

The installation or construction of oxygen installations is the responsibility of the asset manager of the installation concerned.

The direct supervision of the installation must be carried out by a supervisor who is familiar with the special requirements that are imposed on oxygen installations. He should have practical experience in the installation and maintenance of oxygen installations.

The installation management of Tata Steel must ensure that the company personnel, who will be carrying out the work, will follow the “Working with oxygen” toolbox before the start of the work. The names of these instructed persons must be recorded with the installation management of Tata Steel. Only registered company personnel are allowed to work on oxygen installations for the relevant work.

Tata Steel personnel shall also follow the toolbox and this shall be registered in PeopleLink.

8.2. Safety regulations

When carrying out assembly work on oxygen installations, be aware that contact of oil and grease or other combustible material with oxygen poses great dangers. Furthermore, contaminants such as oil, grease, welding granules and combustible material that have entered the installation can be the cause of fire at a later date.

In view of the above, the following safety regulations must be strictly observed during assembly work:

a) Grease and oil shall not be present in the workplace. The presence of combustible materials, such as paper, wood, cleaning cotton, etc., should be kept to a minimum;
b) Clothing and footwear, tools and hands of all employees involved in the handling, maintenance, assembly, testing and commissioning of an oxygen system must be free of grease and oil;
c) Clothing that has been in contact with oxygen should be aired immediately. Do not come near fire with these clothes;
d) Personnel who perform maintenance on oxygen installations must wear fire-resistant outerwear in cases where oxygen leakage can take place, such as when changing appendages, spades etc. (*Please note: clothing, which partly consists of plastic, can pose a great danger due to static electricity!*)
e) The installation must be completely free of oil, grease and organic cleaning agents during all phases of preparation, assembly, testing, commissioning and maintenance;
f) Contaminants, such as sand and rust, must not enter the installation;
g) The use of fluffing material and wire brushes during cleaning work is not permitted;
h) Smoking and open fires (burning a stove) in the vicinity of oxygen installations are strictly prohibited;
i) Work with spark-forming tools, welding, cutting, grinding, etc., is strictly prohibited in places where increased oxygen concentrations may occur;
j) The use of mobile phone or flashlight is strictly prohibited in places where increased oxygen concentrations may occur;
k) Welding transformers or other power tools must never be grounded via parts of oxygen installations;

l) When entering and while being present in closed spaces, trenches, pits or load tents, it must be determined by means of an oxygen measurement that the air contains between 19 and 23% oxygen;
m) When using nitrogen for flushing or testing an oxygen system, care must be taken to ensure that there is sufficient living air. Everyone should carry a personal oxygen meter;
n) When working with open fire, at least a fire blanket and fire extinguisher must be present;
o) During maintenance work, it must be prevented that corrosion occurs due to water ingress, condensation or moisture from the air;
p) The environment is clean and without obstacles; escape routes are clear and well lit;
q) Work may only be performed by specially trained personnel. This can be met (but not limited to) by following a toolbox “Working with oxygen” specially developed for oxygen applications or comparable training. The toolbox must be followed prior to the work.

8.3. Materials

The supplied pipes, elbows, fittings, appendages and other parts of oxygen installations must comply with this standard.

Materials supplied must be presented to Tata Steel for inspection, if requested by Tata Steel.

Pipes must remain sealed until installation to prevent contaminants from entering, as well as fittings, which must be stored in a tightly closed plastic bag or box in a Tata Steel approved area until installation.

8.4. Precautions against corrosion

During the installation of carbon steel pipes, careful attention should be paid to the formation of corrosion that can be caused by the ingress of water into the system or by condensation of moisture from the atmosphere.

8.5. Underground piping

Tata Steel Standard S1938103 applies for ground work near oxygen installations and oxygen pipes.

8.6. Welding

Welding shall be done according to the design code and Tata Steel Standard S1450401. For NDT percentages of pipework see Tata Steel Standard S1481001.

In addition to this, the following requirements apply:

* Excess of the weld root penetration:
  Within 8xD(iameter) downstream of a valve, the penetration is < 2 mm . For pipe diameters <DN25 this must be <1mm.
* Weld methods:
  Only TIG welding is permitted for the root pass, for all materials and all diameters. For pipelines with a diameter > 50 mm, the filling layers may be performed with electrode or MIG/MAG welding.

The welder(s) may be subject to a welding proficiency test, in which he/she must demonstrate that he/she masters the more stringent requirements for the root pass.

When inspecting the weld, the rules and regulations laid down in Tata Standard S1450401 apply.

Stainless steel shall be welded with backing gas as standard. As a result, new welds no longer need to be pickled and passivated on the inside. This is different with steel. No backing gas is used there as standard. If this is done, pickling and passivation after welding is no longer necessary here either.

8.7. Testing

Before purging and commissioning an oxygen system, the installation must be tested for strength and tightness. The rules and regulations for testing pipework apply here, as stated in the Tata Steel Standard S1474001.

Oxygen lines shall be pressure and leak tested with nitrogen. If this cannot be done, the pressure test procedure must be submitted to the Oxygen Committee for assessment and approval.

8.8. Inspection and final acceptance tests

When installing or modifying oxygen systems, depending on the applicable PED category, usually intermediate inspections and always a final acceptance must be performed by an EU-CBI or NL-CBI (formerly NoBo). Clear agreements about this must be made by the client, the executing party and SPME-PTC-CTY-KDT in mutual consultation.

9. DELIVERY OF OXYGEN INSTALLATIONS

9.1. Cleaning by purging with Nitrogen

After the installation has been completed, the installation must be thoroughly checked and cleaned. The installation must be purged with nitrogen, whereby a gas velocity of at least 30 m/s must be achieved. This should be continued until no more contaminants are present.

If necessary, additional or temporary arrangements should be made to allow for proper blowing out. This prevents dirt from being left behind in bends and dead-end pipe sections.

For equipment that cannot be blown clean (buffers, etc.), a cleaning plan must be drawn up and approved in close consultation with the designer prior to implementation.

9.2. Check for cleanliness

After purging a system as described above, the cleanliness of the system should be checked. The measuring method should be the counting of impacts on a polished copper plate at a gas velocity of 30 m/s. Maximum number of impacts: a maximum of 10 impacts per 10 minutes may be counted on a 25 cm^2 plate. If the image size differs, a proportional number of strikes must be taken as reference.

The course and results of the check for cleanliness must be recorded in writing by the person carrying out the check, whereby at least the name of the inspector, the date and the signature must be reported.

9.3. Preventing of rust formation

After purging, rust should be prevented. This can be achieved by:

- to make the period between testing, cleaning and commissioning as short as possible;
- to ensure that no moisture remains or penetrates into the pipe after purging;
- if the pipe remains unused for a long time, fill it with dry nitrogen.

10. COMMISSIONING, MAINTENANCE AND OPERATION

Tata Steel Standard S1938101 provides the conditions for commissioning, maintenance and operation.

11. INFORMATION

For information regarding procedures and safety regulations, as well as in cases of doubt and in cases not covered by the Tata Steel Standards, the Oxygen Committee should be contacted (See Tata Steel Regulation QHSE 1.06).

12. REFERENCES

In this Tata Steel Standard reference is made to:

Tata Steel Standards

S1450401	Execution and inspection of welding work
S1475001	General Rules for Determining Design Code and design/operating conditions of new or to be modified/repaired piping systems
S1481001	NDT percentages for metal piping
S1768101	The marking of media carriers
S1930002	Additional requirements for designing oxygen installations
S1930201	Hoses and accessories
S1938101	Regulations governing commissioning, maintenance and operation of oxygen installations
S1938103	Regulations for ground work near oxygen equipment and piping
S3105601	Corrosion controle by use of protective coatings

Tata Steel Technical Guidelines

R1850101	Field of application and range of gaskets on the basis of media

Tata Steel Other Documents

Tata Steel Regulation QHSE 1.06 Oxygen systems and the use of oxygen
Tata Steel Cross Index Piping (available on Tata Steel intranet)
Toolbox “Working with oxygen” (available on request from the Oxygen Committee)

Other references:

BAM : Bundesanstalt für Materialforschung und -prüfung

Merkblatt M 034 "Sauerstoff" *1
Merkblatt M 034-1: Liste der nichtmetallischen Materialien
zu Merkblatt M 034 "Sauerstoff" (DGUV Information 213-073) *1
Merkblatt M 034-2: Liste der Armaturen, Schläuche und Anlagenteile
zu Merkblatt M 034 "Sauerstoff" (DGUV Information 213-073) *1

**1: Download at: http://downloadcenter.bgrci.de/shop/bgi/mreihe)*

NEN-EN 15001-1 : Gas infrastructure - Gas installation pipework with an operating pressure greater than 0,5 bar for industrial installations and greater than 5 bar for industrial and non-industrial installations - Part 1: Detailed functional requirements for design, materials, construction, inspection and testing

NEN-EN 15001-2 : Gas infrastructure - Gas installation pipework with an operating pressure greater than 0,5 bar for industrial installations and greater than 5 bar for industrial and non-industrial installations - Part 2: Detailed functional requirements for commissioning, operation and maintenance

EIGA IGC Doc 13-20-E : Oxygen pipeline and piping systems

13. STATEMENT

Version 1.0 and 1.1:

This Corus Standard, together with Corus Standard S1 93 00 02 and the Corus Steel Regulations, Safety, Environment and Energy (Regulation 1.6: Installations for the transport and consumption of oxygen), replaces the Corus Standards:

S1 93 80 01 (May 1984)
S1 93 80 02 (May 1984)
S1 93 80 03 (May 1984)
S1 93 80 05 (May 1991)
S1 93 24 01 (May 1996)
S1 93 82 01 (May 1996)

Version 1.2:
Logo changed

Version1.3:
In chap. 2 the 1st paragraph “vol % oxygen” changed to 41 instead of 35

Version 2.0:
Total revision of the document

14. APPENDIX A: INSTALLATIONS FOR BLAST FURNACE HOT WIND ENRICHMENTS

14.1. General

A special application is the injection of oxygen into the cold wind pipes. The oxygen is injected after the wind machines and before the hot blast stoves. The wind is enriched to a maximum of 41 volume % oxygen. When changing this system, contact must be made at all times with the Oxygen Committee.

14.2. Maximum enrichment, homogeneity of mixture and material of the windpipe

The absence of traces of oil, grease, dirt and rust in the wind pipes cannot be granted. In addition, the temperature in the pipe can rise to 260 ºC. For these reasons, enrichment of the wind to a total oxygen percentage of more than 41 volume % oxygen is not allowed.

Enrichment above 41 vol. % oxygen requires special attention. Due to the specific nature of the wind enrichment systems, this Tata Steel Standard is not applicable for enrichments above 41 vol. % oxygen.

In all cases, pure or incomplete mixed oxygen/wind mixtures must be prevented from coming into contact with the wall of the pipe or with obstacles such as valves and valves. To this end, the system must be designed in such a way that sufficient mixing can take place. This must be demonstrated at the design stage of the system and when changes are made to the system.

14.3. Installation safety

To prevent oxygen from leaking into the wind pipe or from wind getting into the oxygen system, the oxygen supply must be equipped with a remote-controlled double block and bleed system. The system should be activated when:

* the available oxygen pressure is lower than the working pressure
* there is no wind supply
* the oxygen/wind ratio exceeds a certain allowed value
* unwanted unsafe situations occur

It must be possible to shut off the oxygen supply from a blast furnace control room and from the wind machine hall (Central 2).

The oxygen percentage in the wind should be continuously monitored with a 2-out-3 performed oxygen analysis measurement. The measurements give a maximum alarm and are part of a maximum protection system.

15. APPENDIX B: INSTALLATIONS FOR OXYGEN SUPPLY TO CONVERTERS

15.1. General

At the Oxygen Steel Plant, oxygen is blown into the converters through lances. Due to the high oxygen pressure (~20 bar) and large amounts of oxygen, this is an installation where safety must be monitored very well.

The oxygen piping system to the converter is also used for nitrogen slag spatter. The nitrogen supply is linked to the oxygen system via a double block and bleed system and it is of the utmost importance that the ingress of oxygen into the nitrogen system and vice versa is prevented.

When changing the above systems, at all times contact must be made with the Oxygen Committee.

15.2. Installation safety

The oxygen supply (and nitrogen supply in case of slag spatter) to the converter must be stopped within a few seconds per lance by means of a quick shut-off valve.

This quick shut-off valve should preferably be fitted downstream of control valve. The quick shut-off valve must be designed in such a way that it closes when its control medium fails.

The quick shut-off valve must not be opened until the control valve is closed.

If there are more lances per converter, such provisions must be made that only the lance that is in operation can be blown.

The quick shut-off valve should close automatically when:

- hoisting the lance;
- the occurrence from velocities in the feed system to the nozzle, which are higher than those prescribed in this standard;
- hose failure;
- other unwanted unsafe situations.

In all these cases, a report must be made of the activation of the system and a feedback of the closing position of the valve, as well as an alarm in the event of non-closing.

By means of a proper design it must be impossible to have oxygen from a main control line and a possible heating control line in operation simultaneously. Simultaneous operation of the nitrogen slag spatter system and the main control line or heating control line must also not be possible.

The converter control room must provide the option of shutting off the quick shut-off valves in the total oxygen supply to the factory network and depressurizing the network.