Omterra - subsea

SpecTRON 10 & 10+

IOM Rev15

Chaize, Eric (EM MS SUS PLM)
[Date]

Unrestricted

Foreword

Thank you for purchasing a Omterra SpecTRON 10 Mk. II or 10+ product. The information that follows is an overview of the protection, storage, shipment, unpacking, deployment and maintenance instructions for SpecTRON 10 Mk II and 10+ products.

Omterra 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
0	C. Plant	W. Barrett	13/08/12	First Issue
1	C. Plant	W. Barrett	20/09/12	Bundle jumper bend radius changed to 500 mm, updated notes on clamping to clarify penetrator requirements
2	C. Plant	W. Barrett	12/11/12	Section 6.1 - Add maximum clamping distance (2 meters) Section 8.1 - Clarify that receptacle should only be exposed when changing from plug to dummy plug and that total exposure time is 28 days in total+ Section 8.1 - Clarify that plug can be left unmated as long as required Section 8.2.2 - Clarify that SpecTRON 10 connectors are not isolated from CP by design Section 8.4.1 - Clarify cleaning and maintenance instructions
3	N. Knight	K. Higgs	04/09/13	Front Cover – Updated. Section 1 – Add 'In Line' to PCE-B62 and PCE-A74 connector descriptions. Section 1 – Add Right Angle connectors, PCE-A74, PCE-B64 and PCE-B76. Section 4 – Add image of Right Angle connector lifting positions. Whole document – Change all 'Tronic' references to 'Omterra Connectors'.
4	M. Gretton	B. Leach	07-03-14	1. – add product safety information to introduction 2. – add the HSE section 11. – add the punch list to document
5	K. Mutton	W. Barrett	28.4.14	New Front cover design added
6	M. Gretton	B. Leach	04/06/14	Section 2. – HSE section comment about receptacle connectors added
7	S. Roberts	D. Church	26/06/14	Section 9.2 amended, reference to CP strap being 30mm^2 is incorrect. CP strap corrected to be 16mm^2.
8	J. Keith	M. Earnshaw	13/09/17	Major update to document. Technical specification update to include more data on cable and hose. Information added for the packing, lifting and handling of Bundled harnesses.

				Section 11 added for cleaning of protective caps and receptacles post SIT and deployment. Connector storage conditions updated. Umbilical section created that outlines testing, handling and umbilical receptacle orientation. Installation section updates for mount orientations and hose routing. SIT section updated for hose routing in SIT and when connector cleaning is required. Added tolerance to OD of Hose in section 3.3.1. Added cable clamp strength rate to section 6. Updated document to latest Siemens template.
09	N. Williamson	M. Earnshaw	27/10/20	Section 3.3: Updated weight values for AquaTRON 200 hose harnesses (single and bundled) with FF70 and FF150 cable. Added info on requirement for hose extenders on AquaTRON harnesses longer than 45m. Section 6: Corrected rating of cable clamp and hose in lifting and handling section. Clarified that statement regarding 5m is in air – i.e. not applicable for deployment in water. Section 7.1: Clarified that connector mounting screws must be tightened to a dead stop before being torqued. Section 9.1: added info on max unsupported length of harnesses in water.
10	C. Plant	N. Williamson	26/10/2021	General: Updated to Omterra branding and product safety focused template, content migrated across. Change maximum length of unsupported bundled harness from 25 m to 75 m.
11	A. Ellis	N. Williamson	17/08/2022	Updated section 1.2 to reflect the fact that the applicable SpecTRON standard is now IEC/IEEE 61886-1 (was SEPS SP-1001). Section 6.3: Added retrieval guidance. Section 6.5: Added buoyancy guidance.
12	S. Maudsley	J. Pridmore	14/11/2023	Section 6.6.1: Updated minimum bend radius advice. Section 6.6.3: New section created to include instruction on fitting the half shell, plastic cable clamps that are required for transportation.
13	M. Brereton	D. O'Donnell	17/10/2024	Section 7.2.1 Add note to say that corrosion protection should be implemented for AA connectors.
14	J. Rogers	M. Earnshaw	28/07/2025	Section 5.2 (Unpacking) updated to capture acceptance of scuff marks arising during production.
15	T. Edwards	D. O'Donnell	17/12/2025	Section 6.9 (Testing) Introduction of earth points on metalwork and instructions for testing.
16	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.

Contents

1 PRODUCT SCOPE 6
1.1 Permeguard™ Wet Mate Receptacle Connector 6
1.2 Product Applicable Standards 6
1.3 Contact details 6
1.4 Product advice label 7
1.5 Product marking 7
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 15
4 SPECIFICATION AND RESIDUAL HAZARDS 17
4.1 Connector General Specification 17
4.2 Misalignment capability of wet mate connectors 17
4.3 Hose Specifications 18
4.4 Cable Specifications 18
4.5 Other specifications 19
4.6 Environmental, disposal and recycling 20
4.7 Personal protective equipment (PPE) 20
5 PREPARING PRODUCT FOR USE 21
5.1 Safety precautions before installation 21
5.2 Unpacking 23
5.3 Safe disposal of packaging 24
5.4 Lifting 25
5.5 Installation and assembly 26
5.6 Storage and protection 29
5.7 Repackaging to prevent damage in transport 31
6 OPERATION OF PRODUCT 32
6.1 Energising Wet Mate Pair 32
6.2 Deployment 32
6.3 Retrieval 33
6.4 Hose Management and Routing 33

6.5 Hose Buoyancy Subsea 39
6.6 Umbilical Power Core Management and Termination 40
6.7 Connecting and Disconnecting Wet Mate Pair 41
6.8 Quick references 43
6.9 Testing 44
6.10 Disposal of waste products 47
7 USER INFORMATION 48
7.1 Normal and faulty/dangerous operation 48
7.2 Cathodic Protection 48
7.3 Troubleshooting (FAQ's) 49
8 PRODUCT MAINTENANCE 50
8.1 Connector Cleaning and Drying 50
8.2 Product maintenance (skilled persons) 52
9 CUSTOMER COMMENTS/FEEDBACK 54

Tables

Table 1 - SpecTRON 10 Mk. II and 10+ Product Certification 6
Table 2 - Contact Details 6
Table 3 - SpecTRON 10 Mk. II and 10+ Connectors General Specification 17
Table 4 - SpecTRON 10 Mk. II and 10+ Connector Misalignment Capability 17
Table 5 - SpecTRON 10 Mk. II and 10+ Hose Specifications 18
Table 6 - SpecTRON 10 Mk. II and 10+ Cable Specifications 18
Table 7 - Troubleshooting product contact details 49

Illustrations

Figure 1 - Product Advice Label 7
Figure 2 - Example Etching for SpecTRON 10 Mk. II and 10+ Products 8
Figure 3 - Example harness marking 8
Figure 4 - SpecTRON 10 harness in packaging 21
Figure 5 - Reinforced Bundled Harness Box 22
Figure 6 – Specific Packing for Bundled Harness 22
Figure 7 - SpecTRON 10 and 10+ Protective Caps 24
Figure 8 - Allowable lift positions (In Line Connectors) 25
Figure 9 – Allowable lift positions (Right Angle Connectors) 26
Figure 10 –Fixed Inline mount orientations 27
Figure 11 – Fixed Right Angle mount orientations 27
Figure 12- Compliant Inline Mount Type 1 Orientations 28
Figure 13- Compliant Inline Mount Type 2 Orientations 28

Figure 14- Compliant Right Angle Mount Orientations 28
Figure 15 - AquaTRON (left) and Gorilla (right) hoses at to minimum bend radius 34
Figure 16 - Incorrectly routed AquaTRON (orange) and Gorilla (yellow) Hose 34
Figure 17 - Immediate fall in routing 34
Figure 18 - Hose kink due to immediate fall in routing and weight application 35
Figure 19 - Plate Former 35
Figure 20 - 'U' Former 36
Figure 21 - 'L' Former 36
Figure 22 - Permanent fixed 'U' former 36
Figure 23 - Minimum clamp spacing from connector 37
Figure 24 - Potential clamping of hose on compliant connector 37
Figure 25 - Example of temporary hose support during SIT 38
Figure 26 - Example of support for immediate fall in hose routing 38
Figure 27 - Fabricated stand with former used for hose support 39
Figure 28 - Umbilical Receptacle Side on Termination (outside UTA) 40
Figure 29 - Umbilical Receptacle orientations 40
Figure 30a - Umbilical clamping position 41
Figure 31b – Temporary Clamp P/N : E1A3807385 41
Figure 32 - Disassembled receptacle protective cap 51
Figure 33 – Receptacle Components for drying and cleaning 51
Figure 34 - Receptacle Pin tip recess 51
Figure 35 - Receptacle pin contact area as supplied 52
Figure 36 - SpecTRON 10 and 10+ Power Washing Locations 53

1 PRODUCT SCOPE

This manual includes information on the following SpecTRON 10 and 10+ connector types:

- SpecTRON 10 Mk. II and 10+ Jumpers, with both Right Angle and Inline Glands
- SpecTRON 10 Mk. II and 10+ Wet Mate Plug
- SpecTRON 10 Mk. II and 10+ Permeguard™ Wet Mate Receptacle Connector
- SpecTRON 10 Mk. II and 10+ Penetrator
- SpecTRON 10 Mk. II and 10+ Test Jumpers

1.1 Permeguard™ Wet Mate Receptacle Connector

SpecTRON 10 and 10+ wet mate receptacle connectors use Omterra's Permeguard™ wet mate receptacle connector to provide industry leading robustness and reliability by preventing direct seawater contact with insulation.

1.2 Product Applicable Standards

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 10+ Compliance with IEC/IEEE 61886-1' (Omterra document 10248398) and 'Product Bulletin for SpecTRON IEC 61886-1 Implementation' (Omterra document 10225662).

Table 1 - SpecTRON 10 Mk. II and 10+ Product Applicable Standards

1.3 Contact details

For additional information or questions regards the products visit the Omterra 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 Omterra subsea connector products.

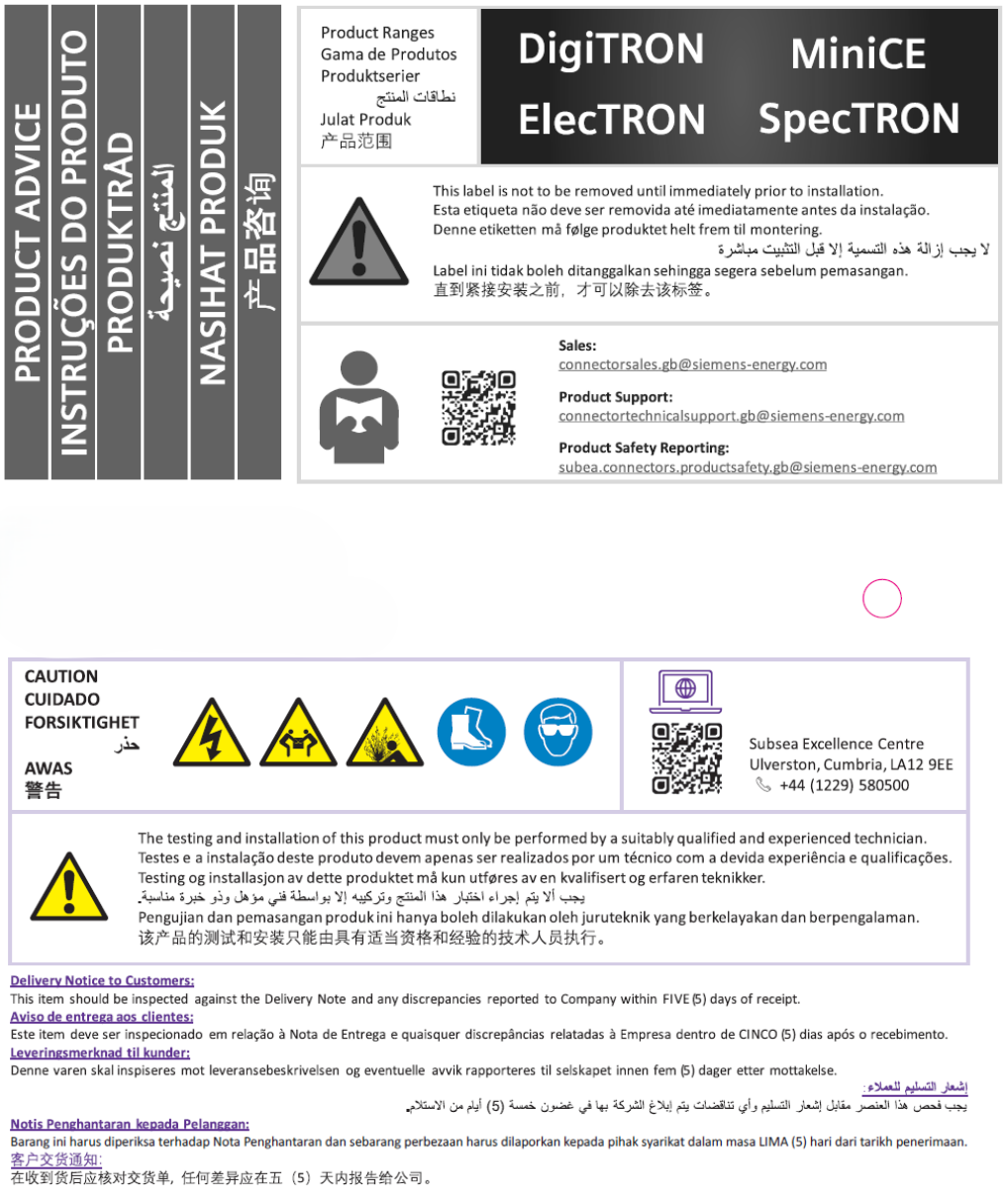


Figure 1 - Product Advice Label

1.5 Product marking

1.5.1 Connectors and Penetrators

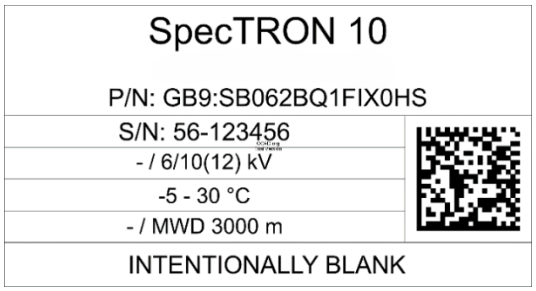


Figure 2 - Example Etching for SpecTRON 10 Mk. II and 10+ Products

Omterra SpecTRON 10 Mk. II and 10+ connectors and penetrators are laser marked on the gland body with the Omterra 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 Omterra 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 10 Mk. II and 10+ is exempt from any current requirement for CE marking. Omterra continue to monitor European and International requirements for applicability to the SpecTRON 10 Mk. II and 10+ product range.

2 PRODUCT SAFETY

Omterra 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 10 or 10+ 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 10 Mk. II and 10+ products must be undertaken by a competent person.
- Installation of SpecTRON 10 Mk. II and 10+ penetrators 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 10 Mk. II and 10+ connectors with 150 mm², 6/10(12) 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 Omterra website http://www.siemens-energy.com/subsea or Omterra 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)	345	bar
Operating Temperature	-5 to 20	°C
Storage Temperature	-25 to 60	°C
Number of Mates (Wet Mate Pair)	100	-
Rated Voltage	6/(10)12	kV
Rated Current	See Datasheet	-
Rated Frequency	5 – 200	Hz

Table 3 - SpecTRON 10 Mk. II and 10+ Connectors General Specification

4.2 Misalignment capability of wet mate connectors

The table below summarises the maximum misalignment capabilities of the SpecTRON 10 Mk. II and 10+ wet mate connectors. For full details, refer to Omterra drawing T25958-1.

	Value	Unit
Maximum Angular Misalignment (Combined)	1	°
Maximum Radial Misalignment (Combined)	5	mm
Maximum Angular Misalignment (Individual)	2	°
Maximum Radial Misalignment (Individual)	10	mm
Under/Overstroke (Independent)	± 10	mm

Table 4 - SpecTRON 10 Mk. II and 10+ Connector Misalignment Capability

4.3 Hose Specifications

	AquaTRON 200		Bundled AquaTRON 200		Gorilla	Bundled Gorilla	
	70 mm²	150 mm²	70 mm²	150 mm²	70 mm²	70 mm²	Unit
Outside Diameter	64,6 +4 / -2,8		147,5		51,8	117	mm
Minimum Bend Radius	375		500		250	500	mm
Storage Temperature Range	-25 to +60		-25 to +60		-25 to +60	-25 to +60	°C
Min.Manipulation Temperature	-25		-25		-25	-25	°C
Maximum Snag Load	1,05	2,25	5		1,05	5	kN
Weight in air	4,75	5,5	16,4	18,6	3,2	10,8	kg/m
Weight in water	1,4	2,1	3,8	6,4	1	3,7	kg/m
Max Length without coupler	45	45	45	45	N/A	N/A	m
Hose Coupler Weight in air	3.8	3.8	11.4	11.4	N/A	N/A	kg
Hose Coupler Weight in water	3.2	3.2	9.6	9.6	N/A	N/A	kg

Table 5 - SpecTRON 10 Mk. II and 10+ Hose Specifications

4.4 Cable Specifications

	70 mm²	150 mm²	Unit
Outside Diameter	28,5	35	mm
Minimum Bend Radius	140	170	mm
Storage Temperature Range	-40 to +80	-40 to +80	°C
Minimum Manipulation Temperature	-25	-25	°C
Max Pull Force	1,05	2,25	kN
Weight in air	1,53	2,55	kg/m
Resistance @ 20 °C	0.277	0,132	mΩ/m
Capacitance (Core to Ground)	0,42	0,56	nF/m

Table 6 - SpecTRON 10 Mk. II and 10+ 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.

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 10+ and 10 Mk. II 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, silicone, or synthetic based oils.

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

5 PREPARING PRODUCT FOR USE

5.1 Safety precautions before installation

SpecTRON 10 and 10+ products are manufactured primarily from materials such as Super Duplex stainless steel and 316L stainless steel, and as such are designed to withstand harsh salt-water environments. However, the connector inserts, and exposed parts are susceptible to mechanical damage if not protected. Protective caps must be fitted to all Omterra 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.

Bulkhead type connectors with exposed tailing wires are 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, they will 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 4 - SpecTRON 10 harness in packaging

Figure 4 shows how a SpecTRON 10+ or 10 Mk II 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.

Bundled harnesses require a large, reinforced packing crate to transport them due to their size and weight as shown in Figure 5. The reinforced packing crate comes with specific lifting points and lifting should only be performed by suitable equipment that is rated to the require weight to lift the bundled harness and the packing crate.



Figure 5 - Reinforced Bundled Harness Box

Figure 5 and Figure 6 show the packing of a bundled harness, the ends are placed in the middle of the crate with all protective caps fitted and the transportation plate for both ends. The hose assembly of the harness is coiled around the outer edge of the box maintaining the bundled MBR of 500mm on the inner edge.



Figure 6 – Specific Packing for Bundled Harness

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



Figure 8 - SpecTRON 10 and 10+ Protective Caps

The protective transport caps are attached to the connector as detailed below:

- Plug Push Fit
- Receptacle Push Fit
- SPO Penetrator M24 Screws
- Square Flange Penetrator 1-8 UNC Screws

5.3 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.

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.
- 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.
- Bundled harnesses must not be lifting using the 4mm^2 strain relief wire which is intended only to manage snag loading of the bundle

SpecTRON 10 Mk. II and 10+ connectors with glands typically weigh more than 30 kg and hence should not be manually handled. The connector can be safely slung around the gland body (see Figure 9 and Figure 10) at a position where the connector is evenly balanced using a noose lifting arrangement.

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 15 kg and can be lifted by hand, however correct lifting practice should always be observed.

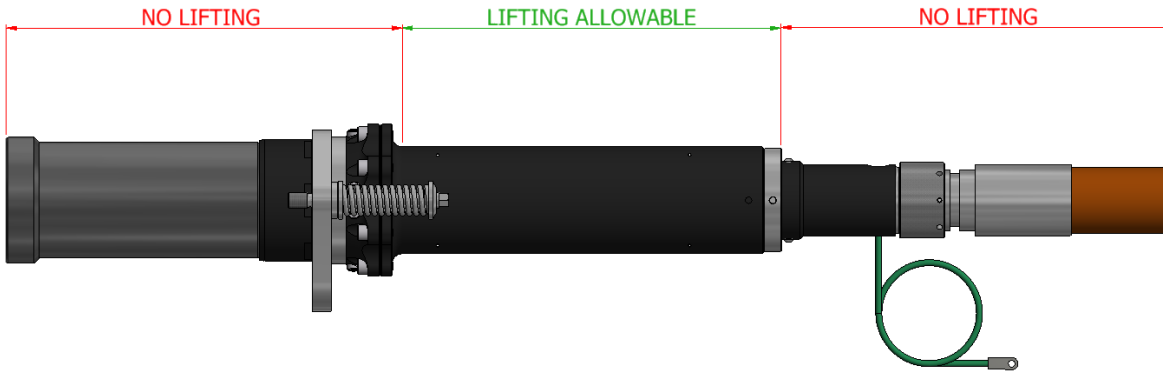


Figure 9 - Allowable lift positions (In Line Connectors)

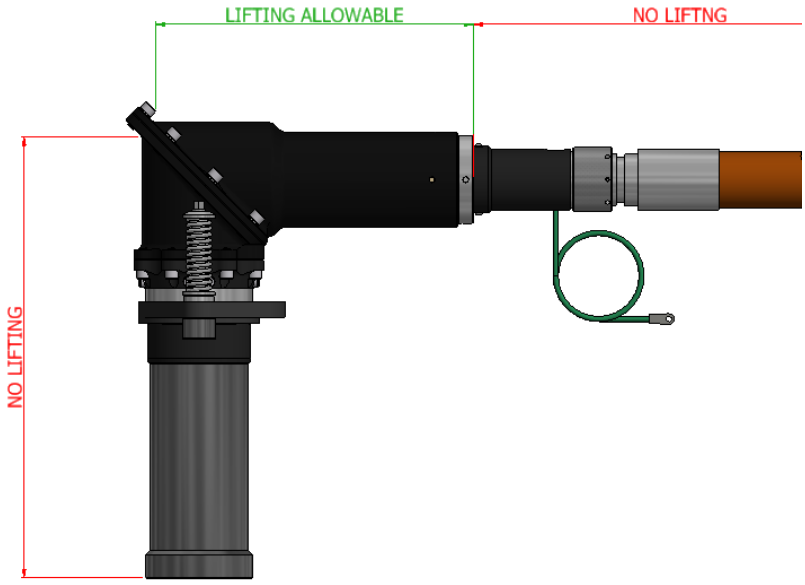


Figure 10 – Allowable lift positions (Right Angle Connectors)

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

For harnesses, the cable or hose should be supported during lifts to minimise strain on the connector. The cable clamp and hose are rated to 2250 N 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. This is to avoid unnecessary strain and stress points on the product.

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 10 Mk II and 10+ 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 5.4.

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 8.1.

5.5.1 Connector Mounts

The mount orientation for SpecTRON 10 and 10+ connectors is defined by the mount type of the connector. The fixed mount Inline and Right Angled connectors, Dummy Plugs and Parking Receptacles can be installed in any orientation.

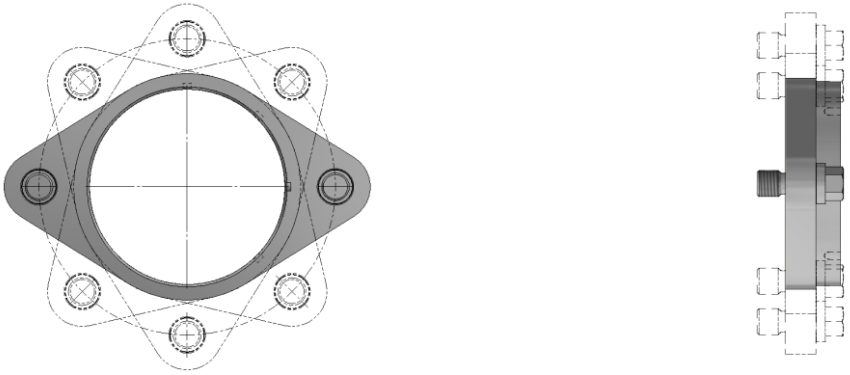


Figure 11 –Fixed Inline mount orientations

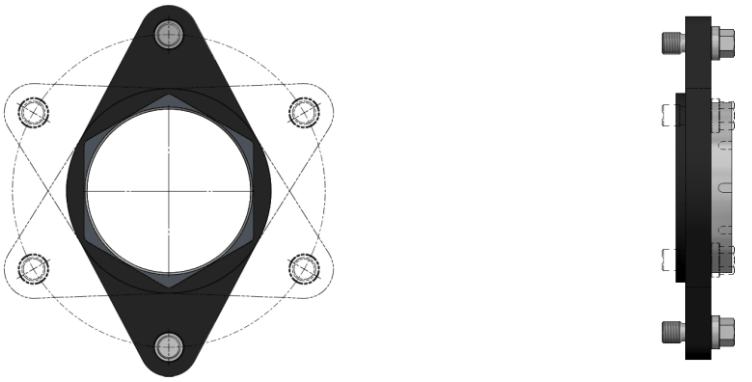


Figure 12 – Fixed Right Angle mount orientations

Design of compliant mounts has restriction to ensure they work effectively. The Inline type 1 Complaint mount is restricted to a vertical orientation plus/minus 45° (see Figure 13).

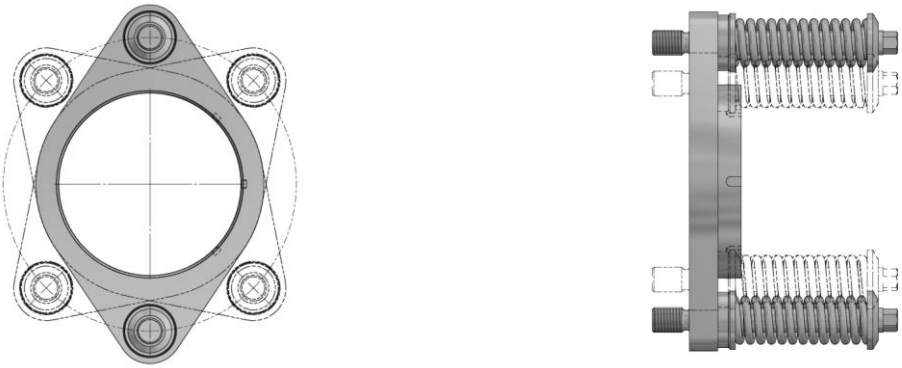


Figure 13- Compliant Inline Mount Type 1 Orientations

The Inline Type 2 Compliant mount and the Right Angled Compliant mount orientation is designed for horizontal mounting with the chin located at the bottom, to handle the force created by the weight of the connector (see figures below).

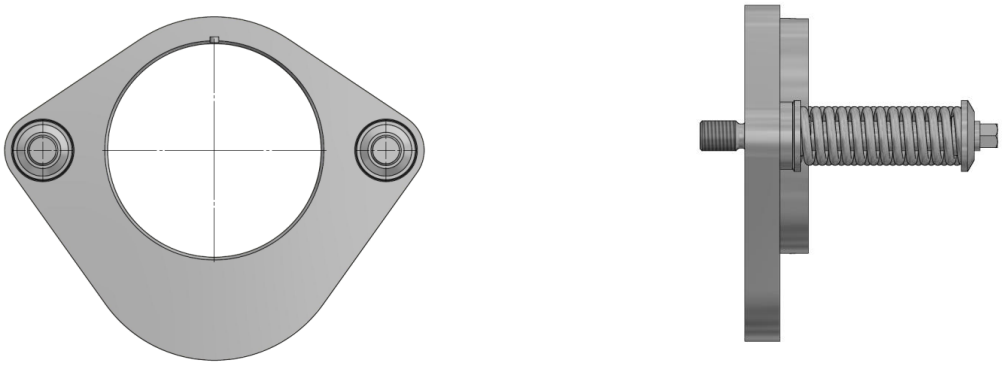


Figure 14- Compliant Inline Mount Type 2 Orientations



Figure 15- Compliant Right Angle Mount Orientations

Orientation of Receptacle connectors can be modified after assembly, so the mount is able to rotate freely for alignment. This is done by removing the location key and tightening the locking ring to a torque specified by Omterra to secure the flange.

For plug connectors it is not possible to remove the location key after connector assembly, hence a freely rotating mounting flange must be specified before factory assembly. The locking ring is then torqued to an agreed value once the connector is installed on site.

When installing connectors without a location key into their interface, the locking ring that holds the mount interface in place must be checked for Loctite. If it is not present Omterra Connectors recommend that the locking ring is secured with a thread-locking compound, e.g. Loctite 2400.

Mounting screws (compliant and fixed mount) should first be threaded into the interface then tightened using standard wrench (or equivalent) till they come to a dead stop against the interface. After this they should be torqued to the below values:

• M16 Screws	SpecTRON 10+ and 10 Mk. II (All)	100 Nm
	SpecTRON 10 Mk. I (Right Angle)	100 Nm
• M12 Screws	SpecTRON 10 Mk. I (In-line)	40 Nm

Omterra Connectors recommend that the mounting screws are secured with a thread-locking compound, e.g. Loctite 2400.

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 5.6.3)
- 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.

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

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.

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 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 Omterra offer parking receptacles and protective caps which can minimise marine growth and contamination.

5.7 Repackaging to prevent damage in transport

In the event of a requirement to return any product back to the manufacturer (Omterra 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 10 Mk. II and 10+ 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 10 Mk. II and 10+, Omterra 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 10 Mk II and 10+ 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 10 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 8.1.1)
- 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



Caution. Risk of material damage.

- The maximum unsupported hose length in water during ROV operations for SpecTRON 10 Mk. II and 10+ harnesses (single and bundled) using AquaTRON 200 hose and 150 mm² Feltoflex cable is 75m
- Maximum unsupported horizontal hose length for SpecTRON 10 Mk. II and 10+ harnesses (single and bundled) is 2m
- Maximum unsupported vertical hose length in water after installation for SpecTRON 10 Mk. II and 10+ harnesses (single and bundled) 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 strain wire within a bundled jumper is for snag loads only, it is not intended for lifting of the jumper

Hose routing is application dependant. However, for straight horizontal runs, Omterra Connectors suggest 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.

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.



Figure 16 - 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 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 17 - Incorrectly routed AquaTRON (orange) and Gorilla (yellow) 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).

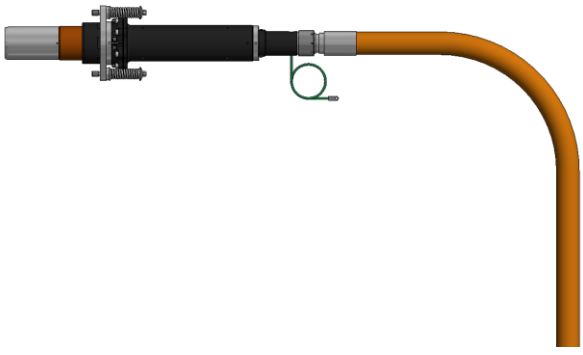


Figure 18 - Immediate fall in routing



Figure 19 - Hose kink due to immediate fall in routing and weight application

Omterra 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).

6.4.1 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

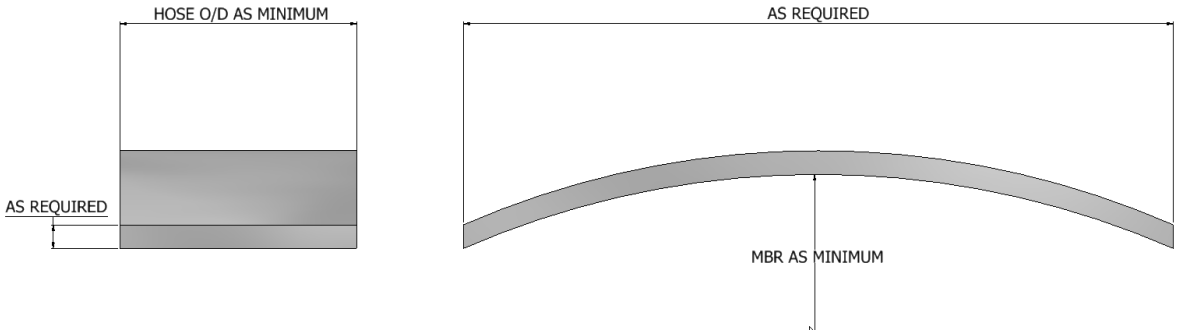


Figure 20 - Plate Former

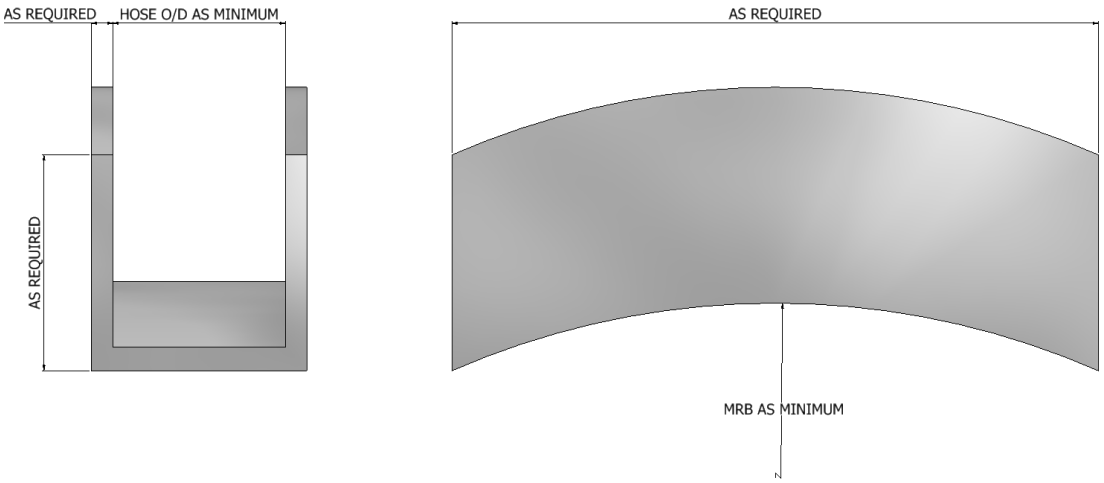


Figure 21 - 'U' Former

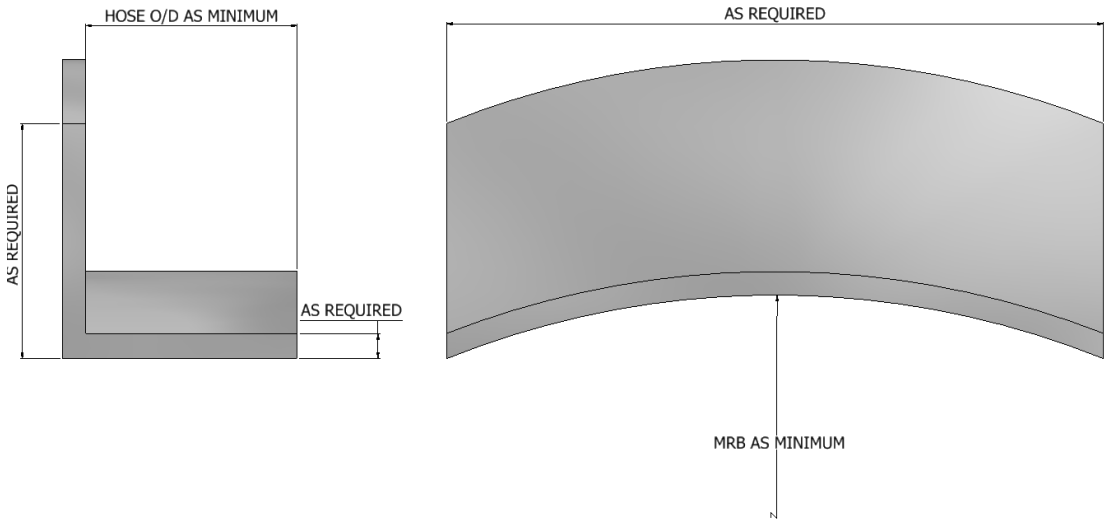


Figure 22 - 'L' Former

6.4.2 Fixed Installations

Routing

To aid routing of hose within MBR and support free hanging hose greater than 5m, formers can be produced to Omterra 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.

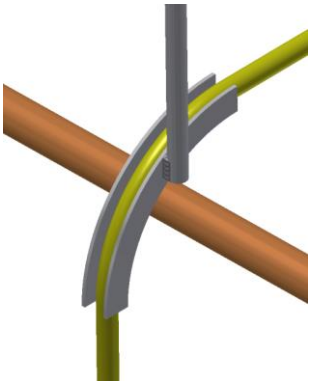


Figure 23 - Permanent fixed 'U' former

Clamping

Omterra 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 25 is utilised to take up the potential movement of the connector. The hose should not be clamped any closer than 750 mm to the start of the hose adaptor on a compliant mount connector and 350 mm for a fixed mount connector or penetrator as shown below.



Figure 24 - Minimum clamp spacing from connector

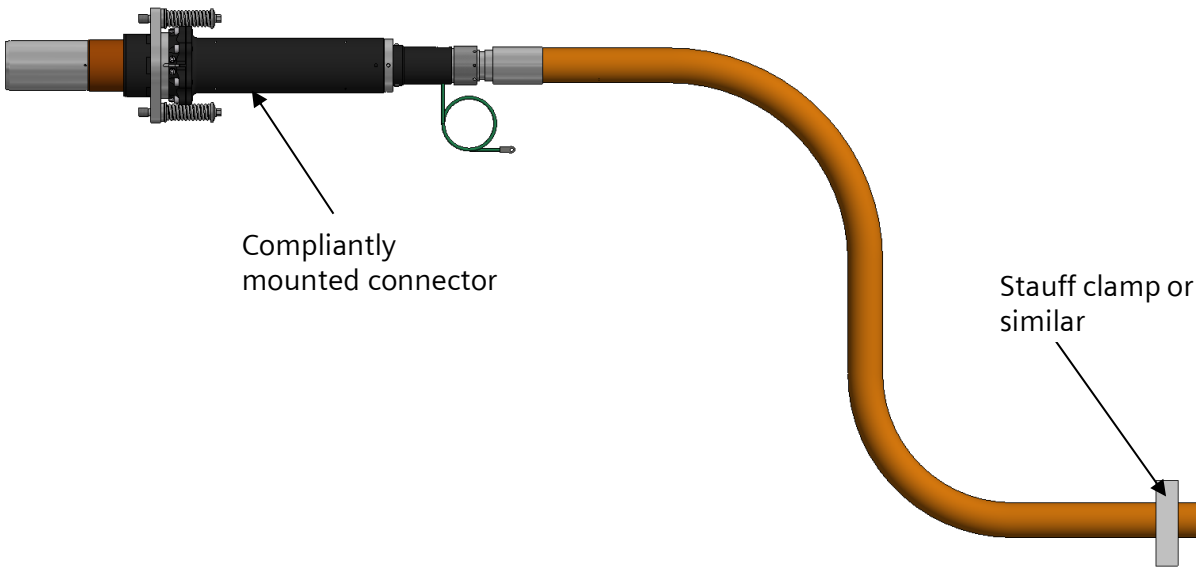


Figure 25 - Potential clamping of hose on compliant connector

6.4.3 Dynamic Installation (SIT Layout)

To aid the support of hose during SIT, formers can be produced to Omterra recommended design (See section 6.4.1) or to client specific design, and temporarily fixed to the client's structures via the use of tie wraps or clamps.

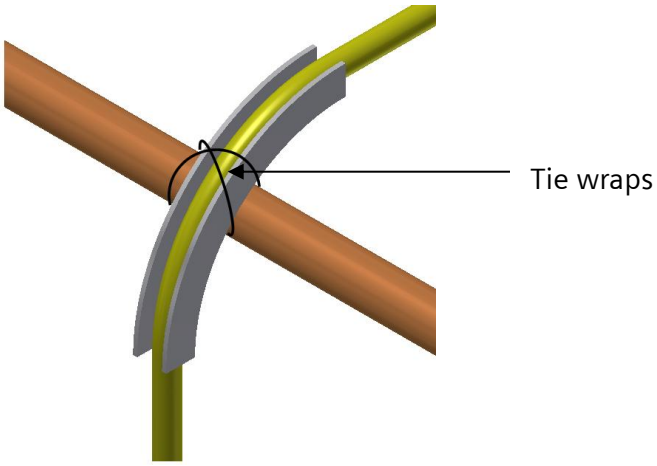


Figure 26 - Example of temporary hose support during SIT

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 27 - Example of support for immediate fall in hose routing

Figure 27 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 27 is to be used, then Omterra 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 28.

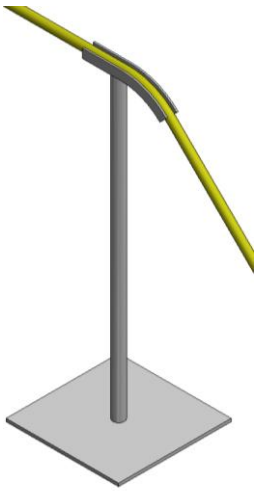


Figure 28 - Fabricated stand with former used for hose support

6.5 Hose Buoyancy Subsea

SpecTRON 10 electrical flying leads (harnesses) under or equal to 75m require no buoyancy aids for subsea deployment.

SpecTRON 10 electrical flying leads over 75m require buoyancy aids suitable to support 2,1kg (see section 4) per metre length in excess of 75m. For example, an 80 metre EFL requires buoyancy aids to cover 5 metres of additional hose weight which is 10,5 kg (5*2,1 = 10,5kg).

These buoyancy aids should be spaced evenly to ensure that the termination on each end of the jumper is not loaded with more than 75 metres of jumper.

The buoyancy aids should be attached to the jumper with a soft sling.

6.6 Umbilical Power Core Management and Termination

6.6.1 Routing

Service loops should be planned into an umbilical termination assembly to give enough length for re-termination purposes and to facilitate the termination of the umbilical receptacle outside of the UTA. If it is not possible to provide a service loop then overlength should be provided in the power core routing. A minimum length of 0,5 metres is required for re-termination, in addition to the length required to manoeuvre the connector outside the UTA structure.

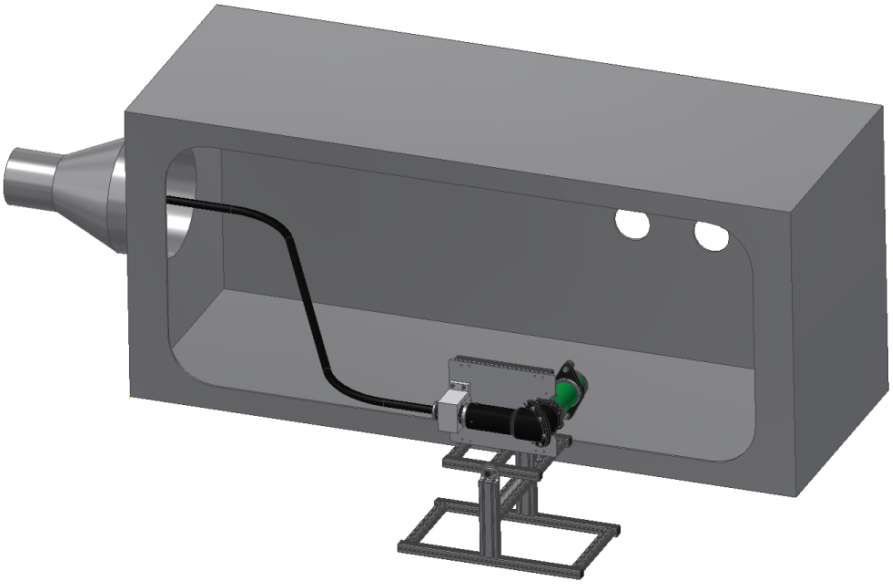


Figure 29 - Umbilical Receptacle Side on Termination (outside UTA)

Omterra offers multiple options for umbilical connector orientation within the UTA. The connector can be side on with the shroud facing left or right and the connector in the vertical position with the connector shroud facing down see Figure 30 - Umbilical Receptacle orientations. Due to the termination process a vertical position with the connector shroud facing up is not available therefore the orientation of the UTA during termination must be considered if this position is required. The position of the mount holes will depend on the mount type see section 5.5.1 and this will drive the angle selected for the cable and cable gland.



Figure 30 - Umbilical Receptacle orientations

Umbilical receptacles should be installed with the minimum of forces applied to the cable. There should be minimal rotation and no bending along the first 200mm of the cable exiting the connector.

6.6.2 Clamping

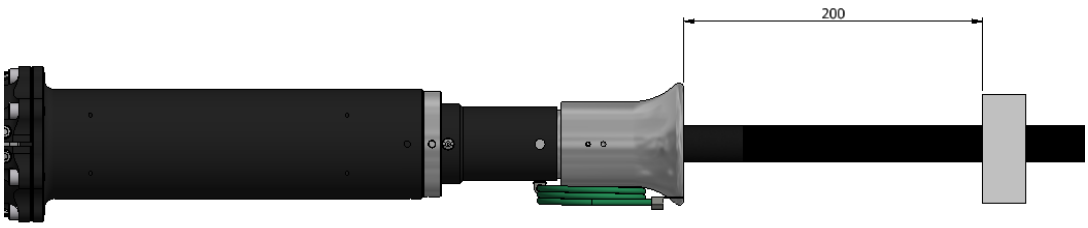


Figure 31a - Umbilical clamping position

Clamping of the umbilical cable may be required to maintain the necessary 200mm, minimum, of straight cable exiting the connector.

6.6.3 Temporary Cable Clamps

Some umbilical connectors may be fitted with temporary plastic cable clamps for shipment to site and site/installation splicing. These are not designed for subsea use and must be removed before deployment after the connector has been mounted in its final position.



Figure 32b – Temporary Clamp P/N : E1A3807385

6.7 Connecting and Disconnecting 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.

- Any mating equipment used to mate the SpecTRON 10 Mk. II and 10+ connector pairs must be designed in accordance with the misalignment and interface guidance provided by Omterra 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



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

- Any mating equipment used to mate the SpecTRON 10 Mk. II and 10+ connector pairs should be in compliance with applicable standards and regulations for machinery.

The connector is primarily offered as a stab plate connector, however a diver mate option is available, for in-line connectors only. The details below refer to a stab plate mated connector.

6.7.1 Compliance

One half of a stab mate connector pair must always be fitted with a compliant mount option ("COM" in the part number). This mount allows movement to accommodate misalignment between the two connector halves.

Two types of compliant mount are offered, Type 1 and 2. Type 1 is used for all connector orientations except when the mounting holes are horizontal (relative to gravity) of the connector, when Type 2 should be used. See section 5.5.1 for further details.

6.7.2 Mate/De-Mate Speed

The connectors have been designed to operate across a wide range of mate / de-mate speeds. Omterra Connectors recommend that:

- Mating speed should not exceed 1 m/s.
- De-mating speed should not exceed 5 m/s

6.7.3 Pre-Mating Checks

Before mating, the receptacle connector should be checked for debris. The connectors have been designed to accommodate sand and silt contamination, however large pieces of debris should be removed using a water jet.

6.7.4 Partial Disconnection

Partial disconnection with the contact pin remaining between the primary and secondary diaphragms is not recommended. In this condition the level of insulation between the contact pin and socket contact is reduced and the connector is relying on the primary seals within the plug. There is also an increased risk of insulation break down at increased voltages.

6.7.5 Interrupted Connection

Interrupted connection (i.e. Partial mate to full de-mate) can be carried out without any adverse effect on connector performance, provided the connectors are not energised unless fully mated.

6.8 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.

6.9 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
- 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.

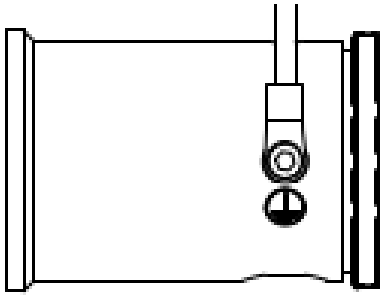


Figure 33: Example of earth connection

Caution. Risk of material damage.

- Any mating equipment used to mate the SpecTRON 10 Mk. II and 10+ connector pairs must be designed in accordance with the misalignment and interface guidance provided by Omterra 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

6.9.1 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

Guide pins where applicable must never be removed from test connectors as this can lead to damage and will invalidate the product warranty.

6.9.2 Test Levels

The SpecTRON 10 Mk. II and 10+ 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 Omterra Connectors onto customer equipment (e.g. transformers, motors).

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

6.9.3 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 dependent 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 8.1. 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, Omterra Connectors technical department should be consulted before starting any testing.

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

6.9.4 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.

6.9.5 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 8.1 whether they are to be placed in storage or to remain on the structure for deployment.

6.10 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 USER INFORMATION

7.1 Normal and faulty/dangerous operation

7.1.1 Visible oil discharges from connector

During normal operation of the SpecTRON 10 and 10+ 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 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

Omterra SpecTRON 10 Mk II Connectors are offered with two material options, 316L stainless steel (UNS S31603), or Super Duplex stainless steel (UNS S32550/UNS S32760). SpecTRON 10+ Connectors are offered in Super Duplex stainless steel (UNS S32550/UNS S32760) only.

7.2.1 Stainless Steel 316L (UNS S31603, Omterra Connectors Material "AA")



Caution. Risk of material damage.

- Stainless steel 316L (UNS S31603) connectors and penetrators must always be connected to a CP (Cathodic Protection) system to withstand harsh salt water 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.

Omterra 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 spade terminal for connection to the CP system.

7.2.2 Super Duplex (UNS S32550/UNS S32760, Omterra Connectors Material "BQ")

Super Duplex stainless steel connectors and penetrators do not require a connection to a CP system. However, Omterra supply CP strap 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.

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 7 - 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.



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

8.1.1 Protective Caps

- Disassemble the Protective Cap by unscrewing (AC-27597-00) with appropriate pin spanner
- Remove all ‘O’ rings and internal parts.
- Clean each part thoroughly 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 O rings. (See Figure).

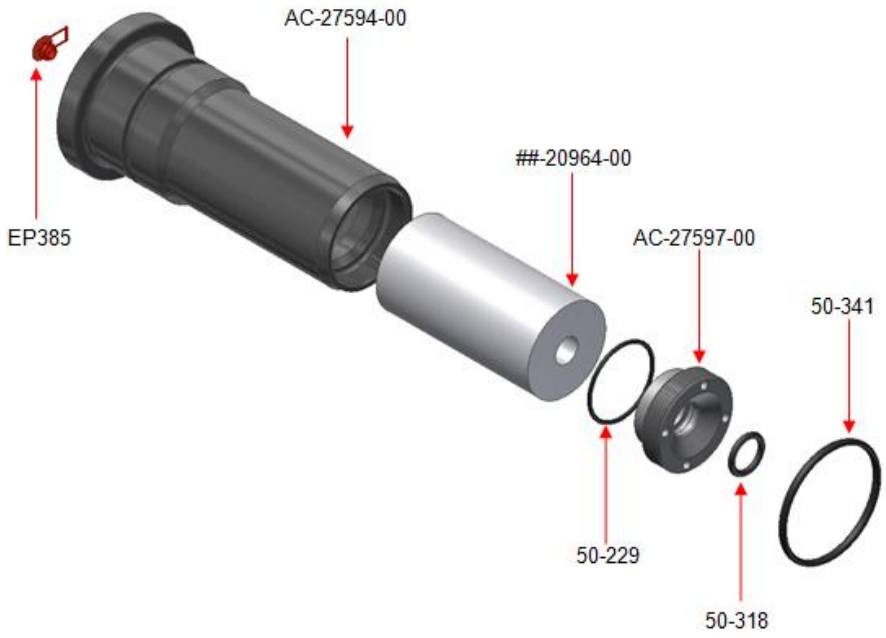


Figure 34 - Disassembled receptacle protective cap

8.1.2 Receptacle

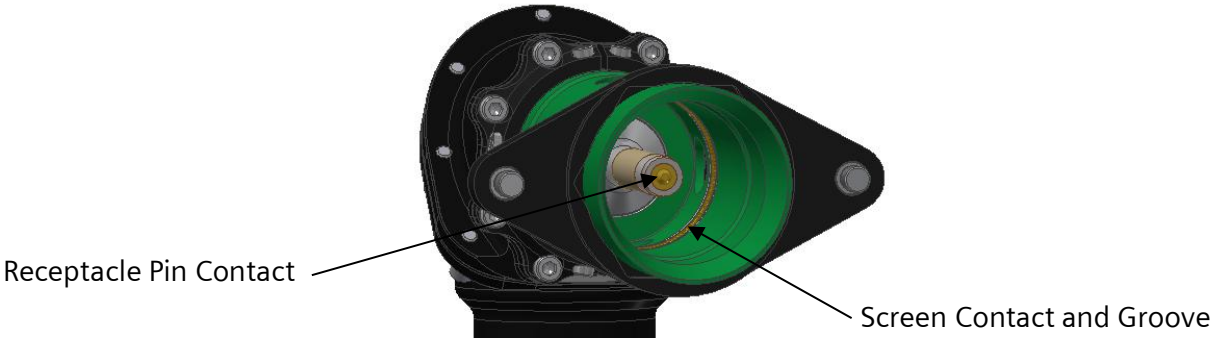


Figure 35 – Receptacle Components for drying and cleaning

- Rinse the whole pin and the screen contact well with fresh water, for the pin tip recess a squeeze bottle can be use to spray in the recess to dislodge any contaminants.

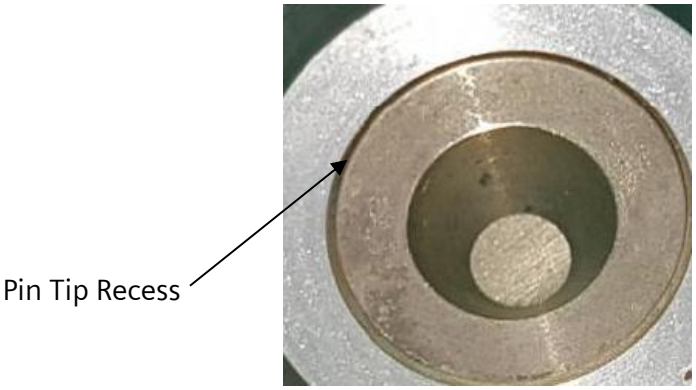


Figure 36 - Receptacle Pin tip recess

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

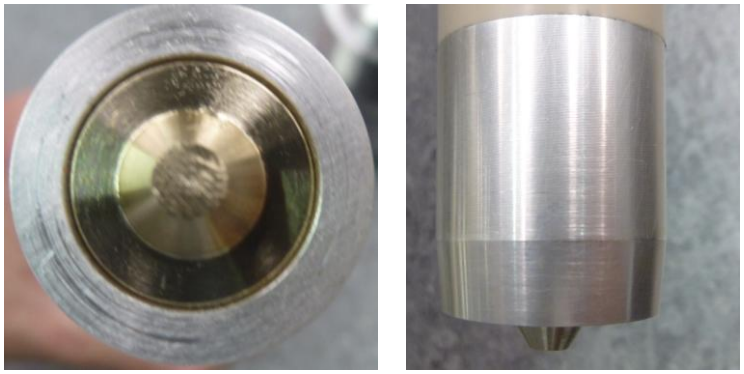


Figure 37 - Receptacle pin contact area as supplied

- Apply dielectric oil to the pin. Dielectric oil must be TD01 to avoid compatibility issue with elastomeric components. Omterra advises that one mate should be performed with a Plug connector to provide sufficient coverage. (If no plugs are available contact Omterra for TD01 oil)
- Protective cap must be refitted at this stage. It is critical that both the protective cap and receptacle Shroud/Pin are clean and dry before fitting, this is so moisture is not trapped around the pin contact area, which could result in corrosion over the long term.

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, Omterra recommend that the connector is cleaned of marine and calcareous growth.

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

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

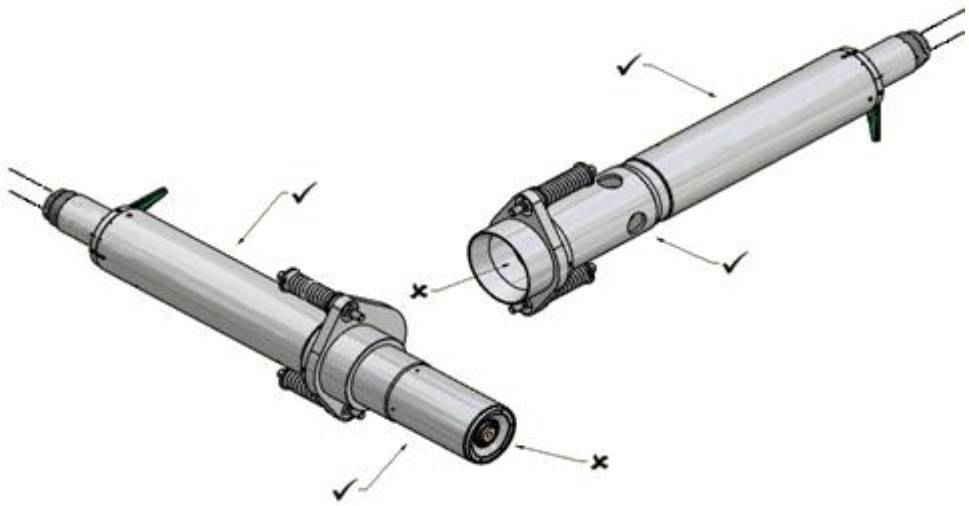


Figure 38 - SpecTRON 10 and 10+ Power Washing Locations

9 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