

Employer  
**SAKO BRNO A.S.**

Project  
**High-efficient combined heat and power facility utilizing renewable sources (OHB  
II - line K1)**

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# **PART III, APPENDIX 14.10**

## **STANDARD FOR STAIRCASES AND GALLERIES**



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Project name **High-efficient combined heat and power facility utilizing renewable sources  
(OHB II - line K1)**

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## SUPPLEMENTS

Annex 1     Stairs, Ladders and platforms

## 1. GENERAL

This specification provides requirements for the design of staircases and galleries.

These conditions and descriptions cover the Contract Objects and are only valid for in-door constructions. Out-door constructions are covered by other conditions, which can be delivered by the Employer.

The purpose of this document is:

- To reassure homogeneity in the execution and appearance of supplies from different Subcontractors.
- To clarify delivery limits.

Please also refer to the general conditions for structural data in appendix C *Reviewable Project and Design Data*.

## 2. CODES OF PRACTICE, STANDARDS AND OTHER REQUIREMENTS

All staircases and galleries shall, unless otherwise stated in the technical conditions, be in accordance with the following:

- EN ISO 14122 (part 1-4) "Safety of machinery - Permanent means of access to machinery"
- EN ISO 7010 (Safety Signs)
- EN 1090-2 "Execution of steel structures and aluminium structures – Part 2: technical requirements for steel structures."

### 3. DESIGN BASIS

#### 3.1 General, Materials, etc.

Staircases and Galleries shall be designed and installed according to the latest issue of EN ISO 14122, part 1-4 and local and national standards.

The execution and appearance of the staircases and galleries from Contractor and its Subcontractors shall be homogeneous and subject to approval by the Employer.

Staircases, galleries and working areas on the Line shall be designed to minimise the risk of personal injury. Locations with an elevated risk for personal injury including traffic routes shall be marked with signage to meet requirements of the latest issue of ISO 7010 (Safety signs). Areas which might pose an elevated risk for personal injury shall at all times be presented to the Employer for the Employer's written approval.

All steel equipment shall be made in steel quality S235JRG2 in accordance with the latest issue of EN 10250 or better.

All bolts shall be made in bolt quality 8.8 in accordance with ISO 898 or DIN 931. Bolt dimensions shall be at least M16, however at least M12 for steps.

All staircases, galleries and ladders shall be supported directly on equipment, equipment steel structure or plinths on concrete floor. It is not acceptable, to support the equipment on the protective building screen or its supports and the Contractor shall establish separate structural supports for staircases, galleries, and ladders to avoid this where necessary.

#### 3.2 Clear Headroom

A clear headroom of at least 2.5 m shall be provided in the entire Line. However, a clear headroom in staircases shall be minimum 2.3 m (measured vertically). Where needed additional headroom must be reserved in order to ensure easy maintenance of the Line.

#### 3.3 Staircases

Staircases shall be designed according to EN ISO 14122 and include slip resistant nosing.

##### Materials

Steps	Gratings with a quadratic mesh of max mesh size of 15 mm x 15 mm (Ø15mm ball proof) hot dip galvanized
Bearers / strings	PL 10 x 200
Stanchions	Ø 42.4 mm pipe
Handrails	Ø 42.4 mm pipe
Knee rails	Ø 33.7 mm pipe
Toe plate	None (except those described below)
Toe plate (intermediate platforms / landings, and bottom step only)	8 x min. 110 mm plate

Stanchions shall be mounted on bearers vertically to horizontal plan, including staircase strings.

Railings shall be designed continuously or exceptionally in sections according to agreement with the Employer.

All staircase strings shall be equipped with hand rails.

All staircase steps shall be designed without toe plates, except for bottom steps level with gangways, platforms or landings.

The free stair width shall be at least 1000 mm for ordinary and escape routes.

Flights of stairs shall be designed with a uniform inclination of 38 degrees from the horizontal. Any deviation from this condition shall be approved by the Employer.

Where stairs constitute a part of an escape route, it is a precondition that the regulatory and insurance requirements are complied with.

Steps and landings shall be delivered as press gratings or welded gratings built up of support and filler bars.

Handrails shall be designed continuously as welded pipe rails with hand and knee rails. Open pipe ends shall be closed with bottom welding-in, and all welds shall be cleaned and made smooth.

Intermediate platforms are necessary for stairs with more than 15 steps or which are higher than 3 m. The platform shall be at least 1000 mm long and must be at least as wide as or larger than the tread width of the step. Free space of size at least 1000 mm x 1000 mm shall be provided in front of the staircase on the top level and the bottom level.

### **3.4 Galleries (including landings and gangways)**

The gallery floor (grating) shall have a smooth surface without projecting edges.

Landings and gangways are included in galleries as well.

Bearers / strings and edge steel shall be UNP-beams with the smooth back facing the gallery.

Support beams shall be established per approx. 1 m to support the gratings. I-beams are acceptable.

Bolted joints are not acceptable, if the bolts pass through the back of bearers/strings and edge steel (except from railing fixings).

Railings and toe plates at least 110 mm high shall be established along all edges.

Galleries shall be accessed via staircases.

Access routes, e.g. routes for the daily inspection rounds, may not be dead-ended.

The main galleries shall be provided as one continuous level without any steps in the gallery floor.

Galleries shall be of broad, robust designs and shall give easy operating and maintenance access to all parts of the Line, including e.g. for adjustment and repair of valves, signal transmitters, and actuators. Additional space for tools and the removal / insertion of instrumentation must be taken into consideration. The necessary connecting galleries to the building's common staircases, galleries, etc. shall also be established.

Access routes shall have a width of at least 1000 mm and allow for easy passage of EUR-pallets (1200 mm x 800 mm).

The width at exits from elevators should be wider than 1000 (however depending on the layout).

Line components (such as piping, cabling, ducts, fittings etc.) shall not restrict the free movement along galleries, landings, gangways, passages and such. Any proposed instances of reduced width, height or free profile of a passage way shall require authorisation by the Employer.

A distance of at least 50 mm must be included between any platform and the main structure to accommodate manufacturing and installation tolerances in the fit of the main structure. Exemptions from this shall be approved by the Employer.

Where the gallery constitutes a part of an escape route it is a precondition that the Authorities requirements are complied with.

A railing shall be provided to the edge of a platform or gallery where the distance between the platform and the outer surface plate / structure of the equipment is more than 100 mm.

### 3.5 Surface Covering of Galleries/Gangways

The Contract Object may only include the surface cover types stated below, and only one type per grating can be accepted.

- Incinerator-top galleries, galleries around the waste pusher, galleries in areas subjected to frequent servicing, and galleries in areas with the presence of oil spills, ashes, etc., shall be fitted with chequer plate.
- The main part of the galleries shall be covered, with press gratings or welded gratings built up of support and filler beams, with a maximum mesh size of 15 mm x 15 mm, so that a Ø15 mm ball cannot pass. The gratings shall be hot dip galvanized.

Grating or chequer plates may not be used as supports for Line components.

Glass fibre-reinforced plastic shall be used in areas where there is potential for chemical exposure.

The gratings shall be dismountable, and where necessary made in separate sections (e.g. for pipes etc.).

Toe plates shall be installed where openings in the gratings are larger than Ø50 mm or 50 mm x 50mm. The height of the toe plate shall be 100 mm above the surface.

Slide or threshold plates shall be used for transition when platform areas are not joined to one another.

Slide or threshold plates shall be used for transition to a solid structure.



### 3.6 Hand rails

Hand rails shall be designed as shown on the enclosed Annex 1.

Railings shall be designed continuously or exceptionally in sections according to prior agreement with the Employer.

All hand rails shall be painted.

The design of hand rails and fixing of hand rails to galleries shall be approved by the Employer.

### 3.7 Ladders

Ladders shall be avoided in general. Only in exceptional cases can the use of ladders be accepted and only if agreed with the Employer. Ladders shall be according with the latest issue of EN ISO 14122 and include slip resistant nosings.

A ladder cannot be accepted as the only access to a platform, however, it can be accepted as a secondary means of escape from the platform where the main access is steps .

All ladder parts shall be hot dip galvanized.

Safety hoops shall be provided in accordance with current regulations and good industry practice.

Ladders up to 2 m high shall be equipped with two handrails, or with one flange approx. 1 m above the surface whereto the ladder leads. Alternatively, another support arrangement shall be established subject to the prior agreement of the Employer.

On ladders higher than 2 m high both stringers / bearers and safety hoops shall extend 1100 mm above the surface whereto the ladder leads, or another support arrangement shall be established subject to the prior agreement of the Employer.

Where a ladder descends from a platform, access to the ladder shall be through a self-closing gate.

Rungs shall be of square shape and the side rail (where fitted) of a round shape. The top safety hoops shall be closed with a fitted cover.

## 4. APPEARANCE

### 4.1 Surface Treatment

All steel, except steps, gratings, bolts and ladders shall be painted.

Steps, gratings, bolts and ladders manufactured from carbon steel shall be hot dip galvanized.

Steps, gratings, bolts and ladders used in areas where there is exposure to chemicals and aggressive / corrosive atmospheres shall be made from suitably resistant materials and shall be subject to review and approval by the Employer.

The requirements in Appendix A14.2 *Steel Constructions for Process* shall be observed.

### 4.2 Colour

The scope and final colour of parts shall be agreed in co-operation with the Employer.

## 5. EXECUTION

All steel works shall be carried out in accordance with EN 1090-2:2008.

The Contractor shall ensure that the staircase and gallery units are delivered in appropriate sizes, so that they can, where required, enter the Line building and be mounted.

### 5.1 Fixing

All Contractor parts which are to be fixed to building structures shall be fixed by the Contractor. Fixing to concrete shall be made with suitable adhesive anchors, unless the conditions require otherwise. The Contractor is responsible for mounting of adhesive anchors and casting of foundations for base plates. In addition, the Contractor shall observe and comply with the conditions for project data for structures.

## 6. DOCUMENTATION

In good time before start of manufacturing, the Contractor is liable to submit the documentation to the Employer. The documentation shall be approved by the Employer before the work can commence. This approval, however, does not make the Employer responsible for the project/Contract Object. Forwarding of the documentation shall be made in good time, allowing for possible changes to be incorporated in a revised project.

The term 'documentation' covers static calculations, including statement of the structures' dynamic characteristics in relation to the intentional use, drawings and structural data.

The term 'structural data' covers information about load sizes, points of action/application and direction, including the size and geometry of the fixings. Please refer to the conditions in Appendix C1 *Reviewable Project and Design Data*.

### 6.1 Loads

The latest issue of the following standards serves as basis for loads, safety and design of platforms and stairs:

- EN 1990 "Basis of structural design"
- EN 1991-1-1 "Actions on structures - Part 1-1: General actions –Densities, self-weight, imposed loads for buildings"
- EN 1993-1-1 "Design of steel structures – Part 1-1: General rules and rules for buildings"
- EN 1090-1 "Execution of steel structures and aluminium structures – Part 1: Requirements for conformity assessment of structural components"

In addition, all gallery structures including steelwork shall be dimensioned for an arbitrarily positioned, vertical mounting load of 20 kN. Platforms and galleries shall be dimensioned for support / suspension of additional small service pipes and cable trays to be installed by the Employer at a future date.

The selection of the surface type and the load-bearing capacity of platforms shall take usage into account. The minimum traffic load requirements for platforms and walkways are:

- Area load for platforms and walkways with no special requirements 3.5 kN/m<sup>2</sup>
- The minimum load-bearing capacity in areas used for maintenance, service and transportation of components is 10 kN/m<sup>2</sup>.
- Depending on requirements, higher load-bearing capacities must be provided (e.g. storage surfaces, transport routes etc.)
- The deflection of the platform steel subjected to the assumed load may not exceed 1/400 of the span
- The deflection of the floor covering subjected to the assumed load may not exceed 1/200 of the span and the difference in height between the adjacent contact points of the floor covering subjected to a load may not exceed 4 mm.

The standard design process does not apply where the Contractor identifies that the platforms or galleries may be subjected to an additional load from e.g. machine parts in connection with outage works, servicing / dismantling or re-mounting. Under these circumstances the Contractor shall prescribe the use of the relevant platforms / galleries, which shall be reviewed and subject to approval by the Employer.

Areas shall be clearly marked according to the maximum permissible loads.