R1105104 Tata Steel Guideline

General Technical Requirements for Hoist Cranes

ATVT 2013

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Content:

1. GENERAL

1.1. Scope

The ATVT applies to the design, construction, calculation, manufacture and operationally-ready delivery of hoisting cranes such as:
- Assembly, workshop and warehouse cranes.

The ATVT also applies to the modification of the aforementioned existing cranes and/or implements with regard to servicing, rebuilding, relocation, repair and modernisation.

1.2. General provisions

Submitting an offer and accepting a commission implies, unless expressly stated otherwise, an unconditional acceptance of the ATVT. It also means that the supplier accepts responsibility for the choice of speeds, engines, brakes, gearboxes, crane wheels, etc. stated in the accompanying specifications. If the supplier is of the opinion that the instructions should be deviated from, in order to increase the reliability and/or improve the construction, this must be expressly stated and explained in the offer.

The delivery must be reliable to a great extent, while maintenance must be kept to a minimum.

This means that:

- all moving parts can be easily accessed and inspected;
- there is no doubt regarding the accessibility and exchangeability of the spare parts;
- the entire construction is smooth and flat so that moisture and dirt cannot collect on surfaces or in corners;
- the construction must be easily accessible for painting and if necessary maintenance;
- areas which will be difficult to access later must be preserved prior to assembly.

1.3. Associated conditions and requirements

In addition to the Machinery Directive 2006/42/EC and the CE mark, the following regulations and conditions apply in their entirety:

- The latest edition of EN-15011 and the references listed in this standard with all legal provisions that apply to hoisting cranes in the Netherlands.
- The standards listed below must be adhered to: Any deviation from these only after written permission of Tata Steel.

- S1.45.04.01	Welding instructions
- S1.51.80.01	Free space for travelling cranes
- S1.91.73.01	Safety colour regulations
- S3.10.56.01	Preservation of new and existing structures.
- R1.05.80.01	Tata Steel drawing requirements
- R1.05.80.02	Tata Steel CAD requirements
- R1.05.80.03	Tata Steel E-plan requirements
- R1.59.01.04	Polyurethane buffers for travel movements

Furthermore, the following must be adhered to:

- NEN-EN 50110-1 en 2	Operation of electrical installations
- NEN-EN 60204-32	Safety of machinery; Requirements for lifting and hoisting equipment

Cranes which are classified entirely within crane service class 1 to 3, and are used predominantly for assembly purposes or as workshop cranes must be fitted with standard components manufactured by KCI (SWF / Stahl / Verlinde / Kone), Demag or GH. Deviation, only after written permission of Tata Steel.

1.4. Subcontracting

The preference is stated for the work to be carried out by the supplier's own company. If, however, the supplier believes he does not have adequate capacity, or that a better delivery would be possible in partnership with a subcontractor, this must be stated in the offer under 'subcontractor'.

The subcontractor requires prior approval from Tata Steel

Changes therein during the term of the contract will generally not be accepted.

If components are withdrawn from the trade, then manufacture, type, material, calculations and so on require our approval.

1.5. Technical information included in offer

We reserve the right to put aside any offers that do not contain the requested data.

In order to enable the proper assessment of an offer, it must contain at least the following details:

- A plan drawing with key dimensions of at least A3 size.
- A description, stating key data, of the steel structure, the mechanical and electrical equipment.
- Electrical safety levels of the applied safety circuits.
- The maximum and minimum wheel loads including the shear forces.
- The weight of the operationally-ready delivery.
- The individual weight of the trolley and crane.
- Delivery Times.
- Separate quotation for:

  .-delivery ex-factory loaded onto means of transport

  .-transport up to the construction site

  .-assembly, commissioning and testing at Tata steel IJmuiden

N.B.:

The maximum and minimum wheel loads requested above must be guaranteed by the supplier to have a maximum deviation of + or -5%. If, after delivery, weighing demonstrates that the tolerance range of + or -5% has been exceeded, any modifications or additions to the crane structure or the support structure will be carried out by the supplier or at his expense. The crane must be able to operate without any problems with a voltage variation of +10% - - 15% .

1.6. Technical information after commissioning

After the commission has been issued, the supplier must supply the manufacturing plan and a quality plan within 3 weeks.
The following information must be provided for assessment and approval (allow approx. two weeks for each assessment): (in consultation)

- time schedule for the operationally-ready delivery;
- block diagram;
- circuit diagrams.
- design drawings.
- provisional assembly drawings, including the set-up of electrical equipment.
- workshop drawings, including parts lists.

- welding plan.
- calculations of machinery and steel structures.
- drawing list.
- Definitive track loads.
- material orders.
- orders for supplies, including documentation.
- orders for subcontractors.
- certificates of Hooks, Ropes and tackle.
- assembly data including drawings.
- regulations for the benefit of commissioning.
- operating instructions, 1x document 1x digital.
- maintenance instructions, 1x document 1x digital.
- crane book in accordance with NEN 2024.

Any comments must be dealt with immediately, after which the relevant drawings should be re-submitted for approval.
After delivery, the digital information of all the documents mentioned above, drawings and calculations will have to be submitted for the purpose of maintenance.
The document titles of the calculations and drawings must be of the same structure as the document management system and will be provided.

1.7. Paint System / Conservation

The blasting and full paint treatment should take place in compliance with Tata Steel Standard S3.10.56.01. The specifications indicate which treatment system should be used for the structure; in the case of standard parts (purchased parts), this will be discussed.

1.8. Material Inspection and testing

For all applied materials, certifications must be supplied stating the chemical analysis and all mechanical properties, including the notch impact strength (Charpy V according to EN 10.045).
The materials for load-bearing components or its welded parts,
must be supplied with a material certificate type 3.2 according to EN 10204 (2004).Furthermore in this case, the buyers authorized representative for inspection or the

inspector appointed through official regulations must be established in one of the CEN Member States. If the manufacturer of the material is located in a country that is a member of CEN a material certificate type 3.1 according to EN 10204 (2004) will suffice. All other non-load-bearing materials must be provided with a material certificate type 2.2 according to EN 10204 (2004).

1.9. Commissioning and testing (FAT & SAT)

(**F**actory **A**cceptance **T**est)

In this phase, the various components that were tested separately during the assembly are integrally tested in a test set-up. With the technical specifications as provided by the client, a test is carried out by the supplier on the crane/installation in the 'factory'. Members of staff of Tata Steel will be present. Usually this test is performed without a test load, but it must be capable of electric operation.

(**S**ite **A**cceptance **T**est)

Before a crane/installation is put into operation for the first time, it must be tested by the supplier on its operational location in the presence of Tata Steel experts, from the Crane Construction and Electrical Engineering departments. Here, the crane as a whole is electrically and mechanically tested. During the test, in addition to the suppliers test protocol, a Tata Steel test protocol will be completed. During the Site Acceptance Test the actual handover of the crane/installation to the client occurs. Once the tests have been successfully completed and the deliverables are handed over, the construction phase is finalized.

2. MACHINERY

2.1. Machinery Calculation

2.1.1. General

The specifications state which group the machinery is classified into, though it is possible that the various drives of an implement are classified into different groups.

2.1.2. Drive mechanisms calculations

Drives whose end position are limited by buffers must be calculated using the forces occurring at buffer impact; furthermore, the kinetic energy of the drive should be included in the calculations.

For travel drives where the drive torques are passed through the crane wheel, slip during buffering with a friction coefficient of 0.25 between wheel and track must be taken in to account.

The speed at the time of buffering should be the nominal speed. The maximum stresses at a buffer impact must not exceed 0.9 x Sigma 0.2.

Where loads are to be lifted and suspended on free-hanging ropes, a horizontal load factor of 0.15 times the load is to be calculated.

2.2. Machinery materials

Machinery components must be made of materials which meet at least the following criteria.

2.2.1. Crane Hooks

Load hooks according to DIN 15400.

2.3. Fits and tolerances

All machinery must be machined in compliance with the ISO fit system and in compliance with NEN 2020.

2.4. Machinery set-up

All the machinery should be constructed and set up in such a way that all components are easily exchanged. If rotating parts are fitted or protrude above platforms, they must be fitted with guards. If shafts protrude through plates or girders then these shall be reinforced to reduce surface pressure to an acceptable level. Reinforcements may not be achieved by welding on thickening plates but by welding a plate of adequate thickness which is applied symmetrically, so as not to create a moment in the girder plate.

2.5. Gearboxes and guards

We prefer flanged reduction units which are suspended from the hubs of the driven shaft, including a support point near the input shaft. Welded gearboxes must be annealed stress-free.

The units must be fitted with easily accessible oil drains and an oil level indicator. An identification plate must be fitted stating clearly the following data: "oil charge:.....litres – oil spec:…..- transmission l: .....". Bearings, shafts and pivotal points.

2.5.1. Bearings

All rotating shafts must be mounted on ball bearings, spherical roller bearings or roller bearings. Conical roller bearings are not permitted. All bearings are preferably supplied with lifelong grease lubrication.

2.5.2. Hinge points

Hinge points of wheel bogies, balances and connecting girders must be fitted with welded hubs. Hinge points of rope suspensions and equalizers with a restricted range (less than 20°) must be fitted with bushes.

2.6. Steel wire ropes

Steel wire ropes should be selected with a guarantee against breakage, depending on the crane service class. The number of rope bends should be kept to a minimum, while counter-bends are to be avoided.

Rope construction –rotation-resistant– for single right-hand-lay hoisting ropes.

Multiple ropes in a winch fitted with left-hand-lay and right-hand-lay versions (rotation-resistant rope construction).

2.7. Overload Protection

To be provided in compliance with NEN 2023 and NEN 2028 with optical and acoustic signalling.

Since the introduction of the Machinery Directive, the load protection must comply with NEN-EN 12077-2. This means that the overload protection itself is a safety component.

This protection should be adjustable in such a way that the crane can operate smoothly under a normal operating load.

The inaccuracy of this protection must not exceed 3%.

The manufacture and type of overload protection are subject to our approval.

2.8. Buffers

All buffers should be made of polyurethane and selected from groups 1 or 2 from the manufactures Wampfler, Krupp or Aclacel.

See R1.59.01.04.

3. STEEL CONSTRUCTION

3.1. General

For the main construction a simple smooth tubular construction is preferred, This construction shall ensure that all loads are taken in and led through in compliance with the calculations.

Statically determined constructions shall be designed wherever possible. The design shall also aim for the prevention of the accumulation of dirt or moisture on or in-between the structural components.

In the case of indoor cranes, bolted connections may be used, but only if they are not in a corrosive atmosphere.

Only fitted bolts may be used for fastening main components, so that the correct dimensions are ensured.

The minimum material thickness for main construction parts is 6 mm, 4 mm for tube constructions and 3 mm for cabins, housings, stairs and platforms. Reinforcements for shaft lead-trough's and hatches and so forth must be provided by welding a thicker plate at the appropriate location, overlay plates are not allowed.

Fastening points for electrical cable ladders and pipes etc. must be shown in drawings.

Welded constructions at the location of stress concentrations of more than two loads against each other are to be avoided.

3.2. Steel Construction calculation

The specifications indicate which group and hoisting class the implement or parts of it are to be classified.
The calculation should be made according to the instructions stated under section 1.3.
Furthermore, the following extra requirements must be met:

The acceptable deflection of girders at two support points as a result of mobile load (crab and load) in crane groups 4, 5 and 6 is 1/1.000 of the support point distance.

In crane groups 1, 2 and 3, the acceptable deflection is 1/900 of the support point distance in which the resonant frequency of this crane girder is greater is or equal to 2.5Hz.

For cantilever girders the acceptable deflection relative to the girder length is twice as large as girders on two supports.

With trolley rails etc. it should be assumed that the wheel load grips 1/3 of the width of the rail head from the centre of the rail as a point load.

This load can be added to the load combinations 1 and 2a from table 26 of NEN 2018. For a free-hanging load, a horizontal load of 0.15 times the load should be calculated unless otherwise stated in the specifications.
Perform rod eye calculations according to the Rötscher method.

In the case of gantry cranes or bridge cranes, the construction must be capable of transferring forces resulting from the following circumstances from one track to another.
It must be assumed that the wheels on one of the tracks are blocked and that the driven wheels on the other track are experiencing wheel slip, or a longitudinal force caused by the drive motors' tipping moment.
The position of crane and crane parts is such that the highest potential forces occur.

0.25 should be used as a friction coefficient in slipping.
This load should be added to load combination 2a from table 26 of NEN 2018.
These loads should be provided for use in checking the crane track.

Buffer supports are to be calculated using buffer force and also a force of 10% of the final buffer force perpendicular to the direction of the buffer force.
This force can occur in all directions in the perpendicular plane. If necessary, the buffers should be protected from heat radiation.

3.3. Steel Construction materials

Parts of the steel construction which take part in the transfer of force (including by additional forces) must at least be made of SxxxJ0+N according to NEN-EN 10025.
With thicknesses over 60 mm SxxxJ2+N according to NEN-EN 10025 must be used

Trolley rail quality must comply with the crab wheels and be accompanied by a suppliers inspection certificate.

3.4. Tolerances

For crane tracks and cranes NEN 2019 - 11

3.4.1. General

All measurements on crane tracks and cranes must be carried out by professionally calibrated tools, taking the ambient temperature into account.

3.5. Welded and bolted joints

3.5.1. Welded joints

All welded joints in the steel construction must be carried out and tested in compliance with Tata steel standard S1.45.04.01.
In steel constructions that are exposed directly to the outdoor air only continuous welds may be used.
External welds must be welded all the way around.
Steps, ladders and platforms must be welded according to category 3 of our regulations.
All other parts of the steel construction are to be welded according to category 1 of our regulations.
The weld between horizontal and vertical plate under the Trolley rails must be a prepared 100% V or K-weld, depending on plate thickness.
Important welds must be X-rayed before further assembly takes place, so that no further welding stresses develop as a result of any repairs.
Trolley rails must be welded together with fully enclosed penetration.

3.5.2. Bolted joints

Fitted bolts must comply with DIN 609 en 610.
If pre-stressed bolts are used, DIN 267 should be followed. However, in the case of all pre-stressed bolts, the length between head and nut must be at least 5 d.
At least steel 8.8 bolts must be used for these bolted joints, while the assembly instructions for these bolts must be followed.
The tightening torque of pre-stressed bolts must be stated in the drawing.
All bolts, nuts and washers must be hot-dip galvanised in compliance with NEN 1275.

3.6. Platforms steps and ladders

Places that require regular access for inspection and maintenance and if so stated in the specifications must be made accessible using platforms and steps in compliance with EN-13586.
Ladders in compliance with EN 13586 are acceptable for other inspection points.
All platforms and steps are preferably fitted with high-edge grids, and durbar plates under E-cabinets.
Longitudinal joints of pipe support rails must be welded with full penetration using an inserted pin.
The platform gratings must be laid in such a way that they will not slide if the fastenings are missing.
Heavy hinges shall be used for hinged gates that fall shut through their own mass or spring assisted.

3.7. Crane bodies and overhead travelling cranes

The wheelbase must be at least 1/6 of the span.

4. ELECTRICAL INSTALLATION

4.1. Supply, assembly etc.

The supply, assembly and operational handover of the electrical installation must be in accordance with this Tata Directive.

4.2. Material

4.2.1. Pendant control station (main control)

Pendant controller should contain at least one Emergency-STOP (with mechanical lock out) and push Button.
For hoists with the maximum number of drives, the pendant controller contains from top to bottom the following consecutive buttons:

1. EMERGENCY STOP
2. HOIST
3. LOWER
4. TROLLEY TRAVEL REVERSE
5. TROLLEY TRAVEL FORWARD
6. CRANE TRAVEL RIGHT
7. CRANE TRAVEL LEFT
8. START/ALARM

If movements are not electrically driven then unnecessary push buttons shall be deleted.

Apply pendant controllers manufactured by DEMAG, type DST with:

- 4 buttons : type DST6 SP 21
- 6 buttons : type DST6 SP 22
- 8 buttons : type DST9 SP222

The pendant controllers are equipped with so-called momentary pushbutton switches SES type 2.
If 1 speed is desired or used, the corresponding contact block can be changed.
If the hoist is equipped with a work light these should be switched from the pendant controller with a 0/1 switch (toggle), do not use a push button switch.
The degree of protection is IP 65. The movements of the hoist should be clearly marked on the bridge and they must correspond to the markings on the controller. Within Tata the convention is to use compass headings.

4.2.2. Pendant controller (emergency operation)

If the pendant controller is used for emergency operation a alternative manufactured controller with equal functionality may be used, as described in Chapter 2.2.1.
A cabinet should be placed on the bridge, which serves as storage for this controller.

4.2.3. Radio control

The remote control unit must be from Theimeg.
For hoists the choice is the Excalibur or the LRC-M1. For the LRC-M1 applies that these must be fitted with a tilt switch and delivered complete with harness.
The remote control unit should also come with two "high capacity" batteries and a fast charger. Before the final order the layout of the controller must be Tata Approved.
The radio frequency used is issued by Tata.
The remote control unit must be ordered from the firm, Actemium ICP from Dieren (Netherlands) this firm knows about all the agreements made with Tata Steel.
The movements of the hoist should be clearly marked on the bridge and they must correspond to the markings on the controller. Within Tata the convention is to use compass headings.
If the hoist is equipped with work-lighting these should be switched from the pendant controller with a 0/1 switch (toggle), do not use a push button switch.

4.2.4. Emergency stop-limit switch

As a final upper position emergency stop limit switch (Block limit switch) the type RE70, protection class IP 65, from the manufacture Rolloos Systems BV must be applied. If placement of said block limit switch is not possible, a second (lever) limit switch may be used as a final upper position limit switch, provided the mechanical drive is independent from the "normal" (lever) limit switch.
This switch block must be equipped with a mechanically forced contact.
When this switch is tripped, a push-button situated in the main electrical cabinet shall be used in combination with the controller to release the winch. This shall be executed at slow speed.

4.2.5. Switching on the hoist

The hoist should be electrically designed in such a way that no sudden movements can take place, the so-called "zero condition detection".
When one of the main relays is energized or it sticks, then the activation of the crane should be impossible.

4.2.6. Limit switches

Each winch must be fitted with a rotary limit switch that turns off the winch in the highest and final position.
On the outermost positions of both the long travel and cross travel movement, limit switches must be provided.
These limit switches represent a penultimate and final circuit. The circuit must be so constructed that the end position is slowly driven into, but can be moved out of quickly.

4.2.7. Signalling lamps

The hoist must be equipped with signalling lamps, which show the status of the hoist.
For a hoist with radio control these are:

- Yellow lamp when **emergency operation** is chosen
- Green lamp with **radio control operation**
- White light when the **installation is switched on**
- Red light 1. when the **installation is switched of**
  2. when **exceeding max load (alongside an acoustic alarm) (may also be a separate lamp).**
  3. flashes during **electrical malfunction**

For a hoists equipped only with a pendant controller, the red warning lamp must be present.
The lamps must be positioned where visible and must have a minimum diameter of 150 mm
The lamps shall have a safe voltage, preferably lower than 50 V DC/AC.

4.2.8. Switch cabinet

Switch cabinet(s) must be provided with the possibility to attach a padlock of at least 8 mm so these cabinets can be secured.

4.2.9. Safety circuits

The safety circuits on the hoist should be built in such manner that they meet the minimum requirement according to DIN EN 15011 and NEN EN 14492.
If a risk analyses requires a higher security level then this will be noted in the application specification which then has to be applied as such.
Upon request, it must be demonstrated that these circuits comply with the safety standards laid down.
For an overview of the prescribed minimum safety on hoists see the table below.

Application	**Safety-related Safety functions**	**Safety control**	**Electronic control**	**Performance Level (PL)**
Normal application (cable controlled)	Overload Emergency stop	cat 1 cat 1	cat 2 cat 2	c
	End position limitation	cat 1	cat 2	
Radio control Tandem operation crab/hoist mechanism	Emergency stop Parallel operation (sync-function)	cat 3 cat 1	cat 3 cat 2	
Tandem operation cranes Bypass control	Parallel operation (sync-function) Endangering man and material	cat 1 cat 1	cat 2 cat 2	
Transition operation	Safe stop hoisting Secured against high RPM	cat 1 cat 1	cat 2 cat 2	
Transport liquid fire mass	Overload	cat 3	cat 3	d
	Emergency stop control switch Emergency stop radio	cat 3 cat 3	cat 3 cat 3	
	End position limitation double Limit switch	cat 3	cat 3	
Normal-→ molten	Overload switching Normal-→ molten	cat 3	cat 3	
Distancing of cranes due to static reasons (new crane)	Load depended crane distancing	cat 1	cat 3	c

Conform NEN EN 15011 en NEN EN 14492