SIEMENS energy

SpecTRON 45

Installation, Operation Manual

Document No: 10051285



siemens-energy.com

Unrestricted

Foreword

Thank you for purchasing a Siemens Energy SpecTRON 45 product. The information that follows is an overview of the protection, storage, shipment, unpacking, deployment, and maintenance instructions for SpecTRON 45 products.

Siemens Energy 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. When a page or pages of the document are revised, the number of the page(s) affected will be entered in the Page(s) Affected/Remarks column and a vertical margin line will appear against the latest amended text.

Rev	Compiled by	Approved by	Issue Date	Page(s) Affected/Remarks
01	C. Plant	N. Knight	08/10/2020	• First Issue
02	C. Plant	N. Williamson	07/01/2022	• Changed to Siemens Energy Template • Section 3 – Added definition of CMI (Common Module Interface) • Section 4.2 - Clarified misalignment capabilities • Section 4.3 – Update jumper weights in air/water and add hose coupler weights. • Section 7.3 – New section to clearly define hose routing • Section 7.8 – Added guidance on management of heat-shrink cable test terminations • Section 9.1 – Add details of connector cleaning and drying procedure
03	C. Plant	M. Earnshaw	09/01/2023	• Correct document header to show correct last issued date • Section 1.2 – Change reference from SEPS SP-1001 to IEC 61886-1. Add note that IEC 61886-1 has replaced SEPS SP-1001. • Section 4.1 – Add maximum mate/de-mate speed for wet mate pair
04	D. Yates	N. Knight	21/08/2023	• Update Section 7.7 to include additional images, instructions, and part table.
05	M. Brereton	D. O'Donnell	27/06/2025	• Update Section 8.2.2 to add CP Note
06	J. Rogers	M. Earnshaw	28/07/2025	• Section 6.2 (Unpacking) updated to capture acceptance of scuff marks arising during production.
07	T. Edwards	D. O'Donnell	17/12/2025	• Section 7.9 Add instruction about testing
08	C. Taylor	T. Edwards	30/07/2026	• Section 6.2 updated to include images and information from internal inspection quality document relating to coatings and scuffing.

Contents

1 PRODUCT SCOPE 6
1.1 Permeguard™ Wet Mate Receptacle Connector 6
1.2 Product Certification 6
1.3 Contact details 6
1.4 Product advice label 7
1.5 Product marking 8
1.6 CE label/marking 8
2 PRODUCT SAFETY 9
2.1 Action-related warnings 9
2.2 Intended use 9
2.3 General safety information 10
2.4 Related documents 13
3 ABBREVIATIONS 14
4 SPECIFICATION AND RESIDUAL HAZARDS 16
4.1 Connector General Specification 16
4.2 Misalignment capability of wet mate connectors 17
4.3 Hose Specifications 18
4.4 Cable Specifications 19
4.5 Other specifications 20
5 HEALTH AND ENVIRONMENTAL INFORMATION 21
5.1 Environmental, disposal and recycling 21
5.2 Personal protective equipment (PPE) 21
6 PREPARING PRODUCT FOR USE 22
6.1 Before installation 22
6.2 Unpacking 22
6.3 Safe disposal of packaging 24
6.4 Lifting 25
6.5 Installation and assembly 27
6.6 Storage and protection 32
6.7 Repackaging to prevent damage in transport 33
7 OPERATION OF PRODUCT 34
7.1 Energising Wet Mate Pair 34
7.2 Deployment 34
7.3 Hose Management and Routing 35

7.4 Hose Buoyancy Subsea 41
7.5 Umbilical Power Core Management and Termination 41
7.6 Connecting Wet Mate Pair Subsea 43
7.7 Temporary Connection of Wet Mate Pair 43
7.8 Quick Connect (Dry Mate) 49
7.9 Testing 50
7.10 Disposal of waste products 54
7.11 Quick references 54
8 USER INFORMATION 55
8.1 Normal and faulty/dangerous operation 55
8.2 Cathodic Protection 55
8.3 Troubleshooting (FAQ's) 56
9 PRODUCT MAINTENANCE 57
9.1 Connector Cleaning and Drying 57
9.2 Product maintenance (skilled persons) 59
10 CUSTOMER COMMENTS/FEEDBACK 60

Tables

Table 1 - SpecTRON 45 Product Certification 6
Table 2 - Contact Details 6
Table 3 - SpecTRON 45 Connectors General Specification 16
Table 4 – SpecTRON 45 Connector Misalignment Capability 18
Table 5 - SpecTRON 45 Hose Specifications 19
Table 6 - SpecTRON 45 Cable Specifications 19
Table 7 - Troubleshooting product contact details 56

Illustrations

Figure 1 - Product Advice Label 7
Figure 2 - Example Etching for SpecTRON 45 Products 8
Figure 3 - Example harness marking 8
Figure 4 - SpecTRON 45 Rated Current Curves 17
Figure 5 - Definition of misalignment directions 17
Figure 6 - AquaTRON hose at minimum bend radius 35
Figure 7 - Incorrectly routed AquaTRON hose 36
Figure 8 - Immediate fall in routing 36
Figure 9 - Hose kink due to immediate fall in routing and weight application 36
Figure 10 - Plate Former 37
Figure 11 - 'U' Former 37

Figure 12 - 'L' Former 38
Figure 13 - Permanent fixed 'U' former 38
Figure 14 - Minimum clamp spacing from fixed mount connector 39
Figure 15 - Clamping of hose on compliant connector 39
Figure 16 - Example of temporary hose support during SIT 39
Figure 17 - Example of support for immediate fall in hose routing 40
Figure 18 - Fabricated stand with former used for hose support 40
Figure 19 – Typical (SpecTRON 10 shown) Umbilical Receptacle Side on Termination (outside UTA) 41
Figure 20 - Umbilical clamping position 42
Figure 21 - SpecTRON 45 Test Jumper Configurations (without protective caps) 51
Figure 22 - SpecTRON 45 Test Termination Support and HV Clearances 51
Figure 23 - Disassembled receptacle protective cap 57
Figure 24 – Receptacle Components for drying and cleaning 58
Figure 25 - Receptacle pin contact area as supplied 58

1 PRODUCT SCOPE

This manual includes information on the following SpecTRON 45 connector types:

- SpecTRON 45 Jumpers
- SpecTRON 45 Wet Mate Pair
- SpecTRON 45 Common Module Interface
- SpecTRON 45 Shallow Water/Test Jumpers

1.1 Permeguard™ Wet Mate Receptacle Connector

SpecTRON 45 wet mate receptacle connectors use Siemens Energy's Permeguard™ wet mate receptacle connector to provide industry leading robustness and reliability by preventing direct seawater contact with insulation.

1.2 Product Certification

SpecTRON 45 was qualified in accordance with SEPS SP-1001, a cross-industry standard which was adopted by IEC/IEEE as 61886-1 with minor modifications. This internationally recognised standard has now superseded SEPS SP-1001. Accordingly, all documentation for SpecTRON 45 now references IEC/IEEE 61886-1.

Standard	Description
IEC/IEEE 61886-1	Power connectors, penetrators and jumper assemblies with rated voltage from 3 kV (Umax = 3,6 kV) to 30 kV (Umax = 36 kV)

Note: Self-certified via in-house testing.

Table 1 - SpecTRON 45 Product Certification

1.3 Contact details

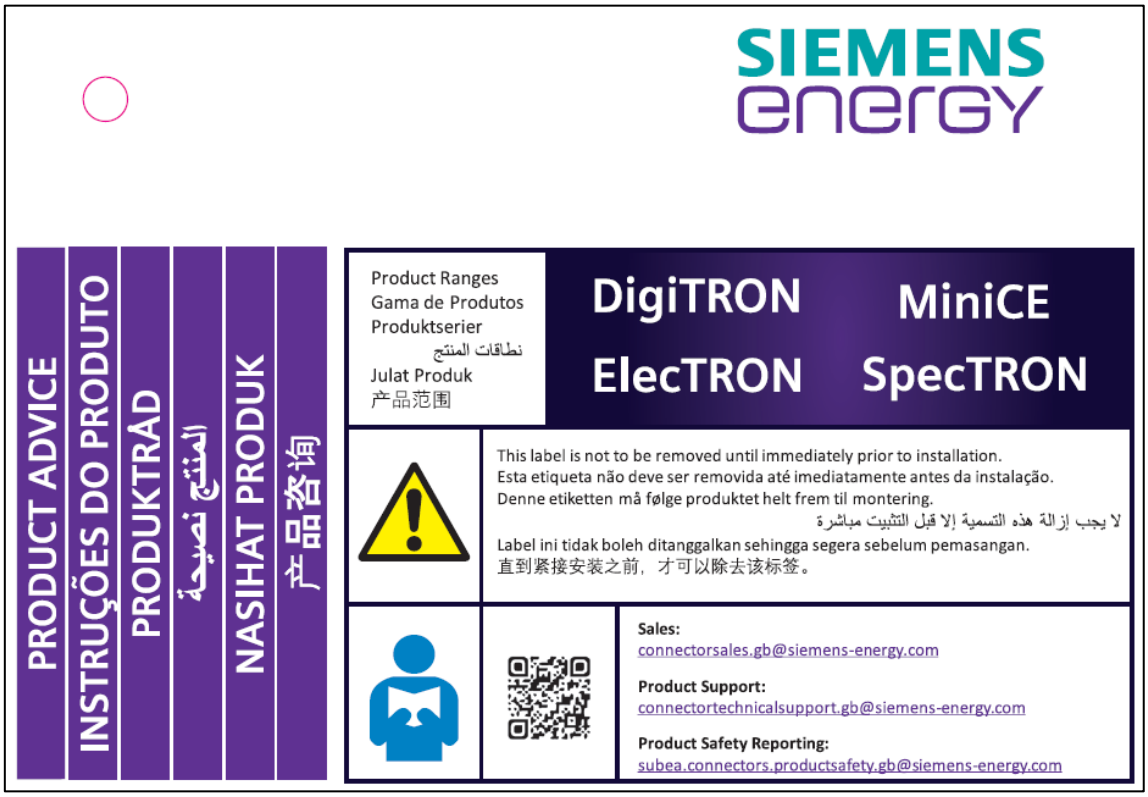
For additional information or questions regards the products visit the Siemens Energy website www.siemens-energy.com/subsea or contact the following:

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

1.4 Product advice label

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



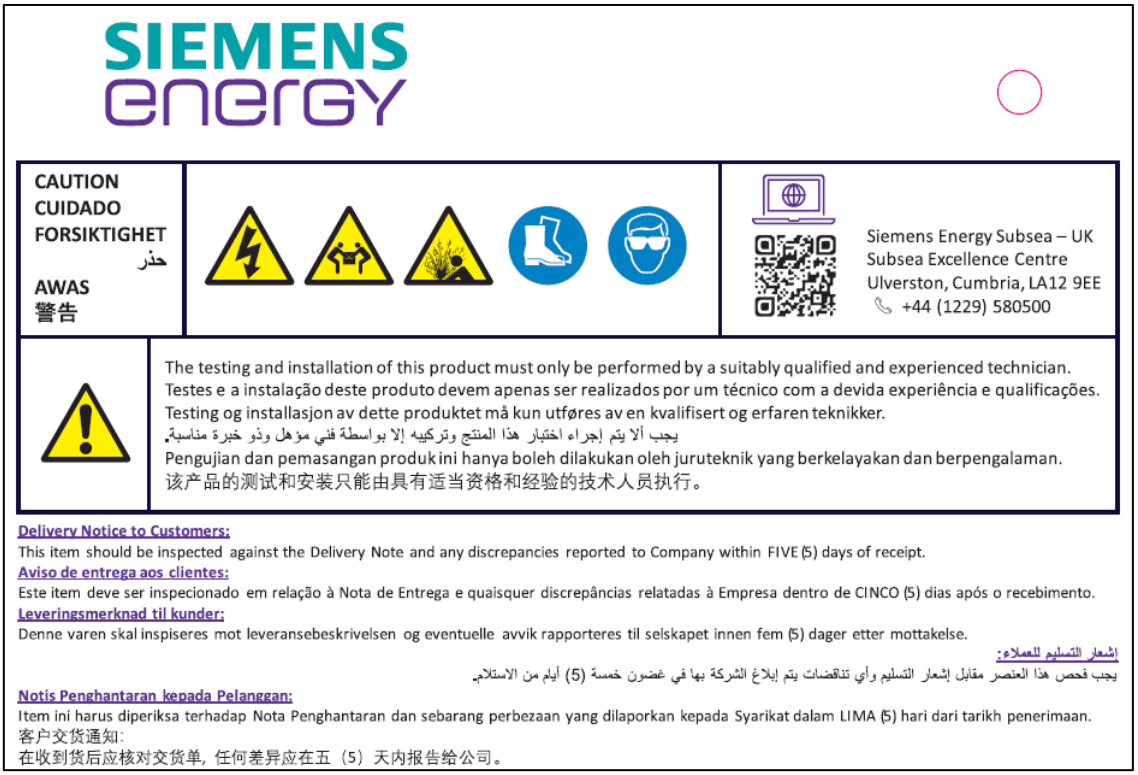


Figure 1 - Product Advice Label

1.5 Product marking

1.5.1 Connectors and Penetrators

SpecTRON 45 (c) Siemens Energy P/N: S1U10505567	S/N: 56-123456 SEPS SP-1001 26/45(52) kV -5 - 60 °C / MWD 3000 m MAWP (INT.) 10 bar
	INTENTIONALLY BLANK

Figure 2 - Example Etching for SpecTRON 45 Products

Siemens Energy SpecTRON 45 connectors and penetrators are laser marked on the gland body with the Siemens Energy 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 aid traceability during manufacturing.

1.5.2 Harnesses

Harnesses are also marked with the Siemens Energy 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

1.6 CE label/marking

SpecTRON 45 is exempt from any current requirement for CE marking. Siemens Energy continue to monitor European and International requirements for applicability to the SpecTRON 45 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 10). 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 (foreseeable misuse).

- 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.
- Communication channels and protocols are observed.



Danger! Risk of death from electric shock due to unscreened HV cables in Jumpers.

- Ensure all test procedures are followed.



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.



Danger! Risk of death from electric shock from test connectors. Live parts accessible with standard finger test, also 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 and cables unscreened.

- Ensure all connectors are assembled correctly with termination sleeves in position prior to conducting standard finger test.



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 45 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.

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 silicone or synthetic ester-based oils.

- Wear appropriate hand protection when handling products or 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.



Warning. Risk of minor personal injury and/or material or environmental damage during assembly.

- Caution shall be exercised during assembly to ensure that fittings and hydraulic/pneumatic equipment are correctly installed.

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
CMI	Common Module Interface, a penetrator which presents a common interface to a dry-mate gland, regardless of the interface to a customer module
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 45 connectors and penetrators with 630 mm², 26/45(52) kV jumper cable 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 datasheets. These are available via the Siemens Energy website http://www.siemens-energy.com/subsea or Siemens Energy Connectors Technical Support connectortechnicalsupport.gb@siemens-energy.com.

4.1 Connector General Specification

	Value	Unit
Design Life	30	years
Number of ways / phases	1	-
Maximum Water Depth	3 000	m
Maximum Differential Pressure (Penetrator)	10	bar
Operating Temperature	-5 to 20	°C
Storage Temperature	-25 to 60	°C
Number of Mates (Wet Mate Pair)	100	-
Maximum Mate/De-Mate Speed (Wet Mate)	30	mm/s
Rated Voltage	26/45(52)	kV
Rated Current	See Graph	-
Rated Frequency	5 – 200	Hz

Table 3 - SpecTRON 45 Connectors General Specification

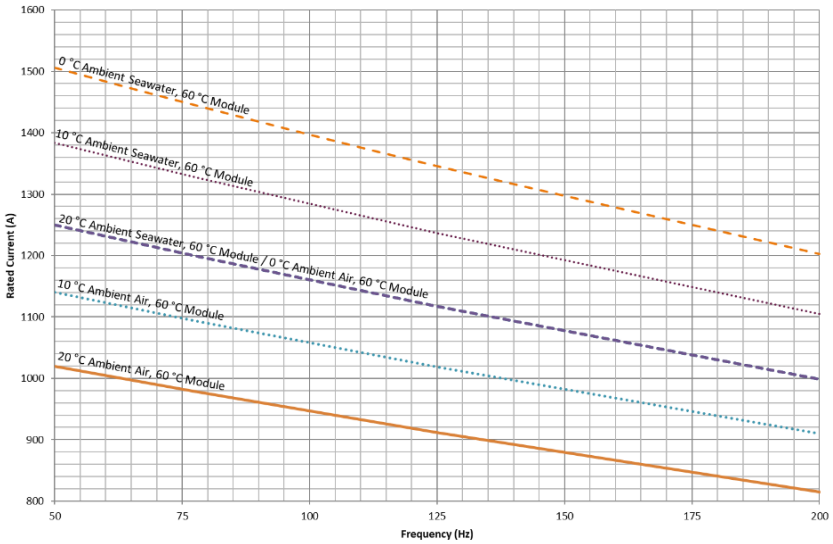


Figure 4 - SpecTRON 45 Rated Current Curves

4.2 Misalignment capability of wet mate connectors

For any wet mate pair, one connector must be rigidly mounted using a fixed mount kit, and the other half compliantly mounted. Siemens Energy Subsea offer two compliant kits which differ in the amount of compliance they offer. Allowable misalignments are defined relative to the mounting mounts in the plates in the mating/stab tool, rather than the connectors themselves. This is to simplify designing mating interfaces and remove the requirement for calculation of connector positions.

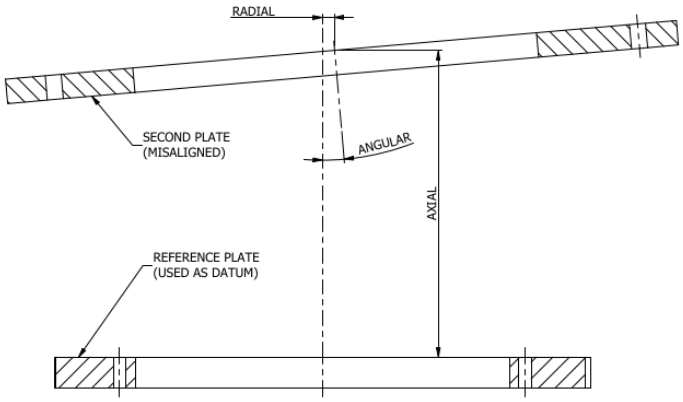


Figure 5 - Definition of misalignment directions

The radial misalignment and angular misalignment are interdependent, any increase in angular misalignment reduces the allowable radial misalignment, and vice-versa. With no angular misalignment, a standard kit offers 17,5 mm maximum radial compliance, and an extended kit offers 35 mm maximum radial compliance. This relationship is shown in the graph below.

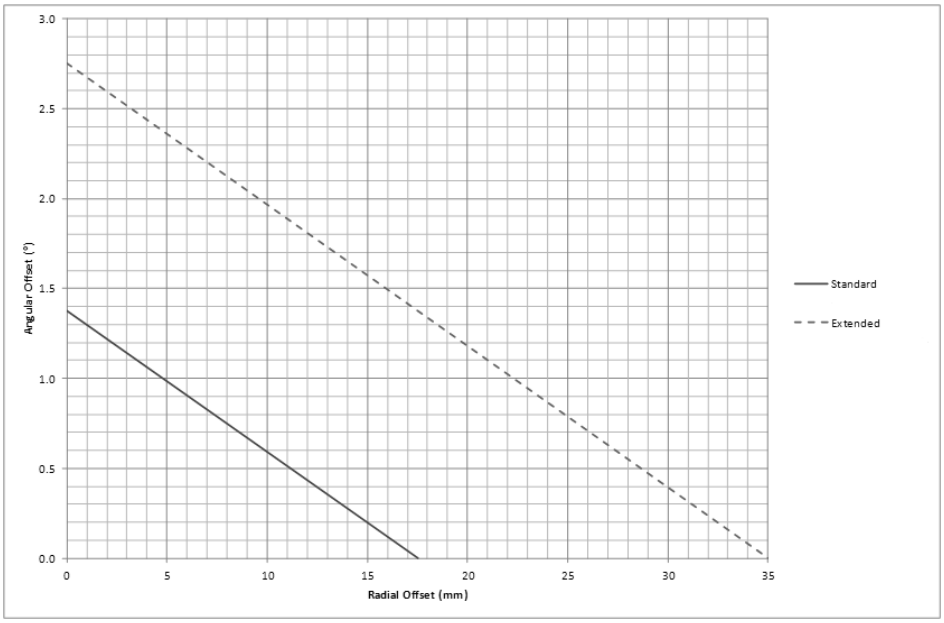


Table 4 – SpecTRON 45 Connector Misalignment Capability

The recommended design points for maximum combined misalignment for the compliant mount kits are:

- Standard Kit, 5 mm radial, 1° angular
- Extended Kit, 10 mm radial, 2° angular

Both kits offer a maximum of 10 mm allowable axial offset relative to the "ideal" position.

4.3 Hose Specifications

	AquaTRON 350	
	630 mm²	**Unit**
Outside Diameter	112,5	mm
Minimum Bend Radius	680	mm
Storage Temperature Range	-25 to +60	°C
Min. Manipulation Temperature	-25	°C
Maximum Snag Load	5	kN
Weight in air	17,0	kg/m
Weight in water	6,9	kg/m
Max Length without coupler	35	m
Hose Coupler Weight in air	6,3	kg
Hose Coupler Weight in water	5	kg

Table 5 - SpecTRON 45 Hose Specifications

4.4 Cable Specifications

	630 mm²	Unit
Outside Diameter	68	mm
Minimum Bend Radius	680	mm
Storage Temperature Range	-25 to +60	°C
Minimum Manipulation Temperature	-25	°C
Max Pull Force	5	kN
Weight in air	9,1	kg/m
Resistance @ 20 °C	0,0292	mΩ/m
Capacitance (Core to Ground)	0,41	nF/m

Table 6 - SpecTRON 45 Cable Specifications

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.

5 HEALTH AND ENVIRONMENTAL INFORMATION

5.1 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 45 products are available on request from the Product Safety Officer at subsea.connectors.productsafety.gb@siemens-energy.com.

5.2 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, silicone, or synthetic based oils.

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

6 PREPARING PRODUCT FOR USE

6.1 Before installation

SpecTRON 45 products are manufactured primarily from Super Duplex stainless steels and Inconel 625 materials, and as such are designed to withstand harsh saliferous environments. However, the connector inserts and exposed parts are susceptible to mechanical damage if not protected. Dust caps or polyethylene protective caps must be fitted to all Siemens Energy Subsea connectors before transport.

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.

Connectors can be shipped singularly or in multiples. Care should be taken to protect the connector(s) with bubble wrap or similar wrapping materials to avoid surface damage during transit. If large numbers are shipped in one consignment suitably reinforced transport box will be necessary to withstand the weight. See Figure(s) for details of transport box(es).



Figure 6 – Typical transport box for short (10m) harness

Connectors are designed to withstand vibration that occurs during transportation and to withstand being dropped from a height of 1 metre whilst in packaging.

6.2 Unpacking

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 mating
- On removal do not allow the hoses to drag over the edges of a transport box.

Remove wrapping material taking care to inspect for any surface damage or separately packed installation or spares kits which may have become separated from a connector.

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

6.2.1 Protective caps

All connectors come supplied with a protective cap. Protective caps (typically white in colour) are typically attached to the products as shown in the images below, with the caps indicated with a red arrow.

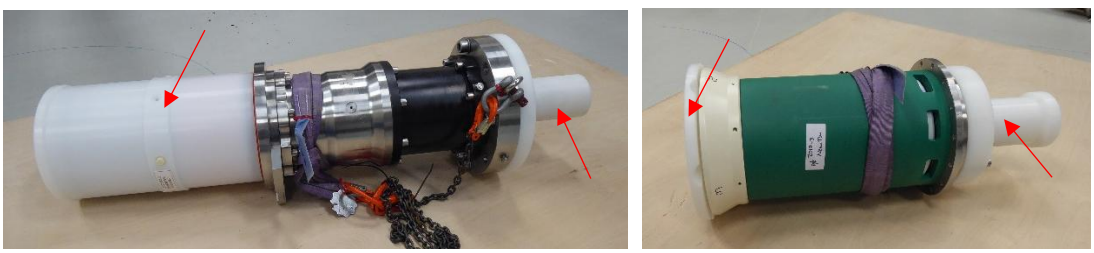




Figure 8 – Protective Caps on SpecTRON 45

The modules below use disposable screws to attach the caps to the connector:

- Shallow Water Gland (M12 Screws)
- Umbilical Gland (M12 Screws)
- Jumper Gland (M12 Screws)
- Wet Mate Plug and Receptacle (Gland Interface, M12 Screws)
- Common Module Interface/Penetrator (M12 and/or customer specific screws)

For the front-end of the wet mate connectors, the caps use plastic screws which engage with the groove on the plug and the flushing holes on the receptacle.

6.3 Safe disposal of packaging

Dispose of the packaging correctly, observing and complying with area, regional, national and 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.

6.4 Lifting

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

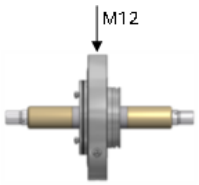
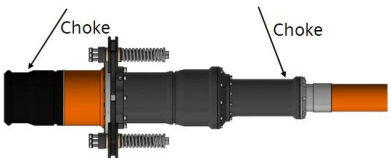
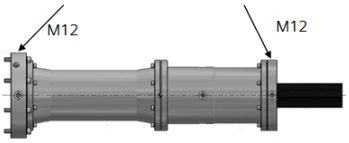
- Connectors must only be lifted at the locations specified below.
- Never use the cable or hose to lift or support a connector gland.
- All lifting operations should be performed by suitably qualified personnel, in accordance with applicable regulations where and when the lift is performed.

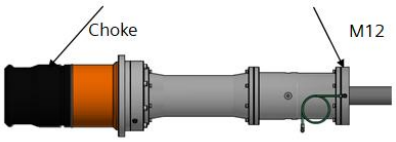
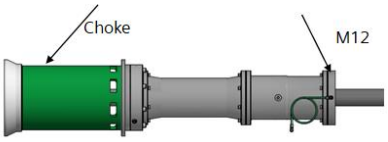
The table below shows the most common modules in the SpecTRON 45 product range and their most appropriate lifting points. It is intended as a guide to correct lifting locations and to aide specification of correct lifting equipment (e.g. lifting eyes, and slings) and is not a replacement for a well-designed lifting plan.

Where a single lifting point is specified the centre of gravity is below the lifting point, and where two or more lifting points are specified, the centre of gravity is between the two points at a location which may vary depending on the project specific configuration of the product.

For assemblies which consist of multiple modules from the table below, use the two outer lifting points to ensure the centre of gravity is within the lifting points.

For more detailed lifting information or guidance, contact Siemens Energy technical support (connectortechnicalsupport.gb@siemens-energy.com).

Module Name	Mass (kg) (in air)	Slinging	Comments/Notes
10" Compact Flange Common Module Interface	49		
Receptacle and Jumper Gland	160		
Plug and Jumper Gland	178		Ensure choke is on narrow band of plug nose
Receptacle and Umbilical Gland	200		
Shallow Water Gland with Dry-Mate	85		

Shallow Water Gland with Plug	175		Ensure choke is on narrow band of plug nose
Shallow Water Gland with Receptacle	157		
Cable & Hose		Support with soft sling every 5 m maximum	

6.5 Installation and assembly

The compliant and fixed mounts for the SpecTRON 45 are shipped in the same packaging as the connectors but are not assembled to the connector.

The connectors need to be routed to their final installation position before the mounting kit is used to mount the connector to the module panel or mating head. There is no requirement for alignment between the connector and the module panel/mating head as the compliant and fixed mount can be attached in any possible alignment using the 15-bolt pattern to avoid rotational strain in the jumper.

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

- Only use fasteners and equipment provided by Siemens as part of installation kit
- Connectors must only be lifted at the locations specified previously
- 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.
- Do not remove the lifting equipment supporting the connector until the mounting is fully assembled, including torquing.

6.5.1 Compliant Mount (Standard and Extended) Assembly

To assemble the compliant mount onto the connector:

1. Verify the correct spacing of the compliant mount points against Siemens drawing 00029936, ensuring that the hole pattern used matches the compliant mount kit supplied.

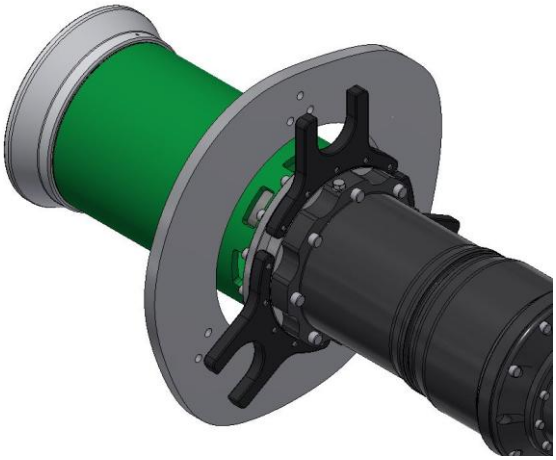
2. Route the connector through the module and to the mounting point



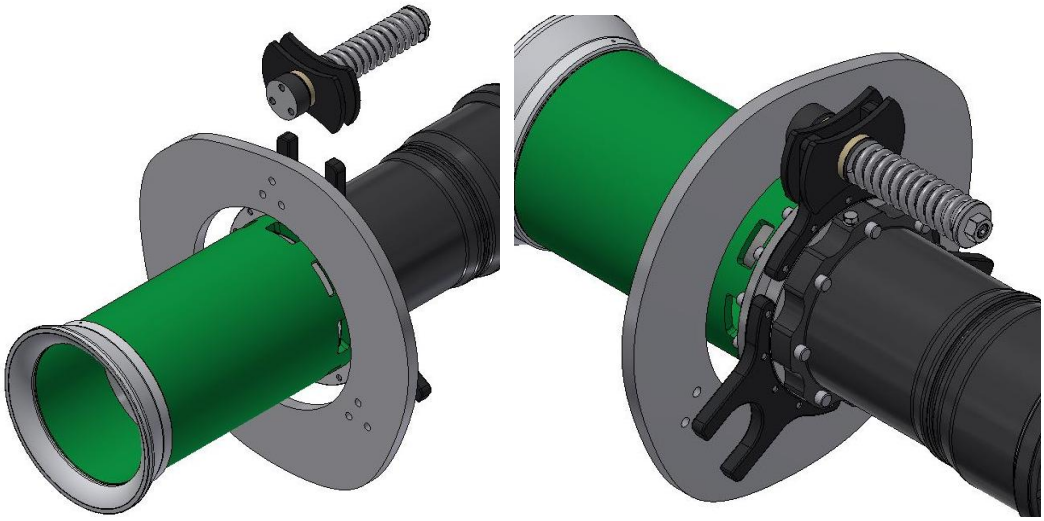
3. Attach the compliant mount arms to the connector using the M10 screws and the M10 Nord-Lock washers. Tighten to a torque of 60 Nm.



4. Bring the connector with the arms to the plate.



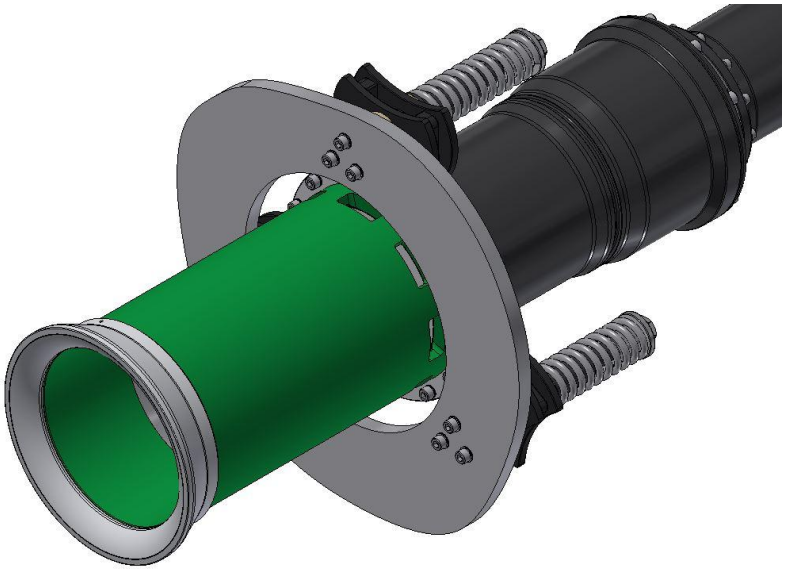
5. Thread the bobbins onto the arms



6. Secure the bobbins to the mounting plate using 3 socket head cap screws and M12 Nord-Lock washers, tighten to a torque of 100 Nm.



7. Verify that all fasteners are correctly tightened.



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

- The connector will drop to the lowest position possible when the lifting equipment and support is removed, this is intended behaviour of the compliant mount.
- Ensure all fasteners are properly tightened before removing any lifting equipment or supports.
- Remove the lifting equipment and supports slowly to ensure that there is no sudden movement of the connector.

8. Verify that the connector, hose and compliant mount are properly assembled and that they can move freely within the mating head.

6.5.2 Fixed Mount Assembly

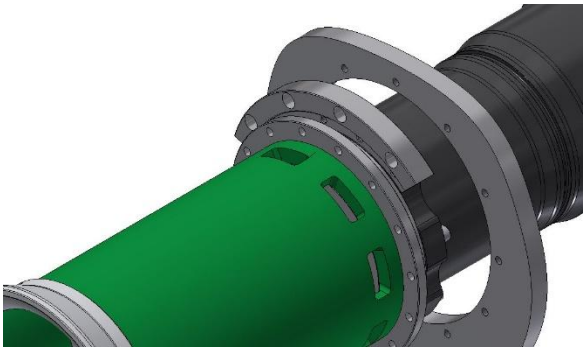
To assemble the fixed mount onto the connector:

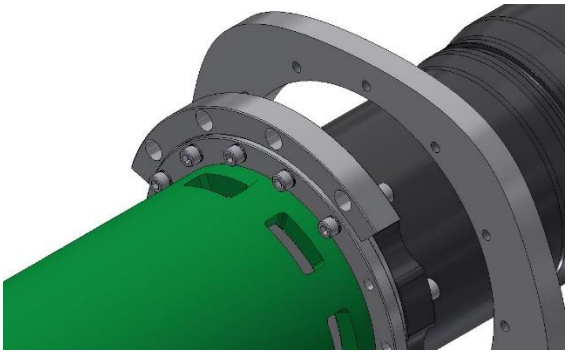
1. Verify the correct spacing of the fixed mount points against Siemens drawing 00029937.

2. Route the connector through the module and to the mounting point

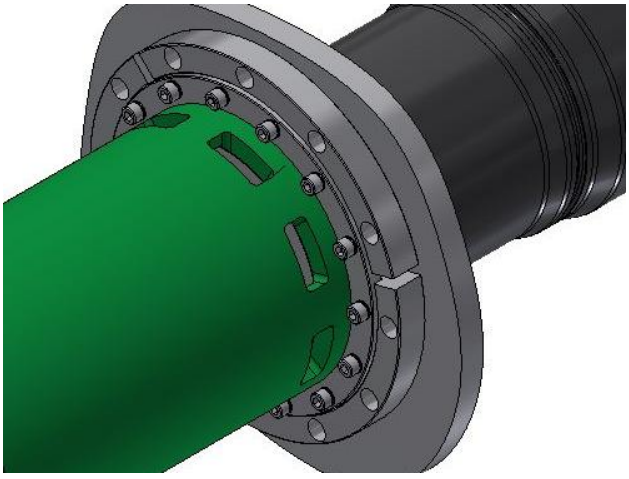


3. Align the fixed mount segments with the connector flange and attach the fixed mount segments to the connector flange using 5 x M10 screws and Nord-Lock washers. Tighten to a torque of 60 Nm.

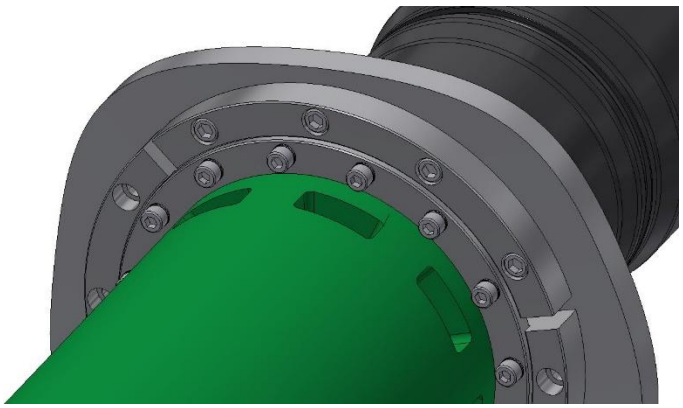




4. Repeat for all three segments and lower the connector back onto the mounting face.



5. Attach the fixed mount flanges to the mounting face with 12 x M12 screws and Nord-Lock washers, tighten to a torque of 100 Nm.



6. Verify that all fasteners are correctly tightened before slowly releasing any supports and/or lifting equipment.

6.6 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 a protective cap ensure that the pin and cap are completely dry (see section 6.6.3)
- 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.

6.6.1 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.

6.6.2 Long 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.

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.

6.6.3 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.

6.6.4 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 28 days 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.

Plugs can be stored subsea indefinitely without any protection, however Siemens Energy offer parking receptacles and protective caps which can minimise marine growth and contamination.

6.7 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.

7 OPERATION OF PRODUCT

7.1 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 discharge 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 discharge 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 45 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 45, Siemens 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.

7.2 Deployment



Caution. Risk of material damage.

- The maximum deployment rate for SpecTRON 45 connectors is 20 bar/minute.

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

7.3 Hose Management and Routing

Caution. Risk of material damage.

- The maximum unsupported hose length in water during ROV operations for SpecTRON 45 harnesses (single and bundled) using AquaTRON 350 hose and 630 mm² cable is 50 m
- Maximum unsupported horizontal hose length in air and water for SpecTRON 45 harnesses is 2m
- Maximum unsupported vertical hose length in air and water for SpecTRON 45 harnesses is 5m
- Hose should be routed in a manner to avoid bending beyond the MBR under any circumstances. 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.

The weight of hose in air will vary from that in water (refer to section 4.3 for weights in air and water). Topside the weights can be significantly different to the weight in water and efforts should be made to avoid application of excessive weight to avoid exceeding the MBR or causing kinking. We recommend that the maximum unsupported hose length in air is 2 meters. At bends the cable must be supported at tangents to maintain the MBR around the bend.



Figure 9 - AquaTRON hose at minimum bend radius

The hose is resistant to bending/ kinking however application of snag force due to unsuitable routing (ignoring hose MBR) or application of force due to unsupported hose weight may cause damage to the conductors or terminations and efforts should be made to avoid this during all applications topside or in water.



Figure 10 - Incorrectly routed AquaTRON hose

Particular efforts should be made to support the hose where it exits the rear of the connector, particularly if the hose is to be routed immediately in an orientation contradictory to the connector (e.g. immediate fall in routing – see Figures below).

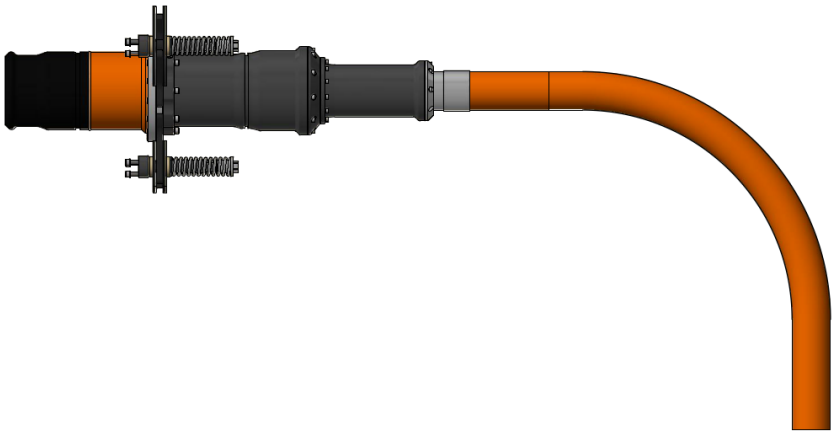


Figure 11 - Immediate fall in routing

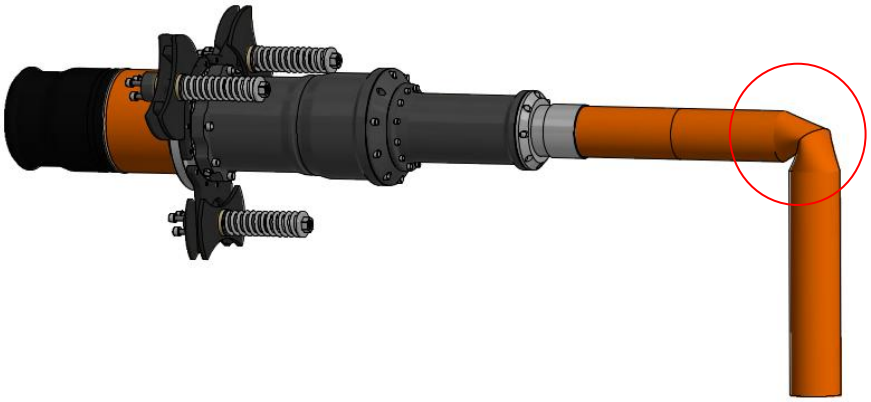


Figure 12 - Hose kink due to immediate fall in routing and weight application

Siemens recommends the use of "formers" to avoid exceeding the MBR of the hose when exiting the connector or passing over acute angled surfaces (through or around structures).

7.3.1 Recommend Hose Former Designs

Detailed below are some recommended shapes of former that may be utilised to aid routing of hose during SIT or structure routing (deployment).

RECOMENDED FORMER DESIGNS

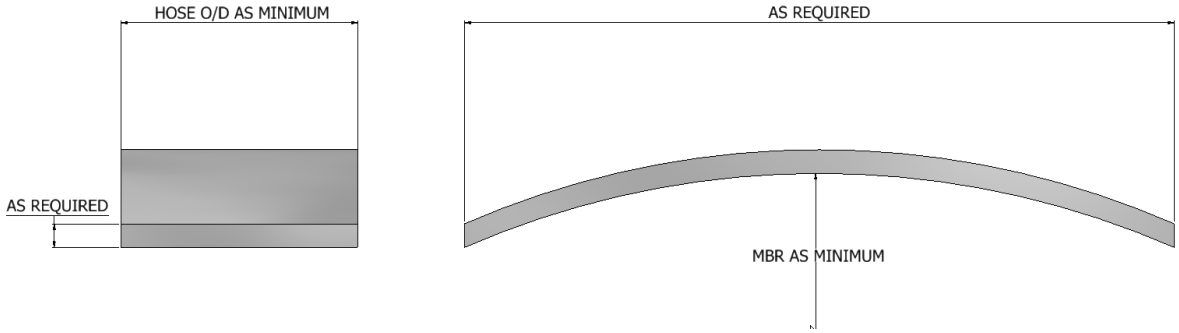


Figure 13 - Plate Former

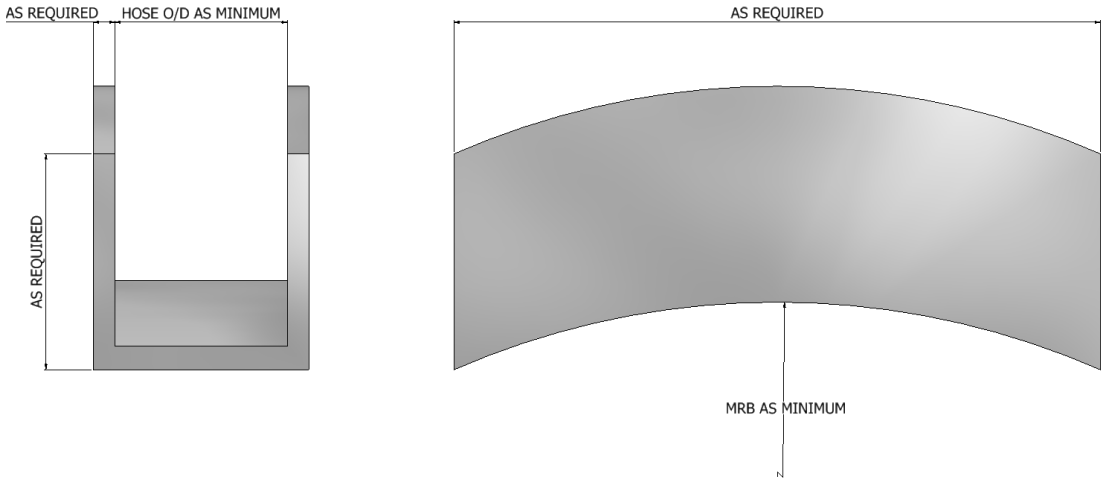


Figure 14 - 'U' Former

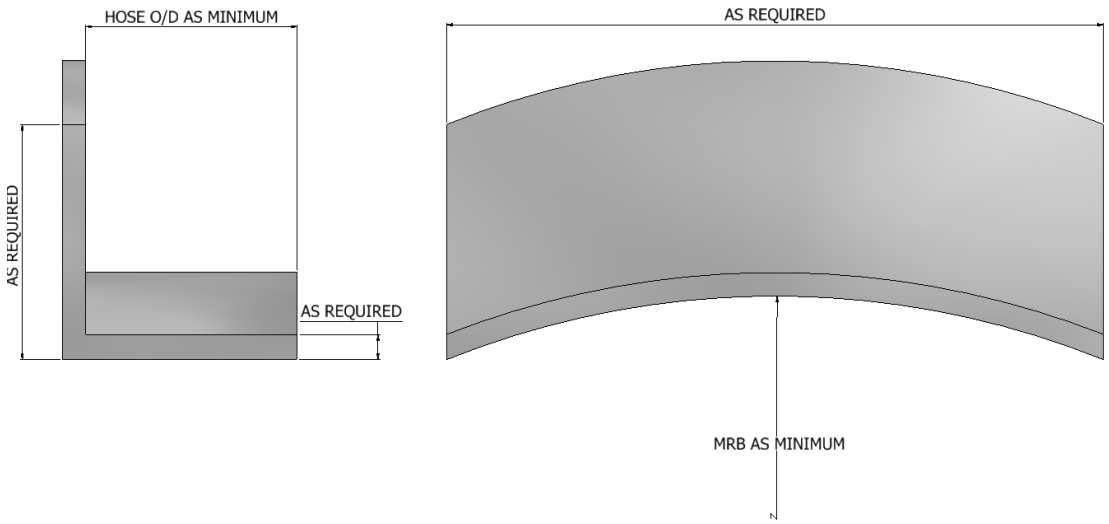


Figure 15 - 'L' Former

7.3.2 Fixed Installations

Routing

To aid routing of hose within MBR and support free hanging hose greater than 5m, formers can be produced to Siemens recommended design (See section 7.2.1) or to client specific design, and permanently fixed to the client's structure via welding or bolt pattern.

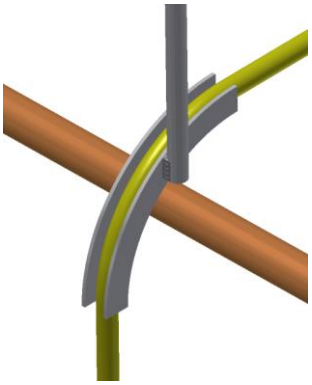


Figure 16 - Permanent fixed 'U' former

Clamping

Siemens Energy recommends that plastic clamps with elastomer insert are used to secure the hose (such as a Stauff pipe clamps with the correct inside diameter, refer to section 4.3 for hose diameters).

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 18 is utilised to take up the potential movement of the connector. The hose should not be clamped any closer than 1 000 mm measured along the

length of the hose to the start of the hose adaptor on a compliant mount connector and 250 mm for a fixed mount connector or penetrator as shown below.

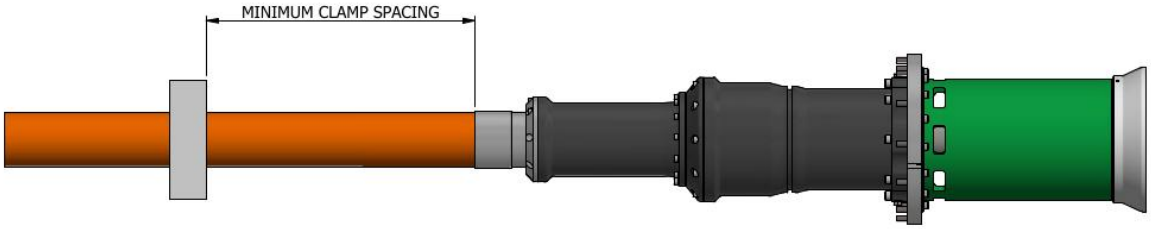


Figure 17 - Minimum clamp spacing from fixed mount connector

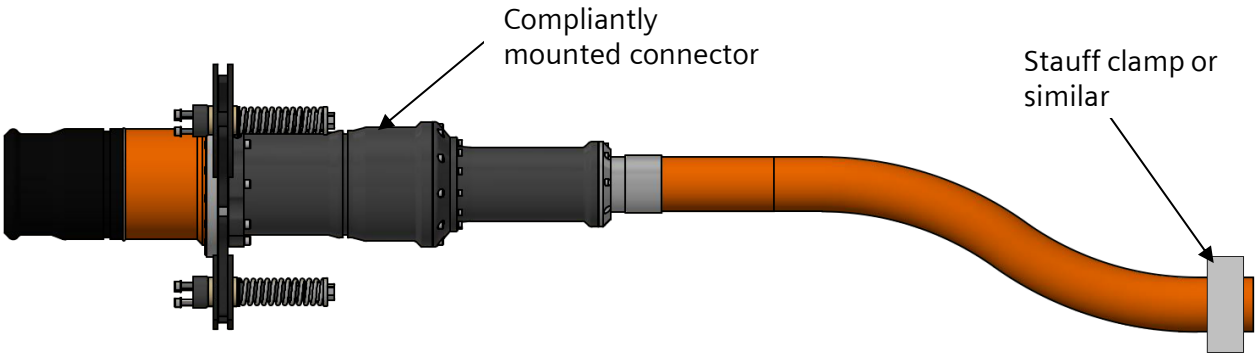


Figure 18 - Clamping of hose on compliant connector

7.3.3 Dynamic Installation (SIT Layout)

To aid the support of hose during SIT, formers can be produced to Siemens recommended design (See section 7.3.1) or to client specific design, and temporarily fixed to the client's structures via the use of tie wraps or clamps.

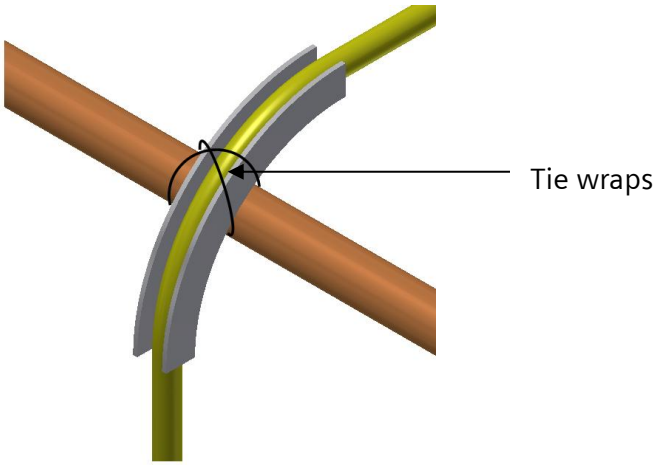


Figure 19 - Example of temporary hose support during SIT

The maximum recommended vertical length of hose which can be unsupported (hang) in air is 5 meters, however the MBR of the hose must still be observed at the hose exit of a connector or change from horizontal to vertical orientation before allowing 5m of hose to hang freely.

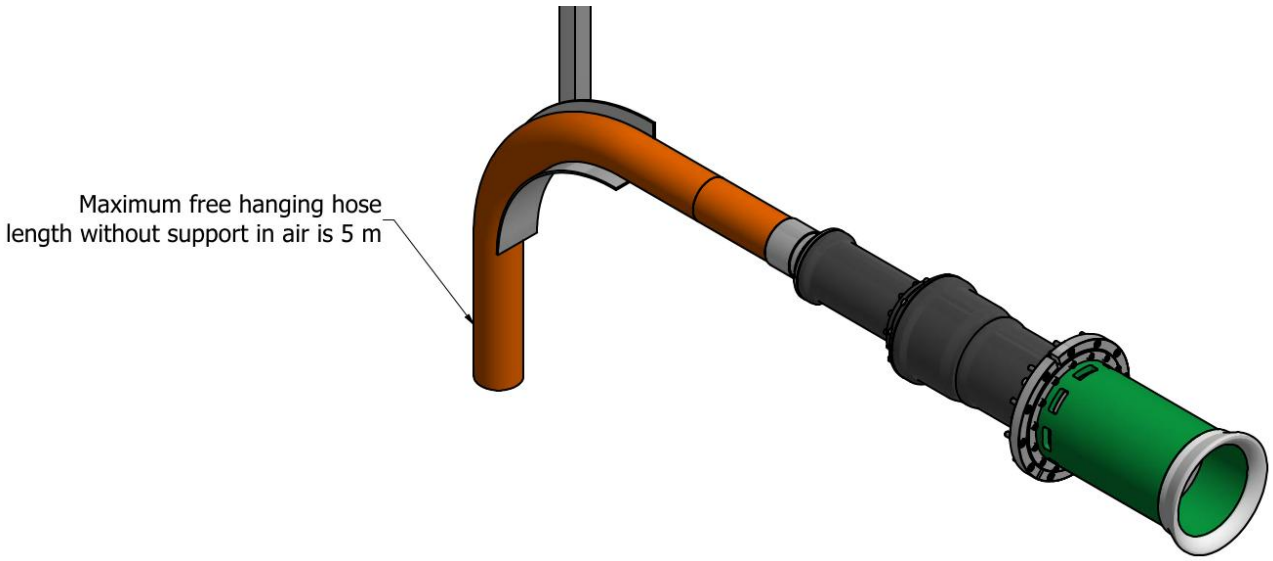


Figure 20 - Example of support for immediate fall in hose routing

Figure 20 shows an example of an immediate fall in routing from an inline plug. The image shows how the hose may be supported using formers mounted to the customer's structure. If a system like Figure 20 is to be used, then Siemens Technical must be consulted to assess the impact on the connectors and their terminations.

During SIT the hose termination has significant weight (refer to section 4.3 for hose weights) and efforts should be made to avoid hanging of this weight from the connector termination itself. This could also be combated by providing a temporary elevated floor for SIT via the use equipment such as scaffolding, scissor lifts and ladders etc or alternatively a fabricated stand with a former attached. See Figure 21.

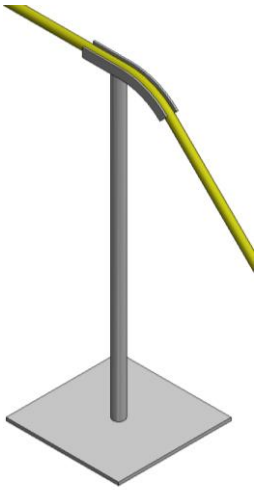


Figure 21 - Fabricated stand with former used for hose support

7.4 Hose Buoyancy Subsea

SpecTRON 45 electrical flying leads (harnesses) under or equal to 60m require no buoyancy aids for subsea deployment.

SpecTRON 45 electrical flying leads over 60m require buoyancy aids suitable to support 6,9 kg (see section 4.3) per metre length in excess of 60m. For example, an 80 metre EFL requires buoyancy aids to cover 20 metres of additional hose weight which is 138 kg (20 * 6.9 = 138 kg).

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.

7.5 Umbilical Power Core Management and Termination

7.5.1 Routing

For site terminated and factory terminated umbilical connectors service loops should be planned into an umbilical termination assembly to give enough length for re-termination (site terminated connectors) or re-splicing (factory terminated connectors) purposes and to facilitate the termination of the umbilical receptacle outside of the UTA.

If it is not possible to provide a service loop are not possible then overlength should be provided in the power core routing. A minimum length of 0,5 metres is required for re-termination of site terminated connectors, in addition to the length required to manoeuvre the connector outside the UTA structure. For splices on factory terminated connectors, please refer to umbilical provider guidance.

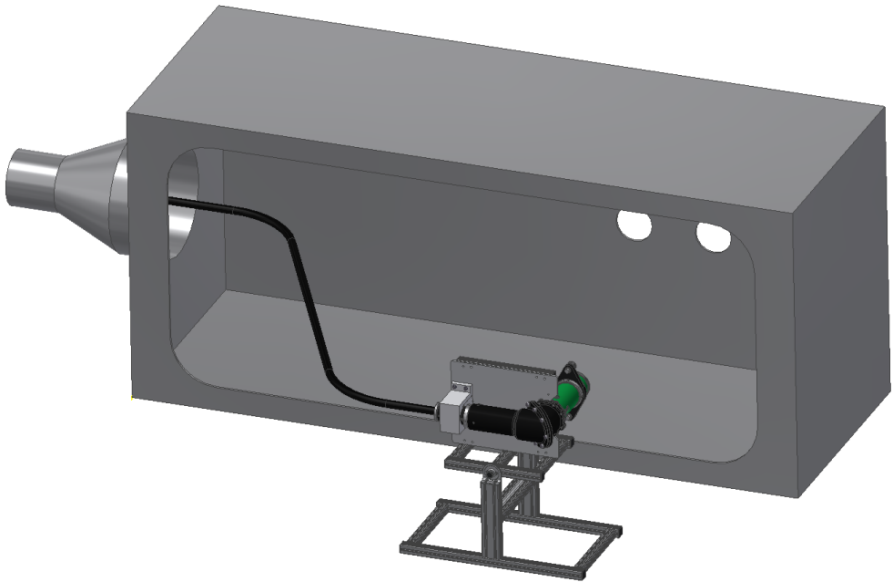


Figure 22 – Typical (SpecTRON 10 shown) Umbilical Receptacle Side on Termination (outside UTA)

7.5.2 Clamping

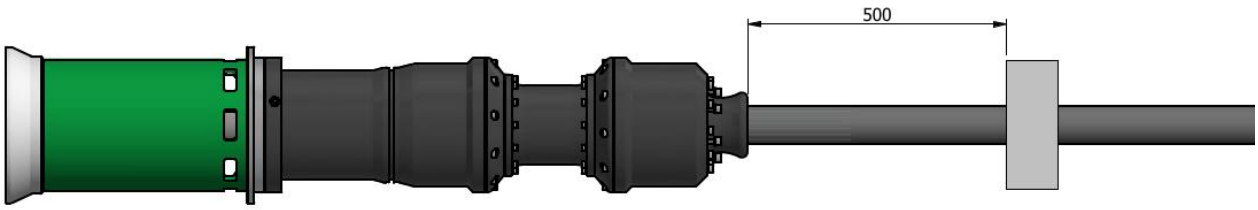


Figure 23 - Umbilical clamping position

Umbilical cable can be clamped at a minimum of 500 mm in line with the axis of the connector to aid with routing and support.

7.6 Connecting Wet Mate Pair Subsea

Caution. Risk of material damage.

- Any mating equipment used to mate the SpecTRON 45 must be designed in accordance with the misalignment and interface guidance provided by Siemens Energy Subsea to avoid damage to the connector pair.

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

- Any mating equipment used to mate the SpecTRON 45 connector pairs should be in compliance with applicable standards and regulations for machinery.

The SpecTRON 45 wet mate pair cannot be mated subsea without specialised mating and locking equipment (mating tool). The maximum mate/de-mate speed for the SpecTRON 45 connector is 30 mm/s.

7.7 Temporary Connection of Wet Mate Pair

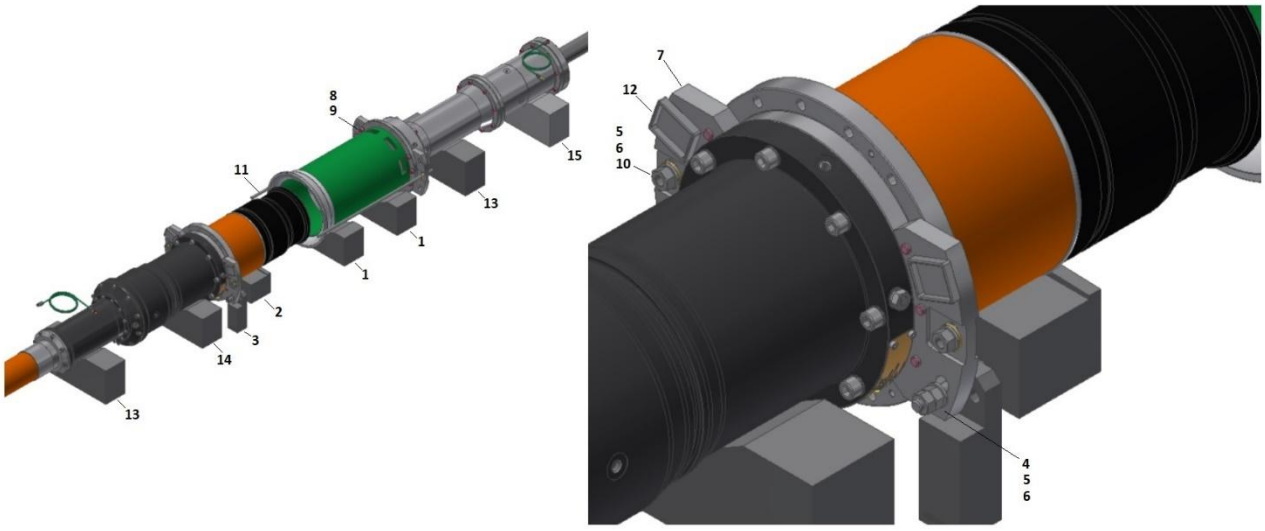
Warning. Risk of musculoskeletal injury from mating heavy connectors

- Connectors should always be moved using appropriate lifting equipment and methods
- During mating of the connectors, the hose and cable should be supported so that they do not induce unforeseen movement or strain in the connectors.
- Only use equipment and procedures specified by Siemens.

For connection of a wet mate pair in a test or workshop environment without a separate subsea mating tool, Siemens offer a mating kit (S1U10509597). The kit allows the connectors to be mated using simple tooling in a safe manner using standard bar clamps (e.g. Irwin Quick-Grip, 600 mm clamping length) which can be purchased separately. The kit can be used to mate the following.

- Wet mate plug jumper to test receptacle harness.
- Wet mate receptacle jumper to test plug harness.

The assembly sequence and image that follow show the mating and de-mating of a wet mate plug jumper to test receptacle harness.



Parts List for Mating Kit S1U10509597			
Item No.	Part No.	Description	Qty
1	S1U10513807	Receptacle Shroud Vee Block	2
2	S1U10513809	Plug Support Block	1
3	S1U10513810	Alignment Block	2
4	GB9:SC-M1270	M12 x 70 Cap Screw	2
5	GB9:WS-M12	M12 Plain Washer	8
6	GB9:NT-M12	M12 Nut	10
7	S1U10513813	Retaining Lug	4
8	GB9:SC-M1035	M10 x 35 Cap Screw	12
9	GB9:WS-M10	M10 Plain Washer	6
10	S1U10513814	Isolation Sleeve	4
11	S1U10513815	M12 x 600 Stud Bar	2
12	E1A3610936	Quick Grip Adaptors	4
13	S1U10513808	Gland Vee Block	2
14	S1U10513811	Jumper Gland Vee Block	1
15	E1A3628528	Test Gland Vee Block	1

7.7.1 Mating the connectors

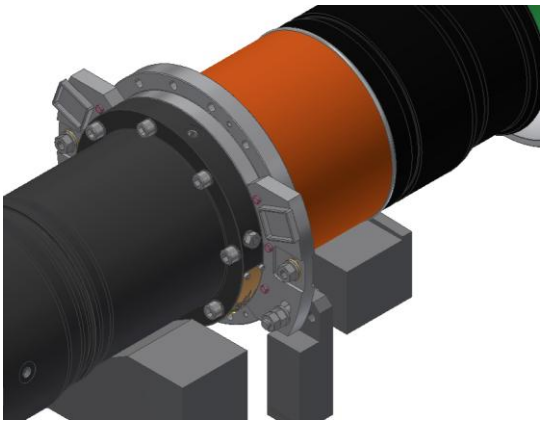
1. Attach 2-off retaining lugs (7) to the wet mate plug harness using 6-off M10 x 35 Cap Heads (8).



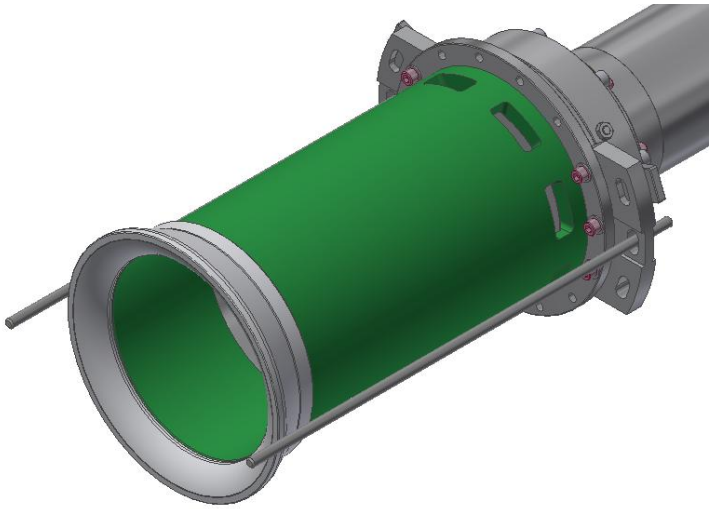
2. Lift wet mate plug jumper and position vee blocks (13 & 14) and plug support block (2) as indicated before carefully lowering the wet mate plug jumper onto them.



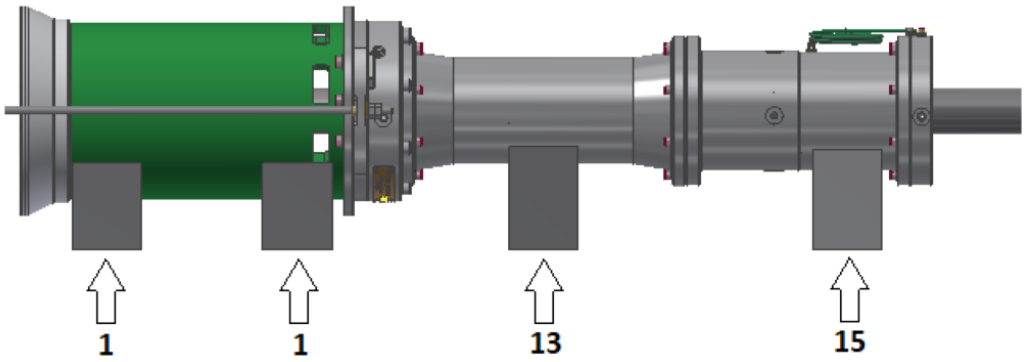
3. Attach 2-off alignment blocks (3) to the retaining lugs (7) of the wet mate plug using 2-off M12 x 70 Cap Heads (4), 2-off M12 plain washers (5) and 4-off M12 nuts (6). Fit 2-off quick grip adaptors (12) to the upper most slots in the retaining lugs (7).



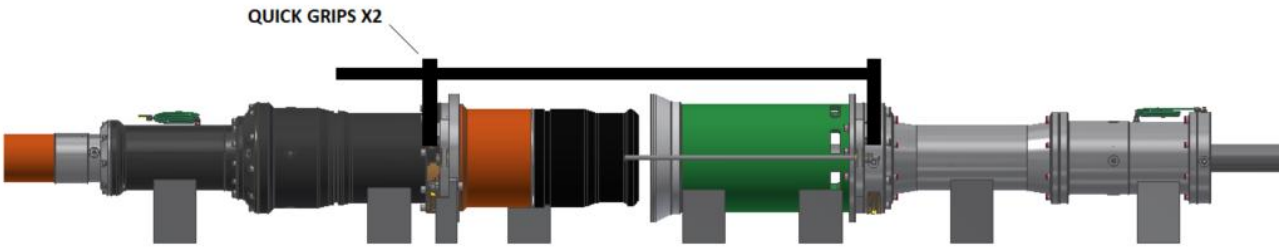
4. Attach 2-off retaining lugs (7) to the test receptacle harness using 6-off M10 x 35 Cap Heads (8). Fit 2- off M12 x 600 stud bars (11) and 2-off isolation sleeves (10) using 2-off M12 plain washers (5) and 4-off M12 nuts (6).



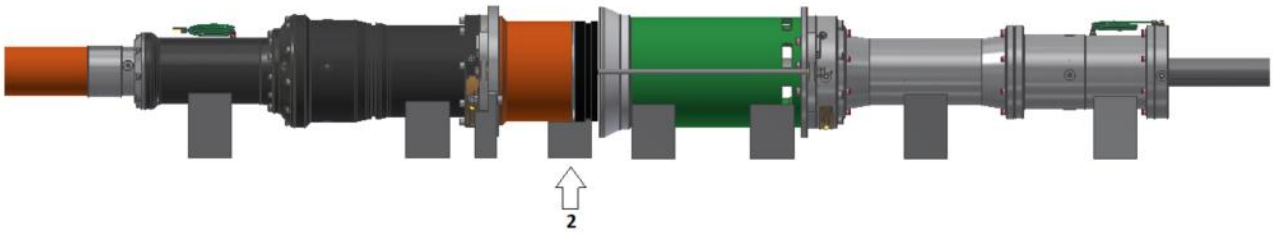
5. Lift test receptacle harness and position vee blocks (1 (2-off), 13, 15) as indicated before carefully lowering the test receptacle harness onto them.



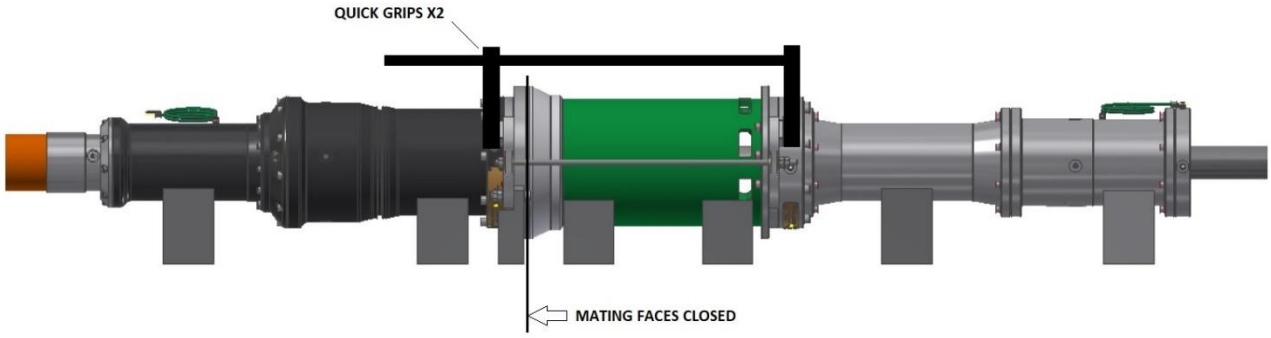
6. Align the two connector halves and position close together before using the 2-off quick grip clamps to drive the two connector halves together.



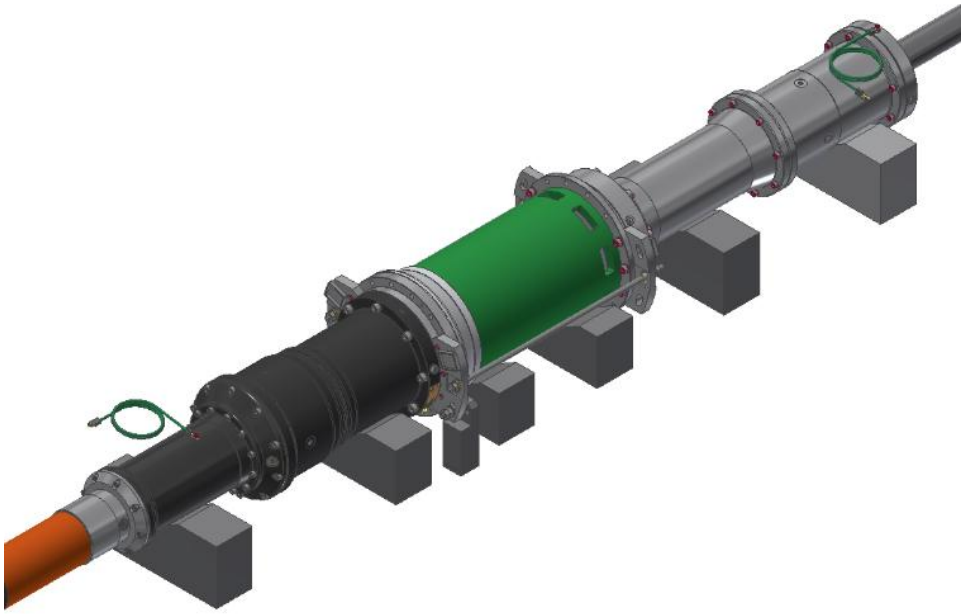
7. When the wet mate plug has entered the test receptacle shroud remove the plug support block (2).



8. Continue to use the 2-off quick grip clamps to draw the connectors together until the mating faces close.

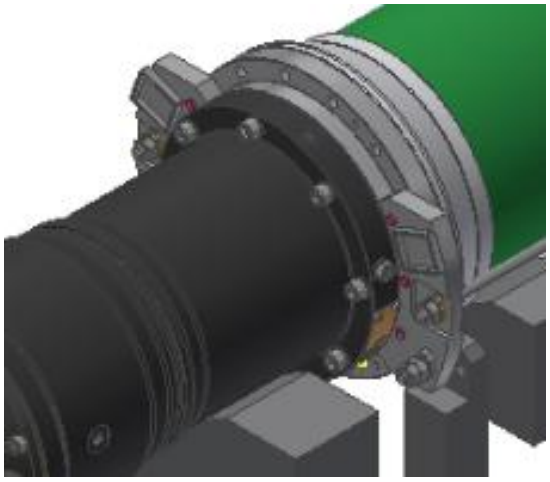


9. Fit 2-off isolation sleeves (10) over the M12 x 600 studded bar (11) that is protruding through the holes in the retaining lugs (7) on the wet mate plug and secure the connectors by fitting 2-off M12 plain washers (5) and 2-off M12 nuts (6). Remove the two quick grip clamps.

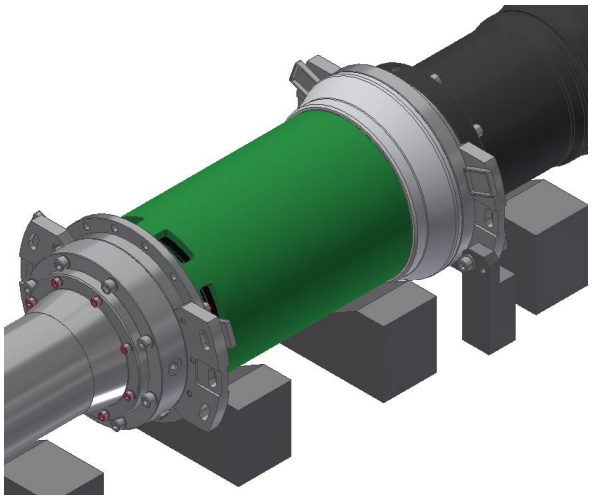


7.7.2 De-mating the connectors

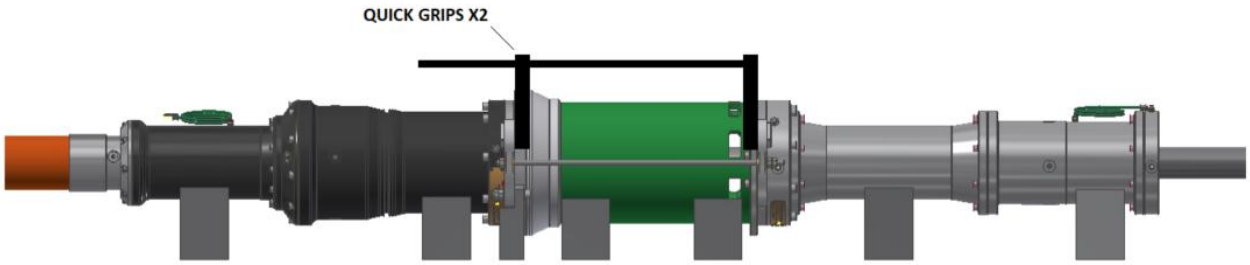
1. Slowly remove the 2-off M12 nuts (6), 2-off M12 washer (5) and 2-off isolation sleeves (10) from the 2-off M12 studded bars (11) on the wet mate plug retaining lugs (7). There should be no force pushing the connectors apart, if connectors are pushing apart, stop and contact technical support for advice.



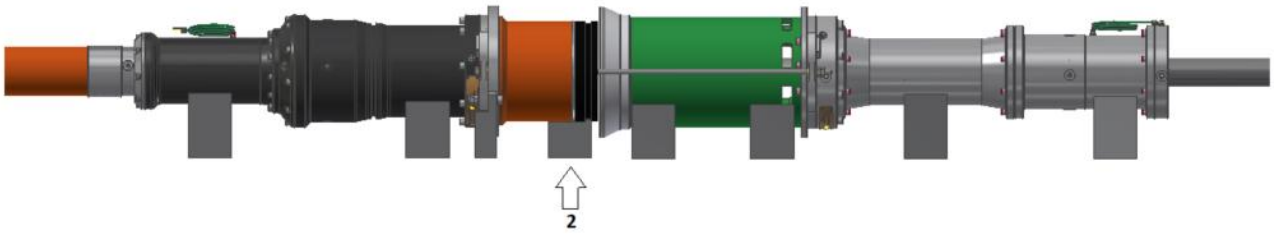
2. Remove the 4-off quick grip adaptor (12) from the slots on the outside of the 4-off retaining lugs (7) and place in the upper most slot on the inside of the 4-off retaining lugs (7) on both the wet mate plug and test receptacle.



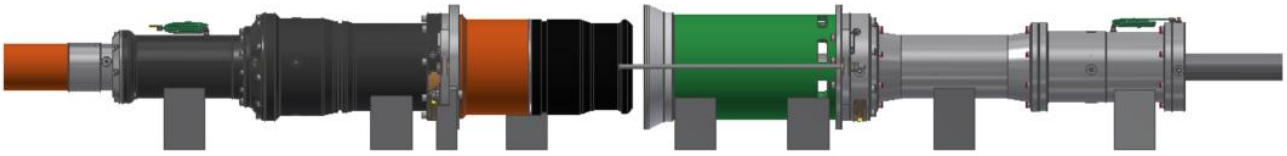
3. Using the 2-off quick grip clamps slowly push the connectors apart.



4. When the groove on the wet mate plug is visible and before it disengages from the test receptacle shroud, slide the plug support block (2) into place.



5. Continue to push the connectors apart with the clamps until there is an audible click as the shuttle pin in the wet mate plug disengages.



6. Slide the connectors apart and remove all mating kit components.

7.8 Quick Connect (Dry Mate)

Caution. Risk of material damage.

- Siemens strongly recommend that the Quick Connect / Dry-Mate operation is only performed by Siemens or suitably certified personnel in possession of the correct equipment and documentation.

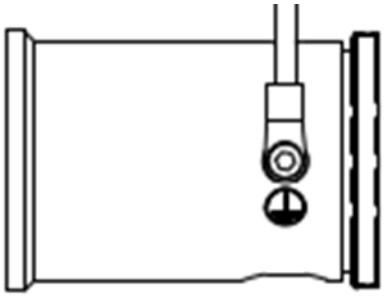
The SpecTRON 45 connector family offers a dry-mate system between the connector gland component and connector/penetrator “front-end” module.

This operation should only be carried out by Siemens or other suitability certified personnel in possession of the correct equipment and work instructions. Please contact Siemens Energy Subsea for more information on training, certification and termination services for SpecTRON 45 provided by Siemens Energy Subsea.

7.9 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
- 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
- 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 metalwork is earthed using a 'bleep' tester or similar.



Example of earth connection

Caution. Risk of material damage.

- Any mating equipment used to mate the SpecTRON 45 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
- 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.

7.9.1 Test connectors

SpecTRON 45 test connectors are available in configurations to support all interfaces within a project, specifically, plug, receptacle, and dry-mate interfaces as shown in Figure 24.

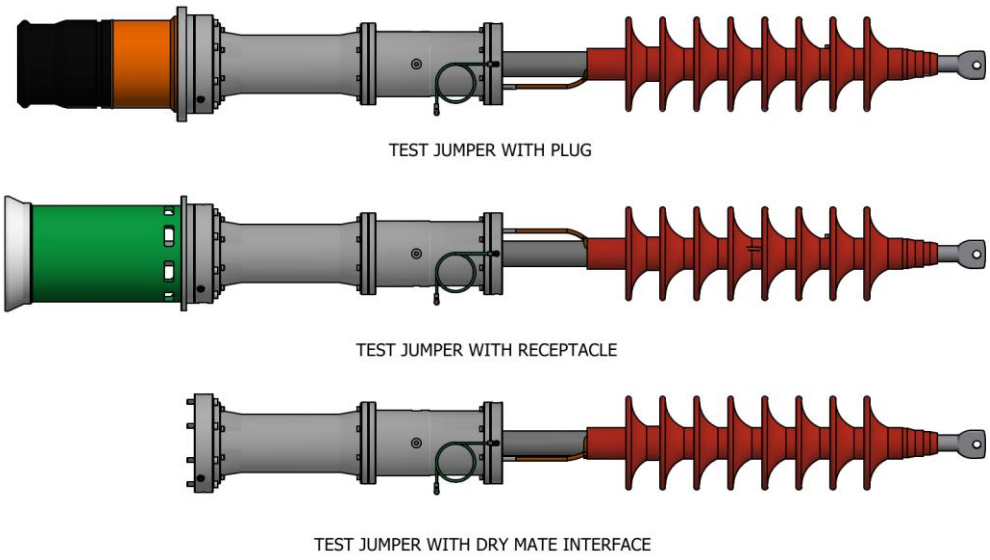


Figure 24 - SpecTRON 45 Test Jumper Configurations (without protective caps)

SpecTRON 45 test connectors are supplied with a heat-shrink cable termination on the free end of the cable, which is sensitive to bending after it has been installed onto the cable. Bending of the test termination should be installed and it should be correctly supported during testing/operation. The termination can be installed vertically, or horizontally with supports and HV clearance/flashover distances as shown below

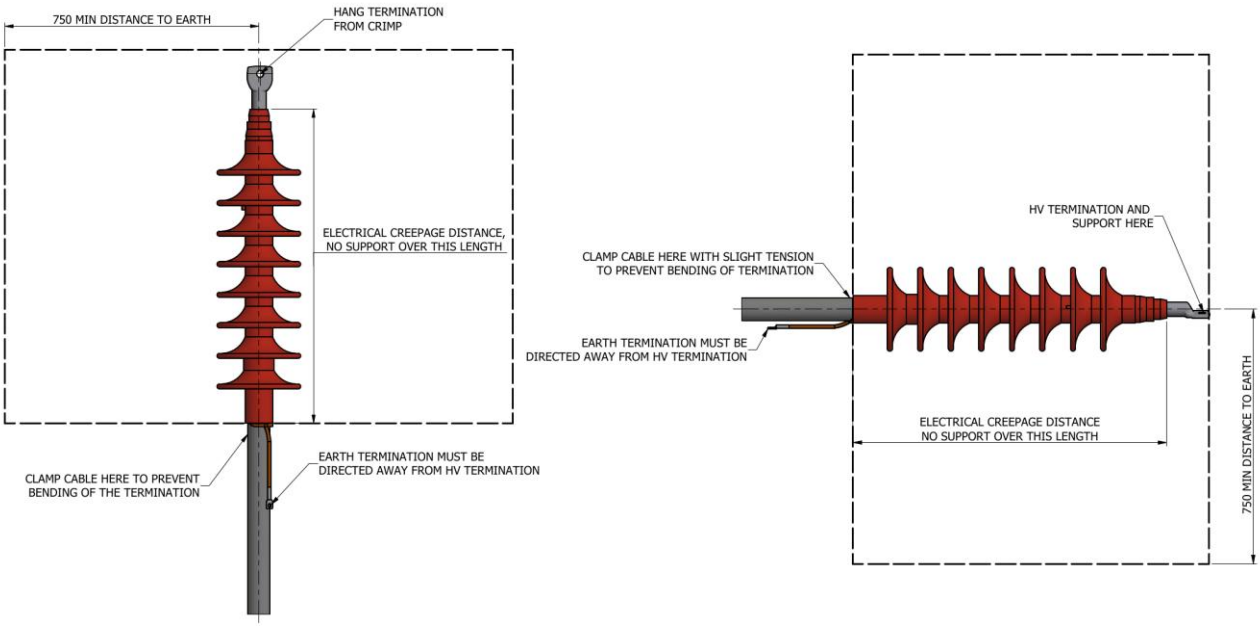


Figure 25 - SpecTRON 45 Test Termination Support and HV Clearances

7.9.2 Test Levels

The SpecTRON 45 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 Connectors onto customer equipment (e.g. transformers, motors).

It is also possible for customers to perform additional testing, subject to the restrictions outlined below.

7.9.3 Electrical Tests

- Insulation resistance tests
  - 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 dependant on the test arrangement, cable/harness lengths, and the equipment (e.g. motor, transformer) under test.
  - IR testing of unmated receptacles can be performed with the protective cap fitted to the receptacle. The protective cap and receptacle contact pin must be clean and dry in accordance with the cleaning process outlined in section 9.1. Contact must be made from the opposite end of the jumper or umbilical power core.

- Line resistance tests
  - 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.

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

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

7.9.4 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.

7.9.5 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 9.1 whether they are to be placed in storage or to remain on the structure for deployment.

7.10 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.

7.11 Quick references

For quick reference of the product, see section 1.4, 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 1.4 and 1.5.

8 USER INFORMATION

8.1 Normal and faulty/dangerous operation

8.1.1 Visible oil discharges from connector

During normal operation of the SpecTRON 45 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.

8.1.2 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.

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.

8.2 Cathodic Protection

Siemens Energy SpecTRON 45 Connectors are offered in Super Duplex stainless steel (UNS S32550/UNS S32760).

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

Super Duplex stainless steel connectors and penetrators do not require a connection to a CP system. However, Siemens Energy supply CP straps with Super Duplex connectors, which can be used to provide electrical continuity during testing. The CP strap is manufactured in 316 stainless steel with a cross section of 16 mm^2, and a M6 spade terminal for connection to the CP system.

8.2.2 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.

8.3 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 7 - Troubleshooting product contact details

9 PRODUCT MAINTENANCE

Danger! Risk of death from electric shock.

- Connectors must not be de-mated whilst live.
- Allow sufficient time for system to discharge 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 discharge 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

9.1 Connector Cleaning and Drying

Caution. Risk of corrosion to electrical contacts.

- Connectors should be mated to a dummy plug or cleaned as detailed below after deployment or contact with water.

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 connection components

9.1.1 Receptacle Protective Caps

- Remove seals and grub screws

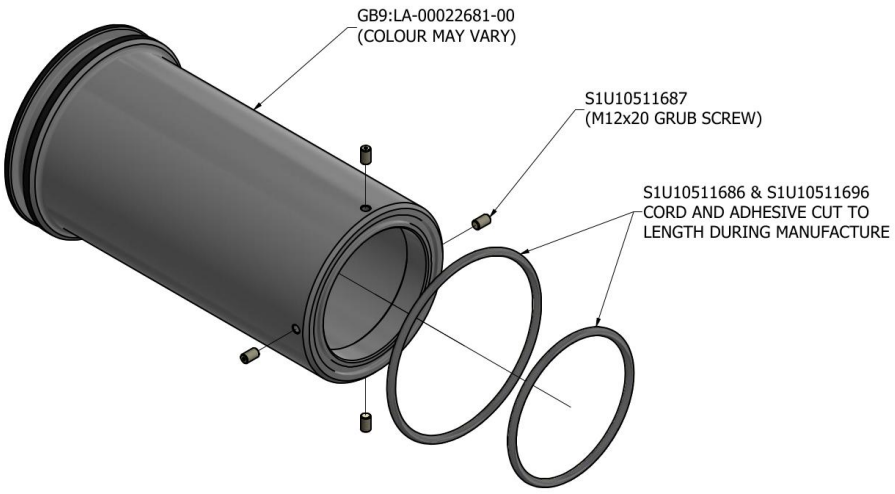


Figure 26 - Disassembled receptacle protective cap

- Clean seals and body with fresh water
- Rinse with Isopropyl Alcohol (IPA absolute alcohol 100%)
- Allow to dry (can be placed in an oven at 50°C for 1 hour if required)
- Check all parts to ensure they are free from dried salts
- Reassemble cap using a small amount of silicone grease on the seals (see Figure 26).

9.1.2 Receptacle

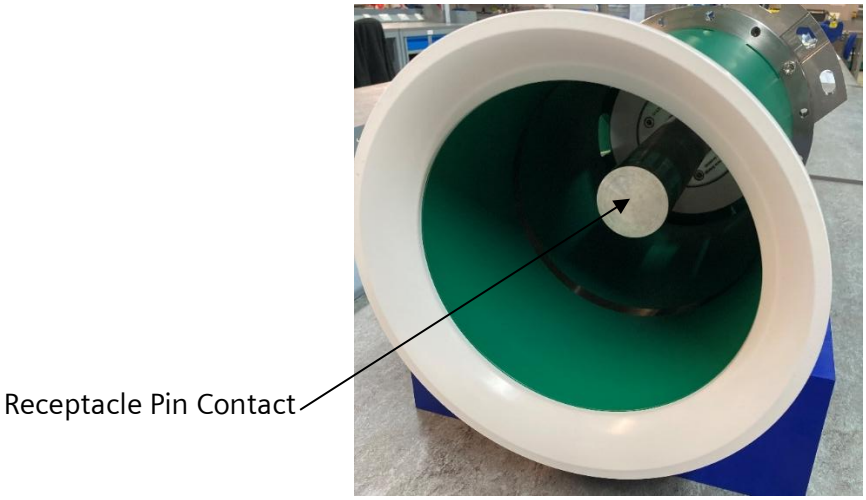


Figure 27 – Receptacle Components for drying and cleaning

- Rinse the whole pin well with fresh water
- Wipe using lint free tissue if required
- Rinse with Isopropyl Alcohol (IPA absolute alcohol 100%)
- Allow Receptacle pin groove to completely dry
- Inspect the receptacle pin contact area, there should be no damage present (Figure 28).

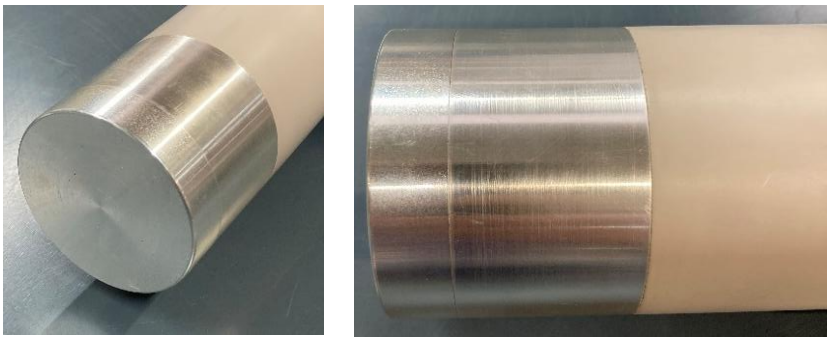


Figure 28 - Receptacle pin contact area as supplied

- Perform a mate with a Plug connector to lightly coat the receptacle pin in oil. If no plugs are available contact Siemens Energy for Midel 7131 oil, which can then be applied directly to the pin using a clean, soft lint-free cloth.
- Protective cap must be refitted at this stage. It is critical that both the protective cap, receptacle shroud and pin are clean and dry before fitting. This is to ensure that moisture is not trapped around the pin contact area, which could result in corrosion of the receptacle pin.

9.2 Product maintenance (skilled persons)

9.2.1 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, skin, and eye protection when handling.

Caution. Risk of material damage.



- 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. Use of a water jet is acceptable, but the jet should not be directed into the shuttle pins at the front of the plug as this could result in a risk of water being forced through the primary seals.
- If performing this operation topside, rinse the connector with water when complete.

To remove calcareous growth from Siemens Energy Subsea connectors, a solution of 50% Citric Acid is recommended. All seawater exposed elastomeric materials in Siemens Energy Subsea connectors have been fully tested against 50% Citric Acid and are compatible for a duration of 1 hour. In addition, the thermoplastic materials have a good resistance to citric acid.

10 CUSTOMER COMMENTS/FEEDBACK

Please complete the Sign Off section at the bottom of form to confirm each page of this document has been read and complied with in full.

Originator Name and Initials (BLOCK CAPITALS)		Date
✉ Contact Details		☎ Contact Details
Project Reference	Customer	Region
Product Type	Part Number (P/N)	Serial Number (S/N)
Please enter details below e.g. comments; complaints; evidence of good practice; incident reports; observations and recommendations, including any associated with health, safety or the environment, etc., also include any names/contact details of other relevant personnel.		

Sign Off Section

Name (BLOCK CAPITALS)	Signature	Date

Please e-mail completed form to the Product Safety Officer at the following address:
subsea.connectors.productsafety.gb@siemens-energy.com

Published by

Siemens Energy Limited
Faraday House Sir William Siemens Square
Frimley, Camberley
Surrey
GU16 8QD, United Kingdom

For more information, please visit our website: siemens-energy.com/subsea

Subject to changes and errors. The information given in this document only contains general descriptions and/or performance features which may not always specifically reflect those described, or which may undergo modification in the course of further development of the products. The requested performance features are binding only when they are expressly agreed upon in the concluded contract.

Siemens Energy is a trademark licensed by Siemens AG.