CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project Contract No. CW-I-WP4-2023-05	ROSETTI MARINO
Document Title:	PACKING SHIPPING HANDLING AND STORAGE PROCEDURES - HV CABLE, T-CONNECTORS, CABLE CLEATS AND ACCESSORIES (including CABLE DRUMS SPECIFICATION (DIMENSION, WEIGHT, EXACT CABLE LENGTH)	Sheet 1 of 22 Date: 19/11 2024 Rev: 00

Base Load Power Hub (BLPH)

PACKING SHIPPING HANDLING AND STORAGE PROCEDURES - HV CABLE, T-CONNECTORS, CABLE CLEATS AND ACCESSORIES (including CABLE DRUMS SPECIFICATION (DIMENSION, WEIGHT, EXACT CABLE LENGTH)

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reynard HIGH VOLTAGE SOLUTIONS

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Revision / Change Log

Rev.	Description
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Table of contents

1 INTRODUCTION 6

1.1 PROJECT OVERVIEW 6

1.1.1 Project Location 6

1.1.2 Project Concept 7

2 DOCUMENT SCOPE 9

2.1 REFERENCES 9

2.2 DEFINITIONS AND ABBREVIATIONS 9

APPENDIX A: Storage and Handling Procedure for HV-Cable 10

APPENDIX B: Storage and Handling Procedure for rstf t-cONNECTROS 11

APPENDIX C: Storage and Handling Procedure for Nexans Euromold K480TB/G-21-95.240CU-FLEX+MWS+KIT MT/RS)-MT-AS044 12

APPENDIX D: Storage and Handling Procedure for cABLE cLEATS koz (stc & tri) 13

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List of Figures

Figure 1 HOLLANDSE KUST NOORD WIND PARK Location Map 6
Figure 2 - Wind Park Details 7
Figure 3 – BLPH Concept 8

List of tables

Table 1 - Reference Documents 9
Table 2 - Definitions and Abbreviations 9

List of Attachments

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1 INTRODUCTION

1.1 PROJECT OVERVIEW

Crosswind, a Shell and Eneco joint venture, was awarded the tender to develop the offshore Hollandse Kust Noord (HKN) wind farm, located 18.5km off the coast of Netherlands near the town of Egmond aan Zee. The consortium plans to have HKN operational in 2023 with an installed capacity of 759MW generating at least 3.3TWh per year. This is sufficient renewable power to supply more than 1 million Dutch households with green electricity.

Offshore wind farms produce intermittent electricity and balancing these dips and peaks and integrating this electricity into the national energy system requires new technologies. For this reason, the offshore wind farm will include several new technologies that could be implemented at full-scale in the future. The new technologies being explored include a floating solar park, a short-duration battery storage as well as long-term storage via green hydrogen produced by water electrolysis and subsequently consumed in a fuel cell. The combination of these individual measures, herein referred to as the Base Load Power Hub (BLPH) will ensure a continuous power supply regardless of the wind situation.

1.1.1 Project Location

The Hollandse Kust Noord (HKN) wind farm is located 18.5km off the coast of the Netherlands near the town of Egmond aan Zee.

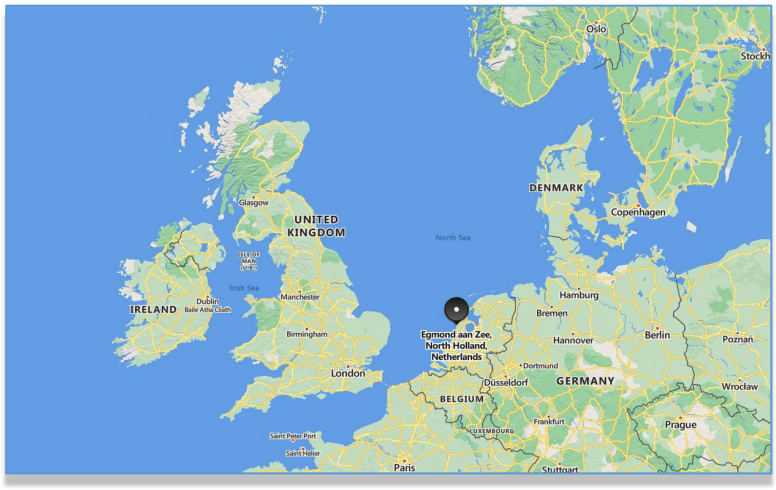


Figure 1 HOLLANDSE KUST NOORD WIND PARK Location Map



Figure 2 - Wind Park Details

The wind farm will consist of No. 69 x 11.5MW wind turbine generators each to be installed on a dedicated monopile structure. A 70th monopile located on coordinates E 590719.1, N 5841602.3 is reserved for installing the platform accommodating the BLPH. The monopile structure was designed and installed by Van Oord Offshore Wind (VooW) and therefore not part of the BLPH scope.

1.1.2 Project Concept

All components included in the BLPH will be integrated onshore on a topsides and installed in an offshore location within the boundaries of the HKN wind farm. At its simplest, the BLPH will store energy during periods of high electricity generation from renewable sources (a wind turbine generator and the floating solar PV farm) and release it during periods of low generation. In practice. It is expected that the energy stored will supplement generation from renewable sources to ensure that at least 1.0MW of power is exported to the electrical grid regardless of wind/solar availability.

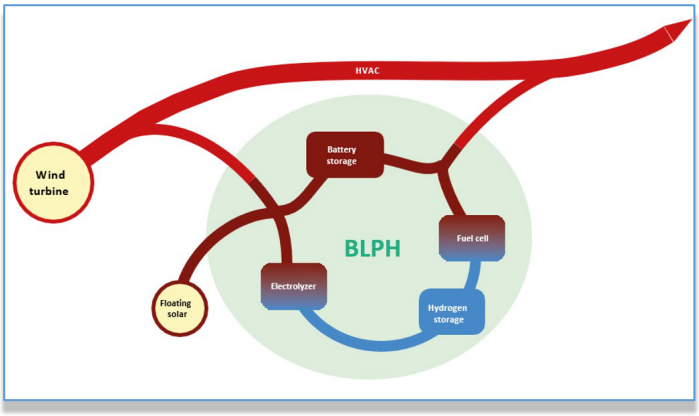


Figure 3 – BLPH Concept

Electricity in the BLPH will be stored in the form of electrons in a battery energy storage system (BESS) as well as converted into green hydrogen via water electrolysis. When the power output from the connecting wind turbine drops to below 1 MWe, the BLPH will return its stored energy to supplement the remaining power output. This will be by discharging the BESS, while stored hydrogen will be converted back into electricity using a fuel cell to extend the discharge duration.

The purpose of the BLPH s to function as a testbed for the integration of energy storage technologies with renewable generation. It is expected that equipment installed on the BLPH will operate as Normally Unmanned Installation for at least two (2) years with no or minimal maintenance and it will have its own independent control room with the ability to communicate with Crosswind's control room.

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2 DOCUMENT SCOPE

Providing the Packing , Handling and Storage information of the, HV-Cable, T-Connectors and Cable Cleats and Accessories that are going to be installed for the HOLLANDSE KUST NOORD WIND PARK Project. The document also references to applied standards and (Employer) requirements.

2.1 REFERENCES

Doc. No.	Description
1724002000-EL-DS-00003	DATA SHEETS - HV CABLE
1724002000-EL-DA-00006	GENERAL ARRANGEMENT AND DIMENSIONAL DRAWINGS - HV CABLE, T-CONNECTORS, CABLE CLEATS AND ACCESSORIES
1724002000-EL-DS-00004	DATA SHEETS - T-CONNECTORS
1724002000-EL-DS-00005	DATA SHEETS - CABLE CLEATS AND ACCESSORIES

Table 1 - Reference Documents

2.2 DEFINITIONS AND ABBREVIATIONS

COMPANY or Client (CPY):	Crosswind
CONTRACTOR (CTR):	ROSETTI MARINO S.p.A.
PROJECT:	HOLLANDSE KUST NOORD WIND PARK Project

Table 2 - Definitions and Abbreviations

APPENDIX A: STORAGE AND HANDLING PROCEDURE FOR HV-CABLE

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BV TWENTSCHE KABELFABRIEK

Recommendation for handling

handling and installation of instrument & power cables

1 Storage and transport

1.1 General

Suitable protection, appropriate to the choice of cable and the installation conditions, should be provided against mechanical damage and solar radiation when other colors than black are used.
Cables stored at temperatures which are below those recommended for installation should not be subject to any mechanical stress including shocks, impact, bending and torsion.

1.2 Sealing and drumming

1.2.1 Clearance

The distance between the outer layer of the cable in the filled drum and the ground or protection lagging should be sufficient to avoid damage to the cable. Further recommendations may be given in particular situations or customer demands.

1.2.2 Barrel diameter

The barrel diameter of delivery drums can differ from the permissible bending radii. This is because of the controlled environment during production. Once the cable is extracted from his original drum, it may only wind up again with respect to the bending radius “during laying” as stated on the particular datasheet of the cable. Even winding up on its original barrel can damages the cable.

1.2.3 Cable sealing

The cable ends should be sealed (after use) to prevent ingress of moisture during transport and storage.

1.2.4 Handling

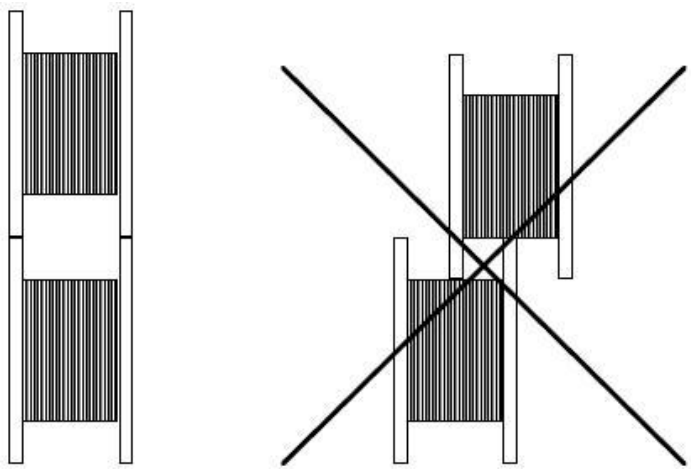
When handling drums, suitable precautions should be taken to avoid damage to the cable and injury to people. Special attention should be paid to the mass of the drum, the method and direction of rolling and the method of lifting.

1.2.5 Drum condition

Cable drums should be regularly inspected during storage to assess their physical condition. Special care should be taken in order to avoid damage to the cables caused by nails and staples, used either in drum manufacturing or when applying battens.

Battens, where applied, should not be removed from drums until the cable is about to be installed.

Special care should be taken in order to avoid deterioration of the drums. The cable drums should be prevented from possible contact of drum flanges to the cable.
Cable drums should be stored with the drum axis horizontal.

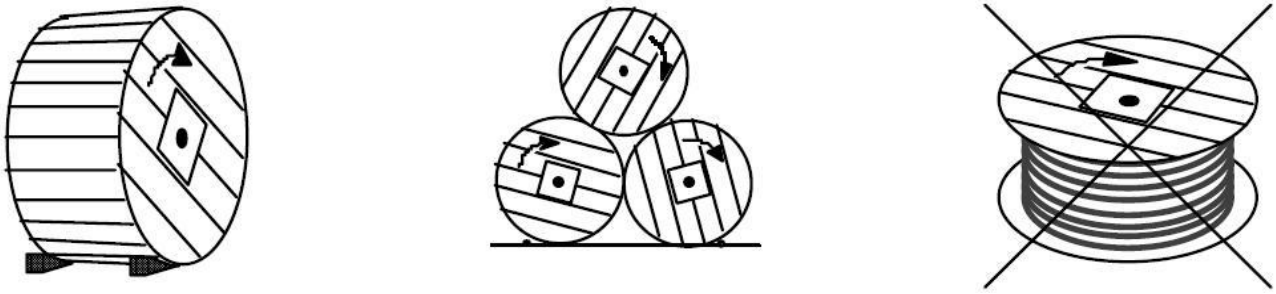


Figuur 1: Storage of drums

2 Transport

2.1 Carriers and Drum axis position

Only suitable carriers should be used. Cable drums should be transported with the drum axis horizontal and any drum movement should be avoided.



Keep the drum standing upright, using wedges in the heels of the flanges

Only drums with protection lagging maybe piled flange on flange. Lower layer to be secured over full drum width

Not recommended

Figure 2: Drum axis position

2.2 Loading and unloading

For loading and unloading of cable drums, suitable lifting and hoisting equipment should be used. A drum should not be dropped.

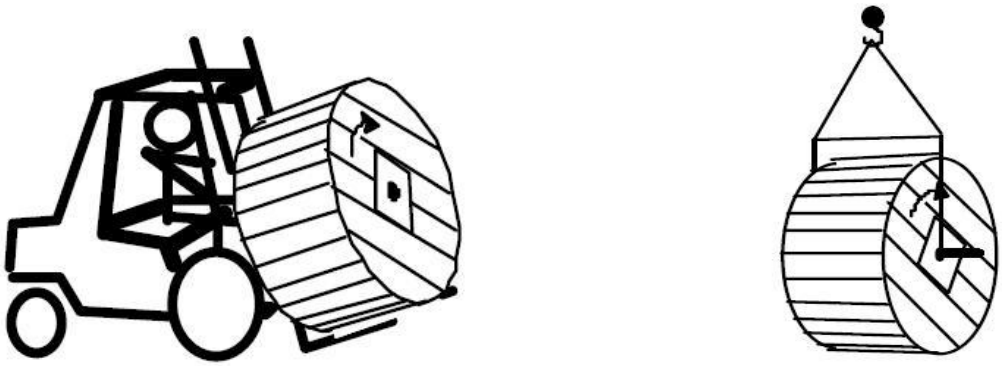


Figure 3: Drums may be lifted either by crane or fork-lift truck

2.3 Rolling of cable drums

Cable drums should be rolled only for short distances over flat solid ground in the direction indicated on the flange.

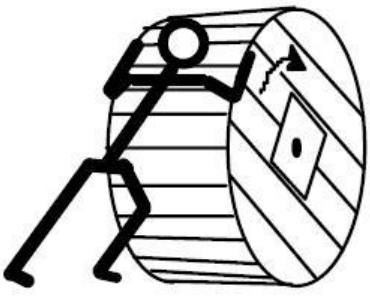


Figure 4: Rolling direction

2.4 Fastening of cable ends to the drum

Cable ends should be firmly attached to the drum during transport and storage.

2.5 Cable coils

Short cable lengths may be coiled, transported and stored horizontally. The coil diameter should not fall below the minimum permissible bending radii for the cable. The values are given on the particular datasheets of the cables. The cable coils should be protected against mechanical stress, shocks and solar radiation.

3 Laying Instruction for low & medium Voltage cables

3.1 Preparations for cable laying:

3.1.1 Set-up of the cable rollers

The cable rollers must be placed at a maximum distance of 4 meters.
The cable rollers must be checked first, (do the rollers turn smoothly).
Special corner rollers with a minimum diameter of the smallest bending radius of the cable must be placed in the bends.
For underpasses, the cable/ tube to be crossed must have been screened.
For cable protection tubes, the cable rollers must be set up in such a way that the cable is entered in the middle of the cable protection tube.
An inlet funnel must be mounted on the inlet of the cable protection tube (possibly made of cable protection band, but then attached so that it cannot slide into the cable protection tube when the cable is pulled through).

3.1.2 Set-up of the cable drum

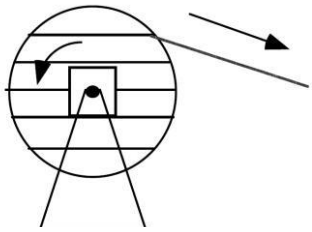


Figure 5: De-coiling

The cable drum must be set up in such a way that the cable is pulled along the top.
The drum must be set up horizontally with a properly fitting axle in a drum carrier.
A proper brake system must be present to prevent the cable reel from slipping when the pulling of the cable is stopped (leading to loose coils around the reel).
The inside end of the cable must be secured but must be able to move out freely.
The cable should, wherever, be de-coiled from the top of the drum. For this the drum must be positioned such that the arrow on the drum points opposite to the direction of rotation for de-coiling.
The drum is lifted on its axle by the aid of winches such that the plank used for braking cannot become wedged beneath.

3.1.3 Pulling winch and Visual inspection

A pulling winch must be used, preferably one which have the possibility to adjust and read off the limitation of tensile force.
The tensile force must be recorded every 100 meters as well as any maximum tensile force that occurs.
Use of a twisted steel pulling rope is also recommended so that a torsional effect is largely prevented during pulling.
During the pulling, the operator of the winch must be in constant touch with the supervisor so that pulling the cable can be stopped immediately at the first sign.
The cable must be inspected in order to be sure there are no external damages. If any damage or suspected signs are visible, always call for advise before de-coiling and laying the cable. It would be recommended to take pictures of the whole drum, the identification card on the drum AND a detailed picture of the suspected point on the cable.

3 .2 Preparations for cable laying

3.2.1 Basket grip / safety wire Visible inspection

The head of the cable can be fitted with a pulling eye.
However, it is usually better to use a basket grip since this allows greater tensile force to be used.
If the pulling winch does not have an adjustable tensile force limiter, then a safety wire must be inserted between the pulling grip and pulling rope.
Basket grips and safety wires are available in all kinds of tensile force classes and must be adjusted to the tensile force permitted.
A swivel must be applied between the pulling grip and pulling rope to make sure than the torsion of the pulling rope is not transferred to the cable.

3.2.2. Preliminary Calculations

A pulling plan must be drawn up for pulling the cable which indicates the presumed tensile force and names the bottlenecks. This makes it possible to determine in advance how many people must at least be present whilst the cable is pulled through.
It must also be indicated whether a pulling head or pulling grip will be used and which type will be used.
The type of safety wire to be applied will also be determined depending on the type of cable.
If the tensile force calculated is higher than the maximum tensile force permitted, alternative a part of the cable length can coiled up in the shape of eights.
This must occur at a suitable location because when laying the cable in eights, the minimum bending radius must be observed.
To reduce the tensile force, a possible solution that can be considered is to fill the (longer) cable protection tubes with water which can considerably reduce the tensile force.

In order to avoid damage to the corrosion protection and the insulation, the cables must not be dragged over sharp objects and must not be bent too sharply (see Table 1).

Table 1: Minimum permissible bending radii (r) when laying cables

XLPE- insulated cables	*(D= Outer diameter of the cable) (d=Conductor diameter)*	
During laying • PE or LSHF jacket • Lead unarmored	***Single-Core*** 12 x (D+d) 15 x (D+d)	***3-Core*** 10 x (D+d) 15 x (D+d)
Installed: • PE or LSHF jacket • Lead unarmored	***Single-Core*** 10 x (D+d) 11 x (D+d)	***3-Core*** 10 x (D+d) 7,5 x (D+d)
For handling of cable the core diameter of the drum shall not be less than 20 times the diameter of the cable. Unwinding and rewinding should be made as shown in Figure 6.		

3.2.1 De-coiling brake

It must be possible to brake the drum at any time in order to avoid continuation of de-coiling in the event of a sudden stop, which would result in sharp bending of the cable. Avoidance of kinking is critical under all circumstances.

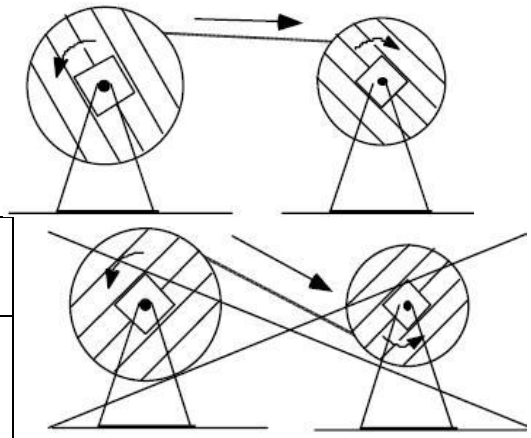


Figure 6: Rewinding for temporary storage

3.2.2 Laying at low temperature

Cables must be heated prior to laying where the cable temperature is below (- 5 C) for polymer insulated cables, otherwise the insulation and corrosion protection can be damaged during bending. These values apply to the cables themselves and not to the ambient temperature, either the drums must be stored for several days in a heated building or heaters or hot air blowers applied at a sufficient distance. During this warming process the drums should be rotated at intervals.

3.3.3 Moisture protection

To avoid ingress of moisture it must be observed that the end capping of the cable is not damaged. Convince that before, during and after laying the end cap fit proper to the cable. Cut points of cables must be immediately capped with a proper end cap size.

4. Cable Laying

4.1 Cable Laying

Communication is very important whilst laying the cables.
Good communication can prevent the cable from being damaged.
That is why it is necessary for at least the following posts to be manned and in touch with the executor whilst the cables are pulled:

- Pulling winch.
- Cable drum (at least 2 people).
- Each cable protection tube inlet.
- In case of distances greater than 100 metres between two observers, 1 additional person.

Whilst the cable is pulled, the inside end of the cable on the drum must constantly be checked and if necessary re-attached.
During the pulling, the inside end will work its way out, letting the cable end hanging loose so that it can become damaged.
The brakeman must also be constantly present.
When the winch stops pulling, the drum will have a tendency to keep turning, leading to loose coils on the drum.
These loose coils must first be removed before the actual pulling can continue.

If the cable has to be laid in eights, this must be done at a suitable location.
Make sure that you start laying properly, otherwise you run the risk of pulling your cable into a “corkscrew”.



Figuur 7: Laying in Eights

After pulling the cable, the cable must be “laid” from the cable rollers into the right position into the trench.
It must be taken into account that sometimes there is insufficient cable length in bends (outside bend) or too much cable (inside bend).
This length will have to be added or removed.

It is very important that the cables lie precisely against each other and in a trifoil over their entire length.

4.1.1 Paying out from a Cable Trailer

Providing there are no obstructions in the trench or its vicinity, cable may be pay off direct from the cable trailer.
However it must be ensured that during the pay off the drum is manually rotated and braked in accordance with the laying speed to avoid high-tensile force or sharp bending of the cable.

4.1.2 Laying by Hand

Cable rollers placed at distances of between 3 to 4m make laying easier. Corner rollers or similar devices should be provided at any bend in the route, always maintaining the minimum bending radii of the cable . If the cable is not guided by rollers it must be guided by hand. The men supporting the cable should be spaced at between 4 to 6 m along the cable.

4.1.3 Laying by Motor Driven Rollers

Motorized rollers are used to pull the cable off the jacked up drum. It is advantageous to use rollers driven by electric motors installed in the cable trench at distances of 20 to 30 m. Where sharp bends occur it may be necessary to place such a roller at both the commencement and the end of the bend.

4.1.4 Pulling off by winches

Pulling off by winch is possible only if there are very few bends or other obstructions in the route. After releasing the cable end from the drum a pulling stocking is placed over the end and tied in position. A rope is secured to the eye of the pulling stocking.
When laying unarmored cables or steel-tape armored cables with the aid of a winch, the rope can be secured to the cable via a pulling head which grips directly on to the conductors.
All cables, in particular single-core cables should not be straightened after laying, but left slightly meandering, to allow for longitudinal expansion and contraction during thermal cycling (changes in current loading).

Table 2: Permissible pulling force (guide values)

Means of pulling	Type of cable	Formula	Conductor type	Factor
With pulling head attached to the conductors	All type of cable	$P=\sigma \cdot A$	Aluminum Class 1 Aluminum Class 2 Copper Class 2	σ = 30 N/mm^2 σ = 20 N/mm^2 σ = 50 N/mm^2
With pulling sleeve	Cable with metal sheath without pull resistant armoring	$P = K \cdot d^2$		K = 3 N/mm^2
laying 3 single-core cable simultaneously with a common pulling sleeve the same max. pulling force applies.				
The pulling force for 3 laid-up single-core cables is 3 times that of a single-core. *The pulling force for 3 non-laid-up single-core cable is 2 time that of a single core.*				

- *P Maximal Pulling force in N*
- *A Total cross sectional area of all conductors (excluding screen or concentric conductor).*
- *d Outside diameter of cable in mm*
- *σ Permissible tensile stress of conductor in N/ mm2*
- *K Empirically derived factor in N/ mm2*

APPENDIX B: STORAGE AND HANDLING PROCEDURE FOR RSTF T-CONNECTROS

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Tel +49 (0)89 6089-0
Fax +49 (0) 89 6089-345

Ottobrunn, 2nd June 2024

STORAGE INSTRUCTION and TRANSPORTATION for RSTF products

Generally, TE Connectivity products should not be exposed to extreme high temperatures, high humidity or damaging media such as sulphurous, acid or basic atmospheres. Unless other specific requirements are documented, TE Connectivity recommends storage conditions in accordance with EN 60721-3-2. In addition, we recommend following guidelines:

- Storage temperature: 0°C to +40°C
- Relative humidity between 10 and 100 % (protect form direct rain)
- Keep components away from dust, heat and direct sun light
- Protect from mechanical forces and shock
- Can be stored in the presence of sea salt fog. Only applicable for salt mist and Ozone

This guideline is not only valid for complete kits but also for the individual components include in each cable accessory kit. In case of a proper storage there should be no effect on the performance of the stress cone and in such case, there is no storage limitation on it.

Additionally, to the storage of the cable accessories TE Connectivity recommends taking following preventions during the transportation of the kits:

- Temperature during transport: 0°C to +40°C if transport is in open air
- Up to 0,1g/m³ of dust is allowed.
- Protect from mechanical forces and shock
- Can be transported in the presence of sea salt fog. Only applicable for salt mist and Ozone.

Yours Faithfully

Andreas Scheiner

Product Manager
HV Cable Accessories

APPENDIX C: STORAGE AND HANDLING PROCEDURE FOR NEXANS EUROMOLD K480TB/G-21-95.240CU-FLEX+MWS+KIT MT/RS)-MT-AS044

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Nexans Network Solutions – Div. Euromold
Zuid III - Industrielaan 12
B 9320 Erembodegem
Belgium

Location : Erembodegem
Date : 05 March 2024

Attn : To whom it may concern

Subject : Storage conditions for Nexans Euromold separable connectors

The connectors and terminations are packed in cardboard boxes.

Storage instructions:

- The box must be stored indoors on a flat dry solid surface, at a room temperature from – 10 °C to 40 °C. Short deviations up to 60 °C are allowed.
- The box can be stored in a rack if this rack is suitable for the boxes.
- The box must be stored away from dust, extreme temperatures, humid conditions which may cause damage and direct sunlight.
- The box must be kept in its original packaging.
- The box must be protected at all times to avoid any mechanical/physical damage.

Philippe Singleton
Technical Manager

APPENDIX D: STORAGE AND HANDLING PROCEDURE FOR CABLE CLEATS KOZ (STC & TRI)

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STORAGE INSTRUCTION and TRANSPORTATION for STC & TRI products

Generally, KOZ products should not be exposed to extreme high temperatures, high humidity or damaging media such as sulphurous, acid or basic atmospheres. Unless other specific requirements are documented, KOZ recommends storage conditions in accordance with EN 60721-3-2. In addition, we recommend following guidelines:

- Storage temperature: 0°C to +40°C
- Relative humidity between 10 and 100 % (protect form direct rain)
- Keep components away from dust, heat and direct sun light
- Protect from mechanical forces and shock
- Can be stored in the presence of sea salt fog. Only applicable for salt mist and Ozone

This guideline is not only valid for complete kits but also for the individual components include in each cable accessory kit. In case of a proper storage there should be no effect on the performance of the stress cone and in such case, there is no storage limitation on it.

Additionally, to the storage of the cable accessories KOZ recommends taking following preventions during the transportation of the kits:

- Temperature during transport: 0°C to +40°C if transport is in open air
- Protect from mechanical forces and shock
- Can be transported in the presence of sea salt fog. Only applicable for salt mist and Ozone.