

Uppgjord Prepared by (also subject manager if other) 2006 Per Anelius, Stig Danielsson	Fac. sign/Type/Project XB	Doc. group 051	Dokument nr- Document no. XB101661	
Dokumentansvarig/Godkänd - Document manager/Approved Bengt Järpenge	Datum - Date 18.03.2009	Rev C	Filekod/Ref -File code/Ref	S class K

Construction description for Teracom's facilities

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General documentation

Responsibility for factual information

Questions relating to this document should first and foremost be directed to Teracom's project manager for the contract assignment in question.

Purpose and scope

The purpose of construction description is to describe the quality requirements for the most common types of construction and installation work that is performed in conjunction with the new building of Teracom's facilities. The description also encompasses certain activities that only occur in conjunction with reconstruction work or extensions to existing facilities.

The construction description is not meant as a rigid set of instructions in the sense that all the stages are to be performed for a particular contract. Nevertheless, the description provides instructions/descriptions as to how particular stages are to be performed, if these have been ordered.

The description does not cover the installation of radio or datacom equipment.

When establishing and documenting the scope of the contract and the particular prerequisites for each facility, the contractor must, together with a representative from Teracom, draw up a specific description of the assignment. For particular projects, separate agreements may be entered into regarding the process and decision paths. In a project organization, for example, Teracom's representative may delegate responsibility for drawing up such agreements to a particular project manager.

The names and contact information for Teracom's project managers will be provided on the order for each contract, unless otherwise agreed for the specific project.

Regulations and handbooks

The contract must be executed in accordance with the regulations and handbooks listed below. The requirements stated in this description should be regarded as minimum requirements. In instances where legislation or supplier requirements demand higher standards, it is necessary to adhere to these.

Regulations and handbooks:

The most recent edition of applicable AMA regulations (General description of materials and works).

Guidelines for the planning and construction of class III and class IV forest roads.

The following regulations will apply to electrical installations:

High voltage regulation ELSÄK 2004:1 and all updates to this regulation.

IBL-96, SS 437 01 40

Rechargeable batteries – Installation and ventilation SS 408 01 10.

Applicable standards according to Swedish standard.

Applicable EU Directives (LVD and EMC).

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Reference to the applicable working environment documents can be found in the Administrative Regulations.

Planning principles

New construction

Planning must conform to the following standards:

- Unless otherwise agreed, AutoCad LT 2005 must be used.
- Layer structure must conform to the Teracom standard. Teracad's prototype drawings and the Teracad application are provided by Teracom.
- Station location map
A4 format document showing a map image which, besides the station building in question, also includes a major road, urban area or other suitable landmarks.
The following are examples of supporting documentation for map images:
 - Topographic maps, such as a map of the terrain, 1:50,000 scale
 - other maps, such as maps of urban areas
 The station building must be marked on the map image with a clearly visible circle, and its coordinates must also be specified as per the Swedish grid (RT90).
The map image must also be supplemented with directions indicating the most appropriate route starting from a major public road. The distance from the closest major city should be indicated.
- Site plan
A drawing of the station building in A4 format, 1:200 scale, which includes information about the property boundaries and lease area, including its outer boundaries with other properties and/or road links. Boundary lengths are expressed in meters.
A measurement scale/scale bar must always be provided. Direction is indicated by an arrow pointing north.
The property name and number must be clearly indicated, along with the names/numbers of bordering properties.
- Layout drawing:
Layout in A4 format, 1:40 scale, indicating where racks and other fixtures are located on the floor area, marked with symbols according to scale.
- Rack layouts:
Based on documents supplied by Teracom, but updated to as-built documentation following installation.
- Mast facility drawing:
Documentation showing masts and what has been assembled, such as relevant mast/tower sections, climbing protection, fall protection equipment, etc.

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- Antenna facility drawing:
Plan and elevation drawing of masts/towers in A4 format, indicating the equipment that has been installed, type of braces, height and direction.
- Power/Alarm/Grounding drawings:
Required drawings showing power network, grounding system and alarm installations at the station.
- Connection table:
Based on documents supplied by Teracom, but updated to as-built documentation.
- Land development drawings:
Required presentation of ground ducting and foundations. Also includes reports from any geotechnical surveys that have been conducted.
- Other drawings:
Other relevant detail drawings for the station (such as construction drawings of specific details, mountings, etc.).

Reconstruction and additions

Review and construction documents must adhere to the following standards:

- Unless otherwise agreed, AutoCad LT 2005 must be used.
- Layer structure must conform to the Teracom standard. Teracad's prototype drawings and the Teracad application are provided by Teracom.
- Existing drawings supplied by Teracom are updated.
- If drawings are missing, new ones must be prepared regarding those parts covered by the contract.
- New drawings must be prepared in accordance with the standard stipulated in Teracom's Documentation Rules.

Teracom provides all existing drawings that are available for the facility in question.

Final documentation

New construction

The contractor must draw up and supply final documentation for those parts covered by the contract.

As-built documentation must conform to the same standard as specified above in point 0.4.1.

The final documentation must include the following:

- Station location map
A4 format document showing a map image which, besides the station building in question,

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also includes a major road, urban area or other suitable landmarks.

The following are examples of supporting documentation for map images:

- Topographic maps, such as a map of the terrain, 1:50,000 scale
- other maps, such as maps of urban areas

The station building must be marked on the map image with a clearly visible circle, and its coordinates must also be specified as per the Swedish grid (RT90).

The map image must also be supplemented with directions indicating the most appropriate route starting from a major public road. The distance from the closest major city should be indicated.

- Site plan

A drawing of the station building in A4 format, 1:200 scale, which includes information about the property boundaries and lease area, including its outer boundaries with other properties and/or road links. Boundary lengths are expressed in meters.

A measurement scale/scale bar must always be provided. Direction is indicated by an arrow pointing north.

The property name and number must be clearly indicated, along with the names/numbers of bordering properties.

- Layout drawing:

Layout in A4 format, 1:40 scale, indicating where racks and other fixtures are located on the floor area, marked with symbols according to scale.

- Rack layouts:

Based on documents supplied by Teracom, but updated to as-built documentation following installation.

- Mast facility drawing:

Documentation showing what has been assembled, such as relevant mast/tower sections, climbing protection, fall protection equipment, etc.

- Antenna facility drawing:

Plan and elevation drawing of masts/towers in A4 format, indicating the equipment that has been installed, type of braces, height and direction.

- Power/Alarm/Grounding drawings:

Required drawings showing power network, grounding system and alarm installations at the station.

- Connection table:

Based on documents supplied by Teracom, but updated to as-built documentation following installation.

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- Land development drawings:
Required presentation of ground ducting and foundations. Also includes reports from any geotechnical surveys that have been conducted.
- Other drawings:
Other relevant detail drawings for the station (such as construction drawings of specific details, mountings, etc.).
- Paper copies of any permits that have been granted.
- Paper copies of any tenancy/rental agreements that are in force.

Test report (TE, Teracom)

- All test reports that have been drawn up for the contract (resistance measurements, attenuation measurements, BER measurements, alarm tests, etc.)
- Internal controls and any reports from the final inspection.

Operating and maintenance instructions (TE)

- Operating and maintenance instructions for products (cooling system, batteries, rectifiers, etc.).
- List of suppliers that have delivered products and carried out work for the station.

Serial numbers (TE)

- A list of serial numbers for installed products:

Photos (TE, Teracom)

- Photos of the facility (optional).

Documentation

Final documentation must be delivered in the form of an editable CD. Drawings must be supplied in DWG format.

Reconstruction and additions

The contractor must draw up and supply final documentation for those parts covered by the contract.

The final documentation must include the following:

- Construction documents prepared for the contract revised in relation to as-built documentation.
- As-built documentation must conform to the same standard as specified above in point 0.4.2.

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- Updated versions of the existing Operating and Maintenance Instructions.
- If Operating and Maintenance Instructions do not exist, new ones must be drawn up for the installations covered by the contract.
- If changes have been made to existing alarm systems, documentation of such changes must be submitted to Teracom. In instances where drawings of alarm systems have been provided, they must be updated by the Contractor, however.
- When it is necessary to revise the Orientation drawing (the drawing displayed in the fire cabinet at each facility), this must be updated by hand. However, when the Orientation drawing has been provided in digital format, it must be updated digitally.
- The Contractor must draw up and provide a completed Internal control report for each Contract. The template for the internal control report must be approved by Teracom.
- Reports from assessments and tests that are required for the Contract.

Final documentation must all be delivered at the same time in paper format in hard folders, as well as on an editable CD. Drawings must be supplied in PDF and DWG format.

Attachments

The list below is a summary of the documents, type drawings, etc., that are referred to in this description:

Document number	Rev.	Content	Date	Rev. date
1.3.3 Grounding system for mast and shed, and 4.5 Ground system				
XMÖ101648	A	Type document, Grounding (2 pages)	15.05.03	15.05.03
XMÖ101649	A	Grounding instructions when making additions/changes to mast facilities	16.05.03	16.05.03
5/XB100668/2	E	Type document, Grounding, Guy foundation (2 pages)	15.05.03	15.05.03
XATM101629	B	Requirements for fittings in Teracom's masts	28.05.03	14.12.04
XE 101701	B	Type document, Ground plan – Grounding and ducting, equipment shed The document shows the external grounding, ducting and location of meter cabinets when erecting equipment sheds and towers.	03.11.04	
XBL 101702	A	Type document, Connection diagram – Control unit 3G alarm. The document shows the connection between the alarm system, power plant and ventilation system in equipment sheds and for co-location when Kontrollelektronik's free cooling is installed.	03.12.04	

Construction description

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Ground work

For each installation, the scope of the ground work must be agreed between Teracom's project manager and the contractor.

Staking out

All surveying and staking out will be carried out by the contractor.

Felling trees and clearing

Trees may not be felled without prior consultation with the property owner.

Unless otherwise agreed, the following applies: The felling of trees applies to trees that have a stem diameter of 0.1 m or more at heights of 1.3 m above ground surface. Any trees that are felled belong to the property owner. The trees must be cross-cut in accordance with the instructions provided by the property owner, and they must be stacked at the designated location. Stumps, branches, and cleared material must be removed by the contractor.

Tree felling and clearing for site plan and access road.

Tree felling and clearing for technical facilities must be executed in accordance with applicable AMA construction regulations.

Tree felling and clearing for masts and guys

Tree felling and clearing for mast and guys must be executed in accordance with applicable standards. The cleared area for the guys must be at least 10 m wide.

Access road

Changes to existing roads

When it is necessary to extend or widen an existing road, the same material and bearing capacity as the existing road must be used for the fill, superstructure, surface course and ditches.

New roads

Roads must be at least 3 m wide, and the minimum construction standard is "forest road, class 4B" in accordance with the Swedish Forestry Agency's regulations. However, such new roads must temporarily (during reconstruction and additions) be able to withstand traffic associated with construction, such as trucks and mobile cranes.

New roads that connect to roads that have paved surfaces must be surfaced with 50 mm dense asphalt concrete (ABT 16) to 6 m from the shoulder, while the remainder of the access road is surfaced using 50 mm surface course gravel.

Superstructure

Changes to existing lot

In cases where it is necessary to expand the existing lot, the same material and bearing capacity as the existing lot must be used for the fill, superstructure and surface course. New surfaces must be aligned for drainage according to the same principle as used for the existing surfaces. See the regulation under point 1.4.2 concerning vegetation and topsoil.

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New lots adjacent to masts and shed sites

Lots must be arranged at a distance of at least 1 meter from all existing above-ground, visible structures, and the lots must be large enough for a car to be able to turn around. Lots must slope to enable water runoff.

Vegetation and topsoil must be removed in accordance with AMA 1998 construction regulation BFE.1. The superstructure must be executed with at least 300 mm friction materials in accordance with AMA 1998 construction regulation DCB.23, and a 30 mm layer of 0-18 mm fraction gravel in accordance with AMA 1998 construction regulation BCB.412.

Foundations for equipment shed

Foundations must be laid in accordance with the instructions provided by the supplier in question.

The distance from a new shed to existing structures must be at least 1.5 m.

When laying foundations for sheds equipped with radio relay link, special consideration must be given to the requirement that the maximum permitted change of angle of the antenna carrier in relation to the radio link is $\pm 1.0^\circ$. This places particularly stringent requirements as regards site preparation and the laying of foundations so that future settlement is avoided.

After the link has been put into operation, the maximum permitted vertical deviation between the equipment shed's various installation areas may never be more than ± 2.5 mm at each foundation plate.

Foundations for technical cabinet

Foundations for technical cabinets that are to be set on the ground must be in accordance with the supplier's instructions.

Foundations for Technical Cabinet TS 60

When the ground is subjected to frost, soil must be replaced with crushed rock to the frost-free level.

The cabinet's foundations are placed on a paved surface 300 mm below the finished ground level. The leveled and compacted surface should extend at least 500 mm beyond the cabinet, measuring approximately 3000 x 1700 mm.

The cabinet is placed on the prepared surface and then aligned. The maximum permitted deviation from vertical is 1.5° . In order to brace the cabinet, concrete slabs should be placed on the foundation's bottom plate before backfilling.

The foundations have open sides underground for ducting. Before backfilling, an external ground ring is installed under the ducting.

The ground ring is connected to the cabinet at two external ground bolts.

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Ducting

Ducting in ground up to technical facility, and where appropriate between technical facility and tower/mast

A pipe of the type Uporen road culvert DN 400 and a metal collar with $t > 1.5$ mm where the cable duct ends must be placed under a new technical shed with a cable inlet in the floor. The protective pipe or collar, which may be produced as a two-part "telescopic version", must protrude at least 250 mm down into the gravel bed. If the collar is the two-part version, the parts must overlap by at least 100 mm. Cable ducts type E 06 639 04 or equivalent must be routed to the required extent. The ducts must be placed at a depth of 600 mm.

After cables have been laid, the ducts must be sealed. Sealing can be carried out with a frame such as Roxtec or equivalent. Sealing must be performed in such a way that subsequent additions can be made.

Where fiber cables are present, a fiber hose type E 06 614 02 or equivalent must be placed inside the cable duct as described above. The hose must be fitted with a draw wire.

Cable ducts must be executed in accordance with SS-EN 424 14 37.

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Technical areas

General

Technical areas comprise a technical building or part of an existing property. The area is intended for the installation of communication and power systems.

Equipment shed

The choice of shed type must be determined in consultation with Teracom's project manager.

The equipment shed must be adapted to the surrounding environment in terms of color choice and other camouflage solutions.

The following standard sheds are available:

Shed type	Size (internal)*
RB C4	W = 2740 mm L = 8100 mm H = 2800 mm
RB C6	W = 2740 mm L = 3930 mm H = 2800 mm
RB C11	W = 2100 mm L = 2100 mm H = 2300 mm
RB C12 RB C8	W = 2400 mm L = 2800 mm H = 2400 mm
RB C13 RB C10	W = 2400 mm L = 3600 mm H = 2400 mm

* Minor variations in dimensions occur between the various suppliers.

Teracom has entered into framework agreements regarding these sheds.

Additional information, type drawings, camouflage solutions, etc., are supplied by the supplier in question.

Mast pipes on equipment sheds

The sheds can be fitted with mast pipes on one gable end. When a mast pipe is installed, the pipe must be supplied with a mounting for a climbing ladder and the required number of loose step brackets above the shed roof, so that the installed antennas are accessible for servicing and maintenance.

The mast pipe is connected to the shed's grounding system.

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New technical area within existing building

New technical areas must be arranged by agreement with Teracom's project manager. The technical area is supplied with fire protection equivalent to that in the existing building.

In general, the existing safety level must be retained.

Applicable parts of this section also apply when equipment is placed in an existing installation without the area being delimited. In those cases where fire protection documentation exists, this must be complied with.

Demolition and dismantling

The contractor is responsible for the existing interior furnishings and building elements that are demolished or dismantled being removed from the facility to a landfill site, unless otherwise specifically agreed with Teracom's project manager. Waste must be sorted.

Bushings

When making holes for bushings, the text relating to safety, section 2.4, must be taken into consideration.

2.3.2.1 Cable bushings and cabling in rooms

Making holes through roof membranes should be avoided.

Cable bushings must be executed according to the following principles:

Bushing through fire cell-separating walls, ceilings and floors with demands for a different level of airtightness must be sealed with a type-approved fire sealant or wall bushing frame of the same type that is used in the rest of the facility.

In outer walls or where specified, modular systems must be used. The wall bushing frame must be made of hot-dip galvanized, composite or stainless steel. The frame and insert blocks must be of the same make and must not be mixed.

Cables must be routed in cable ladders and secured with cable ties. Cable ladders must also be installed between existing ladders and racks. Cables must be routed so that they do not obstruct the installation of new racks. Where there are no cable ladders, new ones must be installed. Cable ties must not be cut in such a way that sharp edges arise.

External plating

Plating must be carried out in a 180 µm plastisol-treated version, unless otherwise agreed with Teracom's project manager.

Floors

Floors must be dimensioned for the loads to which they are subjected.

New floor coverings must be of homogeneous plastic mat unless otherwise specified.

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Walls

New walls must be executed in a way that does not impair fire and burglar protection in relation to surrounding rooms.

New walls must be painted in accordance with AMA code 56-03410 Gloss 40 in the same color as the surrounding paintwork.

If necessary, existing walls must be painted in accordance with AMA code 966-30410 Gloss 40, in the same color as the surrounding paintwork.

Ceiling

New ceilings must be painted in accordance with AMA code 56-03410 Gloss 40, in white.

If necessary, existing ceilings must be painted in accordance with AMA code 966-30410 Gloss 40, in white.

Doors

Outer doors in walls that constitute shell protection for the entire installation

The choice of door type must take place in consultation with Teracom's representative, in accordance with the following alternatives.

Alternative 1 Doors with motor locks

Doors must be of the type aluminum profile system Sapa 2060 S3, natural anodized, and must satisfy the requirements for security doors class 3 according to SS 817345. Externally the panel must comprise 2/4 mm aluminum/checker plate and internally 1.5 mm aluminum/plate.

Size 11 X 21

Doors must be fitted with:

- motor lock Abloy 8154 incl. control unit,
- Abloy cable 8853
- empty ducts for motor lock
- door loop Abloy 8810 incl. recess
- magnetic contact Aritec DC 107
- cabling to magnetic contact
- extra lock Assa 9787
- cover plate Assa 4265 for extra lock
- handle Assa 6696
- door closer Dorma TS-83 with hold-open function

Alternative 2 Doors prepared for motor locks

Doors must be of the type aluminum profile system Sapa 2060 S3, natural anodized, and must satisfy the requirements according to RUS 200:3. Externally the panel must comprise 2/4 mm aluminum/checker plate and internally 1.5 mm aluminum/plate.

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Size 11 X 21

Doors must be fitted with:

- lock Assa 8765 with microswitch
- recess for Assa modular lock (excluding recess for handle and cylinder) incl. face plates
- empty duct for lock case
- door loop Abloy 8810 incl. recess
- magnetic contact Aritec DC 107
- cabling to magnetic contact
- handle Assa 6696
- door closer Dorma TS-83 with hold-open function

Inner doors to technical areas

Inner doors to technical areas must be of the type Steel doors fire class EI 60.

Doors must be factory-painted according to the manufacturer's standard in the same color as the existing doors.

Doors must be fitted with door closer type Dorma, lock case type ASSA 8765 and handle type ASSA 696.

Doors must be supplied with wall-mounted door stops.

Security

In general, the existing shell protection/security level must be retained, i.e. any bushings, holes, etc., must be executed so that they do not impair the shell protection/security level for the facility.

When constructing a new facility that does not have a high or restricted security level, where specific execution rules apply, the choice of security level/protection class must be made according to instructions from Teracom's project manager.

Climate installation

Climate management system

The conversion and supplementing of climate management installations must be coordinated with the existing systems in the premises.

When choosing a combination of Free cooling and Cooling system, Free cooling must be interlocked when cooling machines are in operation.

The choice of air conditioning system must otherwise take place in the following order:

1. Free cooling (Fan system) Executed as displacement ventilation
2. Combination of free cooling and cooling system
3. Cooling system (AC split)
4. Ventilation requirements in accordance with "Rechargeable batteries – Installation and ventilation SS 408 0110" must always be satisfied.

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5. Climate systems should be executed so that the facility is energy efficient.

The design and choice of climate system must be approved by Teracom prior to installation.

Materials

The corrosive class for components mounted indoors must be C 2 according to BSK 99, section 1:23, medium durability in rust protection systems, section 8:7.

The corrosive class for components mounted outdoors must be at least C4 according to BSK 99, section 1:23, high durability in rust protection systems, section 8:7.

Climate requirements

The climate installation, heating/ventilation, must be dimensioned for a normal indoor temperature, min. +15°C, max. +20°C. However, the indoor temperature is allowed to exceed the outdoor temperature by a maximum of 5°C, 1.5 meters above the floor, at outdoor temperatures of above +20°C.

These requirements do not apply if the installed equipment has specific requirements.

Noise requirements, ventilation system

In the first instance, the noise level from the system may not exceed 60 dB (A) at measurement points 1.5 m above the floor, 0.5 m from system components.

In the event it is not possible to achieve the above noise requirements, the fan systems must be supplied with timers so that temporary, timed stoppages of fans for up to 30 minutes can be achieved.

Air filter

The cleaning level for air filters must be at least class F5.

Filter banks must be connected to alarms.

External wall grilles

External wall grilles must be designed so that liquid cannot penetrate (rain protection type), or must be equipped with external hoods.

External wall grilles in buildings with a high or limited level of protection must be supplied with, or through the embedding of threaded sleeves be prepared for the installation of, protective plates that prevent penetration using small arms (panel thickness 10 mm).

External wall bushings in buildings with a high or limited level of protection, measuring > 250 x 250 mm, must be supplied with a grille for entry protection that is type-approved in accordance with the Swedish Theft Prevention Association's standard SSFN 012.

Alternatively, grilles for entry protection can be supplied with burglar alarms.

Electricity

The air conditioning installation's conductive components must be connected to the equipotential bonding busbar.

Power take-offs >2 kW must be executed as 3-phase installations.

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Motors whose starting current exceeds 1.5 * the mains fuse's rated current must be supplied with a starting device that reduces the starting current.

Electrical installations must be executed with 5-wire systems.

Controls and regulation

If possible, speed control should take place with a transformer.

A thermostat for excess temperature alarm must be equivalent to Elkapsling ZR 011. The thermostat is only required when this function cannot be obtained from the climate installation.

2.5.8 Alarms

Alarms functions must be present for:

A-alarm – operational stoppage

B-alarm – high temperature extract air and low temperature supply air

C-alarm – high pressure drop over air filter

Fire function

When adapting in an existing property, the fire protection documentation applicable for the facility must be applied. Where there is no fire protection documentation, the same requirements apply as for the rest of the property. In the event of fire, the ventilation must stop and the dampers must close. Control must take place via an external contact in an existing fire alarm system, or alternatively by a fire detector that is directly linked to the ventilation system, depending on which type of fire alarm system is present in the facility in question. In those cases where there is an existing fire alarm system with a function for removing smoke by restarting the extract air fans from the fire alarm center, new fans must be connected to this function. **Documentation**

The final documentation regarding the air conditioning installation must, as a minimum, be prepared with respect to:

- As-built documentation regarding lot, section, flow chart and wiring diagram
- Operating and maintenance instructions
- Measurement/air flow report CE manufacturer's declaration

Official notification

In the event of refrigerant volumes > 10 kg in total per installation, a notification must be submitted to the environmental authority.

Electrical installation

E is responsible for executed electrical installations conforming to applicable regulations.

All installed products must be CE marked.

Staff qualifications

Electrical installation work requires authorization and must be carried out by or under the supervision of an authorized installation engineer.

The work must be carried out carefully and expertly by professional fitters.

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Systems

The 230/400 V system is carried out as a TN-S system. Neutral and protective conductors are connected at the delivery point.

-48 VDC uninterruptible power. Rectifiers, invertors -48/230 V and batteries, see section 3.

Other systems that occur

- Alarm systems
- Entry control
- Burglar alarms
- Fire alarms
- Operational alarms from the power plant and ventilation
- Presence indicators

Mains connection, electrical service

The contractor dimensions new electrical services for the relevant output.

The ordering of a new service or extending the existing one must be conducted according to IBL-96, SS 437 01 40.

The procedures are checked with a local mains supplier. The supplying network's Ik3 value must be obtained and documented in the group list.

Meter cabinets

Meter cabinets must satisfy the requirements in SS 430 0110 version 6.

Meter cabinet: 125/163 or equivalent with GII/GIII fuse apparatus and equipped as follows.

- Overvoltage protection, 4-pole Elrond ED 150S-275.
- Fuse caps incl. PK.
- Interconnection point for 5-wire system must be easily accessible
- Sign regarding interconnection point for 5-wire system and overvoltage protection
- Locking piece for padlock
- Spare fuses must be included in the delivery.

Equipment sheds are equipped with meter cabinets as above. When placing an equipment shed by an existing station, the shed's meter cabinet will in certain cases replace the existing cabinet. However, meter fusing must be adapted to the relevant power requirement..

The meter cabinet must be grounded to the equipotential bonding busbar.

Environmental conditions

In terms of materials and version form, items of apparatus must be adapted to the prevailing conditions at the site where they are to be used. By means of its version, position or specific devices, wiring must be protected against mechanical damage, chemical attacks, and damage caused by heat or cold.

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Cable entry must take place at a point in an existing or new cable entry frame. If a new cable entry frame is installed, it must be positioned as close as possible to the existing frame. The frame must be grounded to the equipotential bonding busbar.

Technical areas

2.6.6.1 Equipment shed

The electrical installation of the equipment shed is carried out according to the technical specification for equipment sheds.

The equipment shed is equipped with a meter cabinet in accordance with point 2.6.5. The supplying service cable is connected by the power supplier. If the equipment shed's meter cabinet is to replace the existing meter cabinet, the existing station must be connected to the additional outgoing terminal block found in the cabinet, see point 2.6.4.

2.6.6.2 New technical area within existing building

The following applies when a new technical area (delimited or not) is created within an existing building:

Cable inlets in the existing building must be executed and coordinated with existing cable inlets, unless otherwise indicated.

- Connection in existing 230/400 V group central unit as agreed with Teracom's project manager.
- Connection in existing 48 V group central unit as agreed with Teracom's project manager.
- Lighting min. 300 lux at floor level.
- Switches for lighting and a wall socket installed inside the entrance door.
- The wall socket must be positioned 1000 mm above the floor. Rooms must be supplied with at least two wall sockets over and above the socket installed at the central electrical unit. In rooms larger than 10 m², an additional two sockets must be installed per 10 m² of room space.
- Electrical radiator with thermostat, dimensioned for 100 W/m².
- CEE 416 outlet for rectifier must be positioned above the indicated rack location. The outlet must be positioned so that the plugs are accessible, max. rack height 2200 mm.
- Racks of the specified type must be installed according to the instructions.
- The racks are supplied with a vertical equipotential bonding busbar that is connected to an internal ground ring.
- Racks must be supplied with a 230 V socket strip. Schuko socket Rital type 7240.210 or equivalent, vertically mounted.

Wall sockets for general electricity must be connected after ground-fault protection. Items of apparatus that are not connected with plugs must be connected via lockable safety switches, type Cewe Basic or equivalent.

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CEE sockets and 230 V socket strips in racks must be connected before ground-fault protection.

Central electrical unit

The central electrical unit must be connected so that it can be accessed in order to measure differential current with a current clamp.

The central electrical unit and fuses must be of the MG make. Central units must be of the Prisma type. In certain sheds, Pragma C type central units are used.

Central electrical units are supplied with a lockable main switch. Ground-fault protection and miniature circuit breakers are designed according to the pre-impedance "Ik3 value" for the supply network applicable for the facility. The Ik3 calculation is presented in the final documentation.

The central electrical unit must have at least five 10A groups in reserve.

Central electrical units of the specified type are ordered from Elicom.

Ducting

Adaptation of ducting in the station in question takes place as agreed with Teracom's representative. Supplementing with new cable ladders must in the first instance be carried out in accordance with existing cable ladders, in terms of type and height above the floor. Cable ladders must be dimensioned in consultation with Teracom's representative, so that additional space is available when the cabling included in the current contract is laid.

Indoors, basket tray type cable ladders must be installed 2500 mm above the floor. When installing in rooms with a low ceiling height, basket ladders must be installed in the ceiling or vertically on walls 2100 mm to the lower edge of the ladder.

Horizontal ducting must be carried out with a cable ladder/basket tray.

Vertical ducting must be carried out with a basket tray/installation plate.

An installation plate must be used in the first instance.

Cable ladders

Outdoors Wibe KHZ, KHZP, KHZV or equivalent

Indoors Wibe KHZPS or equivalent

Basket ladders

Indoors Defem electro-galvanized (Width 220 or 422 mm, Height 60 mm)

Installation plates MP company type MP MK or equivalent

Wiring

Wiring must be executed as a TN-S system with neutral and protective conductors connected at the delivery point.

The distribution circuit for supplying the group central unit must be of the type EKKJ 4*10/10 mm².

The branch circuit must be EKLK 1.5 mm² unless otherwise indicated.

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Cables for high-voltage current must be installed at a minimum distance of 50 mm from other cables. Parallel routing should be limited as far as possible.

Cables for general electricity must be clamped to walls and ceilings. Cabling for general electricity in cable ladders above radio racks may not occur.

All cables for 230/400 V must be executed with metal sheaths (EKLK, EKKJ, FKKJ).

Cabling for 48 V must be executed with double-insulated cables.

The following types are approved:

- RK two-wire double insulated Red/plus and blue/minus
- TFK two-wire Grey/plus and black/minus

Marking

Marking must be carried out according to Teracom's marking system, see regulation XADN 101077. Marking and signs must be made of permanent materials with permanent text and secure mountings.

Central electrical units must be supplied with signs specifying the unit's designation, system voltage, type of current, as well as the supplying distribution circuit, the number of cables, the cable cross-section and the largest permitted fuse.

A rating plate must be present in the distribution circuit, specifying the designation of the object at the other end of the circuit. The distribution circuit must be marked at both the start and the end of the circuit.

Cables for general electricity are marked with central designation and group number.

Outlets are marked with group number.

48 V cables are marked with "48 V and group number".

Alarm cables are marked according to the Connection table with plastic flag labels located at either end of the cable.

Group designation

Group designation is mounted at the central electrical unit and 48 V distribution. The group designation must be typed. The group designation must specify all supplied objects, areas and fuse sizes. The group designation must also contain information about the supplying network's pre-impedance "Ik-3 value".

Testing and commissioning

The work includes commissioning, testing and adjustment of included equipment and apparatus, so that the intended function is achieved. Internal controls according to the points specified below must be carried out and documented.

- Insulation measurement of all included cables
- Checking 5-wire systems
- Checking protective ground
- Checking equipotential bonding

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- Functional check of ground-fault protection
- Checking fire alarms and burglar alarms if these are affected.
- CE marking

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Power system

General

Co-located customer equipment places different demands on the design and accessibility of the power system. This entails that power supply can take place as follows

- Mains supply 230/400 V unprioritized
- -48 V DC uninterruptible supply
- 230 V AC uninterruptible supply

Mains supply

Co-located equipment that does not require an uninterruptible supply is connected to an unprioritized group central unit before ground-fault protection.

Mains and auxiliary power supply

Co-located equipment that does not require an uninterruptible supply but that requires auxiliary power is connected to a prioritized group central unit before ground-fault protection.

-48 V DC uninterruptible supply

Co-located equipment that requires an uninterruptible supply is connected to the indicated central unit or to a 48 V power system.

230 V AC uninterruptible supply

Co-located equipment that requires an uninterruptible supply is connected to the indicated central unit for uninterruptible 230 V.

Power system -48 V

48 V power systems must be installed in accordance with the supplier's instructions.

Mains connection is executed via plug CEE 416.

Power systems can be placed in racks in accordance with the installation instructions or in a separate cabinet. The racks have the following dimensions: height 1800/2200 mm, width 19 inches, depth 600 mm. The power system is placed in the specified location in the rack.

The technical specification for power systems from each supplier is supplied by Teracom.

Substation 48 V

In some installations, a new 48 V substation can be an alternative to a complete 48 V power system.

Information about possible substations will be provided by Teracom's project manager.

Alarms

In the event of a new establishment, alarms must always be installed, with forwarding to Teracom's Operations Management where possible.

Alarm functions must be present with the following functions:

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Information about which alarms are to be connected and the location of the terminal block will be provided by Teracom's representative.

Alarm cables

Alarm cables for connecting Teracom's alarm system must be:

- if the cable runs externally, ELAKY 10x2x0.5
- if the cable runs internally, EKKX 10x2x0.5

The cable must be routed to the specified location in Teracom's facility.

The ELAKY cable shield must be connected to ground in the equipment shed.

Alarm from 48 V power system

If a new 48 V power system is required, the following alarms must be connected

- A-alarm
- B-alarm
- C-alarm
- Mains failure

Outgoing alarms are connected to the alarm system.

Alarms from the ventilation system

If a new ventilation system is required, the following alarms must be connected

- A-alarm – operational stoppage
- B-alarm – high/low temperature
- C-alarm – filter replacement

Outgoing alarms are connected to the alarm system.

Customer-specific alarms

Different customers can have differing demands as regards alarm connection. Refer to each customer's technical specification.

Other alarms

When building a new technical room in an existing station, the existing fire alarm and/or burglar alarm must be supplemented so that the existing alarm function is not impaired.

Information about which alarms are to be connected and the location of the terminal block will be provided by Teracom's representative.

When supplementing with an equipment shed, it is normally only necessary to connect the operational alarm as per 3.3.1 and 3.3.2 to the existing station's alarm system via terminal blocks P1 and P2. Terminal block P1/2 is located in the equipment shed.

The following additional alarms are prepared in the equipment shed

- Burglar Magnetic contact connected to terminal block P1.

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- Staff Lock contact connected to terminal block P1.

The following may occur if supplementary alarms are ordered from the shed supplier. These are not normally included.

- Obstacle lighting

Functions in addition to those set out above are specified for each facility.

Station monitoring for alarm transfer to the superior Teracom Operations Management.

The following functions must be present:

1. Unauthorized entry
2. Fire alarms
3. Station properly staffed
4. Over/Under-temperature
5. Ventilation buzzer alarm
6. Mains failure
7. Reserve
8. Reserve

All alarm points must be connected.

The inputs for station monitoring must cope with both open and closed contact function from sensors.

The execution of station monitoring can be seen from the station document.

An equipment alarm is connected.

Fire and burglar alarms

When building a new technical room in an existing station, the fire alarm and/or burglar alarm must be supplemented so that the alarm function is not impaired.

Information about which alarms are to be connected and the location of the terminal block will be provided by Teracom's representative.

When supplementing with an equipment shed, all alarms are connected to station monitoring.

Alarms in accordance with 3.3 are prepared in the equipment shed.

Obstacle lighting alarms, where present, must be connected to station monitoring.

Equipotential bonding

During planning work, coordination with the property owner is necessary. (in those cases where Teracom does not own the facility/property)

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General

All conductive construction and installation components must be connected to the facility's equipotential bonding system.

Serial grounding may not occur.

At the center of the system there must be a main equipotential bonding busbar.

Grounding instructions, technical room

The equipotential bonding busbar is installed directly under the ladder/cable tray adjacent to the cable entry into the room. The busbar is connected to the station's grounding system.

Equipotential bonding busbar (Elkapsling item no. 7430100 or equivalent with a length of 400 mm must be used). The equipotential bonding busbar must be supplied with 15 connection clamps (Elkapsling item no. AK 01290) with a connection area of 1.5-35 mm².

All incoming cables must be grounded.

Ground conductors and connections to the station's grounding system must be RK 35 mm² green/yellow or blank.

Internal ground ring RK 25 mm² green/yellow is position at the ladder's underside so that a ring is formed with the equipotential bonding busbar.

Connection of the below items must take place with at least RK 16 mm² green/yellow.

The following must be connected to the equipotential bonding busbar

- Central electrical unit's PE busbar
- Cable entry frame

The following parts are connected to the ground ring

- Rectifier chassis and + busbar
- Radio and transmission rack
- Conductive parts in ventilation system, pipes and building
- Cable ladders/cable trays

Grounding of technical room in external property

In this context, an external property refers to a property that is not owned by Teracom.

If the property has a lightning protection system in accordance with SS 487 01 10, the technical room and the antenna cable carrier must be grounded to this.

If the property does not have lightning protection or has lightning protection that does not satisfy SS 487 01 10, the technical room must be grounded to the electricity supplier's ground in the central electrical unit.

Grounding instructions, equipment shed

The inside of the equipment shed is supplied with a grounding system in accordance with 3.4.2.

The equipment shed's external equipotential bonding busbar is connected to the external ring line. The equipment shed's frame is connected diagonally to the external ring line in at least two places.

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The ring line must be placed approx. 1.5 meters from the shed at a depth of approx. 0.5 m. When crossing other cables, the ground line must be at least 0.2 m below the other cable, see drawing XE 101701.

If the equipment shed is located by an existing installation, the new grounding system must be connected to the existing ground system.

Grounding cables in mast

Coaxial cables

In masts, the antenna cable is grounded before the transition from vertical to horizontal cable ladder. Indoors, the antenna cable's contacts must be grounded to an internal equipotential bonding busbar or to a ground ring. In the event of a long internal antenna cable > 3 m in a technical room, the antenna cable is grounded indoors at the cable entry with a grounding kit for outdoor grounding in connection with an internal equipotential bonding busbar.

The equipotential bonding busbar is mounted in the mast at the transition from vertical to horizontal cable ladder. The equipotential bonding busbar is connected to the ground system at the foot of the mast with "RK 35 mm² black". Equipotential bonding busbar type pot. 5 or equivalent.

The equipotential bonding busbar can be ordered from ELROND KOMPONENT AB, +46 (0)8-449 80 80.

Link cables

Links that are positioned at a height exceeding 50 m must also be grounded before the transition from vertical to horizontal cable ladder. Link cables must always be ground indoors in connection with the cable entry.

General

Grounding cabling and ground connections in the mast must be routed vertically or horizontally, continually downwards from the equipment to be grounded, towards the ground point. The routing of grounding cabling or connections must not turn and "point" upwards.

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Mast installation

General

The term mast in this context refers to constructions both with and without guys.

In addition to the requirements specified in this description, the mast supplier's requirements and regulations must apply.

The extent of the contract work to be carried out can be seen from the project description provided by Teracom.

The construction of foundations and the assembly of new masts must be carried out according to the mast supplier's drawings and assembly instructions. Information regarding mast placement and the direction of mast legs in relation to north will be provided by Teracom. **Mast dimensioning**

The masts are dimensioned by Teracom in accordance with the guidelines (info) below. Mast type is specified by Teracom for each station that will include a mast. Ultimate limit state: Load ratio at dimensioning load ≤ 0.85

Serviceability limit state: The max. permitted change of angle (in any direction) of the antenna carrier at the dimensioning reference wind speed must be 1° for radio links.

The masts are analyzed, in accordance with the National Board of Housing, Building and Planning's handbook "Snow and wind load", with regard to the dynamic effect of the wind.

Wind areas are calculated according to methods specified in "Eurocode 3- Part 7-1 – Towers, Masts and Chimneys – Towers and Masts, Annex A".

Wind areas for antennas are dependent on direction. If there is no information about wind areas in different directions, the largest wind area must be used in all directions.

Load cases with and without ice must be analyzed in those cases where icing is probable.

Capacity analysis of the mast construction's parts is conducted in accordance with the National Board of Housing, Building and Planning's handbook "BSK 99".

Mast foundations

The construction of foundations, prefabricated or cast in-situ, must be carried out according to the mast supplier's instructions.

Ground system

A ground system must be arranged at the mast/tower. See grounding instructions in XE 101701.

The masts are supplied with connecting plates (one per mast leg) for ground lines. The plates are supplied with M8 bolts (incl. nuts) for mounting the terminal lugs supplied by the overall contractor.

Mast construction

The following regulations have been adapted for masts without guys: **General technical regulations**

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In general, drilling, cutting, welding, grinding or other mechanical actions on load-bearing mast sections or the mast's surface protection are not permitted.

Climbing is not permitted in Delta masts. The assembly of masts, antennas and cables must be carried out with the aid of a skylift.

Mast assembly

Assembly must be carried out in accordance with regulations from the manufacturer and/or from Teracom. After assembly, the mast's incline must not exceed the width of a brace. Straightness is checked with a theodolite in two orthogonal directions. Any adjustment is performed with the aid of the nuts in the foundation bolts.

Underpouring of the bottom flanges must be carried out with mortar that is included in the mast delivery. See also the assembly instructions for the mast type in question.

Cable bridge between building and mast

A cable bridge fitted with falling ice protection is normally used. The falling ice protection is installed in accordance with the mast manufacturer's instructions. In certain cases, the cabling is routed in pipes below ground instead. The Delta mast's rock foundation is prepared with a cast pipe (diameter 100 mm), which can be connected to a pipe for buried cables. The prefab foundation has a central through hole and a sideways hole for cable routing (diameter 100 mm). Cable ladder in mast

Included in the mast delivery for the ALTA mast type. Installed in accordance with the documentation that accompanies the mast delivery. There is no cable ladder in the Delta mast. The cabling is secured to the braces with UV-resistant plastic strips or stainless steel bands.

Climbing barriers

Included in the mast delivery. Installed in accordance with the supplier's instructions.

Electrical installation in the mast

Obstacle lights

Only installed when required by the authorities issuing permits.

A low-intensity obstacle light fitting is installed at those levels (two per level) of the mast as required by the authorities.

The power supply to the obstacle lights is connected via ground-fault protection and safety switches located in the technical room.

Obstacle light fittings must be of the type Tycoflex RL 30, item no. 350.

Cables for obstacle lights must be of the type EKKJ 4 x 2.5 +2.5 E 01 012 40

When routing cables, the cable must be unrolled before being pulled up in the mast.

When connecting to the obstacle lights, the cable must be arranged in a loop measuring at least 500 mm.

UV-resistant cable ties may be used when routing smaller cables, where installation on a cable ladder is not possible. On cable ladders, acid-resistant pole clamps must be used.

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Final inspection

Final inspection of the mast must be carried out immediately after assembly.

The inspection is necessary in accordance with the Planning and Building Act's demands for quality control and any complaints. The guarantee period will commence after final inspection and any measures in relation to complaints.

The inspection must be carried out by an inspector appointed or approved by Teracom. The inspection report must be signed/approved by the inspector and the contractor's representative. Copies of the report will be sent to the relevant project manager at Teracom, the quality manager in accordance with the Planning and Building Act, and to the mast supplier.