



Amendments

Robust Fiber

instructions Corrections and additions

2022-08-10

Revision history:

Date	Version	Revised by	Remarks
2022-08-10	1.4.1	Technical Council, Robust Fiber	Revision of the annexes regarding the new Electronic Communications Act and new regulation for security: Main document Appendix 4 Site and nodes Sub-appendix 4.1 Robust sites for digital critical infrastructure protection Sub-appendix 6.1 Checklists, inspection Appendix 7 Fibre installation project
2022-03-01	1.4	Technical Council, Robust Fiber	Revision of appendix: Main document Appendix 2 Robust networks Sub-appendix 2.1 Robust networks, Attenuation calculation Appendix 3 Robust routing methods Appendix 4 Site och nod Sub-appendix 4.1 Robust sites for digital critical infrastructure protection Sub-appendix 6.1 Checklists, inspection Deleted attachments Sub-appendix 4.1.1 Robust site RSA template Sub-appendix 4.1.2 Robust site Routine and guidance_RSA
2021-09-01	1.3.3	Technical Council, Robust Fiber	Revision of appendix: Appendix 1 Terms and definitions Appendix 2 Robust networks Appendix 4 Robust sites and nodes
2021-05-07	1.3.2.2	Technical Council, Robust Fiber	Completion of Appendix 6 and Sub-Appendix 6.1 In accordance with PTS requirements in the inspection certificate.
01/03/2021	1.3.2 /1.3.2.1	a) Working group Robust Site b) Working group of inspectors	a) New Sub-appendix for Appendix 4 Robust Site & Nod. Sub-appendix 4.1 Robust Sites for digital critical infrastructure protection and two sub/sub appendix 4.1.1 Robust site RSA (excel) and 4.1.2 Routine and guidance for Risk and vulnerability analysis /RSA). b) Completion of Appendix 6 and Sub-Appendix 6.1 In

			<p>accordance with SJV requirements in the inspection certificate.</p> <p>Introduced instructions for checking minimum requirements that cannot be checked visually.</p> <p>RF. Verified by inspection question to contractor and inspector.</p>
17/08/2020	1.3.2	Technical Council, Robust Fiber	Amendments, supplements and corrections
25/11/2019	1.3.1	Technical Council, Robust Fiber	Amendments, supplements and corrections
01/04/2019	1.3	Technical Council, Robust Fiber	Amendments, supplements and corrections
10/04/2018	1.2	Technical Council, Robust Fiber	Supplements and corrections. Appendix 3
08/04/2018	1.2	Technical Council, Robust Fiber	Supplements and corrections.
03/04/2018	1.2	Technical Council, Robust Fiber	Amendments, supplements and corrections Appendix 4 Sites and nodes
01/04/2018	1.2	Technical Council, Robust Fiber	Amendments, supplements and corrections
15/03/2017	1.1.1	Jimmy Persson, Robust Fiber	Correction of printing errors. Page breaks. Appendix 4
13/03/2017	1.1.1	Jimmy Persson, Robust Fiber	Clarification of texts. Appendix 3
10/03/2017	1.1.1	Jimmy Persson, Robust Fiber	Correction of printing errors. Page breaks. Appendix 2
22/02/2017	1.1	Jimmy Persson, Robust Fiber Lars Björkman, Robust Fiber	
01/07/2016	1.0	The project	Robust fibre installation

Applicable version for each document:

Appendix	Applicable version	Amended date
Main document	V1.4.1	2022-08-10
Appendix 1: Terms and definitions	V1.4	2022-03-01
Appendix 2: Robust networks	V1.4	2022-03-01
Sub-appendix 2.1 Robust networks, Attenuation calculation	V1.4	2022-03-01
Appendix 3: Robust routing methods	V1.4	2022-03-01
Appendix 4: Robust sites and nodes	V1.4.1	2022-08-10
Sub-appendix 4.1: Robust sites for digital critical infrastructure protection	V1.4.1	2022-08-10
Appendix 5: Documentation	V1.4	2022-03-01
Appendix 6: Inspection	V1.4	2022-03-01
Sub-appendix 6.1: Checklists, inspection	V1.4.1	2022-08-10
Appendix 7: Fibre installation projects	V1.4.1	2022-08-10
Appendix 8: Ledningskollen	V1.4	2022-03-01

Amendments: Amendments of Instructions for Robust Fiber carried out on 10/08/2022

Date 10/08/2022		
Document	Previous text	Addition or revised text
Main appendix Appendix 4 Sub-appendix 4.1 Sub-appendix 6.1 Appendix 7	Electronic Communications Act (2003:389) The Swedish Post and Telecom Agency's regulations on requirements for operational safety PTSFS 2015:2 and 2020:1	Revised text: Electronic Communications Act (2022:482) PTSFS 2022:11 The Swedish Post and Telecom Agency's regulations and general advice on security in networks and services

Amendments: Amendments of Instructions for Robust Fiber carried out on 1 mars 2022

Date 2022-03-01		
Document	Previous text	Addition or revised text
Main document	1.4 About the instructions	Revision regarding appendices <ul style="list-style-type: none"> • Sub-appendix 2.2 Passive secure physical connection <p>The sub-appendix also consists of an RSA template with a guide called:</p> <ul style="list-style-type: none"> • Sub-appendix 4.1.1: Robust Site RSA mal • Sub-appendix 4.1.2: Robust Site tutorial RSA
Main document	2. RESPONSIBILITY FOR A FIBRE INSTALLATION	New Text <p>Being responsible for a fiber installation places considerable demands on the network owner and the organization that will plan, build and manage the plant. For a network owner, the Electronic Communications Act 2003:389 (LEK) applies if the network owner provides:</p> <p>SFS nr: 2003:389, 1 §</p> <p>Public communication networks of the kind that are usually provided for a fee or publicly available electronic communication services may only be provided after notification to the authority determined by the government (the supervisory authority).</p> <p>Below is a summary of the laws and regulations to which a network owner who provides electronic networks and services in accordance with LEK, must consider and relate to.</p> <p>A network owner who has reported activities in accordance with LEK also conducts a socially important activity. By socially important activities is meant activities, services or infrastructure that maintain or ensure societal functions that are necessary for society's basic needs, values or security. In this context, activity should be understood as a broader concept. Operations, services or infrastructure also include, for example, facilities, processes, systems and nodes (MSB).</p> <p>The instructions are always subordinate to applicable laws and government regulations.</p>
Appendix 2: Robust networks	1. Introduction	Addition. <p>Please note that the network owner may have stricter requirements than those specified in this document.</p>
Appendix 2: Robust networks	2.1.1 Plan network structure	Revised text <p>Before the work of planning the design of the network, a check must be carried out regarding any need for reinforcement measures for events that may deviate from the normal and that may involve serious disturbances in important societal functions.</p> <p>For facilities with requirements for enhanced security, Appendix 4 Robust site and node with sub-</p>

		<p>appendices and Sub-Appendix 2.2 Passive secure physical connection are used.</p> <p>Appendix 2.2 is a guide with requirements for how the physical protection for electronic communication is to be supplemented between sites and between site and user node to withstand serious disturbances. The requirements include both requirements for new construction and requirements for rebuilding an existing facility.</p> <p>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://www.ssnf.org/nat-i-varldsklass/robust-digital-infrastruktur.</p> <p>Based on the above control, a rough design is carried out that contains the number of possible customers, a proposal for a network structure to cover the area, suitable installation technology, shaft lengths and the material in which the shaft takes place.</p> <p>Based on the network structure in the rough design, a detailed design is made that leads to a choice of size of optical cables and the number of splice units. Then select the type of cabinet or wells. Then, duct pipes must be selected to suit the optical cables selected for the system. It is recommended to plan some overcapacity for both fiber and ductwork.</p>
Appendix 2: Robust networks	<p>2.1.3 Permits</p> <ul style="list-style-type: none"> Necessary permits must be obtained by the contractor. 	<p>Modified minimum requirements</p> <ul style="list-style-type: none"> Necessary permits must be obtained by the contractor.
Appendix 2: Robust networks	<p>2.2.1 Ducts</p> <p>For this reason, the following requirements must also be satisfied:</p> <ul style="list-style-type: none"> In order to minimise the risk of damage, the fibre optic cable must have sufficient strain relief and, with the exception of blown fibers and nanocables, be longitudinally watertight, for example with filler or a swelling material. If the fibre optic cable does not have this, the duct must be fully moisture protected with sealed splices. This applies in particular when routing in small microducts, e.g. in the dimension 7/3.5 mm 	<p>Modified requirements</p> <p>For this reason, the following requirements must also be satisfied:</p> <ul style="list-style-type: none"> In order to minimise the risk of damage, the fibre optic cable must have sufficient strain relief and, with the exception of blown fibers and nanocables, be longitudinally watertight, for example with filler or a swelling material. If the fibre optic cable does not have this, the duct must be fully moisture protected with sealed splices. This applies in particular when routing in small microducts, e.g. in the dimension 7/3.5 mm
Appendix 2: Robust networks	<p>2.2.2.1 Optical fibre chambers</p> <ul style="list-style-type: none"> Placement of optical fibre chambers in ditches should be avoided. Placement of optical fibre chambers in trenches should be avoided. 	<p>Modified minimum requirements</p> <ul style="list-style-type: none"> Placement of optical fibre chambers in ditches should be avoided. Placement of optical fibre chambers in trenches should be avoided. Optical fibre chambers must be placed in such a way that the risk of damage during trench ditch-cleaning is minimized.
Appendix 2: Robust networks	<p>2.2.2.1 Optical fibre chambers Recommendation</p> <p>The contractor's self-inspection should include photo documentation of the Optical fibre chambers design and location.</p>	<p>Amended recommendation Recommendation</p> <ul style="list-style-type: none"> The contractor's self-inspection should include photo documentation of the Optical fibre chambers design and location. Placement of optical fibre chambers in trench ditch should be avoided. Placement of optical fibre chambers in trenches should be avoided.

Appendix 2: Robust networks	2.2.3.2 Marking MINIMUM REQUIREMENTS, CABLE MARKING IN THE GROUND <ul style="list-style-type: none"> Warning mesh and warning net with green alternatively orange colour should be placed above ducts* to reduce the risk of damage to the cable infrastructure. 	Correction of aiming errors <ul style="list-style-type: none"> Warning mesh and or warning net with green alternatively orange colour should be placed above ducts* to reduce the risk of damage to the cable infrastructure.
Appendix 2: Robust networks	2.2.3.2 <i>Marking</i> MINIMUM REQUIREMENTS IF SEARCH WIRE IS USED: <ul style="list-style-type: none"> If there are several search wires in the same location, these must be labelled to indicate which section the search wire is following. 	Minimum requirements changed to recommendation and adjusted Recommendation If there is more than one KUP, or several search wires there not connected to KUP at the point of spread, marking is recommended with which distance the search wire(s) there follow
Appendix 2: Robust networks	2.3.2 <i>Underground routing</i> <ul style="list-style-type: none"> When routing in the ground, ducts must be laid flat.in the lead bed When crossing another cable owner's infrastructure, check the line owner's minimum distance requirements. 	New plus adjusted minimum requirements <ul style="list-style-type: none"> The projected placement method must be adapted to real conditions. When routing in the ground, ducts must be laid flat. in the lead bed When laying in the vicinity of free-hanging power lines and when crossing another line owner's infrastructure, check the line owner's requirements for minimum distances.
Appendix 2: Robust networks	2.3.2 <i>Underground routing</i>	Addition to recommendation plus picture <ul style="list-style-type: none"> To avoid mistakes when splicing in optical fibre chambers wells and ground cabinets and to help with troubleshooting, cable from the A-side to the splice box should be marked with blue tape, cable from the splice box to the B-side should be marked with red tape and cable from the branch should be marked with green tape.
Appendix 2: Robust networks	2.3.2 <i>Underground routing</i>	Changed image Examples of excavations
Appendix 2: Robust networks	2.3.2.1 Bed in ducts MINIMUM REQUIREMENTS FOR SELECTED SANDFILL AND DUCT BEDDING: <ul style="list-style-type: none"> Measures must be taken so that backfill and duct bedding remain intact throughout the service life of the duct. 	Modified minimum requirements <ul style="list-style-type: none"> Measures must be taken so that backfill and duct bedding remain intact throughout the service life of the duct.
Appendix 2: Robust networks	2.3.2.1 <i>Bed in ducts</i>	Changed image Examples of duct bedding and backfill
Appendix 2: Robust networks	2.3.2.2 <i>Positioning of optical fibre chambers and cabinets</i> Recommendations when positioning optical fibre chambers: <ul style="list-style-type: none"> If necessary, drainage of the bed must be carried out. 	Amended recommendation <ul style="list-style-type: none"> If necessary, drainage of the bed must be carried out.

<p>Appendix 2: Robust networks</p>	<p>2.3.2.2 <i>Positioning of optical fibre chambers and cabinets</i></p> <p>MINIMUM REQUIREMENTS WHEN POSITIONING OUTDOOR GROUND CABINETS:</p> <ul style="list-style-type: none"> Outdoor ground cabinets must be positioned on a bed similar to that used for optical fibre chambers. Legs, stands or bases must be completely folded out and mounted according to the manufacturer's instructions. Outdoor ground cabinets should be positioned so that the marking on the outside of the cabinet is at ground level. If the outdoor ground cabinet is to have ground insulation board, you must fill up with lots up to ground level marking on the inside. If the outdoor ground cabinet is to be filled with lecales, it should be at least 35 cm lecales and the filling should be completed above ground level- Outdoor ground cabinets must be installed with the cabinet opening facing the street/road. Outdoor ground cabinets must be installed at the correct height and the correct incline in accordance with the manufacturer's instructions, and with the correct gravel type packed around the cabinet to ensure it is secure and steady. The top layer of the ground around the cabinet must be the same as the existing ground surface so that it blends into the environment. Backfilling must be performed using Selected Sandfill, medium gravel. If the ground conditions are such that there is a risk of the foundations/cabinet becoming unstable, the installation must be reinforced with concrete slabs or impregnated planks. 	<p>Amended recommendation</p> <ul style="list-style-type: none"> Outdoor ground cabinets must be positioned on a bed similar to that used for optical fibre chambers. Legs, stands or bases must be completely folded out and mounted according to the manufacturer's instructions. Instructions from the supplier must be followed when installing ground cabinets. Outdoor ground cabinets should be positioned so that the marking on the outside of the cabinet is at ground level. Skåp ska marktätas med markisoleringsskiva och godkänt tätningsmedel alternativt med lecakulor. If the outdoor ground cabinet is to have ground insulation board, you must fill up with lots up to ground level marking on the inside. If the outdoor ground cabinet is to be filled with lecales, it should be at least 35 cm lecales and the filling should be completed above ground level. Outdoor ground cabinets must be installed with the cabinet opening facing the street/road. The top layer of the ground around the cabinet must be the same as the existing ground surface so that it blends into the environment. Backfilling must be performed using Selected Sandfill, medium gravel. Backfilling around the cable cabinet must not contain sharp stones or stones larger than 50mm. If the ground conditions are such that there is a risk of the foundations/cabinet becoming unstable, the installation must be reinforced with concrete slabs or impregnated planks.
<p>Appendix 2: Robust networks</p>	<p>2.3.2.2 <i>Positioning of optical fibre chambers and cabinets</i></p>	<p>New Recommendation</p> <p>If the cabinet is to be filled with leca balls, it should, if possible, be at least 35 cm leca balls and the filling should be finished above ground level.</p>
<p>Appendix 2: Robust networks</p>	<p>2.3.2.5 <i>Collocation</i></p>	<p>Changed image Image of Collocation</p>
<p>Appendix 2: Robust networks</p>	<p>2.3.2.6 <i>selected sandfill</i></p> <p>In order to clarify the application of selected sandfill AMA Site works and the table describing soil types are used. For Robust Fiber, sand, fine gravel and medium gravel are used.</p> <p>Refill of the shaft should be done in consultation with the landowner.</p> <p>Selected sandfill recommendations</p> <ul style="list-style-type: none"> Medium gravel should be used as sandfill for standard ducts (larger dimensions). Fine gravel should be used for duct bedding and Selected Sandfill in the case 	<p>Changed text and recommendation</p> <p>2.3.2.6 Backfill masses</p> <p>MINIMUM REQUIREMENTS FOR FILLING MASSES</p> <ul style="list-style-type: none"> Backfill surranging <ul style="list-style-type: none"> Backfill surranging shall be at least 0.1 m thick at the side, and over ducts pipes calculated from the top edge of the coarsest duct pipes. Backfill surranging shall consist of unbroken or crushed material with 0–8 mm grain size. Existing masses at the bottom of the shaft Existing masses in the shaft bottom must correspond to the requirement for backfill surranging.

	<p>of excavation and the routing of microducts</p> <ul style="list-style-type: none"> • Sand should be used as Selected Sandfill in the case of microtrenching. • For the remaining filling of the shaft, the filling mass is used, which is closest to the ducting / cable protection does not contain stones with sharp edges and where a maximum of 10 % consists of the grain size 100-150 mm. 	<ul style="list-style-type: none"> • Backfill surrounding when filling with stone, or other difficult ground A duct bed with a thickness of 0.1 m is laid under the duct pipe. • Ground superstructure A fill 0.15–0.2 m is laid at the top of the trench shaft (0.15–0.2 m) to correspond to existing masses in the rest of the ground. • Remaining filling For the remaining filling of the trench shaft, filling mass is used which closest to the duct pipe/ cable protection does not contain stones with sharp edges and where a maximum of 10 % consists of the grain size of 100–150 mm. • When normal filling height cannot be achieved due to obstacles, such as rock, stone or the like, the following measures must be taken. <ul style="list-style-type: none"> - Filling material closest to the protective duct pipe may have a maximum grain size of 20 mm. - Type, lowest class SRS * if the filling height > 0.25 m. - Type, minimum class SRE * if the filling height < 0.25 m. In the case of open installation, the manufacturer's instructions must be followed. <p>* Duct / pipe Pipe class EBR: SRS / Protection / Pipes / Difficult conditions) * Duct / pipe Pipe class EBR: SRE (Protection / Pipe / Extra strong)</p> <p>Note. For in-depth information on fillers, see AMA facility.</p>
Appendix 2: Robust networks	2.3.3.1 <i>General requirements regarding minimum backfill height:</i>	Changed image
Appendix 2: Robust networks	2.5.1 <i>General requirements</i> MINIMIKRAV FÖR HANTERING AV OPTOKABEL: <ul style="list-style-type: none"> • Loops must be placed at distribution points where future earthworks can be anticipated, for example by large ditches, roads and in the vicinity of urban areas where development can be expected to take place. Length and location of loops must be documented. • Loop must always be routed in optical fibre chambers, regardless of fibre optic cable type. 	Amended recommendation <ul style="list-style-type: none"> • Loops must be placed at distribution points <i>where future ground earthworks can be anticipated</i>, for example by large trenches ditches, roads and in the vicinity of urban areas where development can be expected to take place. Length and location of loops must be documented. • Loop must always be routed in optical fibre chambers, regardless of fibre optic cable type.
Appendix 2: Robust networks	2.5.6.1 <i>ODF (Optical Distribution Frame)</i> MINIMUM REQUIREMENTS REGARDING ODF UNIT: <ul style="list-style-type: none"> • Having different solutions and models in the same rack must be avoided, as they can impede work in the unit above or below. 	Adjustment of minimum requirements for recommendation <ul style="list-style-type: none"> • Having different solutions and models in the same rack must be avoided, as they can impede work in the unit above or below. <p>Recommendation Different solutions and models in the same stand should be avoided as they can prevent work in the unit above or below.</p>
Appendix 2: Robust networks	2.5.12 <i>Delivery measurement of passive fibre</i> MINIMUM REQUIREMENTS IN RESPECT OF DELIVERY MEASUREMENT OF PASSIVE FIBRE: <ul style="list-style-type: none"> • OTDR measurement must be performed between the endpoints on all connections at 1310 nm and 1550 nm. • Two-way OTDR measurement is to be 	Justerat minimikrav <ul style="list-style-type: none"> • Unidirectional OTDR measurement must be performed between the endpoints on all connections at 1310 nm and 1550 nm. • Two-way OTDR measurement is to be performed for

	performed for connection- and regional networks.	connection- and regional networks.
Appendix 2: Robust networks	<p>2.5.13 <i>Delivery measurement of active fibre</i></p> <p>MINIMUM REQUIREMENTS IN RESPECT OF DELIVERY MEASUREMENT OF ACTIVE FIBRE:</p> <ul style="list-style-type: none"> OTDR measurement must be performed at 1625 nm on active fibre connection. The measuring instruments must be calibrated in accordance with the manufacturer's procedures. 	<p>Ändrat minimikrav</p> <ul style="list-style-type: none"> Unidirectional OTDR measurement must be performed at 1625 alt. 1650nm on active fibre connection. The measuring instruments must be calibrated in accordance with the manufacturer's procedures.
Appendix 2: Robust networks	<p>2.5.12.1 <i>Measurement results and limit values for fibre in cables</i></p> <p>2.5.13.1 <i>Measurement results and limit values for fibre in cables</i></p>	<p>Clarification for access networks, adjusted limit values and alternative wavelength (1650nm) for active fiber.</p> <p>Note: Check the network owner's requirements before measuring.</p>
Sub-appendix 2.1 Attenuation calculation		Adjusted limit values and updated calculation formula.
Appendix 3: Robust routing methods	5.1.7 <i>Excavation</i>	Image exchanged
Appendix 3: Robust routing methods	5.1.9, 5.1.10 och 5.1.11	Amended and deleted sections for fillers and reference to Annex 2
Appendix 3: Robust routing methods	5.2.9, 5.2.10 och 5.2.11	Amended and deleted sections for fillers and reference to Annex 2
Appendix 4: Robust sites and nodes	2.1.1 <i>Classification</i>	<p>Deleted text</p> <p>When establishing a new site or node, it is important to first conduct a risk analysis according to that specified in the Operational reliability regulations and the customer requirements. With this as a starting point, the site and/or node must be adapted so that it corresponds to the anticipated requirements.</p>
Appendix 4: Robust sites and nodes	2.1.2. <i>Extended requirements</i>	The section has been removed. The text moved to section 2.2 To create site and node

Appendix 4: Robust sites and nodes	2.2 <i>Establishing sites and nodes</i>	<p>Addition below and removal of the term Extraordinary events in the document.</p> <p>Below is a review of the areas with particular factors to take into consideration when establishing a new site or node.</p> <p>Before the work of planning the design of the site / node, a check must be carried out regarding any need for reinforcement measures for events that may deviate from the normal and that may involve serious disturbances in important societal functions.</p> <p>For facilities with requirements for enhanced security, Sub-Annex 4.1 "Robust site for socially important digital infrastructure" and Sub-Annex 2.2 Passive secure physical connection are used.</p> <p>Sub-appendix 4.1 "Robust site for socially important digital infrastructure" defines a number of security levels with complementary protection measures for Site and node with a focus on protection and functions for extended operating time in the event of serious disturbances.</p> <p>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:</p> <p>https://www.ssnf.org/nat-i-varldsklass/robust-digital-infrastruktur.</p>
Appendix 4: Robust sites and nodes	2.2.12 Fire protection MINIMUM REQUIREMENTS REGARDING FIRE PROTECTION: <ul style="list-style-type: none"> For building materials used in a Site, the conditions of use must be checked with the insurance company for the Site. 	Adjusted minimum requirements <ul style="list-style-type: none"> Building materials used in a site must be approved by the terms of use are checked with the insurance company relevant to the site.
Sub-appendix 4.1: Robust sites		Removal of the term <i>Extraordinary events</i> in the document.
Sub-appendix 4.1: Robust sites	3. THREATS	New text with reference The threats include the following areas: <ul style="list-style-type: none"> Natural events <ul style="list-style-type: none"> - Technical issue - Weather Pests Accident Physical attacks / serious criminal activity / terrorism A complete threat catalog can be found under: <p>https://www.ssnf.org/nat-i-varldsklass/robust-digital-infrastruktur/</p>
Sub-appendix 4.1: Robust sites	5. DESCRIPTION OF PROTECTIVE MEASURES	Addition In the event of a change in the level of protection, or other significant changes, for a site, an RSA must be implemented.
Sub-appendix 4.1: Robust sites	5.2 Site building	Completed text A Site can either be realized as a stand-alone building or as an integrated part of another suitable building. In this section, the Site is treated as a detached building. If the site damages an integral part of another building, protection measures must also include damage that may occur in the surrounding building, see the threat catalog. In addition to the physical protection, the site owner must ensure:

		<ul style="list-style-type: none"> • Contract period • Possession protection • Any reservations about the site's operating conditions
Sub-appendix 4.1: Robust sites	5.2.5 Environment and climate protection	<p>Addition</p> <p>Generally</p> <p>The need for capacity and function of a climate system is, in addition to what is stated in Overall requirements, dependent on the site's geographical location. When dimensioning a climate system, a risk analysis must always be performed that takes into account the geographical location.</p>
Sub-appendix 4.1: Robust sites	5.2.8 Electrical installation Uninterruptible power supply	<p>Addition</p> <ul style="list-style-type: none"> • Batteries should be placed in a separately ventilated battery compartment.
Sub-appendix 4.1: Robust sites	5.2.8 Electrical installation Redundant electric power supply	<p>Addition</p> <ul style="list-style-type: none"> • Installation and earthing of reserve power must meet the requirements according to the electrical installation rules SS 436 40 00
Sub-appendix 4.1: Robust sites	7. RSA	<p>New text with reference</p> <p>For template and instruction regarding risk and vulnerability analysis (RSA) see: https://www.ssnf.org/nat-i-varldsklass/robust-digital-infrastruktur/</p>
Sub appendix 6.1 Checklist		Supplemented with date for inspection and adjusted according to revised requirements

Amendments: Amendments of Instructions for Robust Fiber carried out on 1 september 2021

Date 2021-09-01		
Document	Previous text	Addition or revised text
Appendix 1: Terms and definitions	Microducts: Is a duct with an inner diameter of approx. 3–12 mm. This type of duct is intended to be used either indoors or within other ducts (thin-walled) or directly in the ground (thick-walled).	<p>Revised text</p> <p>Microducts: Is a duct with an inner diameter of approx. 3–12 18 mm. This type of duct is intended to be used either indoors or within other ducts (thin-walled) or directly in the ground (thick-walled).</p>
Appendix 1: Terms and definitions	Manhole Also called chamber, Space level with the ground or buried (manhole) from which ducts start or terminate or connect two or more sections of duct. Examples of various types of chambers: cable manhole, splicing chamber, intake manhole, pulling manhole, splicing box and loop chamber.	<p>Changed name</p> <p>Manhole Optical fibre chamber Also called chamber, Space level with the ground or buried (underground chamber manhole) from which ducts start or terminate or connect two or more sections of duct. Examples of various types of chambers: cable chamber manhole, splicing chamber, intake chamber manhole, pulling chamber manhole, splicing box and loop chamber.</p> <p>Begreppet Manholes har ersatts i samtliga dokument där begreppet har använts.</p>
Appendix 2: Robust networks	<p>2.2.1 Ducts</p> <ul style="list-style-type: none"> • In order to minimise the risk of damage, the fibre optic cable must have sufficient strain relief and be longitudinally watertight, for example with filler or a swelling material. If the fibre optic cable does not have this, the duct must be fully moisture protected, 	<p>Revised requirement</p> <ul style="list-style-type: none"> • In order to minimise the risk of damage, the fibre optic cable must have sufficient strain relief and, with the exception of blown fibers and nanocables, be longitudinally watertight, for example with filler or a swelling material. If the fibre optic cable does not have this, the duct must be fully moisture protected, e.g. with metal foil in the material and

	e.g. with metal foil in the material and carefully sealed splices. This applies in particular when routing in small microducts, e.g. in the dimension 7/3.5 mm	with carefully sealed splices. This applies in particular when routing in small microducts, e.g. in the dimension 7/3.5 mm
Appendix 2: Robust networks	2.2.1.2 Microducts Microducts are thin-walled ducts (sub-ducts or for indoor use) or thick-walled ducts (for direct routing in the ground, water or air), with inner dimensions from approx. 3 mm up to approx. 18 mm. 16/12 and 7/3.5 mm are common. Microducts are used to blow (in certain cases also to pull) micro-cables or blow fibres.	Revised text Microducts are thin-walled ducts (sub-ducts or for indoor use) or thick-walled ducts (for direct routing in the ground, water or air), with inner dimensions from approx. 3 mm up to approx. 18 mm. 16/12, 14/10, 12/10 and 7/3.5 mm are common. Microducts are used to blow (in certain cases also to pull) micro-cables or blow fibres.
Appendix 2: Robust networks	2.2.2.1 Cable manholes Optical fibre chambers	Supplement minimum requirement and new recommendation <ul style="list-style-type: none"> Optical fibre chambers must be placed in agreement with the landowner. Pay special attention to the work environment regarding danger to persons during installation and service Recommendation The contractor's self-inspection should include photo documentation of the Optical fibre chambers design and location.
Appendix 2: Robust networks	2.2.2.2 Outdoor splice cabinet	Supplement minimum requirement <ul style="list-style-type: none"> Outdoor splice cabinet must be placed in agreement with the landowner. Pay special attention to the work environment regarding danger to persons during installation and service.
Appendix 2: Robust networks	2.2.3.2 Marking <ul style="list-style-type: none"> Warning mesh, warning net or other clear marking should be placed above ducts to reduce the risk of damage to the cable infrastructure. 	Revised requirement <ul style="list-style-type: none"> Warning mesh and warning net with green alternatively orange colour or other clear marking should be placed above ducts* to reduce the risk of damage to the cable infrastructure. <p>* Note: Excluded for pressed or controlled drilling when laying duct pipes under eg roads, watercourses, etc....</p>
Appendix 2: Robust networks	2.2.3.2 Marking In order to simplify traceability, the warning mesh should include search wire so that its location can be found with the aid of a tone transmitter and cable locator. should be used.	Revised requirement In order to simplify traceability, the warning mesh should include search wire so that its location can be found with the aid of a tone transmitter and cable locator. should be used.
Appendix 2: Robust networks	2.3.2 Underground routing	Supplement minimum requirement <ul style="list-style-type: none"> Before excavation in farmland a reconciliation with the landowner regarding existing drainage must be carried out When laying in farmland that is used with machines that risk getting close to the depth at which the canalisation is to be laid, it is recommended that a deeper laying is considered Any excavated drainage pipes must be photo-documented before and after repair and notified to the landowner during post-inspection. When crossing another cable owner's infrastructure, check the line owner's minimum distance requirements.
Appendix 2: Robust networks	2.3.2.2 Positioning of optical fibre chambers and cabinets <i>MINIMUM REQUIREMENTS WHEN POSITIONING OPTICAL FIBRE CHAMBERS:</i> The bottom section must be positioned on a bed	Revised requirement The bottom section must be placed on a bed with well-functioning drainage capacity. The grain size of the material must be adapted to the current soil condition. comprising the same material as for the duct bedding, with a

	comprising the same material as for the duct bedding, with a grain size of 8-16 mm.	grain size of 8-16 mm.
Appendix 2: Robust networks	2.3.2.6 selected sandfill Recommendation Medium gravel should be used as sandfill for standard ducts (larger dimensions) and when positioning optical fibre chambers and cabinets.	Revised recommendations Medium gravel should be used as sandfill for standard ducts (larger dimensions). and when positioning optical fibre chambers and cabinets.
Appendix 2: Robust networks	2.3.4.1 Intake of duct above ground level in property <ul style="list-style-type: none"> Mechanical protection (e.g. sheet metal chute) must cover the duct. 	Revised requirement <ul style="list-style-type: none"> UV-sensitive duct pipes must have a mechanical protection (eg sheet metal chute) that covers must cover the duct pipe so that the pipe is protected against both mechanical damage and UV light along its entire length.
Appendix 2: Robust networks	2.3.6.1 Joint construction <ul style="list-style-type: none"> Agreements with other cable owners must be drawn up. The regulations of other cable owners must be complied with. 	Revised requirement <ul style="list-style-type: none"> Agreements with other cable the pole owner must be established. The regulations of other cable owners must be complied with. The pole owner's recommendation for Co-building / Co-location must be used. <p>Supplement minimum requirement Defects in the condominium facility must be reported immediately to the respective cable owner.</p>
Appendix 2: Robust networks	2.3.6.2 Height above ground of overhead cables	Supplement minimum requirement <ul style="list-style-type: none"> When suspending an optical cable, EBR K30: 04 regarding co-assembly of optical fiber cable must be followed. An overhead line over an area with maritime traffic must be installed at a minimum height above normal high-water surface that the Swedish Maritime Administration or another authority prescribes as a sail-free height. When an overhead line crosses an electrified railway, it must be located at the height and in accordance with the instructions determined by the Swedish Electrical Safety Agency after consultation with the railway owner. When overhead line installation, the cable manufacturer's instructions on mounting accessories and installation methods must be followed.
Appendix 2: Robust networks	2.5.9.1 Fibre outlet	Supplement minimum requirement <ul style="list-style-type: none"> When installing fiber outlets the customer's alt. the manufacturer's instructions are followed.
Appendix 2: Robust networks	2.5.12 Delivery measurement of passive fibre <ul style="list-style-type: none"> OTDR measurement must be performed on all connections at 1310 nm and 1550 nm. 	Revised requirement <ul style="list-style-type: none"> OTDR measurement must be performed between the endpoints on all connections at 1310 nm and 1550 nm <p>Supplement minimum requirement</p> <ul style="list-style-type: none"> If the incoming optical fiber to a home is terminated in a fiber outlet, the fiber socket constitutes the end point of the connection. For termination in apartment buildings, see recommendation "Robusta fastighetsnät".
Appendix 3: Robust routing methods	5.2.9 Duct bedding Duct bedding must be flat and must comprise natural sand or rock dust with a grain size of 0-18 mm. Duct bedding with a thickness of at least 5 cm is recommended. When positioning optical fibre chambers, the manufacturer's instructions must be followed. Duct bedding must also be present below chambers.	Revised requirement Duct bedding must be flat and must comprise natural sand or rock dust with a grain size of 0-18 mm. Duct bedding with a thickness of at least 5 cm is recommended. When positioning optical fibre chambers, the manufacturer's instructions must be followed. Duct bedding must also be present below chambers.

Appendix 4: Robust sites and nodes	2.1 Classification of sites and nodes	<p>New headings 2.1.1 Classification Existing text</p> <p>2.1.2 Extended requirements For facilities with requirements for extended operating time in the event of extraordinary events, Appendix 4.1 Robust sites for digital critical infrastructure protection is used. Based on the Site's importance in the electronic infrastructure, the guide defines a number of security levels with complementary protection measures focusing on protection and functions for extended operating time in the event of extraordinary crises.</p>

Amendments: Amendments of Instructions for Robust Fiber carried out on 07/05/2021

Date 2021-05-07		
Document	Previous text	Addition or revised text
Appendix 6: Inspection		<p>3.1 General Appendix: For the completion of the inspection, Appendix 6.1 Checklist final inspection is used. The checklist also includes the additional requirements, for the facility and the documentation, which must be verified if the facility has received broadband support in accordance with Chapter 3.2 Inspection of the facility that has received broadband support from the Swedish Post and Telecom Agency or the Swedish Board of Agriculture.</p> <p>3.2 Inspection of a facility that has received broadband support from the Swedish Post and Telecom Agency or the Swedish Board of Agriculture</p> <p>If the facility has received broadband support from the Swedish Post and Telecom Agency (PTS) or the Swedish Board of Agriculture (SJV), Appendix 6.1 Checklist final inspection is used. The checklist has been supplemented with the additional requirements, on the facility and the documentation, which the authorities prescribe as follows:</p> <ul style="list-style-type: none"> • PTS. Requirements for robustness, reliability, security and overcapacity in accordance with PTS's conditions for investment support for broadband.

Sub-appendix 6.1 Checklist		Updated but the Sub-appendix 6.1 Checklist is not translated into English
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Amendments: Amendments of Instructions for Robust Fiber carried out on 01/03/2021

Date 2021-03-01		
Document	Previous text	Addition or revised text
Main document	1.4 About the instructions	Additions under 1.4 instructions new appendices 4.1, 4.1.1 and 4.1.2.
Sub-appendix 4.1: Robust sites for digital critical infrastructure protection		New sub-appendix 4.1 Robust sites for digital critical infrastructure protection and two sub/sub appendix 4.1.1 Robust site RSA (excel) and 4.1.2 Routine and guidance for Risk and vulnerability analysis (RSA)
Appendix 6: Inspection		Chapter 3 Numbering 3.1 General Appendix: For the completion of the inspection, Appendix 6.1 Checklist final inspection is used. The checklist also includes the additional requirements, for the facility and the documentation, which must be verified if the facility has received broadband support in accordance with Chapter 3.2 Inspection of the facility that has received broadband support from the Swedish Board of Agriculture. New chapter 3.2 Inspection of a facility that has received broadband support from the Swedish Board of Agriculture

		<p>If the facility has received broadband support from the Swedish Board of Agriculture, Appendix 6.1 Checklist final inspection is used. The checklist has been supplemented with the additional requirements, on the facility and the documentation, that the authority prescribes in the following documents:</p> <ul style="list-style-type: none"> • SJV. The Swedish Board of Agriculture's regulations on business support, project support and environmental investments as well as support for locally led development (SJVFS 2016: 19). • SJV. Regulations on amendments to the Swedish Board of Agriculture's regulations (SJVFS 2016: 19) on business support, project support and environmental investments as well as support for locally led development (SJVFS 2020: 33) <p>If the inspection refers to a facility that has received broadband support from the Swedish Board of Agriculture, the inspector must certify that the facility meets the Swedish Board of Agriculture's requirements for the facility and the documentation.</p>
Sub-appendix 6.1 Checklist		<p>Supplemented with requirements according to the Swedish Board of Agriculture's certificate: LSB12_23 CERTIFICATE Documentation at final inspection of Broadband support LSB12_24 CERTIFICATE - Documentation of management plan for broadband networks</p> <p>Sub-appendix 6.1 Checklist is not translated into English</p>
Sub-appendix 6.1 Checklist		<p>Impact adjustments for SJV supplements.</p> <p>Introduced instructions for checking minimum requirements that cannot be checked visually: RF. Verified by inspection question to contractor and inspector.</p> <p>Sub-appendix 6.1 Checklist is not translated into English</p>

Amendments: Amendments of Instructions for Robust Fiber carried out on 17/08/2020

Date 2020-08-17		
Dokument	Tidigare text	Tillägg eller reviderad text
Appendix 2: Robust networks	2.2.1 Ducts	<p>New minimum requirement.</p> <ul style="list-style-type: none"> • When jointing duct pipes, these should not have too much temperature difference to the joint to prevent creep.
Appendix 2: Robust networks	2.2.2.1 Cable manholes	<p>New minimum requirements.</p> <ul style="list-style-type: none"> • Placement of cable manholes in trenches should be avoided • Placement of cable manholes in ditches should be avoided • Cable manholes should be positioned in such a way as to minimize the risk of water ingress and so that the required drainage can be carried out. • Duct pipes installed in the cable manhole should not be bundled.

		<ul style="list-style-type: none"> Duct pipes installed in a cable manhole should be pulled into the center of the manhole to minimize the risk of the pipe creeping out. This should be done with consideration that the establishment and usability of fiber will not be impaired. Cable manholes placement planning should be based on site visits.
Appendix 2: Robust networks	2.2.2.2 Outdoor splice cabinet	<p>New minimum requirement.</p> <ul style="list-style-type: none"> Design of outdoor splice cabinets placement should be based on site visits.
Appendix 2: Robust networks	2.2.2.3 Moisture in outdoor splice cabinet	<p>Adjusted minimum requirement.</p> <ul style="list-style-type: none"> If a cabinet has been supplied without a ground insulation plate, some other ground insulation must be installed, e.g. in the form of Leca granules. Where Leca granules are used, the backfill must be at least 35 cm thick and must reach above ground level. <p>For use of lecules, see section 2.3.2.2</p>
Appendix 2: Robust networks	2.2.3.1 Position measurement	<p>Adjusted minimum requirement.</p> <ul style="list-style-type: none"> Measurement of the position of the fibre installation must be carried out using geodetic measurement with a DGPS (differential GPS) measuring instrument or equivalent.
Appendix 2: Robust networks	2.2.3.2 Marking	Completed with picture on Cable fixation point.
Bilagaz: Nät	Kap 2.3.2.1 Bed in ducts MINIMUM REQUIREMENTS FOR SELECTED SANDFILL AND DUCT BEDDING:	<p>Adjusted minimum requirement.</p> <ul style="list-style-type: none"> Duct bedding and Selected Sandfill must comprise filler material in accordance with section 2.3.2.6. natural sand or rock dust with a grain size of 0-18 mm.
Appendix 2: Robust networks	2.3.2.2 Positioning of manholes and cabinets	<p>Adjusted minimum requirement.</p> <ul style="list-style-type: none"> The bottom section must be positioned on a bed comprising the same material as for the duct bedding, with a grain size of 8-16 mm. The bed must be well compacted and levelled off and must be at least 200 mm thick. Consideration must be given to any differences in level at the surface when creating the bed. <p>Any need for a ground cloth should be taken into account.</p>
Appendix 2: Robust networks	2.3.2.2 Positioning of manholes and cabinets	<p>New minimum requirements.</p> <ul style="list-style-type: none"> A base or plinth must be fully laid out and installed in accordance with the manufacturer's instructions. Legs, stands or bases must be completely folded out and mounted according to the manufacturer's instructions. Outdoor ground cabinets should be positioned so that the marking on the outside of the cabinet is at ground level. If the outdoor ground cabinet is to have ground insulation board, you must fill up with lots up to ground level marking on the inside. If the outdoor ground cabinet is to be filled with lecules, it should be at least 35cm lecules and the filling should be completed above ground level.
Appendix 2: Robust networks	2.3.2.6 Selected sandfill Selected sandfill is generally required in order	<p>Adjusted text.</p> <p>Selected sandfill is generally required in order to form</p>

	<p>to form a bed of gravel with a dimension of \varnothing 0–18 mm. Where the instructions specify selected sandfill with a dimension of \varnothing 0–18 mm, adaptations should be made according to the selected sandfill recommendations.</p> <p>In order to clarify the application of selected sandfill depending on what is being installed in the ground, AMA Site works and the table describing soil types are used. For Robust Fiber, sand, fine gravel and medium gravel are used.</p> <p>Selected sandfill recommendations</p> <ul style="list-style-type: none"> • Sand, fine gravel or medium gravel is used as Selected Sandfill for excavations, generally \varnothing 0–18 mm. • Medium gravel should be used for standard ducts (larger dimensions) and when positioning manholes and cabinets. • Fine gravel should be used for duct bedding and Selected Sandfill in the case of excavation and the routing of microducts • Sand should be used as Selected Sandfill in the case of microtrenching. 	<p>a bed of gravel with a dimension of \varnothing 0–18 mm. Where the instructions specify selected sandfill with a dimension of \varnothing 0–18 mm, adaptations should be made according to the selected sandfill recommendations.</p> <p>In order to clarify the application of selected sandfill depending on what is being installed in the ground, AMA Site works and the table describing soil types are used. For Robust Fiber, sand, fine gravel and medium gravel are used.</p> <p>Refill of the shaft should be done in consultation with the landowner.</p> <p>Selected sandfill recommendations</p> <ul style="list-style-type: none"> • Sand, fine gravel or medium gravel is used as Selected Sandfill for excavations, generally \varnothing 0–18 mm. • Medium gravel should be used as sandfill for standard ducts (larger dimensions) and when positioning manholes and cabinets. • Fine gravel should be used for duct bedding and Selected Sandfill in the case of excavation and the routing of microducts • Sand should be used as Selected Sandfill in the case of microtrenching. • For the remaining filling of the shaft, the filling mass is used, which is closest to the ducting / cable protection does not contain stones with sharp edges and where a maximum of 10% consists of the grain size 100-150 mm.
<p>Appendix 2: Robust networks</p>	<p>2.3.3 Minimum backfill height</p> <p>Backfill height is the distance between the upper edge of a duct and the finished ground level. General requirements regarding minimum backfill height can be seen from the table below.</p>	<p>Adjusted text.</p> <p>Backfill height is the distance between the upper edge of the buried duct and the finished ground level. General requirements regarding minimum backfill height can be seen from the table below.</p>
<p>Appendix 2: Robust networks</p>	<p>2.3.4 Connection to buildings</p> <p>The position of the intake of the duct in a building (a property) is determined by the property owner in consultation with the contractor.</p> <p>2.3.4.1 Intake of duct above ground level in property</p> <p>MINIMUM REQUIREMENTS</p> <ul style="list-style-type: none"> • Ducts must be UV-protected where they are exposed to direct sunlight. Otherwise, mechanical protection (e.g. sheet metal chute) must cover the duct. <p>2.3.4.2 Intake of duct below ground level</p> <p>Intake of duct below ground level must only be used in exceptional cases due to the risk of, among other things, moisture damage.</p>	<p>Adjusted and supplemented text.</p> <p>2.3.4 The location of the intake of the duct in a building</p> <p>The position of the intake of the duct in a building (a property) is determined by the network owner in consultation with property owner. in consultation with the contractor.</p> <p>The minimum requirements for connecting a villa are presented in the following points.</p> <p>2.3.4.1 Intake of duct above ground level in property</p> <p>Intake of ducts above ground level shall be determined by the network owner in consultation with the property owner.</p> <p>The basis for decisions is the network owners risk assessment and local regulations.</p> <p>Minimikrav</p> <ul style="list-style-type: none"> • Ducts must be UV-protected where they are exposed to direct sunlight. Otherwise, mechanical protection (e.g. sheet metal chute) must cover the duct. <p>2.3.4.2 Intake of duct below ground level</p> <p>Intake of ducts below ground level shall be determined by the network owner in consultation with the property</p>

		owner. The basis for decisions is the network owners risk assessment and local regulations.
Appendix 2: Robust networks	2.5.9.1 Fibre outlet	New minimum requirement. <ul style="list-style-type: none"> Fiber outlets in households must be marked with the symbol "Laser warning" in accordance with section 2.5.10 Optical radiation.
Appendix 3 Routing methods	3.1 Staking / cable indication query	Supplemented text. As part of improving collaboration between network owners, authorities, cable operators and other players in the industry, a collaboration project "Grävallvar" is also being run with the aim of reducing digging damage on the cable networks (https://gravallvar.se/).
Appendix 4 Robust sites and nodes	2.2.5.2 Auxiliary power systems	New minimum requirements. <ul style="list-style-type: none"> When installing with UPS, there must be a ByPass function
Appendix 4 Robust sites and nodes	2.2.12 Fire protection Minimum requirements <ul style="list-style-type: none"> Cell plastic should not be used as insulation in a Site 	Adjusted minimum requirement. <ul style="list-style-type: none"> For building materials used in a Site, the conditions of use must be checked with the insurance company for the Site.
Appendix 6: Inspection	3 Inspection An inspector is appointed by the client. The inspector must not be disqualified. Pre-inspection and final inspection are paid for by the client, while any post-inspection is paid for by the contractor.	Adjusted text An inspector is appointed by the client. The inspector appointed by the client must be suitable for the assignment. The requirement of suitability includes, besides technical knowledge, the inspector's objectivity, since the assignment means that the inspection is carried out in an independent manner towards both the client and the contractor. Pre-check and final check are paid by the client, while any post-check is paid by the contractor.

Amendments: Amendments of Instructions for Robust Fiber carried out on 10/01/2020

Date 2018-04-08, 2018-04-10, 2019-04-01, 2019-11-25		
Dokument	Tidigare text	Tillägg eller reviderad text
Main document	1.4 About the instructions Sub-appendix 2.1 Robust networks, Attenuation calculation <i>A review of minimum requirements regarding how ducting and optical cables should be selected and routed, as well as how they should be handled, labelled and measured.</i>	The text is exchanged. A tool for calculating attenuation values in optical fiber networks.
Main document	1.4 About the instructions	Appendix 8: Ledningskollen added. The appendix is a brief description of the elements that are part of a cable indication query.
Main document	2.1 Risk analysis	Heading changed to 2.1 Operational reliability
Main document	2.5 Environmental plan Identification of risks of disruptive noise and vibrations. Ensure that relevant protective equipment is available for personnel.	Adjusted text Identification of risks of disruptive noise and vibrations of the environment.
Main document		Chapter 5 Reference document added.
Appendix 1	2.3 Kanalisation Optical ducts are ducts specially manufactured for routing optical cables. Standard inside diameters range from 15 mm to 50 mm.	Adjusted text Optical ducts: Standard inside diameters range from about 12-15 mm to 50
Appendix 2: Robust networks	2.1.3 Permits	TA plan writing adjusted.

Appendix 2: Robust networks	2.1.4 Cable indication query	Writings regarding "Ledningskollen" supplemented with reference to Appendix 8 "Ledningskollen"
Appendix 2: Robust networks	2.2.1 Ducts	Supplemented minimum requirements. <ul style="list-style-type: none"> When cutting ducts, cut the ducts with tools for cutting ducts. This is to avoid degrees, cuts, etc. which in turn can lead to blow problems.
Appendix 2: Robust networks	2.2.1 Ducts <ul style="list-style-type: none"> The diameter of the optical cable should not exceed 85% of the inner diameter of the ducts when blowing optical cable. Follow the manufacturer's recommendation. 	Adjusted minimum requirements. <ul style="list-style-type: none"> The diameter of the optical cable should not exceed 75% of the inner diameter of the ducts when blowing optical cable. Follow the manufacturer's recommendation.
Appendix 2: Robust networks	2.2.1. Ducts Ducts for direct installation in soil shall have a thickness of at least 1.8 mm.	The text moved to 2.2.1 Ducts and with the following text alignment Ducts for direct installation in soil shall, as a rule of thumb, have a thickness of at least 1.8 mm.
Appendix 2: Robust networks	2.2.1.1 Optical ducts <ul style="list-style-type: none"> The manufacturer must specify the duct dimension regarding material thickness to cope with pressure from the surrounding soil. 	Adjusted minimum requirements <ul style="list-style-type: none"> The manufacturer must state in his duct specification that the duct is dimensioned with a thickness of goods to withstand pressure from the surrounding soil.
Appendix 2: Robust networks	2.2.1.3 Labelling and identification of ducting Labelling of ducting will aid the identification of ducting in the network. Identification is achieved through e.g. coloured, corrugated or numbered ducts in order that the ducts can be distinguished in the event they are excavated or damaged, as well as in the event of optical cables being blown in from outdoor splice cabinets.	Revised text. Labelling of ducting will aid the identification of ducting in the network. Identification is achieved through e.g. coloured, corrugated or numbered ducts in order that the ducts can be distinguished in the event they are excavated or damaged and, for example, when optical cables being blown in from outdoor splice cabinets.
Appendix 2: Robust networks	2.2.2.2 Outdoor splice cabinet	Supplemented minimum requirements <ul style="list-style-type: none"> Outdoor splice cabinet should be adapted for simplicity of post-connection. Installation work in outdoor splice cabinets must be possible without affecting the function of existing installation. Splice unit in outdoor splice cabinets must be installed according to the manufacturer's instructions.
Appendix 2: Robust networks	2.2.3.1 Position measurement MINIMUM REQUIREMENTS <ul style="list-style-type: none"> The fibre installation must be measured, i.e. ducts, all termination points, cabinets, cable manholes and cable trays, ducting end points as well as cable fixation points. 	Adjusted minimum requirements. <ul style="list-style-type: none"> The fibre installation must be measured, i.e. ducts, all termination points for ducting, cabinets, cable manholes and cable trays, ducting end points as well as cable fixation points.

Appendix 2: Robust networks	2.2.3.2 Marking MINIMUM REQUIREMENTS <ul style="list-style-type: none"> The warning mesh must be centred, at least 10 cm above the ducts. The warning mesh must be made of a material that is ageing-resistant in the ground, and must have good handling properties, even at low temperatures. The colour of warning mesh and warning net must be clear. 	Adjusted minimum requirements <ul style="list-style-type: none"> The warning mesh must be centred, at least 10 cm above the ducts. The warning mesh must be made of a material that is ageing-resistant in the ground, and must have good handling properties, even at low temperatures. The colour of the warning mesh and warning net must be clear.
Appendix 2: Robust networks	2.2.3.2 Marking	Adjusted minimum requirements <ul style="list-style-type: none"> Search wire must generally not be inside a protective duct. It must be routed above the duct, except in the case of pressing and drilling, when it is placed in the duct.
Appendix 2: Robust networks	2.3.2 Underground routing	Supplemented minimum requirements <ul style="list-style-type: none"> When pressing through a railway bank, the Swedish Transport Administration's instructions must be followed.
Appendix 2: Robust networks	2.3.2.1 Bed in ducts. Dimensioning of spacers	Corrected heading 2.3.2.1 Bed in ducts. Dimensioning of spacers
Appendix 2: Robust networks	2.3.2.2 Positioning of manholes and cabinets	Supplemented recommendation If necessary, drainage of the bed should be carried out
Appendix 2: Robust networks	2.3.2.2 Positioning of manholes and cabinets	Adjusted minimum requirements <ul style="list-style-type: none"> Backfilling must be performed using Selected Sandfill, medium gravel, with a grain size of 6-3-18 mm.
Appendix 2: Robust networks	2.3.2.3 Gauging	Example of gauge implemented
Appendix 2: Robust networks	2.3.3.1 General requirements regarding minimum backfill height:	Supplementary minimum filling height requirements changed to Minimum backfill height requirements. The table Backfill height is marked green and updated with what was previously stated as supplementary requirements.
Appendix 2: Robust networks	2.3.4.1 Intake of ducting above ground level in property MINIMUM REQUIREMENTS <ul style="list-style-type: none"> Sealing must be performed as close to the inner wall as possible. 	Adjusted minimum requirements <ul style="list-style-type: none"> Sealing must be performed as close to the inner wall and outer wall as possible.
Appendix 2: Robust networks	2.3.4.2 Intake of ducting below ground level	Supplement. Intake of ducting below ground level should only be used in exceptional cases due to the risk of, among other things, moisture damage.
Appendix 2: Robust networks	2.3.4.2 Intake of ducting below ground level MINIMUM REQUIREMENTS <ul style="list-style-type: none"> A hole must be drilled into the property at an incline of at least 10°, with the highest point inside the property. If the hole is drilled through the foundation's existing drainage protection, the protection must not be impaired, rather it must be reinstated. 	Adjusted minimum requirements <ul style="list-style-type: none"> A hole must be drilled into the property at an incline of at least 30°, with the highest point inside the property. If the hole is drilled through the

		foundation's existing drainage protection, the protection must not be impaired, rather it must be reinstated.
Appendix 2: Robust networks	2.3.4.3 Intake of ducting in property with ground cover:	<p><i>Chapter 2.3.4.3 removed</i> <i>Text moved to the bulleted list in chapter 2.3.4.2.</i></p> <ul style="list-style-type: none"> If the property has ground cover such as Isodrän or Platon membrane, the manufacturer's recommendations regarding sealing must be followed.
Appendix 2: Robust networks	<p>2.3.5 Routing in lakes or watercourses</p> <p>MINIMUM REQUIREMENTS</p> <ul style="list-style-type: none"> When routing optical cable (underwater cable) in lakes and large water courses, it is necessary to use a cable design approved for the purpose in respect of water depth, the nature of the bottom, future dredging, etc. You must therefore always consult with the cable manufacturer. 	<p>Adjusted minimum requirements</p> <ul style="list-style-type: none"> When routing optical cable (underwater cable) or ducts in water, it is necessary to use a design approved for the purpose for placing in water in respect of water depth, the nature of the bottom, future dredging, etc. You must therefore always consult with the cable manufacturer. <p>Supplemented minimum requirements.</p> <ul style="list-style-type: none"> If ducting is intended for water in watercourses, optocables need not be adapted to water more than the requirements for long-waterproof optocables for ground.
Appendix 2: Robust networks	2.3.5.2 Checking routing in lakes or watercourses with regulated maritime transport	<p>Revised heading.</p> <p>2.3.5.2 Checking routing in lakes or watercourses with regulated maritime traffic in accordance with the regulations of the Maritime Administration.</p>
Appendix 2: Robust networks	2.3.6.2 Height above ground of overhead cables	Minimum requirements revised
Appendix 2: Robust networks	<p>2.4-1 Optical cables, general</p> <ul style="list-style-type: none"> The optical cable's strain relief must be adapted to the splicing units that are used in the fibre installation. 	<p>Adjusted minimum requirements.</p> <ul style="list-style-type: none"> The optical cable's strain relief must be adapted to the installation methods and the splicing units that are used in the fibre installation.
Appendix 2: Robust networks	<p>2.4.3 Optical cables for indoor routing</p> <p>MINIMUM REQUIREMENTS</p> <ul style="list-style-type: none"> Ducts and optical cables intended solely for outdoor use may not extend by more than 5 m into a building and must remain within the same fire cell, according to Boverket's (National Board of Housing, Building and Planning) CPR class Dca-s2, d2, a2, valid from 2017. After this, ducts and optical cables classified for indoor use must be used. 	<p>Revised heading and Adjusted and supplemented minimum requirements</p> <p>2.4.3 Optical cables, cable gutters and cable ladders for indoor routing</p> <p>Adjusted minimum requirements</p> <ul style="list-style-type: none"> Ducts and Optical cables intended solely for outdoor use may not extend by more than 20.5 m into a building and must remain within the same fire cell, according to Boverket's (National Board of Housing, Building and Planning) CPR class Dca-s2, d2, a2, valid from

		<p>2017. After this, ducts and optical cables classified for indoor use must be used.</p> <ul style="list-style-type: none"> • If the ducting and cable extend further than 5 m into the building, analytical dimensioning must be performed to demonstrate that it is as good as that stipulated in Boverket's advice. <p>Supplemented minimum requirements.</p> <ul style="list-style-type: none"> • Cable gutters and cable ladders can be designed according to SS-EN 61537. Cable rails can be designed according to SS-EN 61534 series. Suspension devices in escape routes should be designed in material class A2-sl, do. (BSF 2018: 4)
Appendix 2: Robust networks	2.4-5 Optical cables for routing in water Routing must take place using optical cables that are adapted for direct routing in water.	Adjusted minimum requirements. Routing must take place using optical cables that are adapted for routing in water.
Appendix 2: Robust networks	2.5.1 General requirements	Adjusted minimum requirements <ul style="list-style-type: none"> • Loop must always be routed in cable manhole, regardless of optical cable type. Loop optional in other types of distribution points.
Appendix 2: Robust networks	2.5.2 Routing optical cable in wells and cabinets	Adjusted minimum requirements. <ul style="list-style-type: none"> • In the event of a loop of fibre optic cables in a manhole, ensure that the looped cable is not routed in water over time.
Appendix 2: Robust networks	2.5.5 Splicing units	Completed with picture on facade boxes
Appendix 2: Robust networks	2.5.5 Splicing units MINIMUM REQUIREMENTS FOR SPLICING BOXES AND WALL BOXES: <ul style="list-style-type: none"> • Splicing boxes must withstand the strains to which they are subjected in water-filled manholes, installed in the open air or buried directly in the ground. 	Adjusted minimum requirements <ul style="list-style-type: none"> • Splicing boxes must withstand the strains to which they are subjected in water-filled manholes, mounted outdoors or buried directly in the ground.
Appendix 2: Robust networks	2.5.5 Splicing units MINIMUM REQUIREMENTS FOR FACADE BOXES:	Supplemented minimum requirements (Facade box). <ul style="list-style-type: none"> • If penetration in the façade is done behind the façade box by drilling a hole in the façade box, it must be ensured that the occupied hole and through-hole penetration are sealed. Sealing takes place with the intended sealant to maintain the moisture barrier
Appendix 2: Robust networks	2.5.5 Splicing units MINIMUM REQUIREMENTS REGARDING SPLICING CABINETS: Splicing cabinets for outdoor routing above ground must be surrounded with an external enclosure that satisfies at least classification IP34. Ensure that the IP classification for the splicing cabinet is sufficient, e.g. in respect of pests and water penetration, for the environment where the splicing cabinet is located.	Adjusted minimum requirements (splicing cabinet) <ul style="list-style-type: none"> • Splicing cabinets for outdoor routing above ground must be surrounded with an external enclosure that satisfies at least classification IP34. Ensure that the sealing of the splicing cabinet is sufficient, eg. in respect of pests and water penetration, for the environment where the splicing cabinet is located.

Appendix 2: Robust networks	2.5.5 Splicing units	Supplemented minimum requirements (Façade box) <ul style="list-style-type: none"> Splicing of fiber in the facade box can be done by welding or with a facade box mounted with a splice piece for mounting fiber
Appendix 2: Robust networks	2.5.11 Delivery measurement of fibre connections	Corrected text. No new content
Appendix 2: Robust networks	2.5.12 Delivery measurement of passive fibre	Supplemented minimum requirements <ul style="list-style-type: none"> OTDR measurement must be done according to the instrument manufacturer's instructions.
Appendix 2: Robust networks	2.5.12 Delivery measurement of passive fibre	Supplemented minimum requirements <ul style="list-style-type: none"> Two-way OTDR measurement is to be performed for connection- and regional networks.
Appendix 2: Robust networks	2.5.12.1 Measurement results and limit values for fibre in cables	Adjusted minimum requirements. <ul style="list-style-type: none"> Average attenuation 0.20 dB, connection and regional networks.
Appendix 2: Robust networks	2.5.13 Delivery measurement of active fibre	Duplicate removed
Appendix 2: Robust networks	2.5.13 Delivery measurement of active fibre Active fibre refers to a connection that has an active CPE/Switch that signals at 1310 nm and 1550 nm on the fibre. Delivery measurement can then be conducted with a filtered wavelength of 1625 nm. Delivery measurement for an active fibre connection may only be used for single dwelling unit connections (SDU).	Adjusted text Active fibre refers to a connection that has an active CPE/Switch that signals at 1310 nm and 1550 nm on the fibre. Delivery measurement can then be conducted with a filtered wavelength of 1625 nm. Delivery measurement for an active fibre connection may only be used for single dwelling unit connections (SDU). Active measurement assumes that measurement is from one direction only. Supplemented minimum requirements OTDR measurement must be done according to the instrument manufacturer's instructions.
Appendix 2: Robust networks	2.5.13.1 Measurement results and limit values for fibre in cables	Adjusted minimum requirements. <ul style="list-style-type: none"> Average attenuation 0.20 dB, connection and regional networks.
Appendix 2: Robust networks	2.6.1 Labelling of ducting	Revised heading 2.6.1 Labelling and designation of ducting Revised headline for minimum requirements MINIMUM REQUIREMENTS IN RESPECT OF LABELLING AND DESIGNATION OF DUCTING:
Appendix 2: Robust networks	2.6.4 Splicing units <ul style="list-style-type: none"> On a splice cassette, it must be clear which fibres/cables in an optical cable are spliced in the cassette. 	Adjusted minimum requirements. <ul style="list-style-type: none"> On a splice cassette it must be clear which fibers / cables are in the cassette.
Appendix 3 Routing methods	3.1 Staking / cable indication query Local regulations and procedures determine how staking and	Adjusted text. Local regulations and

	cable indication queries are to take place and be ordered through Ledningskollen and any other local procedures.	procedures determine how staking and cable indication queries are to take place and be ordered through Appendix 8 Ledningskollen and any other local procedures.
Appendix 3 Routing methods	3.2 Prior survey on site	Must exchanged to should
Appendix 3 Routing methods	3.3 Collocation	Must exchanged to should
Appendix 3 Routing methods	3.4 Permits and land issues	TA plan writing adjusted.
Appendix 3 Routing methods	3.5 TA-plan	TA plan writing adjusted.
Appendix 3 Routing methods	3.9 Warranties	Supplementary text. However, these terms in AB 04 / ABT 06 can be changed in agreements, so other warranty periods may apply in individual cases.
Appendix 3 Routing methods	3.12 Trees, roots and vegetation Local regulations must be complied with, although it is generally not permitted to excavate within a tree's drip line. The principal is responsible for trees and plants that are affected by the work not sustaining damage.	Adjusted text Local regulations must be complied with, although it is generally not permitted to excavate within a tree's drip line zon .
Appendix 4 Robust sites and nodes	2.2.12 Fire protection	Supplemented minimum requirements Cell plastic should not be used as insulation in a Site
Appendix 5: Document-tation	2.3.2.6 Register fibre installation <i>Register that the fibre installation is present according to Ledningskollen's procedures or in accordance with local procedures and regulations.</i>	Adjusted text. The fibre installations must be registered in accordance with Appendix 8 Ledningskollen or in accordance with local procedures and regulations.
Appendix 5: Document-tation	2.3.3.1 Cable drawing	Supplemented minimum requirements. • It should be stated in which optical duct a cable is placed.
Appendix 5: Documentation	2.3.3.5 Measurement report The measurement report is ideally attached to the cable specification.	Added text The format of the measurement record can be PDF.
Appendix 5: Document-tation	2.4 Requirements regarding documents that should be included	Heading changed to 2.4 Documents that should be included Adjusted text. The following documents are not mandatory but should be included. If the documents are included in the documentation, the minimum requirements must be met.
Appendix 6: Inspection	3.7 Final Inspection	Added text Comment: If the contract at the final inspection is obviously not completed so that it can be approved, the Inspector may cancel the Inspection and prescribe a new final inspection. The inspector must state in his opinion the reasons for this. The fact that a party fails to attend the inspection without acceptable reason does not impede the conduct of the inspection. If the final inspection is not carried out within the prescribed time due

		to the failure of the client, the contractor is considered approved and delivered from the date when the inspection would have been properly carried out
Appendix 6: Inspection	3.11 Special inspection Applies both to faults that have been discovered during the warranty period and to faults that have emerged after the warranty period but within the 10-year responsibility period.	Adjusted text. Applies both to faults that have been discovered during the warranty period and/or to faults that have emerged after the warranty period but within the 10-year responsibility period and for the status of the contract in a certain respect
Appendix 6.1: Checklists, inspection		Adjusted for corrections in appendices
Appendix 7: Fibre installation projects		Adjusted regarding to the new Appendix 8 Ledningskollen.
Appendix 7: Fibre installation projects	1.2.3 Apply for permits	TA-plan requirements adjusted.
Appendix 7: Fibre installation projects	1.3.4 In-house checks MINIMUM REQUIREMENTS: In-house checks must be performed and documented for each section.	Adjusted minimum requirements. MINIMUM REQUIREMENTS: In-house checks must be performed and documented for each part of the installation.
Bilaga 8 Ledningskollen		New appendix

Amendments: Amendments of Instructions for Robust Fiber carried out on 03/04/2018

Date 01/04/2018		
Document	Previous text	Addition or revised text
Appendix 4 Sites and nodes	Addition 2.2.15 Compilation of requirements and recommendations for sites and nodes	Supplementing with table regarding requirements and recommendations for sites and nodes

Amendments: Amendments of Instructions for Robust Fiber carried out on 01/04/2018

Date 01/04/2018		
Document	Previous text	Addition or revised text
General	MINIMUM REQUIREMENTS	All minimum requirements are indicated with green text.
General	IMAGES	Supplementary images and updated illustrations are generally included to create clarity. Some images have been moved to other positions.
Main document	1.4 About the instructions	Updated list of appendices
Main document	1.6 Limits	1.6 Network topology and limits The chapter has been supplemented with a network overview
Main document	1.6.1 – 1.6.5	Updated information. Image altered national networks. 1.6.4 MINIMUM REQUIREMENTS In the event the access node constitutes a connection point

		between various network owners, the linking of the fibre connections must take place through a cross-connection.
Main document	1.7	Adjusted body text.
Main document	3.2 3-3	Adjustment of standards and recommendations.
Main document	4.	Additional contributory organisations.
Appendix 1	New terms	Splicing box and Facade box introduced
Appendix 1	2.6	Splicing plan. Corrected text.
Appendix 1	2.9	Adjusted heading
Appendix 2: Robust networks	2.2.1 Ducting pipe. Text regarding ducting pipe and minimum requirements has been moved here from point 2.2.1.3, as well as adjustment of minimum requirements and additional requirements.	Additional minimum requirements: Ducting pipes must be spliced with a sealed splice connection according to the manufacturer's instructions. Corrected additional requirements in respect of longitudinal water sealing. From moisture barrier to longitudinally watertight cable.
Appendix 2: Robust networks	2.2.1.1 Marking of ducting. Point moved and new numbering, 2.2.1.3.	New text
Appendix 2: Robust networks	2.2.1.2 Optical pipes. New text and new minimum requirements. Numbering altered to 2.2.1.1.	Rewritten text and minimum requirements introduced regarding optical pipes. SDR value must be at least 10.
Appendix 2: Robust networks	2.2.1.3 Micropipes. Numbering altered to 2.2.1.2	Size 18/12 removed.
Appendix 2: Robust networks	2.2.2.1 Cable wells 2.2.2.3 Moisture in outdoor splice cabinet	2.2.2.1 Cable wells. New image. 2.2.2.3 New image of slotted casing 2.2.2.3 Supplementary minimum requirements regarding slots in casing for drainage
Appendix 2: Robust networks	2.2.3.1 Position measurement	Minimum requirements adjusted. Removed is recommended under requirements.
Appendix 2: Robust networks	2.2.3.2 Marking	Corrected text in respect of marking.
Appendix 2: Robust networks	2.2.3.2 Marking	Minimum requirements adjusted. The search string's location removed
Appendix 2: Robust networks	2.3.2 Underground routing	Minimum requirements adjusted with regard to labelling of outdoor splice cabinets according to the client's instructions. Recommendation adjusted. Removed in event of pressing through railway embankment
Appendix 2: Robust networks	2.3.2.1 Backfill and pipe bedding	2.3.2.1 Bed in pipes. Dimensioning of spacers New image, pipe bedding and backfill material

Appendix 2: Robust networks	2.3.2.2 Minimum requirements when positioning outdoor splice cabinets	Supplement. Placement of outdoor splice cabinets, opening. According to the manufacturer's instructions. Backfill adjusted.
Appendix 2: Robust networks		2.3.2.6 Backfill material New section regarding grain size of backfill material
Appendix 2: Robust networks	2.3.3 Supplementary requirements	Adjusted. Cleared ditch bottom.
Appendix 2: Robust networks	2.3.4.1 Intake of ducting....	Adjusted minimum requirement: sealing must be performed as close to the inner wall as possible. Cleared ditch bottom.
Appendix 2: Robust networks	2.3.6 Routing on poles	2.3.6 Supplement: • Guys to counteract lateral forces in the event of branching or bends
Appendix 2: Robust networks	2.3.6.2 Requirements regarding height above ground of overhead cables	Requirement regarding EBR K30:04 has been added Image changed.
Appendix 2: Robust networks	2.3.7 Installation at bridges	Minimum requirements adjusted: There must be a cable loop on at least one side of the bridge if the cable is a trunk fibre cable. Customer cables do not need to be looped. Image changed
Appendix 2: Robust networks	2.4.3 Optical cables for indoor routing	2.4.3 Optical cables for indoor routing Minimum requirements supplemented with Boverket's regulations.
Appendix 2: Robust networks	2.5 Cable management	When blowing micro-cable, a compressor with a moisture separator and the correct filter according to the compressor manufacturer must be used. Text regarding looping optical cable in cable well amended.
Appendix 2: Robust networks	2.5.2 Minimum requirements regarding routing of optical cable in cable wells and outdoor splice cabinets	Addition: All fibre-optic cables for outdoor use must be able to cope with lying in water.
Appendix 2: Robust networks	2.5.4 Splicing cables	Adjustment: welding splices.
Appendix 2: Robust networks	2.5.5 Splicing units	2.5.5 Splicing units Minimum requirements regarding splicing box and wall box: • Splicing boxes and wall boxes for outdoor use must satisfy class IP68 as a minimum • Wall boxes for outdoor use must be able to be locked in the form of a seal. • Wall boxes that are positioned so that they are accessible to the general public must be class IK 8. • Splicing boxes must be UV-resistant • Splicing boxes must be pressure-tight in order to cope

		<p>with a water pressure equivalent to a 5 m water column</p> <ul style="list-style-type: none"> • Splicing boxes must withstand the strains to which they are subjected in water-filled wells, installed in the open air or buried directly in the ground. <p>Supplementing with facade box.</p>
		<p>Minimum requirements regarding splicing cabinet:</p> <ul style="list-style-type: none"> • Splicing cabinets for outdoor routing above ground must be surrounded with an external enclosure that satisfies at least classification IP34. Ensure that the IP classification for the splicing cabinet is sufficient, e.g. in respect of pests and water penetration, for the environment where the splicing cabinet is located. • When outdoors, splicing cabinets must be installed in an outdoor splice cabinet or equivalent enclosure. • Splicing cabinets must be UV-resistant. • Splicing cabinets that are positioned so that they are accessible to the general public must be class IK 8.
Appendix 2: Robust networks	2.5.6 Termination of cable in node	CPR requirement introduced.
Appendix 2: Robust networks	2.5.9 Termination in property	Minimum requirements supplemented: Standalone also means a unit/plate on which a switch is installed and there is a separate space for fibre on the unit/plate.
Appendix 2: Robust networks	2.5.11 Delivery measurement of fibre connections	<p>Revised measurement methods and limit values. Can be found under 2.5.11–2.5.13</p> <p>Passive and active measurement</p>
Appendix 2: Robust networks	2.6 & 2.6.1	<p>2.6 Clarification regarding the ageing and weather resistance of the labelling.</p> <p>2.6.1 Supplementary minimum requirements</p> <ul style="list-style-type: none"> • Ducting pipes must be labelled at both inputs and outputs in wall bushings when connecting a building/property. Exceptions may be made if the ducting pipe is present for an individual customer connection, e.g. connection to a single dwelling unit.

Appendix 2: Robust networks	2.6.4 Minimum requirements regarding labelling of splicing units: <ul style="list-style-type: none"> • On a splice cassette, it must be clear which fibres in an optical cable are spliced in the cassette. • Splice cassettes must be labelled with "Warning: laser". 	2.6.4 Minimum requirements regarding labelling of splicing units: <ul style="list-style-type: none"> • On a splice cassette, it must be clear which fibres in an optical cable are spliced in the cassette. • The splicing unit must be labelled with "Warning: laser".
Appendix 2.1 Calculating attenuation	2.1 Calculation for calculating attenuation	New appendix
Appendix 3 Routing methods	2.1 General advantages and disadvantages	Adjusted text
Appendix 3 Routing methods	3.2 Prior survey on site 3.3 Collocation	Updating of text.
Appendix 3 Routing methods	3.4 Permits and land issues	Updating of the text on the requisite permits and agreements. Updating of text "Items that often differ between different land owners". As well as cable location.
Appendix 3 Routing methods	3.5 TA plan	Updating of text.
Appendix 3 Routing methods	3.6 Work environment	Updating of text.
Appendix 3 Routing methods	3.8 Subsequent survey on site	Updating of text.
Appendix 4 Robust sites and nodes	2.2.5 Electricity supply	Title changed to Electrical installation The electrical installation in sites and nodes must be executed in accordance with applicable laws and regulations.
Appendix 4 Robust sites and nodes	2.2.5.2 <i>Auxiliary power system</i>	2.2.5.2 <i>Auxiliary power system</i> Minimum requirements regarding auxiliary power systems: <ul style="list-style-type: none"> • Where there is a UPS with batteries, the site must have an externally accessible intake for connecting the auxiliary power unit (emergency power generator).
Appendix 4 Robust sites and nodes	2.2.12 Fire protection	2.2.12 Fire protection <ul style="list-style-type: none"> • Boverket's building regulations (BBR) handle regulations relating to fire protection. • 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. Changed from 6 kg to 5 kg fire extinguisher.

Appendix 5: Documentation	2.3.2.3 <i>Survey file</i> Example of list of measured coordinates that has been created during geodetic position measurement of the ducting:	2.3.2.3 <i>Survey file</i> Below is an example of a list of measured coordinates that has been created during geodetic position measurement of the ducting. Z indicates the height in metres above sea level (in principle) and can be used to determine the flatness of the ducting's routing.
Appendix 6: Inspection		Appendix 6 has been supplemented with a process image and sentence in relation to AB 04 and ABT 06, as well as linguistic adjustments.
Appendix 6: Inspection	3.7 Final inspection	Minimum requirements adjusted for practical implementation.
Appendix 6.1: Checklists, inspection		The section Checklists has been transferred to a separate document, Sub-appendix 6.1 Checklists, inspection
Appendix 7: Fibre installation projects		Only linguistic adjustments.

Amendments: Amendments of Instructions for Robust Fiber carried out on 22 February 2017

Date 22/02/2017		
Document	Previous text	Addition or revised text
Main document		Description of fibre installation project removed. Information contained in appendices is removed. Rearrangement of headings.
Appendix 1: Terms and definitions	Chapter 2.3 Ducting Ducting is an arrangement that provides space and protection for cables. The term Ducting includes all components that jointly make up an arrangement for the protection of cables, e.g. ducting pipes, optical pipes, micropipes, cable pipes, wells, search string. Ducting pipes are also known as ducts or cable protection.	Revised text: Ducting is an arrangement that provides space and protection for cables. The term Ducting includes all components that jointly make up an arrangement for the protection of cables, e.g. ducting pipes, optical pipes, micropipes, cable pipes, wells, search string. Ducting pipes are also known as ducts.

	Chapter 2.9 Pressing Can also be referred to as auger boring. Presses a steel pipe (casing pipe) from one point to another. The pipe remains in the ground and becomes the outermost ducting, into which ducting pipes are then inserted. This method is only used for short distances.	Pressing Can also be referred to as auger boring. A steel pipe (casing pipe) is pressed from one point to another. The pipe remains in the ground and becomes the outermost ducting, into which ducting pipes are then inserted. This method is only used for short distances.
Appendix 2: Robust networks	Chapter 2.2.1 Ducting pipes	Addition Marking of ducting Marking of ducting will aid traceability of ducting in the network. Traceability is achieved through coloured or numbered ducting pipes so that the pipes can be distinguished in the event they are excavated or damaged, and in the event of optical cables being blown in from outdoor splice cabinets.
	Chapter 2.2.1 Ducting pipes Micropipes Micropipes are thin-walled pipes (sub-ducting or for indoor use) or thick-walled pipes (for direct routing in the ground, water or air), with inner dimensions from approx. 3 mm up to approx. 12 mm. Micropipes are used to blow (in certain cases also to pull) micro-cables or blow fibres.	Revised text Micropipes Micropipes are thin-walled pipes (sub-ducting or for indoor use) or thick-walled pipes (for direct routing in the ground, water or air), with inner dimensions from approx. 3 mm up to approx. 18 mm. 18/12, 16/12 and 7/3.5 mm are common. Micropipes are used to blow (in certain cases also to pull) micro-cables or blow fibres.
	Chapter 2.2.2.2 Outdoor splice cabinets	Addition Minimum requirements regarding outdoor splice cabinets: The cabinet must be of corrosion class C3.
	Chapter 2.2.2.2 Outdoor splice cabinets	Addition For this reason, the following requirements must also be satisfied: In the case of thick-walled micropipes that are bundled through a plastic casing, this must be cut during installation in the outdoor splice cabinet, see image below.

	<p>Chapter 2.3.2 Underground routing</p> <p>Minimum requirements for underground routing:</p> <ul style="list-style-type: none"> In snowy areas or in the case of dense vegetation, outdoor splice cabinets must be supplied with a marker rod to avoid collision damage and to make the cabinets easier to find. 	<p>Revised text/Addition.</p> <p>Minimum requirements for underground routing:</p> <ul style="list-style-type: none"> In snowy areas or in the case of dense vegetation, outdoor splice cabinets must be supplied with a marker rod (white/green) to avoid collision damage and to make the cabinets easier to find. Outdoor splice cabinets must not be labelled.
	<p>2.3.2.2 Positioning of wells and cabinets</p>	<p>Addition</p> <p>Minimum requirements when positioning cable wells:</p> <ul style="list-style-type: none"> Instructions from the supplier must be complied with when positioning cable wells.
	<p>2.3.2.2 Positioning of wells and cabinets</p>	<p>Addition</p> <p>Minimum requirements when positioning outdoor splice cabinets:</p> <ul style="list-style-type: none"> Instructions from the supplier must be complied with when positioning outdoor splice cabinets.
	<p>Chapter 2.3.2.5 Collocation</p> <p>Collocation means that pipes and cables that are owned by several network owners are routed in the same trench. Agreement regarding terms and conditions for collocation is reached between the parties on a case-by-case basis. The requirements regarding collocation must be at least in accordance with "Instructions for Robust Fiber".</p>	<p>Revised text.</p> <p>Collocation means that pipes and cables that are owned by several network owners are routed in the same trench.</p> <p>Agreement regarding terms and conditions for collocation is reached between the parties on a case-by-case basis. The requirements regarding collocation must be at least in accordance with "Instructions for Robust Fiber". It is important to consider different colour markings in the event of collocation.</p>
	<p>Chapter 2.3.3 Minimum backfill height</p> <p>General requirements regarding minimum backfill height:</p> <p>Farmland 55 cm.</p>	<p>Revised text</p> <p>General requirements regarding minimum backfill height:</p> <p>Farmland 70 cm.</p>
	<p>Chapter 2.3.3 Minimum backfill height</p> <p>Supplementary requirements regarding backfill height:</p> <ul style="list-style-type: none"> Where ducting crosses smaller roads, such as farm roads, country roads or forest roads, the backfill height must be at least 70 cm. When pressing through a road or railway embankment, the road operator's and the Swedish Transport Administration's regulations must be followed. <p>At intersections with other lines, optical cables are normally routed above power cables, water and sewage pipes as well as district heating. Additional protection around the ducting may be required.</p>	<p>Revised text</p> <p>Supplementary requirements regarding backfill height:</p> <ul style="list-style-type: none"> Where ducting crosses smaller roads, such as farm roads, country roads or forest roads, the backfill height must be at least 70 cm. When pressing through a road or railway embankment, the road operator's and the Swedish Transport Administration's regulations must be followed. <p>At intersections with other lines, optical cables are normally routed above power cables, water and sewage pipes as well as district heating. Additional protection around the ducting may be required. A risk analysis is recommended to ensure that the correct measures are implemented.</p>
	<p>Chapter 2.3.4.1 Intake of ducting above ground level in property</p> <p>Minimum requirements regarding intake of ducting pipes above ground level:</p> <ul style="list-style-type: none"> For introduction into the property, a hole must be drilled at an incline of at least 10°, with the highest point inside the property. 	<p>Revised text/Addition</p> <p>Minimum requirements regarding intake of ducting pipes above ground level:</p> <ul style="list-style-type: none"> For introduction into the property, a hole must be drilled at an incline of at least 30°, with the highest point inside the property. Ducting pipes must be sealed against the optical cable in the fibre outlet to prevent water leaking in from the pipe. In the case of overhead cables, connections must be made in accordance with the manufacturer's instructions.

	Chapter 2.5.1 The ends of all non-connected cables must be sealed.	The ends of all non-connected cables must be sealed.
	Chapter 2.5.2 In order to position the optical cable correctly in the cable well or outdoor splice cabinet where a loop is to be created, careful preparation and handling are required. The cable's properties are changed if the cable is twisted, and this can easily happen during looping if this is not done correctly. Comply with the cable manufacturers instructions regarding looping. For example, some cable types may need to be looped in the form of a figure of eight. Checking whether the optical cable is twisted can be performed by inspecting that the cable's longitudinal labelling is in the same direction. A cable length of approx. 20 metres is suitable as a loop length.	In order to position the optical cable correctly in the cable well or outdoor splice cabinet where a loop is to be created, careful preparation and handling are required. The cable's properties are changed if the cable is twisted, and this can easily happen during looping if this is not done correctly. Comply with the cable manufacturers instructions regarding looping. For example, some cable types may need to be looped in the form of a figure of eight. Checking whether the optical cable is twisted can be performed by inspecting that the cable's longitudinal labelling is in the same direction. A cable length of approx. 20 metres is suitable as a loop length.
	Chapter 2.5.6 Termination means that the fibres in an optical cable are made accessible via connectors in a connection panel. The connection panel is part of an ODF unit (Optical Distribution Frame), see below.	Termination means that the fibres in an optical cable are made accessible via connectors in a connection panel. The connection panel is part of an ODF unit (Optical Distribution Frame), see below.
	Chapter 2.7 As regards cable wells, there are a great many different types of locks, e.g. lockable inner hatches or specific "opening tools". If a cable well is placed below ground level, i.e. with backfill material above the well cap, no locking device is required. The same applies if the well cap is so heavy that it makes unauthorised access difficult.	As regards cable wells, there are a great many different types of locks, e.g. lockable inner hatches or specific "opening tools". If a cable well is placed below ground level, i.e. with backfill material above the well cap, no locking device is required. The same applies if the well cap is so heavy that it makes unauthorised access difficult.
Appendix 3: Robust routing methods	Chapter 4.8.1	New text: In the case of directional drilling, it is important to measure the location of the actual pipe, not that of the pilot. The position of these can vary quite considerably.
Appendix 4: Robust sites and nodes	2.2.6.1 Lightning protection Minimum requirements for lightning protection: <ul style="list-style-type: none"> The site must be properly earthed, for example with an earthing rod or earthing ring. 	Revised text Minimum requirements for lightning protection: The site must be properly earthed.
	2.2.9.2 Sabotage protection Minimum requirements for sabotage protection: <ul style="list-style-type: none"> Towing and lifting eyelets must be removed from technical shelters or climate cabinets. 	Revised text Minimum requirements for sabotage protection: <ul style="list-style-type: none"> If possible, towing and lifting eyelets must be removed from technical shelters or climate cabinets.
	2.2.10.1 Burglar alarm	Revised text Minimum requirements if a burglar alarm is present: <ul style="list-style-type: none"> Alarms must be wired
	2.2.11 Biological damage Minimum requirements for protection against biological damage: <ul style="list-style-type: none"> Where optical cables or ducting pipes are exposed to pests, such as rodent attacks, they must be supplied with rodent protection. 	Revised text Minimum requirements for protection against biological damage: <ul style="list-style-type: none"> Where optical cables or ducting pipes are exposed to pests, such as rodent attacks, they must be supplied with rodent protection, e.g. by means of additional metal reinforcement or pipes and optical cables treated with repellent.
	Chapter 2.2.12.1 Fire extinguishing equipment Minimum requirements regarding fire extinguishing equipment: <ul style="list-style-type: none"> Personnel who work in the site or node must have access to hand-held CO₂ extinguishers of at least 6 kg. 	Revised text Minimum requirements regarding fire extinguishing equipment: <ul style="list-style-type: none"> Personnel who work in the site or node must have access to hand-held CO₂ extinguishers of at least 6 kg in the premises.

Appendix 5: Documentation	Chapter 2.3.3.5 Measurement report Measurement reports from delivery measurements in the form of attenuation measurements and/or OTDR measurements must be included in the documentation.	Revised text Measurement reports from delivery measurements in the form of attenuation measurements or OTDR measurements must be included in the documentation.
Appendix 6: Inspection	Chapter 2 Inspection An inspector is appointed by the client and must be approved by the contractor. The inspector must not be disqualified. Pre-inspection and final inspection are paid for by the client, while any post-inspection is paid for by the contractor.	Revised text An inspector is appointed by the client. The inspector must not be disqualified. Pre-inspection and final inspection are paid for by the client, while any post-inspection is paid for by the contractor.
	Chapter 2.1 Review with the client prior to implementation If a review with the client is conducted prior to implementation, the minimum requirements are as follows: <ul style="list-style-type: none"> Review of contract documents, e.g. contract agreement, equipment list and timetable, as well as agreements regarding labelling and documentation. 	Revised text If a review with the client is conducted prior to implementation, the minimum requirements are as follows: <ul style="list-style-type: none"> Review of contract documents, e.g. contract agreement, equipment list and timetable, as well as requirements regarding labelling and documentation.
	Chapter 2.3 Visual inspection with land owners prior to implementation Minimum requirements for visual inspection prior to implementation: <ul style="list-style-type: none"> A report must be drawn up setting out the inspected sections. Deviations from normal conditions must be noted. 	Revised text Minimum requirements for visual inspection prior to implementation: <ul style="list-style-type: none"> A report must be drawn up setting out the inspected sections. Faults and deficiencies must be noted.
	Chapter 2.4 Normative inspection If a normative inspection is performed, the minimum requirements are as follows: <ul style="list-style-type: none"> Check that the employed routing method corresponds with the agreement. Review that pipe bedding, number of ducting pipes, cable marking, backfilling and backfill height correspond with the agreement. Check that used equipment corresponds with the agreement. Check that labelling has been carried out in accordance with the agreement. 	Revised text If a normative inspection is performed, the minimum requirements are as follows: <ul style="list-style-type: none"> Check that the employed routing method corresponds with the requirements. Review that pipe bedding, number of ducting pipes, cable marking, backfilling and backfill height satisfy the requirements. Check that the employed equipment satisfies the requirements Check that labelling has been carried out in accordance with the requirements
	Chapter 2.5 Visual inspection after implementation If a visual inspection after implementation is carried out, the minimum requirements are as follows: <ul style="list-style-type: none"> A report must be drawn up setting out the inspected sections. Deviations from normal restoration (e.g. deficiencies in respect of gravel, asphalt, slabs and grass) must be noted. 	Revised text If a visual inspection after implementation is carried out, the minimum requirements are as follows: <ul style="list-style-type: none"> A report must be drawn up setting out the inspected sections. Faults and deficiencies must be noted.

	<p>Chapter 2.6 Final inspection</p> <p>Minimum requirements in respect of final inspection: Review with representatives of the client and the contractor:</p> <ul style="list-style-type: none"> • Check that the selected routing methods correspond with the agreement. • Review of notes regarding deviations in respect of pipe bedding, number of ducting pipes, cable marking, backfilling and backfill height. The inspection plan is supplemented with a check of deviations that are to be rectified. • Review of notes regarding deviations from normal restoration (e.g. deficiencies in respect of gravel, asphalt, slabs and grass). 	<p>Revised text</p> <p>Minimum requirements in respect of final inspection: Review with representatives of the client and the contractor:</p> <ul style="list-style-type: none"> • Check that the selected routing methods correspond with the requirements. • Review of notes regarding deficiencies in respect of pipe bedding, number of ducting pipes, cable marking, backfilling and backfill height. The inspection plan is supplemented with a check of deficiencies that are to be rectified. • Review of notes regarding deficiencies from normal restoration (e.g. deficiencies in respect of gravel, asphalt, slabs and grass).
	<p>The inspection plan is supplemented with a check of deviations that are to be rectified.</p> <ul style="list-style-type: none"> • Check that used equipment corresponds with the agreement. • Check that labelling has been carried out in accordance with the agreement. <p>If a normative inspection and/or visual inspection before/after implementation have not been carried out, the following will be added during the inspection in the field:</p> <ul style="list-style-type: none"> • Check with the contractor that employed routing methods correspond with the agreement. • Review with the contractor that pipe bedding, number of ducting pipes, cable marking, backfilling and backfill height correspond with the agreement. • Checking of deviations from normal restoration (e.g. deficiencies in respect of gravel, asphalt, slabs and grass). • Check that used equipment corresponds with the agreement. • Check that labelling has been carried out in accordance with the agreement. 	<p>The inspection plan is supplemented with a check of faults and deficiencies that are to be rectified.</p> <ul style="list-style-type: none"> • Check that used equipment corresponds with the requirements. • Check that labelling has been carried out in accordance with the requirements. <p>If a normative inspection and/or visual inspection before/after implementation have not been carried out, the following will be added during the inspection in the field:</p> <ul style="list-style-type: none"> • Check with the contractor that employed routing methods correspond with the requirements. • Review with the contractor that pipe bedding, number of ducting pipes, cable marking, backfilling and backfill height correspond with the requirements. • Check of faults and deficiencies from normal restoration (e.g. deficiencies in respect of gravel, asphalt, slabs and grass). • Check that employed equipment corresponds with the requirements • Check that labelling has been carried out in accordance with the requirements.
	<p>Chapter 2.7 Inspection report Approval: Adopting a stance in respect of approval/rejection.</p>	<p>Revised text</p> <p>Approval: Adopting a stance in respect of approval/rejection from both parties with a written signature, digital signature or e-mail signature</p>

Amendments: Amendments of Instructions for Robust Fiber carried out on 10 March 2017

Date 10/03/2017																																				
Document	Previous text			Addition or revised text																																
Appendix 2: Robust networks	Chapter 2.3.3 Minimum backfill height			Generella krav på minsta fyllningshöjd: <table border="1"> <thead> <tr> <th>Yta</th> <th>Fyllningshöjd</th> <th>Metod</th> <th>Information</th> </tr> </thead> <tbody> <tr> <td>Tomtmark intill bostadshus</td> <td>30 cm</td> <td>Alla</td> <td></td> </tr> <tr> <td>Körbana och gång/cykelväg</td> <td>25 cm</td> <td>Mikrotrenching Spårfräsning</td> <td>Ytterligare 10 cm vid ej belagd yta (grusväg).</td> </tr> <tr> <td>Gång/cykelväg</td> <td>30 cm</td> <td>Alla</td> <td></td> </tr> <tr> <td>Körbana</td> <td>45 cm</td> <td>Alla</td> <td></td> </tr> <tr> <td>Orörd mark (ej åkermark)</td> <td>45 cm</td> <td>Alla</td> <td></td> </tr> <tr> <td>Grönnya utanför tomtmark</td> <td>45 cm</td> <td>Alla</td> <td></td> </tr> <tr> <td>Åkermark</td> <td>70 cm</td> <td>Alla</td> <td>Hänsyn måste tas till eventuell dränering.</td> </tr> </tbody> </table>	Yta	Fyllningshöjd	Metod	Information	Tomtmark intill bostadshus	30 cm	Alla		Körbana och gång/cykelväg	25 cm	Mikrotrenching Spårfräsning	Ytterligare 10 cm vid ej belagd yta (grusväg).	Gång/cykelväg	30 cm	Alla		Körbana	45 cm	Alla		Orörd mark (ej åkermark)	45 cm	Alla		Grönnya utanför tomtmark	45 cm	Alla		Åkermark	70 cm	Alla	Hänsyn måste tas till eventuell dränering.
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Amendments: Amendments of Instructions for Robust Fiber carried out on 13 March 2017

Date 13/03/2017		
Document	Previous text	Addition or revised text
Appendix 3: Robust routing methods	Chapter 3.9 Warranties Local regulations for restoration vary between different local authorities, land owners and road operators. Always check applicable local rules and regulations. With certain land owners, the contractor itself can perform the restoration and then provides a warranty. At others, the land owner itself will conduct restoration, and the client will often also have to pay a fee for future maintenance. According to the land AMA, the warranty period is 5 years, which most land owners normally comply with.	Local regulations for restoration vary between different local authorities, land owners and road operators. Always check applicable local rules and regulations. With certain land owners, the contractor itself can perform the restoration and then provides a warranty. At others, the land owner itself will conduct restoration, and the client will often also have to pay a fee for future maintenance. The warranty period is regulated in AB 04 General conditions of contract for building and civil engineering works and building services, Chapter 4 Section 7, as well as ABT 06 General conditions of contract for design and construct contracts for building, civil engineering and installation works, Chapter 4 Section 7. AB 04 states that the Warranty period is 5 years for the contractor's work performance and 2 years for materials and goods. ABT 06 states that the Warranty period is 5 years for the contract. For specific material or specific goods (makes) prescribed by the client, the Warranty period is 2 years.
	Chapter 4.1 Microtrenching and other end milling Minimum requirements in the case of microtrenching: <ul style="list-style-type: none"> Ground-penetrating radar must be used Backfill height in accordance with "Instructions for Robust Fiber" 	Minimum requirements in the case of microtrenching: <ul style="list-style-type: none"> The contractor must define the depth of existing infrastructure, ideally performed using ground-penetrating radar or physical inspection by means of excavation before starting the work. Backfill height in accordance with "Instructions for Robust Fiber" Point 1, point 4.1.1, point 4.2.1 and point 4.2.6 are also supplemented with the text "or physical inspection by means of excavation" after requirement for ground-penetrating radar.

Amendments: Amendments of Instructions for Robust Fiber carried out on 13 March 2017

Date 13/03/2017		
Document	Previous text	Addition or revised text
Appendix 4: Robust sites and nodes	Chapter 2.2.5 Electricity supply The electrical system in sites and nodes must be executed in accordance with applicable laws and electrical safety regulations.	The electrical system in sites and nodes must be executed in accordance with applicable laws and regulations for electrical installations.
	Chapter 2.2.5.1 Electrical system Minimum requirements regarding electrical system: <ul style="list-style-type: none"> • Distribution boards in the site must be adapted for 230/400V as a TN-S system and supplied with residual current devices • Distribution boards must be grouped and fused for each group. • Service outlets must be supplied with RCBOs. Recommendations: <ul style="list-style-type: none"> • At racks, electric outlets must be installed so that they are easily accessible and evenly distributed between three phases. 	Minimum requirements regarding electrical system: <ul style="list-style-type: none"> • 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 must be supplied with RCBOs. Recommendations: <ul style="list-style-type: none"> • At racks, electric outlets must be installed so that they are easily accessible and evenly distributed between three phases. • In larger sites and nodes, the installation must be supplied with residual current devices.