Instructions for Robust Fibre

Appendix 4 Robust sites and nodes

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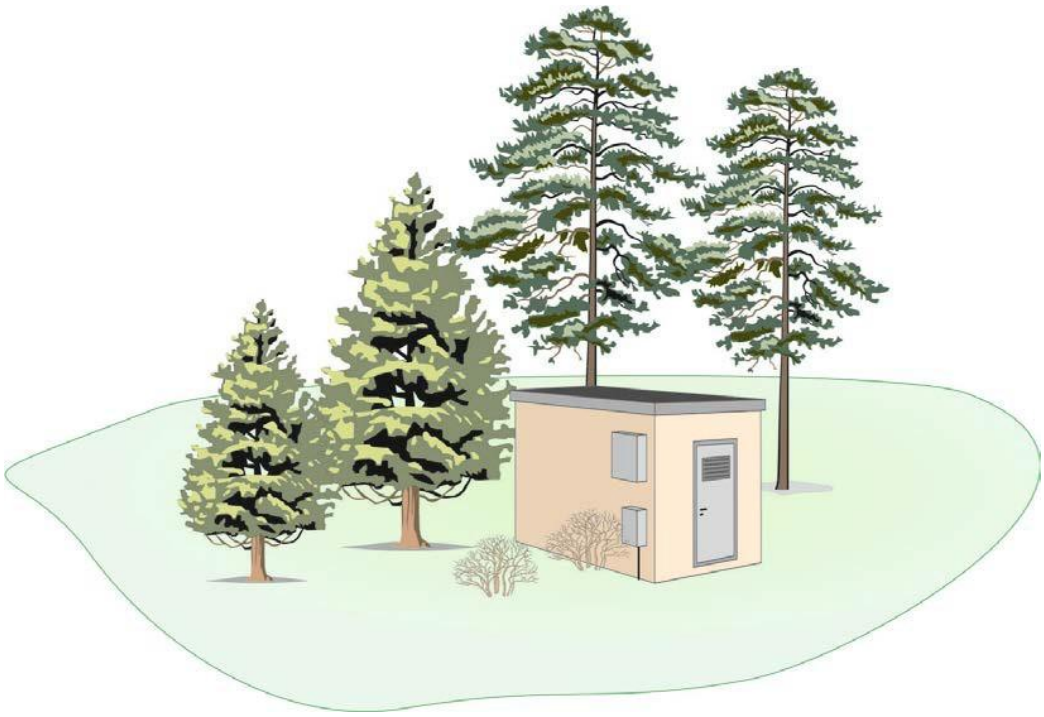


CONTENTS

1. INTRODUCTION

The document "*Instructions for Robust Fibre*" comprises one main document and a number of appendices.

This appendix, Robust sites and nodes, contains minimum requirements regarding how a robust site or node should be installed. The appendix also contains recommendations and examples of the possible appearance both outdoors and indoors. The appendix also contains recommendations and examples of what it can look like both outdoors and indoors, as well as guides for installing customer equipment and cross-connection.

The appendix begins with the classification of sites and nodes based on The Swedish Post and Telecom Agency's regulations and general advice on security in networks and services and then goes through various requirements and recommendations that apply to a robust site and node.

Minimum requirements within the following areas are defined in the appendix.

- Location
- Building consents and permits
- Type of site and node
- Design of sites and nodes
- Electricity supply
- Electrical safety
- Environment and climate regulation
- Dust, dirt and moisture
- Safety (mechanical protection)
- Alarms
- Biological damage
- Fire protection
- Maintenance plan
- Signs

2. SITES AND NODES

To gain a good understanding of the content of this chapter, it is good to know the difference between a site and a node.

Site

Site refers to the physical space. For example, this might be a technical shelter, an outdoor cabinet, one/more buildings or a room.
Sites incorporate e.g. the following functions:

- Shell protection.
- Electrical system.
- Auxiliary power system.
- Climate system.

Node

Node refers to a distribution point (connection point) where traffic flows are forwarded, concentrated and/or distributed. A node is located in a site.
The node has e.g. the following components:

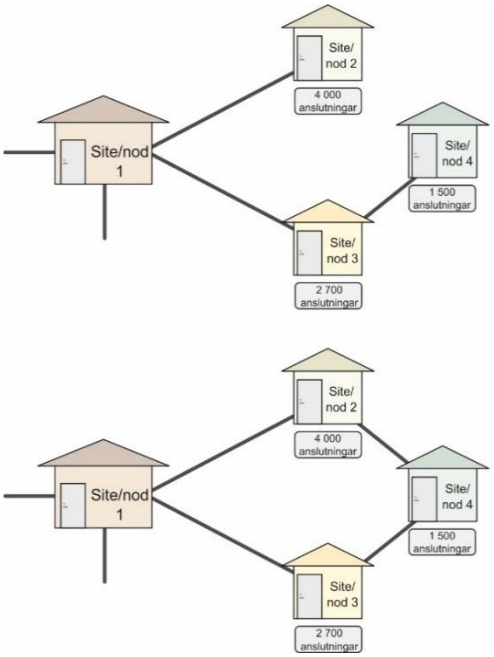
- ODF rack.
- ODF units.
- Patch (connecting) cables.
- Active communication equipment (routers, switches, etc.).

2.1 Classification of sites and nodes

2.1.1 Classification

To read more about requirements that apply to the classification of sites and nodes with the aim of achieving operational reliability for a fibre installation, in line with the relevant ordinance, please refer to PTS Security Regulation.

A management model for reliability, with templates showing how the network owner can handle operational reliability, can be found at the Swedish Local Fibre Alliance, https://stadsnatsforeningen.se/branschstod/robust-digital-infrastruktur/



Site	Klass	Ansl.
1	C	8 200
2	D	4 000
3	D	4 200
4	E	1 500

Site	Klass	Ansl.
1	C	8 200
2	C	8 200
3	C	8 200
4	D	5 500

Example of classification of nodes and sites

2.2 Establishing sites and nodes

Factors to consider

Here is a review of areas with special factors to consider when constructing a new site or node.

Before the work of planning the design of the sitens/node, a check shall be carried out for any need for reinforcement measures for events that may deviate from normal and that may involve serious disturbances in important societal functions.

Factors to consider in enhanced safety

For the completion of facilities with requirements for increased safety, the document Facilities with increased safety and function, Appendix 1, is used. Robust site for essential digital infrastructure and Appendix 2. Passive secure physical connection.

Appendix 1. Robust site for socially important digital infrastructure is an instruction for how the physical protection of sites should be supplemented to be able to withstand serious disruptions. The requirements include requirements for new construction and for rebuilding existing facilities.

Appendix 2. Passive secure physical connection constitutes an instruction with requirements for how the physical protection of electronic communications should be supplemented between sites and between site and user node in order to be able to withstand serious disturbances. The requirements include requirements for new construction and for rebuilding existing facilities.

For the complete versions see: https://www.ssnf.org/nat-i-varldsklass/robust-digital-infrastruktur/.

Note. An existing facility must have undergone a risk and vulnerability analysis (RSA). An existing facility that is being upgraded will undergo a renewed RSA. Threat directories and RSA for Site and Node as well as Robust secure physical connection can be found under: https://stadsnatsforeningen.se/branschstod/robust-digital-infrastruktur/

2.2.1 Location

The location of the fibre installation's sites and nodes is determined during the planning phase.

MINIMUM REQUIREMENTS REGARDING LOCATION:

- Outdoor cabinets must be positioned in locations that are well protected from snow clearance operations.
- Sites must never be located close to watercourses or in dips where there is a risk of flooding.

Recommendations for location:

- In the first instance, locate the site in a building intended for telecommunications. This can be done by erecting a separate building or by placement with another network owner.
- Avoid placement in buildings for which another party is responsible and where the premises are not intended to be used for telecommunication. For this reason, placement in schools, homes for the elderly, club premises, etc., must be avoided as far as possible.
- Outdoor cabinets should in the first instance be placed in a shady location.
- Select a location where the cable distances are optimised for connection up to the node, from the end customer and to other nodes.
- Position the node where the option of several connection paths exists, with a view to redundancy Both for fibre optic cables and for the electricity mains.
- For fibre alliances, it is good to position the node where it is possible to connect to several network owners.

2.2.2 Building consents and permits

When a new site is to be established, local provisions and permits have to be managed.

MINIMUM REQUIREMENTS IN THE CASE OF ESTABLISHMENT:

- Building consents are generally always required when establishing a new site.
- The landowner's consent (e.g., land agreements and easements for roads) must be obtained in order to position the site in the intended location.

Local provisions that may occur:

- Requirements regarding the appearance of the facade, choice of materials and colours.
- Requirements regarding noise levels (the site's climate system, the equipment's fans and auxiliary power systems can produce noise that is considered disturbing). Noise protection or requirements for a different location may be demanded.

2.2.3 Type of site or node

A site or node can be executed in various ways and in different forms. Below are a few examples.

2.2.3.1 Climate cabinet

Also known as an outdoor cabinet or environmental cabinet.

Climate cabinets are common in small networks and where few connections are terminated. They are less suitable for the placement of active equipment due to the lack of space, climate regulation and the work environment.

The installation depth for equipment in a cabinet is often critical, as the equipment may require a considerable depth, e.g., UPS.

MINIMUM REQUIREMENTS REGARDING CLIMATE CABINET:

- The climate cabinet must have at least IP class 54.

Example of outdoor cabinet

2.2.3.2 Technical shelter

It is an advantage to select a technical shelter instead of a climate cabinet. The technical shelter provides more space and the potential to work indoors, which creates a better work environment during service and maintenance.

The technical shelter's appearance and function can be adapted according to the client's wishes. They are available in different sizes, from one rack location up to the required number. The technical shelter is well suited for all types of fibre installations and can be dimensioned so that other parties can be offered placement.

Example of a technical shelter

MINIMUM REQUIREMENTS REGARDING TECHNICAL SHELTER:

- The technical shelter must be designed for the Nordic climate (e.g. cope with snow loads, cold conditions and heat).

2.2.3.3 Utilise part of an existing building.

When utilising an existing building, an area can be adapted for the fibre installation in e.g. a cellar.

Enter into a clear agreement with the property owner regarding placement and electricity supply. Being forced to move a node requires a great deal of work and therefore constitutes a major expense. It is important therefore to take care regarding the agreement's terms and conditions as well as its duration.

MINIMUM REQUIREMENTS WHEN USING EXISTING BUILDING:

- Ensure that access to the space is guaranteed, if possible, 24 hours a day. Ideally with a separate door from the outside.

2.2.3.4 Placement in another party's site

Site space can be hired from another network owner for placement of your own node. This could be in an existing telecommunications exchange, for example.

MINIMUM REQUIREMENTS FOR PLACEMENT:

- Ensure there is access 24 hours a day and make sure that affected personnel have permission to be in the area.
- Enter into an agreement with the property owner regarding the supply of electricity, with the required output level, as well as ensuring that the correct climate is maintained.

Chapter 3 GUIDANCE FOR INSTALLING CUSTOMER EQUIPMENT contains guidance for various alternatives regarding the placement of customer equipment.

2.2.4 Design of sites and nodes

2.2.4.1. General

The physical space of the site may be limited, so it may not always be possible to perform the installation in accordance with the minimum requirements in this section. Deviations from the minimum requirements must be documented.

2.2.4.2. Interior design and space requirements

The site's fittings and physical space requirements are dependent on the number of connections that are to be terminated, whether active equipment is to be placed there, and whether other parties are to be given the opportunity to place equipment in the space. When designing the fittings, it is important to consider several things.

MINIMUM REQUIREMENTS FOR A SITE:

- Site must have sufficient space for racks that are dimensioned for the Connections that can be terminated in the space
- A site must be dimensioned in order to handle auxiliary power systems based on customer requirements and the site's function in the network.
- A site must be equipped with a climate system.
- A site must have a non-return valve in the floor drain (where present).
- In Site located below ground level, electronics and sensitive equipment must be placed at least 20 cm above the floor.
- A risk analysis shall be performed for a Site located below ground level and for the site with and retracted water-sewage and district heating pipes. Measures in the event of a confirmed risk may include, for example, moving the site, introducing automatic shutdown of water pipes, humidity sensors and instructions for shutting off water pipes.
- For the site, there must be a site plan/site drawing of how the site is equipped.
- The site must contain instructions for what applies regarding safety, ESD protection and staying on the site.
- The site must have an information sign with contact information, the site's GPS coordinates and any address that can be provided when reporting an accident.
- The site must have an information sign with information about the handling of fire extinguishing equipment.
- The site must contain a description of escape routes.

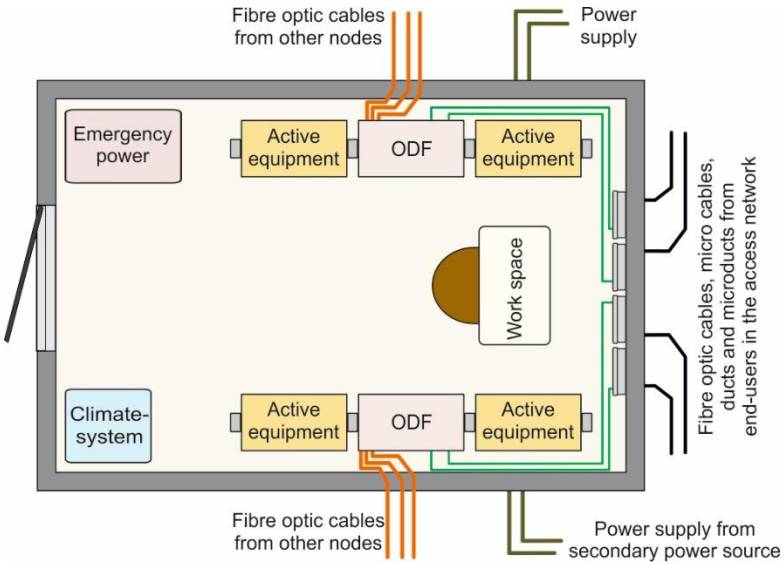
MINIMUM REQUIREMENTS FOR A NODE:

- A node must have sufficient space for the active communication equipment that will be placed in the node.
- A node must be planned to ensure that mutual location of heat-generating equipment does not heat up other equipment, but rather that the heat is removed

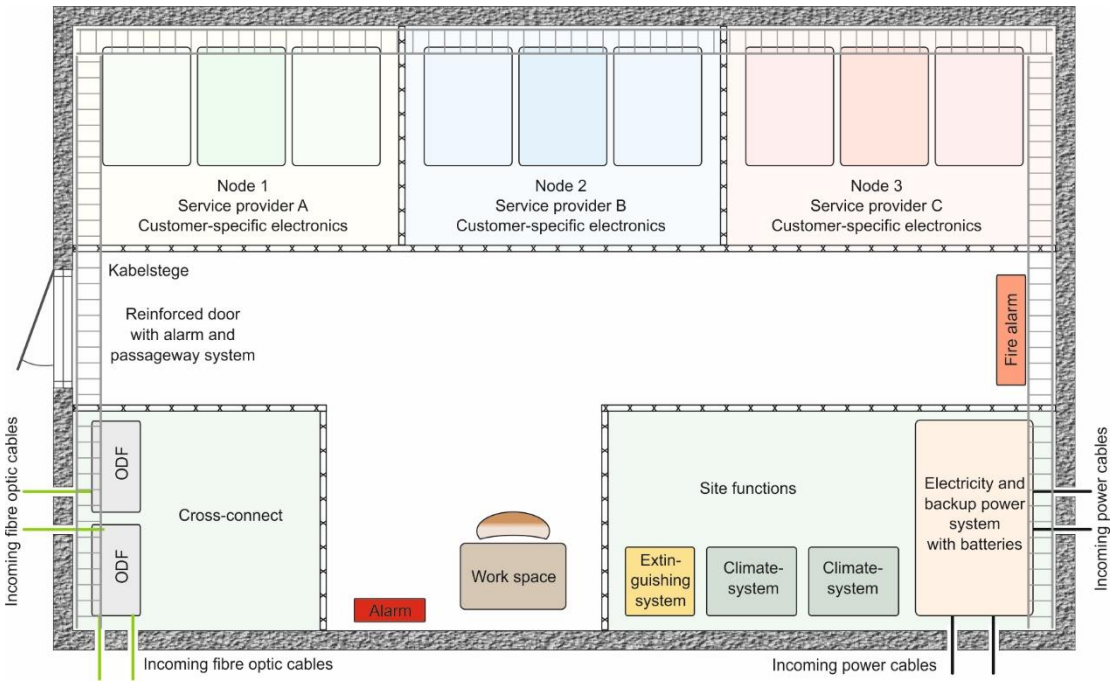
Recommendations for fittings:

- Space for a workspace is something that is often forgotten, but that makes service and maintenance work easier.
- Position equipment to optimise the area within the space.
- Position and design installation routes to ensure good order in the space and the potential for smooth service and maintenance work.
- There should not be any heating, water or sewage pipes passing through the space, in order to minimise the risk of water damage.

Examples of nodes:



Example of a technical shelter



Example of larger site with several nodes

2.2.4.3 Equipment cabinets and racks

An Equipment cabinet is a type of cabinet or device that is used to organize and protect various technical and electronic components, such as networking equipment, cables, power supplies, and other similar appliances. If the cabinet has electrical outlets, access to these must be considered when installing the rack.

Recommendation

If the cabinet(s) with active equipment are fitted with doors, they should be "perforated" on two sides to allow air to be drawn in and blown out. Cover plate should be fitted to cover empty spaces in the cabinet if it provides increased energy efficiency. Some sites have different airflow technology. Then the site owner's recommendations regarding airflow must be followed.

Rack

Rack refers to a frame designed for mounting servers, networking equipment, telecommunications equipment, and other electronic devices.

MINIMUM RACK REQUIREMENTS

The size of the rack and equipment must be adapted so that the equipment can fit in the rack.

Recommendation

Equipment should not protrude outside the rack in any way as there is a risk of equipment or cables being damaged.

Front guards should be fitted to protect protruding equipment.

2.2.4.4. Cable routing

To get cables and connecting cables in cabinets and racks in order, there must be a structure for how these should be routed. Cables and crossover cables must not hang with their own weight in connectors, as this can lead to cable breakage over time. Racks must therefore have devices for cable routing (vertically and horizontally). There must also be devices to handle overlength of cables and crossover cables. Below are examples of devices for cable routing and overlength of crossover connection cables.

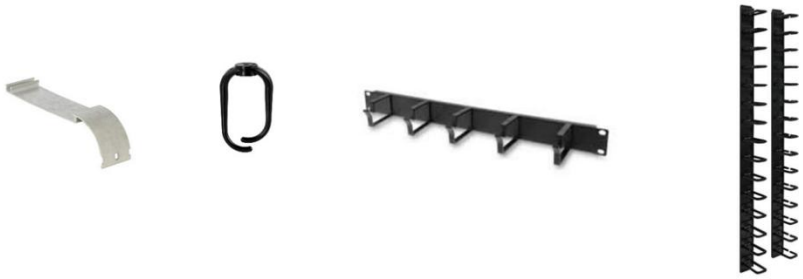
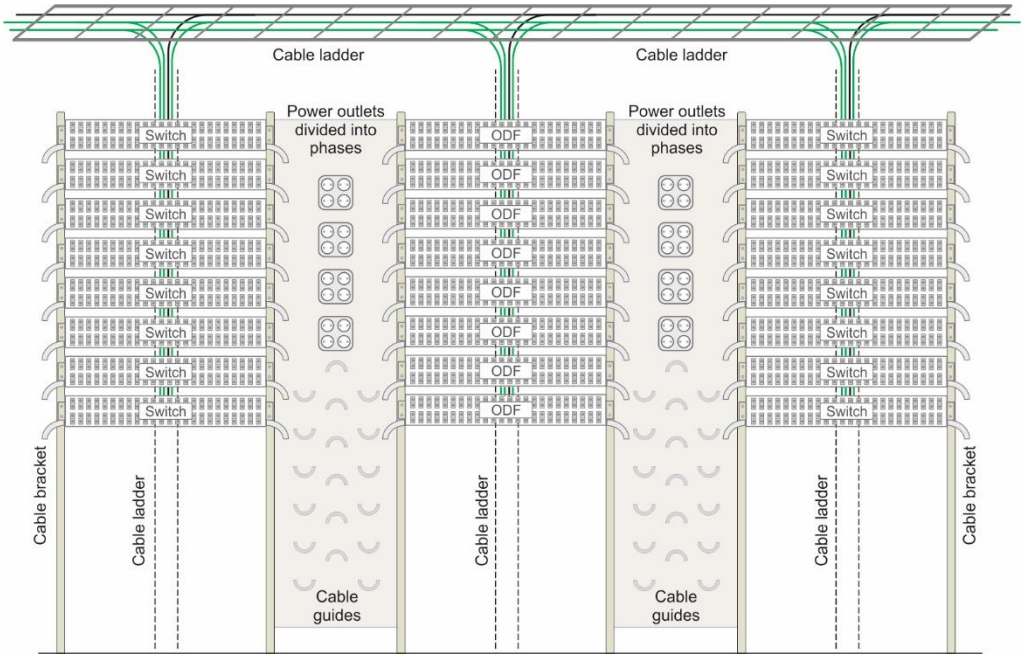


Image. Examples of cable routing in the form of radius limiters, wire jumpers and wire conductorsBild. Exempel

Image. Example of handling of overlength/sling in cable magazines and between racks

MINIMUM WIRING REQUIREMENTS

- In technical cabinets and stands where there is cross-connection of fibre, there must be devices for cable routing (vertically and horizontally). There must also be devices to handle overlength of cables and crossover cables.
- For cable routing between rackss, there must be horizontal cable guides with radius limiters. The radius limiter relieves the crossover cable's transition between horizontal and vertical wire liners. The cable guide should protrude outside the cabinet in line with the vertical cable guides.
- If fibre cables are placed on the same cable ladder as electrical cables, there must be a separation between the cables.



Example of rack placement

*2.2.4.5 Contact Numbering ODF Device**

MINIMUM CONTACT NUMBERING REQUIREMENTS

Contact numbering on ODF devices must be in place and be as clear as possible.

Recommendation

Each contact should have the contact number to the left of the contact.

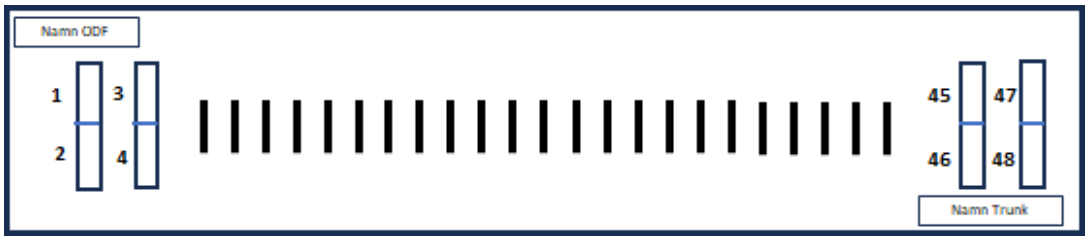


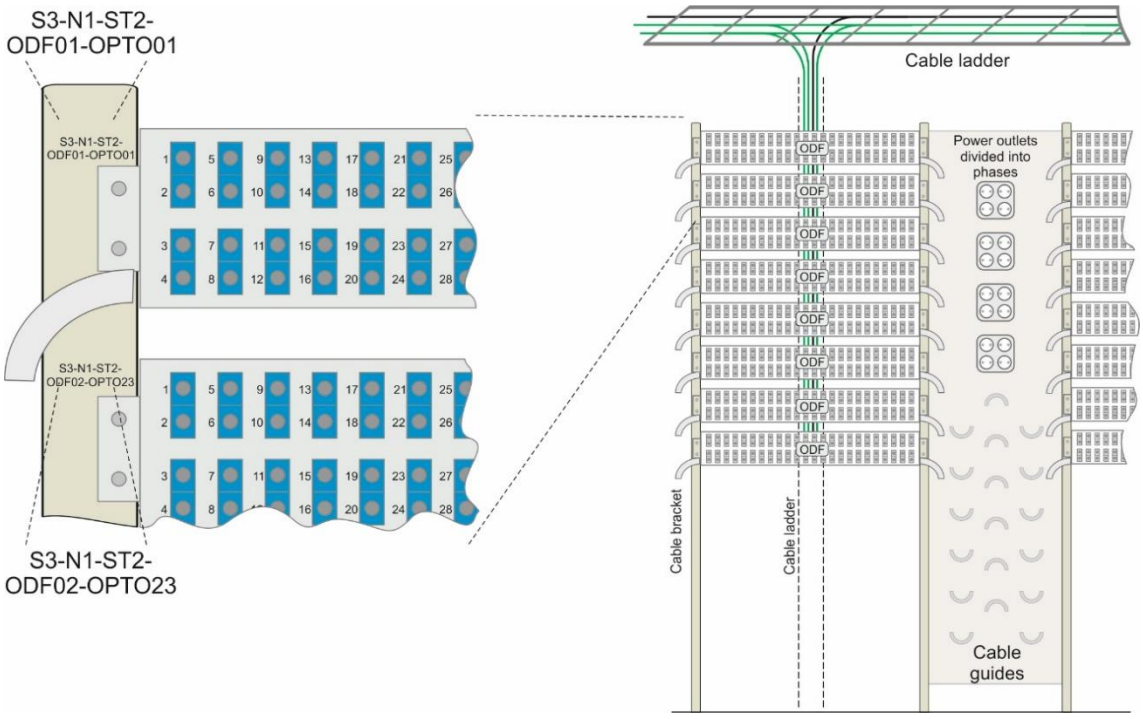
Image. Example of contact numbering in ODF device

2.2.4.6. Labelling

MINIMUM LABELLING REQUIREMENTS

- All equipment must be clearly marked according to the site owner's instructions.
- The label must be included in the documentation.

Note. When marking equipment, an assessment must be made of whether there are safety-related restrictions.



Example of rack labelling

2.2.5 Electrical installation

Electrical installations must be carried out in accordance with Swedish law and the regulations of the National Electrical Safety Board, as well as in accordance with Swedish Standards (SIS) and Swedish Electrical Standards (SEK).

For supplementary information regarding the management of telecom equipment, ETSI EN 300 253 (Equipment Engineering (EE); Earthing and bonding of telecommunication equipment in telecommunication centres).

MINIMUM REQUIREMENT

Before an electrical installation is commissioned, there must be an inspection report or certificate that reports that the electrical installation has been carried out in accordance with applicable laws and regulations.

Recommendation

Ring conductors or earth roofs should be measured using GIS systems.

2.2.5.1 Electrical system

Depending on the site's function and classification, redundant connections to the electricity mains may be required.

MINIMUM REQUIREMENTS REGARDING ELECTRICAL SYSTEM:

- Distribution boards in the site must be adapted for 230/400 V as a TN-S system.
- Distribution boards must be grouped and fused for each group.
- Service outlets only, i.e. all outlets in the node that are not specifically intended for communication equipment (and rectifiers/UPS that supply power to it) must be supplied with RCBOs. (Residual current circuit breaker with built-in overcurrent protection).
- Service sockets must be marked and easily accessible, for example at the door and/or electrical distribution board for connecting temporary equipment during work.

Recommendations:

- At racks, electric outlets must be installed so that they are easily accessible and evenly distributed between three phases.
- The need for earth fault monitoring should be investigated.

2.2.5.2 Auxiliary power systems

Auxiliary power systems supply sites and nodes with electrical power in the event of interruptions in incoming electrical power supplies. This could e.g. be a generator that is powered by a motor (permanently installed or portable), a fuel cell or a UPS with batteries. An auxiliary power system must be present when stipulated by PTS Security Regulation or customer requirements.

MINIMUM REQUIREMENTS REGARDING AUXILIARY POWER SYSTEMS:

- Auxiliary power systems must be dimensioned for an operating time in accordance with requirements in PTS Security Regulation or from connected customers.
- Where there is a UPS with batteries, the site must have an externally accessible intake for connecting backup power units (backup generators) according to Subappendix 4.1 Instructions for connecting portable backup generator to a site.
- When installing with UPS, there must be a ByPass function.

Recommendations:

- In the event of racks, electric outlets from the auxiliary power system must be easily accessible and clearly labelled.
- Damage that may arise in conjunction with over-voltage and short interruptions can be countered through appropriate fusing and systems for equipotential bonding. A UPS is suitable for this.
- When connecting an emergency power generator, the incoming supply to the site should be a TN-C system. After the emergency power generator, the internal electrical system in the site is then converted to a TN-S system.
- For additional information on connecting portable backup generator to the site, see Subappendix 4.1 Instructions for connecting portable backup generator to a site.

2.2.6 Electrical safety

2.2.6.1 Lightning protection

Disruption caused by lightning is common. It is therefore important to protect the site and the equipment placed there against disruption caused by lightning.
Avoid using ducts containing metal connected to nodes as these conduct current.

MINIMUM REQUIREMENTS FOR LIGHTNING PROTECTION:

The SEK Handbook 452 is to be used for the assessment and evaluation of applicable lightning protection measures. The manual is based on the lightning protection standard SS EN 62305.

2.2.6.2 Equipotential bonding

Equipotential bonding is used to connect all conducting units to each other at a common point so that they thereby receive the same potential. This minimises problems in respect of earth currents, galvanic isolation, static electricity and improves lightning protection within the site.

MINIMUM REQUIREMENTS FOR EQUIPOTENTIAL BONDING:

- All exposed parts are connected directly to the main equipotential bonding.
- The main equipotential bonding is connected to earth.
- All incoming conducting parts must be connected to the main equipotential bonding.

Recommendation

Depending on the type of installed electronic equipment, there may be a risk of electrostatic disturbances, which is why the need for ESD protection should be investigated.

2.2.6.3 EMC (electromagnetic compatibility)

Electromagnetic radiation can arise in the vicinity of electrical installations, fan motors, lift motors, distribution boards, etc. If the equipment is poorly/incorrectly earthed, stray currents can occur that can give rise to interference.

MINIMUM REQUIREMENTS FOR EMC:

- Installed equipment must satisfy the applicable standard for CE marking according to the EU-EMC directive.

2.2.7 Environment and climate regulation

It is very important to keep the temperature and humidity at the correct level within the site. Heat damage can arise in electronic equipment if it is installed in an environment with a raised temperature. Cold damage can arise in the winter if equipment is located in areas that do not have sufficient heating, e.g. optical connectors and certain cables can be affected in cold conditions. Condensation can arise when the humidity is too high, while static electricity can arise when the humidity is too low. Below are examples of climate systems.

Heating element

In certain cases, a heating element may be sufficient. Applies primarily in areas with a low ambient temperature.

Fan

Temperature-controlled fan for the removal of surplus heat or blowing in of cold outside air.

Free cooling

Free cooling uses colder ambient air for cooling. Fans force in cold air, through filters, producing overpressure in the site. Warm air is evacuated at the opposite end of the site. Free cooling is a good choice when the ambient temperature is normally lower than the temperature in the site, and ensures low energy consumption during normal operation. Free cooling can be supplemented with another cooling unit for occasions when the ambient temperature is high.

Example of free cooling unit

Air heating pump

Works both as a heating and cooling unit, providing an even climate all year around.

MINIMUM REQUIREMENTS FOR CLIMATE REGULATION:

- A climate system must be present and dimensioned so that temperature and humidity are kept within the limit values that apply to the equipment placed in the node.
- A cooling system must be located so that leaks of liquid or condensation cannot reach the installed equipment.
- Drainage from the cooling system must be led out of the area.

Recommendations for climate systems:

- Select a climate system that can be controlled and monitored remotely.
- Dimension the auxiliary power system for the climate system as well, or ensure in some other way that the climate can be maintained at the correct level for a limited period.
- Plan for the potential for an emergency cooling system or bear in mind the need for a redundant climate system.

2.2.8 Dust, dirt and moisture

Dust, other dirt and moisture can damage active equipment in the site and make the connection of optical connectors difficult. Dust can also cause heating problems, as dust particles in the fans gradually impair air circulation over time, resulting in overheating of the active equipment.

MINIMUM REQUIREMENTS FOR FILTERS:

Filters must be installed in all valves and supply air routes.

Recommendations for filters
Recommended are filters that are at least EU3 rated.

Water damage can arise as a result of e.g. flooding, damaged equipment or carelessness. Moisture can cause damage and disruptions to active equipment, electrical cables and connectors (optical and electrical).

MINIMUM REQUIREMENTS FOR MOISTURE PROTECTION:

- Sites or nodes located where there is a risk of flooding must be provided with elevated thresholds.

2.2.9 Safety (mechanical protection)

The shell protection for a fibre installation is important. Installations can be protected to some extent through locks and alarms. The choice of cable routes and their protection are also important. The safety measures you implement will in practice be a matter of weighing up between the current threat situation, the significance of the site and the cost of implementing safety measures. The safety issues are also important when insuring the installation.

Recommendations for safety:

- In a site where space has been granted to another party, it is recommended that the site owner's own equipment (power supply, climate system, etc.) and nodes (communication equipment, ODF units, etc.) be located separately from equipment that is owned by the other party that is hiring space from the site owner.
- Parties that hire space for the placement of their own equipment cabinets or that hire space for placing equipment in equipment cabinets that are owned by the site owner, are themselves responsible for the protection of their own cross-connection points and equipment.

2.2.9.1 Burglar protection

Mechanical burglar protection refers to physical/mechanical measures that are implemented to prevent burglaries in node spaces.

MINIMUM REQUIREMENTS FOR BURGLAR PROTECTION:

- Doors to the area with direct access from outside must be made of steel.
- Doors in the existing building must be secured with e.g. a bolt, trailing edge strengthening device or equivalent protection.
- Only personnel authorised by the site owner may have access to the area.
- Keys must not be stored in the area.

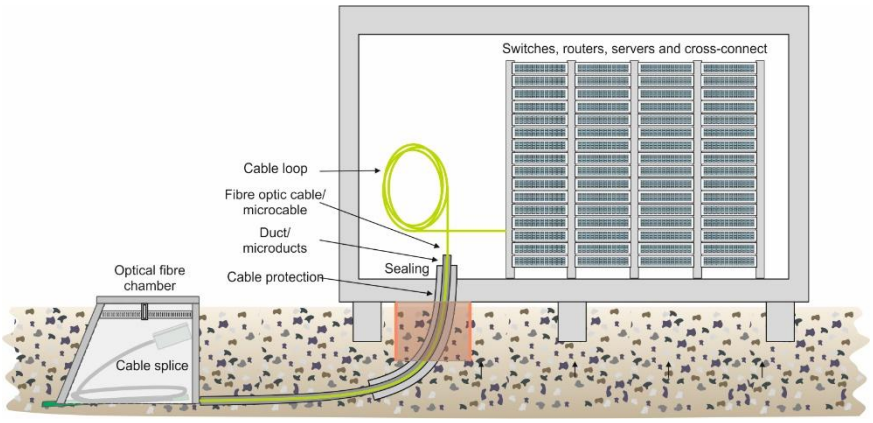
You can find out more about burglar protection from the Swedish Theft Prevention Association.

2.2.9.2 Sabotage protection

Sabotage protection refers to the measures that are implemented to impede or prevent sabotage to the fibre installation. Where there is a risk that incoming cables might be subjected to sabotage or other external effects, the cables must be supplied with a protective arrangement that impedes or prevents this.

MINIMUM REQUIREMENTS FOR SABOTAGE PROTECTION:

- Accessible cables must be protected against sabotage.
- For sites that do not have a cast foundation, the protection between the ground and the underside of the floor must be designed so that it covers at least three sides around incoming cables. The protection must be buried at a depth of at least 25 cm and must be anchored in the floor. It may be executed as a robust protective pipe, a steel plate (at least 1.5 mm) that covers at least three sides of the ducts, or other equivalent protection.
- If possible, towing and lifting eyelets must be removed from technical shelters or climate cabinets.
- Shelters or containers must be securely anchored to the ground, e.g. through properly buried plinths or concrete beams.



Example of cable intake

2.2.10 Alarms

Alarms refer to specific functions for obtaining information about the status of the site.

2.2.10.1 Burglar alarm

The purpose of a burglar alarm is to increase the security of monitored buildings.

MINIMUM REQUIREMENTS IF A BURGLAR ALARM IS PRESENT:

- Alarms must be transmitted to the operations centre and/or a surveillance company.

Recommendation regarding burglar alarm:

- In the event a burglar alarm is tripped, a buzzer signal should sound as a preliminary warning before the alarm siren is engaged (approx. 30 seconds).

The burglar alarm can be extended with an assault alarm to increase personal safety.

2.2.10.2 Operation alarm

An operation alarm refers to a function for receiving alarms from equipment in the site.

Examples of functions that can be monitored via an operation alarm:

- Climate (temperature, humidity).
- Water (moisture and flooding).
- Incoming power supply (power failure).
- Auxiliary power system (battery status).
- Entry alarm (unlocked door).
- Climate system (temperature, humidity).

MINIMUM REQUIREMENTS FOR OPERATION ALARM:

- There must be a function for receiving operation alarms.

As regards requirements for monitoring communication services, see the Operational reliability regulations.

2.2.10.3 Access control

Access control systems are a good way for the site's owner to see which individuals have been on the site. For personal safety, it is also good to know that a person is or has been on the site. This also provides the potential to follow up faults or defective installations.

Examples of access control systems include:

- Signed out key.
- System with cards or tags.
- System with dialled code.

2.2.11 Biological damage

Biological damage refers to damage that can arise due to pests (e.g. rodents, ants or insects).
A good form of protection against insect attacks is to install filter devices at the site's ventilation openings.

MINIMUM REQUIREMENTS FOR PROTECTION AGINST BIOLOGICAL DAMAGE:

- Where fibre optic cables or ducts are exposed to pests, such as rodent attacks, they must be protected with rodent protection, e.g. by means of additional metal reinforcement or pipes and fibre optic cables treated with repellent.
- Ducts must be sealed so that pests cannot travel through them.

2.2.12 Fire protection

Boverket's building regulations (BBR) handle regulations relating to fire protection. The level of the site's fire protection is determined by the risk analysis that is performed in conjunction with the establishment of the site. Also consult with the insurance company regarding which fire protection will apply and whether fire alarms are required.

MINIMUM REQUIREMENTS REGARDING FIRE PROTECTION:

- The site's surrounding surface (e.g., walls, floor, roof, doors and windows) must satisfy fire class EI 30 on both sides as a minimum.
- Building materials used in a site must be approved by the terms of use are checked with the insurance company relevant to the site.

Recommendation regarding fire alarm:

- In order to avoid the site being disabled by means of e.g. corrosive gases or water vapour penetrating the site due to a fire in the surroundings, the site should be built as a sealed unit with the exception of the ventilation system.

2.2.12.1 Fire extinguishing equipment

MINIMUM REQUIREMENTS REGARDING FIRE EXTINGUISHING EQUIPMENT:

- Personnel who work in the site or node must have access to hand-held CO_2 extinguishers of at least 5 kg in the premises.
- When there are premises or a building for an emergency power generator, this area must be supplied with powder extinguishers.

You can read more about fire protection and extinguishing equipment at the Swedish Fire Protection Association.

2.2.13 Maintenance plan

Some equipment requires recurring maintenance. For this reason, a maintenance plan must be drawn up containing a list of the maintenance that has to be carried out and when it has to be done.
PTS Security Regulation specify that structured work on operational reliability must be conducted in the long term, continually and systematically.

MINIMUM REQUIREMENTS FOR A MAINTENANCE PLAN:

- Sites and nodes must have a maintenance plan.
- In addition to that specified in PTS Security Regulation, the maintenance plan must include regular inspection of filters, climate systems, electrical systems, locks and access control systems according to the manufacturer's instructions and, if necessary, clearance of snow, brushwood and grass

2.2.14 Other

The presence of signs outside the site must be limited so that interest in the site or node is kept to a minimum. However, there should be a sign giving telephone numbers that the public can call if they notice that something or someone is acting unusually at the site.

MINIMUM REQUIREMENTS FOR SIGNS:

There should not be any signs specifying the site's owner etc.

Note. Observe any requirements and regulations regarding marking in camera surveillance.

3. GUIDANCE FOR COLLOCATED CUSTOMER EQUIPMENT

Placement of customer equipment in a site can be done in different ways depending on the site's basic design. This guide provides an overview of the most common configurations for managing deployed customer equipment in a site.

The most common configurations for managing deployed customer equipment in a site are:

- Configuration 1. The site only allows in exceptional cases to place your own rack.
- Configuration 2. The site has a separate cross-connection space where cross-connection between external network owners/operators can take place (Meet Me) and allows placement of your own cabinet/rack.

Note. The racks in the below configurations are schematic only. For interior fittings and cabling, see chapter 2.2.4 Design of site and node.

Configuration 1

The network owner provides racks for placing customer equipment.

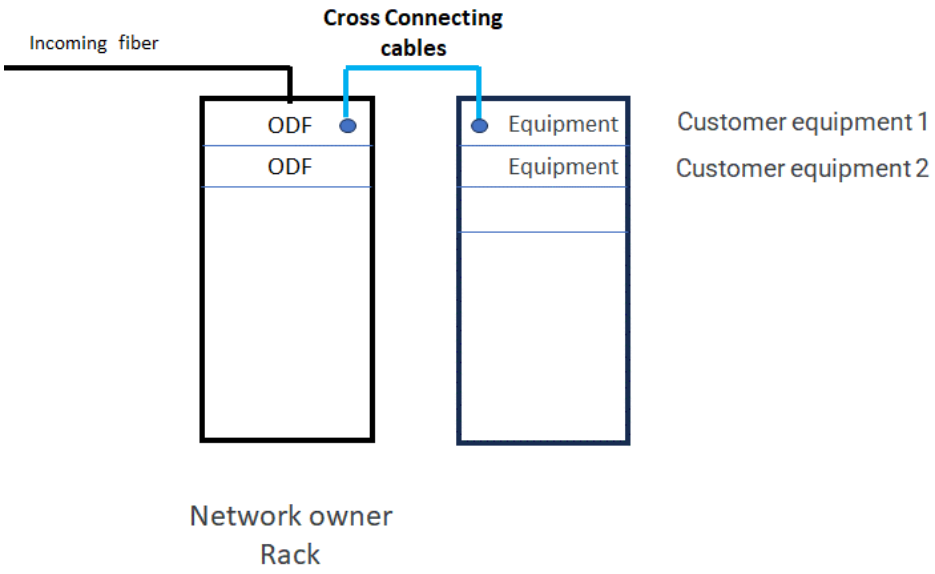


Image. Configuration 1

Configuration 2

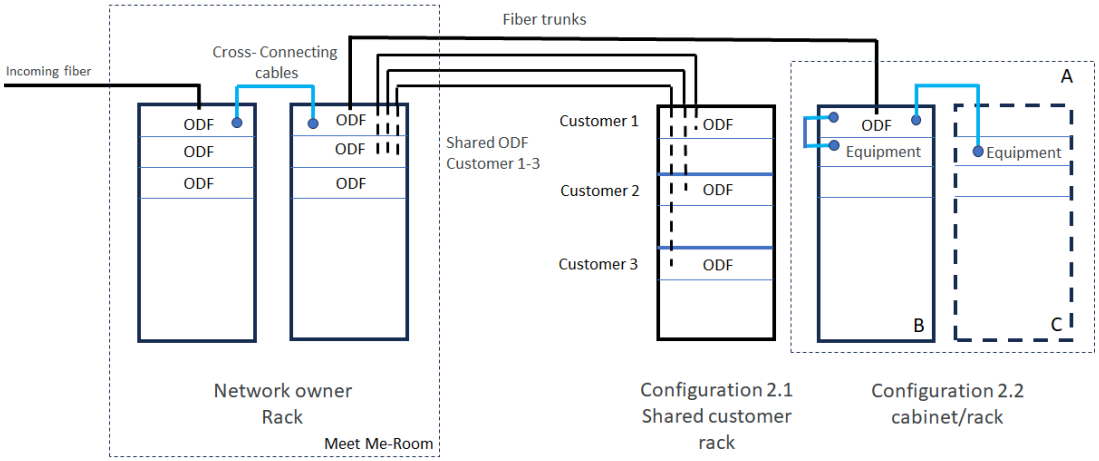


Image. Configuration 2

Configuration 2.1
The network owner provides a shared rack, for placing customer equipment.

Configuration 2.2
The network owner provides alternative solutions as below for the placement of customer equipment.

A. Rack placed in:

- Common space
- Separate room
- Separate cage

B. Composed of:

- Technology cabinets
- Rack
- ODF Devices
- Equipment

C. Composed of:

- Technology cabinets
- Rack
- Equipment

4. CROSS CONNECTION CABLE GUIDANCE

Cross-connection using cross-connection cables can lead to several types of problems during troubleshooting and maintenance if not done correctly. This guidance provides recommendations to minimize cross-linking errors.

Based on this guidance, the network owner should develop detailed instructions for cross-connection.

General recommendations:

- Cross-connection cables should be adapted to the distance.
- Cross-connection cables cables should not hang in front of the ODF stands.
- Cross-connection cables cables should not be spliced with a loose spacer.
- The permissible bending radius must not be lowered.
- When cross-connection cables turn in the vertical ducting, wire holders should be used.
- As cross-connection cables must not be pinched, care should be taken during handling.
- There must be instructions for how to change an existing cross-connection/duct to be performed.
- Before cross-connection cables, the following check should be performed:

  o If there is already a cable connected, the operating instructions must be checked before disconnection

  o that contacts on cross-connection cables and connectors in ODF/equipment are clean. Controlled with fibre camera (according to standard IEC 61300-3-35). If necessary, contacts should be washed. More info can be found in Guidance - Optical Reinforcement with High Power Laser for Fibre Optic Access Appendix. Examination and cleaning of optical contacts.

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In the following examples, two examples are shown of cross-connection and overlength handling of cross-connection cables in cable magazines and overlength handling in vertical wire liners.

Cross connection between ODF units via cable magazine
Cross-connect cables should be routed down from the ODF via/over the cable magazine and down to the wire guide and then out to the right or left edge to vertical wire guides.

Example rack 1. Cross connection between low port numbers (e.g. P1-48) of ODF 1 and (e.g. P49-96) ODF 2 respectively.

Example rack 2. Cross connection between low port numbers (e.g. P1-48) of ODF 1 to high port numbers (e.g. P49-96) of ODF 2.

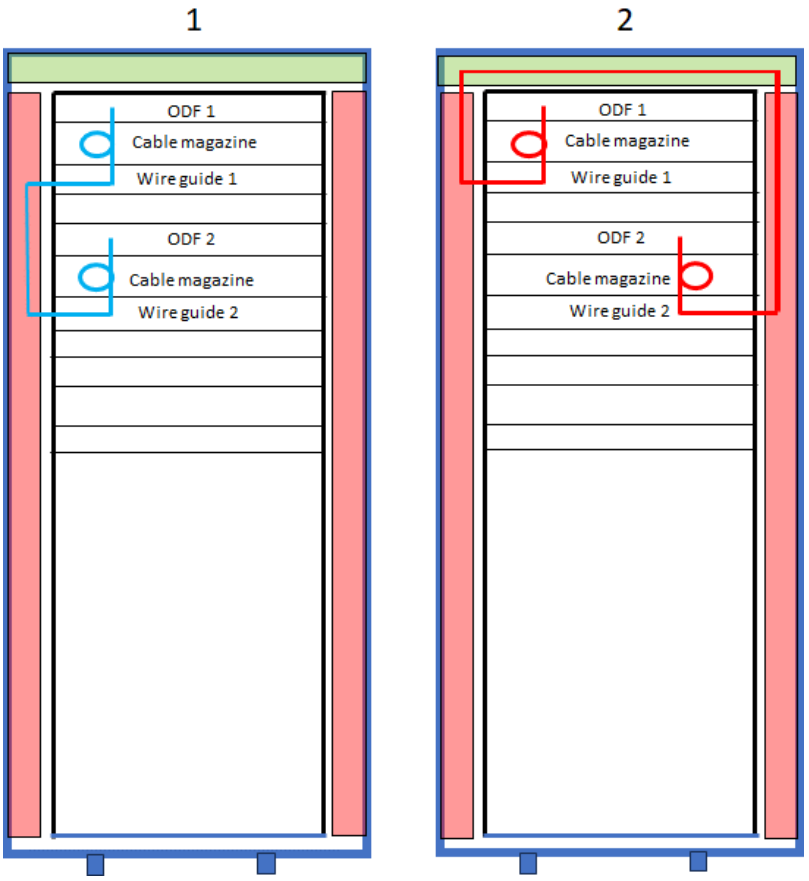

Image. Cross-connect in ODF cabinets/rack via cable magazine

If ODFs with several HEs are used, the upper half should be pulled up to the horizontal wire guide and the lower half down to the horizontal wire guide.

If the cross-connection cable is the right length, cable magazine do not need to be used.

Cross-connection cables running between different cabinets use horizontal wire ladders above the cabinets.

Cross connection between ODF units via loop in vertical wire conductor
Cross-connection cables are pulled out to the right or left edge to vertical wire conductors. Excess length is managed by loops over, for example cable guides, in the vertical wire guide.

Example rack 1. Cross connection between low port numbers (e.g. P1-48) of ODF 1 and (e.g. P49-96) ODF 3 respectively.

Example rack 2. Cross connection between low port numbers (e.g. P1-48) of ODF 1 to high port numbers (e.g. P49-96) of ODF 3.

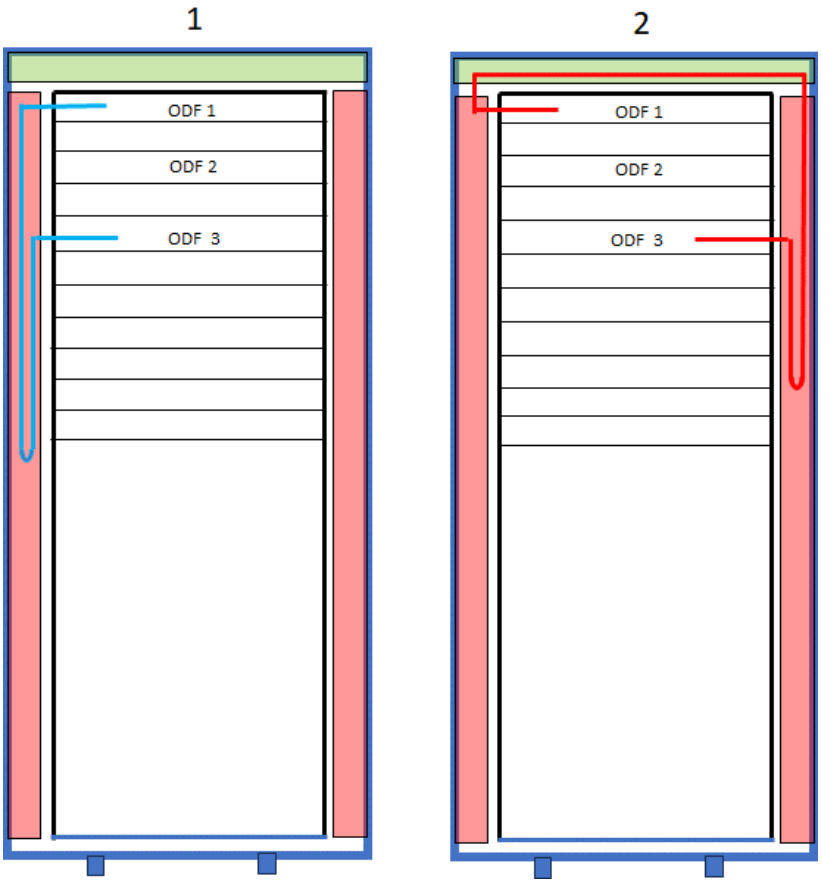

Image. Cross-connect in ODF cabinets/rack

Cross connection in cabinet/rack with active equipment
Cross-connection is handled in the same way as in the examples above.

If a cabinet/rack has a rectifier with 48 volts, there is often a fuse strip at the top of the rack, which is why there should be a distance between the fuse strip and ODF1 of 1U-2U.

Example rack 1. Cross connection via cable magazine.

Example rack 2. Cross connection via loop in vertical wire guide.

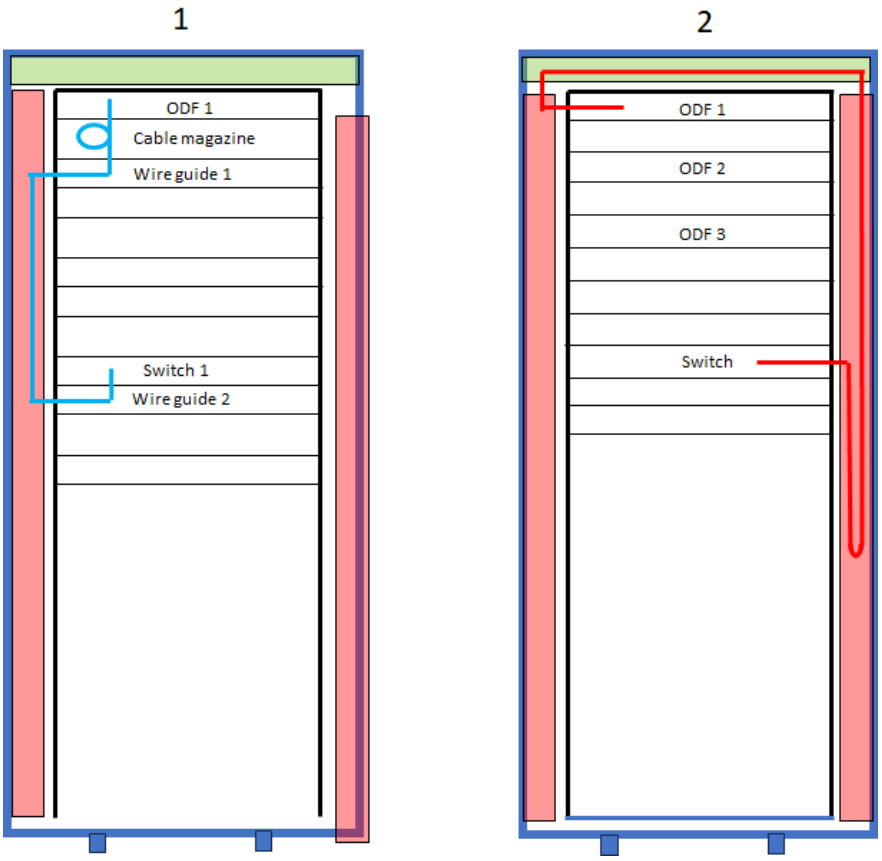

Image. Examples of cross-connect in equipment cabinets

Cross-connection – exceptions
For equipment that has "lying" cards and wire guides on the side of the equipment, cross-connection cables must be routed directly to the wire guides on the nearest side.

Looping of cross connection cable in cable tray

If cable magazines are used, the excess length of the cross-connection cable must be placed in the correct cable magazine according to the principle shown in the picture below. Loop end that should go towards the ODF port should exit the cable magazine at the bottom, loop end that should go out into the wire guides should exit the cable magazine at the top.

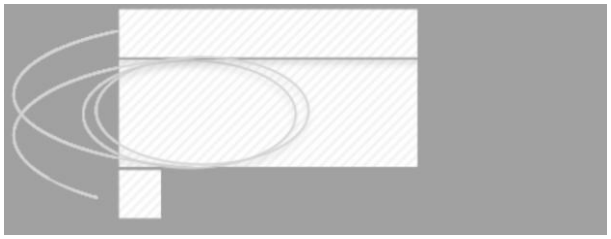

Image. Loop in cable magazine seen from the side

Marking of crossover cables

Cross-connection cables must be labeled according to the site owner's instructions.

Removal of crossover cables

- Check that the documentation corresponds to reality.
- Before disconnection, any light must be checked in the fibre using a fibre identifier. The network owner must establish rules for the removal of cross-connection cables in the event of light in the fibre.
- When removing cross-connection cables, they should be pulled out carefully/slowly so that remaining crossover cables are not damaged by frictional heat. Rather, cut the crossover cable and pull it out in parts.
- When disconnecting fibre, the dust cover must always be put back in the ODF.
- Cross-connection cables that are disconnected must be removed and disposed of appropriately.

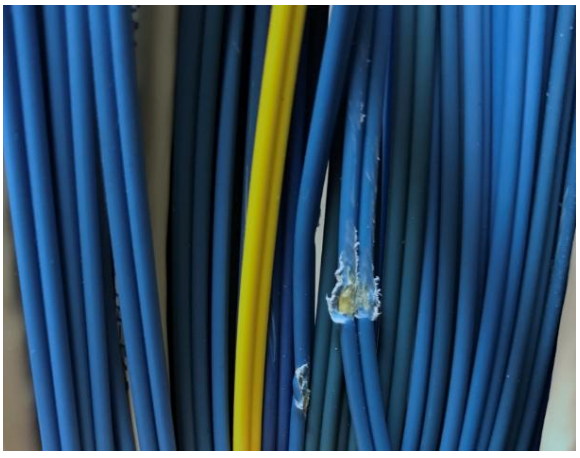

Image. Damage to cross-connection cables

5. COMPLATION OF REQUIREMENTS AND RECOMMENDATIONS

Compilation of requirements and recommendations for sites and nodes					
X MINIMUM REQUIREMENTS R RECOMMENDATIONS • Action based on risk analysis and customer requirements	SITE/NODE CLASS				
	A	**B**	**C**	**D**	**E**
2.2.3 Type of site					
Outdoor cabinet (Climate cabinet, Environmental cabinet)				X	X
Technical shelter	X	X	X	X	X
Building (technical premises)	X	X	X	X	X
2.2.2 Building consents and permits					
Building consents are generally always required when establishing a new site.	X	X	X	X	X
The land owner's consent (e.g. land agreements for roads) must be obtained in order to position the site in the intended location.	X	X	X	X	X
2.2.1 Location of Site					
Outdoor cabinets must be positioned in locations that are well protected from snow clearance operations.				X	X
Sites must never be located close to watercourses or in dips where there is a risk of flooding.	X	X	X	X	X
Outdoor cabinets should in the first instance be placed in a shady location.				R	R
2.2.1 Location of Node					
In the first instance, locate the node site in a separate building intended for telecommunications.	X	X	R	R	R
Select a location where the cable distances are optimised for connection up to the node, from the end customer and to other nodes.	R	R	R	R	R
Position the node where the option of several connection paths exists, with a view to redundancy Both for fibre optic cables and for the electricity mains.	R	R	R	R	R
For fibre alliances, it is good to position the node where it is possible to connect to several network owners.	R	R	R	R	R
2.2.3.1 Climate cabinet					
The climate cabinet must have at least IP class 54.				X	X
2.2.3.2 Technical shelter					
The technical shelter must be designed for the Nordic climate (e.g. cope with snow loads, cold conditions and heat)	X	X	X	X	X
2.2.3.3 Existing building (technical premises)					
Adapt a space for the fibre installation	X	X	X	X	X
Ensure that access to the space is guaranteed 24 hours a day. With a separate door from the outside.	X	X	X	X	X
2.2.3.4 Placement of node in another party's site					
Ensure there is access 24 hours a day and make sure that affected personnel have permission to be in the area.			X	X	X

Enter into an agreement with the property owner regarding the supply of electricity, with the required output level, as well as ensuring that the correct climate is maintained.			X	X	X
2.2.4 Design of site					
A site must be dimensioned in order to handle auxiliary power systems based on customer requirements and the site's function in the network.	X	X	X	X	X*
A site must be equipped with a climate system.	X	X	X	X	X*
A site must have a non-return valve in the floor drain (where present).	X	X	X	X	X
The site must have automatic shut-off of water pipes present in the space.	X	X	X	X	X
Space for a workspace is something that is often forgotten, but that makes service and maintenance work easier.	R	R	R	R	R
Position equipment to optimise the area within the space.	R	R	R	R	R
Position and design installation routes to ensure good order in the space and the potential for smooth service and maintenance work.	R	R	R	R	R
Separate power and fibre optic cables in installation routes. Despite the fact that fibre optic cables are not affected by electricity, service and maintenance are made easier by separating the cables.	R	R	R	R	R
There should not be any heating, water or sewage pipes passing through the space, in order to minimise the risk of water damage.	R	R	R	R	R
2.2.4 Design of node					
A node must have sufficient space for racks that are dimensioned for the connections that may be terminated in the space	X	X	X	X	X
A node must have sufficient space for the active communication equipment that will be placed in the space	X	X	X	X	X
A node must be planned to ensure that mutual location of heat-generating equipment does not heat up other equipment, but rather that the heat is removed	X	X	X	X	X
2.2.5.1 Electrical system					
Distribution boards in the site are adapted for 230/400V as a TN-S system and supplied with residual current devices	X	X	X	X	X
The site must be fitted with residual current devices	X	X	R		
Distribution boards must be grouped and fused for each group.	X	X	X	X	X
Service outlets must be supplied with RCBOs.	X	X	X	X	X
At racks, electric outlets must be installed so that they are easily accessible and evenly distributed between three phases.	R	R	R	R	R
2.2.5.2 Auxiliary power system					
Auxiliary power systems must be dimensioned for an operating time in accordance with requirements in PTS Security Regulation or from connected customers.	X	X	X	X	X*
Where there is a UPS with batteries, the site must have an externally accessible outlet for connecting the auxiliary power unit (emergency power generator).	X	X	X	X	X*
In the event of racks, electric outlets from the auxiliary power system must be easily accessible and clearly labelled.	R	R	R	R	R
Damage that may arise in conjunction with over-voltage and short interruptions can be countered through appropriate fusing and systems for equipotential bonding. A UPS is suitable for this.	R	R	R	R	R

When connecting an emergency power generator, the incoming supply to the site should be a TN-C system. After the emergency power generator, the internal electrical system in the site is then converted to a TN-S system.	R	R	R	R	R
2.2.6.1 Lightning protection					
The site must be properly earthed.	X	X	X	X	X
The site must be equipped with over-voltage protection and RCDs.	X	X	X	X	X
2.2.6.2 Equipotential bonding					
All conducting parts are connected directly to the main equipotential bonding.	X	X	X	X	X
The main equipotential bonding is connected to earth.	X	X	X	X	X
All incoming conducting parts must be connected to the main equipotential bonding.	X	X	X	X	X
2.2.6.3 EMC					
Installed equipment must satisfy the applicable standard for CE marking according to the EU-EMC directive.	X	X	X	X	X
2.2.7 Environment and climate regulation					
A climate system must be present so that temperature and humidity are kept within the limit values that apply to the equipment placed in the node.	X	X	X	X	X
A cooling system must be located so that leaks of liquid or condensation cannot reach the installed equipment.	X	X	X	X	X
Drainage from the cooling system must be led out of the area.	X	X	X	X	X
Select a climate system that can be controlled and monitored remotely.	X	X	X	R	R
Dimension the auxiliary power system for the climate system as well, or ensure in some other way that the climate can be maintained at the correct level for a limited period.	X	X	X	X	X
Plan for the potential for an emergency cooling system or bear in mind the need for a redundant climate system.	X	X	X		
2.2.8 Dust, moisture and dirt					
Filters: Filters must be installed in all valves and supply air routes. Filters that are at least EU_3 classified are recommended.	X	X	X	X	X
Moisture protection: A site or node in a building must be fitted with raised thresholds where there is a risk of flooding.	X	X	X	X	X
2.2.9 Safety					
In a site where space has been granted to another party, it is recommended that the site owner's own equipment (power supply, climate system, etc.) and nodes (communication equipment, ODF units, etc.) be located separately from equipment that is owned by the other party that is hiring space from the site owner.	X	X	X		
Parties that hire space for the placement of their own equipment cabinets or that hire space for placing equipment in equipment cabinets that are owned by the site owner, are themselves responsible for the protection of their own cross-connection points and equipment.	X	X	X	X	X
2.2.9.1 Burglar protection					
Doors to the area with direct access from outside must be made of steel.	X	X	X		
Doors in the existing building must be secured with e.g. a bolt, trailing edge strengthening device or equivalent protection.	X	X	X		

Only personnel authorised by the site owner may have access to the area.	X	X	X	X	X
Keys must not be stored in the area.	X	X	X	X	X
2.2.9.2 Sabotage protection					
Accessible cables must be protected against sabotage.	X	X	X	X	X
For sites that do not have a cast foundation, the protection between the ground and the underside of the floor must be designed so that it covers at least three sides around incoming cables. The protection must be buried at a depth of at least 25 cm and must be anchored in the floor. It may be executed as a robust protective pipe, a steel plate (at least 1.5 mm) that covers at least three sides of the ducts, or other equivalent protection.	X	X	X	X	X
If possible, towing and lifting eyelets must be removed from technical shelters or climate cabinets.			X	X	X
Shelters or containers must be securely anchored to the ground, e.g. through properly buried plinths or concrete beams.			X	X	X
2.2.10.1 Burglar alarm					
Alarms must be transmitted to the operations centre and/or a surveillance company.	X	X	R	R	
In the event a burglar alarm is tripped, a buzzer signal should sound as a preliminary warning before the alarm siren is engaged (approx. 30 seconds).	X	X	R	R	
2.2.10.2 Operation alarm	X	X	X	X	X
There must be a function for receiving operation alarms.	X	X	X	X	X
2.2.10.3 Access control	X	X	X	X	X
2.2.11 Biological damage					
Where fibre optic cables or ducts are exposed to pests, such as rodent attacks, they must be protected with rodent protection, e.g. by means of additional metal reinforcement or pipes and fibre optic cables treated with repellent.	X	X	X	X	X
Ducts must be sealed so that rodents cannot travel through them.	X	X	X	X	X
2.2.12 Fire protection					
The site must satisfy fire class EI 30 as a minimum.	X	X	X	X*	X*
In order to avoid the site being disabled by means of e.g. corrosive gases or water vapour penetrating the site due to a fire in the surroundings, the site should be built as a sealed unit with the exception of the ventilation system.	X	X	X	X*	X*
2.2.12.1 Fire extinguishing equipment					
Personnel who work in the site or node must have access to hand-held CO_2 extinguishers of at least 6 kg in the building.	X	X	X	X	X
When there are premises or a building for an emergency power generator, this area must be supplied with powder extinguishers.	X	X	X	X	X
2.2.13 Maintenance plan					
Sites and nodes must have a maintenance plan.	X	X	X	X	X
In addition to that specified in PTS Security Regulation, the maintenance plan must include regular inspection of filters, climate systems, electrical systems, locks and access control systems according to the manufacturer's instructions and, if necessary, clearance of snow, brushwood and grass.	X	X	X	X	X
2.2.14 Other					

There should not be any signs specifying the site's owner etc.	X	X	X	X	X