R2 10 51 03
Tata Steel Technical Directive

Electrical specifications for cranes (ETVK)

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Intended for the Location IJmuiden

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Contents:

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1. INTRODUCTION

This specification contains the requirements for electrical installations mounted on cranes at Tata Steel. They form an addition to the Mechanical specifications for electric cranes and bulk handling machines (ATVK, R1105102 and ATVH, R1105101).
This document is applicable for new installations and also for overhaul, rebuilding, repair and modernizations. Only new techniques like frequency control are mentioned.
In order to explain the specifications below, several circuit diagrams of the Main distribution board have been added as illustrative drawings. The installations must at least comply with the European and Dutch regulations.

European Directives

Number	Description
2006/42/EC	Machinery directive
2006/95/EC	Low voltage directive
2004/108/EC	Electromagnetic compatibility directive (EMC)

A number of publications related to the electrical installations on cranes are mentioned below. This short list is not complete and the latest additions have to be used.

1.1. Standards

NEN-EN 12077-2	Limiting and indicating devices
NEN-EN-IEC 61936-1	Power installations exceeding 1 kV AC
NEN-EN 50522	Earthing of power installations exceeding 1 kV AC
NPR 3299	Safety requirements for charging of traction batteries
NEN-EN 13155	Non-fixed load lifting attachments
NEN-EN-ISO 13849	Safety-related parts of control systems
NEN-EN-IEC 61800-3	EMC requirements and specific test methods
NEN-EN-IEC 61000-5-2	Earthing and cabling
NEN-EN 50160	Voltage characteristics of electricity supplied by public electricity networks
NEN-EN-ISO 15011	Health and safety in welding and allied processes
NEN-EN 14492-2	Power driven hoists
NEN-EN 14985	Slewing jib cranes
NEN-EN-IEC 60204-32	Requirements for hoisting machines
NEN-EN-IEC 61508	Functional safety of electrical/electronic/programmable electronic safety-related systems
NEN-EN-IEC 62061	Functional safety of safety-related electrical, electronic and programmable electronic control systems
NEN-IEC 61511	Safety instrumented systems for the process industry sector
NEN-EN-IEC 60034	Rotating electric machines
NEN 8012	Selection of cable type with the objective to limit the damage due fire
NEN-EN-IEC 60332-3	Tests on electrical and optical fibre cables under fire conditions – Part 3-10: Test for vertical flame spread of vertically-mounted bunched wires or cables -Apparatus
NEN-EN-IEC 60228	Conductors of insulated cables
NEN-EN 1366-3	Fire resistance tests for service installations – Part 3: Penetration seals

Earthing- / equipotential bonding structure shall comply with the latest version of the HD (IEC) 60364 / NEN 1010 for LV and the EN 50522 for HV systems.

All instructions of the manufacturers of systems/components shall be strictly adhered to

1.2. TATA STEEL Standards

S2.17.32.01	Power systems
S2.62.81.01	Radio-controlled cranes
R1.05.80.01	Drawing regulations for Tata Steel IJmuiden
R1.05.80.02	Tata Steel drawing rules
R1.05.80.03	Tata Steel Eplan drawing rules
R1.105.102	ATVK
R1.105.101	ATVH
R2.620.101	Resistor box
R4.127.901	F.O cable

2. FUNCTIONAL DESIGN

As an example of electrical supply systems figure 3 from the earlier mentioned NEN-EN 60204-32 is used. The adjustments made by Tata Steel are visible in the drawings on page 29 till 32 (see appendix).

2.1. Power supply

Cranes supplied by high voltage are normally equipped with a cable reel and transformer.
The transformers on the low-voltage side in that case, constitute the feeding point.
The 3, 6 and 10kV system are normally not earthed, so special attention is required for voltage rating of the supply cable. Check transformer circuit for earthing.
See S2 17 32 01 for earthing and protection.

If current collectors are used for supply, they must be mounted in such a way that:
- they are properly protected against contact (at least IP 2X)
- they are easily accessible
- the earth collector should remain on the rail when opening the collector protection door(s) (separate door(s)).

2.1.1. Shore power

When the crane is switch off from his main power supply, it must be possible to feed the crane via a so called shore power socket.
When a crane has an on-shore power supply, it must be foreseen of:
- Flexible power cable connection with a CEE plug (400Vac, 5-pole 63A);
- A phase sequence relay has to be used, see 60204-32;
- When shore power plug is connected, long travel must be blocked.
- A 2 circuit's selection:
  1: only lighting
  2: lighting and control (24VDC circuits for PLC and drives)

The example drawing is shown on page 33 (see appendix).

2.2. Main circuit breaker cabinet

The main circuit breaker cabinet is placed directly behind the feeding point and outside the E-room. It is equipped with a circuit breaker for crane movement, a breaker for power and light current distribution and, if required, a breaker for the load hoisting magnet.

The main circuit breaker cabinet must be located closely to the current collectors, at a distance with respect to the short circuit capacity. The short distance is necessary to increase safety in case of service and maintenance operations at the cabinet, as the turned-away current collectors will cause a visible interruption.
The cabinet must comply with protection degree IP 54 and must have a facility to make it possible to lock the breakers by means of a padlock for an 8mm Tata Steel safety lock.

The switch positions of the circuit breakers must be visible from the outside of the cabinet when it's closed.

2.3. Main distribution board

The main distribution board of crane movements contains an outgoing feeder for every single movement. The hoisting movement is to remain separate.
The feeders must be constructed with a circuit breaker for protection and a contactor for remote control.
The use of a switchgear unifying both functions is permitted.
The crane driver must be able to switch the contactors from his cabin collectively. During regular operation they remain switched on continuously.

If electric equipment has been placed in another room than the main distribution board, the equipment must be provided with an additional separator, where it must be possible to shut down the equipment in every phase.

The auxiliary power, 230V, 50 Hz, for all drives must be supplied by a central transformer. The interlocks to be maintained are indicated in the additional diagrams.

For each crane movement, a separate panel must be mounted, including all necessary switchgear and control equipment for this specific movement.

The power, 230V 50 Hz, for all lighting and sockets shall be 2-pole switched.
For sockets, additional earth leak protection is needed.

2.3.1. Harmonic distortion

The voltage characteristics of the MV and LV network on the TATA IJmuiden site shall comply with the NEN EN 50160.
In addition to table 1 and 4 of this standard:

- the harmonic voltages above the 25th up to the 40th harmonic, shall be less than 1,0 % each.
- the maximum values of the individual harmonics and also the THD shall be reduced with a load, and a safety factor:
  THD Tata network = THD50160 x Csafety x Cload

C_{safety} = 0,75 and C_{load} is the quotient of Maximum total new load of the network and the rated power of the feeding transformer.
Network calculations on harmonic distortion shall be made by contractor for loads > 500kW.
New networks for drive systems with dedicated transformers shall be configured as 12- or 24-pulse systems (or alternatives with equal/lower THD).

2.4. Security devices

All security devices should be build according PL-c, cat. 3 for all cranes as a minimum, or higher to determined by the risk assessment.

There must be an emergency limit switch, controlled by the hook block or hoist yoke which will de-energize the hoist contactor, to secure the uppermost position. (see also 2.4.6 software).
On the main distribution board of the hoist, there must be a bypass push-button with auxiliary-relay, which only clears the lowering direction for the hoist-drive.

The hoist movement should be equipped with an over speed detection.

All remaining movements must be provided with end position security devices (including over speed: electronic over speed acceptable), in compliance with NEN-EN 12077-2 and RI&E.
There will be for each movement one condition relay. The contacts of that relay will be in the Emergency circuit.

2.4.1. Performance levels

Safety controls
All safety circuits shall be implemented according to the determined safety level (EN 13849-1 PL or 61508 SIL and underlying EN/IEC 62061, IEC 61511).

Toepassing	veiligheidsgerichte veiligheidsfuncties	Veiligheidsbesturing	elektronisch bestuurd	Performance Level (PL)
Normale toepassing (aan kabel gebonden)	Overbelasting	cat 1	cat 2	c
	Noodstop	cat 1	cat 2	
	Eindpositiebegrenzing	cat 1	cat 2	
Draadloze besturing	Noodstop	cat 3	cat 3	
Tandembedrijf kat/hefmechanisme	Parallel bedrijf (synchrone functie)	cat 1	cat 2	
Tandembedrijf kranen	Parallel bedrijf (synchrone functie)	cat 1	cat 2	
Omleidingbesturing	In gevaar brengen van mensen, materiaal	cat 1	cat 2	
	In gevaar brengen van mensen	cat 1	cat 2	
Omvormerbedrijf	Veilige stop hijsen	cat 1	cat 2	
	Veiligheid tegen te hoog toerental	cat 1	cat 2	
Transport vloeibare vuurmassa's	Overbelasting	cat 3	cat 3	d
	Noodstop, besturingsschakelaar	cat 3	cat 3	
	Noodstop, radio	cat 3	cat 3	
	Eindpositiebegrenzing, dubbele eindschakelaar	cat 3	cat 3	
normaal -> gesmolten	Overlastomschakeling normaal -> gesmolten	cat 3	cat 3	
Distantiering van kranen om statische redenen (nieuwe kraan)	Lastafhankelijk kraandistantiëring	cat 1	cat 3	c

The safety levels mentioned in the table are the minimum safety levels in accordance with the NEN-EN 15011 and the NEN-EN 14492. Follows from the risk graph a higher level of security, than this should be used.

Verification of the circuits will be part of the engineering documents to be delivered.

All safety function are defined by the risk analysis and the list of safety components out of the appendix 5 of the machine directives.

The control system of the safety functions must with build with a fail safe PLC.
It must be possible to test all safety related functions without adjusting the installation.
Therefore only safety levels of cat. 3 has to be build.
The Performance Level calculation must be handed to Tata for Approval.

2.4.2. Security devices for load hoisting magnets

In order to ensure the magnet current is not interrupted by an external cause, the magnet power supply is taken directly from a separate circuit breaker in the main circuit breaker cabinet.
To prevent switching off a load hoisting magnet with the maintenance switch it must be provided with a blocking device which releases when the load hoisting magnet is not magnetised.
See also ATVH, EN 13155 and NPR 3299

Special attention for the DC voltage in the panels from battery.

Extra label plates in/on the panels should be mounted, for attention during working on/in the panels/cables. Wiring from DC battery supply with different colour

2.4.3. Overload protection (hoist weight)

The crane should be equipped with an overload protection. The minimum safety level of this system should be PL-c, Cat. 3, or higher according to the risk graph.
When an overload occurs, a red light will come up and sounds a warning signal. The hoist movement will stop hoisting and only lowering will be possible. The overload protection will reset itself, when the overload is disappeared.
The warning signal will stop after 30 seconds, even when the overload is still there and the red light stays on until the overload is disappeared.

2.4.4. Warning lights

For safety is on each corner of the crane body a red warning flashing light foreseen, which will be activated during maintenance or failure: manual operated.
Signal light hoisting magnet magnetised with green light

2.4.5. Emergency pushbuttons and stops

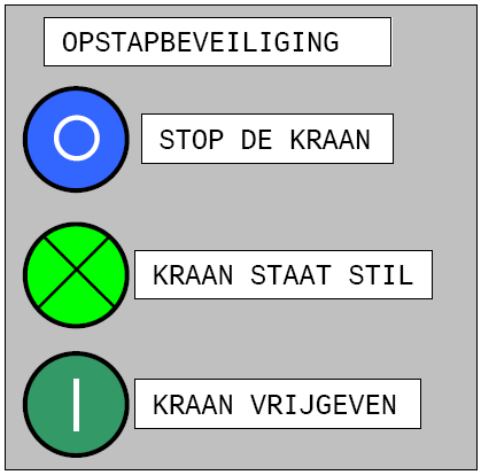
Emergency pushbuttons have to switch of the power of all crane movements. The emergency switching circuit should be cat 3 (24 VDC) for line contactors or safe stop for drives.
Emergency stop pushbuttons (mushroom type) shall be placed:
on entrance to the crane
on entrance to the trolley
in E-house (girder)
in Cabin

Main and auxiliary hoist need to be secured with a block end switch (emergency stop, stop cat 0)

2.4.6. Access Safety

The crane must be equipped with access safety system at all dangerous accesses to and on the crane / trolleys (the location will follow out of the risk assessment).

Description of the standard access safety system which should be applied is:



- Request to access the crane (press the blue push button)
- The operator in the crane cabin will receive a message on the HMI. On the control access panel the green light is flashing.
- The operator accepts the request, the concerned movement will be blocked and the green light stops flashing (light up continuously). It's now safe to enter the crane.
- On the crane the person give back the crane operation by pressing the green button on the panel. The green light will go off.
- For leaving the crane the same order is applicable.
- If the operator declines the request, the green flashing will go off. It's not permitted to enter the crane.

Two panels are required for each access.

Near the control access panel the next Resopal text plate must be installed for entering the crane.

OPSTAPBEVEILIGING:
BETREDEN VAN DE KRAAN ALLEEN TOEGESTAAN ALS DE GROENE LAMP AAN IS.

GROENE LAMP:
- UIT : VERBODEN TE BETREDEN
- KNIPPERT : AANVRAAG BETREDEN INGEDIEND
- AAN : BETREDEN TOEGESTAAN (RIJDBEWEGING GEBLOKKEERD)

LET OP! VERGEET NA HET BETREDEN VAN DE KRAAN DEZE NIET TERUG TE GEVEN AAN DE BEDIENER (LAMP UIT).

Near the control access panel the next Resopal text plate must be installed for leaving the crane.

OPSTAPBEVEILIGING:
VERLATEN VAN DE KRAAN ALLEEN TOEGESTAAN ALS DE GROENE LAMP AAN IS.

GROENE LAMP:
- UIT : VERBODEN TE VERLATEN
- KNIPPERT : AANVRAAG VERLATEN INGEDIEND
- AAN : VERLATEN TOEGESTAAN (RIJDBEWEGING GEBLOKKEERD)

LET OP! VERGEET NA HET VERLATEN VAN DE KRAAN DEZE NIET TERUG TE GEVEN AAN DE BEDIENER (LAMP UIT).

The access safety system is used to block the concerning movement according to the NEN-EN 60204-32 and also to prevent unexpected movement (for speed regulated motors: IEC 61800-5-2 Safe Torque Off, STO).

These circuits must be designed according the NEN EN ISO 13849-1.

2.5. Limit Switches

All movements have to be switched off in its end positions.
Movements in the opposite direction, however, should remain possible and should be in a slow in fast out configuration.
Furthermore, a slow down position must be provided in order to enable movement deceleration to low speed.
If the construction however is not made and designed for full impacted of the crane, i.e. buffer construction, the limit switches should be build as a safety device.

2.6. PLC

The PLC should have the following assumptions:

- The hardware modules should work with **positive** logic.
- PLC memory has to be of the non-volatile type.
- Proven technology, usage of standard package solutions.
- Industry standard communication busses and protocols (for example: Ethernet, profinet).
- All circuit breakers that cause fall-out of the crane must trigger an alarm in the control system.
- After commissioning the systems (PLC / PC) shall have a processor- and user memory load of less than **60%** and the expandability of the system
- Remote I/O is allowed for e.g. Trolley, Cabin, etc.
- The communication between PLC, drives, remote I/O, HMI, etc. preferable via fibre optic cable.
- The following spare I/O is required: **10%** installed after commissioning.
- The spare I/O must be wired out on terminals.
- The power supply of the PLC and each remote I/O card must be protected separately and provided with an alarm indication on the control system.
- The power supply and circuit breakers must be selective.
- The 24 VDC power supply unit has not be a “switched” type, but manual reset type.

2.6.1. Software development

Software shall be programmed in small and modular parts and shall be foreseen with extensive (Dutch or English) comments. The system shall present all relevant information to support fault finding and trouble-shooting. Also information must be presented to trace which component of the installation caused the failure.

All software should be well documented: Every block and network must contain a proper header and, if necessary, comment.
“Protected” blocks are strictly prohibited. Only Siemens standard-blocks are permitted.
A separate software specification can be part of the specification.

2.7. Closing Cable Passages

Passages of cable in panels and walls should be through fire retention barriers and shall be made fire retardant material. (i.e. 30 or 60 minutes according NEN EN 1366-3)
See PvE from the fire brigade of Tata Steel

2.8. Motors

The motors must be squirrel cage type with a cable connection box on top.
The motors must be selected so they shall be suitable for the proper operation/duty.
The specification of the used motors must be handed over for approval.
Motors with forced cooling are not allowed.
Building form shall meet standardized size and shafts according applicable IEC standards.
All motors shall have insulation class F; temperature raise class B and protection IP55 with anti-condense heating. Natural ventilated (with fan on axis). Each motor is to be provided with a thermal security device, based on temperature *sensors* in the stator (NTC).
The applied motors shall be suitable for the specified duty as described in the Functional and Technical specification.
Contractor shall submit the motor calculation for comments to TATA;
Noise level: < 80 dB(A) at 1m. distance, unless specified otherwise.
Motors shall be classified by IEC/EN 60034-30-1 (2014):

IE2 (High efficiency) for frequency drives and IE3 (Premium efficiency) for DTL use.

The motors shall be monitored on temperature when frequency converter controlled.
The temperature monitoring system must have two levels: one pre-alarm and one alarm. By an alarm, the crane movement must be switched off.

2.9. **Drives**

Drives with front-end converters and/or DC-bus have to be used. Special attention is required to voltage drop of the supply (i.e. extra brake choppers and resistors)
Thermal overload relays must have hand-reset.

Recommendations for new installations regarding EMC:
- Use redundant, combined rectifier + inverter units (no common rectifiers + DC-bus as this minimizes the effects of inductance/capacitance of the shared DC bus)
- Specify emission level as per cat C2 or maximum cat. 3 (I<100A) per product standard EN-IEC 61800-3. Do not allow category C4.

Recommendations to reduce common mode currents on the control cables:
- Segregate the control cables from power cables.
- Bond the panels with short braided earth connections, between the panels, the DC duct and (DC) cable shield connections.
- Use symmetrical earth wiring: insulate the PE earth bars from the back panel and interconnect the earth bars from each set of cables with a short earth connection (<15cm; special attention in terminal boxes).

2.10. **Brakes**

Each brake on the crane has to be equipped with a status switch, which gives the status of the brake. If this switch is not of a reliable type, i.e. micro switch on a plate brake, also a current measurement should be used.

3. ARRANGEMENT OF THE EQUIPMENT

The electric equipment must be resistant to shocks and vibrations due to heavy hoisting operations. Among other things, this implies that all plug in cards and other electronic components, must be mechanically locked. Cabinets and panels must be fitted with vibration isolators. Plug in relays must be provided with spring clips. Large magnet switches must be mounted separately from other equipment.

Cabinets installed on the outside of the crane must meet protection degree IP 54. The anti corrosive paint must be similar to that of the crane.

3.1. Electrical room

It is necessary to equip electric rooms (longer than 6 m) with outward-turning doors on both sides. The door locks will be provided by Tata Steel.
The room and all equipment (and floor) have to be fire resistant (i.e. 30/60 minutes) and doors self-closing. Also attention for Fire valves in air ducts (see PvE)
Safety lighting should be placed inside the electric room(s), which is battery operated and self-checking.
On the floor insulating covering should be used; a heavy duty rubber flooring with:

- Ohm x cm >10^12
- Temperature range (continuous) 70 degrees Celsius
- Electrical penetration 15kV/3mm or 25 kV/5mm

The operator's cabin, the switchboard cabinets and the electronic panels must be provided with sockets supplied by the power and light distribution system and are provided with earth leakage protection.

Measures shall be taken to replace heavy and large components from out of the e rooms. All facilities and tools that are necessary to replace these components are part of the scope of deliveries.

3.1.1. IP- Protection classes

All equipment requires the following NEN-EN-IEC 60529- IP classes (unless stated otherwise):
- Inside production area's: IP65
- Inside E-rooms: IP2X
- Components and wiring inside equipment with open doors: IP2X

Robust foreclosure shall be used, which should be easy to re-install after maintenance.

All equipment outside the E-room should be built in a lockable cabinet by means of a padlock for an 8mm Tata Steel safety lock.

3.2. Drivers cabin

Functions and layout will be described in the Electrical specification.

All movements are controlled from the driver's cabin. All control equipment is positioned within the reach of the crane driver.
The descriptions of all switches, buttons, signal equipment etc. are to be executed on white-black-white resopal in the **Dutch** language.
There will be a monitoring system in the driver's cabin for all the movements.
Attention for:
- Cooling (Airco)
- emergency lighting

3.2.1. Controller combinations in crane cabins

All controllers in the crane cabin must be of a variable type.
Unless decided otherwise, the controllers to be used should have at least the following positions,

Controllers for hoisting:
- 3 positions hoist
- 1 zero
- 3 positions lower

Controller's bridge- and trolley movement:
- 3 positions forward or right
- 1 zero
- 3 positions backwards or left

Controllers for hook- and trolley turning, tongs/plate cage open/close and load hosting magnets etc.:
- 1 position to the right / open / "lift"
- 1 zero
- 1 position to the left / close / "drop"

Whereby all controllers are constructed with the spring enforced default position "zero" (not for the "lift" position of hoisting magnets!).

For hoisting liquid loads the brake control circuit should be fitted separately. This means one extra contact in the controller for position "zero"

Equipment to be used:

- Controllers: SPHON & BURKHARDT
- Push button, signal fittings, selection switches: ELAN
- LED signal lamps
- IP 2X (in panels)

The number of controller positions can be changed;

- in the crane specification or
- during engineering discussions

4. WIRING AND CABLES

All cables and wiring shall be according PvE from Fire brigade Tata Steel:
- suitable for the environment e.g. oil resistant and/or
- all cables / wires must be handed over for approval during engineering
(Remark: a NEN-IEC standard is coming in the near future: like/equal NEN 8012)

4.1. Fixed cables

All fixed cables must be class 1 or 2 according IEC 60228.

Insulated cores must be covered with an insulation sleeve or shrink-wrap film along the complete cut. The transition from cable sheath to core insulation must be finished using shrink-wrap film, NOT TAPE. (For numbering see paragraph 6)
Cores connected to resistor boxes must be covered with glass shrink-wrap over the complete length exposed to the heat of the resistors.
If E-cabinets are not (placed) mounted in a girder or a separate “E-room”, all cables must be led in via the bottom. In spots with a high risk of mechanical or heat damage, cables must be laid in cable trenches or tubes, not obstructing any required replacement of the cables.
Cable trenches or tubes must be installed in such a way that there is no risk of stumbling.
New trenches or tubes must have 40 % spare space.
Attention of levelling of cables (to be discussed during engineering).

4.2. Flexible cables

All cables connected to end switches; motors and brakes must be flexible
All flexible cables must be class 5 according IEC 60228
The cables used in conjunction with a cable festoon or tender must be suitable for continuous bending applications.
Lynenwerk NSHTöu-K cable or comparable type must be used for high short circuit capacity with respect to strength.

The connection to the trolley and to a possible mobile cabin is generally realised by means of a festoon. The use of cable caterpillars and cable chains must be agreed upon with Tata Steel in advance.

4.3. Single core cables

The installation of single-core cables for three-phase applications must be such, that induction currents are prevented. This can be attained by installing all cables in one fixing bracket or by wrapping the cables separately in non-magnetic material. In case the cables are led through swivels, these and the material between the cables must be made of non-magnetic components. Single core cable needs approval from Tata Steel with respect to EMC.

4.4. Wiring in panels

Colours should be according factory standards or NEN-EN EIC 60204-32 The wiring should be type H05 V-K. All wire connections shall have contact numbers on both wire ends and on the terminal strip (multilayer terminal strip is not allowed). Terminal strip should be with screw-fixation.

5. INFORMATION

5.1. Coding

See also cable numbering in 5.2.
All cables have to be marked on both sides, in compliance with the numbering indicated in the drawings.
Cable cores have to be marked by cable number, core number and terminal number. The marks must be UV-resistant.
All equipment must have an identification plate in accordance with the designation in the drawings or otherwise where agreed upon. This identification plates on the outside of the panels and cabinets must be made of Resopal and printed in black characters on a white background and are preferably fitted by means of screws. They may not be glued. The code indications must be mounted onto the components as well as onto the back plate of the panel.
Wiring in panels connected to terminals must be marked with terminal number
Solid type of marking should be used.

5.2. Drawings

The electrical drawing package for cranes can be drawn in EPLAN or ACAD. For the drawings the general drawing guidelines is applicable (see R1058001). When EPLAN is used then also the EPLAN regulations are applicable (see R1058003). When ACAD is used then also the ACAD regulations are applicable (see R1058002). The frames that must be used are provided by Tata.

Beyond these general, EPLAN and ACAD regulations, the following supplements need to be applied:

Drawing numbers
For the electrical drawing package of the crane four numbers are given.
These numbers must be used for the following drawings:

- Circuit diagram
- Connection diagram
- Cable block diagram + cable list
- Lay-out and component list.

Function codes (in addition location codes are preferred)
Various installation parts on the crane must be coded. See example below.

00	Main power
01	Auxiliary power
1	Main Hoist
2	Auxiliary Hoist
3	Bridge Travel
4	Main Trolley travel
45	Magnet
5	Auxiliary Trolley travel
31	Hook rotation
32	Cabin Trolley travel
34	Tong

Component code
See overview below of the most commonly used codes for components:

K	Relay
S	Switch
T	Transformer
F	Fuse
Q	Circuit breaker
V	Power supply unit
Y	Coil / reactor
M	Motor
B	Sensor
A	Control unit / drive
X	Terminal
W	Cable

Page numbering / lay-out
For numbering the following sequence must be used:

00	Power	page 10 - 99
01	Auxiliary power/ intercom / BMI/CCTV	page 900<…
1	Main hoist	page 100-199
2	Auxiliary hoist	page 200-299
3	Bridge travel	page 300-399
4	Main trolley travel	page 400-449
45	Magnet	page 450-499
5	Auxiliary trolley travel	page 500-599
31/32/33	Hook slewing/Cabin travel/roll tong	page 600-699
	PLC / IO / network equipment	page 700-799

The exact format varies per crane and factory within Tata Steel. The exact format shall be determined in consultation with Tata Steel during the detailed engineering.
Every movement / function is drawn in the following order:
Main power, control, signalling etc.
Always start with the positive direction. Positive directions are: Forward, right, hoisting, right rotation, etc.. Right rotating field must be applied for the positive movement, seen from the current collectors until the motor.

Components must be provided with the necessary information regarding current range settings, capabilities, etc.

By use of E-plan location and function codes have to be used.

Per page 8 component location columns should be used. At the bottom of each column a description (in Dutch) must be given.

Cabinet / terminal

For the terminals function code plus x followed the type of signal. See an example of the terminal strip lay-out below:

0x1= Terminal Main power 400VAC
0x2= Terminal Main power 230VAC
0x3= Terminal Main power 24VDC
0x4= Terminal Main power Signals

01x1= Terminal Auxiliary power 400VAC

01x2= Terminal Auxiliary power 230VAC
01x3= Terminal Auxiliary power 24VDC
01x4= Terminal Auxiliary power Signals

1x1= Terminal main hoist 400VAC
1x2= Terminal main hoist 230VAC
1x3= Terminal main hoist 24VDC
1x4= Terminal main hoist Signals

2x1= Terminal auxiliary hoist 400VAC
2x2= Terminal auxiliary hoist 230VAC
2x3= Terminal auxiliary hoist 24VDC
2x4= Terminal auxiliary hoist Signals

3x1= Terminal bridge travel 400VAC
3x2= Terminal bridge travel 230VAC
3x3= Terminal bridge travel 24VDC
3x4= Terminal bridge travel Signals

4x1= Terminal main trolley travel 400VAC
4x2= Terminal main trolley travel 230VAC
4x3= Terminal main trolley travel 24VDC
4x4= Terminal main trolley travel Signals

5x1= Terminal cabin 400VAC
5x2= Terminal cabin 230VAC
5x3= Terminal cabin 24VDC
5x4= Terminal cabin Signals

6x1= Terminal right console control seat 400VAC
6x2= Terminal right console control seat 230VAC
6x3= Terminal right console control seat 24VDC
6x4= Terminal right console control seat Signals

7x1= Terminal left console control seat 400VAC
7x2= Terminal left console control seat 230VAC
7x3= Terminal left console control seat 24VDC
7x4= Terminal left console control seat Signals

9x1= Terminal radio frequency controller 400VAC
9x2= Terminal radio frequency controller 230VAC

9x3= Terminal radio frequency controller 24VDC
9x4= Terminal radio frequency controller Signals

10x1= Terminal in e-room connection to main trolley 400VAC
10x2= Terminal in e-room connection to main trolley 230VAC
10x3= Terminal in e-room connection to main trolley 24VDC
10x4= Terminal in e-room connection to main trolley Signals

11x1= Terminal main trolley connection to e-rooms 400VAC
11x2= Terminal main trolley connection to e-rooms 230VAC
11x3= Terminal main trolley connection to e-rooms 24VDC
11x4= Terminal main trolley connection to e-rooms Signals

12x1= Terminal Rotating Hook 400VAC
12x2= Terminal Rotating Hook 230VAC
12x3= Terminal Rotating Hook 24VDC
12x4= Terminal Rotating Hook Signals

13x1= Terminal roll tong 400VAC
13x2= Terminal roll tong 230VAC
13x3= Terminal roll tong 24VDC
13x4= Terminal roll tong Signals

20x1= Terminal cabin to e-room connection 400VAC
20x2= Terminal cabin to e-room connection 230VAC
20x3= Terminal cabin to e-room connection 24VDC
20x4= Terminal cabin to e-room Signals

21x1= Terminal cabin trolley connection to e-rooms 400VAC
21x2= Terminal cabin trolley connection to e-rooms 230VAC
21x3= Terminal cabin trolley connection to e-rooms 24VDC
21x4= Terminal cabin trolley connection to e-rooms Signals

60x1= Terminal auxiliary power cabin 400VAC
60x2= Terminal auxiliary power cabin 230VAC
60x3= Terminal auxiliary power cabin 24VDC

The exact structure varies per WE and crane and should be determined in consultation with the client further.

Cable numbering
The cable numbering has the following structure: the code, the letter W, index number, which refers to the current track number. A cable code might look like this: 1W101, 31W601, etc.. Cables, which are used outside of the crane, and thus are on the "fixed" world, are provided with a number from Tata Steel.

5.3. Descriptions

The supplier must include descriptions of the electric equipment. Furthermore, he has to supply the operating instructions for the crane driver, as well as maintenance instructions for service personnel, in Dutch. Form and content of the descriptions are to be further agreed upon.

The supplier must draw up a functionally descriptive document prior to the programming phase, of which form and content are to be agreed upon.

The supplier must keep up a technical construction dossier in accordance with the instructions machine Guidelines

6. COMPLETION

Certain parts of the installation to be assembled at the plant of the supplier, like panels and static converters, should be tested there as much as possible in the presence of a representative of Tata Steel. The date of testing is to be agreed upon with Tata Steel at least two weeks in advance. The equipment is to be shipped only after approbation by Tata Steel.

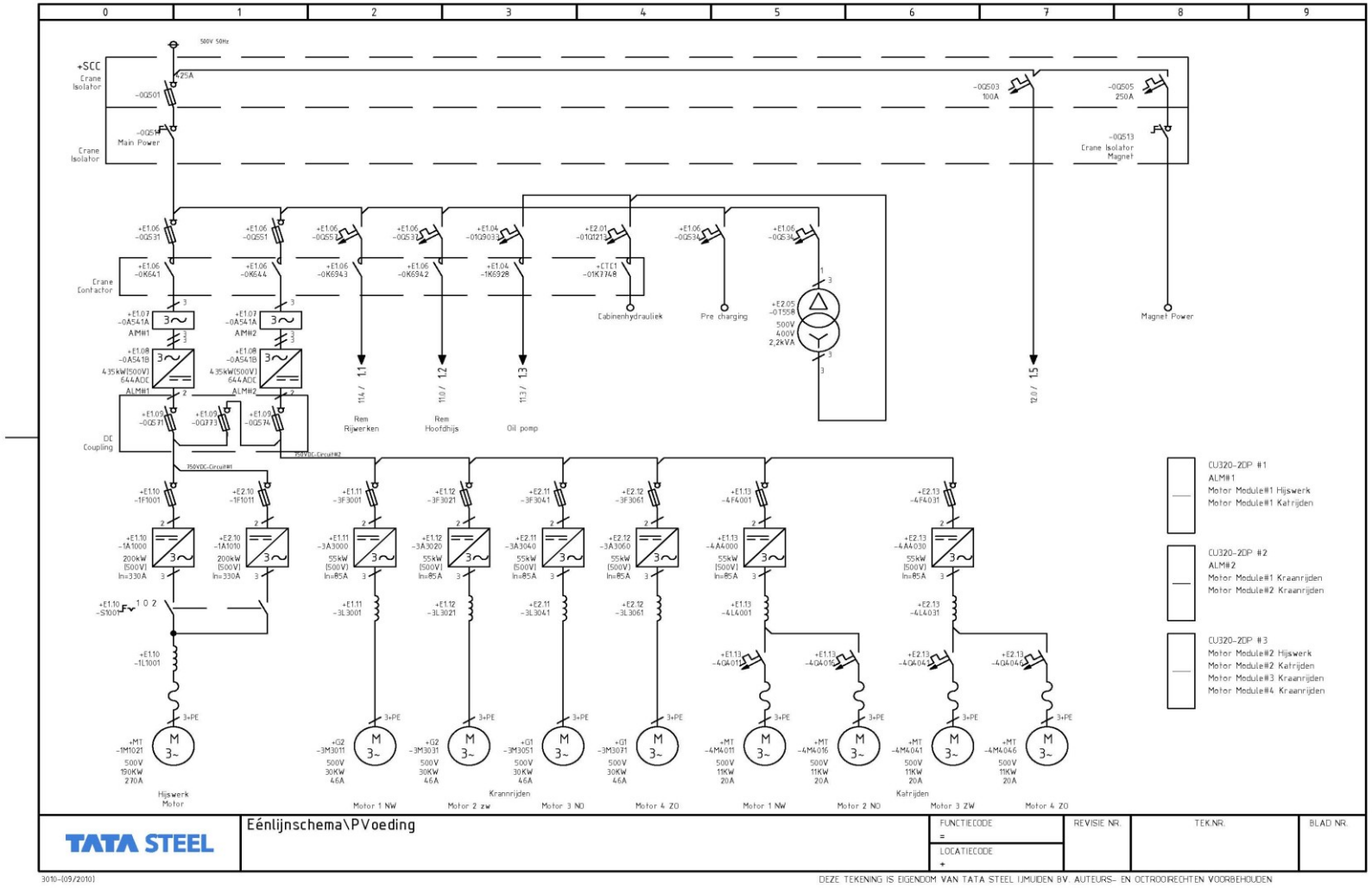
After the complete mounting on the crane, it must be tested and adjusted by the supplier. The supplier has to draw up a protocol that must be approved by Tata Steel for at least four weeks before commencement of the job. The adjustment values of the security devices must be captured in the protocol.

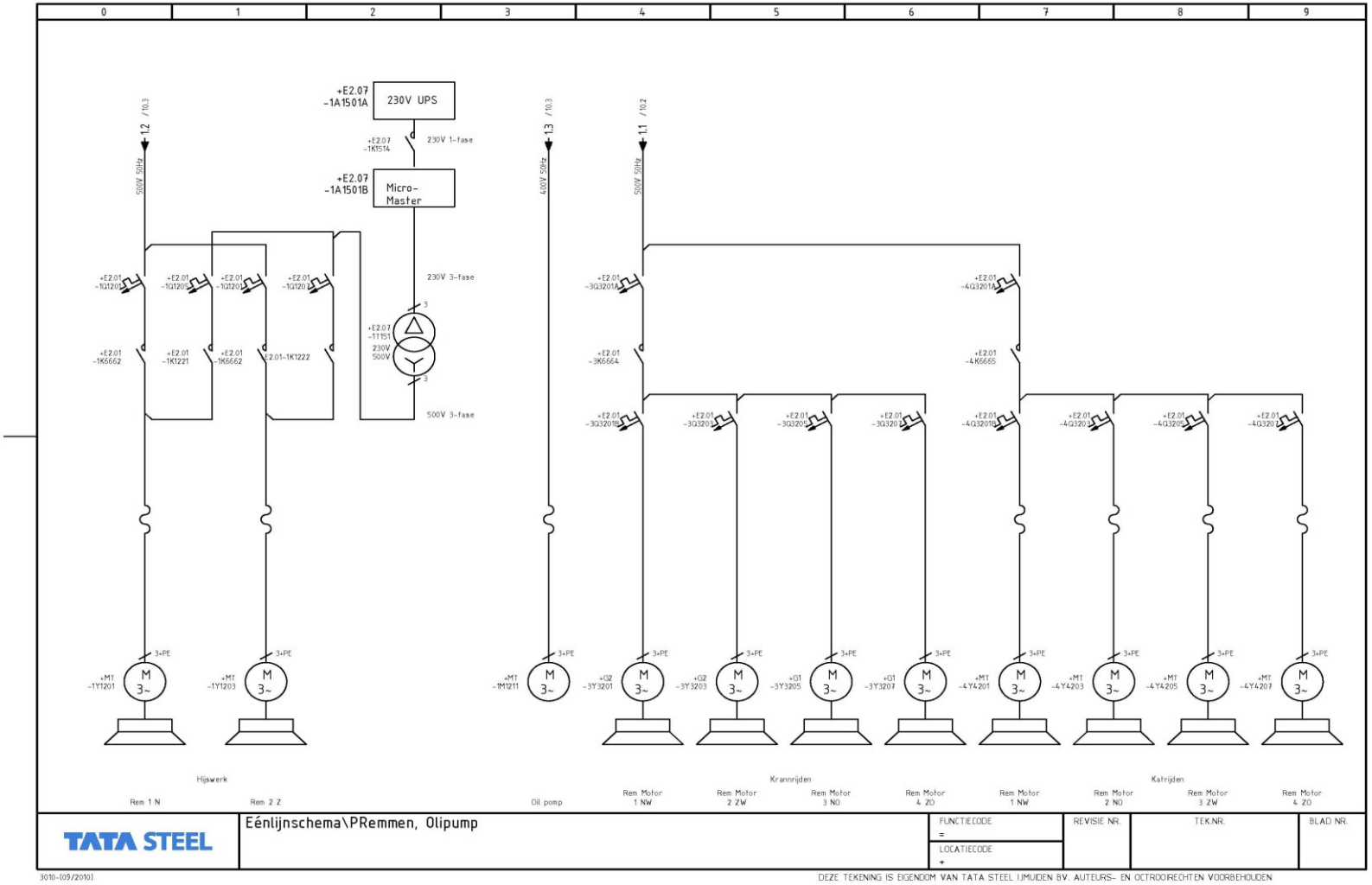
A functional test of the auxiliary circuits must be executed prior to the testing of the main circuits.

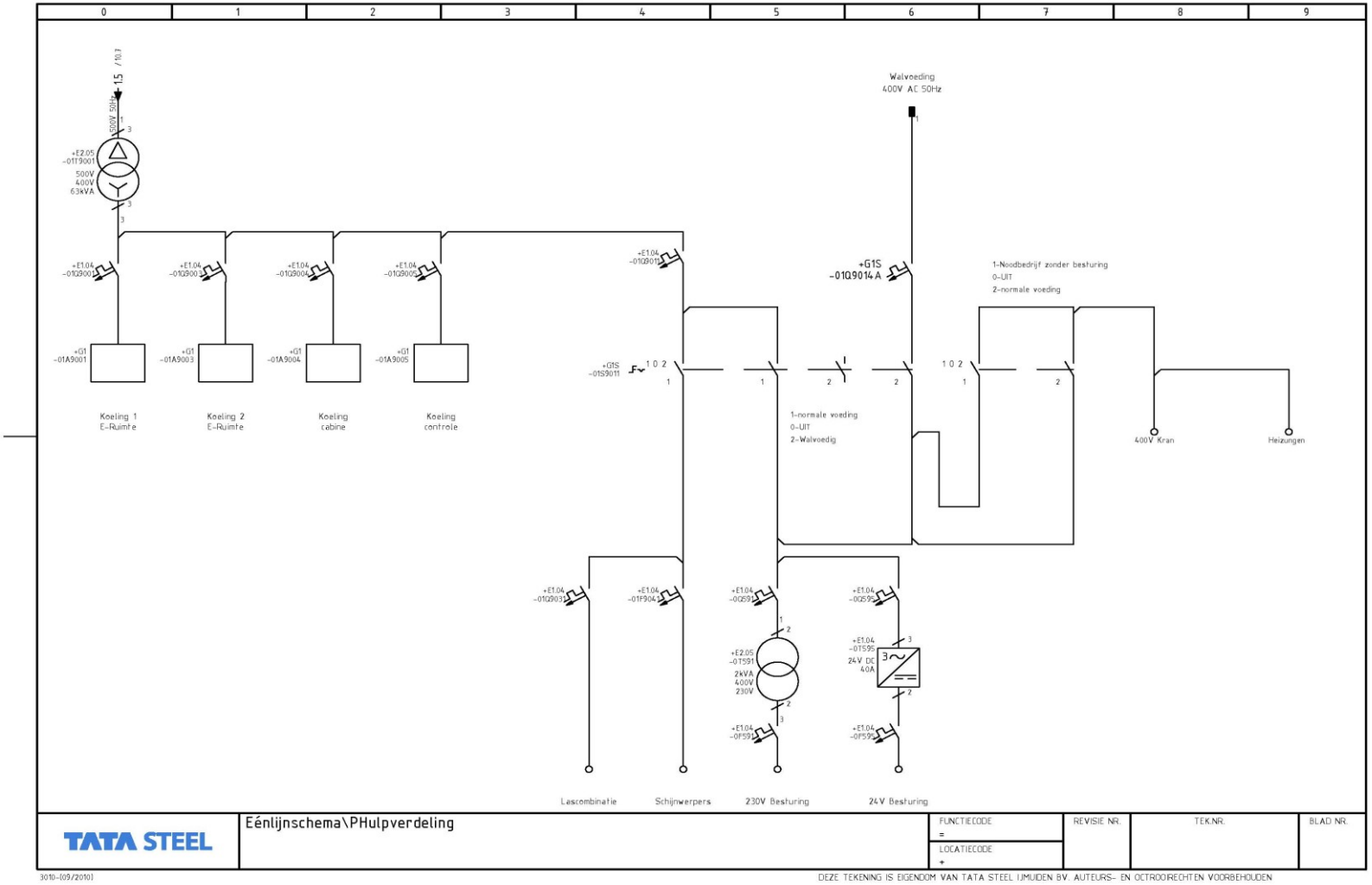
The testing of the main circuits will take place in compliance with the parameters stated in the specifications. For each drive the following must be assessed:
the current/voltage of the motors;
the rotation speed of the motors and the movement speed.(including ramp times)
These values must be registered under no and full load conditions in all controller positions.
The course during start-up of the drives/ motors has to be registered under no and full load conditions. In case more than one motor is used for a single movement, the currents of at least two motors must be registered simultaneously.

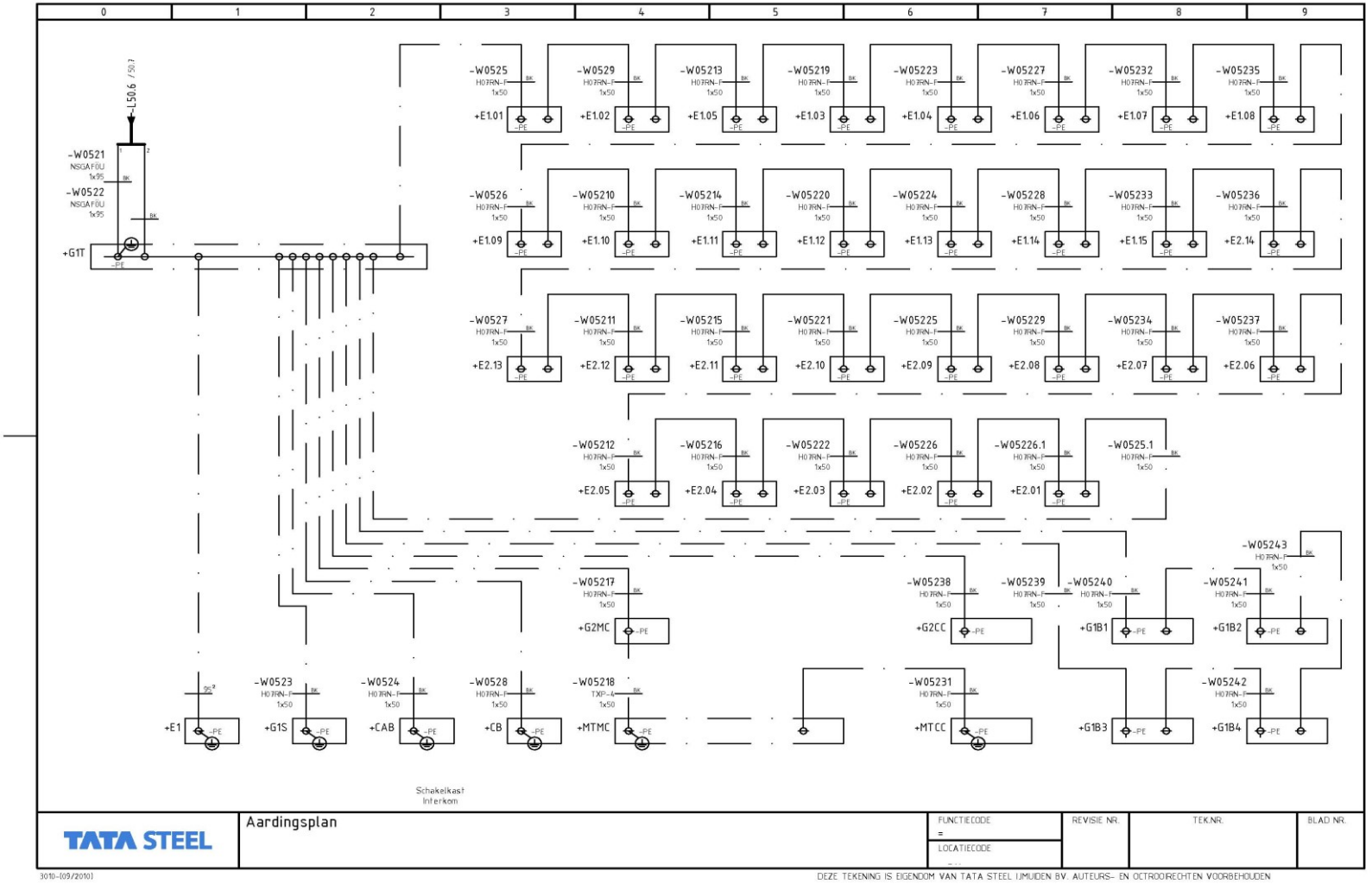
An oscillogram is to be made for drives with a static converter, clearly indicating the course over one operating cycle.
In addition to the foregoing, the course at the installation's overload must be determined in order to indicate that the security circuits are functioning properly.

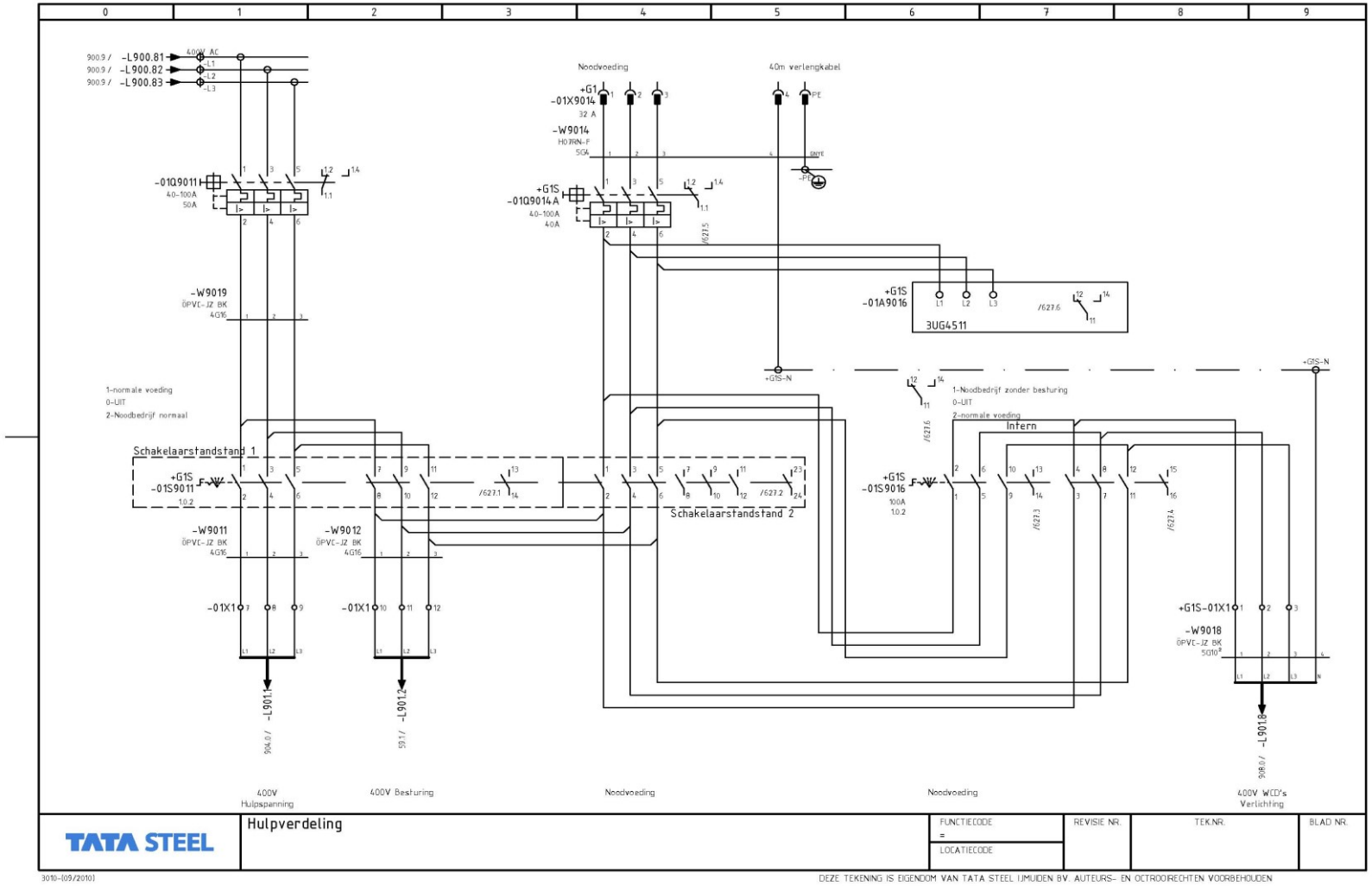
7. APPENDIX


0
1
2
3
4
5
6
7
8
9
500V 50Hz
+SCC
Crane Isolator
-0Q501
250A
-0Q514
Main Power
-0Q503
100A
-0Q505
250A
-0Q513
Crane Isolator Magnet
Crane Contactor
-0K641
-0K644
-0K6943
-0K6942
-1K6928
-01K7748
Cabinenhydrauliek
Pre charging
Magnet Power
AM#1
AM#2
4,35kW(500V) 644 ADC
ALM#1
ALM#2
DC Coupling
Rem Rijwerken
Rem Hoofdhijs
Oil pomp
750VDC-Circuit#1
750VDC-Circuit#2
200kW (500V) In=330A
55kW (500V) In=85A
-1L1001
-3L3001
-3L3021
-3L3041
-3L3061
-4L4001
-4L4031
3+PE
-1M1021
500V 190KW 270A
Hijswerk Motor
-3M3011
-3M3031
-3M3051
-3M3071
-4M4011
-4M4016
-4M4041
-4M4046
500V 30KW 46A
500V 11KW 20A
Motor 1 NW
Motor 2 zw
Motor 3 NO
Motor 4 ZO
Krannrijden
Katrijden
Motor 3 ZW
CU320-2DP #1
ALM#1
Motor Module#1 Hijswerk
Motor Module#1 Katrijden
CU320-2DP #2
ALM#2
Motor Module#1 Kraanrijden
Motor Module#2 Kraanrijden
CU320-2DP #3
Motor Module#2 Hijswerk
Motor Module#2 Katrijden
Motor Module#3 Kraanrijden
Motor Module#4 Kraanrijden
TATA STEEL
Eénlijnschema\PVoeding
FUNCTIECODE
LOCATIECODE
REVISIE NR.
TEK.NR.
BLAD NR.
3010-(09/2010)
DEZE TEKENING IS EIGENDOM VAN TATA STEEL IJMUIDEN BV. AUTEURS- EN OCTROOIRECHTEN VOORBEHOUDEN


0
1
2
3
4
5
6
7
8
9
+E2.07
-1A1501A
230V UPS
230V 1-fase
+E2.07
-1A1501B
Micro-
Master
230V 3-fase
500V 3-fase
1.2 /10.3
1.3 /10.3
1.1 /10.2
500V 50Hz
400V 50Hz
Hijswerk
Rem 1 N
Rem 2 Z
Oil pomp
Krannrijden
Rem Motor 1 NW
Rem Motor 2 ZW
Rem Motor 3 NO
Rem Motor 4 ZO
Katrijden
Rem Motor 1 NW
Rem Motor 2 NO
Rem Motor 3 ZW
Rem Motor 4 ZO
TATA STEEL
Eénlijnschema\PRemmen, Olipump
FUNCTIECODE
LOCATIECODE
REVISIE NR.
TEK.NR.
BLAD NR.
3010-109/2010
DEZE TEKENING IS EIGENDOM VAN TATA STEEL IJMUIDEN BV. AUTEURS- EN OCTROOIRECHTEN VOORBEHOUDEN


0
1
2
3
4
5
6
7
8
9
Walvoeding
400V AC 50Hz
+G1S
-01Q9014 A
1-Noodbedrijf zonder besturing
0-UIT
2-normale voeding
1-normale voeding
0-UIT
2-Walvoedig
Koeling 1
E-Ruimte
Koeling 2
E-Ruimte
Koeling
cabine
Koeling
controle
400V Kran
Heizungen
Lascombinatie
Schijnwerpers
230V Besturing
24V Besturing
TATA STEEL
Eénlijnschema\PHulpverdeling
FUNCTIECODE
=
LOCATIECODE
+
REVISIE NR.
TEK.NR.
BLAD NR.
3010-009/2010
DEZE TEKENING IS EIGENDOM VAN TATA STEEL IJMUIDEN BV. AUTEURS- EN OCTROOIRECHTEN VOORBEHOUDEN


0
1
2
3
4
5
6
7
8
9
-L50.6
-W0521
NSGAFÖU
1x95
-W0522
NSGAFÖU
1x95
+G1T
-W0525
-W0529
-W05213
-W05219
-W05223
-W05227
-W05232
-W05235
+E1.01
+E1.02
+E1.05
+E1.03
+E1.04
+E1.06
+E1.07
+E1.08
-W0526
-W05210
-W05214
-W05220
-W05224
-W05228
-W05233
-W05236
+E1.09
+E1.10
+E1.11
+E1.12
+E1.13
+E1.14
+E1.15
+E2.14
-W0527
-W05211
-W05215
-W05221
-W05225
-W05229
-W05234
-W05237
+E2.13
+E2.12
+E2.11
+E2.10
+E2.09
+E2.08
+E2.07
+E2.06
-W05212
-W05216
-W05222
-W05226
-W05226.1
-W0525.1
+E2.05
+E2.04
+E2.03
+E2.02
+E2.01
-W05243
-W05217
-W05238
-W05239
-W05240
-W05241
+G2MC
+G2CC
+G1B1
+G1B2
-W0523
-W0524
-W0528
-W05218
-W05231
-W05242
+E1
+G1S
+CAB
+CB
+MTMC
+MTCC
+G1B3
+G1B4
Schakelkast
Interkom
TATA STEEL
Aardingsplan
FUNCTIECODE
=
LOCATIECODE
-
REVISIE NR.
TEK.NR.
BLAD NR.
3010-109/2010
DEZE TEKENING IS EIGENDOM VAN TATA STEEL IJMUIDEN BV. AUTEURS- EN OCTROOIRECHTEN VOORBEHOUDEN


0
1
2
3
4
5
6
7
8
9
400V AC
-L900.81
-L900.82
-L900.83
-Q109011
40-100A
50A
-W9019
ÖPVC-JZ BK
4G16
1-normale voeding
0-UIT
2-Noodbedrijf normaal
Schakelaarstandstand 1
+G1S
-Q1S9011
F W
-W9011
ÖPVC-JZ BK
4G16
-W9012
ÖPVC-JZ BK
4G16
-01X1
-L901.1
-L901.2
400V
Hulpspanning
400V Besturing
Noodvoeding
Noodvoeding
Noodvoeding
+G1
-01X9014
32 A
-W9014
H07RN-F
5G4
+G1S
-Q109014A
40-100A
40A
40m verlengkabel
+G1S
-01A9016
3UG4511
+G1S-N
1-Noodbedrijf zonder besturing
0-UIT
2-normale voeding
Intern
Schakelaarstandstand 2
+G1S
-01S9016
100A
1.0.2
+G1S-01X1
-W9018
ÖPVC-JZ BK
5G10
-L901.8
400V WCD's
Verlichting
TATA STEEL
Hulpverdeling
FUNCTIECODE
=
LOCATIECODE
REVISIE NR.
TEK.NR.
BLAD NR.
3010-(09/2010)
DEZE TEKENING IS EIGENDOM VAN TATA STEEL IJMUIDEN BV. AUTEURS- EN OCTROOIRECHTEN VOORBEHOUDEN