SIEMENS energy

SpecTRON 8

Installation, Operation Manual

Document No: DOC0075



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Foreword

Thank you for purchasing a Siemens Energy Subsea Connectors SpecTRON 8 product. The information that follows is an overview of the protection, storage, shipment, unpacking, deployment and maintenance instructions for SpecTRON 8 products.

Siemens Subsea Connectors recommend the termination and installation of all equipment only be undertaken by suitably trained and qualified personnel.

Revision Summary

This page records the revision status of the entire document and its authorisation for issue.

Rev	Compiled by	Approved by	Issue Date	Page(s) Affected/Remarks
See TeamCenter revision history for earlier revision history				
17	D. O'Donnell	N.Williamson	14/05/2025	Section 5.2.1 Added new protective cap illustration Section 5.4 added info for lifting test connectors Section 6.12 Updated electrical test section. Section 6.4.2 Added caution point for when one end of the harness is fixed. Section 6.8 Added warning on observing the maximum allowable de-mating force. Section 8.1.1 Added protective cap cleaning instruction. Section 7.2 clarified guidance on fasteners
18	J. Rogers	M. Earnshaw	28/07/2025	Section 5.2 (Unpacking) updated to capture acceptance of scuff marks arising during production.
19	T. Edwards	D O'Donnell	17/12/2025	Section 6.12 (Testing) reference to earth connections on all metalwork when topside testing.
20	C. Taylor	T. Edwards	11/05/2026	Section 5.2 (Unpacking) updated to remove the statement of "Any lifting of a leading-edge is QC inspected and experiences a scratch test prior to dispatch." As this is not actually performed. Addition of images from internal inspection quality document.
21	T. Edwards	C. Taylor	16/07/2026	Rectify revision No. in header

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1 PRODUCT SCOPE

This manual includes information on the following SpecTRON 8 connector types:

- SpecTRON 8 ROV Wet Mate Plug
- SpecTRON 8 ROV Wet Mate Receptacle
- SpecTRON 8 Stab Wet Mate Plug
- SpecTRON 8 Stab Wet Mate Receptacle
- SpecTRON 8 Penetrator
- SpecTRON 8 Dual Penetrator
- SpecTRON 8 Single Feed-through
    - Tree Cap Penetrator and Plug
    - Tubing Hanger Receptacle
- SpecTRON 8 Dual Feed-through
    - Tree Cap Penetrator and Plug
    - Tubing Hanger Receptacle
- SpecTRON 8 ROV Dummy Connectors
- SpecTRON 8 ROV Parking Receptacle

1.1 Product Certification

Standard	Description
IEC/IEEE 61886-1	Subsea equipment – Part 1: Power connectors, penetrators and jumper assemblies with rated voltage from 3 kV (U_{max} = 3,6 kV) to 30 kV (U_{max} = 36 kV)

Note: For further information, see 'ERP for SpecTRON 8 Compliance with IEC/IEEE 61886-1' (Siemens Energy document 10154569) and 'Product Bulletin for SpecTRON IEC 61886-1 Implementation' (Siemens Energy document 10225662).

Table 1 - SpecTRON 8 Product Applicable Standards

1.2 Contact details

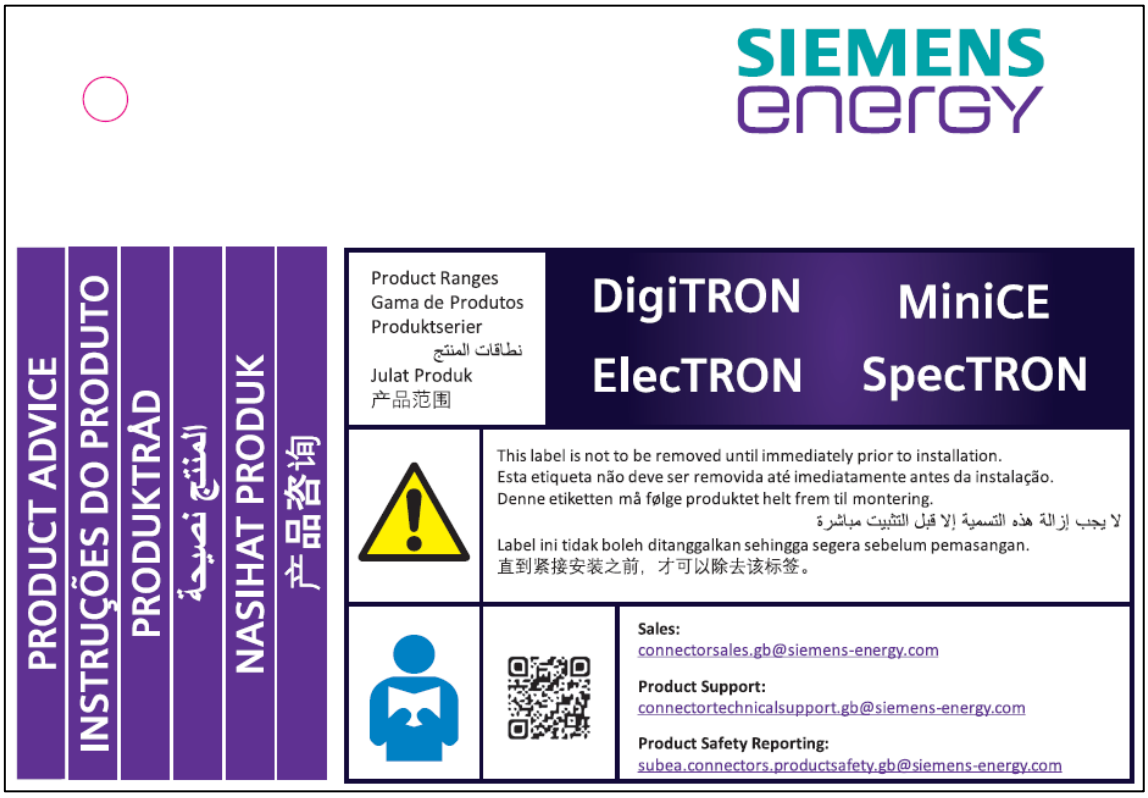
For additional information or questions regards the products visit the Siemens Energy website www.siemens-energy.com/subsea or contact the following:

Department	E-mail address
Product Safety Officer	subsea.connectors.productsafety.gb@siemens-energy.com
Technical Support	connectortechnicalsupport.gb@siemens-energy.com
Service (Site Team)	susultlcmsupport.gb@siemens-energy.com
Sales	connectorsales.gb@siemens-energy.com

Table 2 - Contact Details

1.3 Product advice label

The following product advice label is supplied with all Siemens Energy subsea products.



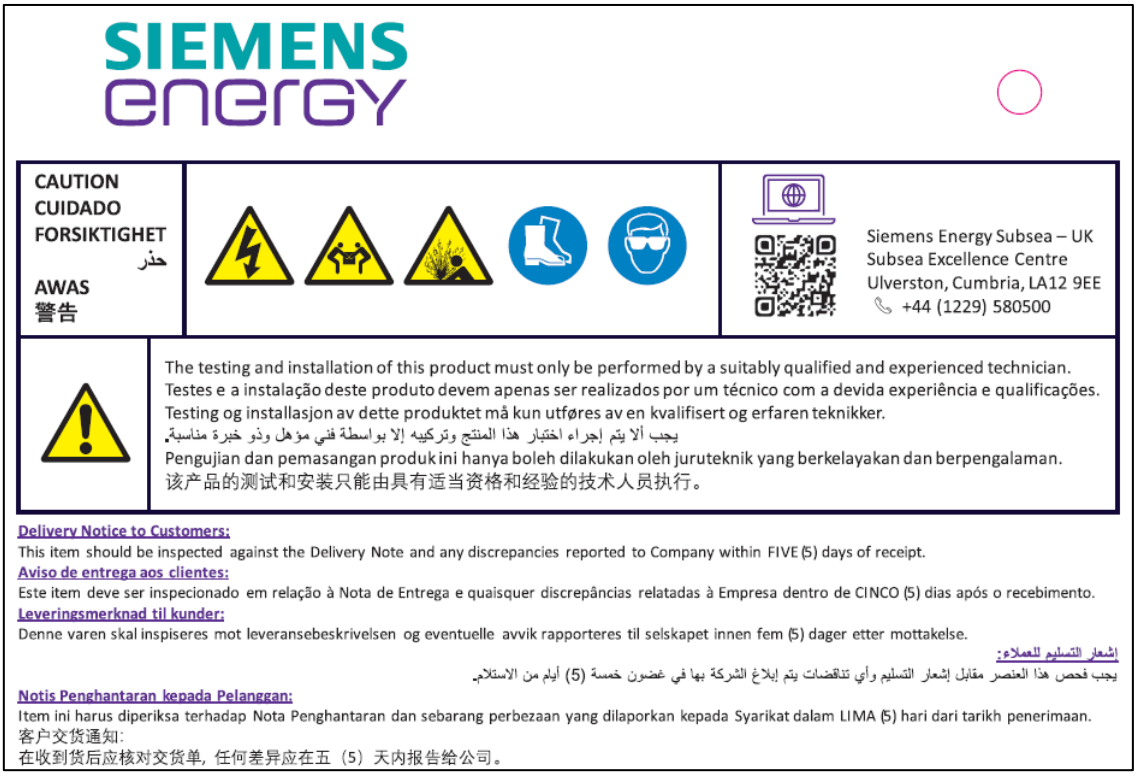


Figure 1 - Product Advice Label

1.4 Product marking

1.4.1 Connectors and Penetrators

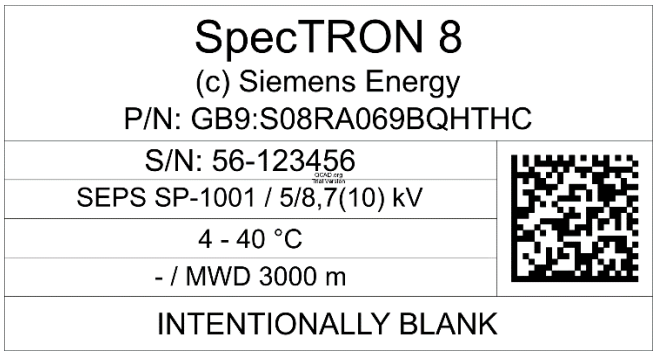


Figure 2 - Example Etching for SpecTRON 8 Products

Siemens Energy Subsea SpecTRON 8 connectors and penetrators are laser marked on the gland body with the Siemens Energy Subsea part number, unique serial number, and product rating information. Additionally, connector front-ends are also marked with their part number and unique serial number to aide traceability during manufacturing.

1.4.2 Harnesses

Harnesses are also marked with the Siemens Energy Subsea part number and unique serial number as shown in Figure 3. Client and project specific information is also usually added to these labels. Labels are typically black text on a yellow background underneath clear heat shrink. Typically, labels are located at each end of the harness and centrally.



Figure 3 - Example harness marking

1.5 CE label/marking

SpecTRON 8 is exempt from any current requirement for CE marking. Siemens Energy continue to monitor European and International requirements for applicability to the SpecTRON 8 product range.

2 PRODUCT SAFETY

Siemens Energy Subsea recommends the termination of all equipment shall only be undertaken by trained, suitably qualified and experienced personnel (SQEP) i.e. competent person.

2.1 Action-related warnings

Classification of action-related warnings

The action related warnings are classified in accordance with the severity of the possible danger using the following warning signs and signal words:

Warning symbols and signal words



Danger!

Imminent danger to life or risk of severe personal injury



Danger!

Risk of death from electric shock



Warning.

Risk of minor personal injury



Caution.

Risk of material or environmental damage

2.2 Intended use

Following installation, commissioning, and deployment of product, please complete and return the Customer Comments/Feedback form (Section 9). Please e-mail completed form to the Product Safety Officer at subsea.connectors.productsafety.gb@siemens-energy.com.

There is a risk of injury or death to the user or others, or of damage to the product and other property in the event of improper use or use for which it is not intended.

The product is intended as a subsea high voltage electrical connector, for use by suitably trained personnel in industrial applications only.

Intended use includes the following:

- observance of the installation and operating instructions included for the product and any other system components.
- compliance with all inspection and maintenance conditions listed in the instructions.
- Use of all recommended tooling appropriate for specific tasks.
- All activities to be undertaken by a competent person (see 2.3.1 for definition).

Any other use that is not specified in this document or covered in installation and operating instructions, or beyond that specified in this document shall be considered improper use.

2.3 General safety information

2.3.1 Installation by competent persons only

The installation, inspection, maintenance and repair of the product shall be undertaken by trained, suitably qualified and experienced personnel (SQEP) i.e. competent person, to carry out a specified activity. Installation, inspection, maintenance and repair of products by untrained and deemed non-competent persons could invalidate the product warranty.

For further information contact Service (Site Team) susultlcmsupport.gb@siemens-energy.com.

2.3.2 Danger caused by improper operation and foreseeable misuse

Improper operation and foreseeable misuse may present a danger to you and others and cause material damage. Carefully read the enclosed instructions and all other applicable documents, particularly the "Safety" section and the warnings.



Danger! Risk of death from electric shock if user dismantles/incorrectly re-assembles/incorrectly re-terminates product (foreseeable misuse).

- Maintenance, disassembly, re-assembly and termination activities must only be carried out by a competent person.



Danger! Risk of death from electric shock if shuttle pins are depressed e.g. with a screwdriver when plug is live.

- Maintenance and testing activities must only be carried out by a competent person.
- Correct tools must always be used.



Danger! Risk of imminent danger to life, risk of severe personal injury caused by a shuttle pin projectile due to damage caused to shuttle pins e.g. with a screwdriver (foreseeable misuse).

- Maintenance and testing activities must only be carried out by a competent person.
- Correct tools must always be used.

2.3.3 Risk of death due to electrocution



Danger! Risk of death from electric shock due to exposed live pins, e.g. factory or top-side system test and unmated receptacle is energised, e.g. by diver subsea.

- Ensure all test procedures are followed.
- Receptacles must be mated to a wet mate or test plug before energisation
- Communication channels and protocols are observed.



Danger! Risk of death from electric shock from any exposed conductors due to stored electrical energy, e.g. capacitance of cable or elsewhere in the system.

- Ensure all procedures are followed.
- Allow sufficient time for discharging of items after testing



Danger! Risk of death from electric shock from test connectors. Live parts can be exposed by disassembly without a tool (e.g. termination sleeves are accessible and can be removed). Also exposed cable conductors at free end of test connectors, and unscreened cables in some terminations.

- Ensure all test procedures are followed.
- Receptacles must be mated to a wet mate or test plug before energisation
- Communication channels and protocols must be observed.



Danger! Risk of death from electric shock if product is terminated incorrectly by 3rd party e.g. loose conductor touching metal body, or live wire terminated to metal body in error.

- Installation/termination activities must be carried out by a competent person



Danger! Risk of death from electric shock due to metal body of connector not being earthed during test and connector having earth fault (e.g. conductor touching metalwork) during electrical testing.

- Ensure all testing of products both factory and deployed in-field have been completed by competent persons.



Danger! Risk of death from electric shock or severe personal injury through burning from de-mating live conductors by hand.

- Ensure all procedures are followed for mating/de-mating connectors.

2.3.4 Risk of injury and material damage due to maintenance and repairs carried out incorrectly or not at all

Maintenance work or repairs on the products should only be carried out by a competent person. Faults and damage should be immediately rectified by a competent person. Adhere to the maintenance intervals specified.



Danger! Risk of imminent danger to life, risk of severe personal injury from burning and material damage from ohmic heating in short-circuit condition or high over-currents.

- Ensure all testing of products both factory and deployed in-field have been completed by competent persons.



Danger! Risk of imminent danger to life, risk of severe personal injury caused by released pressure and or projectile due to incorrectly installed pressure retaining product, e.g. during system pressure test (e.g. SpecTRON 8 penetrator fitted with wrong/insufficient screws or seals).

- Ensure all product assembly and testing activities are completed by competent persons.



Danger! Risk of imminent danger to life, risk of severe personal injury to persons with pacemakers or implantable cardioverter-defibrillators (ICDS) from electromagnetic interference (EMI) e.g. high frequency testing with large load currents.

- Ensure all testing of products both factory and topside are not conducted by or in the presence of persons with pacemakers or ICDS.



Danger! Risk of severe personal eye injury due to pressurised oil squirting out of damaged hose or removal of fill/vent screw.

Ensure all testing of products both factory and deployed in-field have been completed by competent persons.



Warning. Risk of eye/bodily injury caused by released pressure during product disassembly, in the event of retrieval from subsea with a fault that causes depth pressure to be trapped inside the product.

- Ensure all product disassembly activities are completed by competent persons in accordance with relevant procedures and using relevant personal protective equipment (PPE).



Warning. Risk of bodily injury caused by pressure retaining parts becoming projectile due to user over-pressurising the system, e.g. during Site Installation Test (SIT).

- Ensure all product SIT activities are completed by competent persons in accordance with relevant procedures.
- All pressure testing of SpecTRON 8 products must be undertaken by a competent person.
- Installation of SpecTRON 8 penetrators, and bulkhead connectors must be undertaken by a competent person.

2.3.5 Risk of injury and material damage due to manual handling

Manual handling, lifting and carrying are known to be one of the largest contributors to occupational ill-health. Ensure mechanical handling aids are used wherever possible to avoid manual handling. Where manual handling is considered appropriate for the task, safe lifting guidelines must be followed, e.g. adopt correct posture, consider team lifting, employ safe lifting technique, etc. Only competent persons are permitted to perform tasks without supervision, if in doubt, ask.



Warning. Risk of musculoskeletal injury from hand-mating connectors with high mate/de-mate force and/or connector rapidly fires out during de-mate due to high shuttle spring force, e.g. factory/topside testing.

- Ensure all product testing activities are completed by competent persons in accordance with relevant procedures.
- Ensure mechanical handling aids are used wherever possible to avoid manual handling.
- Where manual handling is considered appropriate for the task, safe lifting guidelines must be followed, e.g. adopt correct posture, consider team lifting, employ safe lifting technique, etc.



Warning. Risk of musculoskeletal injury from manual handling of heavy products.

- Ensure mechanical handling aids are used wherever possible to avoid manual handling.
- Where manual handling is considered appropriate for the task, safe lifting guidelines must be followed, e.g. adopt correct posture, consider team lifting, employ safe lifting technique, etc.
- Only competent persons are permitted to perform tasks without supervision, if in doubt ask.



Warning. Risk of bodily injury from heavy product falling during lift with machinery.

- Ensure machinery/slings used have been tested and are within their expiry date.
- Safe lifting guidelines must be followed, e.g. lifting plan, banksman, etc.
- Correct lifting points must be identified and used.
- Only competent persons are permitted to perform tasks without supervision, if in doubt ask.



Warning. Risk of minor personal injury to persons with sensitivities to mineral, silicone or synthetic ester based oils.

- Wear appropriate hand protection when handling products, mineral, silicone or synthetic ester based oils.



Warning. Risk of minor personal injury and material damage due to slips, trips and falls.

- Good housekeeping avoids slips, trips and falls, keep all work areas clean and tidy.

2.4 Related documents

Installers shall perform a full site risk assessment and put into place all necessary steps and procedures to comply with applicable area, regional, national and international health and safety legislation, e.g. The Health and Safety at Work Act (HASAWA) in the United Kingdom (UK) and ensure safety of themselves and others regarding manual handling and working at height requirements.

During the product installation (and any subsequent work) it will be necessary to employ caution. All installers and operatives involved from unloading the product until it is deployed in its final installed location must exercise a full duty of care for themselves and others regarding safety. When lifting and handling this product, operatives should employ assistance if required. In certain situations, it may be necessary to use mechanical handling aids. Take care to avoid trip hazards, slippery or wet surfaces.

Employers and installers should refer to the Health and Safety Executive (HSE) web site in the UK for full advice and manual handling assessment charts (MAC) tool.

In addition, where no specific instructions are given then reference shall be made, but not restricted to, where applicable, British Standards and codes of practice such as the following:

- The Health and Safety at Work Act.
- COSHH Control of substances hazardous to health.
- BS 7671 Requirements for electrical installations. IEE Wiring Regulations.
- The Electricity at Work Regulations.

It is the operator's and installers responsibility to comply with current Company, area, regional, national and international health and safety legislation.

Following installation, commissioning and deployment of product, please complete and return the Customer Comments/Feedback form (Section 9). Please e-mail completed form to the Product Safety Officer at subsea.connectors.productsafety.gb@siemens-energy.com.

3 ABBREVIATIONS

A	Ampere
ac	Alternating Current
Assy	Assembly
API	American Petroleum Institute
AWG	American Wire Gauge
BOM	Bill of Material
°C	Degree Celsius
CE	Community European
Comms	Communication Signal
COSHH	Control of substances hazardous to health
CP	Cathodic Protection
dc	Direct Current
DWG	Drawing
EFL	Electrical Flying Leads
EMF	Electrical Magnetic Field
EMI	Electromagnetic Interference
FAT	Factory Acceptance Test
IR	Insulation Resistance
ICDS	Implantable Cardioverter-Defibrillators
ISO	International Organization for Standardization
ITP	Inspection Test Plan
IWIS	Intelligent Well Interface Standardisation
K	Kelvin
LTC	Long Term Cover
M	Metres
Max.	Maximum
MFG	Manufacturer
Min.	Minimum
NACE	National Association of Corrosion Engineers
No.	Number
PPE	Personal Protective Equipment
ROV	Remotely Operated Vehicle
SI	Standard International
SIT	Site Installation Test

SRT	Site Received Test
SST	Stainless Steel
TBD	To Be Defined
TSP	Twisted Screened Pair
UNS	Unified Numbering System for Metals and Alloys
V	Volt

4 SPECIFICATION AND RESIDUAL HAZARDS

The following is the typical specification for SpecTRON 8 connectors with jumper cables offered by Siemens Energy and will differ for connectors terminated to umbilical power cores or internal pigtails, and in other situations. For connector specific information, please refer to product specific data sheets. These are available via the Siemens Subsea website www.siemens-energy.com/subsea or Siemens Subsea Connectors Technical Support connectortechnicalsupport.gb@siemens-energy.com.

4.1 Connector General Specification

	Value	Unit
Design Life	30	years
Number of ways / phases	3	-
Maximum Water Depth	3 000	m
Maximum Differential Pressure (Penetrator)	345	bar
Maximum Differential Pressure (Bulkhead Receptacle)	15	bar
Operating Temperature	-5 to 20	°C
Storage Temperature	-30 to 60	°C
Number of Mates (Wet Mate Pair)	100	-
Rated Voltage	5/8,7(10)	kV
Rated Current	See Graph	-
Rated Frequency	5 – 200	Hz

Table 3 - SpecTRON 8 Connectors General Specification

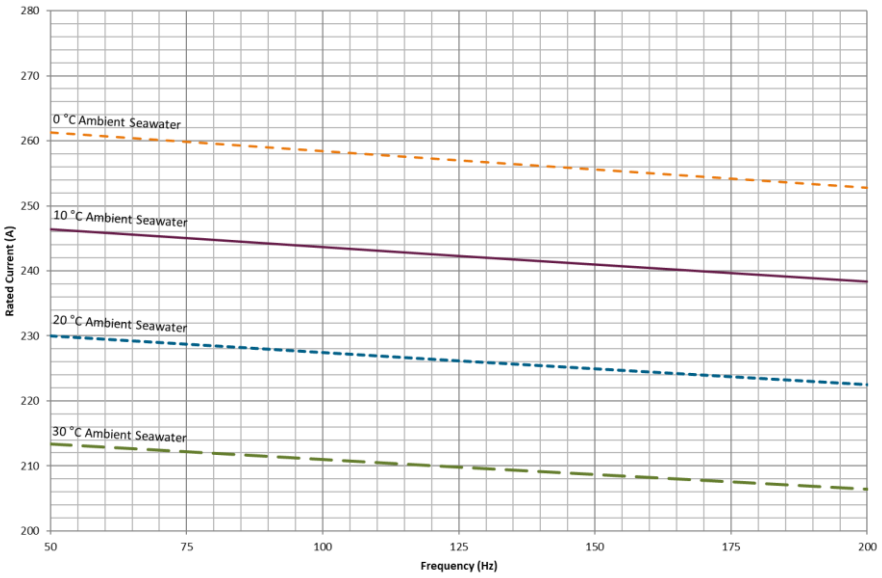


Figure 4 - SpecTRON 8 Current Rating

4.2 Misalignment capability of wet mate stab connectors

The table below summarises the maximum misalignment capabilities of the SpecTRON 8 stab wet mate connectors. For full details, refer to Siemens Energy drawings T33259. For misalignment capabilities of ROV wet mate connectors, tree-cap plugs and tubing hanger connectors, please refer to datasheets provided by Siemens Energy Subsea Connectors Technical Support connectortechnicalsupport.gb@siemens-energy.com.

	Stab Mate	Unit
Maximum Angular Misalignment (No radial or rotational)	2	°
Maximum Radial Misalignment (No angular or rotational)	3	mm
Maximum Rotational Misalignment (No radial or angular)	3	°
Under/Overstroke (Independent of other misalignments)	± 1,5	mm

Table 4 - SpecTRON 8 Stab Connector Misalignment Capability

4.3 Hose Specifications

	AquaTRON 200	Gorilla	AquaTRON 50	Unit
Outside Diameter	64,6 +4 / -2,8	51,8	25,2 ± 0,6 mm	mm
Minimum Bend Radius	375	250	125	mm
Storage Temperature Range	-40 to + 70	-25 to + 70	-40 to + 70	°C
Min.Manipulation Temperature	-25	-25	-25	°C
Maximum Snag Load	5	2,5	5	kN
Weight in air	4,8	3,2	0,66	kg/m
Weight in water	1,45	1	0,14	kg/m
Max Length without coupler	45	N/A	80	m
Hose Coupler Weight in air	3,8	N/A	0,87	kg
Hose Coupler Weight in water	3,2	N/A	0,69	kg

Table 5 - SpecTRON 8 Hose Specifications

4.4 Cable Specifications

	4 mm² (Signal Return)	16 mm² (Siwokul)	16 mm² (S1U10510150)	Unit
Rated Voltage (U_o/U(U_m))	0[1]	3,6/6(7,2)	3,6/6(7,2)	kV_{ac}
Maximum AC Test Voltage to Ground	0[1]	9	9	kV_{ac}
Maximum DC Test Voltage to Ground	0[1]	5	5	kV_{dc}
Outside Diameter	8,95 ± 0,2	11,25 ± 0,3	10,9 ± 0.4	mm
Screen CSA	N/A	N/A	N/A	mm²
Minimum Bend Radius	55	61,8	75	mm
Storage Temperature Range	-40 to + 70	-40 to + 70	-40 to + 70	°C
Minimum Manipulation Temperature	-25	-25	-25	°C
Weight in air	0,11	0,23	0,29	kg/m
Weight in water	0,04	0,13	0,20	kg/m
Resistance @ 20 °C	13	1,24	1,24	mΩ/m

[1] Cable is insulated with U_o = 6,6 kV, but is directly connected to connector metal bodies

Table 6 - SpecTRON 8 Cable Specifications (4 – 16 mm sq.)

	35 mm² (Sp. Siwokul)	35 mm² (S1U10510151)	35 mm² (Feltoflex)	Unit
Rated Voltage (U_o/U(U_m))	5/8,7(10)	5/8,7(10)	5/8,7(10)	kV_{ac}
Maximum AC Test Voltage to Ground	12,5	12,5	12,5	kV_{ac}
Maximum DC Test Voltage to Ground	5	5	5	kV_{dc}
Outside Diameter	18,10 ± 0,4	16,0 ± 0,2	24,5	mm
Screen CSA	N/A	N/A	16	mm²
Minimum Bend Radius	110	110	125	mm
Storage Temperature Range	-40 to + 70	-40 to + 70	-40 to + 70	°C
Minimum Manipulation Temperature	-25	-25	-25	°C
Weight in air	0,55	0,63	1,04	kg/m
Weight in water	0,29	0,43	0,56	kg/m
Resistance @ 20 °C	0,565	0,565	0,565	mΩ/m

Table 7 - SpecTRON 8 Cable Specifications (35 mm sq.)

4.5 Other specifications

For all other specifications not included in the above tables, refer to product/project specific data sheet(s), alternatively contact Technical Support connectortechnicalsupport.gb@Siemens-energy.com.

4.6 Environmental, disposal and recycling

Safe disposal or recycling of waste packaging and/or end of life product is recommended by correctly, observing and complying with area, regional, national or international environmental legislation where applicable.

To return waste packaging and/or end of life product to the manufacturer, contact the Product Safety Officer at subsea.connectors.productsafety.gb@siemens-energy.com.

Hazardous substances, Control of substances hazardous to health (COSHH) Assessments regards to materials such as elastomers and oils, etc. used in SpecTRON 8 products are available on request from the Product Safety Officer at subsea.connectors.productsafety.gb@siemens-energy.com.

4.7 Personal protective equipment (PPE)

Personal Protective Equipment (PPE) is legally defined as 'all equipment (including clothing affording protection against the weather) which is intended to be worn or held by a person at work and which protects the user against one or more risks to their health or safety'.

In the hierarchy of risk control, PPE is considered to rank lowest and represent the option of last resort. PPE is only appropriate where the hazard in question cannot be totally removed or controlled in such a way that harm is unlikely (for example by isolating the hazard or reducing the risk at source to an acceptable level).

All company personnel and operators should wear appropriate Personal Protective Equipment (PPE) defined as a result of relevant risk assessments in accordance with the Personal Protective Equipment (PPE) Regulations.



Warning. Risk of minor personal injury to persons with sensitivities to mineral and silicone based oils.

- Wear appropriate hand protection when handling products, mineral, silicone, or synthetic ester based oils.

5 PREPARING PRODUCT FOR USE

5.1 Safety precautions before installation

SpecTRON 8 products are manufactured primarily from Super Duplex stainless steel and are designed to withstand harsh saliferous environments. However, the connector inserts, and exposed parts are susceptible to mechanical damage if not protected.

Caution. Risk of material damage.

- Dust/protective caps must always be fitted during transport.
- It is recommended that caps remain in place until immediately prior to testing activities or deployment subsea.

The connectors can be shipped singularly or in multiples. Care should be taken to protect the connector with bubble wrap or similar wrapping materials to avoid surface damage during transit. If large numbers are shipped in one consignment a suitably reinforced box will be necessary to withstand the weight. Protection caps must be fitted at all times during transport.

Bulkhead type connectors with exposed tailing wires should be packed and shipped in a suitably sized packing crate to allow adequate space for the tailing wires without bending or kinking.

If the connectors are assembled onto hoses these must be suitably coiled and secured with tape to prevent uncoiling during transit. The minimum bend radii specified in section 4.3 must be maintained during the storage and transportation of jumpers.



Figure 5 - SpecTRON 8 harness typical packaging

Figure 5 shows how a typical SpecTRON 8 harness is packaged. The connectors on either end of the harness have a transportation cap fitted and are surrounded in bubble wrap. The base of the shipping crate is lined with protective packaging and the harness is positioned so that the hose can be coiled without kinking. Any loose items are placed in a box inside the crate. Protective packaging is then

placed on top of the harness and secured in place with a wooden baton, before the lid of the crate is screwed down.

Figure 6 shows a different type of optionally purchased packaging the harness could be supplied in. This crate is manufactured from polyethylene plastic and is dust, oil, chemical and water resistant. The connectors on either end will have a transportation cap and will sit within a foam insert which will be sized to the connector. Any loose items will be placed in a box inside the crate.



Figure 6 - Optional polyethylene plastic packaging

5.2 Unpacking

Connectors are designed to withstand vibration that occurs during transportation and to withstand being dropped from a height of 1m whilst in packaging. Despite this, damage may still occur during transportation, and it is important to document any obvious signs of mishandling or damage which may have occurred in transit.

Remove wrapping material taking care to inspect for any surface damage or items that may have become separated from a connector, such as 'O' seals.

Caution. Risk of material damage.

- Do not use a knife to cut the wrapping material, as this may cause damage to any elastomeric parts of the connector.
- Do not remove dust/protection caps until connectors are ready for installation.
- On removal do not allow the hoses to drag over the edges of a transport box.

CP can increase calcareous growth, which may bind connectors, Siemens Energy applied a low-friction coating to combat this. PTFE coating has been shown to reduce demate forces on connectors affected by calcareous growth. Occasionally, during testing and handling, these surfaces can experience scuffing, but this will not impact connector functionality.

Figure 7 shows typical wear that has occurred on the mating interfaces during production, any loss of coating (not to bare metal) is accepted as there is no expected loss of function as a result.



Figure 7 – Scuffing examples

5.2.1 Protective caps

All SpecTRON 8 Connectors/Penetrators come supplied with a protective cap. These can either be dust caps or protective caps. Dust caps (typically yellow in colour) can be simply removed by twisting or pulling them off. Protective caps (typically black in colour) can be removed as detailed below.

ROV Plug Cap

The ROV Plug cap is latched onto the Plug connector via the connector latching mechanism. In order to remove the cap, it is recommended that the operator stand the Plug vertically on the cap, stand on the flange of the cap and pull on the ROV handle of the Plug connector. This will disengage the latching mechanism of the Plug. Do not try to pull the cap directly off the plug as this may damage the latching mechanism of the Plug. Use the same method when engaging and disengaging the ROV plug cap on the Plug connectors with the locking mechanism.

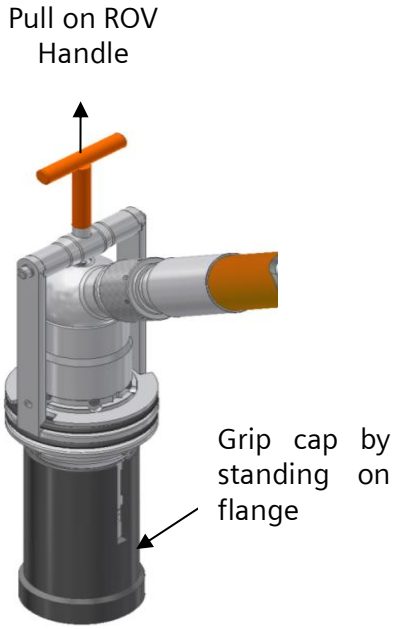


Figure 8 - ROV Plug Cap

Refitting the Plug cap can be done by simply pushing the cap back onto the nose of the plug until the latching mechanism of the plug engages.

ROV Receptacle Cap

The ROV Receptacle Cap can be removed by firmly pulling on the cap. Refitting the Receptacle cap can be done by simply pushing the cap back into the Receptacle shroud until cap ball bearings slot into place. If the protective cap is removed in a high humidity environment the silica sachet inside will need to be replaced, see section 8.1 for details.



Figure 9 – ROV Receptacle Cap

TREE CAP PENETRATOR CAP – Version 1

Penetrator caps would usually be removed by Siemens Subsea site engineers during the termination of the Penetrator to the module. It is recommended that only trained personnel remove Penetrator caps though details are provided here for information only. The Tree Cap Penetrator version 1 consists of modular parts to protect the entire length of the connector. Carefully position the Plug & Penetrator on a suitable bench and remove the protective cap taking care not to bend the compliant gland between plug and penetrator.

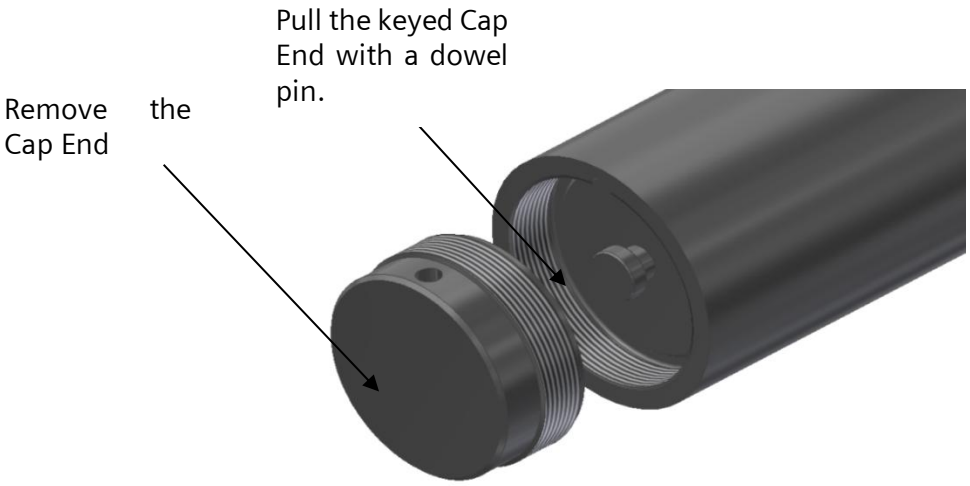


Figure 10 - Tree Cap Penetrator / Plug Removal of Keyed Cap

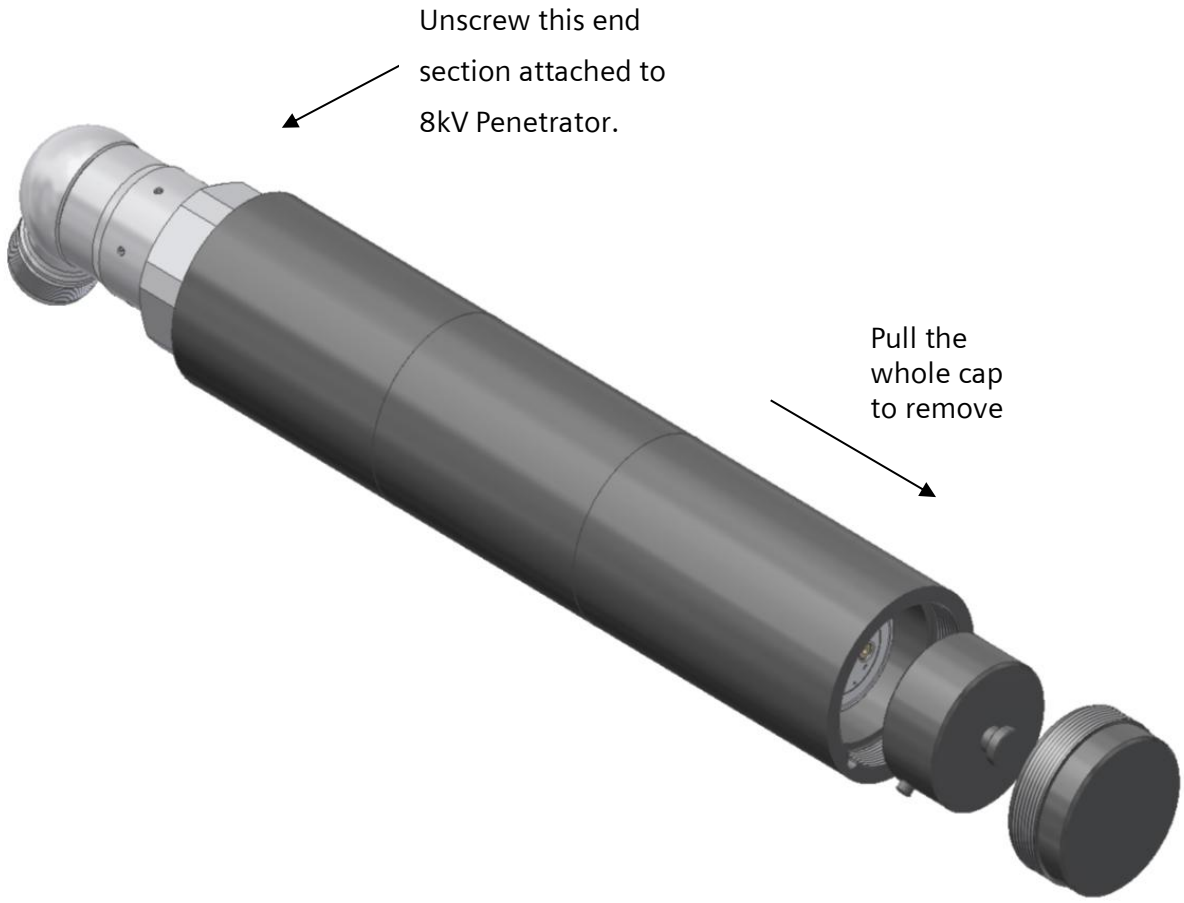


Figure 11 - Tree Cap Penetrator / Plug Protective Cap Removal

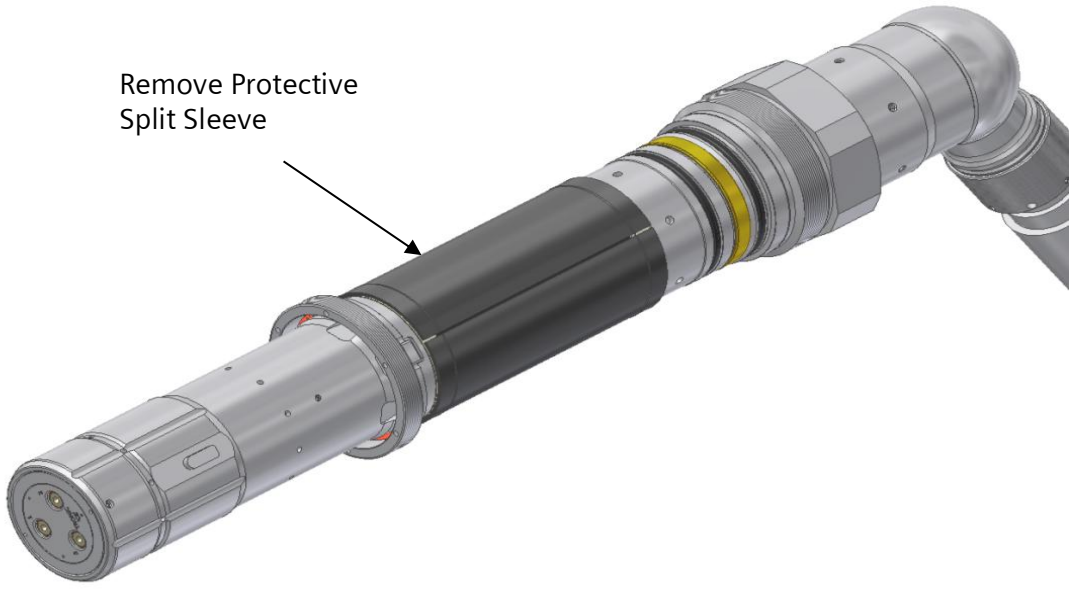


Figure 12 - Tree Cap Penetrator / Plug Split Sleeve Removal

Refitting the Penetrator cap is a reversal of the removal procedure.

Tree Cap Penetrator – Version 2

Penetrator caps would usually be removed by Siemens Subsea site engineers during the termination of the Penetrator to the module. It is recommended that only trained personnel remove Penetrator caps though details are provided here for information only. The Tree Cap Penetrator version 2 consists of split halves to protect the compliant gland. Carefully position the Plug & Penetrator on a suitable bench and remove the protective cap taking care not to bend the compliant gland between plug and penetrator.

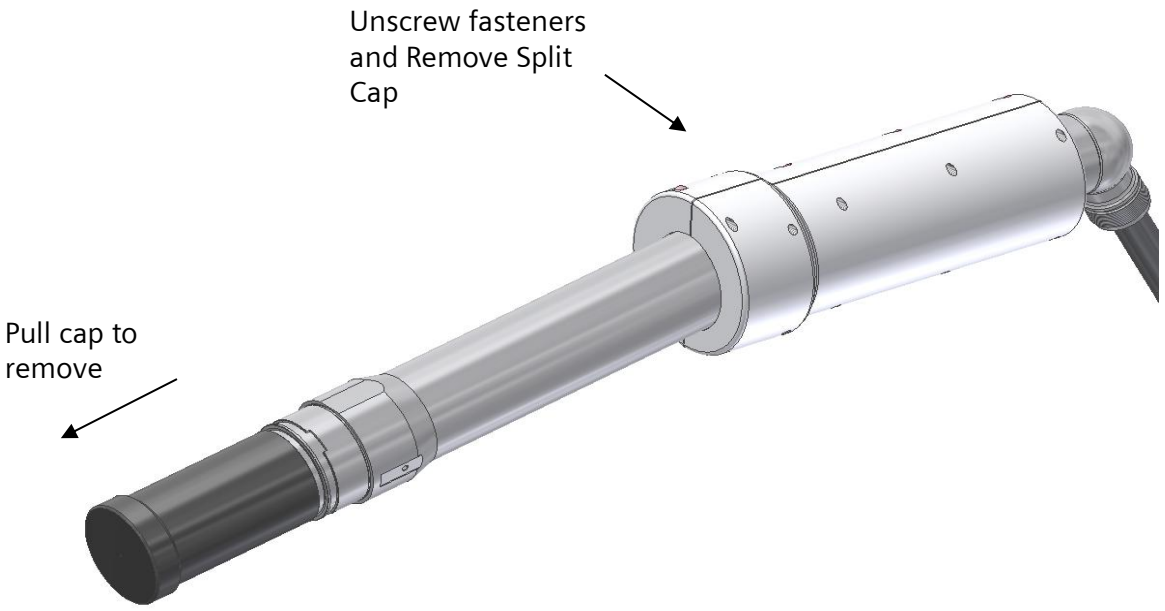


Figure 13 - ROV Receptacle - Penetrator - Tree Cap Plug Jumper

5.3 Safe disposal of packaging

Dispose of the packaging correctly, observing and complying with area, regional, national or international environmental legislation. Where possible recycle responsibly.

To return waste packaging to the manufacturer, contact the Product Safety Officer at subsea.connectors.productsafety.gb@siemens-energy.com.

5.4 Lifting

Danger! Risk of serious personal injury or death, and material damage to product

- Connectors must only be lifted at the locations specified below.
- Never use the cable or hose to lift or support a connector gland.
- All lifting operations should be performed by suitably qualified personnel, in accordance with applicable regulations where and when the lift is performed.
- Connectors should never be lifted by the hose or cable, as this places unnecessary strain on the cable clamp and connector internals.
- Harnesses weigh more than 30 kg and should not be manually handled.
- Dummy, or parking connectors weigh less than 20 kg and can be lifted by hand, however correct lifting practice must always be observed

The connectors can be safely slung around the locations shown in, Figure 14 , Figure 15, Figure 16 and Figure 17. The centre of gravity for the Connector or Penetrator is usually marked on the outline drawing (supplied in documentation pack) but must be verified at low level before commencing any lift.

For particularly heavy connectors (e.g. SPO flange penetrator), lifting eyes positions are provided on the connector flange. These are shown on the connector outline drawing, which is part of the connector datasheet. The datasheet is available separately upon request and is included as part of the connector documentation.

Dummy, or parking connectors weigh less than 20 kg and can be lifted by hand, however correct lifting practice should be observed at all times.

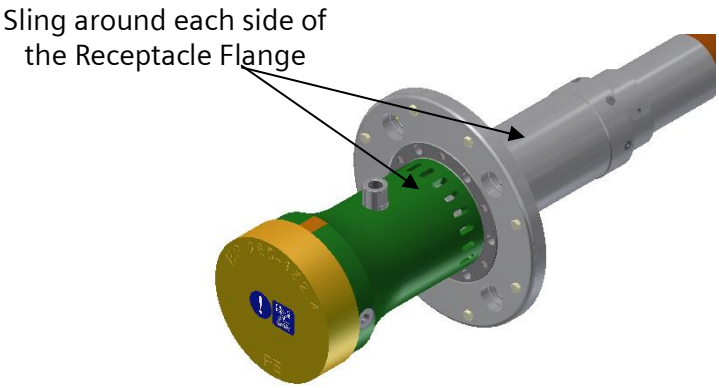


Figure 14 - Recommended lift position - ROV Receptacle

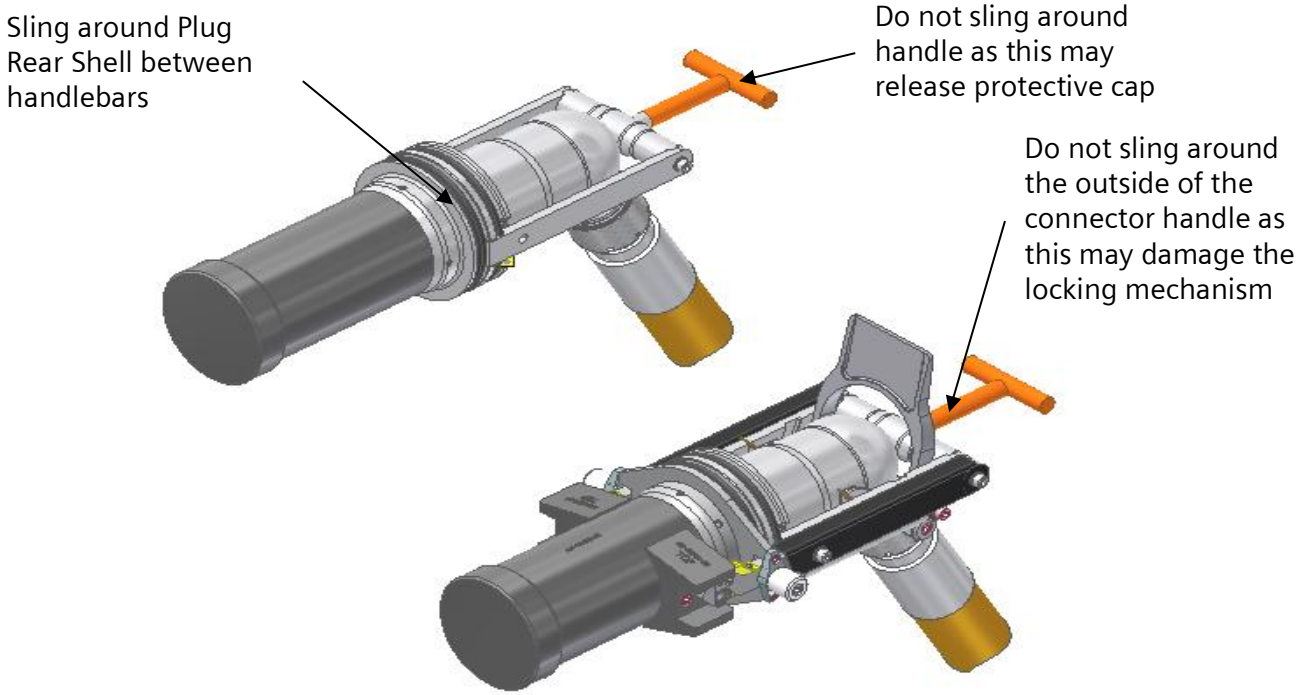


Figure 15 - Recommended lift positions - ROV Plug (Without / with locking mechanism)



Figure 16 – Recommended lift positions - Tree Cap Penetrator / Plug (Version 1)

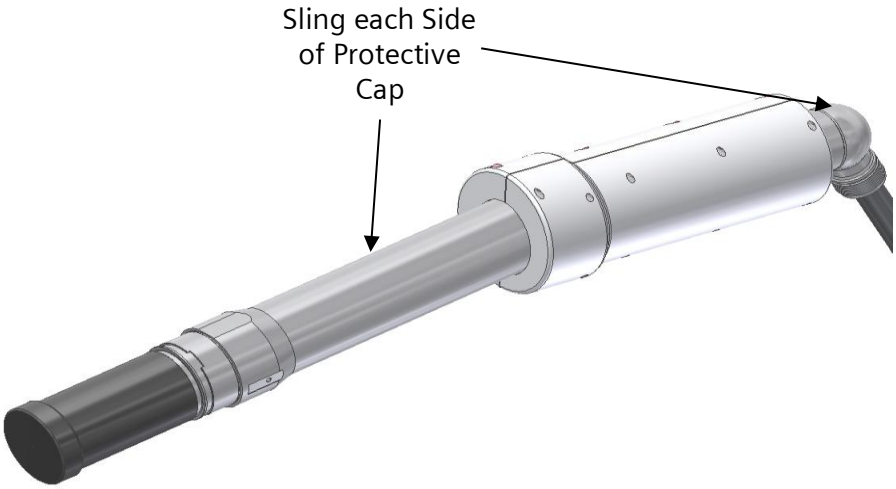


Figure 17 - Recommended lift positions Tree Cap Penetrator / Plug (Version 2)

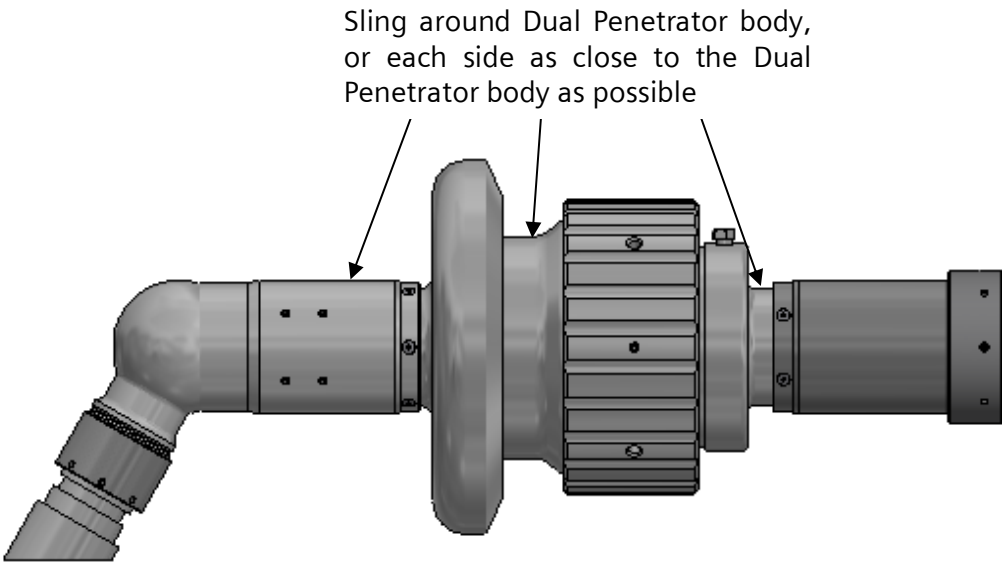


Figure 18 - Recommended Lift Positions - Dual Penetrator

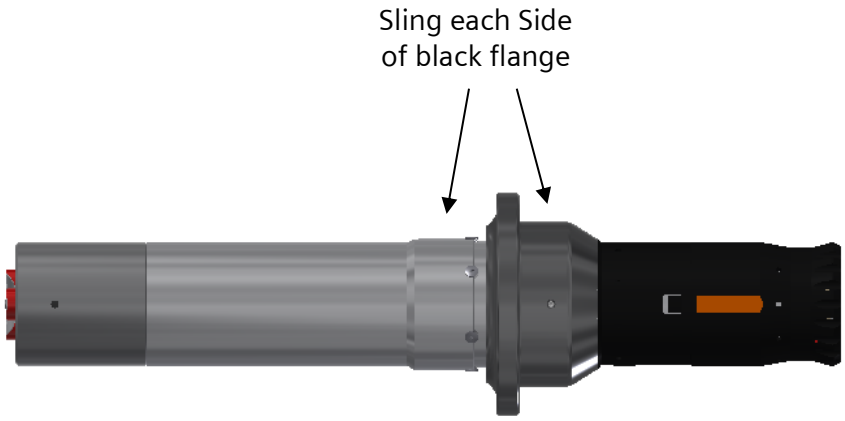


Figure 19 - Recommended Lift Positions – Top Side Test Plug

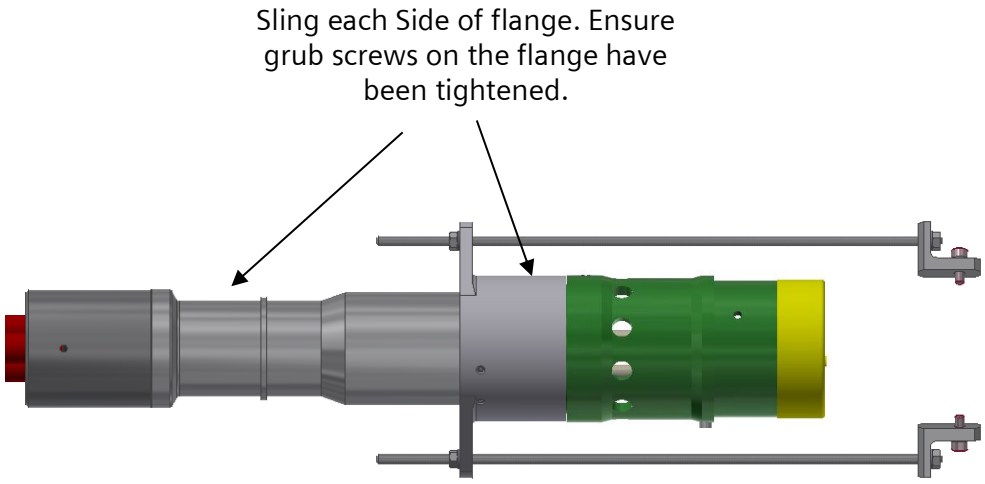


Figure 20 - Recommended Lift Positions – Top Side Test Receptacle

Protective caps should remain on wherever possible during lifting operations to minimise the risk of damage to connector sealing or electrical components.

For harnesses, the cable or hose should be supported during lifts to minimise strain on the connector. Jumper assemblies are rated to 2,5 kN in all scenarios (Topside and Subsea), however it is recommended that the maximum length of harness (bundled or single) which is left unsupported during a lifting operation in air is 5 meters.

Cable only connectors or hose break out connectors with cable should be handled with care as these connectors do not have the hose to protect the cable jacket from mechanical damage. These types of connectors are usually used for testing purposes. During unpacking and use, these should not be dragged along surfaces, protected when routed over edges and kept away from abrasive materials to keep the outer jacket in the best possible condition.

5.5 Installation and assembly



Danger! Risk of serious personal injury or death, and material damage to product

- Termination of umbilical connectors must be carried out by a competent person
- Installation and internal termination of penetrators onto customer modules must be carried out by a competent person

When any equipment is removed from storage for installation or SIT testing a thorough inspection should be made of the harness as a whole.

The SpecTRON 8 connectors can be installed onto client subsea structures by the end user provided the guidance in this document is followed. It is important to ensure that the handling guidelines are followed during all parts of the installation process. This is particularly important for hoses and cables, which must be adequately supported during any lifting operations to prevent damage to the hose/cable and the termination inside the connector.

During lifting and manoeuvring of the connector the transportation/protective caps should be left on the connectors for as long as possible to protect the mechanical interfaces. Care must be taken to ensure that the hose does not bend beyond its stated MBR as this may cause kinking which could damage the hose and the cable within. All manoeuvring of any SpecTRON equipment must be done in accordance with Section 6.4.

During or after the installation of SpecTRON equipment if any structural work is performed around the connectors such as welding or grinding, where contaminants may affect the connectors they must go through the cleaning process outline in section 8.

5.6 Storage and protection



Caution. Risk of corrosion to electrical contacts.

- If the connector has been tested in a wet environment, mate receptacle to a full dummy plug, or if using an Acetal protective cap ensure that the pin and cap are completely dry (see section 8.1)
- If storage is carried out in high humidity or salinity conditions, e.g. on a ship's deck or hold, or near a dockside, then full dummy connectors should be used.



Caution. Risk of material damage.

- Connector surface temperature must not exceed 60°C, maximum storage temperature accounts for solar gain.
- Suitable protection must be used to ensure maximum storage temperature is not exceeded.
- Elastomeric components such as hose and connector termination kits should not be stored near natural or artificial sources of ozone (e.g., high voltage electrical equipment, laser printers, or welding operations).
- Connectors must not be exposed to combustion gases, organic vapour or equipment which generate organic vapours.

Caution. Risk of material damage.

- Connectors should not be allowed to encounter solvents, oil, grease or other semi-solid materials.
- No modification to the internal profile of the protection cap or any foreign materials such as Silica gel should be introduced into protective caps, as these will lead to damage of the critical seals and electrical contact areas.

5.6.1 Short term connector storage

Prior to installation the connectors are sensitive to environments where grit and dirt are present. To prevent ingress of the above, they should be stored in a clean dry area and be protected by bubble wrap or similar wrapping material. Dust/protective caps must be fitted.

5.6.2 Long term connector storage

Connectors must be stored in a clean dry area. Suitable protection caps must be fitted, and the storage temperature should be between -25°C and 60°C. Humidity of the storage room should be between 10% and 60%. The equipment should be protected from ozone, strong sunlight and strong artificial light with a high ultraviolet content.

5.6.3 Connector Termination Kits

Elastomeric components supplied in termination or re-termination kits should be kept in their packaging until required for use. The date of expiry stated on the packaging should be observed, as should the following storage conditions.

- Temperature – the storage temperature shall be between 15 and 25°C and the components will be stored away from direct heat sources. If the storage temperature falls below 15°C the components shall be handled carefully and the temperature of the components shall be raised to approximately 30°C prior to use.
- Humidity – the relative humidity shall be at a level that prevents condensation occurring as a result of temperature fluctuations.
- Light – the elastomeric components shall be protected from light sources including direct sunlight and artificial light having a high ultraviolet content.
- Ozone – elastomeric components shall not be stored near ozone generating equipment (e.g. high voltage electrical equipment, laser printers) or operations (e.g. welding). The storage area must also be free from combustion gases and organic vapour and equipment that generate organic vapours.
- Stress – components shall be stored free from superimposed tensions and compressive stresses or other causes of deformation.
- Radiation – components shall be protected from all sources of ionizing radiation.

5.6.4 Subsea Storage

Caution. Risk of corrosion to electrical contacts.

- In a subsea environment the receptacle connector must be mated to full dummy plug or subsea rated protective cap when not mated to a plug.

- Over the life of the connector, the receptacle pin contact cannot be left exposed for more than 60 days (for connectors supplied since 2013) or 28 days (otherwise) cumulatively

If the connectors are to be left unmated in seawater dummy connectors or subsea protective cap must be used to protect the pin contacts in the receptacle connectors. Over exposure will increase the risk of corrosion damage or marine growth on the contact surfaces of the receptacle contact pins. This could lead to damage to the seals and insulation within the socket contacts.

Plug connectors may be left unmated in seawater for their full lifetime, but it is recommended that the Plug connectors are mated into a Parking Receptacle during this time in order to protect the latching mechanism.

5.7 Repackaging to prevent damage in transport

In the event of a requirement to return any product back to the manufacturer (Siemens Energy Subsea Connectors), it is recommended that the original dust/protective cap is fitted to the connector(s) after cleaning and care should be taken to protect the connector(s) with bubble wrap or similar wrapping materials to avoid any surface damage. It is recommended that a suitably reinforced box be used to withstand the weight. Contact Technical Support connectortechnicalsupport.gb@siemens-energy.com to discuss details of typical boxes.

6 OPERATION OF PRODUCT

6.1 Energising Wet Mate Pair



Danger! Risk of death from electric shock.

- Connectors must not be de-mated whilst live.
- Allow sufficient time for system to allow any residual voltage to discharge before de-mating connectors
- Connectors must be fully mated before energisation
- Receptacles must not be energised unless mated to a plug



Caution. Risk of material damage.

- Connectors must not be de-mated whilst live.
- Allow sufficient time for system to allow any residual voltage to discharge before de-mating connectors
- Connectors must be fully mated before energisation
- Receptacles must not be energised unless mated to a plug

SpecTRON 8 connectors should be integrated and managed as part of a well-designed high voltage system with appropriate validation of system status and connections before energisation.

When performing high-voltage testing of an electrical system containing SpecTRON 8, Siemens Energy offer appropriate test equipment which can be used to provide safe termination of wet-mate and dry-mate connectors. Product marking on the test equipment must be verified to ensure that they are appropriately rated.

6.2 Deployment



Caution. Risk of material damage.

- The maximum deployment rate for SpecTRON 8 connectors is 20 bar/minute.

Refer to project specific data sheets and scope of supply drawings for performance specifications and detailed deployment instructions.

6.3 Retrieval



Caution. Risk of material damage.

- The maximum retrieval rate for SpecTRON 8 connectors is 20 bar/minute.



Danger! Risk of serious personal injury or death, and material damage to product

- Potential for trapped hydrostatic pressure within hoses, connector front-ends, and compensation volumes. This risk is significantly increased if there is significant marine or calcareous growth.

- When cleaning or handling jumpers and connectors after retrieval appropriate protective equipment (gloves, goggles) should be worn until all flooding and compensation ports are clear.

Caution. Risk of corrosion to electrical contacts.

- After retrieval, mate receptacle to a full dummy plug, or if using an Acetal protective cap ensure that the pin and cap are completely dry (see section 8.1)
- If storage is carried out in high humidity or salinity conditions, e.g., on a ship's deck or hold, or near a dockside, then full dummy connectors should be used.

6.4 Hose Management and Routing

6.4.1 General Guidance (topside and subsea)

Hose should be routed in a manner to avoid bending beyond the MBR under any circumstance (topside or subsea). Care should be taken when designing mounting arrangements for hose and compliant mount connectors to ensure that the compliance does not bend the hose beyond its MBR.

Efforts should be made to avoid application of excessive hose tension, which could cause the hose to void its MBR or become kinked. This is particularly pertinent when the hose is topside, as hose weight in air is significantly greater than its weight in water (refer to section 4 for specific hose weight values).

When topside (in air), the maximum length of horizontal unsupported hose is 2m. When hose is vertically oriented in air, the maximum unsupported length is 5m. These values apply both to Gorilla and AquaTRON hose. (See section 6.4.2 for information on subsea handling of flying harnesses.)

If wet mate connectors are oriented vertically with plug above receptacle, there will be an abrupt change in plug hose orientation if this hose is unsupported. In this situation, to prevent the hose weight from contravening the MBR, Siemens Energy recommend that the height from structure base to receptacle does not exceed 3m.



Figure 21 - AquaTRON (left) and Gorilla (right) hoses at to minimum bend radius

The hose will have some natural resistance to bending/ kinking however application of snag force due to sharp routing around the corner of a structure (ignoring hose MBR) or application of force due to unsupported hose weight (beyond stated allowance) may cause damage to the conductors or terminations and efforts should be made to avoid this during all applications topside or in water.



Figure 22 - Incorrectly bent AquaTRON (orange) and Gorilla (yellow) Hose

Siemens Energy recommends the use of "formers" to avoid exceeding the MBR of the hose when passing over acute angled surfaces (through or around structures). These formers may also be used to support free hanging hose longer than the limits above.

Formers can be produced to Siemens recommended design (as shown below) or to client specific design, and fixed to the client's structure as appropriate.

RECOMENDED FORMER DESIGNS

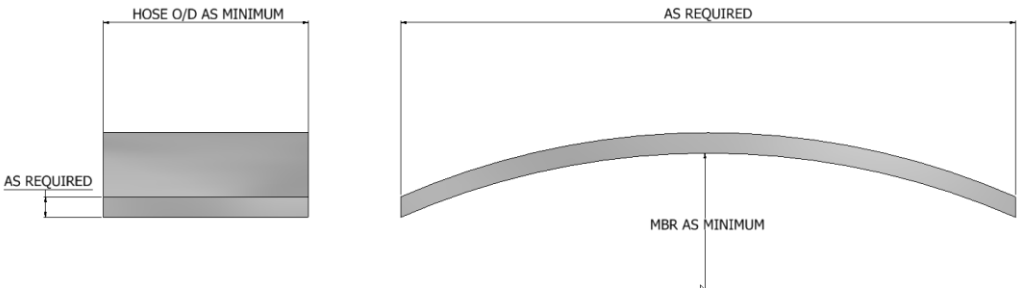


Figure 23 - Plate Former

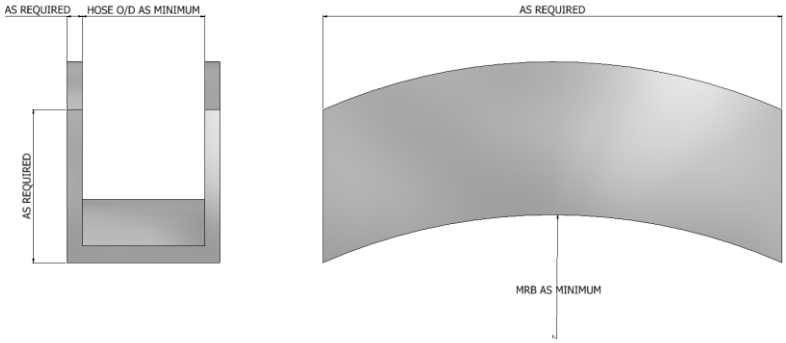


Figure 24 - 'U' Former

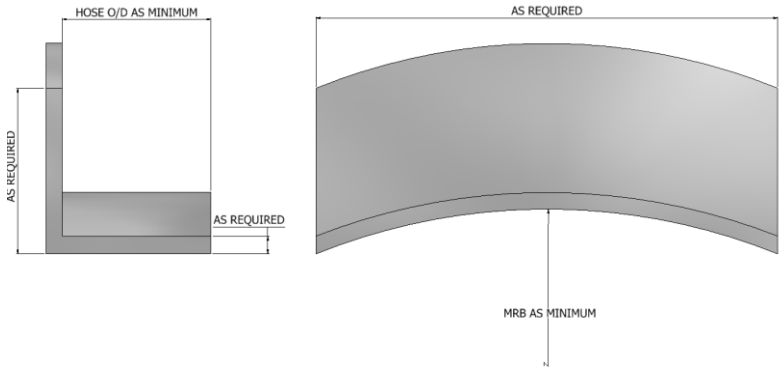


Figure 25 - 'L' Former

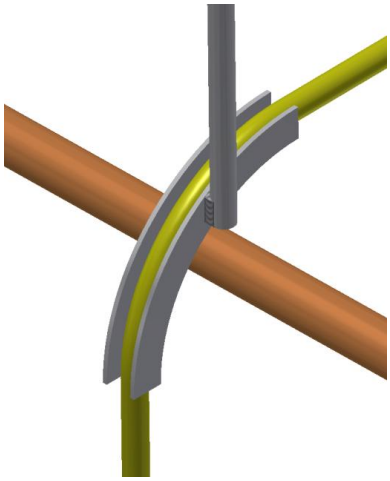


Figure 26 - 'U' former

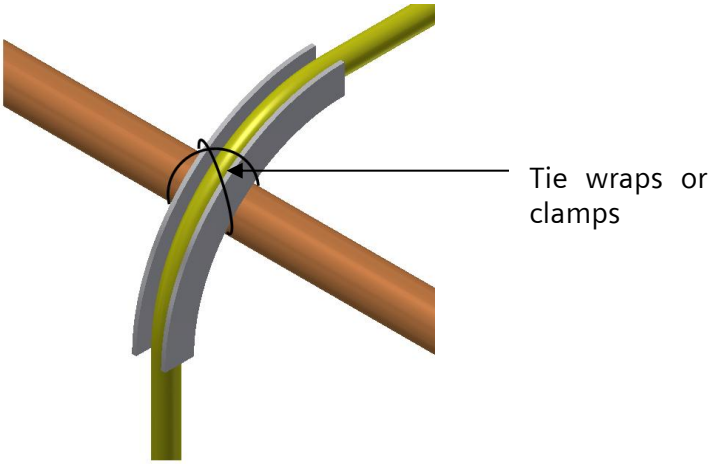


Figure 27 – Temporarily fixed former (e.g. for topside SIT)

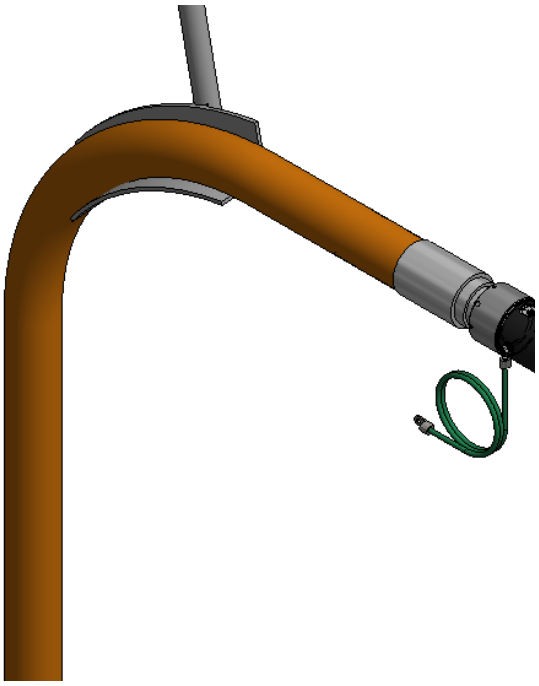


Figure 28 - 'L' former

If temporary hose support is required during SIT, a temporary elevated floor could be created via the use of equipment such as scaffolding, scissor lifts and ladders etc or alternatively a fabricated stand with a former attached. See Figure 29 below for an example of such a stand.

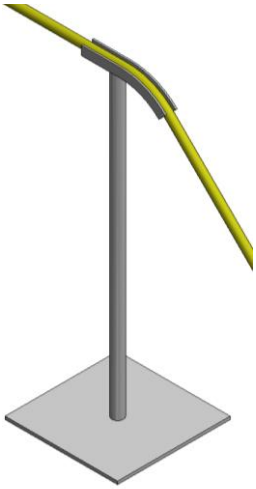


Figure 29 - Fabricated stand with former used for hose support

6.4.2 Subsea Manoeuvring of 'Flying' Harnesses

- **Caution.** Risk of material damage.
  - The maximum unsupported hose length in water for SpecTRON 8 flying harnesses is 30 m

- SpecTRON 8 flying harnesses under or equal to 30m require no buoyancy aids for subsea deployment.
- SpecTRON 8 flying harnesses over 30m require buoyancy aids suitable to support 1.45kg (see section 4) per metre length in excess of 30m. For example, a 50 metre EFL requires buoyancy aids to cover 20 metres of additional hose weight which is 29 kg (20*1.45 = 29kg).
- These buoyancy aids should be spaced evenly to ensure that the termination on each end of the jumper is not loaded with more than 30 metres of jumper. The buoyancy aids should be attached to the jumper with a soft sling.
- When flying out second end of harness, with first end either mated (plug) or rigid fixed (Penetrator), consideration must be given to length of harness and planned extension to mating point. Any over extension beyond the designed hose length, could cause damage to the conductor / electrical termination within.

6.4.3 Compliantly mounted Connectors

Careful consideration should be given to the placement of the first clamp on a compliant mount connector so as not to restrict the compliancy of the connector or impart stresses into the hose and cable. Where clamping is required on compliantly mounted connectors, It is recommended that an 'S' type arrangement or similar as shown in Figure 30 is utilised to take up the potential movement of the connector.

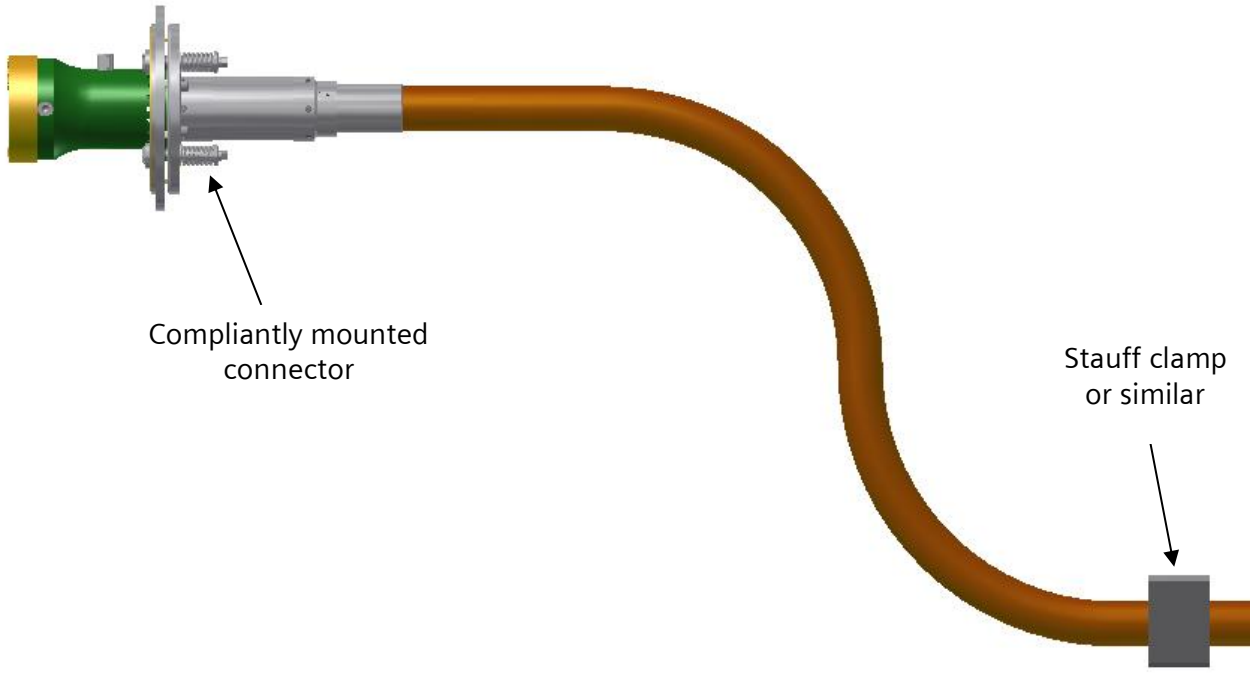


Figure 30 - Potential Clamping of Hose on Compliant Connector

6.5 MUTU cable management

The umbilical power cables must extend straight out of the MUTU cable glands for a minimum of 200mm. If, after MUTU termination has been completed, the umbilical power cables must be moved or bent, then jigs or clamps must be used to prevent cable movement within the MUTU's glands. This is necessary to prevent issues with the MUTU cable sealing system.

This need for a clamp also applies if the MUTU itself must be moved after completion of cable termination and installation of the MUTU into the umbilical termination assembly.

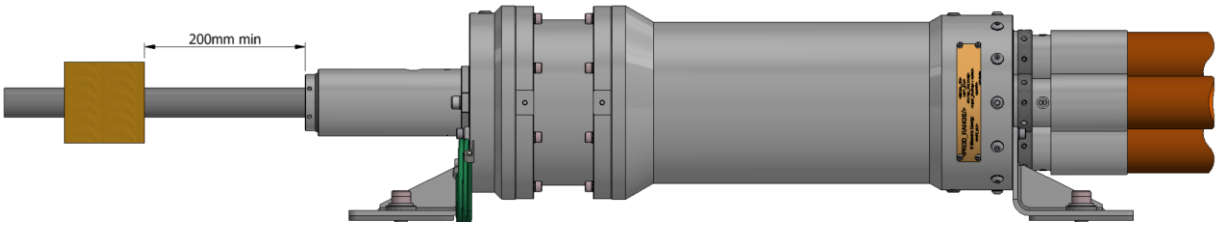


Figure 31 – Required length of straight cable and MUTU clamp position

6.6 ROV Manipulator

SpecTRON 8 connectors are fitted with either an ISO 13628 T-bar handle or an ISO 13628 Fish Tail Handle.

6.6.1 T Bar Handle

T-bar handle connectors must be manipulated using a Parallel Jaw ROV manipulator similar to that shown in Figure 32.



Figure 32 - Recommended ROV Manipulator Jaw for T Bar Handle

The T bar should be held by the crossbar of the T as shown in Figure 33 and not by the shaft. If the T bar is held incorrectly there is a risk that the latch mechanism of the connector will not engage correctly.



Figure 33 - ROV Connector Handling (without and with locking mechanism)

6.6.2 Fish Tail Handle

Fish Tail Handle connectors must be manipulated using a 3-finger ROV manipulator jaw similar to that shown in Figure 34. The handle should be held in the ROV jaw as shown in Figure 35.



Figure 34 - Recommended ROV Manipulator Jaw for Fishtail Handle

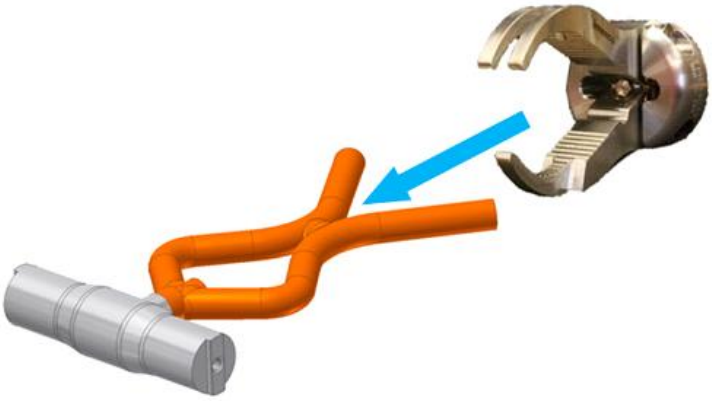


Figure 35 - ROV Connector Handling

6.7 Connecting ROV Wet Mate Pair Subsea

6.7.1 Pre-mating Checks

Before mating, the receptacle shroud should be checked for debris. The connectors have been designed to accommodate sand and silt contamination. However, large pieces of debris should be removed.

6.7.2 Without additional locking mechanism

Caution. Risk of material damage.

- Any mating equipment used to mate the SpecTRON 8 connector pairs must be designed in accordance with the misalignment and interface guidance provided by Siemens Subsea to avoid damage to the connector pair.
- Do not pull on the ROV handle to check the connector is correctly mated as this will disengage the internal latch mechanism and de-mate the connector.
- Never pull on the ROV handle without first disengaging the locking mechanism as this may result in damage to the locking mechanism. (Applicable only to connectors with additional locking mechanism)

Warning. Risk of injury from trapping of limbs in mating tools

- Any mating process used to mate the SpecTRON 8 connector pairs should be in compliance with applicable standards and regulations for machinery.

The connectors will self-align during mating; however, they must be roughly aligned using the alignment marks on the top of the Connector body & Alignment flange / Receptacle shroud prior to mating.

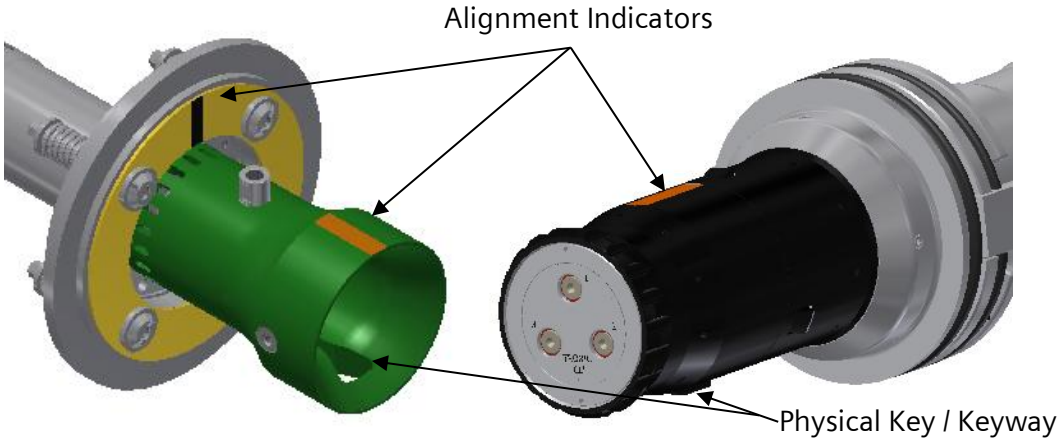


Figure 36 - Visual alignment indicators on plug and receptacle (coated connectors)

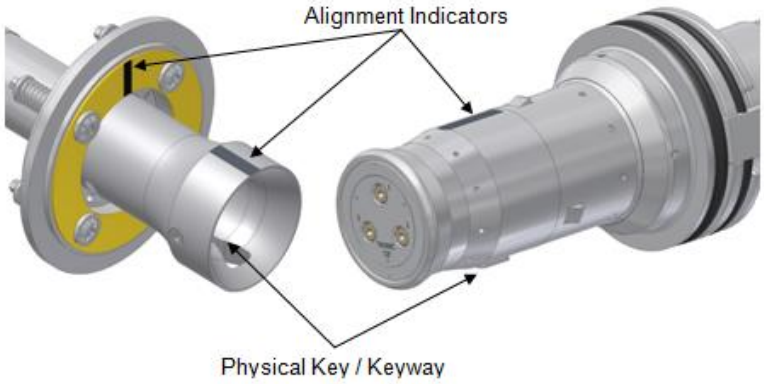


Figure 37 - Physical alignment keyway relative to visual indicator (uncoated connectors)

Compliance is built into the connector handle, and the receptacle mount. This flexibility accommodates misalignment and allows fine adjustments during the final approach prior to connector engagement.

The mating stroke should be as close as possible to one smooth movement, i.e. avoid 'pumping'. Using the ROV manipulator jaw, the pilot should grip the ROV handle as shown in Figure 33 or Figure 35.

The internal latch mechanism is activated by pushing the connectors together until the flanges of the plug and receptacle are fully home, as shown in Figure 40.

To ensure correct engagement, the ROV pilot should open the jaw and operate a final push operation before withdrawing from the T bar with a fully open jaw as shown in Figure 38. This ensures that the internal latch mechanism is not accidentally disengaged as the ROV pulls away from the connector.

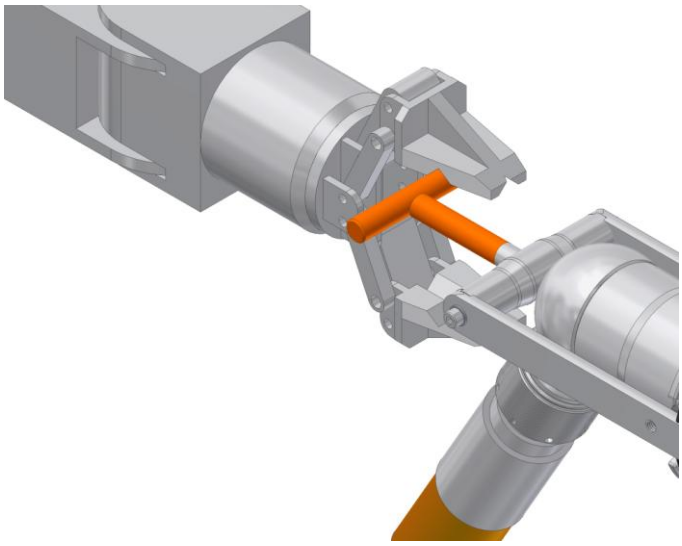


Figure 38 - Final Push with open jaw

6.7.3 With additional locking mechanism

The procedure for mating a connector with Locking Mechanism is identical to the standard ROV connector without Locking Mechanism (refer to Section 6.7.2).

The locking mechanism engages automatically during mating and requires no additional action from the ROV pilot.

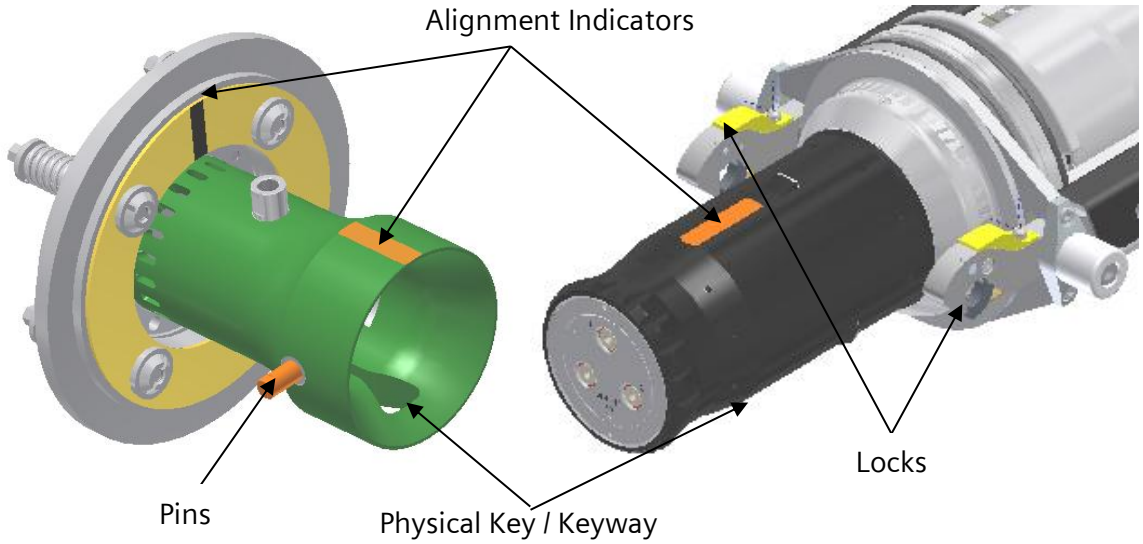


Figure 39 - Alignment Indicators (Connectors with Locking Mechanism)

6.7.4 Post Mating Checks

All Connectors

When relaxed there may be a small gap between the two (due to the springs in the Plug pushing against the Receptacle pins). The shoulder on the Plug should also butt up against the shroud of the Receptacle.

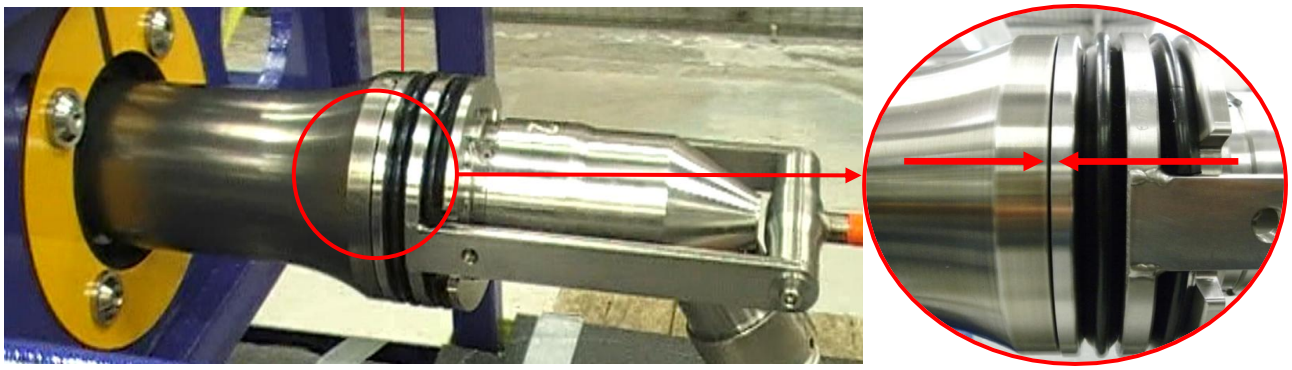


Figure 40 - Mating Check - Fully Mated. (NB: Small Gap between Flanges)

As dictated by Industry best practice, Siemens Energy recommends that all ROV mating operations are recorded on video and retained for future reference.

With additional locking mechanism

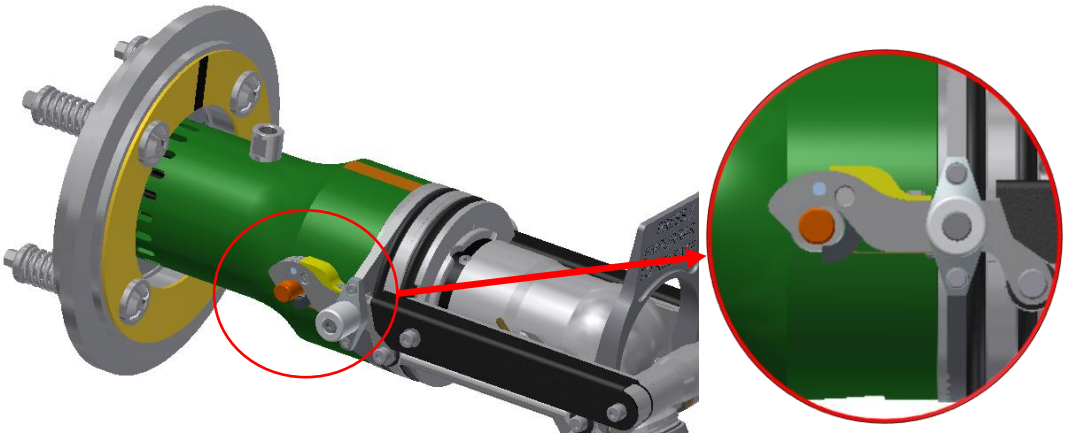


Figure 41 - Mating Check - Locking Mechanism Engaged.

Correct engagement of the locking mechanism must be confirmed by visual inspection as shown in Figure 41. If the post mating check shows that the locking mechanism is not correctly engaged then the plug must be de-mated following the procedure in section 6.8 then re-mated as detailed in section 6.7.

6.8 Disconnecting ROV Wet Mate Pair Subsea

Caution. Risk of material damage.



- Any mating equipment used to mate the SpecTRON 8 connector pairs must be designed in accordance with the misalignment and interface guidance provided by Siemens Energy Subsea to avoid damage to the connector pair.
- If the ROV handle is held incorrectly there is a risk that the internal latch mechanism of the connector will not disengage properly.
- Never pull on the gland or hose to de-mate the connector
- When de-mating, observe the maximum allowable de-mating force (stated on connector-specific datasheets). If connector is stuck due to excessive calcareous or marine growth, acid wash the connectors in accordance with section 8.2 before attempting to de-mate again.

6.8.1 Without additional locking mechanism

- Grip the ROV handle (T-handle or fishtail) correctly with the ROV jaw (Figure 33 or Figure 35).
- De-mating is achieved by a straight pull on the ROV handle sufficient to release the internal latching mechanism.

6.8.2 With additional locking mechanism

- Before De-mating the connector the ROV pilot must first release the locking mechanism.
- The locking mechanism is released by pushing forward the release paddle using the nose of the ROV manipulator jaw as shown in Figure 42.
- The locks will disengage from the receptacle pins when the paddle is pushed fully forward as shown in Figure 42.
- When this action has been performed correctly the release paddle will remain in the forward position after the ROV jaw is retracted.
- The detail view in Figure 42 shows the locks in the disengaged position.
- To De-mate the connector, Grip the ROV handle (T-handle or fishtail) correctly with the ROV jaw (Figure 33 or Figure 35).
- De-mating is achieved by a pull on the ROV handle sufficient to release the internal latching mechanism. Do not pull on the gland or hose.
- As the connector is de-mated the release paddle will automatically return to the default position. No ROV pilot action is required.
- On de-mating, the locking mechanism re-sets automatically and can be immediately re-mated if required. No ROV pilot action is required prior to re-mating.

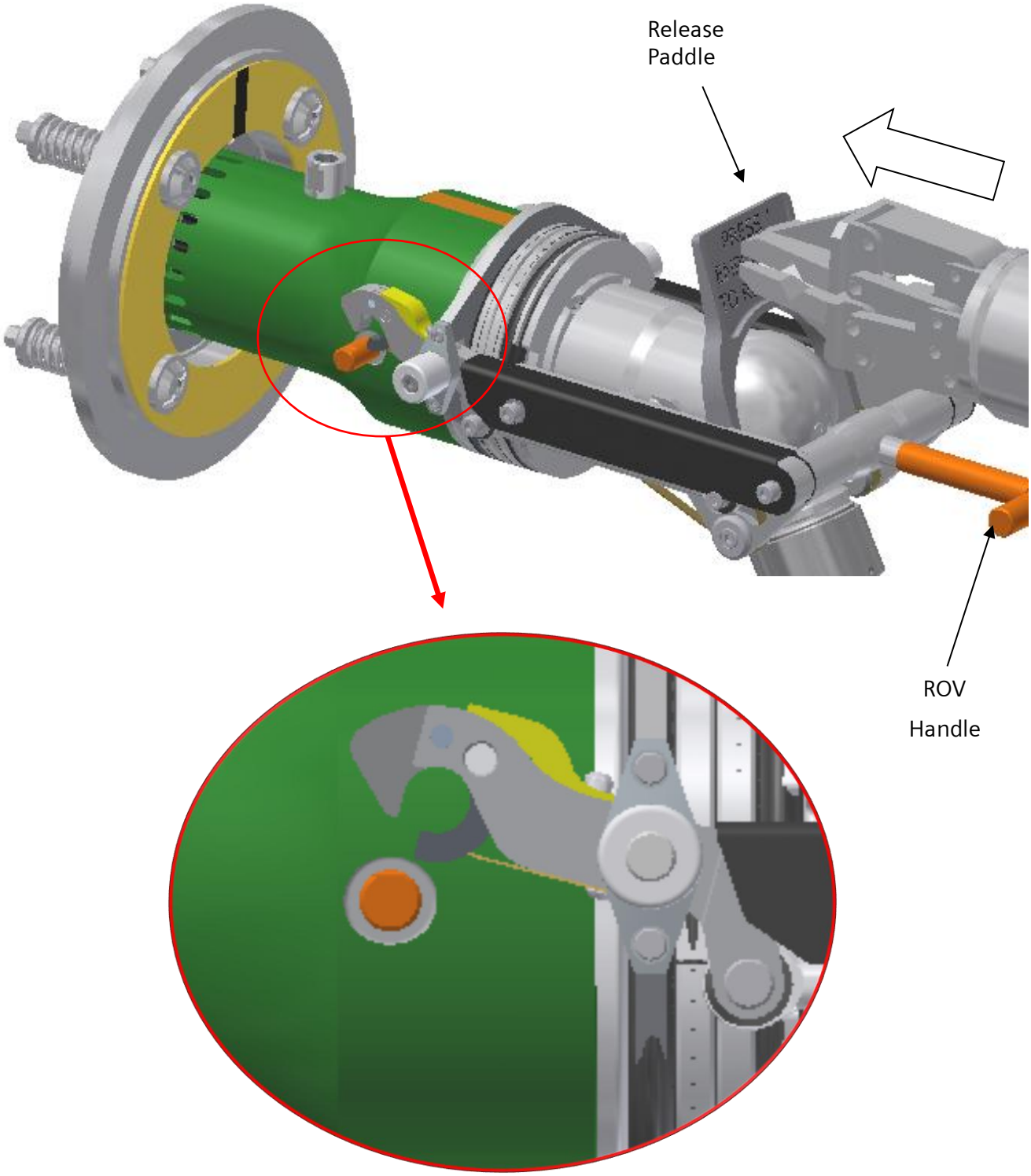


Figure 42 - Locking Mechanism Disengaged

6.9 Connecting ROV Wet Mate Pair Manually/Topside

Caution. Risk of material damage.

- Any mating equipment used to mate the SpecTRON 8 connector pairs must be designed in accordance with the misalignment and interface guidance provided by Siemens Energy Subsea to avoid damage to the connector pair.
- Do not pull on the ROV handle to check the connector is correctly mated as this will disengage the internal latch mechanism and de-mate the connector.
- Never pull on the ROV handle without first disengaging the locking mechanism as this may result in damage to the locking mechanism (Applicable only to connectors with additional locking mechanism).

Warning. Risk of injury from trapping of limbs in mating tools

- Any mating process used to mate the SpecTRON 8 connector pairs should be in compliance with applicable standards and regulations for machinery.

6.9.1 Pre-Mating Checks

Prior to commencing the mating of the connector pair, it is assumed that:

- The Receptacle connector is mounted to its associated mounting plate
- The Plug connector is in the near vicinity.
- Grab bars or other interfaces should be present on the Receptacle mounting structure. These should provide the diver with purchase and allow them to address the connector square-on with the connector at chest height.

6.9.2 Without additional locking mechanism

- Remove protective cap from Plug connector, or if Plug connector is mated to a Parking/Dummy Receptacle remove as detailed in the manual de-mating procedure below.
- If a Dummy Plug connector is mated to the Receptacle, remove using the manual de-mating procedure detailed below.
- Inspect the Receptacle pins and shroud, and ensure they are clean and free from debris, etc. If any debris is present remove using a water jet (in water) or through wiping (in air).
- Insert the Plug Connector nose into the shroud of the Receptacle, and initially locate the key on the Plug nose into the slot of the Receptacle shroud using the alignment indicators, as shown in Figure 36 and Figure 37. It should be noted that the physical key/keyway are located on the underside of the connectors.
- The operator should now get into a comfortable position, square on, ready to fully mate the connectors. The connector should be at chest height, with the grab bars or other provided interfaces on the mounting structure being within easy reach. Using the grab bars or other means to brace themselves (i.e. tied to structure), the operator should mate the connector by holding the ROV handle (Figure 43) and using one smooth single stroke to push the Plug connector until it butts up against the Receptacle. A maximum force of 76.5kgf (750N) will be required to mate the connectors. Ensure the mating stroke is level, and the operator can complete the stroke in one smooth consistent movement. Confirm that no bounce-back and failure to latch home has occurred.

- When the plug connector end stops abut to the receptacle this activates the internal spring loaded internal latch mechanism, which prevents the connectors de-mating. Pulling on the ROV Handle will de-activate this latch and hence will de-mate the connector.



Figure 43 - Mate using ROV Handle

- To confirm that connectors are fully mated and the Plug is correctly latched home, gently pull the Plug connector by holding the angled downward section of the Plug gland near to the hose termination, as shown in Figure 44. If the connectors are correctly latched and mated no axial movement in the Plug connector should be present. As a visual inspection, the shoulder on the Plug should butt up against the shroud of the Receptacle. However, when relaxed there may be a small gap between the receptacle and connector (due to the springs in the Plug pushing against the Receptacle pins), as shown in Figure 40.



Figure 44 - Check Connectors are Mated

6.9.3 With additional locking mechanism

- The procedure for mating a connector with Locking Mechanism is identical to the standard ROV connector without Locking Mechanism (refer to Section 6.9.2).
- The locking mechanism engages automatically during mating and requires no additional action from the operator.

6.9.4 Post-Mating checks:

- Correct engagement of the locking mechanism must be determined by visual inspection (Figure 41).
- If the post mating checks show the locking mechanism is not correctly engaged (Figure 41) the plug must be de-mated following the procedure in section 6.10 and then re-mated following the procedure in section 6.9
- The shoulder on the Plug should butt up against the shroud of the Receptacle.
- As an additional confirmation that connectors are fully mated and the Plug is correctly latched home, gently pull the Plug connector by holding the angled downward section of the Plug gland near to the hose termination, as shown in Figure 44**.** If the connectors are correctly latched and mated no axial movement in the Plug connector should be present.

6.10 Disconnecting ROV Wet Mate Pair Manually/Topside



Caution. Risk of material damage.

- Any mating equipment used to mate the SpecTRON 8 connector pairs must be designed in accordance with the misalignment and interface guidance provided by Siemens Subsea to avoid damage to the connector pair.
- If the ROV handle is held incorrectly there is a risk that the internal latch mechanism of the connector will not disengage properly.
- Never pull on the gland or hose to de-mate the connector



Warning. Risk of injury from trapping of limbs in mating tools

- Any mating process used to mate the SpecTRON 8 connector pairs should be in compliance with applicable standards and regulations for machinery.

6.10.1 Without additional locking mechanism

Prior to commencing the de-mating of the connector pair it is assumed that the Receptacle connector is mounted in its associated structure, and a Plug connector is mated to it.

- The operator should brace himself using the grab bars or other provided interfaces, and ensure the connector is at chest height. By gripping the ROV handle (as shown in Figure 43), the connector can be de-mated from the Receptacle using one smooth pulling movement along the axis of the connectors. Pulling the ROV handle automatically releases the internal latching mechanism. A force of 40kgf (392N) is required to de-mate the connectors.

- Once the Plug connector is fully separated from the receptacle connector, if appropriate it can then be mated to the parking Receptacle, using the steps described in the mating procedure in section 6.9.
- A dummy plug should also be mated to the remaining Receptacle, again using the mating procedure in section 6.9.

6.10.2 With additional locking mechanism

- Before De-mating the connector the operator must first release the locking mechanism.
- The locking mechanism is released by pushing the release paddle fully forward.
- The locks will disengage from the receptacle pins when the paddle is pushed fully forward. (Figure 42)
- When this action has been performed correctly the release paddle will remain in the forward position after the operators hand is removed.
- The operator should brace themself using the grab bars or other provided interfaces, and ensure the connector is at chest height. By gripping the ROV handle (as shown in Figure 43), the connector can be de-mated from the Receptacle using one smooth pulling movement along the axis of the connectors.
- Pulling the ROV handle automatically releases the internal latching mechanism. A force of 40kgf (392N) is required to de-mate the connectors.
- Once the connector is de-mated the locking mechanism will re-set automatically and can immediately be re-mated. The release paddle will automatically return to the default position. This can be confirmed by a quick visual inspection
- Once the Plug connector is fully separated from the receptacle connector, if appropriate it can then be mated to the parking Receptacle, using the steps described in the mating procedure in section 6.9.
- A dummy plug should also be mated to the remaining Receptacle, again using the mating procedure in section 6.9.

6.11 Test Connectors



Caution. Risk of material damage.

- An appropriate test connector must always be used to make electrical contact during testing.
- Under no circumstances should a foreign object (such as a screwdriver, test probe or crocodile clip) be used as a test connection as this could damage the seals and insulation. Such actions will invalidate the product warranty.



Danger! Risk of death from electric shock.

- An appropriate test connector must always be used to make electrical contact during testing.
- Under no circumstances should a foreign object (such as a screwdriver, test probe or crocodile clip) be used as a test connection
- Receptacles must not be energised unless mated to a plug

Warning. Risk of injury from trapping of limbs in mating tools

Any mating process used to mate the SpecTRON 8 connector pairs should be in compliance with applicable standards and regulations for machinery.

SpecTRON 8 connectors can be electrically tested with the use of SpecTRON 8 plug and receptacle topside test connector tailed harnesses as shown below in Figure 45.

These connector harnesses are terminated with 3-off M10 lugs for connection to a HV supply and 3-off M4 lugs for connection to an earth source. Cable management must be considered to ensure that the HV and earth connections are kept separated by the largest reasonable distance possible to ensure no flashover between the different cores and earth.

Cleaning should be performed with "safe wipes" only. "Safe wipes" are available on the internet and are lint-free, non-static, IPA based wipes for electronics. Consideration should also be given to guidance in Section 8.2 on marine growth and calcareous deposit removal.

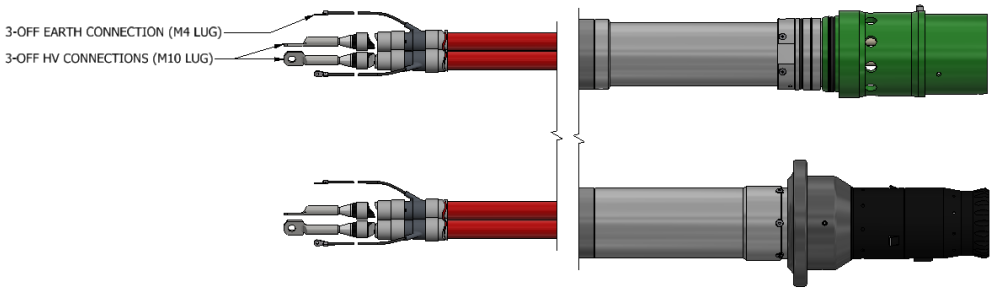


Figure 45 - Tailed Test Harness Connection Points

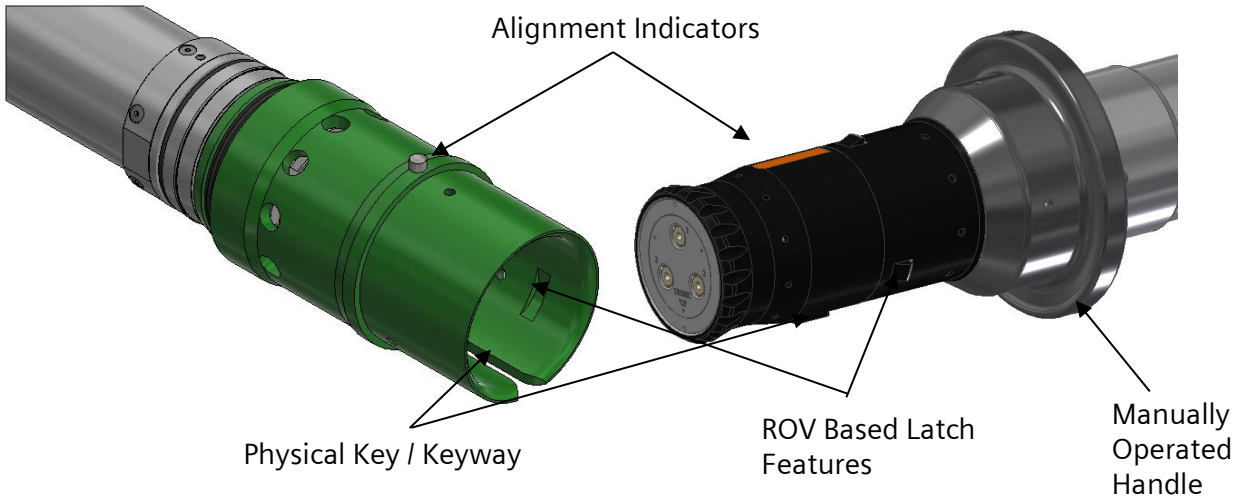


Figure 46 - Alignment Indicators (Topside Test Connectors)

6.11.1 ROV Wet Mate Pair

The design of these connectors is based on the ROV mating mechanism as described in previous sections, therefore no additional mating / retaining equipment required. The collar, stud and nuts are not required for connecting to ROV wet mate connectors, and hence can be removed, before following the instructions in section 6.9.

6.11.2 Single ESP Feedthrough

Test Receptacles

SpecTRON 8 test receptacles are provided with a collar, stud, and nuts which can be used to hold the test receptacle in place.

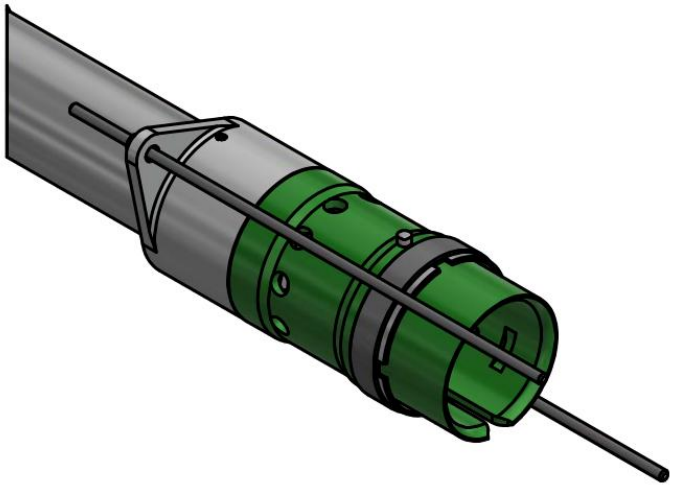


Figure 47 - SpecTRON 8 Test Receptacle with collar, stud, and nuts

To draw the connectors together safely, the SpecTRON 8 test connector should be offered to the subsea connector and drawn in using the stud iron to ensure that it is not possible for the connector to "bounce".

Test Plug

SpecTRON 8 tubing hanger receptacles include the latching features necessary to interface with the latching mechanism of the ROV connector. Hence the instructions in section 6.9 should be followed.

6.11.3 Dual ESP Feedthrough

Test Receptacle

The dual ESP feed-through test receptacle is fixed to the tree cap plug using an integrated latch system. The test receptacle should be pushed onto the plug, before turning the latch lever to hold the two connectors together.

Test Plug

A test plug is available to connect to a tubing hanger receptacle, although typically this connector is only used by Siemens Energy site installation teams. For further information, please contact Siemens Energy Technical Support connectortechnicalsupport.gb@siemens-energy.com.

6.12 Testing



Danger! Risk of death from electric shock.

- Connectors must not be de-mated whilst live.
- Allow sufficient time for system to allow any residual voltage to discharge before de-mating connectors.
- Connectors must be fully mated before energisation.
- Receptacles must not be energised unless mated to a plug.
- When performing IR, HV or PD electrical tests, all phases not under test MUST be earthed out. For all topside testing all connector housings should also be earthed out. Earth connection points are being added to aid in this operation. If available these should be used, if not, use a Croc Clip and cable to earth the metalwork. Ensure all metal work is earthed using a 'bleep' tester or similar.
- **Please Note: When testing connectors in the vertical position both receptacle and plugs require to be separately grounded.**

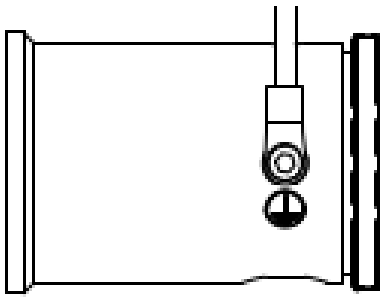


Figure 48: Example of earth connection



Caution. Risk of material damage.

- Any mating equipment used to mate the SpecTRON 8 connector pairs must be designed in accordance with the misalignment and interface guidance provided by Siemens Energy to avoid damage to the connector pair.
- Connectors must not be de-mated whilst live.
- Allow sufficient time for system to allow any residual voltage to discharge before de-mating connectors.
- Connectors must be fully mated before energisation.
- Receptacles must not be energised unless mated to a plug.
- Do not connect to an unmated receptacle pin unless using a test plug

6.12.1 Test Levels

The SpecTRON 8 connectors and penetrators are subjected to a complete FAT program as part of the manufacturing process. Penetrators will also be subjected to SIT testing after installation by Siemens Energy Subsea Connectors onto customer equipment (e.g. transformers, motors). It is also possible for customers to perform additional testing, subject to the restrictions outlined below

6.12.2 Electrical Tests

- Insulation resistance tests, (IR).

- Connectors may be subjected to IR tests at voltages of up to 5 kV. It is not possible to give a universal acceptance criterion as the result is dependent on the test arrangement, cable/harness lengths, and the equipment (e.g. motor, transformer) under test. For verification tests on equipment after delivery, results obtained on site should be compared to the factory acceptance test results detailed in the equipment manufacturing documentation.

- Line resistance tests, (LR).
  - Connectors and penetrators can be subjected to line resistance tests either at low current or rated current. Please consult connector or project specification before commencing a test at rated current. It is not possible to give a universal acceptance criterion as the result is dependent on the test arrangement, cable/harness lengths, and the equipment (e.g. motor, transformer) under test. For verification tests on equipment after delivery, results obtained on site should be compared to the factory acceptance test results detailed in the equipment manufacturing documentation.

- High Voltage Testing, (HV).
  - Although it is possible to carry out high voltage AC or DC tests of connectors, jumpers and penetrators, Siemens Energy Subsea Connectors technical department should be consulted before starting any testing.

- Partial Discharge Test, (PD).
  - Please consult Siemens Energy Subsea Connectors technical department before carrying out partial discharge (PD) testing of harnesses, connectors and penetrators.

6.12.3 Pressure/Hydrostatic Tests

- Hydrostatic Tests
  - Connectors can be subjected to hydrostatic test pressures as defined by the connector and harness datasheets.

- Differential Pressure Testing (Penetrators)

  Penetrators can be subjected to differential pressure testing as defined in the project requirements or connector datasheet.

- Gas Testing (Penetrators)
  - Penetrators can be subjected to low pressure helium leak testing of environmental seals but must not be tested using high pressure gas. It is not possible for the end user to perform leak testing on connectors or harnesses.

6.12.4 Visual Inspection

After any systems integration test, a full inspection of all SpecTRON equipment tested should be carried out. Focus should be on critical areas such as the receptacle pin, and receptacle shroud screen contact which should be free from any mechanical damage such as scratches or pitting.

If the SIT requires the SpecTRON equipment to be partially or fully submerged in water or seawater they must undergo a full cleaning process outline in section 8.1 whether they are to be placed in storage or to remain on the structure for deployment.

6.13 Quick references

For quick reference of the product, see section 1.3, which provides basic warning, caution and contact details among other information.

In addition to the above, some details are also listed on the product label and marking such as, system type, part number (P/N), serial number (S/N), electrical, pressure and temperature rating as detailed in Sections 1.3 and 1.4.

6.14 Disposal of waste products

Safe disposal or recycling of waste/end of life product is recommended by correctly, observing and complying with area, regional, national, or international environmental legislation where applicable.

To return waste packaging and/or end of life product to the manufacturer, contact the Product Safety Officer at subsea.connectors.productsafety.gb@siemens-energy.com.

7 USER INFORMATION

7.1 Normal and faulty/dangerous operation

7.1.1 Visible oil discharges from connector

During normal operation of the SpecTRON 8 wet mate pair, it is normal for a film of oil to be left on the receptacle pin after mating. There may also be some oil residue from assembly left in the compensation volume within the connector which may be visible during initial wetted testing.

Continuous, or heavy leakage of oil from the compensation ports on the gland and plug, or from the plug nose may be evidence of damage to the connector internals.

7.1.2 Protection of receptacle contact pins



Caution. Risk of material damage.

- Under no circumstances must the contact pins in the receptacle connector be exposed to seawater with power on. If this situation does occur the contact surfaces of the pins will very rapidly degrade by electrolytic action.
- If these damaged pins are subsequently mated into a socket insert there is a **very high risk** of damage to the insulation and seals within the plug connector.

If the connectors are to be left unmated in seawater dummy connectors and subsea protective caps must be used to protect the pin contacts in the receptacle connectors. The maximum cumulative time for which the pin contacts can be exposed to sea-water over the entire lifetime of the connector is 60 days, for connectors supplied before 2013, this duration is 28 days.

Over exposure will increase the risk of corrosion damage or marine growth on the contact surfaces of the receptacle contact pins. This could lead to damage to the seals and insulation within the socket contacts.

7.2 Cathodic Protection

The SpecTRON 8 Connectors are typically manufactured from Super Duplex stainless steel (UNS S32550/UNS S32760). Some modular umbilical termination units (MUTU), test connectors, umbilical terminations, and accessories are manufactured from 316L stainless steel (UNS S31603).

7.2.1 Super Duplex (UNS S32550/UNS S32760, Siemens Energy Subsea Connectors Material "BQ")

Super Duplex stainless steel connectors and penetrators do not require a connection to a CP system, and Siemens Energy Subsea Connectors do not typically supply CP straps with Super Duplex connectors, however, if required, Siemens Subsea Connectors can supply CP strap with Super Duplex connectors, to the same specification as the strap used on 316L connectors, as above.

SpecTRON 8 connectors manufactured in Super Duplex materials have been analysed for susceptibility to HISC in accordance with DNV RP-F112 (Design of Duplex Stainless Steel Subsea Equipment Exposed to Cathodic Protection). As such, they can be connected to cathodic protection systems, but as calcareous growth can vary in different seawater conditions, it is the end user's responsibility to evaluate the calcareous growth expected over the life of the connector system.

Note: Penetrator fasteners may be provided separately by Siemens Energy or 3rd party and individual corrosion protection needs should be considered on a case by case (including shallow water testing).

7.2.2 Stainless Steel 316L (UNS S31603, Siemens Energy Subsea Connectors Material "AA")

Caution. Risk of material damage.

- Stainless steel 316L (UNS S31603) connectors must always be connected to a CP (Cathodic Protection) system to withstand harsh saliferous environments.
- There is a requirement for corrosion protection to be implemented when there is any short term exposure to seawater e.g. performing shallow water testing.

Siemens Energy Subsea Connectors provide a CP strap with connectors manufactured to the length specified by the end-user. The CP strap is manufactured in 316 stainless steel with a cross section of 16 mm^2, and a M6 ring terminal for connection to the CP system.

7.3 Troubleshooting (FAQ's)

For any questions not included below, please contact any of the following:

Department	E-mail address
Product Safety	subsea.connectors.productsafety.gb@siemens-energy.com
Technical Support	connectortechnicalsupport.gb@siemens-energy.com
Installation and Servicing	susultlcmsupport.gb@siemens-energy.com
Sales	connectorsales.gb@siemens-energy.com

Table 8 - Troubleshooting product contact details

8 PRODUCT MAINTENANCE



Danger! Risk of death from electric shock.

- Connectors must not be de-mated whilst live.
- Allow sufficient time for system to allow any residual voltage to discharge before de-mating connectors
- Connectors must be fully mated before energisation
- Receptacles must not be energised unless mated to a plug



Caution. Risk of material damage.

- Connectors must not be de-mated whilst live.
- Allow sufficient time for system to allow any residual voltage to discharge before de-mating connectors
- Connectors must be fully mated before energisation
- Receptacles must not be energised unless mated to a plug

8.1 Connector Cleaning and Drying



Caution. Risk of corrosion to electrical contacts.

- The specified cleaning process must be followed when connectors have been retrieved from deployment or after they have been in contact with water.
- Silica sachet inside ROV receptacle protective cap should be replaced if cap is removed in a high humidity environment or the sachet has absorbed moisture.



Warning. Risk of eye injury

- Wear appropriate eye protection when using compressed air to remove water or isopropyl alcohol from the connector internals



Warning. Risk of skin irritation

- Wear appropriate hand protection when using isopropyl alcohol to clean connector components.

8.1.1 Receptacle & Protective Cap

- Remove cap and silica sachet (if present).
- Rinse the receptacle shroud and pins well with fresh water, a squeeze bottle can be used to dislodge any contaminants around the pin tip.

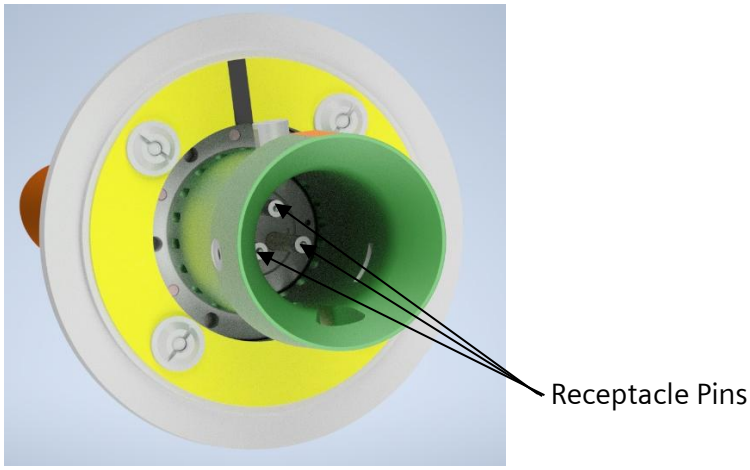


Figure 49 – Receptacle Components for drying and cleaning

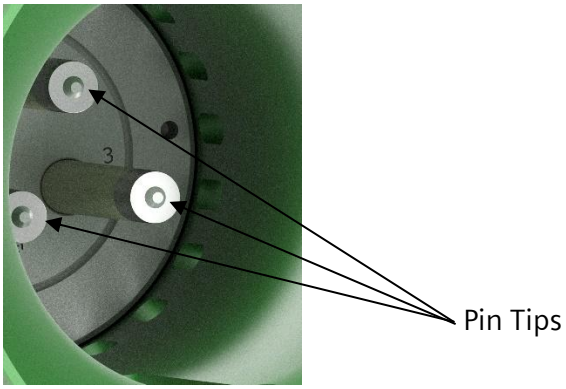


Figure 48 - Receptacle Pin tip

- Wipe using lint free tissue if required
- Rinse with Isopropyl Alcohol (IPA absolute alcohol 100%)
- No pooling of IPA or water within the Receptacle Shroud. Compressed air can be used to disperse any pooled fluid, but the Receptacle pins must be rechecked for contamination
- Allow Receptacle pin to completely dry
- There should be no damage present on the receptacle pin contact area (see Figure)

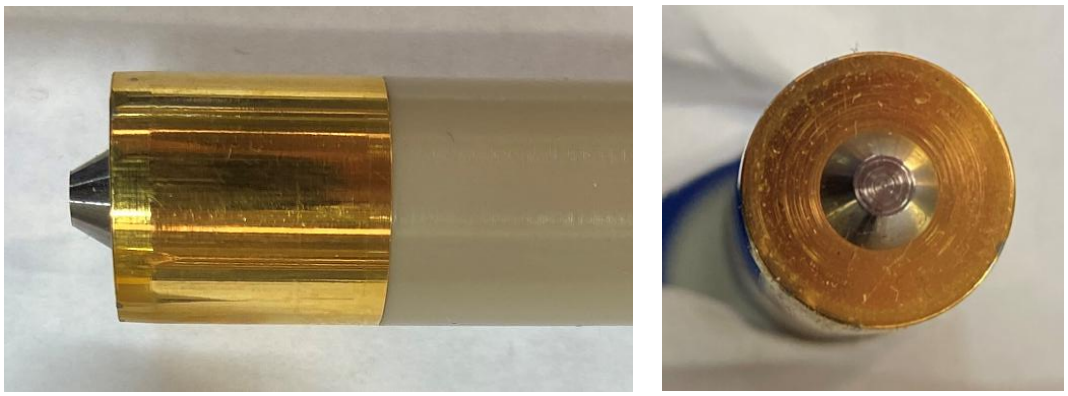


Figure 51 - Receptacle pin contact area as supplied

- Apply dielectric oil to the pin. Dielectric oil must be TDO1 to avoid compatibility issue with elastomeric components. Siemens Subsea advises that one mate should be performed with a Plug connector to provide sufficient coverage. (If no plugs are available contact Siemens Energy Subsea Connectors for TD01 oil)
- The protective cap, Figure comes with a silica sachet to prevent trapped moisture from corroding the pin tips. However, both the inside of the receptacle shroud and inside of cap should be clean and dry before fitting the cap as trapped moisture around the pin contact area could result in corrosion over the long term.
- Remove the silica sachet and discard
- Rinse the bore of the cap with Isopropyl Alcohol (IPA absolute alcohol 100%) and allow to completely dry.
- Ensure there is pooling of IPA or water within the cap. Compressed air can be used to disperse any pooled fluid.
- Insert the new Silica sachet (0.5g, 35x20mm sachet) into the cap.
- Insert protective cap into receptacle shroud, ensuring silica sachet is not trapped between shroud and cap.



Figure 52 – Receptacle Protective Cap

8.2 Product maintenance (skilled persons)

8.2.1 Removal of Marine Growth and Calcareous Deposits

Warning. Risk of minor personal injury to persons with sensitivities to a solution of 50% Citric Acid.

- Wear appropriate hand and eye protection when handling.

Caution. Risk of material damage.

- Only use 50% Citric Acid during cleaning. Other acid cleaners, such as 50% Acetic Acid, should not be used as they may cause deterioration of the elastomeric materials.
- Chiselling and abrasive methods are not recommended.
- Water jetting in air should be avoided to minimise probability of damage to the connector. However, use of a water jet is acceptable, provided that the jet is never directed into the shuttle pins at the front of the plug, or into the bore of the receptacle.
- Rinse the connector with fresh water thoroughly after any cleaning operation

After retrieval, Siemens Energy recommend that the connector is cleaned of marine and calcareous growth.

To remove calcite growth from Siemens Energy Subsea connectors, a solution of 50% Citric Acid is recommended. Figure shows locations which should be avoided for power washing removal of calcite growth.

It is recommended the solution is introduced through the flushing port adaptor (as per Figure) to provide maximum saturation within the Plug/Receptacle annulus. Other cavities on the receptacle shroud can be utilised to introduce the solution dependant on access.

All seawater exposed elastomeric and polymeric materials in Siemens Energy connectors have been tested against 50% Citric Acid and are suitable for intermittent exposure during cleaning operations through the life of the connector.

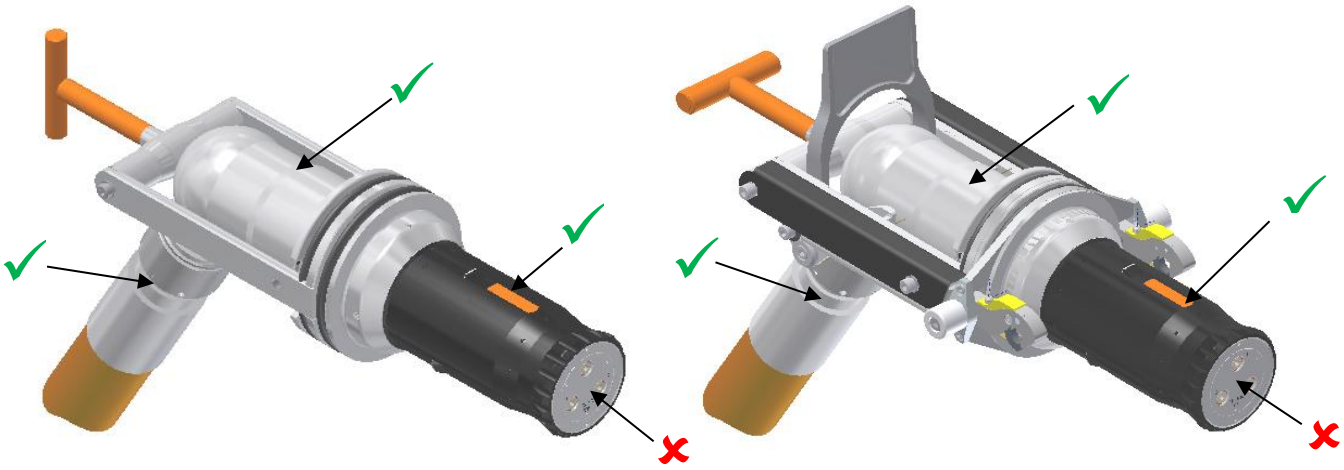


Figure 53 - SpecTRON 8 Plug Power Washing Locations

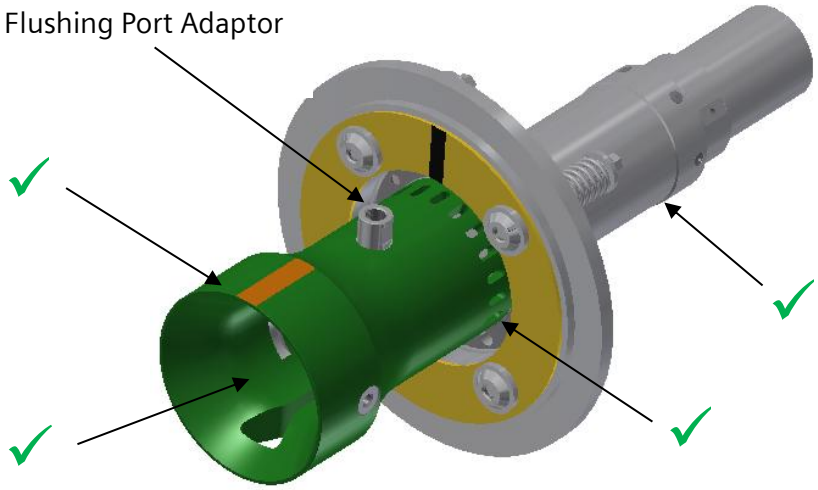


Figure 54 - SpecTRON 8 Receptacle Power Washing Locations

8.2.2 Receptacle Flushing Port

Caution. Risk of material damage.

- Only use 50% Citric Acid during cleaning. Other acid cleaners, such as 50% Acetic Acid, should not be used as they may cause deterioration of the elastomeric materials.
- Maximum injection pressure is 0,5 bar

Warning. Risk of injury

- Injection of 50% Citric Acid into the plug/receptacle interface should be performed with the connector immersed in water, or suitable splash/spray protection around the connector.
- Wear eye protection if the operation is performed topside
- Wear appropriate hand protection when handling connectors after separation
- Maximum injection pressure is 0,5 bar

The SpecTRON 8 receptacle flushing port can be connected to a subsea hot stab or topside equipment to allow chemical injection directly at the plug/receptacle interface to remove calcareous growth. The flushing port adaptor (shown in Figure) has a G 3/8-19 (3/8" BSP-P) interface. This interface can be configured to allow injection in several scenarios, as described below:

- Connected to a flexible pipe and a hot stab to allow use subsea on modules which are difficult to retrieve, e.g., Subsea Umbilical Termination Assembly (SUTA) connectors, improving resilience to subsea calcareous growth
- Blocked off with a suitable bung to protect threads from marine and calcareous growth, to allow use after retrieval to simplify separation of connectors on modules which are designed for retrieval.
- Left open, if not intended for use, or if cleaning the interface after retrieval is possible.

In any of these scenarios, 50% citric acid can then be injected into the interface, at a maximum pressure of 0,5 bar. A volume of 500 ml to 1 litre will fully flush the annulus between the plug and receptacle. If the connectors do not release after one application, the process can be repeated.

9 CUSTOMER COMMENTS/FEEDBACK

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